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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 15

SACRAMENTO, JANUARY, 1929

No. 1

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SACRAMENTO RIVER SALMON FISHERY

By G. H. CLARK

One often hears of the salmon that "used to be" in the rivers of California. The old timers are full of such stories as the salmon being so numerous in the streams on their spawning migrations that one could easily walk across the stream on their backs. Even after allowing for exaggeration, it is evident that salmon were extremely abundant in past years. One hears constant complaints on every side about present scarcity of salmon, with numerous reasons for this condition and many

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suggested theories for its remedy. All these suggestions are in good faith. Some of them may be the thing that is needed, but it must be proved before the rest of the "theory makers" are satisfied.

However, before advancing theories, let us look into the past and see what has gone on in this salmon fishery. Suppose the Sacramento and San Joaquin river systems are used as a historical background, as they were the first rivers to be fished for salmon by white men. Salmon first became a commercial product on the lower river, where it empties into San Francisco Bay.

Before this country was inhabited by white men, the Indians came each year to the banks of the rivers and speared and captured their winter's supply of fish. Their catch may have seemed large to them, but was in all probability nothing compared to later catches. Shortly after gold was discovered in California, there was a great influx of white men. The salmon fishery as a commercial industry was established. Dates are not certain, but it is known that about 1850 the industry was well established.

The number of fish taken is impossible to determine. In an article written in 1860, appearing in Harper's *California Magazine*, the author states that in 1852, 337,500 pounds of salmon were used by the local markets during the season. At that time, the author says, the salmon were decreasing. He compares the abundance of fish in 1852 with 1849, saying that in 1849 any amount of fish could be secured with a spear and now [1855-1860] it was becoming hard to get salmon [evidently by spearing]. Gill nets of shoe tread, 150 to 300 fathoms long, were used. A whitehall boat with two men and a single net could catch as many as 300 fish with a drift of a mile in the lower river. Rio Vista was the main fishing center during the early period.

In 1864 the first salmon cannery was started on the Pacific coast by G. W. and William Hume and A. S. Hapgood. It was at Washington, Yolo County, on the Sacramento River. Their methods of canning were crude, of course, as every operation had to be done by hand. Nevertheless, quantities of salmon were canned and, because of the success of the first cannery, numerous other canneries sprang up until in 1881 there were twenty canneries operating on the Sacramento River and in the San Francisco Bay region. These canneries produced, in 1881, 181,000 cases of salmon, and, in 1882, 200,000 cases, as contrasted with the first cannery, which produced 2000 cases in 1864. The canning industry was no bed of roses in those days. The canneries could not afford to pay the fishermen the high prices that the fresh markets could; consequently, the canning companies got a poorer grade of fish and the overflow, after the fresh markets were supplied. After 1882, canning salmon on the Sacramento River declined until in 1919 only 3125 cases were produced, with two canneries operating. Canning was discontinued after 1919.

Canning of salmon was but a small part of the industry, as will be seen by the accompanying graph. In 1880, when canning was at its height, the total poundage of salmon caught in the Sacramento and San Joaquin river regions was over ten million pounds, live weight. Statistical data are meager and not wholly reliable from these early periods,* but the sources of these data were the same and so afford a

* Data on the catch were obtained from the fish dealers and canneries where the fishermen sold their fish.

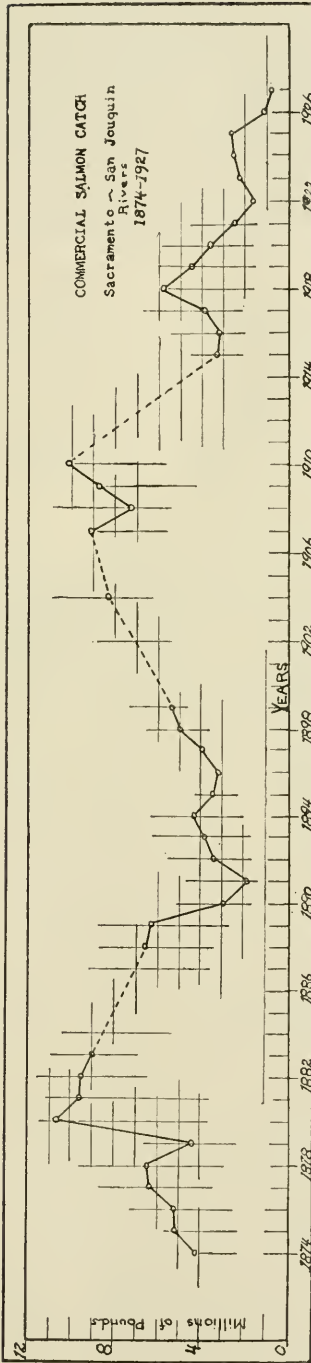


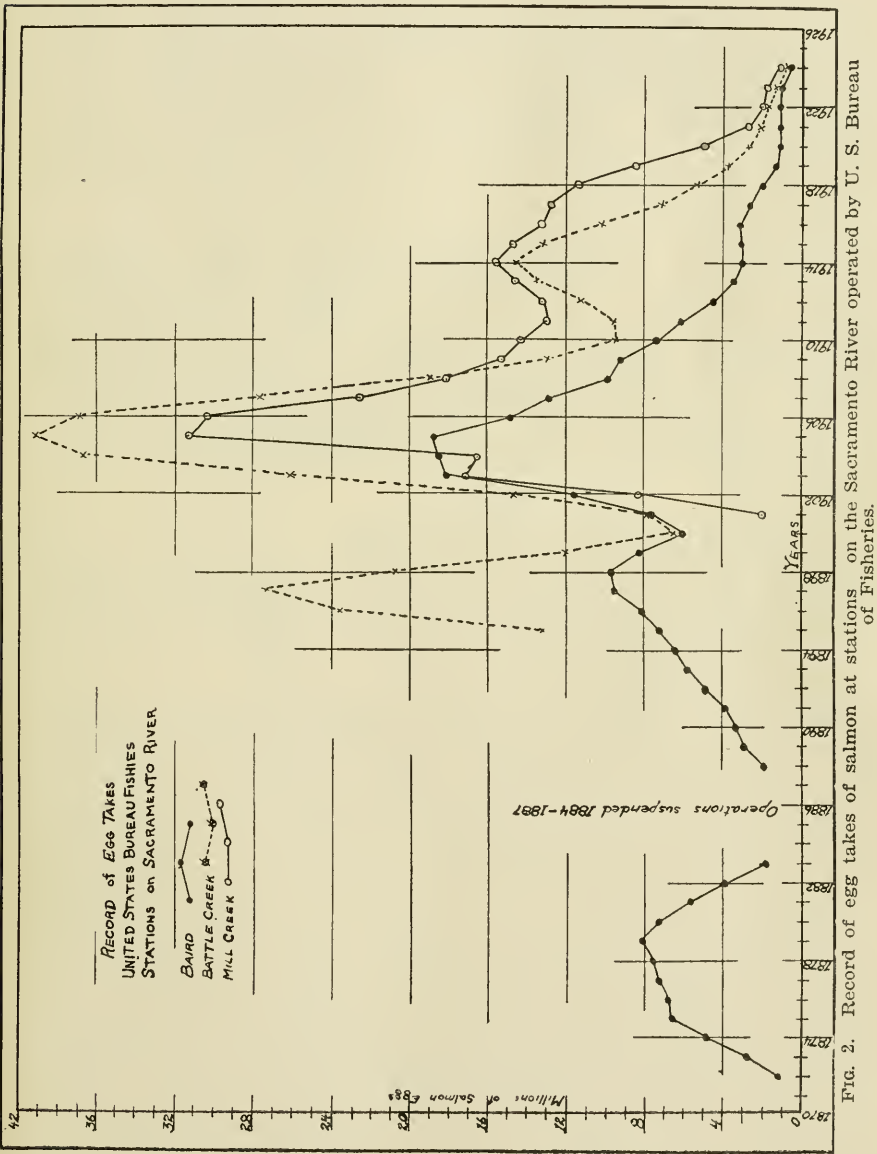
FIG. 1. Commercial salmon catch Sacramento and San Joaquin rivers, 1874-1927. Dots indicate incomplete data.

comparison of the years, even if the figures are incorrect. The graph of the catch from 1874 to 1927, with a few years missing, shows the sudden climb of the fishery to 1880, its slump to a low point in 1891, then its gradual climb again to a high level in 1910 of over 10,000,000 pounds. From 1910 the fishery has been on the downward trend, with a slight rising in 1918 and 1925. From all indications (considering catch records, fishing effort and price increases), the fishery is in a state of serious depletion. The drop in late years is not sudden but gradual, giving every evidence that the fishery is nearing the home stretch to extinction.

Do many of us realize that the Sacramento and San Joaquin river salmon fishery has produced over 205 millions of pounds of salmon since 1874, and in this total some of the early catch figures are missing? What has it produced before? Using 1850 as a starting point of the salmon industry in California, there have been seventy-seven years of more or less intensive fishing of the waters in question. Is it not remarkable that the fishery has not been worked out years ago? These two rivers, until the last fifteen years, have been able to produce immense quantities of fish each year.

Unlike other resources, such as minerals, coal, etc., the salmon could be built up and the resource put back on its former high level. Artificial propagation of fish was established to build up such depleted fish resources. In 1872 the United States Commission of Fish and Fisheries established a salmon egg-collecting station and hatchery on the McCloud River, a tributary to the Sacramento. This station was established for the purpose of taking salmon eggs from the Sacramento, for shipment to eastern states and foreign countries to introduce them into other waters. This policy was carried on for a number of years, until the salmon became so scarce at the egg-collecting station that operations were suspended. After resuming operations in 1888, most of the eggs were hatched for the express purpose of planting them in the river and building up the run of salmon. The egg take at the McCloud station began to fall off, so a station was established on Battle Creek in 1895; another station was constructed on Mill Creek in 1901. Both Battle Creek and Mill Creek are tributaries to the Sacramento River, and were known for their large runs of salmon. These three stations began a period of intense productivity and produced a tremendous amount of salmon eggs which, when hatched, were planted into the creeks and rivers as young salmon. The accompanying graph shows the rise of these stations and the large amount of eggs produced. A state hatchery at Sisson was supplied with eggs from these stations, where the salmon were hatched out and planted in the Little Sacramento River. In spite of the large number of salmon being planted each year in the river (nearly 100,000,000 young salmon were planted in 1906), the catch after 1910 fell off, and, of course, as the catch has fallen off, so has the egg take from the stations decreased. One would think that from such large plantings tremendous returns might be expected. Such expectations did not, or have not seemed to, materialize. Other causes of depletion which may have had a distinct bearing on the fishery are the destruction of the young and adult salmon by pollution, predatory fishes, and the large number of overflow basins in the valley. However, the damage done by these causes is hard to estimate. It is known that

pollution from the drainage of rice fields does cause the death of some salmon. It is also known that some of the fishes of the river prey on the small salmon fry and consume them in numbers, notably the minnow *Ptychocheilus grandis* (Sacramento pike). Until by-passes were constructed through the overflow basins, a large number of young salmon were trapped each year in these lakes and there perished. That condition has now been remedied by the by-passes enabling the salmon to again reach the river.



Fishing methods and gear have changed somewhat since the early years of the fishery. In the early days gill nets and seines were used on the rivers. The fishermen used sail boats and row boats. Their range was somewhat limited for each day's fishing, although the fishermen followed the run of salmon up the river in seows in which their families were housed. Legislation had not closed part of their fishing time until 1880, when the season was closed for the month of August and on Saturdays. Since 1924, when seines were prohibited, there has been no change in the gear. The mesh of the nets is restricted in length. Most of the fishermen use gasoline motor boats, which enable them to run up and down the whole fishing district in a day or night. Legislation has been passed from time to time until now the fishing area is restricted. The closed period lasts for three and one-half months (June 15 to August 1, and September 17 to November 14), and another month, May 15 to June 16, is closed except to 7½-inch mesh nets. The fishermen have increased, the number of boats have increased and the intensity of the fishing effort has increased.

It is evident, even to the most casual observer, that the Sacramento fishery is in a state of depletion. This is quite conclusively shown by the graph of the egg takes, by stations. The small amount of eggs taken in the last few years, as compared to those taken before, shows a distinct downward trend since 1910. The catch has fallen off despite the fact that the fishing effort has increased. The cause of depletion can not be pinned to any one factor because there are a variety of things that combine to make this depletion. Perhaps the following causes, listed in order of their importance, may help to clear up the matter:

1. Overfishing in the river and in the ocean.
2. Cutting off of spawning grounds by dams.
3. Destruction of salmon by overflow basins in the Sacramento Valley has been the cause of great loss of fish, but is now remedied by by-passes.
4. The loss of fish by pollution and predatory fishes is a factor that can not be estimated but is known to occur.

Before the intelligent direction and conservation of a fishery can be administered, it is necessary to have an historical background and to know the present status of that fishery. The life history of the fish, its habits and enemies must be known. Work was started on the Sacramento River early in its history as a salmon stream. Livingston Stone, as early as 1872, did some investigation work in connection with establishing a hatchery on the McCloud River. Some of our earliest records of abundance, as well as life history notes, come from Mr. Stone's observations. Nothing more was done until N. B. Scofield undertook an investigation of the Sacramento River salmon for the California Commission in 1897. That fall, Rutter, for the United States Fish Commission, took up the work, assisted by Scofield who turned his findings over to Rutter. These investigators made a study of the natural history of the king salmon in the Sacramento River. We are greatly indebted to Rutter and Scofield for these valuable and lasting investigations which brought to light many facts and put an end to many controversies. Mr. Scofield, in 1900, published his observations on movements of salmon fry in the streams of Marin County and also the seaward migration of young in the Sacramento River.

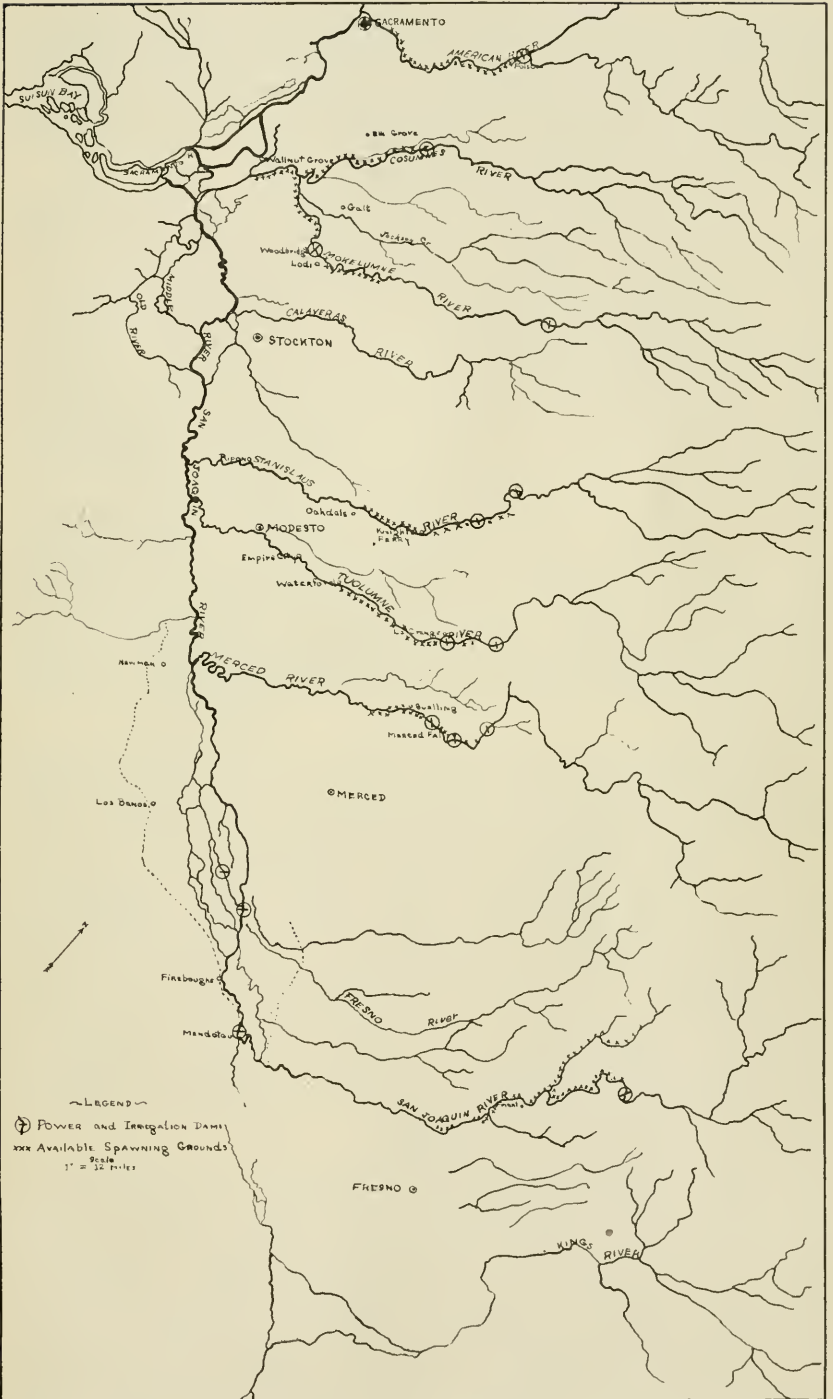


FIG. 3. Map of the San Joaquin River, showing power and irrigation dams and available spawning grounds for salmon.

In 1911, Dr. Charles H. Gilbert and Scofield started to make an investigation of the Sacramento, principally to find the cause of loss of such a great number of salmon fry. Their attention was attracted to the great overflow basins in the valley and the fish in them, so that the investigation centered on the basins, abandoning the rest of the river. Scofield made observations of young salmon and steelhead trout while towing them in live ear from Sacramento to the sea.

W. H. Rich (1920) carried on investigations of the "Early History and Seaward Migration of Chinook Salmon in the Columbia and Sacramento Rivers." Rich's work was another step upward in completing the life history of Sacramento River salmon.

Dr. J. O. Snyder, who has been in charge of the salmon investigation since 1918, has done some work on the Sacramento River, but most of his efforts have been directed to the ocean-caught fish and to the Klamath River. Dr. Snyder has done much with marking experiments, both in the Sacramento and Klamath rivers. Scale studies for age determination have been carried on extensively. McGregor, an assistant to Dr. Snyder, made a study of the anatomical characters of king salmon of the Sacramento and Klamath rivers.

All the investigation work on the river has had to do with the life history, movements of salmon, and some experimentation with fertilization of eggs, both natural and artificial. Until recently, nothing has been done with abundance, age of maturity, age classes and sex representations in the catch, nor has any work been carried on that would disclose the amount of spawning grounds that were available to salmon, since so many power and irrigation dams have been built in the last twenty years.

With material on hand collected by the California Fish and Game Commission at Pittsburg in 1919 and 1921, and some material of previous workers on the river, the writer has undertaken a study of the scales to determine age and maturity of the salmon of the river.

A brief outline of the more important results will perhaps have some interest. In these studies it was found that the greater percentage of salmon in the Sacramento River mature at four years. In 1919, 49% of the catch examined were four-year fish. In 1921, 44% were four-year fish. Next in order were the five-year fish; in 1919, 24% matured and in 1921, 41%. Next comes the three-year-olds with 22% and 12%, respectively. Then the six-year-olds, with 4% and .7%; and last the two-year fish with .2% and 2%, respectively. These percentages are in agreement with Dr. Snyder's findings in other places in California. In 1919, 68% of the catch samples were females and 32% males. In 1921, 70% were females and 30% males.

The study of salmon scales also gives an insight into the early history of the salmon. Some of the salmon spend all or more of their first year in the stream, before going on to the ocean to mature and returning to spawn; while, on the other hand, a large portion of the young go directly to the ocean as soon as they can swim freely. The fish that stay in the streams for a portion or whole of a year are known as "stream type" fish. In the 1919 samples, 13% of the fish were of that type. In 1921, only 9% were of that type. The ocean-going class or "ocean type" were represented in 1919 samples by 87% and in 1921 by 91%.

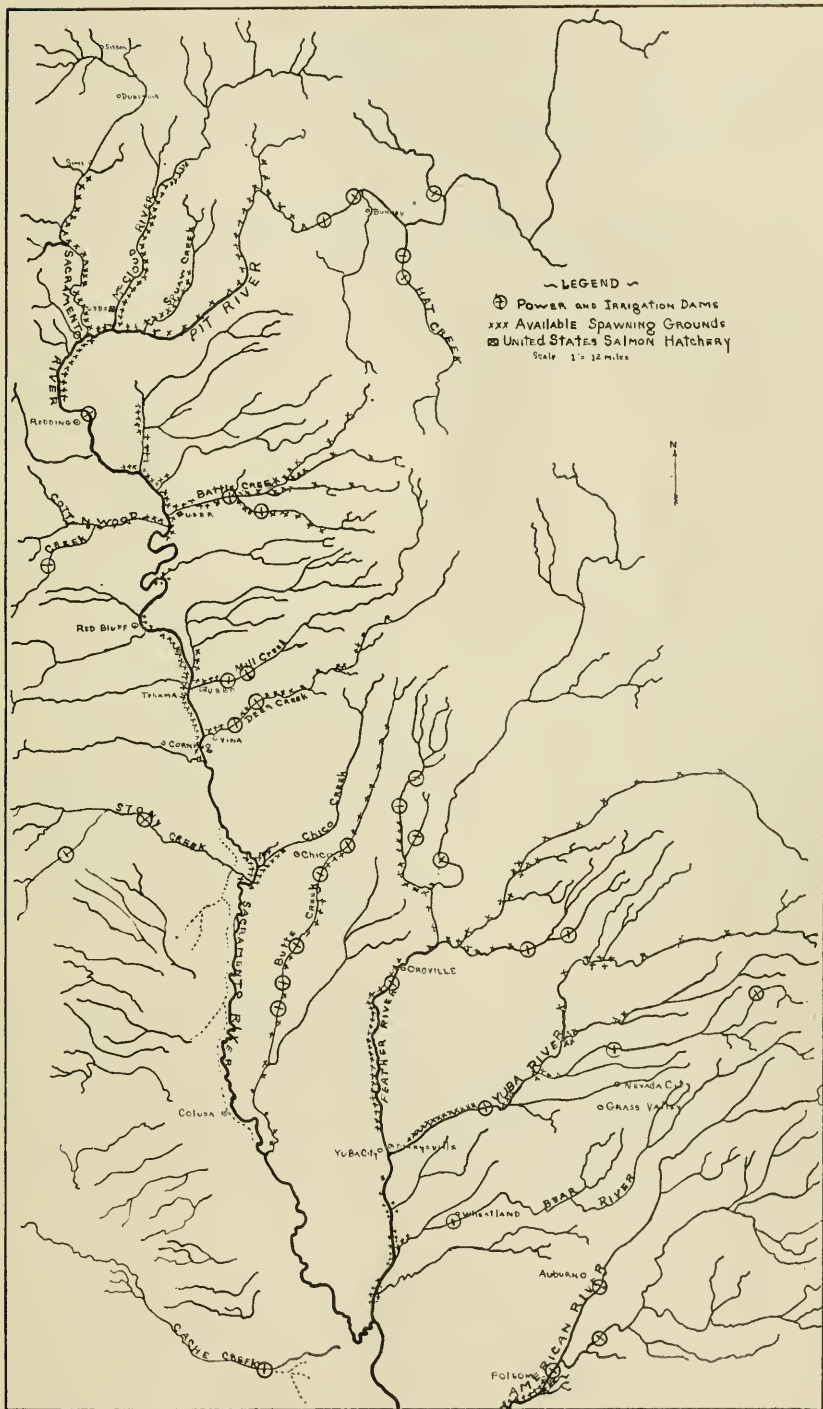


FIG. 4. Map of the Sacramento River above the city of Sacramento, showing power and irrigation dams and available spawning grounds for salmon.

Information as to the available spawning grounds in the Sacramento and San Joaquin river systems had long been a need, in order that a comparison of the spawning beds of early years might be made with those of the present. With the above in view, an investigation of the spawning beds of the Sacramento and San Joaquin river systems was started. In connection with this investigation, the obstructions in the streams had to be dealt with, also observations made of fish ladders and screens and their success in operation. Such a survey or investigation as this has been difficult to pursue and has necessitated a great deal of traveling and personal observation, as well as personal interview work among the residents of the sections in question.

Herein are presented the important results of the investigation. The accompanying maps of the Sacramento and San Joaquin rivers will show the location of the spawning beds and of the obstructions that are a detriment to the fish. It has been determined by this survey that 80% of the spawning grounds of the salmon in the Sacramento and San Joaquin river systems have been cut off by the obstructions of dams, both power and irrigation. Dams as an obstruction to adult salmon are not as important as they are as a destructive agent to the young descending the stream. As near as it can be calculated, there are now (1928) 510 lineal miles of stream in which salmon may, and some do, spawn, as compared to an estimated 6000 miles of spawning beds before dams were constructed. There are eleven dams in the San Joaquin system that are either a hindrance to salmon or a complete barrier. Of those in the Sacramento River system there are thirty-five dams which directly or indirectly affect the salmon migration. It has also been determined that the available spawning grounds do not support the amount of salmon they are capable of holding. The explanation of this fact is that when an impassable dam has been built in a stream, and no means provided to get the adults over or the young back, the run usually perishes, or a great part of it does. Each year they come against the same obstacles. Some survive and spawn. Their progeny will return and spawn in grounds below the dam; but in the process of getting the salmon accustomed to a new spawning bed, most of the run is lost. Consequently, we have the dam as another agency in depletion, as they cut off beds and deplete the runs.

In order that protective legislation may be passed, the facts as to the state of the fishery should be presented to the people and the legislature. A bulletin, giving in more detail the facts presented in this paper, it is hoped will appear soon. The salmon fishery in California is now at the point where something must be done and at once, in order that it may be preserved for future generations to enjoy. It might be said that it must be conserved so that we, ourselves, may enjoy it while we live. Unless it is conserved in a very few years, the salmon fishery will be nothing more than history.

WILD DUCK DISEASE*

By HENRY VAN ROEKEL

An investigation on the duck disease this year has been started by the Fish and Game Laboratory at George Williams Hooper Foundation for Medical Research, University of California, San Francisco, California.

It is reported that the duck disease has been observed for the last twenty years. Apparently from the information at hand the malady confines itself to shallow water areas, and the fall of the year. According to recent information, losses among waterfowl, largely ducks, have occurred this year in Arizona, California and Idaho. Since clinical studies and autopsy findings are missing, it is impossible to state whether all these losses are due to the same cause. The telluric and aquatic conditions and the general descriptions given by those who have seen sick birds are quite similar in the places in which the disease has been extensively studied.

In California, during the past year, the disease has been observed at Tule Lake (Modoc County) the first week in September. The water in this lake is very shallow, and at places the mud bottom rises above the water. During the dry summer months very little water flows into the lake. A greater part of its basin has been reclaimed and cultivated. Part of the lake was surveyed as to the number of apparently normal and sick birds. Sick birds were collected on the water, some were autopsied immediately and others were taken to the laboratory for further observation and examination.

During the second week of September the duck disease appeared at the duck clubs near Delano, California. Here the conditions were not identical with those at Tule Lake. The duck ponds were adjoining the old Tulare Lake bed. The country is very level, with clay-like soil and little vegetation. The water supply comes from nearby wells. The water change in the ponds was slow and the depth about eighteen to twenty-four inches. Although the telluric conditions differed in many ways, the findings made thus far revealed no difference between the sick birds from the two affected areas.

Many opinions have been advanced as to the cause of the duck disease; unfortunately they are based on casual observations and incomplete investigations. Some observers have propounded the theory that the disease may be prevented by avoiding shallow and stagnant bodies of water for wildfowl. This may or may not be the solution in the end. With no proof for this, and meager experimental evidence, the important problem suggests a thorough and systematic investigation as to the nature and source of the cause. With this in mind a scientific program of field and laboratory experiments has been outlined and the work to execute it is now in progress.

Field studies were conducted at the Hollywood Duck Club near Delano. The nature of the experiments were such as to determine where the cause of the trouble might exist. Two screened enclosed pens, each containing thirty birds, were placed on the ponds. The birds were fed barley and milo-maize. Thirty birds were also placed in an enclosure on land. These were fed pond water and no fresh

* The research staff expresses its sincere appreciation for the cooperation received from gun clubs, the patrol force and others in this investigation.

water. Since no normal wild ducks were available at the time, it was necessary to employ ducks which had recently recovered from the sickness. Body temperatures and recovery records on sick birds were taken. The field work covered a period of six weeks. No definite conclusions can be deducted from the results at this time, since the microscopic study of the collected pathological specimens has not been completed.

Reports have been received that the disease had ended at Tule Lake about the latter part of October. At the duck clubs few sick ducks were found after the first rain on November 11 and 12. Weather changes, such as rains and decrease in temperature, apparently had a marked influence in arresting the malady.

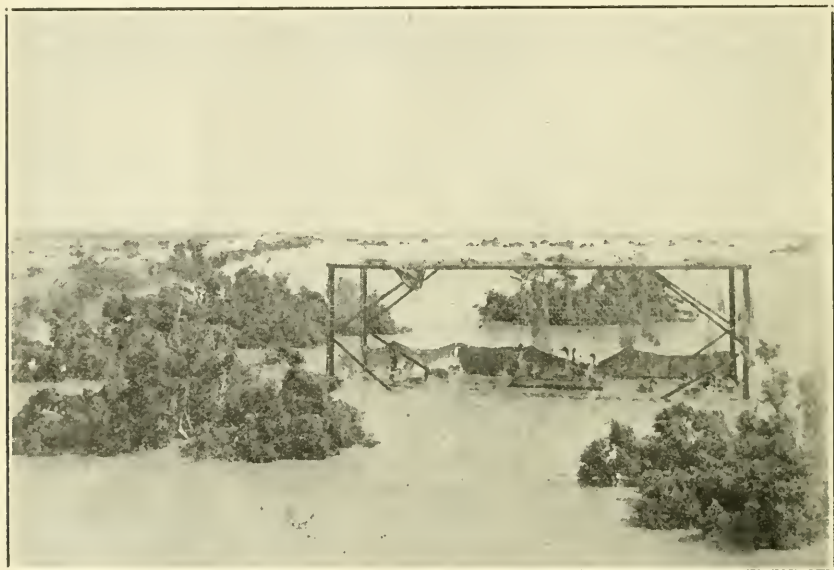


FIG. 5. An experimental pen of ducks on the Hollywood Duck Pond. Hollywood Gun Club, Kern County, California, 1928. Photograph by E. S. Cheney.

The investigation will be continued through laboratory experiments on trapped normal ducks. It is hoped that the results will either prove or disprove certain phases of the duck disease. The progress of this work is greatly retarded because it is very difficult to duplicate natural conditions at the laboratory. Hence, any results that may be obtained by laboratory experiments will have to be repeated under natural field conditions as soon as the disease reappears in California.

It is needless to emphasize that the conservation of the waterfowl is markedly affected by the duck disease. At the present time relatively few suitable nesting and loafing areas absolutely free from the malady can be found in California. More water areas are being taken away from the birds each year by agricultural and industrial enterprises. A committee on game refuges has been appointed to correct, if possible, such conditions as exist in order to assure a safe and suitable refuge for waterfowl. However, little progress can be made until the origin and nature of the duck disease has been established.

THE STATUS OF SALMON IN CALIFORNIA

By N. B. SCOFIELD.

Are We Going to Save the Sacramento River Salmon?

While our fisheries as a whole are in a healthy condition, it can not be said that our oldest fishery, that of the salmon, shares this condition. The most important conservation problem having to do with fish or game in this state is that of saving what is left of the salmon.

We have repeatedly called attention to the fact that the salmon of the Sacramento River are not being given sufficient protection and that this valuable natural resource of the state is fast being destroyed. The legislature has been told that if these salmon are not given more protection they will soon become commercially extinct. We have pointed out that the run on the river is only 5 per cent of what it was twenty years ago; that the hatcheries on the river can not obtain enough eggs with which to run them at even 10 per cent of their capacity. At each session of the legislature for the past twelve years, the Fish and Game Commission has sponsored bills which would have given these fish at least a measure of the protection needed, but in no instance was it possible to get more than a very small portion of the protection asked for.

At the last session the Commission was sponsor for a bill which would have eliminated sea trolling for salmon. It was pointed out that the salmon supply had been so diminished that to fish for them, both in the sea and the river, was fast destroying the supply, and to save the remnant that was left, one or the other method of fishing should be stopped. As the river fishing has more to commend it than the sea trolling, we proposed that trolling be stopped.

The measures embodied in this bill were indorsed by the Associated Sportsmen's Clubs and included a prohibition of all salmon spearing. For a number of years salmon spearing had been stopped in all but the extreme northern half of the state. When the several salmon bills came up for consideration before the Assembly Fish and Game Committee this bill was not given a hearing and it had to give way to a bill sponsored by San Joaquin Valley sportsmen's clubs, member clubs of the state organization but whose only desire was to have the law changed so as to permit salmon spearing in their part of the state. Instead of advancing, we took a step backward. The committee consented to amendments for the purpose of confining spearing to a season when the salmon are in good condition to eat, and thus prevent the killing and discarding of fish which are not fit to eat although they may be of the greatest value for the purpose of reproducing the race. The committee also accepted amendments to prevent the spearing or killing of salmon on spawning beds, but it would not accept an amendment which, as a compromise, would have stopped sea trolling for salmon south of Mendocino County.

Due to the confusion caused by numerous changes in the bill as it progressed through the two houses and the two committees, in an effort to get spearing and angling seasons to suit the various desires of sportsmen in the different parts of the state, a number of errors entered into the bill. As a whole, the salmon law is now quite unsatisfactory in that it does not suit the sportsmen anglers and does not give more than

* This article appears in the Thirtieth Biennial Report, Division of Fish and Game, pp. 112-117.

a small part of the protection from commercial fishing which is needed if we are to save the Sacramento salmon from commercial extinction. When this salmon bill came up before the Senate Fish and Game Committee a very strong effort was made by Sacramento commercial fishermen to have the fall season extended to permit them to catch more fish on the claim that the salmon are running later than a few years ago. The fishermen are honest in their conviction that the run on the river is getting later, but what appears to be a lagging of the run is not real but is due to serious depletion of the supply, during which the fish have become so scarce that it does not pay the fishermen to fish until a later time in the running season than formerly, when the fish were more plentiful. This is a well known phenomenon to fisheries investigators. See our article, "Is the Salmon Run Becoming Later on the Sacramento River?" The committee listened to our plea and refused to extend the season.

Commercial fishing on the Sacramento and San Joaquin rivers must not be entirely blamed for the present scarcity of salmon on these rivers. In the past years the fall season for commercial salmon fishing on these rivers has been extended at two or three different times to a later date on the claims of the fishermen that the fish were running later. It was not recognized at the time that what appeared to be a gradual retarding of the run was the effect of serious overfishing. Four years ago we were able to get the closing date of the season put back from September 25 to September 17. That date is not early enough. It should be not later than September 7. There are other causes which explain the growing scarcity of salmon on the Sacramento River. The chief cause is the building of power and irrigation dams which can not be surmounted by salmon. It is estimated that fully 75 per cent of the former area of suitable spawning beds have been shut off from the salmon. The silt from placer mining ruined most of the Sierra streams for salmon. Unscreened irrigation ditches have in the past taken a large toll from the young salmon migrating to the sea and this loss has not yet been entirely stopped. As the reproduction of the salmon was cut down by these factors the commercial catch on the river should have been cut down in proportion. But it was not. Then later the sea trolling for salmon grew to be important, being first developed at Monterey and later outside San Francisco harbor. The troll catch of some years exceeded five million pounds on Monterey Bay and that, coupled with the catch off San Francisco, equaled, roughly, the catch on the Sacramento River. Due to this large troll catch, which was largely made up of Sacramento salmon, the total catch on the river was greatly reduced. If this great added drain on the Sacramento salmon supply by troll fishing was to be permitted, the fishing seasons on the river should have been cut so as to compensate for it, but this was not done—just as in the same way nothing much had been done in the way of curtailing the river catch to compensate for the damage done by dams, placer mining and screenless irrigation ditches.

The troll catch in Monterey Bay is now only about ten per cent of what it was a few years ago. The number of salmon escaping the nets and reaching the spawning grounds, as evidenced by the number of eggs the Sacramento spawn-taking stations are able to take, is only 5 per cent of what it was twenty years ago. The total catch of salmon, including the Sacramento River and the troll catch in the sea from

Monterey to Mendocino, is less than one-third of what it was ten years ago. All of this is sufficient evidence to convince the most skeptical that we have only a remnant of our former salmon supply left, and that nothing short of drastic measures will save the small remnant that remains.

Is the Salmon Run Becoming Later on the Sacramento River?

It is generally believed by fishermen that the salmon run on the Sacramento River is becoming later and that for that reason the open commercial season for netting should be extended to a later date. They believe that when the season now closes, on September 17, the run is just getting good or that the best part of the run has not yet arrived. The run does have the appearance of becoming later, but in fact it is not later. The appearance of being later is due to the serious depletion of the river's salmon population, as I will attempt to show.

This appearance of a retarded run is a phenomenon which is not peculiar to the Sacramento River alone. It has been observed on other salmon streams in this country and on some of the salmon streams of Scotland. There may be two runs of salmon on a stream, as on the Sacramento, a summer and a fall run. These two runs are made up of the same salmon species. The summer run is always the smaller and is made up of individuals which come in earlier than the main run. On a stream with two runs, the fishing is poorest during the summer run because there are fewer fish in the river then. This summer run may be so light that it does not pay the commercial fishermen to fish. As the supply of salmon in the streams is depleted, the summer run is the first to be reduced to a point where fishing does not pay. It is a well known fact that this summer run is the first to show the effects of overfishing. Salmon streams in Scotland are called "early rivers" and "late rivers," the early rivers being those with spring and fall runs, the late rivers those without the spring run. W. L. Calderwood, the Scottish authority on salmon, has the following to say about the effects of overfishing.

After speaking of the reappearance of spring fish in a stream which has been given protection against pollution and overfishing, he proceeds:

"In other cases where serious overfishing has been allowed to continue, rivers have naturally acquired a late character. With overfishing, or other causes of reduction of breeding stock, the first class of fish to disappear is the spring run."

Overfishing, pollution of the stream by factory waste or destruction of spawning beds by the erection of impossible dams affect both the early and late runs, but the early run, being the smaller, is the first to reach the low point where it does not pay to fish. As this summer run begins to fail, some of the fishermen do not fish until the later fall season, and the belief arises that the salmon run later.

We have this same appearance of the run becoming later in the fall run itself. The runs do not come into the rivers suddenly. A run starts by a few fish arriving, and the run gradually grows in proportions over a period of several weeks or months until the peak is reached. After the peak is reached, the run quickly subsides and is soon over. For this reason, when serious overfishing is taking place, the peak and conclusion of the reduced run will remain fairly constant in time, but the time at which profitable fishing begins during the early stages of

the run comes later and later, as the salmon supply is reduced. This is exactly what is happening on the Sacramento River. The run is not later. The profitable fishing is later but the conclusion of the run is not later.

A number of years ago the Sacramento season closed on September 16. The Fish and Game Commission and the legislature were convinced by the fishermen that the salmon run was growing later and that too large a portion of the run was protected by the closed seasons. Therefore, the open time was extended five days and a few years later again extended to September 25. It was then observed that before September 25 arrived all the salmon had arrived and the last stragglers, or so many of them as were not caught by the nets, were well up the river. The fishermen on the lower salmon fishing grounds found that there were no salmon to catch as the run was over. Therefore, before the season closed, they would move up the river with their nets and the last remnant of the run was subjected to the intensive fishing of the combined commercial forces of the bay and the river. The closed season, theoretically designed to let at least one-third of the run pass up the river unhindered by nets, was not freeing any portion of the run from the destruction of the nets.

It took years of effort to get that closing time back to where it was. In fact, it never has been gotten back to where it was. It closes one day later, on September 17. The season should close one week earlier than it does now, if we are to continue to have a Sacramento commercial salmon fishery. The fishermen are seeking to have the season close again at a later date. The object, of course, is so they can take more salmon. They still use the argument that the run has become later. I hope I have made it clear that where it appears the run is later, that is due to the serious depletion of the salmon supply. What we need is enough protection for our salmon that the run will have the appearance of becoming earlier.

Klamath River Salmon.

It is being claimed, by sportsmen mainly, that the salmon run in the Klamath is being destroyed by the commercial salmon fishery on that river. There is also complaint from the same source that the steelhead run is being destroyed by the nets and it is proposed to close the river to commercial fishing. I do not wholly agree with these charges, nor do I agree that the river should be closed to commercial fishing. As the conditions on the river, in relation to the commercial fishing, are so generally misunderstood, I propose to review briefly the recent history of the fishery on that river.

Prior to 1913 the salmon seasons for the Klamath were the seasons adopted for the Sacramento and did not fit and were not enforced. It was lawful to net steelheads on all of our northern streams, as is still the law on most of the streams of Oregon and Washington. In 1913 the present fall salmon season was adopted and the commercial fishing was confined to a tidewater district extending up the river about six miles. A short open season was also provided during part of the time the spring run of salmon was on; and a few years later, during the war, a season from September 30 to November 1 was opened to permit the taking of silver salmon which enter the river later than the chinook run.

In 1913 there were three salmon canneries on the river. A year or so later the number was reduced to one and that has been the only cannery on the river since, unless we count the two or three small, portable canneries termed "sportsmen's canneries" because they can salmon and steelheads which the sportsmen catch. Under the law of 1913 the chinook salmon run on the river increased, as was evidenced by the increased commercial catch coupled with an increasing egg yield at the Klamathon station many miles up the river, where the eggs were taken from salmon which escaped the nets or passed up during the closed seasons. The fall chinook season closed on September 6, and it was believed that a sufficient portion of the run entered the river after that date to spawn and maintain the supply, even if all the salmon entering the river during the open season should be caught. This belief was later justified by the decided increase in the number of salmon in the river.

At that time, there was no sea trolling for salmon in that part of the state to act as an added drain on the river's salmon supply. The highways were yet so poor that it was not profitable for the San Francisco fresh fish markets to draw on the river's supply of fish. Under these conditions, the fish supply of the river was actually being built up. Later came the development of a salmon troll fishery out of Eureka, whose field of operation gradually extended to the north until the Klamath's salmon were being caught in large numbers off the mouth of the river. The improved roads have not only opened the river up to sportsmen and subjected it to heavy fishing, but they have made it possible for fresh fish markets to send buyers to the river and to truck out the salmon and steelheads. The scarcity of salmon in California, due to the failing runs at Monterey and on the Sacramento, has added to the zest with which they are sought in the Klamath and in the sea outside the mouth. The chinook run in the river has begun to show signs of depletion. I am convinced that sea trolling is the principal cause of this depletion and that the salmon in the river would have held their own if it had not been for the development of the sea trolling off the mouth of the river.

A number of conservation measures have been passed by the legislature for the regulation of commercial fishing on the river. About six years ago the spring salmon open season on the river was done away with. Four years ago the late silver salmon season was taken out of the law, and it was made unlawful to take steelheads in nets or to sell steelheads which have been taken any place in California. At the same time, to prevent steelheads from being taken by the gill nets being used on the lower Klamath River for salmon, the minimum size of the mesh which may be used in the gill nets was raised from $6\frac{1}{2}$ to $7\frac{1}{2}$ inches. As the steelheads running between July 1 and September 6, the present netting season, are small, very few, if any, will be taken by the $7\frac{1}{2}$ -inch gill nets. These measures which have been adopted should allay any fear sportsmen may have had that the steelhead run on the river will be damaged. There is no need to stop commercial fishing on the river as far as steelheads are concerned. As for the salmon, they will get about all the protection they need from the action of the last legislature, which cut off two months of the troll fishing by providing a closed season extending to the first of June. I am referring here only to the

Klamath River and to trolling in the northern coast districts of the state, and do not wish to imply that the salmon are getting necessary protection in the rest of the state, for they are not.

It has been here stated that only 5 per cent as many salmon eggs can be taken now on the Sacramento for the hatcheries as was taken twenty years ago. There has been no such falling off in the number of eggs which are taken on the Klamath. For a number of years, an average of at least seven million young salmon a year have been planted in the Sacramento, which were hatched from eggs taken from the Klamath.

TROUT FISHING IN CALIFORNIA TODAY AND FIFTY YEARS AGO

By WALTER R. WELCH

It is said that "angling differs from fishing in that it is practiced not as a means of obtaining a livelihood but as a source of recreation and refining pleasure. It implies a certain degree of æsthetic culture, coupled with moral and religious susceptibility, and is thus pre-eminently the scholarly gentleman's pastime—the brainworker's diversion.

"The meditative, humane, unselfish nature of the angler is proverbial, his sympathetic disposition, his regard for the rights of others, his moderation in the pursuit of his sport. Angling may, therefore, be appropriately defined as a 'school of virtues,' in which, while the tendency to introspection and self-examination is decided, men learn also lessons of wisdom, resignation, forbearance and love—love for the lower forms of animal life, love for their fellow creatures and love for the God of Nature."

That is why when

"Nature calls and we long to go
Into the woods where the sweet pines grow;
Where the swift brook runs and the big trout play—
O'er the hills and far away."

Since at this time so much is being said and done regarding the depletion and restocking of trout streams and public waters of the state, it occurs to me that a review of the causes largely responsible for present conditions will offer a moral and discourage their repetition so that future generations may enjoy the sport of fishing for trout, and may practice the "art of angling" in California.

It was long and faithfully believed by observing fishermen that all of the trout, colloquially called "mountain trout," "brook trout," "rainbow trout," "salmon trout" and "silversides," which inhabited the waters of the coastal streams of California, were steelhead trout. It is now known that steelhead belong to a particular group of fish anadromous in habits. Their connection with the sea is not an incident, but a potent element to the reproduction, growth and development of the species, and these facts are now well established by scientific investigation.

Many present-day anglers listen with deep interest and great wonder to the stories dad and "old timers" tell of the great catches they have made and of the big ones that didn't get away, during the good old days when the lakes, rivers and streams of California teemed with trout,

salmon and other game and food fish. Reflecting on present conditions, and with a deep sigh, they wish that they, too, could enjoy such sport with rod and line.

In 1867 I caught my first trout in Alameda Creek, near Sunol, Alameda County. My first real catch of trout was taken from San Gregorio Creek, San Mateo County, in 1869, and for thirty-five years thereafter I annually fished the streams of this and Santa Cruz County, as well as many other streams within the state.

During all of these years the catching of steelhead trout was not confined to hook and line. Night fishing and the sale of trout was not prohibited. The season opened above tidewater on April 1, but one



FIG. 6. A catch of nineteen steelhead trout on the Rogue River, Oregon, in October, 1897. Catches similar to this were made in California prior to 1921, when a limit of five fish a day during the winter tidewater season was fixed by law. Photograph by W. W. Richards.

could legally catch trout in tidewater during the entire year. It was not until about 1905 that a creel limit was placed upon the daily catch of trout.

Prior to 1905 and the enactment of a law fixing the daily creel limit at 50 trout, a catch of from 100 to 300 trout taken from the coastal streams by one fisherman during the day was not unusual. A catch of a dozen adult steelhead trout, or from 20 to 30 so-called "grilse" (one- and two-pound steelhead trout) was not exceptional. I can personally vouch for, since I have seen catches of this kind made in the San Gregorio, Pescadero, Butano, Waddell, Scotts, San Lorenzo, Soquel and Aptos creeks in San Mateo and Santa Cruz counties, to say nothing of the catches of steelhead trout that were made in Paper Mill Creek,

the Russian, Gualala, Garcia, Eel, Klamath and other coast rivers and streams.

Between 1895 and 1905 fishermen who sold their fish frequently made catches of from 200 to 350 trout per day in the streams of Santa Cruz County. These fish were sold at Santa Cruz at an average price of about 1 cent apiece, the average price paid for adult steelhead trout being about ten cents per pound.

In April, 1900, I saw 600 (four to ten inches) steelhead trout that had been taken on hook and line from Soquel Creek in Santa Cruz County, by one fisherman during one day. I have seen as many as 27 adult steelhead trout speared by one fisherman in Butano Creek, near Pescadero, during one night. I recall a catch of 618 trout and 21 adult steelhead trout taken on hook and line by four fishermen during one day in the lagoon at the mouth of San Gregorio Creek, in April, 1887.

During the sixties, seventies and eighties, thousands of so-called "grilse" or "salmon trout" were caught by hook and line by fishermen fishing off "Meiggs Wharf," from the wharves all along the San Francisco waterfront and off the Oakland Mole. On any Sunday during the fall months of these years hundreds of fishermen could be seen all along the wharves of San Francisco Bay and the Oakland Mole fishing for steelhead trout. The rig used by these fishermen was similar to that used by smelt fishermen, being a bamboo cane pole, cork float, and hooks baited with mussel, pile or angle worms, and fresh shrimps.

During the seventies and eighties I was able to take many a creel of nice trout from San Mateo, San Francisquito, Adobe, Stevens, Los Gatos and other streams in the Santa Clara Valley. Among the fishermen who fished for steelhead trout in the streams of the Peninsula and along the coast within 100 miles of San Francisco from the sixties to the nineties were Alex and James Butchart, Al Weeks, Al Goldson, Harry and Ed Thompson, "Stor" Armas, Dave Mills, P. P. Chamberlin, Lon Cook, Charley Green, Tom McLaehlan, John Benn, John Butler, Al Wilson, J. P. Babcock, M. L. Cross, Ed Jenney, Harry Green, Ted and Bert Blanchard, "Bootsie" Griffiths and many others.

While the majority of these fishermen found their sport in fishing for adult steelhead in the lagoons at the mouths of the streams, Ed Jenney, Harry Green, Ted and Bert Blanchard and "Bootsie" Griffiths fished the streams of Santa Cruz County. Their outfit consisted of a light cane pole, a spool of linen tread which they used as a line, and a few snell hooks, sizes 7 to 9. With a few BB shot to be used as sinkers, and using sand fleas and angle worms for bait, they were able to exceed the catches, in both large and small trout, made in the streams by other fishermen.

While I have not had as much experience in fishing for rainbow and other trout native to the lakes and streams of the Sierra as I have had in fishing for steelhead trout along the coast, I have witnessed the depletion of trout in those lakes and streams. For years I had heard that the fishing for rainbow trout to be had in the Truekee River was not to be equaled in any part of the world, and that Lake Tahoe, Donner, Webber and Independence lakes teemed with trout of great size, but it was not until about 1902 that I was able to wet a line in those waters. In May of that year I went to Independence Lake,

where I saw four fishermen take one hook and line, and in a lawful manner, an average of 50 pounds of trout each per day. For several years these four men had made it a practice to go to Independence Lake each year during the months of April, May and June. Their daily average catch was 50 pounds of trout each, the trout being shipped from Corey's Station to Truckee, where they were sold for $27\frac{1}{2}$ cents per pound.



FIG. 7. A limit of steelhead trout ranging from $5\frac{1}{2}$ inches to $13\frac{1}{2}$ inches, caught on November 8, 1907, in the San Lorenzo River, Santa Cruz County, California. The fisherman is 13 years of age. During 1907 and 1908 it was unlawful to catch trout under five inches in length and to use fish eggs for bait.

For several years prior to the passage of the law which limited the daily catch of trout to 50 trout not to exceed 25 pounds in weight, not pounds but tons of trout were taken from Independence Lake during the months of April, May and June of each year, and were shipped and sold on the open market.

The conditions relative to market fishing for trout that prevailed at Independence Lake during these years also prevailed at lakes Weber, Donner and Tahoe and all along the Truekee River. I recall having stood on the banks of Blackwood Creek about 11 o'clock a.m. on a day in June, 1904, and in twenty minutes having counted no less than thirty adult trout pass a given point in that stream on their way upstream to their spawning beds. On the same day there were about twenty market fishermen in boats fishing for trout in Lake Tahoe off the mouths of Blackwood, Ward, McKinney and other streams that flow into the lakes. It is safe to say that during a number of years

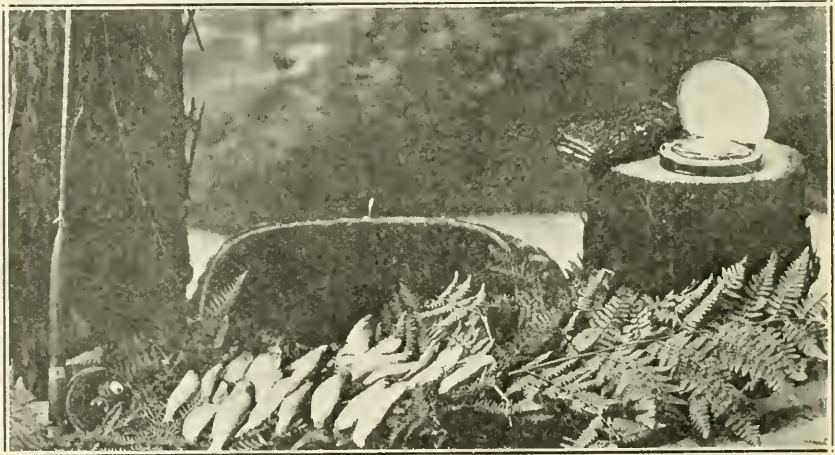


FIG. 8. Results of one hour with a fly on Soquel Creek, Santa Cruz County, California, in November, 1908. Photograph by Walter R. Welch.

before the law prohibiting the sale of trout in this state was passed, from one to two thousand pounds of trout taken from these lakes and the Truckee River were shipped daily and sold in the markets of San Francisco and other cities. The result was that the accessible lakes and streams of the Sierra, as well as those along the coast, were overfished and depleted of their once bountiful supply of native trout.

During the years mentioned anglers were known as "fishermen" and their rod and fishing outfit was referred to as "pole and rig." The reputation of being a fisherman was based on the number of fish one was able to catch, irrespective of size, how, when or where the fish were caught. The great majority, if not all, of the native trout caught during the months of April, May and June, and speared during the winter months, were either in a spawn-bearing, breeding or spent condition. What spring shooting did to our ducks and geese, this spring fishing did to our trout.

During the years of wholesale and oftentimes wanton fishing, those who angled with split bamboo rods, light tackle and flyhooks were

stigmatized as "sports." They were seldom to be seen on the streams in the spring months, and when they did put in an appearance were more or less sneered at.

It is needless to say that had there been more "anglers" or so-called "sports" and less "fishermen" during the early days, there would be more trout in the lakes and streams of the state today. The great majority of the old-time "fishermen" with pole, rig and spear have passed on and crossed the Great Divide. The "angler" with split bamboo rod, light tackle and flyhooks has now taken his place along the lakes and streams.

I am wondering if the anglers of today will be more considerate than the fishermen of yesteryear? I am wondering if the anglers of today will practice their art as a "source of recreation and refining pleasure," or will they be "fishermen" and continue the slaughter of spawn-bearing, breeding and spent trout during the spring months? I am wondering if the anglers of today

"With rod and creel will wander away
And cast a fly where the rainbows stay;
To feel the thrill when the game fish rise
And strike at the coachman flies."

or be "fishermen," and, using salmon eggs for bait, continue to creel fingerling trout irrespective of size.

Regardless of what the Division of Fish and Game may do towards restocking the streams and depleted waters, upon the answer to the above question rests the future supply of trout and the angler's opportunity to practice the art of angling in California.

GOLDEN TROUT PLANTING DURING 1928

By O. P. BROWNLOW

(With six photographs by F. A. Bullard)

There are more lakes and streams in the High Sierra of eastern Fresno County than in any other area of the same size in the State of California. The fact that most of these waters have continued barren of fish life has caused comment by the many tourists and campers who annually visit this wonderland, and has brought criticism of the Fish and Game Commission for its neglect to develop this important region.

With the idea in mind that some day this country would be the playground of thousands, A. D. Ferguson, who was in charge of the Fresno division in 1914, planned and directed the first pack train that transported golden trout from their native home in Tulare County to these barren waters. As time and money and the long distance these fish had to be transported on mules would not permit of an intensive plant, the fish were placed at strategic points. It was hoped that later, if the trout thrived, they could be distributed throughout the surrounding country and ultimately all this vast area would become a fisherman's paradise.

The writer was with the party that carried and planted the first golden trout in barren waters of the San Joaquin watershed. On August 24, 1914, our pack train of twenty-six animals crossed Piute Pass with trout taken from Golden Trout Creek in Tulare County. Having planted most of our load on the east side of the Sierra in Inyo County, we could only make a few small plants in Fresno County. On

this trip a small lake near Desolation Lake and French Canyon were planted. On August 25, 1914, Deputy F. A. Bullard and myself planted Marie Lake and the headwaters of Bear Creek. Less than 200 trout were available to make the plant.



FIG. 9. Pack train laden with golden trout at Muir Pass, Fresno County, California, August, 1928. Photograph by F. A. Bullard.

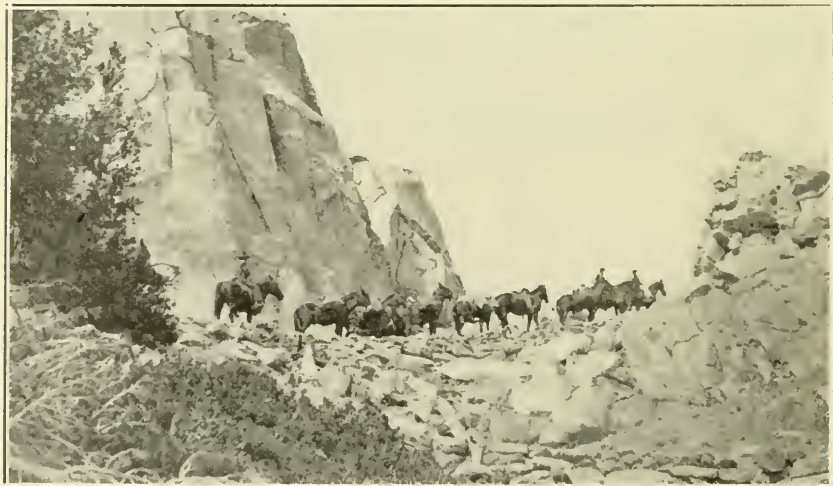


FIG. 10. Extending the range of golden trout. Seldon Pass, Fresno County, California, August, 1928. Photograph by F. A. Bullard.

From 1914 until 1928, there was no intensive planting of golden trout in this area. In 1928, Executive Officer Eugene D. Bennett, after a survey of conditions, approved the request that another pack train be placed in the field to further distribute these fish.

On July 1, 1928, Deputy F. A. Bullard, in charge of a crew of three assistants and eleven head of animals left General Grant National Park for Kennedy Canyon, where the first camp was made. From this camp 17 plants, totaling 1308 trout, were made in barren creeks and lakes. (See Map No. 1.)

On July 15 camp was moved to the head of Bear Creek. From the camps on Bear Creek and French Canyon, 89 plants were made in barren streams and lakes from Minnow Creek on the north, a tributary of Fish Creek, which empties into the middle fork of the San Joaquin, to Kennedy Canyon on the south, a tributary of the middle fork of the Kings River, a distance of approximately forty miles. The smallest plant was 20 fish and the largest 250. The total number of fish planted in this area was 6967. (See Map No. 2.) It should be borne in mind that all these fish were taken from waters planted to golden trout in August, 1914.



FIG. 11. Stocking a barren lake with golden trout. Evolution Lake, Fresno County, California, August, 1928. Photograph by F. A. Bullard.

Some of the lakes planted may not contain enough food for trout or may be lacking in other biological factors, but the fish will drift downstream to more suitable water. Thus, it is expected, there will be but slight loss.

All these plants were made according to spawning ground conditions. For instance, Hilgard Creek, a beautiful barren stream of water, having abundant spawning beds, received, in six plants, 369 fish so that it would be built up quickly.

Evolution Creek and the lakes of its headwaters were planted the heaviest, eight plants being made with a total of 1052 fish. This is one of the finest streams in the Sierra and has very few, if any, fish in it above the falls. Other smaller streams and isolated lakes received only from 20 to 50 fish.

Many wonderful lakes, such as Italy, Rose, Desolation, Murial, Evolution, Wanda, Martha, State, Horseshoe and Volcano, as well as many

unnamed lakes, were included in this year's plant. Lake Helen near Muir Pass, 11,612 feet, was one of the highest lakes planted, though many were over 11,000 feet in altitude.

All the fish planted this year were taken by hook and line, using barbless hooks or hooks with the barb filed off. This is the first time barbless hooks have been used by our fish planting crew and the results are so satisfactory that their use is recommended in future work.

The fish taken this year averaged from five to eight inches in length. Four of the pack animals were equipped with specially constructed pack cans known as the "Ferguson can." This can is so constructed that it fits on the side of the mule. It holds about six to eight gallons of water and will carry from 30 to 200 fish, depending on the distance and size of fish to be moved. These cans are covered with four thicknesses of burlap which, when wet, keeps the water in the cans at an even low temperature. The fifth set of cans was of lighter construction, built with knapsack straps and used to carry fish to points that could not be reached with pack animals.



FIG. 12. Trout-planting crew fishing for golden trout in Bear Creek planted in 1914. Bear Creek, Fresno County, California, August, 1928. Photograph by E. A. Bullard.

Considering results obtained and the benefits that may flow from these plants in the future, the cost of the whole summer's work was very small. They are as follows:

1 deputy, 2 months at \$160-----	\$320 00
3 assistants at \$85, 2 months 9 days-----	580 75
11 head of stock at \$1 per day, 71 days-----	781 00
Food, horse feed, etc., approximately-----	300 00
Total-----	\$1,981 75

If we may use the results obtained from plants made in 1900, 1910, 1913 and 1914, we are safe in saying that the greater majority of these fish will live and, as they were all adult trout, will spawn next season, which means that at least 3000 fish will deposit an average of 200 eggs

next season, or approximately 600,000 eggs. If only 10 per cent of these eggs hatch and reach maturity, we can say that the area planted is well stocked.

Deputy Bullard and his assistants have set a record in catching and transporting golden trout. In the seventy-one days from the time of leaving to the date of return they caught and planted in 106 different places a total of 8350 golden trout. They are entitled to a great deal of credit for such efficient work.



FIG. 13. Stocking Slide Canyon Lake, a barren lake, with golden trout. Slide Canyon, Fresno County, California. Photograph by F. A. Bullard.



FIG. 14. Four hundred golden trout were placed in this lake in 1928. Salt Lake, Fresno County, California, July, 1928. Photograph by F. A. Bullard.

The opening up of our mountains by means of state and federal roads, the building of roads by lumber and power companies, are causes that have contributed to the decrease of fish in streams and lakes that in 1914 were considered isolated. The trail from Blaney Meadow to the head of Bear Creek in 1914 was a dim path used only by cattlemen and an occasional camper, but when Deputy Bullard returned in 1928 he found this dim trail gone and in its place the John Muir Trail, the boulevard of the High Sierra. This trail passes through Seldon Pass and down Bear Creek. What will the next fourteen years bring? Certain there will be increased numbers of fishermen each year.

To meet the demands for fishing that we may reasonably expect in the future, this work with pack trains in the High Sierra should be continued. It will take at least another year to assure good stocking of the area covered by this report, and there will still remain much more work to be done. From Yosemite, on the north, to Sequoia National Park, on the south, a distance of 150 miles, there stretches a great wilderness where virgin nature reigns supreme. As wilderness areas become steadily scarcer and more prized for their recreational values, this area is destined to become a great American playground. Delay in stocking it now will only increase the difficulties and expense of introducing suitable fish in the future. Further, experience in transplanting golden trout has shown that the range of this fish can not be extended if the supply is taken from water heavily fished.

THE CRAB FISHERY OF MONTEREY BAY, CALIFORNIA

Catching the *Cancer magister* with Nets

By GEO. ROGER CHUTE

During the ten-year period between 1917 and 1928 the Monterey Bay crab fishery experienced two great fluctuations—the first a swift five-year decline, the second an even more rapid five-year rise. These trends, say the fishermen, tell the story of the failure and disappearance of one type of crab tackle and the later adoption of an entirely different mode of fishing which threw open to the crabmen areas of rich and virgin grounds where they had never been able to work before. But to an understanding of what took place there some knowledge of the local geography is necessary:

Monterey Bay is a mud-bottomed bight, indented, like a great horse-shoe, in a coast of rocks and cliffs. Just within the bay's north eape lies the little cove of Santa Cruz, and directly opposite, inside the south cape, in a corresponding position, is Monterey. Seaward from both towns the shore is rocky and the land high, but in the opposite direction, inward toward the bay, the bottom is smooth mud, the shore is sandy beach and the land makes off at low levels.

The fishermen of the bay, therefore, have at hand two entirely dissimilar water areas in which to operate, and it would be surprising indeed had the unlike nature of the bay and the Pacific Ocean not produced special adaptations of gear and tackle to meet the variances in working conditions which the two present. The modification of apparatus to meet diverse situations, and to overcome complex combinations of natural obstacles, has as one of its most conspicuous examples the gear used in the crab fishery.

The ports of Santa Cruz and Monterey, on Monterey Bay, are the most southerly contributors to the commercial catch of the king crab or *Cancer magister*. Although in distribution this crustacean is known to extend from Alaskan latitudes to Point Conception, it is not taken for market purposes south of the range of the Monterey boats. Both Santa Cruz and Monterey always have caught small but regular quantities of crabs, but never, until recent months, such tonnages as to affect, in a large way, the total for the state.

Crab-catching by the fishermen of both Santa Cruz and Monterey seems to have been practiced from early times. The gear originally utilized was the same as that used generally throughout the state, and was of the sort that is employed at the present time by the fishermen of San Francisco and more northerly ports. This tackle is called a "hoop-net" or "hoop," and is a baited apparatus consisting of a single metal ring of several feet diameter, with cotton webbing hung to fill its interior area, and lowered by a buoyed line to rest in a horizontal position on the ocean floor. The bait is secured in the center of the gear, and usually consists of fish or fish heads. When hauled, the webbing bags downward, forming a depression or pocket which experience has shown to be suitably effective in preventing the escape of the crabs that have been induced to approach the "hoop," and venture upon it, by the water-borne scent of the lure.

The "hoops" of the pioneer crabmen were set among the kelp and rocks, close to shore, outside the heads of the bay, in the Pacific proper. Crabs were known to abound inside Monterey Bay also, because the early trawlers that swept the bottom there with paranzella nets often took considerable quantities of them in that fishing, but repeated experiments proved to the crabmen that the "hoop" apparatus was useless as a means of capture within the waters of the bay itself.

Continued fishing depleted the "outside" Pacific ledges until only one or two boats remained at the "hoop" work, say the older men. This practical cessation of activity took place, however, during the period of depression following the World War, at a time when industries of many kinds, and fisheries in particular, reflected the unhealthy state of the country by curtailed production. Whatever may have been the cause of the decline, the statistics of the fishery show that from a combined total of 30,000 pounds of crabs caught by Santa Cruz and Monterey in 1918 the catch dropped to 2000 pounds in 1921.

Repeated attempts were made by "hoop" fishermen to operate with their gear within the bay. But two circumstances combined to defeat their efforts. One of these is that such depths of spongy ooze lie upon the floor of the bay that the "hoop" sinks from sight and is entirely buried in it. It is the popular belief that this concealment is so complete that the traveling crabs are not able to locate the bait, and never enter upon the trap. The second difficulty arises from the bay's being infested with a species called "hag-fish," known to the fishermen as "eels." The crabmen describe the hag-fish as an exceedingly rapacious animal, which will eat its way into a fish caught upon a long line, or even imprisoned in the cod-end of a trawl, and consume it entirely from within. This inedible pest is so numerous that within a few minutes after setting a crab "hoop" it will have eaten the last particle of the bait, say the fishermen.

Men of northern experience, skilled in the use of the "hoop" apparatus, still occasionally come to Monterey to try their tackle there. One of the most recent of these was a Russian who came in 1927 from Eureka and San Francisco with a complete outfit of northern crab gear. His trial sets were made with eight "hoops," and resulted in the capture of not one legal-sized crab. Two of the sets yielded a few imma-

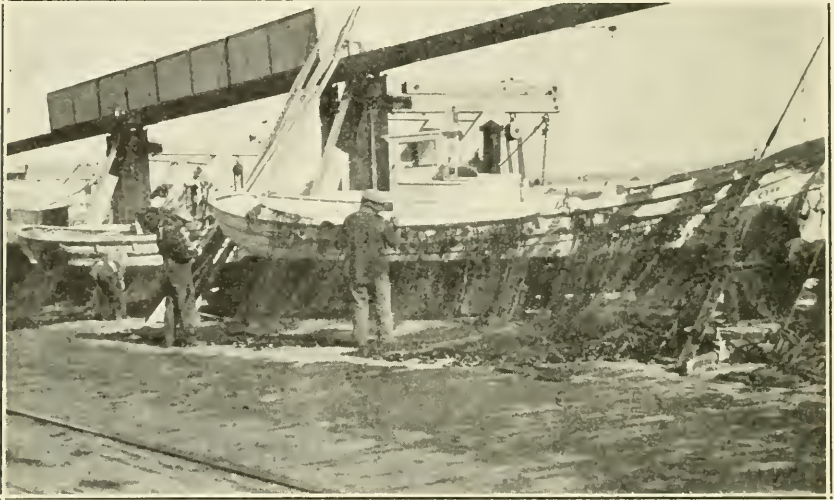


FIG. 15. Mid-day scene on the Municipal Fishermen's Wharf at Santa Cruz, California. Crab fishermen busy repairing the large-meshed gill nets. Photograph by George Roger Chute.

ture specimens; the others were entirely barren. The failure of the fishing was attributed entirely to the depredations of hag-fish. Notwithstanding that the baits had been covered carefully with two thicknesses of heavy burlap and then each enclosed in the customary basket of woven brass wire, the toothed "hags" had succeeded in gnawing an entrance, for the bait was entirely gone from six of the "hoops" and only a part remained in the other two. The Russian said that this attempt was made in twenty-one fathoms, in the same general locality where he now operates successfully with a different sort of gear. Since in the north his crab work had been done in six to sixteen fathoms, he decided to test shallower water, and did so. In six to eight fathoms he found that hag-fish did not interfere with operations, but that there were no crabs there, either.

The inability of the hoop-net fishermen to operate within the bay and the decline in productiveness of the rocky ledges of adjacent Pacific shore are cited as the reasons for the practical disappearance of crab fishing at the two Monterey Bay ports in 1921. Indeed, the year's catch at Monterey was exactly two dozen crabs! Santa Cruz landed only about 2000 pounds. But from that date until the present a swift change has taken place, the crab catch has greatly exceeded any in the past, and the Monterey Bay region has come to be a principal contributor to the total for the state. This happening is attributable to the employment of a new net apparatus, which has relieved the fishery from depending upon the "depleted" Pacific rocks by throwing open to exploitation the untouched areas of crab grounds inside the bay itself.

The crab net gear is of conventional gill net pattern, practically identical to and certainly the direct offshoot from the sea bass gilling nets still in common use in the kelp beds along the coast. Indeed, the modification of the sea bass apparatus for application to crab catching has been surprisingly slight. This will seem the less remarkable, perhaps, when it is remembered that various sorts of gilling gear set close inshore in Alaska often take quantities of *Cancer magister* or king crabs, and that south of Point Conception, in California, many spiny lobsters of all sizes are caught in the gill nets which fishermen place among the kelp and over the tidal rock ledges, ostensibly for the purpose of catching fish. It is hardly less than probable that the chance capture of large lots of crabs in sea bass gear was originally responsible for the first intentional use of the gill net as a crab-taking apparatus.

The Monterey Bay crab net is of 9-, 9½- or 10-inch mesh, light linen gilling twine. It is 40 meshes long by 18 deep, and measures approximately 30 by 13 feet. The foot-rope carries a disproportionately heavy load of oval leads threaded like beads upon it, so that the gear sounds quickly, the cork floats serving only to support the webbing in upright position on the bottom. Each net is provided with pennants or points for attaching to other segments or "pieces." It is the practice to tie together several nets in a "string" which is set on the bay's bottom like a strip of straight fence, the "string" being moored at each end with a dory anchor connected by a line to a floating buoy keg and a "marker" consisting of a flag-bearing bamboo staff about ten feet long. These buoys and markers are the only evidences visible on the surface

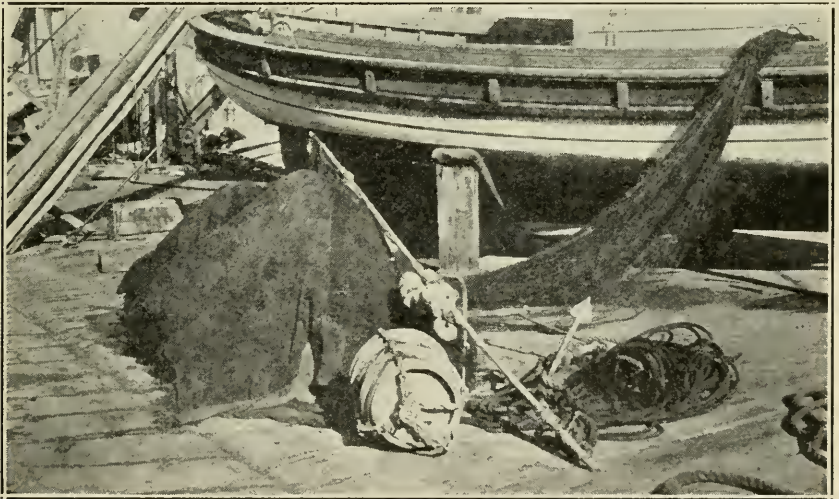


FIG. 16. Complete outfit of a Santa Cruz gill net fisherman. Photograph by Geo. Roger Chute.

to indicate the presence of the crab nets on the banks. It is the universal practice to paint this floating equipment in bright colors; this as an assistance to the boatmen themselves in locating their sets from a distance, and also for the sake of protective conspicuity, that the paranzella trawlers, who drag across these flats, may have warning to keep off the nest of anchors on the bottom.

The sets are made on the 20-fathom and 21-fathom shoals. Usually the fishermen will set a series of parallel "strings"—perhaps three, of three "pieces" each. The individual "strings" are run east and west, to the westward of Elkhorn Slough and the mouth of the Pajaro River. This is on a southeast bearing from the Santa Cruz municipal Fishermen's Wharf, or from Soquel Point.

In early 1928 there were 57 fishing boats registered at Santa Cruz, and an additional three at the neighboring anchorage of Capitola. A large proportion of this total of 60 boats, together with several additional operators from Monterey, fish crabs during at least a part of the season. The desultory operators sometimes work as few as two or three pieces of gear, but it is the testimony of the fishermen themselves that all crab boats making a serious business of the fishery carry an equipment of from 10 to 30 nets each. Only one-half of the gear is in the water at a time, the other half being ashore for purposes of overhauling and repair. From one to three men constitute a boat crew.

The boats leave Santa Cruz in the early morning, run to the grounds, pull their nets, set the repaired gear that they have brought from shore, and run back to port while disentangling the catch from the wet nets. Ordinarily the boats commence arriving at the wharf about nine in the morning, and by two in the afternoon the last of the fleet will be in.

The business of extracting a live and struggling crab from a fine linen net is an undertaking hardly to be appreciated by one not having tried it or at least witnessed it done. It would be hard to imagine an animal more completely wound up and ensnarled than the crabs which the fisherman finds "gilled" in his nets. All of the spiny corners and projections of their shell catch up the twine, and the leg joints especially become entangled until to extract the fighting prisoner seems a hopeless undertaking. But to meet this situation the fisherman has invented tools to assist him—implements looking very like the old-time, long-handled buttonhooks that our mothers used to have. With these hooks the crabmen can operate at a conservative range from the menace of gaping claws and continue with the patience-trying labor until he has the crustacean free. When the catch is heavy this is a long task, and one which is often finished on the wharf—sometimes with the assistance of the boatman's entire family.

The netters insist that their mode of fishing is not destructive of immature crabs, and that the undersized specimens which are returned to the sea are not so liberated in an injured condition or maimed to the extent of lacking one or more legs. The crabs do not hurt themselves while in the net, they say, and are usually entirely whole when removed. The leglessness so noticeable in the Santa Cruz catch results, they say, when the animals are released together in the bottom of the boat. Having been bound for hours in utter motionlessness, all of their energies have been preserved, and when, having been enraged by the untangling process, they are turned loose together, a free-for-all fight ensues that is a spectacle to behold. The crabs fly furiously at each other, like an arena full of raging gladiators. In the battle there are casualties to the extent of lost legs, but since the condition is one for which the fishermen have been unable to find remedy, the markets do not discriminate against crabs having missing members—in which regard the Santa Cruz dealers are more lenient than those of San Francisco, say the netmen.

Since the crab banks, where the nets are set, are in a remote and disused portion of the bay, the fishermen are spared that hazard to their gear which is always present when fishing is done directly in the path of marine traffic following the steamship lanes. No vessels have ever run amuck of the crabmen's set nets excepting on one or two occasions when San Francisco paranzella outfits failed to see the buoy kegs and the flags on the tips of the markers. In these instances the damage to the trawls by the nests of dory anchors was so severe that since that time the trawlers have stayed strictly away from the shoals where the crabmen are known to fish. However, a real hindrance to the business does exist, that being the daily damage done to the light weight twine by the sharks that blunder into it. Practically all of the repairs are made necessary by this cause.

The Monterey Bay crab catch has increased phenomenally, particularly of late. From the 2000-pound total for 1921 it rose to 50,000 in 1924 and then to 259,000 in 1927. During the first 90 days of 1928 the catch was 384,000 pounds, or 50 per cent greater than that for the whole year previous. Combining the last six months of 1927 with the first three months of 1928, the nine months' total is seen to attain the unprecedented sum of 511,000 pounds. How long the limited area of Monterey Bay can endure a drain of more than a half-million pounds of crabs a year is a question that can not fail to interest conservationists.

The Crab Catch of Monterey Bay

	<i>Santa Cruz</i>	<i>Monterey</i>	<i>Monterey Bay total</i>	<i>State total</i>
1918 -----	16,968	12,744	29,712	1,618,992
1919 -----	10,272	3,072	13,344	1,305,024
1920 -----	11,280	432	11,712	1,220,568
1921 -----	3,288	144	3,432	800,952
1922 -----	2,424	48	2,472	860,328
1923 -----	4,848	2,568	7,416	1,075,800
1924 -----	29,208	21,096	50,304	1,506,816
1925 -----	63,456	11,112	74,568	3,234,312
1926 -----	47,832	3,672	51,504	3,296,280
1927 (first 3 quarters) -----	130,224	1,248	131,472	2,251,360
1927 (last quarter) -----	127,512	336	127,848	773,952
1927 -----	257,736	1,584	259,320	2,960,352
1928 (first quarter) -----	372,768	10,944	383,712	1,367,184
1927 (last quarter) and 1928 (first quarter) -----	500,280	11,280	511,560	2,141,136

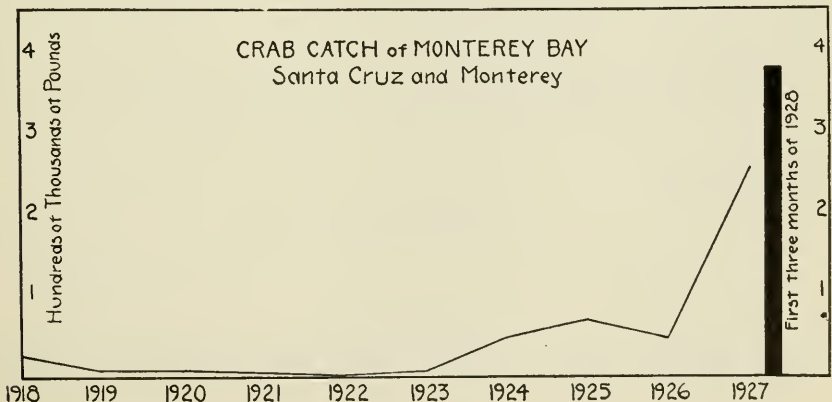


FIG. 17. The crab catch of Monterey Bay for the years 1918 to 1927.

SAN DIEGO TUNA INDUSTRY

By COBURN F. MADDON

The fact that San Diego is fast becoming the tuna capital of the Pacific coast is evidenced by the marked increase of boats and catches in the last fiscal year, there having been considerably more than a two-fold increase in the amount of tuna fish delivered in that time. This marked increase in the so-called "high seas" boats and catches has been brought about largely by a desire on the part of the fishermen to eliminate from their operating expenses the excessive Mexican duties. These were, during the summer of 1928, \$35.31 U. S. gold per ton on all scale fish, being assessed as follows:

Exploitation Duty

4c Mex. per kilo (2.2 lbs. U. S.), 1000 kilo (1 Mex. ton)-----	\$40 00 Mex.
10% federal tax -----	4 00 Mex.
$\frac{1}{2}$ % sales tax -----	20 Mex.
1000 kilo ton-----	\$44 20 Mex.

Exportation Duty

3c Mex. per kilo-----	\$30 00 Mex.
10% federal tax -----	3 00 Mex.
2% municipal tax -----	60 Mex.
	\$33 60 Mex.
	16 80 U. S.
Total duty -----	\$77 80 Mex.
	38 90 U. S.

One 2000-pound ton equals 907.6 kilos, which would figure out:

Exploit duty -----	\$20 06
Export duty -----	15 25

\$35 31 U. S. gold

This duty is too high and might be cut down if the assessments were made by the Department of Agriculture and Development (Secretaria de Agricultura y Fomento) only. It is claimed that, according to an act of the Mexican congress of January 7, 1925 (the law governing organization of members of the President's cabinet), the *only* department authorized to legislate and assess duties and taxes relative to the commercial fishing industry is the Department of Agriculture and Development.*

The Treasury Department of Mexico, in alleged violation of this act of congress which gives all authority to the Department of Agriculture

* On December 21, 1928, an official decree signed by President Calles became effective changing the Mexican Fish Tariff Act on Exploitation Duty, paragraph 87, to read as follows:

Exploitation Duty

2 $\frac{1}{2}$ c Mex. per kilo (2.2 lbs. U. S.) 1000 kilos (1 Mex. ton)-----	\$22 50 Mex.
10% federal tax -----	2 25 Mex.
$\frac{1}{2}$ % sales tax -----	11 Mex.
1000 kilo ton -----	\$24 86 Mex.
	12 43 U. S.

Exportation Duty

3c Mex. per kilo -----	\$30 00 Mex.
10% federal tax -----	3 00 Mex.
2% municipal tax -----	60 Mex.

\$33 60 Mex.

and Development to assess and collect duties, has placed in its tariff an export duty on fish and fisheries products in addition to the duty or tax already fixed by the department authorized to fix said tax or duty.

The principal reason the duty or tax on fish and fisheries products is so excessive and prohibitive is that the Department of Agriculture and Development taxes fresh fish, say, 4 cents Mexican per kilo, and the Treasury Department taxes this same fish, say, 3 cents per kilo; in addition to that a 10 per cent federal tax is assessed by both departments; a 2 per cent municipal tax is assessed on the export duty and a ½ per cent sales tax (renta interior) is assessed on the exploitation of Department of Agriculture and Development tax. Were these facts brought to the proper authorities through the right channels, calling attention to the fact that the Treasury Department tax is technically a violation of their own laws in taxing a commodity already taxed by the proper authorities, the present exploitation tax of \$16.80 per ton might be eliminated, leaving only the Department of Agriculture and Development taxes of \$22.10 per kilo, or \$20.06 per 2000-pound ton.

Another method suggested of reducing the present high duty is that of a sliding scale of duties which might be agreed upon. Low priced fish, such as skipjack, should not have the same duty as higher priced fish, such as yellowfin or bluefin tuna. The duty might be governed by the price of the fish when sold; if halibut sells for 8 cents per pound, have the tax a certain relative amount, and if it is 12 cents, add so much more. In other words, make the duty on an ad valorem basis.

In all fairness to the Mexican government, it should be said at this time that the main reason these duties have been raised is that Mexico City was not receiving the revenue that should have been derived from this source. This is due to two facts. First, in many cases the Mexican inspectors were tricked out of the duty on many tons of cannery fish by American fishermen by various methods, which decreased the income of the Mexican fisheries offices located in San Diego and San Pedro. Second, it is claimed by the Mexican government, and in some cases proved, that not all of the amount of the duties paid into those offices by American fishermen and packers reached Mexico City. Therefore, to secure a sum adequate to operate this branch of her government, the Mexican officials increased duties, in the hope of obtaining a greater per cent of income.

A sincere effort was made by Colonel Jose M. Tapia, while in charge of the San Diego office of the Mexican Fisheries Service, to get the Mexican export duty reduced to an amount that, when paid, would leave a reasonable profit for the fishermen. Colonel Tapia was more than fair in his dealings with the American fishermen, but in his

	16 80 U. S.
Total duty -----	\$58 46 Mex.
	29 23 U. S.
One 2000-pound ton equals 908 kilos which would figure out :	
Exploit duty -----	\$11 29
Export duty -----	15 25
	\$26 54 U. S. gold

As is shown by the above table this reduction lowers the total duty from \$35.32 to \$26.54, making a saving to fishermen of \$8.78 U. S. currency on one two-thousand-pound (2000 lb.) ton, and though this present duty is considered by the industry as fair enough for fresh market fish it is still considered too high on cannery fish.

apparently sincere efforts to put an end to the duty dissension by a reduction of the tariff, he was not successful, having met with opposition in Mexico City.

The full importance of this phase of the industry may be seen in the following statistics on tuna for the fiscal years 1926-27 and 1927-28,

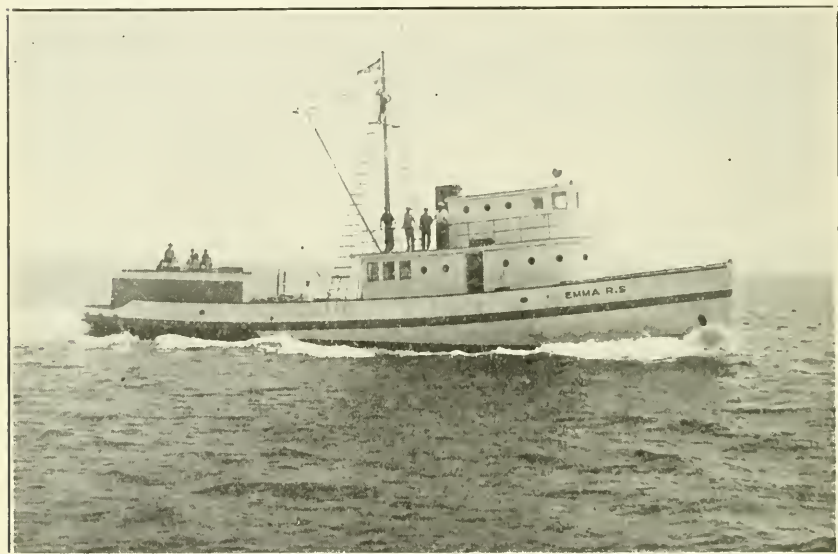


FIG. 18. The *Emma R. S.*, operating out of San Diego, California. A new high seas fishing boat having a cruising radius of 3000 miles.

there having been delivered at San Diego alone, mostly from south of the international boundary, 46,929,672 pounds of this fish as follows:

Fiscal year 1927-28	29,483,367 pounds
Fiscal year 1926-27	17,446,305 pounds
Increase	12,037,062 pounds

This increase of 6019 tons of cannery fish in the last fiscal year was brought about by the necessary addition to the San Diego fishing fleet of nineteen new boats (see appended list) at an expense of approximately \$958,000. These are all high seas, Diesel-type boats and are able to cruise to remote banks, as they have an average speed of $10\frac{1}{2}$ knots per hour and a cruising radius of from 2500 to 6000 miles. All are insulated with cork, being in effect huge refrigerators, and have bait tanks which will hold from four to six tons of live sardines and keep them alive for three weeks. In the case of the *Emma R. S.*, the bait tanks are also cork-insulated and may be used for storage of the catch in emergencies. These boats are equipped with either gasoline, crude oil or electrically powered auxiliary engines which operate the bait-well pumps, winches, light plants and other gear. The galleys are on the main deck and are most compact and complete. All are equipped with electric refrigerators and up-to-date plumbing systems. The crew, from eight to twelve men, have palatial, light, airy quarters, the equal

of many passenger boat staterooms. For such fishermen, the days of sleeping in dark, ill-ventilated cubbyholes are past.

In a way, this change from the old-style, small bait boats to these large fishing vessels will revolutionize the fishing industry. It is no longer necessary for canners to hold barges at Turtle Bay, Todos Santos and other points in Mexican waters off the coast of Lower California, for receiving fish to be delivered to the canneries by tender. This was always an expensive operation, necessitating handling the tuna at least four times—first, on the boat making the catch; second, from the boat making the catch to the barge receiving same for the packer; third, from the barge to the tender; and, fourth, from the tender to the floor of the plant canning the fish. Every step in the old way of handling bruised the meat just a little bit more. By the elimination of two of the most injurious of these operations—the time on the barges and icing aboard the tenders—the value of the catch is greatly increased and a big improvement is effected over the old, and what will soon prove to be, antiquated methods.

The new boats may hold the fish thirty days if necessary, and then deliver it direct to its destination. Because the fish has not been handled so much or exposed to flies and heat, as it was when held on the barges, the canneries will thus receive it in better condition. The new method will result in benefit to all concerned, from the fishermen

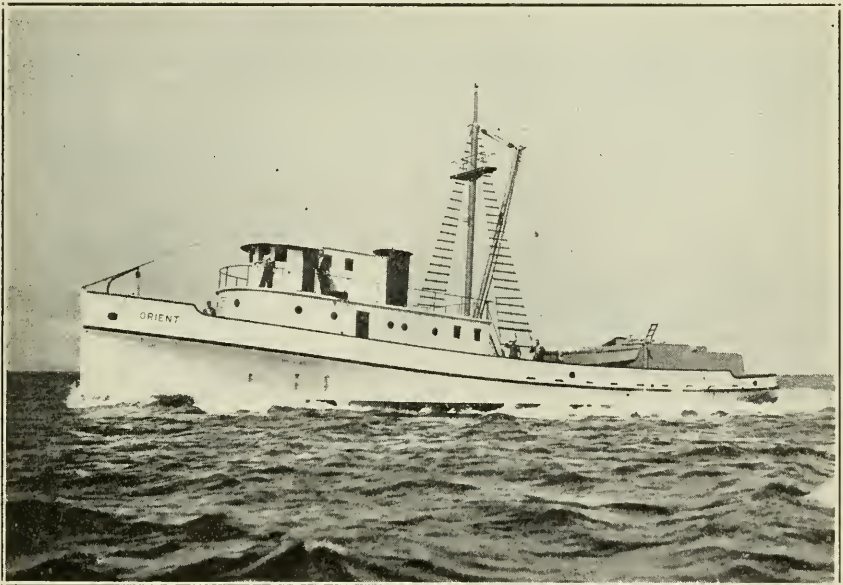


FIG. 19. A recent addition to the tuna industry of San Diego, California. The *Orient* has a cruising radius of 6000 miles.

who will profit because of elimination of duties and their ability to deliver a better product with no cut for spoiled fish, to the consumer who will receive a better pack from the canner at no increased expense. However, it will limit the operations of the small boat largely because of prohibitive duty and lack of fueling and icing capacity.

The two most outstanding boats of this new fleet are the *Emma R. S.* and the *Orient*. The former is electrically equipped throughout and has a short wave radio telephone and telegraph outfit. This will enable her to go places heretofore avoided by fishermen, due to danger in case of breakdown, since they were out of any steamer route and a chance of rescue was doubtful. The *Emma R. S.* may communicate with San Diego and other vessels at all times. Her forty meter signal outfit will keep her in touch with the time signals of the Arlington station, thereby assuring her captain, Guy Silva, the correctness of his navigation.

The *Orient* is the only all-metal fishing boat operating out of San Diego. It is captained by Joe Sousa, who may well be proud of his 113-foot steel fishing boat, which is decked over and whose gunwales are inlaid in wood to protect the fish from the heat of the metal in hot weather. Being built of steel, reduces her bulk and thickness of hull. It also permits thicker insulation and increased cubic space in cargo hold on the same wooden boat dimensions. She has the largest fuel capacity and bait-tank dimensions (50 tons water, and storage 150 tons of iced fish) of any of the boats her size. Further, being constructed of steel has reduced the fire hazard. She has a total of nine inches of insulation in her fish holds, seven inches of cork and two inches of wood, with only four inches inside the frame. This type of insulation on a wooden boat would take a total of sixteen and three-fourths inches, where the outside beam of both vessels is the same. This makes it unnecessary for the *Orient* to have as large an ice machine, thereby greatly reducing the amount of pipe necessary in its construction. This in turn reduces the weight of the ship, the amount of machinery and power necessary to run the ice and pumping machines, and lessens fuel consumption and cost of operation.

TABLE OF NEW BOATS FISHING FOR SAN DIEGO CANNERIES

Van Camp Sea Food Company

Name of boat	Captain	Built	Length, feet	Net ton	Engine	Cruising radius, miles
Emma R. S.	Guy Silva	San Diego	95	75	400 FM*	3000
Grey Hound	Manuel M. Medina	Sausalito	115	110	450 WE	3000
Glory of the Seas	O. H. Dickason	San Diego	117	141	400 U	3500
Funchal	Obilio C. Pires	Sausalito	115	126	360 AI	3500
Mariner	Joe Monise	San Diego	115	95	350 U	4500
Adventurer †	A. Felando	San Pedro	115	95	300 U	3000
Patriotic †	Y. Ryono	San Pedro	81	50	210 FM	3000
Sacramento †	Santo & Souza	San Pedro	115	95	400 FM	3500

Westgate Sea Products Company

Conte Verde	Laurie Massa	San Diego	80	52	180 WE	3000
Flying Cloud	T. Yamaguchi	Long Beach	108	129	360 FM	8000

California Packing Corporation

California	Manuel Silveria	San Diego	114	94	300 U	5500
Taiyo	N. Seki	San Pedro	114	112	375 WE	5500
Del Monte	Manuel Freitas	San Diego	90	53	225 U	3000
St. Veronica	John Cardosa	San Diego	114	94	300 U	5500

* Abbreviations of kinds of engines as follows:

- FM—Fairbanks-Morse (3).
- WE—Western Enterprise (4).
- U—Union (7).
- AI—Atlas Imperial (4).

† These boats are to deliver their fish to Van Camp's San Diego plant, according to Van Camp's San Diego manager, A. K. Johnson, who also gave me the net tonnage of the *Patriotic* and *Sacramento*; the net tonnage of the *Adventurer* being given me by the Campbell Machine Company, as the local custom house has no record of these three boats.

Cohn-Hopkins, Inc.

Name of boat	Captain	Built	Length, feet	Net ton	Engine	Cruising radius, miles
G. Marconi	M. Crivello	San Diego	85	65	200 AI	2500
Stella Di Genoa	Fred Canepa	San Diego	109	97	300 U	2500
St. Therese	Frank Silva	San Diego	110	99	375 WE	3000

K. Hovden Company

Point Loma	Manuel Perry	San Diego	95	75	350 AI	4500
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San Diego Packing Company

Orient	Joe Sousa	San Pedro	112	121	350 AI	6000
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Other new high seas fishing crafts operating out of San Diego are:

Abraham Lincoln	Milwaukee
Amour Da Patria	New Princess
Atlantic	Olympia
Betty B	San Antonio
Calpac	San Diego
Chesapeake	San Joaquin
Enterprise	Supreme
Lisboa	Uncle Sam
Lois S	Vasca Da Gama
Lusitania	

THE FOOD OF TROUT

By GEORGE A. COLEMAN

The more I study the data available from the dissection of the stomachs of trout caught in our lakes and streams, the more I am convinced that our trout in the wild state exercise great powers of selection of their food from the available natural supply, whether that be insect or crustacean.

Just what the factors are that govern this selection is a problem which has not yet even been worked upon.

The contents of the stomach of a trout caught in any lake or stream on any given day does not by any means determine the food of that trout through the year. It is simply an index of the available supply of food for that particular section of the lake or stream where the trout was caught and of what the trout in question selected during the day.

There is frequently a great variety in this daily menu. I am often very much surprised to find not a single specimen of the insect or crustacean which is in the greatest abundance and by all man-made rules should fill that trout's stomach to bursting. I have often watched young trout fry, only an inch or so long, jumping at gnats, or midges, on the surface of the water. I have observed them catch and swallow insects almost as large as their heads when they could, without any trouble, be quietly taking great quantities of minutes crustaceans available in the water. This must be explained as some biological urge of which we know nothing, otherwise we would put it down as just "pure cussedness."

In order to make sure that my eyes did not deceive me in this matter, I caught and examined the stomachs of some fry, but ten days old. The collection was made between 10 and 11 a.m. after a good morning's meal. One such lot gave the following results:

15 fry averaging 25 mm. in length—

Average number gnats (2 species)-----	20 each
Chironomous larvæ-----	1 each
Young water boatmen-----	1 each
Crustacea (very abundant)-----	2 each
Water fleas-----	2 each
Water fleas Daphnia-----	1 each

It would seem, in this case, that in spite of the prevalence in the water of thoroughly good natural food, the instinct to jump and catch food on the surface was stronger than the mere hunger urge—even at this early age.

On the other hand, when circumstances require it, young trout will go to any trouble and exercise great ingenuity in obtaining food. An instance illustrating this fact occurred during the course of an exploration on the headwaters of the Kern and the Kings rivers late in September of 1924. This was an exceptionally dry year. We found many instances of small tributary streams which were dried down to a series of mere pools only a few yards in extent. In many cases, these would be a mass of decaying vegetation and mire. In these, I often found hundreds of young trout, 2½ to 4 inches in length, their stomachs filled with the larvæ of *Chironomous* (a midge) and other insect larvæ which were available in the mud of these pools. This adaptation enables the young trout to survive until the middle of October, when the early snows would supply these streams with water, and these trout would again be able to assume a somewhat normal existence.

Thus, mother nature has provided the fish organization with wonderful powers of adapting itself to its environment. If this were not so, the fish culturist would never be able to take fish from their natural environment and place them in entirely artificial surroundings with artificial food, and still make good fish of them.

Age has a great influence upon the selection of the daily menu of trout. Apparently they become cannibalistic in their tendencies after they are a few months old and become more so as they reach adult size. It further seems that they find it easier to devour a few of their fellows, who have already fed on insects, than to hunt up their own insect or crustacean food. It, therefore, takes something unusual in appearance in the way of an insect or crustacean, alive or in artificial bait, to attract a big fish whose predaceous instincts are fully developed.

The question whether a given stream or lake is suitable for trout and, if so, how many it will support, is one which can not be determined definitely by a hasty survey of that lake or stream on any given date. The plant life plankton, insect and crustacean food must be studied at different seasons in order to obtain reliable data on the available supply throughout the year. Physical data, such as temperature, dissolved oxygen and carbon dioxide and chemical composition, must also be noted. Then, if there are trout living in the lake or stream, collections of these and examination of their stomach contents at different seasons will give further reliable data.

Another study, which should engage our attention before any extensive planting of our barren lakes at high altitudes with either plant or insect food is undertaken, is an intensive study of the life histories of a few of our more abundant aquatic insects which we know to be frequently taken by trout for food. This study should further embrace an investigation of a few of the most abundant crustaceans, their

requirements for food, temperatures for growth and other physical requisites.

As we compile more and more data on the food requirements of each species of trout, and gain more knowledge about the plant, insect and crustacean life of each lake and stream, we will arrive at a sounder and more scientific basis upon which to rely for the distribution of the trout from our hatcheries.

NEW ACCESSIONS AT LIBRARY OF CALIFORNIA STATE FISHERIES LABORATORY *

The library of the California State Fisheries Laboratory has been most fortunate recently in obtaining missing back numbers of serials. In a special library such as this, "finds" of this description are rare and are valued in proportion. We have been successful also in obtaining books, of which twelve of the most interesting are listed below :

1. Afalo, F. G. British salt water fishes. With a chapter on the artificial culture of sea fish, by R. B. Marston. Hutchinson, London, 1904.
A descriptive account of the most important groups of fishes of this region.
2. Alexander, W. B. Birds of the ocean. A handbook for voyagers. Containing descriptions of the sea birds of the world, with notes on their habits and guides to their identification. Putnam's, 1928.
3. Couch, Jonathan. A history of the fishes of the British Islands. Groombridge, London, 1867.
One of the classics on ichthyology. The four volumes are illustrated with 252 colored plates.
4. Daniel, R. J. Animal life in the sea. University Press, Liverpool, 1928.
This is a short popular account of the organisms, both plant and animal, living in the sea. The animal species considered are mainly the larger, more conspicuous forms.
5. Elton, Charles. Animal Ecology. Sidgwick & Jackson, London, 1928.
A work applicable to the problems encountered by those endeavoring to understand the changes taking place in fish populations.
6. Floud, Sir Francis. The ministry of agriculture and fisheries. Putnam's, 1927.
The author, who was the Permanent Secretary to the Ministry from 1920 to 1927, has written a very readable account of the work of the Ministry. The chapter on the Fisheries Department, by Henry G. Maurice, Fisheries Secretary to the Ministry, is regrettably brief.
7. Harvey, H. W. Biological chemistry and physics of sea water. Macmillan, 1928.
The author, who is hydrographer at the Laboratory of the Marine Biological Association, Plymouth, England, takes up the chemistry of sea water, water movements, the significance of temperature, and in the concluding chapter gives a very interesting account of the chemical and physical factors controlling the density of population.
8. Haskell, Allan C. How to make and use graphic charts. Codex, New York, 1920.
A highly technical work which contains much valuable material that can be directly applied to the making of charts and graphs used in fisheries publications.
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* Contribution No. 75 from the California State Fisheries Laboratory, compiled by Genevieve Corwin, Librarian, October, 1928.

CALIFORNIA FISH AND GAME

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"... we have so increased the number of sportsmen fishing in our streams and lakes that the longer time between bites is becoming a political issue."—Herbert Hoover.

THE FUTURE

There is possibly no division of state government confronted with such difficult and uphill problems and yet more subject to critical scrutiny than the Division of Fish and Game.

The extensive growth in population and development of our state continues to circumscribe and draw upon the supply of fish and game in manifold ways. More than a half million license holders, whose numbers are rapidly mounting, finding less available and abundant the sources of their favorite sport and recreation, outspokenly demand more results from the fees they pay, many of these having divergent views of how such results are best obtained.

The division is now confronted with and probably always will face the impossible task of pleasing or satisfying all. Endeavor as we may, there will always be some to criticise and find fault. This should not, however, deter us from seeking and carrying out the course best calculated to bring the greatest good to the greatest number.

Conservation and restoration of wild life, to be effective, is dependent on certain fundamentals and is best accomplished by pursuing a definite program which should not be radically overturned or varied from except where new or changed situations arise, and then only after scientific experience and knowledge point the way.—EUGENE D. BENNETT, Thirtieth Biennial Report, Division of Fish and Game.

THE THIRTIETH BIENNIAL REPORT

The work of conserving and protecting the fish and game resources of California

is becoming with the years a more complex problem. It is true, the science of game management has discovered and developed certain fundamentals and that the correct practice of these so-called fundamental methods has in many cases brought about much of the desired protection and restoration. It is also true that the development of the state and the exploitation of its natural resources have made the difficulties of maintaining the state's wild life resources more acute and burdensome.

To make certain a better solution of these problems, the division has been faithful to a plan of centralized and uniform administration during the thirtieth biennium of the division. It has further followed a definite and consistent program. This program has for its object the maintenance of fish and game resources in existing remnants of natural areas, the adjustment to bring about suitable conditions for wild life survival in other areas where the natural environment has been changed or modified by a vigorous and thriving civilization, the replacement of native species with introduced species that will flourish in spite of cultivation, and, lastly, the artificial assistance of nature to increase her reproductive capacity, which, in the case of fish, makes possible the production of literally millions of fish.

The Thirtieth Biennial Report of the division epitomizes the accomplishments made during the past biennial period. The income for the fiscal year of 1928 was \$850,000. This is an actual increase of \$37,051.35 over the seventy-eighth fiscal year. This larger revenue, however, has permitted enlargement in scope of every major activity of the division, has made possible the extension of its endeavors to fields of action greatly needing attention and permitted many worthwhile opportunities to be grasped of great importance to the needs and pleasures of generations to come.

Increased revenue has made possible an enlarged patrol force. The division now has 120 law enforcement officers, making effective and efficient patrol now possible in every section of the state. Records show that deputies made 2317 arrests for violations of the hunting laws and 4390 arrests for violations of the fishing laws. Court fines increased from \$56,742.64 in 1926-27 to \$72,109.70 in 1927-28.

Increased revenue has enabled such hatcheries as were in bad need of repair and improvement to be placed in a more workable condition, thus permitting the bureau to increase its output of fish and offset the increased drain on streams. Thirteen new hatcheries have been con-

structed, nearly doubling the existing number. These are located at strategic places remote from existing hatcheries and should improve fishing in waters adjacent to them. The output for the biennium was 51,444,562 trout and 26,728,590 salmon. The greater majority of the trout were planted by experienced deputies, being scattered in the more favorable locations where big fish have difficulty in preying upon them. A new fish planting truck has made possible the movement of fry over long distances not reached by rail with practically negligible loss.

Increased revenue has allowed enlargement of the personnel of both the Bureau

disaster of 1906 has been established. Contributions have been made to the relationship of birds to agriculture through field investigations of life histories and habits of birds.

Exhaustive investigations have been conducted by the Bureau of Research in cooperation with the Hooper Foundation for Medical Research to ascertain "the cause and means of prevention" of the so-called duck disease. Studies have also been made of the life cycles of internal and external parasites of deer, quail, pheasants, ducks and geese and other species.

For the first time in the annals of the state an actual record of the number of

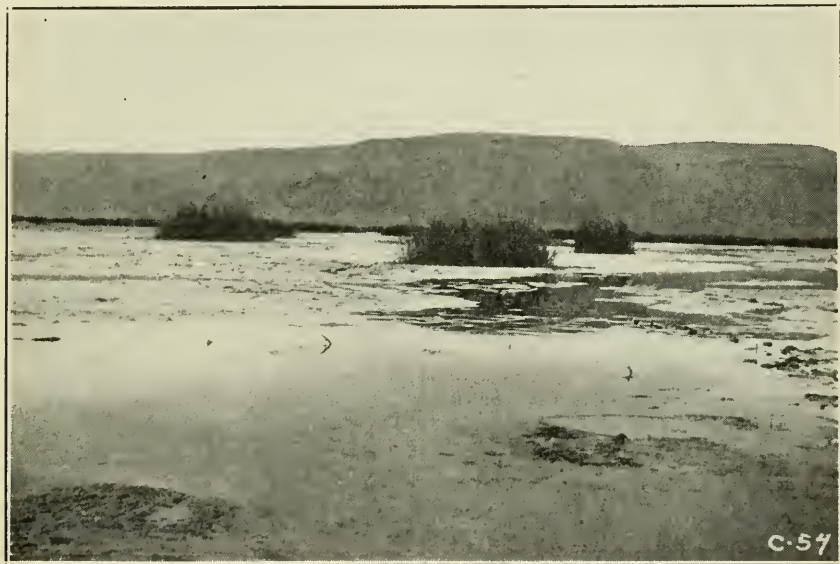


FIG. 20. Mud bottom rising out of water of Tule Lake, where duck sickness was prevalent. Tule Lake, Modoc County, California. October, 1928. Photograph by E. S. Cheney.

of Education and the Bureau of Research. The former was a one-man bureau and its functions were limited to the ingenuity and capacity of its director. Additional lecturers have materially expanded the scope of its educational activities and permitted personal contacts with schools and colleges, service clubs and lodges and conservation organizations in every section of the state. Two cameramen experienced in wild life photography have been employed and many reels of motion pictures have been produced, capable of winning a more sympathetic appreciation for the work of the division and its wards, the living things of the state. The first reference library since the San Francisco

deer killed and of the number of fur bearers taken by trappers has been obtained. The information that may be secured from such statistics is of great value in the formation of game administration programs. When records show that a species suffers progressive diminution from year to year, it is a sign that depletion has set in. Ability to detect when the breeding stock of a particular species is being impaired, resulting in diminishing returns in the annual birth rate, is fundamental in the successful practice of game management. The biennial report shows that a plan is now well under way to make an accurate analysis of game conditions and take a

state-wide census of California's game resources.

Increased revenue has permitted the employment of a game refuge survey crew which will survey and post the 2,372,355 acres now closed to hunting. Already many refuges have been surveyed and posted and the completion of this work will make possible better functioning of these important areas conserving a nucleus of mother stock.

The past two years have witnessed the completion and dedication of the state's game farm. Several minor, though not unimportant additions have been made at the Yountville Farm, probably the largest completely roofed-by-wire enclosure of its kind in America. Three thousand Chinese ring-necked pheasants were planted the first year and nearly eight thousand the second, so that now Chinese ring-necked pheasants are found in practically every part of the state where climate and topography permit their continuance.

Through the efforts of the Bureau of Hydraulics nearly eleven hundred important streams and ditches throughout the state have been screened to prevent fish from being diverted to irrigated lands or other places where they are lost to the angler.

Over four hundred fishways have been installed to permit the free migration of fish over dams and other obstructions. The pollution situation in the state, principally in bay and ocean waters, is reported to be in a far more satisfactory condition than ever before. Oil pollution has a decided detrimental effect on fish and even birds.

Control and regulation of the commercial fishery industry and fishery products of the state to safeguard the fishes of the sea and prevent overfishing has been not without its trials. In the sardine canning industry, the manufacture of by-products and the reduction of these food fish to fertilizer appears to be the most profitable part of the business. Litigation has been resorted to in order to successfully enforce the fish reduction and commercial fishery laws. The Commercial Fishery Bureau has assisted in efforts to prevent botulism in canned fishery products by contributing \$15,000 a year to the Hooper Foundation for Medical Research. The bureau has made beneficial strides in the eradication of carp from Clear Lake and conducted a valuable survey of the sea lions of the California coast. Through its laboratory located at Terminal Island, it has made many valuable studies and scientific investigations of marine fishes. A knowledge of the supply, breeding grounds,

habits and other characteristics of fishes of commercial importance is not only of practical aid to the commercial fishing and canning industry, but also provides a means of more accurately determining the proper rules, regulations and laws necessary to insure their conservation.

Two measures inaugurated during the thirtieth biennium have an important bearing on the future: The appointment of a committee provided by the legislature to investigate and to recommend game refuge sites and public shooting grounds, and the power granted to the Department of Natural Resources to close lakes and streams. These measures will play a considerable part in future accomplishments of the Division of Fish and Game.—RODNEY S. ELLSWORTH.

THE NATIONAL COMMITTEE ON WILD LIFE LEGISLATION

The president of the Fish and Game Commission, I. Zellerbach, has been honored with a place on the National Committee on Wild Life Legislation. He will represent the Western Association of Fish and Game Commissioners in the important and far-reaching work of the national committee.

The organization of the national committee has been heralded as the most advanced step ever taken in behalf of the wild life of America. The reason for such high praise is not solely due to the magnitude of the task which the committee will set before itself to accomplish, but it is also due to the fact that the recognized leaders in conservation affairs throughout all America are represented on the committee.

The best conservation thought of the entire nation will be brought to bear on the problems dealt with by the committee, which has announced, as its first order of business, the passage of the Norbeck Game Refuge Bill.

DEER KILL FOR 1928

According to the information compiled from the duplicate deer tags, hunters killed 21,515 deer during the 1928 season. This is 2008 more than were accounted for by the rifles of deer hunters during the year of 1927, when the first accurate count of the deer kill was possible.

Again, Siskiyou County leads with 1654 deer killed. Mendocino County is second, hunters operating in this section killing 1468 deer. Lake County is third with 1038.

San Francisco County, being entirely a metropolitan district, produced no deer. Los Angeles County, however, covers a huge area and furnished big

game devotees with 369 bucks. In Sacramento County but two deer were killed. In Sutter and Kings counties, three fell. Imperial furnished four, while San Diego, the adjoining county, contributed 232 of the deer killed.

REQUISITES FOR CALIFORNIA WATERFOWL

No species of wild life can be assured of perpetuity in the face of an aggressive and vigorous civilization without the requisites of adequate food, natural cover affording safe retreat from enemies, and uncontaminated breeding grounds. In this light, it should seem self-evident that restrictive hunting as a method of conserving species has its shortcomings.

A study of any good map issued before 1890 will show an almost unbroken marshland extending up and down the great interior valley of California. Had airplanes been invented previous to 1890, an air reconnaissance of the migratory bird areas of the state would have disclosed vast overflow areas and the expanses of Tulare and Buena Vista lakes. Below the observer, countless thousands of smaller patches threaded by sloughs would have given their shining signals.

Now, during the late summer and fall, probably as much as 80 per cent of these water areas, so eminently suited as loafing and feeding grounds for the myriads of waterfowl that formerly haunted them, have disappeared. Reclamation, drainage and evaporation are responsible for this great reduction. Reproduction of waterfowl in the state has decreased in proportion to the reduction of suitable nest sites, while the number of ducks and geese wintering in California have correspondingly decreased, for dry land never attracts waterfowl.

Duck hunters have viewed with alarm the rapidly thinning flight of migratory birds, but there will be no danger of their extermination. The constructive steps being taken by the members of the Governor's Advisory Committee on Game Refuges and Public Shooting Grounds will insure a future to this popular sport.

The survey now being conducted by the committee has primarily for its purpose the establishment of refuges that will hold and sustain waterfowl during the open season in sufficient numbers to maintain an adequate breeding stock, and, secondly, the creation, by purchase, lease or rental of public shooting grounds that will prove attractive to birds breeding in the far north that formerly wintered in California.

Funds for carrying out this program

will be forthcoming for the next five years and will amount to one-third of the increased hunting license fee annually. It is very probable that the committee will map out their whole plan of action for the entire five-year period before making an outlay of much of this fund. The purpose of such a step will be to avoid hasty investments which may prove to be sadly out of harmony with the ultimate objects desired.

SENTIMENT AND FORCE

Experience has proved that the vicious and law-breaking elements of society can be little influenced by sentiment. They are not moved by appeals for the protection of wild life because of its aesthetic value and beauty or because of its value as living neighbors to man. Regardless of the dwindling numbers of game, regardless of its brave struggle to prevail where man has thrown out of adjustment the old natural order, this element still takes pride in being photographed with an automobile load of slaughtered game of mixed varieties. In spite of the widespread spirit of conservation and appreciation for living things, their mental horizon still extends no further than the meat value of game.

The strong arm of the law has been the only effective method so far discovered to curb the activities of these who know no conscience in killing game. Force is also necessary as a means of occasionally reminding those who stray from the path of law obedience under the belief that, like the Ten Commandments, the fish and game laws are not supposed to apply to them.

Fines and punishment, however, are not as appropriate, nor as far reaching, in the case of those whose habits of life are being formed. Plastic minds under the proper stimulation are open to enlightenment. Education, which aims to establish a fixed respect for the higher values of wild life, can accomplish more in saving youthful offenders from becoming habitual violators than any form of punishment.

It is gratifying to record that law enforcement officers of the division embrace every opportunity to win converts to the cause of conservation. A recent instance where a deputy successfully appealed to the benign influence of a court on behalf of two boys, shooting ducks out of season, occurred in Riverside County. Investigation showed that the juveniles were not "repeaters" and had never been in trouble before. Judge R. M. Aitchison, of Thermal, therefore, applied the remedy of an impressive lec-

ture and dismissed the youths with a "message of conservation ringing in their ears."

SOUTHERN VOLUNTEERS CONVENE

A convention, unique because it was the first gathering of its kind ever held, occurred in Los Angeles on November 17, 1928. Seventy-three of the volunteer protectors of fish and game who operate south of the Tehachapi attended.

The meeting was presided over by R. E. Jeffries, captain of the deputies in Los Angeles County. Captain of Patrol Walter Welch instructed the men on

Judge Wilbur McDill acted as toastmaster at the banquet which lent a happy termination to the convention. Lieutenant Governor H. L. Carnahan, Fish and Game Commissioner Reginald S. Fernald and the executive officer were the featured speakers of the evening. R. M. Grose, representing the volunteers of the San Francisco Bay district, gave a brief address.

The convention was pronounced a highly beneficial one. It gave renewed vigor and zeal to those who participated and kindled a fine spirit of healthy cooperation.



FIG. 21. An airplane view of some marshy area taken during air reconnaissance of northern California by Governor's Advisory Committee on Game Refuges and Public Shooting Grounds. September, 1928.

their status as fish and game enforcement officers and the proper discharge of their duties. President I. Zellerbach and Executive Officer Eugene D. Bennett made forceful addresses and impressed those present with the importance of real conservation and protection. Federal Game Warden George Tonkin told of the cooperation between federal and state officers, while Assistant Chief of Patrol Charles Bauder expressed his pleasure at being able to work with the volunteer forces, who devote their time to the work without compensation.

NEW ASSOCIATION URGES INTERNATIONAL AND INTERSTATE COMMISSION

Due to the similarity of many problems confronting conservationists of the three Pacific coast states and the western provinces of Canada, and because these California, the Oregon Game Protective Association and Washington State Sports-mutual problems can be more harmoniously dealt with when handled by an men's Association organized the Western

Fish and Game Association at Medford, Oregon, in September.

One of the most significant problems having an international character is that of salmon trolling along the Pacific coast. Investigations of the U. S. Bureau of Fisheries disclose that salmon range from San Francisco Bay to southeastern Alaska. Great numbers of these fish are taken by trollers before they have reached maturity and at a time in their development when they have little market value. All who have studied the problem agree that these fish should not be exploited for commercial purposes until they enter the fresh-water streams and are of greatest food value. Resolutions unanimously adopted by the association urge the passage of legislation, both interstate and international, which will control the activities of the salmon trollers.

Another problem affecting the conservation of wild life on the Pacific coast, but having interstate significance, is the development of hydroelectric projects on the major fishing streams. Hence, Oregon's water and fish bills, which are intended to regulate unrestricted encroachment of such projects, are endorsed by the association.

PASSAGE OF FEDERAL REFUGE BILL URGED BY LEADING CONSERVATIONISTS

Major L. W. T. Waller, Jr., is accredited with the unique saying that conservationists should unite and take the "rest" out of federal restoration. Fortunately, an unanimous agreement has now been reached and the most important conservation organizations are supporting the passage of the Federal Migratory Bird Refuge Bill. Practically all of the leading conservationists were agreed when the first Norbeck bill was introduced in congress six years ago that the migratory bird situation in America was indeed a grave one and that it could be best solved through federal action. There was also unanimity that time was of importance, and that the need for government action was immediate. But the methods by which the federal refuges were to be obtained and managed proved to be storm centers which developed controversies so violent that they shook the very foundations of the conservation movement.

The present Norbeck bill has been stripped of the odious and objectionable features and provides merely that the government shall purchase and maintain refuges for migratory birds. The provision for public shooting grounds, about which there was much disagreement, has

been left out. The cost of establishing the refuges and of maintaining them is to be met by direct congressional appropriations. Hence, there is to be no federal license tax of \$1 for those who hunt migratory game. An actual initial expense appropriation of \$50,000 is provided.

The new Norbeck bill passed the Senate in May, 1928, and is now pending in the national House of Representatives. To better effect its passage in the House, a resolution supporting the measure and urging its becoming a law was read during the convention of the International Association of Game, Fish and Conservation Commissioners, and the Western Association of State Game Commissioners, representing the official state game departments in twenty-eight states, held at Seattle, Washington. The resolution was unanimously adopted.

A further provision of this resolution embodied the creation of a "National Committee on Wild Life Legislation." Six members of this committee were to be appointed from the following organizations: International Association of Game, Fish and Conservation Commissioners; Western Association of State Game Commissioners; The American Forestry Association; American Game Protective Association; Isaak Walton League of America, and the National Association of Audubon Societies. Additional power was granted to the above committee to add to its numbers five additional members selected at large throughout the United States.

Besides the important duty of assisting in the passage of the Norbeck bill, this committee is to represent these several organizations in other congressional efforts that may be undertaken, looking for the further protection of our wild mammals and birds.

PAST AND PRESENT JUSTIFICATION FOR THE UTILIZATION OF WILD LIFE RESOURCES.

No natural resource has played a more romantic role in the development of the nation than the profusion of wild creatures which roamed the forests and plains of the American continent. Witness the part fur-bearing mammals had in the exploration of America. The rich abundance of these creatures was the marvel of the first white men to behold them. Their rapid exploitation lured men on through the trackless forests, across the limitless plains and over superb mountain systems. Due to the intense rivalry of the fur-trading companies, some of them amounting to im-

perial organizations, outposts of civilization were progressively thrown out into the wilderness and the wildest parts of the continent made known.

No natural resource has been more unjustly exploited. There is some justification in the destruction of forests when lumber products have served a useful function in improving the well-being of a people. The rapid use of mineral resources, the stored-up capital of centuries, can also be viewed with less alarm when consideration is had for the improvement and development, both in science and industry, which their exploitation has brought about.

But what justification, either economic or social, can be given to balance the loss of countless numbers of wild creatures wantonly destroyed? The first settlers killed game for food. They warded off starvation by dependence largely on the natural food the country supplied. It is quite true, further, that the presence of large game was incompatible with agricultural settlement and the pasturage of domestic stock.

Who can view, but with dismay, these records? Before the sale of deer hides was prohibited in California, one Trinity County hide hunter killed 2000 deer in one season for their hides, leaving the flesh to fatten coyotes. The books of two shipping firms at Redding show in 1880 a total of 38,000 deer hides, buck, doe and fawn, secured from hunters operating in Shasta, Trinity and Siskiyou counties. A report of an agent of the Fish and Game Commission shows that "during the open quail season for 1895-1896, 177,336 quail were sold in the open markets of Los Angeles and San Francisco alone." As late as 1910, market hunters disposed of 500,000 ducks in the San Francisco markets.

Killing game wholesale was a business with the market hunters. No advantage they could possible gain was spared over the game they sought. Not satisfied with legitimate methods of slaughter, they killed deer at salt lies; "ground sluiced" quail at waterholes and springs, killing 40 to 60 birds at a shot; approached ducks from behind a trained bull, with a double-barreled number four gun, frequently killing 150 to 200 ducks at one time.

Manifestly as soon as the present social values of wild life resources gained their place in the rising sun of conservation, the wholesale utilization of the state's game resources as a mere food product fell rapidly from popular favor. It was unjust that a few should have a right to enrich themselves by extrava-

gant and wasteful consumption of a resource belonging to all the people. The market hunters and their highly effective methods of destruction were outlawed.

California today is a state made prosperous through the exploitation of the accumulated natural wealth of ages. Its population is growing rapidly, concentrating in cities and acquiring certain social ideals and physical comforts. To complement an unprecedented amount of material well-being is a large amount of leisure. Assuredly, wholesome means for the expenditure of these leisure periods can not be neglected. Outdoor recreation has been defined as "The most wholesome expression of leisure and a needful social force in the readjustments of American life to meet new conditions." Moreover, as stated by Herbert Hoover, it is a "fundamental need in American life and satisfies a fundamental desire to do something to escape the drabness of civilization."

Americans, and Californians in particular, turn naturally to the mountains and woods for their outdoor recreation. How barren and dead, indeed, would be the woodsy solitudes, the flowering meadows, the rock-strewn flats and the wind-swept balds, if they were ungraced by so much as a single sign of wild life to gladden the spirits and charm the eye. Without mountain sheep to animate the higher ranges, deer and bear, grouse and quail to enliven the forests and valleys and trout swimming lazily about in the lakes and streams, outdoor recreation in California would lack that fundamental power to infuse new life and vigor; that power to soothe and quiet "the restless pulse of care."

INTERSTATE HIGH DAM PREVENTS USE OF FISHWAY

An 85-foot dam on the Susquehanna River, resting on one side on Maryland soil and on the other on Pennsylvania soil, known as the Conowingo Dam, has been the center of much interest. The Conservation Department of Maryland, the Commissioner of Fisheries of Pennsylvania and the United States Bureau of Fisheries, after "innumerable conferences" have been unable to find any type of fishway which would prove adequate to guarantee the interests of the people. By agreement, the Conowingo Power Company has committed itself to pay \$4,000 to each state annually. This money is to be employed in the propagation of fishes by the respective states to offset the loss caused by the obstruction.

The *Maryland Conservationist*, in its fall issue for 1928, says further on this subject:

"The laws of Maryland for years have required persons damming any of the public waters to establish at least one adequate fish ladder on such dam for the purpose of providing free access for fish up and down stream at all times. This law was effective as long as small dams were built, but with the ever increasing height of dams in this state, some running from sixty to one hundred feet in height, it becomes impracticable to enforce this law, as it has been proved conclusively that no fish ladder has ever been designed which will take fish over dams of such height. The department has solicited the aid of the U. S. Bureau of Fisheries from time to time on this subject, but they have been unable up to the present time to recommend a fish ladder that is adequate for high dams.

"The fishway question is a very perplexing one to conservationists of all states, requiring careful study and planning in each case before unwise expenditures are made. The public feels that their God-given rights of fishing are being trespassed on by power companies and others who are damming the public waters, and claim that the erection of such dams destroy valuable fish resources which are essential for food and sport. * * *

"Mr. Henry O'Malley, the U. S. Commissioner of Fisheries, has written an excellent article on this subject, entitled, 'Giving the Fish a Lift,' which appears in the August number of *Outdoor America*. His article shows conclusively that the Bureau of Fisheries has been unable up to the present time to find any fishways which they could recommend for dams of from sixty to one hundred feet in height, and indeed there is no sound mechanical device for elevating fish over dams which are more than twenty-five feet in height."

THE USE OF FISH EGGS FOR BAIT

Elsewhere in these pages a plea is made for more "sportsmen" along our streams and less "fishermen." Due to the widening popularity of angling as a wholesome form of recreation, a greater fishing effort is being put forth every season. The Division of Fish and Game is attempting to meet these increasing demands and to keep California streams and lakes stocked with gamey fish. Its success in this program depends, in no small measure, upon the encouragement of the practice of those methods which insure greater fairness to all those who fish.

The Bureau of Fish Culture has advocated against the use of fish eggs for bait or for chumming fish into schools to facilitate their capture. Fish eggs are a natural food. Their employment often yields a substantial catch without the slightest use of skill or ingenuity.

Probably the greatest objection to the use of fish eggs is that they are invariably swallowed by the striking fish. If the fish is below the legal size and the hook extracted, the wound is, in the majority of cases, of such a nature that the fish has a very slender chance of continuing life when returned to the water. A fish caught on a fly is usually hooked in the mouth and is not injured seriously. Another important objection is that small, immature fish readily take a salmon egg, when they will not rise to a lure which appeals to the predacious instincts of a matured, large fish.

It should seem that the use of artificial lures, such as spoons, spinners, plugs and flies, as well as natural bait, like insects or worms, are sufficiently tempting. At least their use, coupled with a certain amount of skill and ingenuity, guarantees the enjoyment of that "indefinable pleasure" which comes as the reward of landing a big fish on light tackle. And is this not the very marrow of sportsmanship? Certain it is that the use of fish eggs constitutes a drain on an already well exploited natural resource and does not "assure more and better sport for everybody."

DIVERSITY OF FISHERIES AN AID TO CONSERVATION

The Thirtieth Biennial Report of the division reveals that the commercial fish catch of 1927 exceeds that of any year in the history of California's fisheries. The total amount of fresh fish caught in state waters, off the California coast and brought into the state during this year, was 486,499,672 pounds. For the year 1926 the total catch amounted to 394,707,016 pounds.

Such record catches as these are not exceeded by any other state. In fact, Alaska alone surpasses California in the volume of its catch. To offset any fear that the state's fishery resources might be in danger of being overfished, it is well to notice that these splendid records are in part due to the great diversity of California's fisheries. There are over sixty species of fish and shellfish of commercial importance in the state, thus allowing for a better balancing between competing species.

"From the viewpoint of conservation," writes N. B. Scofield in the Thirtieth

Biennial Report, "there is a great advantage in having diversified fisheries such as California's for the reason that the species of fish compete with each other, either for food or by actually devouring each other. Under natural conditions there exists more or less of a balance between these species so that if man comes in and concentrates his fishing efforts on only a few of the species, the check is removed from the unutilized varieties with the result that they will prosper at the expense of the kinds which are being fished for. In other words, the fisheries will stand the strain of fishing better if the commercial catch is made up of many species, instead of a few.

Another advantage our state derives from its diversified fisheries is the splendid assortment of fish and shellfish to be found in our markets at all seasons of the year. One of the things which makes a lasting impression on visitors to the state is the large number of sea food restaurants which serve such a variety of sea foods."

REFUGES EFFECTIVE IN PERPETUATING GAME

The place game refuges should play in game management was emphasized at the first meeting of the International Association of Game, Fish and Conservation Commissioners sixteen years ago. The recommendations urged at the time were reiterated at the last convention and are as follows:

"Inasmuch as game refuges afford the most effective means of protecting the scattered remnants of our native game, it is recommended that every state should have one or more state refuges. Commissioners and wardens should be given adequate authority to arrange for refuges on private or state lands, and to cooperate with the proper officers of the federal government in the establishment of such refuges on public lands not now utilized for other purposes.

At that time the state refuges in existence did not number more than twenty, of which the Superior Refuge in Minnesota was the largest. Montana had two good-sized refuges and Pennsylvania five. Three waterfowl refuges had just been established in Louisiana, through private initiative, and Idaho had one refuge. Beyond that there were practically none of consequence.

Now there are hundreds of refuges, state and federal. Nearly every state has from one to seventy-five or more of varying size, the total aggregating over 20,000,000 acres of land or over 30,000 square miles set aside by the states as sanctuary for wild creatures.

Federal game and bird refuges also number 125, including national parks, some of which, particularly in the national forests and national parks and Alaska, are extensive.

The establishment of game sanctuaries has been the most notable feature of the

development of wild life conservation methods during the past fifteen years and is now regarded as essential to any effective plan for the maintenance of the game supply."—Proceedings Twenty-first Convention of Game, Fish and Conservation Commissioners.

SLAUGHTER METHODS STILL EXIST

California has long been noted for goose hunting. Seven different species winter within the state. In the supply of geese, the state has a splendid natural resource. Yet practically no other game bird has received less attention. For many years, geese were hunted by a method known as bull hunting, the market hunter using an animal blind. Later, however, ducks were saved from this sort of destructive hunting, but geese were still so hunted.

It has only been in recent years that any protection whatsoever has been given geese. Years after there were bag limits on ducks, no limit was set on geese. Finally, with numbers greatly reduced, the federal government lessened the bag limit. The restrictions, however, have not satisfactorily handled the situation. In the Sacramento Valley, there are a number of licensed commercial clubs where organized destruction is practiced. The owner loads onto a truck about 250 wild geese decoys. These wing-clipped birds are placed in enclosures out in a field. A group of ten hunters, along with a professional, hide themselves in pits. A flock of geese is attracted and upon signal from the professional hunter, ten men rise from the pits and blaze away. Oftentimes every member of a flock falls victim to the barrage. No hunter knows whether he killed a particular goose or whether his near neighbor shot it. After sufficient geese have been killed to furnish each man with a bag limit of eight, firing is stopped and the geese are collected. The men who try out this sort of hunting are usually disgusted. They fail to see how sportsmanship is displayed.

The Division of Fish and Game has for several years been endeavoring to have the legislature pass a law prohibiting the use of live decoys in the hunting of geese, but in each instance the movement was blocked by the professional hunters of the Willows district.

There is grave danger in this sort of hunting from a conservation point of view. Suppose a flock of geese from the north is made up of a number of birds which come from one particular locality. Suppose these birds, having migrated together, keep the flock intact with but a few additional stragglers added. If

every goose in the flock is killed by fire from ten automatic guns, there are no breeders left to return to this locality in the north. There are always a few birds left in every flock to serve as breeders and furnish birds for another year, when wholesale methods are not used and the hunter is thrown on his individual skill and ingenuity.

There is growing sentiment to the effect that this sort of organized slaughter must be stopped in California, if we expect to save a noted resource of our state. Undoubtedly a strenuous endeavor will be made to correct the situation during the present session of the legislature.

COTTONWOOD LAKES CLOSED TO ANGLING

The future of angling in California from a fishcultural standpoint is based on the ability of the division to retain a supply of spawn-bearing fish. Excessive fishing in certain localities readily accessible to densely populated areas has served to lessen the numbers of adult or egg-producing game fish, while contamination of natural spawning grounds in such areas has produced very unfortunate conditions. Physical factors beyond the power of the division to control have also entered in. For the last two years, seasonal floods have washed out racks at egg-taking stations and seriously cut down the number of eggs the division has been able to take.

The power of the Commission to close streams or lakes to angling has been exercised already in one important instance to conserve the breeding stock of a valuable and beautiful fish, the golden trout. The Cottonwood lakes in the High Sierra have developed into an exceptional spawning ground for this fish, yielding an average of 450,000 eggs a year. Golden trout thrive in lakes of high altitude where the water is clear and cold. Because this important spawning ground can be made to serve as the source of supplying High Sierra lakes with golden trout hatched and developed at the Mt. Whitney Hatchery, it has been closed to angling. It is predicted that since anglers are now deprived of the privilege of fishing in the Cottonwood lakes, the yearly egg take will show a decided improvement.

GAME AND FORESTRY

Successful examples are becoming less rare where owners of wild forest lands are managing their estates so as to obtain an additional profit from a by-product of their forests, namely, game. The advance of the science of game management,

coupled with the desire of land owners to develop the full producing powers of their properties, may be considered the foremost factors that have brought about the increase of such projects.

The November issue of *American Forests and Forest Life* contains an article by William T. Cox proving the worth of a joint commercial undertaking which gave due importance to the raising of game on land producing timber wealth. Actual profits derived from harvesting the fur and game crop off 30,000 acres embraced in Itasca Park and Forest reveal a yield of 66½ cents an acre a year gross. Supported by these figures, the author ventures to assert that a profit of at least 50 cents an acre could be derived from any area comparable to Itasca Park and Forest.

"There are in Minnesota alone," he goes on to state, "approximately 18,000,000 acres comparable in character and in fur and game carrying capacity to Itasca Park. If this immense area of woodland and lake, marsh and stream were allowed to become fairly well stocked with game and fur-bearing animals, the revenue derived from these sources, not to mention the timber and the fish, would be not less than \$9,000,000 a year. The fur crop in the forests of Minnesota, if given a fair chance, would pay the entire cost of thoroughgoing fire and game protection and leave a handsome revenue besides. The various forms of wild life probably give to water areas a value acre for acre just as great as that possessed by ordinary farm land. Muskrat lands in extensive holdings bring about 50 cents an acre profit. Commercial fishing over large areas of lake and river show about the same return. But most important of all, let us bear in mind that the game, the fish and the beaver, especially, have a recreational or attraction value less definite perhaps, but none the less real and probably greater, than their utilitarian value."

AERIAL SURVEY OF WATERFOWL CONDITIONS

Probably the most unique feature thus far of the survey being made by the Governor's Advisory Committee on Game Refuges and Public Shooting Grounds has been the attempt of the committee to gain a comprehensive grasp of the waterfowl situation by means of airplane flights. Indeed, what is believed to be the first extensive air reconnaissance of any migratory bird area occurred on September 29, 1928. The Standard Oil Company of California placed at the

committee's disposal its trimotored passenger monoplane.

In a comparatively short time the big monoplane, taking a southward course, flew over the Suisun marshes, the Sacramento delta and the important water areas of the Sacramento Valley. Some 400 miles were covered and great numbers of waterfowl were seen. Water was most plentiful in the vicinity of Willows, Colusa County, while the Suisun marshes seemed to be suffering mostly from lack of it.

It is proposed that later flights will be made to survey other portions of the state.

SMALL GAME REFUGES EXPRESSIONS OF CONSTRUCTIVE EFFORT

The average sportsman cheerfully expends as much as \$10 to \$20, and sometimes more, to enjoy a good quail hunt. Curiously enough, he resents any project whose object is to induce him to reach into his pocket and subscribe a small sum for quail preservation. His attention will most times be attracted by descriptions of the old-time abundance of quail. He will even agree that no opportunity should be overlooked to bring the little "plumed knight" back to their former numbers so that they can prevail everywhere again. When pressed, however, to subscribe money; when told that it is his duty to make a return for the birds he has bagged, he will be, indeed, above the average sportsman if he elects to accept such a burden.

Happily a movement is about to be set on foot by the San Diego Fish and Game Protective Association to acquire a fund to be used for the purpose of leasing a desirable plot of quail land for a long term of years. The plan embodies the building of a gamekeeper's house and the hiring of a man to patrol the refuge. The refuge is to be stocked with birds trapped in a few areas where quail are now common.

The small refuge represents a scope of activity logically within the domain of local sportsmen's associations. Once established and serving as a means of perpetuating a certain nucleus of seed stock producing a continuous supply for adjacent covers, the small refuge would stand as a splendid testimony that local sportsmen had entered actively into the practical business of wild life protection. The refuge would not alone be a source of local pride, but would also satisfy its creators that their collective money was being devoted towards constructive ends.

Let it be hoped that sportsmen everywhere in California will see this light;

that they will be willing to subscribe to the success of such projects so that they themselves may reap where they have sown.

THE MOST MODERN OF VIOLATORS

The Alaska Guides Association has gone on record as opposed to the use of aeroplanes by hunters to reach remote hunting grounds. They complain that the use of such means of conveying hunters readily to areas almost inaccessible by other means constitutes a serious menace. It permits molestation of some of the most valuable breeding grounds for Alaskan big game and makes law violation easy.

California has recently experienced something of the threat which the use of aeroplanes manifests toward the future of conservation. While the game refuge survey crew were posting and surveying Game Refuge 1-Q, an aeroplane was observed to land miles away in the middle of the refuge. The place was not readily accessible by road and could be reached only after a considerable journey. Afterwards, it was learned that the occupants of the aeroplane enjoyed a fine sage hen shoot and had winged their way back home, having violated the sanctity of the refuge with complete safety and freedom from apprehension.

STATISTICAL REPORT ON FRESH AND CANNED PRODUCTS FOR 1927

Illuminating facts showing that canned, smoked and dried fish valued at \$23,348,516 was produced by canners and packers in California during 1927 are contained in Circular No. 2, released for general distribution to all who desire this information, by the Commercial Fishery Bureau.

The circular mentioned, one of the most complete ever published by the division, also contains a complete record of the catch for 1927, with detail showing the various kinds of fish taken as well as a complete report of the sardine canners' operations during the period.

Packing plants numbering 75, valued at \$8,606,383 and employing 6461 people, handled the heavy pack of seafood specified in the report. Sardines as usual headed the list, six types of pack resulting in the production of 2,625,412 cases, while abalone scored the least with but 1987 cases being packed.

In the San Pedro district the highest canning record was made with 1,916,422 cases being packed, while Monterey came second with 1,398,762 cases. The total number of cases of canned fish is given as 3,882,900. Dried and smoked fish

included anchovies, Bismarck herring, mackerel, rollmop, sablefish, salacchini, salmon, sardines, shad, shrimps and squid. Squid leads in this class with 1,200,000 pounds being turned out at Monterey. Salted sardines follow with 110,770 pounds. Mild cured salmon numbered 2052 tierces, and smoked salmon totaled 66,805 pounds.

In addition to the products mentioned, 263 tons of fish flour, 21,111 tons of fish meal and 2,618,490 gallons of fish oil were turned out in the by-product plants operated by the canners and packers.

GAME BIRD FARMING IN CALIFORNIA

Records of licensed game breeders show an increase to 201 issued in 1927

of public interest and a desire on the part of many people to assist in the work of propagation.

Many of the private breeders tell me that people who apply to them for game bird eggs for hatching make it known that they desire to rear these birds for liberation. This is a line of work that the Fish and Game Commission can well afford to encourage. It has been said that any poacher who can be induced to rear a brood of either pheasants or quail will never again follow this nefarious practice.

It requires no stretch of the imagination to suppose that by a very little work, 100 people in different sections of the state might be induced to rear 100 broods of birds. This would equal the

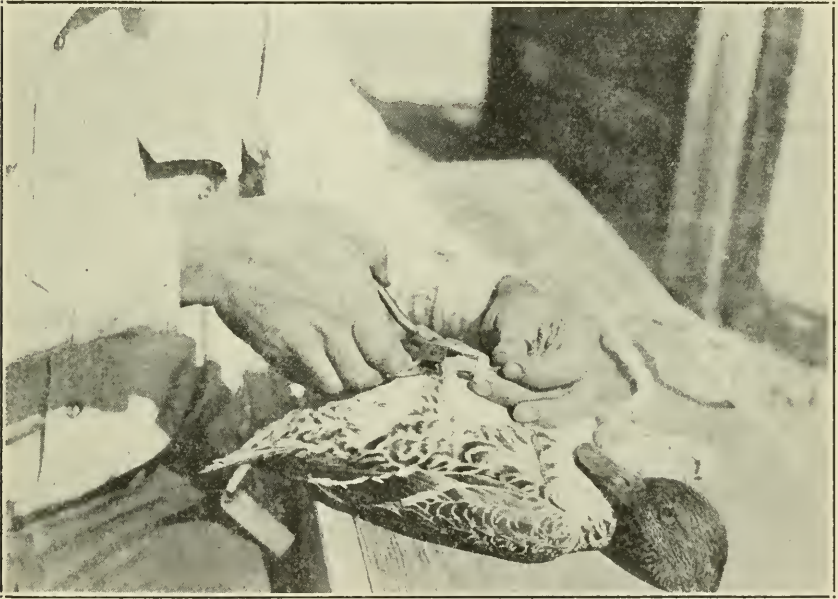


FIG. 22. Banding sick ducks prior to placing them in recovery pen for observation. Hollywood Gun Club, Kern County, California. October, 1928. Photograph by E. S. Cheney.

from 164 licenses issued in 1926. This means that 37 more people took out game farming permits in 1927 than in the previous year. This is a gain of 22½ per cent. While it is not large, it nevertheless shows the trend of a healthy growth. The figures for the year 1928 are not available, but it is the opinion of the writer, based on inquiries received at the Yonntville Game Farm, that this percentage figure will be raised considerably. This is as it should be, for these figures give a very accurate cross-section

output of a very large game farm and the cost to the division would be very much less. The necessary element in a program of this kind is the right sort of information.

In the state of Washington, the writer well remembers one year when many thousands of eggs were sent to various individuals and organizations. Most anyone could get them who would apply. The weak point in that program was the fact that insufficient information was furnished to enable the one who received

the eggs to hatch and rear the birds properly. The average man and woman on the farm can do this work, if they are shown, or if the proper kind of information is furnished them.

This last season, a prominent man of San Francisco, who has a large country place, applied to the farm for birds for liberation. I asked him why he did not rear his own birds. He replied, "he did not know how." He was informed that we would gladly cooperate with him if he would send his attendant here so that we could give him first-hand information on just how the work was carried on. This request was complied with and the man was sent to the farm.

This attendant received 400 Chinese ring-necked pheasant eggs about the middle of May. The first of September a friend, who had been spending his vacation at this ranch, informed me that he counted 199 fine pheasants around the place. The attendant who looked after the pheasant rearing had never raised a game bird before. This was his first attempt, and it was a success.

In this work, like many other lines, a proper understanding of the requirements of game birds is the thing that counts. Often, at the request of a game breeder, when giving advice or trying to untangle some difficulty that has arisen, I am impressed by this fact. It would be a fine thing if those who start to raise game birds would first familiarize themselves with the general environment necessary for the comfort of the birds they intend to place in confinement. Fully 90 per cent of the cases where help is requested, the trouble hinges on the problem of insufficient room, and the lack of, or too much, sunlight.

Not long ago, I took some quail from a person who had them confined under a porch on a concrete floor. The sun had little chance to reach them. They never had so much as a single opportunity to get a dirt bath or dust themselves. This was just as important to them as a water bath is to a human. Birds and animals can not be confined in small enclosures for any length of time without bad results. Very few people know the real habits of the birds and animals they have in confinement, yet they expect them to get along. It is one of the finest tributes to the gameness of these creatures that they do as well as they do.

In a lecture before a parent-teacher association, Judge Ben Lindsey remarked that "the boys and girls who loved animals and birds" never came into his Denver Juvenile Court. In fostering this very important line of work it may be

possible that we will also be contributing something to the much talked about "youthful delinquency."—AUGUST BADE, Yountville, Cal.

LOCAL HUNTERS MOST SUCCESSFUL IN KILLING DEER

Facts and figures gathered from the deer tags turned in by hunters to the division for the season recently closed clearly prove that a man must have a better chance to kill a deer in his own county than an outside seeker of big game. A careful analysis of the residence of the hunters who killed deer this year and the place where the buck fell, shows that a man is much more efficient when working in his own territory.

There are exceptions to this in a few counties only, but in the counties where heavy kills were recorded the "home boys" bagged the most deer.

In Siskiyou County, where a grand total of 1654 deer tops the list for the state, residents of the county killed 983 bucks. While Los Angeles County hunters shot the most deer throughout the state during the season, of the 369 killed in Los Angeles, 320 were brought down by those who claim Los Angeles County as their home.

Alpine is an exception. Alpine County hunters bagged but 12 of the '66 bucks killed. The local lads fell down also in Mono County, getting only 23 of the 552 killed.

Of the 263 killed in Alameda County, residents were responsible for 197, while in San Diego the hunters in the southern boundary county shot 190 of the 232 that were checked out this year.

Residents of Del Norte County killed 54 deer. Despite the fact that only 48 were killed in the county, local hunters shot 45 of these, which shows considerable prowess in the seeking of big game.

HOLDING PONDS

Various fish and game protective associations have been aiding in fish distribution by building holding ponds. The Tulare Association, by securing the cooperation of various clubs, has to their credit, three holding stations as follows: Kernville, 7 ponds, 10'x80'; Nelsons, 3 ponds, 10'x50'; Mineral King, 4 ponds, 10'x50'. An attendant has been employed to feed and properly care for the fish at each station. The ponds are so arranged that they can be cleaned and the water held at any particular level. The eastern brook trout held in some of these ponds attained splendid size before the volunteer packers took them into the back country and planted them.

Those responsible for these holding ponds maintain that the advantages gained are:

1. Fish planted at the most ideal time of year for the locality; not the time when water is lowest in the streams.

2. Early growth is in natural environment and under controlled conditions, enabling the weaker fish to become more vigorous before planting. Hence a sturdier stock is planted.

DEER HERDS ON INCREASE

A report issued by the Washington office of the Forest Service in November states that deer throughout the national forests of the west are increasing. In a few places, they have multiplied in numbers beyond the ability of the locality to sustain them. Protected by man and not destroyed by lions, wolves, coyotes and lynx, because these predators have been removed by predatory animal control measures, many of them face starvation or disease from the weakening effects of lack of food.

It is clear that in such cases where deer multiply beyond their means of sustenance, conditions have been allowed to obtain which overreach the ultimate object of the conservation of the species in question. There is need for measures to be taken to stabilize conditions surrounding the welfare of such animals. Why not a plan of management which will permit killing by hunters up to the point of taking each year what would amount to the annual increase? A given locality is capable under normal conditions of producing a certain amount of food for deer. The deer population should be kept stationary in the sense that it should never be allowed to exceed the maximum number of animals the locality is able to feed. Less cruelty to the animals will be effected by such a plan than if their numbers are reduced by starvation and disease.

THE MYSTERY OF GAME WARDENS

Many unthinking people have come to believe that there is something mysterious and awful about game wardens. It is the duty of every deputy of the division to make an earnest endeavor to break down this somewhat popular superstition, and to have the people and the sportsmen feel that game wardens are their friends and that in their efforts to protect and conserve the supply of wild life within the state they are working in and for their best interests.

The best game warden in the world is a human being—neither half devil nor half god—but just a man. A good game

warden must be quick to think, keen to analyze, persistent, resourceful and courageous. As a matter of fact the work of game wardens is just plain business, like any other business, and in order to be successful must be undertaken and conducted in a businesslike manner.

However, the game warden's business is full of vexations. There are times when the warden knows to a certainty that the fish and game laws are being violated and the identity of the violator, yet arrest must wait until evidence of a positive nature is at hand; but sometimes the evidence never comes. If there is mystery attached to the movements of game wardens it is simply because, in order to be successful in their work, secrecy is imperative.

These are some, but not all, of the troubles met by game wardens. If the warden is "spineless" he is sure to be inactive and lax in the discharge of his duties and soon becomes a liability instead of an asset to the cause of wild life protection and conservation. The game warden who is energetic, honest and faithful to his duties, persevering and courageous, will keep the fish and game law violators a-guessing, and will catch the boldest and the shrewdest of them in the end.—WALTER R. WELCH.

RAINBOW TROUT IN NEW ZEALAND

Further indication of the popularity and success of the American rainbow trout in foreign waters is contained in a consular report from New Zealand, which states that the stock of this fish introduced in the Tongariro River has yielded over 4,000,000 eggs. Most of these eggs were incubated in the hatchery operated by the New Zealand department of internal affairs, some were sent to the fisheries department at New South Wales, a small number was sent to Tasmania, and a few were distributed to local acclimatization societies, which are similar to sportsmen's associations in this country.

That the New Zealand authorities are acquainted with the latest developments in fishcultural work is indicated by the fact that they are undertaking the planting of food organisms in waters that have been stocked with rainbow trout. Four hundred and twenty-six thousand freshwater shrimp were planted in Lake Taupo, and plans are being made to transplant small indigenous fishes from other waters to this lake. It is stated that the work is being done with the idea of insuring a food supply sufficient for the future needs of the lake.—Fisheries Service Bulletin, Bureau of Fisheries, No. 162, p. 1.

GAME REFUGE 1-Q

Of all the game sanctuaries in the state, Refuge 1-Q is the most interesting as to the number of species of game sheltered. Located in the eastern part of Lassen County, it borders on a similar refuge in Nevada. There is very little timber; in fact, the game survey crew had to carry their own posts for signs. Within the boundaries are located more species of game than in any other similar area. Probably the only white-tail deer in the state range in the sagebrush along with hundreds of antelope.

On one of the higher and rougher elevations is a small band of mountain

the fish hatcheries. In this field relatively little study and investigation has been conducted in the United States. Needless to say that past experiences demand a systematic and scientific program that will attack the difficulties encountered in the hatching of eggs and raising of fish. With the present knowledge of fish diseases in this state one is largely dependent on analogy, deductions drawn from an analysis of the literature.

In Europe many fish diseases have been recognized. An excellent summary may be found in "Praktikum der Fischkrankheiten," by Plehn. The number of investigations in this country has been



FIG. 23. Boy Scouts of State Conservation Training Camp having a personal experience with a mule deer, Yosemite, California, August, 1928. Photo by B. C. Cain.

sheep, the only band in northern California. Sagenen may be counted by the hundreds. Mule deer are abundant and quail are not uncommon. There are numerous places where waterfowl find adaptable nesting places.—J. S. HUNTER.

FISH DISEASES

The time is here when the fish hatcheries will soon be in full operation again in the hatching of trout eggs and the rearing of fingerlings. Those concerned with fish culture turn their thoughts toward what problems they may anticipate and guard against. Fish diseases play a prominent role among the problems of

small, and consequently very few publications are available.

During the past year in the months of June and July several outbreaks of disease in the different hatcheries have come to the attention of the laboratory. Two hatcheries experienced disastrous mortalities in one instance due to a severe epizootic (furunculosis) which killed the entire stock, and in the other an unknown factor reduced the fish to 50 per cent. In another holding pond a mold infection was reported to have caused a 100 per cent mortality. Parasites and fungi also caused trouble in a few instances. These brief reports clearly indicate that fatal fish

diseases do occur in California. It is obviously the duty of the laboratory to institute measures to prevent these losses. Not all the diseases are due to parasites. Some factors, such as too high temperatures, poor aeration of water, improper and contaminated food, and polluted water acted as predisposing and probably also as contributory causes.

Whenever abnormal conditions are observed in the fish or their environment, immediate action should be taken to determine the nature and cause of the trouble. Only affective treatments should be applied to troubles of which the cause is known. In the past, in certain outbreaks where remedial agents failed, the fish were dumped into the streams where natural environment might be more suitable. This was carried out as the last resort to save them. From an epidemiological point of view, such a practice is exceedingly dangerous, since it encourages the dissemination of infectious or communicable diseases. It should be appreciated that prevention is always less costly than treatment and the institution of control measures when an epizootic is once on its way.—H. VAN ROEKEL.

NEW GAME FARM FOR CATALINA ISLAND

A large game farm has been established near Avalon, on Catalina Island. It is under the supervision of Mr. Lewis, who formerly was assistant at the State Game Farm at Yountville. One hundred thirty large breeding and rearing pens have been built. A red tile roofed wall encircles the entire grounds which are surrounded by landscape gardens. A very large flight aviary built of steel and including a large circular pool for waterfowl has also been erected. Many varieties of pheasants and quail, together with many showy tropical birds, are on exhibition. Mr. Wrigley is sparing no expense in making the Catalina Bird Farm one of the greatest avicultural exhibits in the country. Special emphasis is to be laid on the propagation of game birds heretofore found difficult to rear in captivity.

DESTRUCTION OF UNDESIRABLE FISH

A number of states are endeavoring to improve fishing conditions by eliminating undesirable or rough fish. Minnesota has been active in this sort of work. Within the past few months, California has attempted the destruction of undesirable fish in Clear Lake.

An interesting article by J. G. Burr, which appeared in *Field and Stream* for

November, 1928, reports that a unique method has recently been tried out in Texas. The idea of using a strong electric current was obtained from reports of fish farming in Germany, where undesirable fish are removed in this way. A current of 332 to 350 volts was used and suckers and carp were stunned and rose to the surface. Men in boats with dip nets removed these fish from the water. Bass and perch were allowed to recover and swim away.

KLAMATH FISHING ACCORDED HIGH PRAISE

When the steelhead fishing is at its best in the Klamath, it is doubtful if there is any stream in the United States that will hold more thrills for the trout fisherman than that California river. Fly fishing, spinner fishing, bait fishing, all yield sport, and when the fresh run fish of several pounds in weight strike, the fortunate angler is in for a battle. There are many streams, some in the west, but mostly in the east and along the east coast, that are better known and more fished. But fishermen who have wandered along such waters as the Nipigon, the Beaverkill, the Neversink, the Gunnison and even the Madison, say that there is nothing to surpass the Klamath in any of them.—*The American Field*, Sept. 29, 1928.

HUNTING ETHICS

Many outdoor writers devote columns to such matters as where to hunt, how to bag game and the kind of equipment to use. Such basically essential problems as perpetuating and increasing the game supply, improving the relations between farmers and sportsmen, and saving human life are items which are invariably neglected.

The Izaak Walton League believes that clean sportsmanship, an even break for both the hunter and the hunted, constant vigilance to prevent accidents, and a square deal for the landowner, are matters which can not be stressed too forcefully. America needs more real sportsmen pulling together in a common cause. We need less of the "hoodlum" element.

Observance of the following suggestions will help perpetuate America's scheme of publicly-owned game and assure more and better sport for everybody:

1. A human life is worth more than all the game in America—see clearly before shooting.
2. Carelessness with firearms is criminal—play safe and avoid accidents.
3. Healthful recreation and the thrill of the chase are a true sportsman's prime objectives always.

4. Observance of the law and eradication of the game hog are responsibilities no sportsman can evade.

5. A few fools with matches kill more game than many shotguns—prevent fires.

6. Only vandals destroy farmers' fences, injure their stock or disregard their wishes.

7. Real sportsmen never try their skill about farmyards, pastures and on trespass signs.

8. Saving ample seed stock, and feeding it during the winter time, will perpetuate the sport.

9. A clear conscience at the end of the trip and an invitation to come again beats

bands on the legs of our native birds, an important investigation is being carried on by our Government. The purpose of this investigation is to learn how long birds live, what routes they travel in migration, how many miles they travel in a day, whether or not they return to the same locality, whether or not they keep the same mates and many other interesting questions. If you handle any game bird or find any other kind of bird, dead or alive, examine its legs for a band and read the number very carefully. If the bird is alive, leave the band on and release the bird, but if the bird is dead, remove the band and send the band and all infor-



FIG. 24. State Conservation Training Camp for Eagle Scouts. Yosemite, California. August 5-15, 1928. Photograph by B. C. Cain.

a full bag.—SETH E. GORDON, Conservation Director, Izaak Walton League of America.

SPORTSMEN REQUESTED TO REPORT BANDED BIRDS

The United States Bureau of Biological Survey wishes to stir greater interest on the part of hunters in banded birds. The knowledge to be gained through reports of such birds killed by sportsmen is fundamental to an understanding of their travels. The following is an announcement explaining the reasons for such work:

"By means of numbered aluminum

mation possible in either case to the Biological Survey, Washington, D. C. More volunteers to place these bands on birds are needed. If you are interested, write to the Inland Bird Banding Association, William I. Lyon, president, 124 Washington street, Waukegan, Ill."

MOUNTAIN LION CONTROL

Bounties have been paid on mountain lions by the state since 1907. The yearly average during these 21 years has been 246 claims paid each year. Records from the Thirtieth Biennial Report disclose that during the past biennium the number of lions killed bordered on this yearly

average. The claims of lion killers over the entire state for 1926 amounted to 249 lions and for 1927, 241 lions.

It is believed that the total lion population in California is not greater than 500. This population is probably able to reproduce yearly not more than the number slain every year by hunters. In other words, control measures have been effective in that they have kept these large predators from increasing. The lion population has remained stationary. Further aggressiveness, making possible a greater yearly toll, would soon find the death rate in excess of the birth rate.

THE DEER SITUATION IN PENNSYLVANIA

Due to the considerable controversy in the state of Pennsylvania on the exact status of food for its wild life, and the belief entertained by the Pennsylvania Board of Game Commissioners that deer were "destroying not only food for themselves, but were also consuming natural food for small game," the commission "decided to get some well known authority from outside the state who could give an unbiased opinion, for the use of the public as well as the game commission."

Vernon Bailey, of the U. S. Bureau of Biological Survey was secured. Mr. Bailey's reports are given with indisputable data with which to substantiate them. He has been with the United States government service for forty years, with most of his time given over to conservation problems, especially with regard to food conditions.

Due to the soundness and value of this report, it is summarized in the following:

"The country examined lies mainly in Mifflin, Centro, Clearfield and Elk counties, and includes some of the best deer range in the state." The region is mountainous, being from 1800 to 2300 feet elevation. It is rugged and deeply eroded into narrow canyons and gulches with broad plateaus at the tops of the ridges. Except for cabins of rangers or hunters, the country is uninhabited; only in the lower valleys has the farmer encroached. It was heavily forested at one time, with white pine, hemlock and hardwoods. However, it has been cut or burned over many years ago. Now forested in second growth hardwoods, such as oak, chestnut, maple, birch, aspen, alder, black cherry, pin cherry, beech and scattered conifers such as white pine, red pine, scrub pine, and hemlock and a great variety of shrubby vegetation.

The life zone is Transition, but on the highest, coldest slopes there is a trace of

Canadian. In the lower valleys there is a strong element of the Carolinian zone.

"The chestnut trees, which at one time formed a large part, possibly, one-half, of the forest timber, have all died with the chestnut blight, but young sprouts are still coming up around the base of the trees and these sprouts furnish much browse for the deer." The former crop of chestnuts are not now available for deer food. The oaks are large enough now to furnish some food in the form of acorns for deer.

Deer were reduced in 1907 to a very low number, but at that time they were given better protection. The hunting of deer with dogs had been prohibited in 1905. Deer were imported from Michigan, Vermont and Kentucky for the purpose of restocking the depleted range. In 1907 the buck law went into effect, allowing the killing of bucks with visible antlers. This law was modified in relation to length of horns and in 1925 only those bucks with two-point antlers or greater could be killed. No does had been legally killed for 21 years except in 1923 to 1926, when a limited open season on does was allowed in certain townships where they were too numerous. However, in the four years only 2400 does were killed in the state. In 1913 there were only 800 bucks killed, while in 1927, through a steady increase, 15,000 bucks were killed.

There are 45,000 bucks over two years old in the state at this time, according to estimates. It is also estimated that there are 25 does to one buck so that would indicate over 1,000,000 does in the state. Only one fawn to every 10 does is the estimated increase made by game protectors.

All the live deer seen during the investigation were does, while only one last year's fawn was noted.

Mr. Bailey said he had never seen deer feeding on such a variety of vegetation. These varieties were listed in his report. Five deer in an enclosure near Lewiston were evidently hungry for green foods as they eagerly ate dandelions, wild lettuce, mauldrake, plantain, poison oak, clover and grass. These were gathered from outside and fed to them. A heavy growth of skunk cabbage in their enclosure was untouched. "The stomach of one buck which had been killed in December and had lain on the ground through the winter was dried up and preserved." It contained a mass of masticated plant fibres, bark, buds, leaves, and other woody material. A yearling fawn stomach contained buds, leaves, twigs, and a large amount of white pine leaves. Another contained leaves, twigs and bark with a few laurel leaves.

A two-year-old doe found dead where there was an abundance of laurel contained a large amount of these leaves which made up one-half of the stomach contents. Very few farm crops go unattacked by deer.

The upper limit of browsing of deer is clearly defined and conspicuous where deer are abundant. This is known as the "deer line." It averaged about six feet from the ground where deer are congregated, but only four or five feet where it is less heavily browsed. The "deer line" is the extreme height to which the large animals can reach, while standing on their hind feet. Where the slopes have been grazed to a height of six feet by the large deer, the fawns and yearlings can not reach the lowest branches and are thus deprived of the best food. This is an apparent cause of the recent loss of large numbers of last year's fawns.

During February and March of the past winter, an unusual number of deer died. Most of these were last year's fawns; only two out of 250 carcasses were two-year-old deer. It was estimated that there were 1000 dead fawns in four townships.

The old deer seen were generally thin, but active and apparently in good health at the time. "No bucks were seen that could be recognized as such and only a few of the does that were seen at close range showed signs of carrying fawns." The fawns died because of their handicap in procuring food which was out of their reach.

Poisoning by laurel was kept in mind, but no evidence of such poisoning was secured. Much laurel and rhododendron had been eaten by both young and old deer, so that the shrubs were being rapidly killed out. "If seriously poisonous, the plant would have been avoided, but otherwise would have killed others as well as the fawns." The whole trouble is from overstocking the range with deer.

The deer have done great damage to young trees, planted in a reforestation program. Only the deer-proof fences have proved a safety measure. Norway, white and Scotch pines, European larch, Norway spruce and a few hardwoods have all met a similar fate.

"The destruction of crops at the edges of farms is also a serious problem and has given much trouble to the game commission." The commission furnishes wire and staples and the farmers build the fence in order to keep out the deer. This can only be done on a limited scale, however.

Deer have destroyed much of the cover and food required by grouse, pheasants,

turkeys, quail, rabbits and other small game.

Some of the suggested improvements are that there should be an open season on does which, besides reducing their numbers, would scatter them over a much larger area and make them wild again. This would prevent massing in favorite spots with the consequent loss by starvation. There should be at least one buck to three does. Their numbers should be kept well balanced from year to year.

Only one sex at a time should be hunted because of danger to hunters when no restrictions on sex are made, and the hunters shoot at anything.

Scattering the deer with small barking dogs in early winter would help to equalize the distribution and avoid danger of starvation. Game protectors say that all deer ranges are overstocked with does, however, and only a reduction of their numbers will relieve the situation.

Improvement of food conditions could be accomplished on the open unforested lands, where perennial plants for deer food could be introduced. It might be possible to introduce the chinquapin to take the place of the chestnut. It is a member of the chestnut family, but not effected by the chestnut blight. Various species of small oaks that produce abundant acorn crops are also possible. Some of these would grow where now vegetation is scarce or killed off. Replanting, however, is slow and expensive.

"Study of this particular instance of loss among deer indicates clearly and forcibly the practical necessity of delegating to game commissions large discretionary powers in administering game resources so that action may be taken promptly as specific conditions may require and to make possible effective introduction and use of up-to-date management practices based on sound knowledge of the habits and requirements of the animals and of conditions affecting them."—D. D. McLEAN.

SOME FACTS ABOUT FISH

The smallest known fish is the tiny Goby of Philippine waters. Average adult length is about one-half inch.

The largest known fish are perhaps the Basking Shark of sub-Arctic waters, and the Carcharodon of the tropical waters near Australia and New Zealand. They both grow to a length of about 45 feet.

The most extraordinary fish is the Vampire Ray of the West Indian waters. It reaches a width of about 25 feet across the wings.

The most remarkable fish is the Regalecus or "King of the Herrings," of the

littoral waters of northern Europe. It grows to about 20 to 25 feet in length, about 4 inches wide and about a foot high or deep.—*Montana Wild Life*, October, 1928.

SPORTSMEN'S CLUBS AND THE LAW

As the wealth of the country increases the tendency for men of means to buy large hunting and fishing preserves for their exclusive use is growing at an alarm-

on an adjacent territory. Unfortunately, however, some clubs still persist in condoning practices which are unsportsmanlike, illegal and unfair. The effect is most deplorable.

How can Mr. Average Citizen be expected to obey the law when reputable citizens of high standing tolerate violations and make game hogs of themselves?

The board of directors of a well known Mississippi Valley club last fall issued a

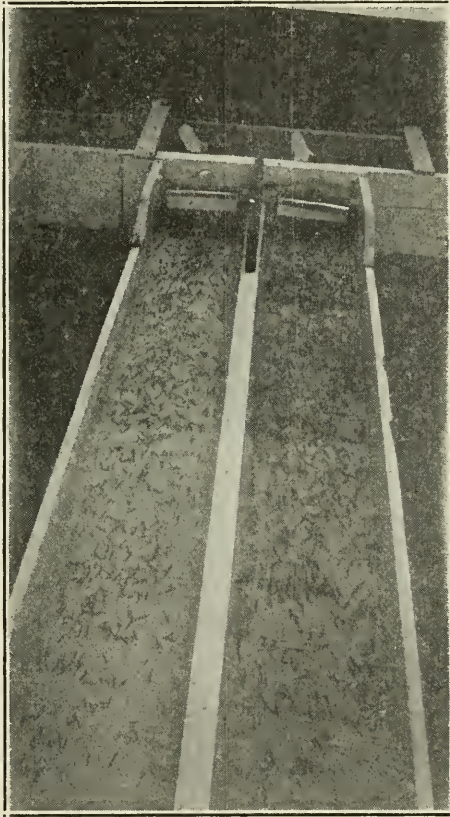


FIG. 25. Three and four-inch fingerlings, Rainbow trout. Kings River Hatchery, Fresno County, California. September, 1928. Photograph by Kenneth Shebley.

ing pace. And if the general public will not take time by the forelock and provide public lands for these purposes, certainly individuals can not be criticized for protecting themselves.

The majority of these clubs are composed of clean, upstanding sportsmen. Many of them protect, feed and stock game and fish on a much more intensive scale than is done by the general public

warning to all its members in the following language:

"Our attention has been called to the necessity for a more strict observance of the federal and state game laws, especially those pertaining to the daily bag limits and sunrise and sunset restrictions. To preserve our good standing, and the respect and morale of our employees and neighboring clubs, it is essential that this

be done. Members who deliberately violate these restrictions will be reported to the authorities."

More clubs should be doing the same thing, then follow it up with real action—not just a bluff. How about your club?—*Outdoor America*, December, 1928.

SOME RETURNS FROM CALIFORNIA BANDED BIRDS

Leo K. Wilson, writing in the *San Francisco Chronicle* for November 30, 1928, makes the following interesting report on flights made by some California banded birds:

"During the last few days of the open season on ducks and geese last year, and during the first few weeks in February of 1928, A. D. Trempe of Sault Ste. Marie, Michigan, and H. P. Gray of Piedmont, California, carried on considerable work in banding ducks, geese and other waterfowl on the various shooting preserves in the Los Banos and Gustine regions. According to a recent report from Mr. Trempe, many of the birds so banded have already been picked up by shooters. Since several of the records were of geese and mudhens, they may be of interest to other sportsmen.

Of the geese banded at the Gustine Gun Club on February 2, 1928, three have been reported as killed. Len Hawxhurst, well known local trapshooter, killed one of them at Gustine on October 1, and on the same day J. Armstrong killed one at Byron. On October 7, 1928, J. E. Doan killed the third at Gustine. Apparently the white-fronted geese return to the same winter feeding grounds after the summer breeding season in the north.

The records of mudhens are particularly interesting. Not infrequently one hears duck shooters discussing the migration of these birds. Because of their clumsy flight, it is thought by many shooters that their migrations are quite limited. However, mudhens banded at Gustine between the sixth and tenth of February, 1928, have been picked up by shooters as follows: One was found dead by H. Beaudry at Morinville, Alberta, on June 7, 1928. Another was killed at Walker Lake, Nevada, by an Indian, and was reported by E. W. Fronquist of the Indian Field Service. Another was found dead by N. D. Haylett at Eston, Saskatchewan, Canada. It seems strange that these two mudhens were found, while very few banded ducks are reported as "pickups." Perhaps someone shot them and left them where they fell."

RESOLUTIONS OF THE AMERICAN FISHERIES SOCIETY

The following resolutions were passed by the American Fisheries Society at its

fifty-eighth annual convention held in Seattle from September 28 to 31, 1928:

The American Fisheries Society approves the fish cultural policy of the U. S. Bureau of Fisheries and its program of biological and technological research along practical lines and urges the adoption by congress of the five-year program recommended by the committee on Merchant Marine and Fisheries at the last session of congress, providing for the extension of the work of the Bureau of Fisheries.

"In view of the growing menace to the fisheries through encroachments of hydro-electric developments on our streams, the American Fisheries Society urges that streams of real importance to the fisheries' resources be determined and designated without delay and that such streams be withdrawn from further power development until urgent public need for such development is clearly shown, and until a known method whereby anadromous fishes shall not be interrupted in their nuptial journey has been provided for without any doubt.

The American Fisheries Society strongly approves the efforts of the U. S. Bureau of Fisheries and the several states interested in the problem to devise an efficient method of preventing the enormous loss of fishes in irrigation ditches, and we urge that the efforts be continued until a satisfactory solution is found and applied.

It is also urged that sufficient appropriations be provided by congress for a similar investigation tending toward the solution of the fishway problem.

In view of the fact that many important fisheries in industrial districts have been destroyed by pollution of the waters; and that other important fisheries are in imminent danger from the same source; and that the state of Pennsylvania has adopted a very effective method of dealing with this problem, it is therefore urged by the American Fisheries Society that similar methods be adopted by other states.

It is also recommended that the establishment on unpolluted waters of industries having injurious wastes be delayed until satisfactory methods of handling such wastes can be applied.

The American Fisheries Society recognizes the existence of the various fisheries conservation problems common to the United States and Canada—in particular, of those relating to the salmon fisheries of the Great Lakes, and recommends the immediate adoption of appropriate treaties looking towards the restoration of such international fisheries as are depleted and the adoption of uniform regulations where such are desirable; and to a closer cooperation in dealing with such matters.

The American Fisheries Society approves the work accomplished by the Western Food and Game Fish Protective Association through the cooperation of sportsmen, commercial fishery operators and others interested in the preservation of the fisheries; and urges a closer cooperation between these various interests throughout the country in securing constructive action on fishery problems.

WHEREAS, There has been an increase of considerable proportion in commercial troll fishing in the Pacific Ocean off the coasts of Alaska, British Columbia, Oregon, Washington and California, during recent years; and

WHEREAS, There are numbers of immature salmon taken, especially during the early spring months; and

WHEREAS, This has resulted in a depletion of the salmon supply; and

WHEREAS, It is evident that in the interests of conservation and perpetuation of

a major industry that some remedial legislation is needed; now, therefore, be it

Resolved, By the American Fisheries Society, in convention assembled, at Seattle, Washington, this thirty-first day of August, 1928, that the several legislatures of California, Oregon and Washington, as to their respective coasts, the Department of Marine and Fisheries of Canada, as to the British Columbia coast, and the U. S. Department of Commerce, as to Alaska, be asked to pass uniform legislation or promulgate uniform orders, that will regulate commercial trolling, and the landing of troll-caught fish, by the establishment of closed season periods.—*Science*, November 9, 1928.

TULE LAKE BIRD REFUGE

By executive order, President Coolidge has created the Tule Lake bird refuge in northern California, thus bringing to 80 the number of wild-life reservations administered by the United States Bureau of Biological Survey. The new refuge consists of 10,300 acres of government lands in northeastern Siskiyou County, within the Klamath irrigation project. These lands are flooded to a considerable extent by waste water and thus form an excellent waterfowl resort.

Paul G. Redington, Chief of the Biological Survey, in commenting on the establishment of this project, states that this is a most important addition to the list of wild fowl refuges established by executive order and by acts of congress. Tule Lake has long been the mecca for such wildfowl as the mallard, redhead, ruddy duck, cinnamon teal, avocets, stilts, and other shore birds. It also is a favorite wintering ground for the cackling goose, a bird that breeds on the northwest coast of Alaska.

The layout of the area is such, due to mud conditions along the shores, that a natural refuge has existed in the northern part of the Tule Lake area, but sportsmen have in the past found their recreation on other portions of the area. In order not to mete out undue hardship to these sportsmen, it was deemed advisable to allow a continuance of hunting privileges on an area at the southern end of the lake, and accordingly the Secretary of Agriculture on October 10 approved an order permitting hunting on 2800 acres south of the line forming the north boundary at sections 33 and 34 of township 47 north, range 4 east, Mount Diablo meridian. The inviolate refuge, therefore, comprehends 7500 acres of land extremely valuable for resting and feeding grounds for the birds which frequent the area.

Mr. Redington further states that this refuge, which lies just south of the California-Oregon line, will supplement the Clear Lake refuge in California, just east of Tule Lake, and the recently established

Upper Klamath refuge, on the west shore of Klamath Lake, in Oregon. A year ago it was announced that because of lack of water a reflooding program on Lower Klamath Lake, west of Tule Lake, would have to be abandoned. The establishment of the refuge, therefore, on Tule Lake will in a measure offset the loss of possible sanctuary caused by the abandonment of the Lower Klamath project.

It is further stated that because of the encroachment of industrial and agricultural development the wild fowl have in many areas throughout the United States lost their former homes and stopping places, and that the government in its obligations under the Migratory Bird Treaty with Great Britain is steadily working for the reestablishment of suitable water areas so that the wild fowl may regain something of what they have lost. The setting aside of such areas strategically located along the principal lines of migration will probably do more for the future welfare of the wild fowl than any other one measure. Protective laws relating to seasons and bag limits are in effect and play their part in the conservation of ducks and geese, but these will be of little avail if they are not backed by the establishment of refuges such as the one just set aside.

NEED FOR GAME AND BIRD REFUGE STRESSED

In his report to Secretary of Agriculture Jardine on the work and accomplishments of the Bureau of Biological Survey for the year 1928, Paul G. Redington, chief of the bureau, places emphasis on wild-life research. He considers this fundamental to all other functions of the bureau and basic to the chief service expected by the public and by the various states. He also stresses the importance of the establishment of game and bird refuges as being without doubt the greatest single factor in successful wild life administration.

"The development of additional refuge areas for wild life," says Mr. Redington, "has been brought more intimately to public attention, and the sentiment throughout the country is more definitely crystallized in favor of a unified program, as it becomes generally understood that the onward march of civilization, with its farming and industrial operations, threatens, at least locally, the ultimate extinction of the various form of wild life that were the delight of our forbears and that can not be perpetuated for future enjoyment unless provided with ample range, including feeding, breeding, and resting grounds. There is urgent need for

funds to enable the Biological Survey to investigate and determine the suitability of areas that are being proposed for refuge purposes."

Mr. Redington mentions as outstanding among the accomplishments and new lines of work undertaken in research during the year, the following:

Inauguration of studies of the relative abundance of migratory wild fowl from year to year, through systematic and repeated censuses taken by cooperators on important waterfowl concentration areas.

Authorization by congressional act of more extended research having to do with the relations of wild life to forestry—the effects of birds, mammals, and other forms on forest production.

Successful crossbreeding of Alaskan reindeer with native caribou captured for the experiments, and the birth of fawns of materially increased weight.

Establishment of a Rabbit Experiment Station at Fontana, California, to supplement other investigations on the production of rabbits for fur and food, and progress in cooperative investigations of diseases of foxes and measures for their prevention and cure on fox farms.

Progress in research work on the food of the English sparrow, in studies of the requirements of the Wyoming elk, in the administration of other game animals and birds on reservations, and in coordination of state and federal policies in wild life administration generally.

Important measures mentioned for the welfare of wild life are the authorization by congress of a refuge for migratory birds in the extensive Bear River marshes, Utah, and first steps in its administration, as an aid to conserving the wildfowl resources of the west; and greater expedition in the work of acquiring lands for the Upper Mississippi River wild life refuge through congressional aid and through private donation of areas important to the purposes of the refuge.

Of importance to cooperative work for the control of wild animal pests of agriculture, horticulture, forestry, stock raising, and wild game was the development, through a conference of field leaders in rodent and predatory animal control at Ogden, Utah, of improved plans for research work and definite policies in local and general control operations. "Congress has requested," says Mr. Redington, "that there be submitted to it at the next session a plan that will operate to insure adequate control of the predatory animals throughout the country."

Seven federal conservation laws are listed that are administered by the Biological Survey, including the migratory bird treaty and Lacey acts, and, by cooperation with the Alaska Game Commission, the Alaska game law.

"Respect on the part of sportsmen and the public in general for federal and state laws for the conservation of wild life,"

says Mr. Redington, "is increasing from year to year, and United States district courts and district attorneys have continued their interest in the enforcement of the regulations. There are still too many hunters who will violate the law whenever opportunity is afforded. Demands for better enforcement of the federal migratory bird regulations are insistent and general. Citizens everywhere express their approval of the law but assert that enforcement is notably inadequate. The reason for this criticism becomes evident when it is realized that the appropriation available for enforcing the migratory bird treaty act regulations allows for the full-time employment of only 24 salaried game protectors throughout the entire country. Each game protector must on the average cover two states, and in his work can have little assistance from the United States deputy game wardens, since funds are not sufficient to permit many of these latter officials—generally voluntary cooperators—to be assigned to this duty. The establishment of an adequate force of game protectors would have immediate beneficial results in a quickening of public interest in wild life protection and in strengthening the public support of the migratory bird treaty act."

The regulations promulgated by Secretary Jardine for the protection of game and fur animals in Alaska, under the new law of 1925, are declared by Mr. Redington already to have shown their effectiveness in the conservation of the wild life resources of the territory.

"Alaska possesses many interesting and highly valuable forms of wild life," he continues, "that need more protection than is now afforded them through the limited resources available to the Alaska Game Commission. With fairly large numbers of such noted big game animals as the mountain sheep, the moose, the caribou, the mountain goat, the deer, and the grizzly and Alaska brown bears; and with foxes, beavers, minks, muskrats, and lynxes present in considerable numbers, there exists a real opportunity to put into effect a wild life administration program that not only will insure a continuance of game and fur animals in present numbers, but should operate to increase the stocks of many of these and of other species, which, without better protection, must rapidly go down hill. Forward-looking Alaskans are behind the work of the Alaska Game Commission. Demands are being made for more strict law enforcement than can be given by the commission through its force of seven full-time wardens. Each of these wardens is ex-

pected to handle an area of more than 70,000 square miles, as compared with only 100 square miles covered by wardens in the better organized states."

Prominent mention is made in the report of the "continued cordial relations with scientific institutions and individual research workers; with officers of state departments of agriculture, extension services, live stock and other associations, cooperating stockmen, and farmers; and with state conservation departments, the Alaska Game Commission, sportsmen's associations, hunting clubs, and individual sportsmen and other conservationists. Through the interest of cooperators in the varied duties assigned to the Biological Survey, the influence and helpfulness of the bureau is greatly extended, far beyond the sphere of activity of the limited force of workers that can be carried on its rolls."

"LIGHT BURNING" MENACE TO CALIFORNIA FORESTS

Periodically, the forest protection policy of the United States Forest Service, which seeks (1) to prevent fires from starting, and (2) to suppress quickly those that may start, is attacked by people who hold that the deliberate and repeated burning of forest lands offers the best method of protecting these lands from the devastation of summer fires. The "light burning" advocates base their contentions on the false premises that fire prevention is in the long run an impossibility, that controlled burning does protect the merchantable stands of timber, and that this can be done at a lower cost than by fire prevention methods. But they present no facts to prove the correctness of their theory.

The Forest Service is not interested in any "whispering campaign" of generalities against its fire prevention methods, unsupported by reliable observations or established facts. Its business, in so far as the national forests are concerned, is the growing of timber and the protection of watersheds. The present fire protection policy in effect in the federal forests is not based on guesswork, hearsay or local prejudice, but is the result of more than 25 years of active field experience in the fire game both in California and throughout the entire United States. This policy is being built up and improved by modern methods and inventions, because it has been proved that in the long run fire prevention and not "light burning" is the best system for protecting and conserving our rapidly disappearing forest resources.

Let us critically examine some of the

contentions of the "light burning" advocates:

1. It is stated that in the early days of Indian fires there were no great conflagrations; that the forests were open and free from brush, and that the forests withstood repeated burning without serious injury.

The records prove all these statements to be incorrect. The forests of California that were swept by early day fires now support only $\frac{1}{3}$ to $\frac{1}{2}$ the amount of timber per acre as compared to the stands growing on land which escaped fire. In other words, periodic burning has reduced our forest capital more than 50 per cent, and has also turned millions of acres of valuable timber-bearing land into brush wastes. On the 6,000,000 acres of forest land burned by early day fires, the loss from fire, insects and other results of burning is conservatively estimated at \$3,000,000,000. Can California afford to repeat such a waste?

Great conflagrations occurred in California during the early days. Records from both the northern and southern part of the state prove that these fires often burned from four to six months and frequently swept over more than 100,000 acres of forest and major watersheds before being extinguished by rain. No such conflagrations as these have destroyed the timber wealth of the state since fire prevention measures have been put into effect by the Forest Service. Writings of pioneer explorers and government surveyors also disprove the statement that the early day forests were open and free of brush. In fact, the records prove that brush was everywhere found, as today.

2. The "light burning" advocates further state that periodic fires improve grazing conditions, kill the "wood beetles" and make hunting easier. While those are largely selfish contentions, with little thought to the welfare of the forest, they, too, can be proved incorrect.

Periodic burning does at first increase the stand of forage plants, but extensive experiments have shown that if this practice is continued the noxious weeds and shrubs, which are more hardy than the forage plants, will soon take possession of the range and turn it into a weed and brush patch. Repeated fires eventually destroy or seriously reduce the productivity of valuable range lands, as is well illustrated by the hundreds of thousands of acres of worthless brush range along the borders of the great interior valleys.

Entomologists have proved that pine beetles and other destructive forest insects, which live in green not dead trees, are increasingly attracted to burned areas and readily attack and destroy trees

weakened by repeated fires. Experiments have shown that the volume of merchantable timber destroyed on a burned area by insect attack increases 250 per cent the first season following a fire. Also, that the "wood beetles" of which the "old-timers" talk so much, are in reality not destructive to green timber at all, but live entirely in dead and fallen trees and logs.

Brush in the forest undoubtedly makes game difficult to hunt. If game seeks the brush, that is evidence that the brush is attractive to it, just as is the forest. Destroy the brush and forest and you destroy the home and breeding place of wild life, as well as countless thousands of game birds and animals. Even with present forest protection methods the yearly toll of wild life taken by fire is enormous. What must it have been in the days when fires were looked upon with indifference or as a necessary evil?

But what actually does happen when the forest is periodically "light burned"?

First—Light fires, even if it were possible to properly control them, cause serious damage to the most valuable veterans of the stand by burning them at the base and causing cat-faces—a loss that amounts to several dollars per acre in merchantable timber every time a fire runs through the forest. In addition, all the little trees and saplings, which are the basis of the next timber crop, are killed outright. No more effective method of sure and total forest destruction could be devised. "Light burning" causes the same sort of forest destruction it is claimed to prevent.

Second—Another serious result of the repeated burning of forests is that the gradual destruction of the tree cover and the burning of the humus and top soil leads to the invasion of the land by worthless brush which makes the reestablishment of the forest more difficult. Furthermore, the brush is never entirely consumed by these fires, and each light burn makes more fuel for a later and more destructive fire. Over 2,000,000 acres of brush fields in the timbered regions of California today bear mute witness of

the destructive effects of the repeated burnings of the forest.

Third—"Light burning," contrary to the belief of its advocates, is not an easy practice either in the spring or fall, as extensive field experiments have proved, nor can it be carried on without damage to the forest. In rough mountainous country, such as makes up the greater part of our forested area, it is practically impossible to get the fires to "run" lightly over any large area, or to control them after they are once started. The cost of such work, 35 cents to \$1 per acre, is also prohibitive, even if the practice were a good one.

The absurdity of the "light burning" theory becomes apparent when we consider this proposal in the light of cold figures. Picture the job that the Forest Service would have to "light burn" each year over 12,000,000 acres of government timber and brush land in the national forests alone. At an average cost of 50 cents per acre for the job this would mean an annual outlay of \$6,000,000, or approximately *ten times the present yearly expenditures by all state, federal, and private individuals for fire suppression on all forest, brush and range lands in California.*

Do we want brush fields or forests in the mountains of California? If we want brush, let us "light burn" and deliberately destroy the great natural forest wealth of the state. But if we want a present and future supply of timber for homes and industry, water for irrigation, power and domestic use, an abundance of good fishing and hunting, and recreation grounds for all the people, we must stamp out this pernicious "light burning" sentiment which fosters and abets the spirit of incendiarism, and renew with added vigor the never-ending fight against the demon fire. And this will be a fight in which every citizen must join with federal, state and private interests to help wipe out the blot of man-caused fires which today marks the fair name of California as the worst fire state in the Union.

DIVISION ACTIVITIES

More and definite information relative to the abundance and estimated number of various species of game birds and mammals throughout the state is being gained. Requests that deputies in the field report the information desired have met with a ready response. It is believed that when all of this information has been collected that the division will be in a position to know the number of square miles of game country, and how densely populated it is with game. Emphasis has been placed upon the area of open territory in all sections of the state, how much territory is closed to hunting in each district, and how much is closed to all except owners of lands and their friends.

Despite the fact that his left eye can discern no more than light, Jay Bruce, state lion hunter, has been able to maintain his old record. Records from the Thirtieth Biennial Report show that state lion hunter Bruce has killed on an average of 15 per cent of the big cats destroyed by hunters yearly in California.

While Jay Bruce admits that the loss of his eye handicaps him in his work, it is predicted that he will be able to carry on without a rival, due to the methods which he has perfected and the number of years spent in hunting and shooting mountain lions.

Bureau of Patrol

To provide for greater effectiveness in the patrol work, deputies have been transferred from districts to which, in a few cases, they have been assigned to for years. The change affects deputies in all the northern counties and as far south as Porterville and San Luis Obispo.

The following are those affected by the general order of November 26, 1928:

Captain William Lippincott, transferred from Yreka to Eureka, to be captain of the district of which Eureka is the central point; Deputy Sam Gilloon was appointed captain of patrol at Shasta City; Deputy W. J. Harp, from Willits to Arcata; Deputy R. J. Yates from Crockett to Eureka; Earl P. Barnes, from Eureka to Colfax; Theodore M. Benson, from Fortuna to Maxwell; R. C. O'Connor, from Grass Valley to Los Banos; W. C. Blewett, from Los Banos to San Luis Obispo; H. E. Black, from San Luis Obispo to Madera; George Smalley, from Madera to San Rafael; Euell Gray, from Placerville to Crescent City; W. T.

Smalley, from Porterville to Willits; McPherson Lough, from Eureka to Mayfield; A. W. Sears, from Colfax to Placerville; Ralph Newsome, from Monterey to Fall River Mills; Lee Atkinson, from San Rafael to Douglas City; H. S. Prescott, from Crescent City to Crockett; R. C. Marshall, from Douglas City to Monterey; and A. H. Millett, from Fall River Mills to Shasta City.

Captain O. P. Brownlow, formerly in charge of fish planting, has been assigned a new district comprising Tulare and Kern counties with headquarters at Visalia.

In the southern patrol department only one change has been made. Deputy Sam Lyons has been promoted to captain and has charge of Santa Barbara and Ventura counties.

In appreciation of his activities and resourcefulness as captain of the volunteer deputies, San Francisco district, Allan G. Curry, has been placed on the regular patrol working out of the San Francisco office.

Taylor London was given employment during the month of November. He served as a deputy in the Colusa duck fields.

During the month of October, 242 arrests were made, 32 of which were dismissed, making a total of 210 cases. \$8,250 was levied in fines. In one instance a violator received a sixty-day jail sentence.

Deputy Forrest J. McDermott, recently assigned to the Santa Cruz district, achieved an unique record by making eleven cases in four days. Judge Donald Younger imposed fines totaling \$760.

Among the more outstanding cases were:

An arrest made by C. E. Holladay, of Morgan Hill, for the possession of 25 ducks during the closed season. Judge J. M. Moore assessed a fine of \$500.

A fine of \$250 was assessed by Judge Louis J. Morris, as the result of an arrest made by Deputy Sam Lyons. The arrest was made for the killing of a fawn.

Judge D. W. Rohrback levied a fine of \$200 upon a violator who was apprehended by Deputy Fred Post for killing two quail during the closed season.

As the result of an arrest made by Deputy J. P. Vissiere and volunteer deputy Jacobsen, Judge Donald Younger fined

a violator \$200 for the possession of undersized Pismo clams.

One violator had in his possession untagged salmon when arrested by Captain L. T. Ward and Deputy Charles Sibeck, who brought him before Judge Silas Orr, of Sacramento. He was fined \$200.

Deputy M. I. Joy, recently assigned to San Mateo County, made four arrests in one day at Salada Beach. Judge Edward McAuliffe, of Redwood City, tried the cases, two of which were for having non-game birds in possession.

Deputies of the San Francisco bay and river patrol have seized thirty-two illegal nets during the year. Their district comprises the ocean waters near San Francisco, the north bays and rivers and sloughs, as far north as Cache Slough above Rio Vista. This area has been patrolled continuously by deputies Charles England and Charles Bouton on the *Quinnat* and William Armstrong on the *Hunter*.

It was reported that the opening of the sagehen season on August 1, in District 4½ found several hundred hunters in Long Valley and the adjacent country to Bodie in eastern Mono County. Deputies Edward Ricketts and A. H. Crocker assert that 34 limits were taken in the Long Valley section. Accurate figures are not available, but there is reliable information on hand that indicates that fewer sagehens were killed during the two weeks open season this year than during the same period last year. Conservative estimates are that about four hundred sagehens were killed in this district this season.

Bureau of Fish Culture

The Mount Shasta Hatchery has been completely overhauled, the troughs and ponds cleaned, and the screens repaired.

During the month of October, 1,510,000 trout released by this hatchery were distributed. This left 450,500 trout and 805,000 salmon for distribution during November.

A new experimental hatchery has been completed and is in operation on the Yuba River, Sierra County.

The Kings River Experimental Hatchery has proved successful. A new dam has been built, since this hatchery will now be maintained throughout the year.

A shipment of 2,000,000 eastern brook trout eggs has been received from the American Fish Culture Company, Rhode Island. They have been distributed to the various hatcheries.

Experiments are being conducted at the Brookdale Hatchery to determine losses in trout fry. The experiments are under the supervision of J. O. Snyder and George A. Coleman.

John Marshall has been transferred from the Mount Shasta Hatchery and has been placed in charge at Brookdale.

During the winter, the hatchery crews employ their time in cleaning and repainting the troughs, building dams in preparation for the winter storms, and eyeing the eggs from the egg-collecting stations.

Bureau of Commercial Fisheries

Sardine canning operations are now in full swing, necessitating the employing of several extra men to assist the regular force in checking the canneries. During September, approximately 25,000 tons of sardines were landed at Monterey as against 23,000 tons in September of the preceding year.

In the effort to conserve California sardines for food purposes, it was necessary to file suits against four canneries. These canning companies failed to pack the required number of cases from each ton of sardines brought in.

Through study made by the workers of the Bureau it has been learned that the common hoop nets, also known as crab nets, can not be used successfully in Monterey Bay.

In the past the fishermen have been in the habit of using strings in gill nets, which really make trammel nets out of them. There has been some complaint that the use of these nets were destroying female and undersized crabs. In order to avoid this destruction, it has been agreed with the crab fishermen working out of Santa Cruz and Monterey that they should use only gill nets without any strings, and of mesh not less than nine inches in length. All crabs are to be removed from these nets on the fishing grounds, and any undersized or female crabs must be returned to the water alive and uninjured.

Joe A. Craig, statistical expert of the California State Fisheries Laboratory, Terminal Island, left for the east, where he was called by the U. S. Bureau of Fisheries to remain for a month's period to do some special work on Alaskan salmon trap statistics. While in Washington he consulted with Mr. Henry O'Malley, the U. S. Commissioner of Fisheries, and from there he went to Harvard University, where he met Mr. O. E. Settee, formerly an employee of the California State Fisheries Laboratory, and now the assistant in charge of the Division of Fisheries Industries of the U. S. Bureau of Fisheries.

Bureau of Hydraulics

Arrangements were made for the rebuilding of a fish ladder by the Clover Valley Lumber Company on Grizzly Creek, in Nevada County. The fish ladder previously installed had been washed out by the storms of last winter.

The Pacific Gas and Electric Company has repaired the fish ladder at the Folsom Dam which was damaged by the high waters of last winter. One boulder, the estimated weight of which was about 15 tons, was lodged in one pool of this fish ladder.

The Union Oil Company, cooperating with the Bureau of Hydraulics, has installed facilities to obviate pollution in the Orcutt section. Other southern California oil companies have also taken steps to avoid pollution and from investigations made, it appears that most of the oil now found on the beaches north and south of San Pedro comes from vessels entering or departing from the harbor of San Pedro.

Several inspections have been made of various dams and fish ladders, the main ones being the dams of the Feather River Power Company in Plumas County, Lassen County, and an inspection and survey of screens and ladders in the vicinity of Orleans, Siskiyou County.

Cooperating with the Bureau of Hydraulics, the Water Waste Disposal Company, of Orange County, has just finished a project for handling of oil waste at the cost of almost \$500,000. This system, which is the third of those installed in the southern California oil fields for this purpose, consists of pipe lines and tanks where the water and oil is separated. The cost of maintenance will be at least

\$50,000 annually. Pipe lines are connected with all wells and the accumulation is a heavy mixture of oil, mud and water. If allowed to flow into the natural drainage channels it becomes a serious menace to fish and plant life as well as cause of annoyance to those who seek recreation on the beaches.

The first of these systems was that of the Oil Operators Inc., which is located in the Signal Hill field near Long Beach. This system has been enlarged until ten huge settling tanks have been put in use.

Bureau of Education and Research

Dr. H. C. Bryant represented the Western Association of Game Commissioners at the Fifteenth National Game Conference held in New York City in December. Leaders in conservation from all parts of the nation attended this convention, viewpoints were exchanged, and ways and means considered for further legislation and means of protection. Dr. Bryant addressed the convention on "Conservation Fundamentals in the West" on December 3, 1928.

Official photographer E. S. Cheney has greatly augmented the prong-horned antelope film with the addition of a number of splendid close-up views of these interesting game mammals. A graphic picture of a young antelope in its natural habitat was secured, together with several views of a band in the wild. With these additions, the division is now able to give a faithful presentation of another of California's disappearing game mammals.

Additional material, sufficient to complete a reel on shorebirds, has also been secured. Outstanding in interest is a picture of a phalarope spinning and churning the water so that insects desired for food rise to the surface. A close-up of a little brown crane is considered quite remarkable when regard is had for the difficulties of stalking such a bird.

The Forest Tragedy exhibit was erected at the Lassen County Fair. Its plea for observance of the game laws lest similar tragedies be enacted made quite an impression in a country where game is so common that its abundance is considered one of the fixed facts of nature.

The miniature Mount Shasta Hatchery exhibit was displayed in the Third Annual Food Products Exposition in the

Civic Auditorium, San Francisco, in October. The portable framework for the Forest Tragedy exhibit was utilized as a background.

Bureau of Game Farms

Pheasants reared at the State Game Farm and released in Clino Valley are reported to be increasing rapidly. They have received every possible protection from the farmer in this district. Half grown pheasants in groups of from eight to sixteen birds have been seen along the roadside. Reports have come in that many birds are having a second setting.

The electric brooders recently installed at the game farm are proving very suc-

cessful with the bantams. They are being kept under close watch in order to check any possible defect.

Golden pheasants have been furnished to Griffith Park at Los Angeles and Hancock Park at Santa Maria, Santa Barbara County. These birds are supplied to parks, upon receipt of application for them, for display purposes.

Another plant of wild turkeys has been made in the mountain region where the counties of Napa, Lake and Sonoma corner. Most of the remaining stock will be sent out to individuals for breeding purposes. It is the intention to foster this plan, in order that more turkeys will be reared and wider distribution will be possible.



FIG. 26. Exhibit displaying miniature of the Mt. Shasta Hatchery. Third Annual California Food Products Show, Civic Auditorium, San Francisco, California. October, 1928.

COMMERCIAL FISHERY NOTES

N. B. SCOFIELD, Editor.

THE NORTHERN RANGE OF THE ALBACORE

The albacore, or long-finned tuna, ordinarily ranges from a short distance south of the international boundary line between California and Mexico to a short distance above the Santa Barbara Islands. Occasionally they have been taken far to the north of this. In CALIFORNIA FISH AND GAME, Vol. 13, No. 2, for April, 1927, C. B. Andrews, a member of the Fisheries Laboratory staff, tells, under date of December 16, 1926, of large numbers of albacore being caught near Monterey in that and the year preceding. He says, in part:

"For the second consecutive year albacore have been caught near Monterey in abundance sufficient to warrant interest. Last year (1926) was the first time in many years that albacore had been noticed and a great deal of excitement among the fishermen of San Francisco and Monterey resulted over the prospects of the development of a new industry. Albacore appeared off Point Sur and nearby regions last year about September 5, according to the notes of W. A. Selle, and were caught throughout the month and for some time following. This year they appeared in the same region late in October, and have continued to be caught intermittently throughout November and the first few days of December. * * * The gear that is being used is the ordinary market fisherman's boat equipped with jig poles and jigs which most of the fishermen carry with them. Individual boat catches range from a few pounds to well above 700 pounds and a goodly number range about 500 pounds when fishing is good."

Reviewing the statistical reports of the fish catch for the past four years as compiled by the Bureau of Commercial Fisheries, we find that in 1924, 420 pounds of albacore was brought in to Monterey while none was delivered at San Francisco. In 1925, Monterey and Santa Cruz received 439,504 pounds, while San Francisco received 20,525 pounds. In 1926, Monterey and Santa Cruz got 118,683 pounds, while San Francisco got none. In 1927, Monterey got 1051 pounds, while Santa Cruz and San Francisco did not get any albacore. It would appear from this that the albacore by 1927 had ceased to come so far north, but such a surmise may be but a good example of mistakes which are made by drawing conclusions from insufficient

evidence. The albacore may have been farther offshore or may have gone on past without the Monterey or San Francisco fishermen locating them, or both of these things may have happened. As evidence along this line we have the following from Mr. Perry Clark, of the San Francisco laboratory staff of the U. S. Bureau of Chemistry, who knows his fish so well he tells what species they are after they are in the can, no matter what the label on the can says they are. Mr. Clark has recently returned from an inspection tour in Alaska and gives us the following information regarding the occurrence of albacore well to the north of here.

About August 7, 1927, Capt. Matt Brandes, operating a schooner for the Union Codfish Company of San Francisco, took five albacore in approximately latitude 47° north and longitude 152° west. He continued to troll and caught about two albacore every other day until 22 were taken. The last ones taken were in 30° north and 125° west. The period of time covered was about August 7th to 18th. Capt. Brandes said that on his schooner they had taken albacore in previous years by using a troll and by sailing approximately on the great circle course between Unimak Pass and San Francisco. The captain was quite sure of the fish and described its long pectoral fins. The position given for the first albacore caught on about August 7th, is about one thousand miles west of Cape Flattery.—N. B. SCOFIELD.

WHALING INDUSTRY PROSPEROUS

According to the *Catalina Islander* more than 6000 barrels of whale oil, valued in excess of \$25,000, have been taken by the California Sea Products Company off San Clemente Island this past season. Operations have extended as far south as Cedros Island off the coast of Mexico. Four boats are used by this company. Another company operating three ships, one of them equipped with reduction machinery, is operating in the same waters.

AN UNAPPRECIATED FOOD FISH

As an illustration of how the appreciation of carp differs in different states: California is spending thousands of dollars in an effort to reduce the number of carp in certain waters where they are considered a pest, while in Wisconsin the privilege of seining carp is granted to

commercial interests and the state gets twenty-five per cent of the gross receipts. The state of Wisconsin has received from this source during the past five years \$262,942.51, according to the *Fishing Gazette*. During this time 18,119,882 pounds of rough fish, mostly carp, were taken from the state waters.—N. B. SCOFIELD.

OPENING DATE FOR THE 1928-1929 SARDINE SEASON

The sardine season usually opens at Monterey some three or four months earlier than in the San Pedro region. On three different years recently one or two canneries have opened as early as May, but the majority of plants have waited until June or July, and most of the Monterey canneries have been well launched in sardine packing by the middle of July. At San Pedro some plants have opened as early as September, but in most cases October is the first month of active sardine canning.

The opening date at Monterey has not been governed entirely by the appearance of fish in the fishing area. Economic conditions have played a very important part, especially the sale price of case goods, oil and fish meal, and in some cases the general financial standing of the canning plants. On a few occasions canneries have opened and found that fish were abundant but of mixed sizes, so that they were not desirable. In most cases, however, plants have been encouraged to open on a date earlier than they considered economically profitable because some one plant opened, and in this way obtained the pick of the choice fishing crews and cannery help. This caused uneasiness among the employees of other plants, and in this way indirect pressure was responsible for opening the canning season weeks in advance.

During 1928 the cannery men of the Monterey and San Pedro regions formed an organization for mutual benefit and, among other points discussed, was the question of agreeing on an opening date for each fishing port. It was considered an economic advantage for all plants in each port to open on a fixed date so that all would be on an equal footing in arranging for sales, ordering materials, contracting with fishermen, and employing cannery help. The advantages in economy of operation and in the placing of competitors on an equal basis were so obvious that opening and closing dates for sardine packing were agreed upon for Monterey and San Pedro.

This year then for the first time in the brief history of sardine canning the be-

ginning of the season has been determined by agreement and no plants began active canning operations at Monterey before August 6, and the San Pedro plants by agreement did not open until October 6. This agreement was distinctly for mutual economic advantage and was in no sense a conservation measure. The opening dates were chosen, having in mind the purpose of allowing each fishing region an equal number of months in which to operate, and were not determined solely by the appearance or behavior of sardines in the respective fishing areas. Likewise, the agreed upon closing dates for each region were selected for economic rather than biological reasons. We do not intend to imply an adverse criticism by this statement. On the contrary, the agreement for fixing opening and closing dates was very commendable and a decided economic advantage to the industry. We wish merely to point out that the agreed upon dates were selected for the benefit of the industry and not for the purpose of conserving our sardine supply.—W. L. SCOFIELD.

PISMO CLAM CENSUS

During the last week of November, the staff of the California State Fisheries Laboratory made the 1928 census of the clams on Pismo Beach. The relative number of Pismo clams is determined by digging a standard trench, termed a cross-section, through the intertidal zone in three different localities on the beach, and keeping a detailed record of the number and age of the clams in each locality. Such a census has been made yearly since 1923 and the results published in previous issues of CALIFORNIA FISH AND GAME. From 1918 to 1922 the survey was based on one cross-section.

Each year the work becomes more discouraging, for the supply of clams is declining steadily and rapidly. The results of this year's survey indicate that the 1928 set of clams was practically a failure. Clams spawned during the summer of 1928 comprised only 5 per cent of the total number of clams found. In 1927 the year's set constituted 25 per cent of the total, and in 1926, 32 per cent. There has been no heavy set of clams, however, since 1924, and individuals of this year-class are now very scarce on the beaches. Apparently, clams from this last successful spawning season will be seriously reduced in numbers if not entirely wiped out before they reach a legal size. Clams older than the 1924 year-class formed less than 1 per cent of the 1928 census. Previous to 1924 a very successful spawning occurred in 1919.

But clams of this year-class have not been taken in the intertidal zone since 1925. Individuals are still found in the surf beyond low tide line, but these clams are only available to the experienced digger.

The constant falling off in the supply of Pismo clams demonstrates that the present protective measures are inadequate to conserve this natural resource,

even for the immediate future. The closing of certain areas of beach to all digging has been suggested as the next step in the solution of this problem, and it is highly important that such a measure be enacted at the present legislative session.—FRANCES N. CLARK, California State Fisheries Laboratory, Terminal Island, California, December, 1928.

LIFE HISTORY NOTES

A CLOSE ENCOUNTER WITH A MOUNTAIN SHEEP

During a recent patrol trip to the mountains west of the Old Borego Valley in San Diego County, assisted by Special Deputy Alfred Wilson of Santa Ysabel. I had a novel experience, one which may never occur again.

We had just finished eating lunch in the shade of a desert juniper when Wilson motioned for me to look. I saw a mountain sheep feeding about 200 yards away. He was nibbling a bunch of grass on a small plateau on the side of a rocky mountain. We watched him through glasses for some little time, until he disappeared back of a large boulder. We knew he had bedded down and decided to see just how close we could get to him before he would either see or scent us.

There was a stiff west wind blowing, so we crept up-wind, making no noise and keeping the boulder, which hid him from view, between him and us. After considerable stalking we crawled upon the same boulder that shielded the sheep.

At sight of us he jumped up, stood stiff legged, with legs apart. We did not move. He watched us, not for five seconds, but for a full thirty seconds. He then made a few jumps and again turned around and watched us for a few more seconds, and instead of taking fright and running, he turned and walked away leisurely over the rocks.

After he had gone, I measured the distance. One may believe this or not, but we were within just twenty-one feet of this mountain sheep. He was an old ram, apparently in good condition. Both horns were broken and worn off at the turn. Wilson and I estimated him to weigh close to 200 pounds.

At different times while on patrol of this same vicinity, I have cut the track of mountain sheep, but this is the first time in my life that I had the pleasure to meet one in the wild.—E. H. GLIDDEN, San Diego, California.

LAMPREYS INJURE STRIPED BASS

For a number of years, striped bass fishermen have discussed the sore spots to

be found on striped bass caught in the San Francisco Bay region. Several fish recently sent in for investigation indicated that injury was due to the lamprey eel. The lamprey eels holds onto the bass by a suction of its round mouth. The normal place for fastening is on the sides or belly where the scales are not so thick. The rasp-like teeth help in cutting through the skin to secure the blood and juices of the fish.—N. B. SCOFIELD, Russ Bldg., San Francisco.

MOUNTAIN LION SEEN KILLING A DOE

The following is the account of watching a California mountain lion kill a doe.

May 1, 1928, I took my station in the Ash Mountain lookout tower in Sequoia National Park. This tower was recently constructed and is one of the most modern of fire lookouts. As wild life is protected here in the park, it became evident to me that there was much to be seen from the tower, and I therefore lived there.

Bears were my first visitors. They came for the bacon and honey that was placed out for them. Deer came later and it was very interesting to watch the young fawns take their first taste of salt, which they did surprisingly early in life.

About May 15th, a female mountain lion walked out on a ledge some two hundred yards away. This ledge is on the face of a cliff about 1200 feet high and overlooks the Kaweah River. Immediately behind the lioness were two very small, wobbly, clumsy cubs or kittens. The lioness stretched out full length in the sun and the cubs nuzzled around her. They all disappeared back in the brush about 4 o'clock in the afternoon. This was repeated for two or three weeks. The cubs grew very fast and were the most playful little animals I had ever seen.

The female lion started training the cubs on grasshoppers, for she would pounce upon them and then watch the kittens try their luck. Much time was spent in manicuring their claws on tree trunks. One small sapling is so badly scratched that I doubt if it will live.

The lioness very rarely corrected the cubs, but when she did, she was quite severe. Butterflies, also, attracted considerable of the cubs' attention.

One morning early in July, just as the sun was coming up, I was watching an old doe and a fawn on a rock-covered hillside. The doe was feeding, and being curious to know what there was to eat in such a barren place, I trained the glasses on her. There were small bunches of grass growing out of the crevices in the rock on which she was nibbling. The doe was standing with her front feet down hill. She was just raising her head when

The lion grasped the neck of the deer and pulling with her shoulder and back, half-carried the carcass about ten or fifteen feet to a comparatively level place where she laid the deer down. She then took a very careful look around.

The fawn disappeared at the first sign of trouble and I have never seen it since that I know of.

The lion then walked back, and, placing her left foot on the flank of the deer ripped the stomach open with the right. She then tore away the left flank of the deer, eating some of it and the short ribs. She cleaned the small intestines by pull-



FIG. 27. Mountain lion killed in Calaveras County by Deputy Frank Pickering, December, 1928. Photograph by Jack O'Connell.

the lioness jumped on her. I did not see the lioness until she was in midair although she was full in the finder of the glass. I am sure the doe never, at any time, knew what hit her. The lioness was spread out and landed full length on the deer, the left forefoot striking back of the deer's left shoulder and catching into the chest or lower ribs. The lion's right foot hit the deer in the neck and knocked the deer's head clear round toward the shoulder. The impact could be heard plainly from quite a distance. The deer either sank or was forced down at once. There was no struggle.

ing them from under her foot and ate a considerable amount of them. She ate well into the loin before she seemed satisfied. All during this time she would stop and look around at very short intervals.

Apparently at some given signal, the two cubs now came down out of the nearby brush. The lioness stood guard while the youngsters ate from the hams and the insides. After one cub had eaten all he wanted, the female walked between the kill and the cubs. One little fellow seemed to be still hungry, but was refused the privilege. He apparently contested her authority and was promptly

slapped, rolling over and over from the cuff.

The two cubs then came under the tower and went on to their den. The lioness retired up the hill some seventy or eighty yards to a rocky, brushy point and stretched out full length with her head between her forepaws. At 4:30 p.m. she arose and went back to the kill and ate all she could hold, in fact, when she passed below me her sides were actually bulging out. The lioness never came back to this deer, although I waited until the fourth day before going over to the kill.

During the summer, I have gone to or found eleven kills. One of them showed signs of a hard struggle; the others were mostly clean kills. The cubs must be good sized lions at the present writing, October 3, 1928, and it seems they have gone into new country as I have not seen them for over three weeks.

After this observation, I am wondering if mountain lions are not right handed as all the major activities were performed with the right foot. I had been given the impression that lions used their hind feet in killing. However, I do not wish to have it said that I doubt this statement. I was not in a position to see just

what was done with the hind feet. My entire attention was attracted to the front feet and head. It all happened so fast that probably only a slow motion camera could satisfactorily record the action.—J. GILBERT WADE, Giant Forest, California.

BLACK BRANT AGAIN ON MISSION BAY

For several years I have been watching the goings and comings of waterfowl in Mission Bay, in San Diego County, knowing that black brant appeared there. However, more recently a group has utilized the bay as a feeding ground. The present season, a flock of 17 arrived on November 16. The records for previous years have shown that these birds arrive regularly between November 15 and 20. Last season I recorded the fact that some 200 were present for a period of several months.

From all reports, the different lakes of San Diego County have had an unusually good supply of pintail, canvasback and baldpate ducks, as compared with other seasons. Scaup ducks appear to be less abundant than in former years.—AD B. PEARSON, North San Diego, California.

CONSERVATION IN OTHER STATES

GAME CONDITIONS IN ATLANTIC STATES

That there is more game today in a number of the older settled states of the Union than half a century ago is a claim made by John B. Burnham in *The American Field*, for October 13, 1928. This fact that game is being brought back he takes as evidence "of the good results of game administration under the modern system, the keystone of which is the inviolate sanctuary where nothing can be killed at any time of the year, with the exception of destructive birds and animals."

In the formerly "shot out" industrial state of Pennsylvania he points out that "game has increased to such an extent that it is worth at market value more than all of the state's domesticated stock, including sheep, cattle, hogs, horses and poultry. In the old state of Vermont, deer were exterminated shortly after the Civil War. Some Rutland County sportsmen secured seventeen deer for restocking the state. This restocking was so well administered that there are, probably, more deer to the square mile in the Green Mountain area than in almost any other place. * * *

"The most important reason why we can never have as much game as existed in colonial times has nothing whatever to do with hunting. Agriculture and industry have taken the best game ground. Industry follows the harbors and streams and the course of agriculture. Agriculture naturally takes the most fertile ground and the ground which will raise the most food for human beings will similarly raise the most food for the game; consequently agriculture and industry have driven game to the poorer lands. As long as rail fences were in existence the situation was not clearly so bad for the game, but with wire fences and close cultivation, their hiding places and refuges were destroyed. The mowing machine and the cultivator and other farming implements have destroyed the nests of ground-nesting game birds, so that there are few natural sanctuaries left. This is the reason why, through federal and state action, we must create large numbers of what, for want of a better term, may be called 'artificial sanctuaries.' Many such areas require reforestation. All of them require improvement in the food supply."

WISCONSIN GIVEN POWER TO CLOSE SEASON

Prior to the present year, no authority existed under the statutes of Wisconsin to exercise any discretion on the part of administrative authorities in the protection of fish and game. The last legislature, however, provided that the Conservation Commission shall have power to close seasons, "when it shall find after investigation and public hearing that such action is reasonably necessary for the perpetuation of any species of fish and game and the maintenance of a reasonable supply thereof." This new provision has resulted in numerous applications to the commission for additional protection to various species in some parts of the state and a series of hearings are being held to determine what action shall be taken. Additional protection has been asked for all species of grouse for a closed season on rabbits during October in certain counties.—*American Game*, August and September, 1928.

MISSOURI URGES SPORTSMEN TO ASSIST IN VERMIN CONTROL

The plan of organized control of predatory animals adopted by New Jersey sportsmen is urged by Missouri. Its commission is earnestly striving to inform sportsmen of the harm stray cats do. Acknowledged to be the most insidious destroyer of small game like rabbits, quail and squirrels, Missouri authorities urge sportsmen to wage constant warfare against the stealthy and deceptive woods cat. The goshawk and Cooper's hawk are also blacklisted and are held up for eradication by hunters.

NEW YORK SUCCEEDS IN CON- SERVING DEER

The Conservation Department of New York reports that the kill of antlered deer for 1927 was 7000. This figure is indeed impressive when it is realized that not so many years ago deer were nearly extinct in New York due to their slaughter by market hunters. By application of the buck law and adequate sanctuaries, New York has been able to restore her deer supply.

CANADIAN PARK RECEIVES BUFFALO

According to a bulletin of the American Game Protective Association, the Canadian government plans a further movement of over 1000 yearling and two-year-old buffalo from the Buffalo National Park at Wainwright, Alberta, to Wood Buffalo Park, near Fort Smith, Northwest Territories.

This shipment will bring the number of buffalo introduced in the Buffalo National Park to over 6600. Buffalo were first placed in the park in 1925, and wardens estimate that the grand total, after this year's shipment is completed, will be over 9000 head.

NATURE GUARDS ORGANIZING IN SOUTH STATES

Two of the southern states have inaugurated a very important educational movement among boys and girls. It was started by Commissioner Peter S. Twitty, of the Georgia Game and Fish Department, and has recently been inaugurated in Louisiana. The movement has taken the form of an organization of boys and girls as "Nature Guardians," the members of which are pledged to protect and preserve the wild life, including animals, birds and plants.

"The lack of information about the common things about us is almost beyond belief," says a bulletin of the American Game Protective Association, and an organization such as this will do more than anything else, not only to inform the young generation but to create an interest and love for the wild creatures and desire to protect and care for them. Very few people, comparatively, are able to identify common birds and plants which is not as it should be and accounts in a measure for the prevalent lack of interest in their preservation.

Members of the "Nature Guardians" subscribe to the following pledge:

"Upon my honor as a Nature Guardian, I promise to help take care of all our natural friends, to guard and protect them to the best of my ability, and, as far as possible, influence others to do the same.

1. I will not injure or kill a bird, fish or animal in violation of the law.

2. I will try to preserve the forests and wild flowers from destruction by fire or otherwise.

3. I will assist whenever possible the conservation agents in caring for these, my friends.

4. I will familiarize myself with the game laws of my State so as to learn how best to protect and guard the GREAT OUTDOORS.

All this I promise upon my WORD OF HONOR."

The organization is extended through schools, clubs, scout organizations, etc., and the educational departments of the two states cooperate heartily in extending its activities.

The movement is of such an excellent character that it will probably extend throughout the entire country.

(The above is a copy of an article which appeared in the *Game and Fish Conservationist* (Sept.-Oct., 1928, page

72), issued by the State Commission of Game and Inland Fisheries, Richmond, Virginia.)

ANOTHER GAME REFUGE FOR MISSOURI

The tenth auxiliary game refuge for northern Missouri was established in October. The refuge embraces 1700 acres of rolling land with an abundance of cover and water and will be stocked shortly with Chinese ring-necked pheasants.

Only three north Missouri districts remain now without auxiliary refuges.

MICHIGAN STUDIES BLACK DUCK MIGRATIONS

The black duck has displaced the mallard in Michigan and become the most important duck of interest to sportsmen. For this reason, the Conservation Commission has trapped and banded a large number of the species this season. Conservation officials are interested in knowing if these birds, which breed in the state, return after migrating to other regions.

NEW YORK REPORTS ON HUNGARIAN PARTRIDGES

Announcement is made by the Conservation Department of New York that favorable reports have been received from various parts of the state on the result of planting Hungarian partridges. In the northeastern corner of the state the Hungarians have been especially successful and have spread over considerable area and even north into Canada. A number of young broods have been seen in various sections. The final test will come after several years and after the birds have passed through the severe winter weather. The reports so far are encouraging.—*American Game*, August and September, 1928.

MONTANA HAS FIRST OPEN SEASON ON PHEASANTS

In answer to the appeals of sportsmen, farmers and landowners, the Montana Fish and Game Commission permitted a two-day open season on Chinese ring-necked pheasants, November 24 and 25, 1928. This is the first open season on the "multi-colored strutters" since their introduction several years ago.

ARKANSAS BIENNIAL REPORT HIGHLIGHTS

Some outstanding accomplishments listed by the Arkansas Commission are as follows: More than 8,000,000 fish re-

claimed and planted in live waters; 8,392,000 buffalo fry hatched and planted; 135,000 bass, bream and trout produced or procured from the United States Bureau of Fisheries and distributed; construction of world's largest fish hatchery started; 44 deer, 13 turkeys and 4443 pheasants bought or produced and liberated in suitable areas; 2000 pheasant eggs distributed among interested persons; 660 predatory animals killed; 1447 convictions gotten for game and fish law violations; 331 pieces of illegal tackle destroyed; 1669 pounds of fish and 362 pelts of fur-bearing animals, illegally taken or possessed, confiscated and donated to charity; 291 birds and animals, illegally taken or held, liberated; extensive educational work done, and more effective law enforcement provided.

OREGON RESCUES MILLIONS OF FISH

Through the efforts of the Oregon Game Commission, some four millions of bass, crappies and catfish have been rescued from waters being drained in reclamation areas about the city of Portland. It is claimed that this is a unique record. Some of the salvaged fish were placed in barren lakes and sloughs throughout the state. The waters of the Columbia and Gilbert rivers, Big Sturgeon, Marquam, Oswego, Carlton and Smith lakes and the Bybee, Columbia and Willamette sloughs all benefited greatly from this work.

NEVADA SPORTSMEN AID STATE

According to *American Game*, October and November, 1928, several Nevada counties have taken action to limit hunting to three days a week during this season. Formerly there was a provision on the statute books of the state limiting shooting in this manner. Sportsmen of the state quite generally believe that the limitation is necessary and have taken steps independently of the state law to continue it.

WISCONSIN STUDIES AGE OF FISH

A geological and natural history survey of the lakes and streams of Wisconsin will include the collection of scales of some 50,000 fish. The age of a fish can be determined by microscopic study of its scales, each year's growth being indicated by rings. By studying the scales of sample fish, it is expected that their rate of growth will be shown for various waters, and this together with other evidence collected, will furnish the Wisconsin Commission with valuable data.

REPORTS

GAME CASES

July, August, September, 1928

Violation	Number arrests	Fines imposed	Jail sentences imposed (days)
Hunting License Act.....	95	\$2,445	340
Deer: closed season; does, fawns, deer tag license act.....	132	9,875	250
Deer: running with dogs, closed season.....	3	100	.....
Ducks: closed season, over limit.....	22	1,115	30
Geese: closed season.....	1	25	.....
Doves: closed season, over limit.....	26	1,000	180
Quail: closed season, over limit.....	35	1,435	.....
Pheasants: closed season.....	3	125	.....
Sagehens: closed season.....	1	25	.....
Grouse: closed season.....	2	35	.....
Pigeons: over limit, closed season.....	2	50	.....
Shore birds.....	2	75	.....
Non-game birds.....	9	575	.....
Rabbits: cottontail and brush, closed season.....	14	435	.....
Squirrels, tree: closed season.....	1	25	.....
Sierra hare.....	1	.....	.....
Night hunting.....	5	50	.....
Game refuge: hunting or possession of firearms in.....	13	500	.....
Shooting from automobile.....	10	160	25
Bird traps.....	1	.....	100
Commercial Gun Club License Act.....	1	25	.....
Trespass.....	1	25	.....
Totals.....	380	\$18,100	925

FISH CASES

July, August, September, 1928

Violation	Number arrests	Fines imposed	Jail sentences imposed (days)
Angling License Act.....	72	\$1,605 00	32½
Commercial Fishing License Act.....	36	230 00	.....
Trout: over limit.....	12	322 50	.....
Black bass: undersized.....	15	355 00	20
Striped bass: over limit, undersize.....	50	1,590 00	.....
Salmon: over limit.....	2	125 00	.....
Clams: undersize and over limit.....	82	2,735 00	.....
Obsters: under or over size.....	5	200 00	.....
Abalones: undersize, over limit.....	20	655 00	100
Halibut: over limit, undersize.....	2	50 00	.....
Barracuda: undersize.....	6	180 00	.....
Sturgeon possession of.....	2	25 00	.....
Illegal night fishing.....	1	.....	.....
Illegal fishing: within 250 feet fishway; 150 feet lower side of dam.....	2	50 00	.....
Nets, traps, seines, lines; illegal possession or use of.....	24	2,620 00	207
Failure to keep commercial fishing data.....	1	10 00	.....
Fishing in closed district.....	7	125 00	.....
Small fish.....	3	225 00	.....
Pollution.....	1	200 00	.....
Totals.....	343	\$11,302 50	359½

SEIZURES OF FISH AND GAME

July, August, September, 1928

Halibut, pounds.....	565
Sunfish, perch.....	29
Catfish.....	2
Black bass.....	101
Striped bass.....	263
Trout.....	193
Abalones, pounds.....	4,330
Salt water eels.....	12
Clams.....	1,796
Crabs.....	65
Blue fin tuna, pounds.....	2,668
Bonita, pounds.....	2,862
Barracuda, pounds.....	2,529
Shad.....	6
Carp.....	5
Salmon.....	340
Sturgeon.....	2
Lobsters.....	1,479
Pigeons.....	2
Shorebirds.....	23
Sierra Hare.....	1
Ducks.....	178
Mud hens.....	2
Rabbits.....	45
Quail.....	41
Pheasants.....	1
Non-game birds.....	37
Grouse.....	2
Doves.....	380
Sagehens.....	6
Geese.....	3
Deer.....	46
Deer meat, pounds.....	353
Deer hides, green.....	3
Nets, traps.....	2

STATEMENT OF INCOME

For the Period July 1, 1928, to September 30, 1928 of the Eightieth Fiscal Year

License sales:	Detail	Total
Angling licenses—1927.....	\$1,040 00	
Angling licenses—1928.....	147,686 70	
Hunting licenses—1928.....	65,686 00	
Market fishermen's licenses—1928-29.....	19,990 00	
Wholesale fish packers' and shell fish dealers' licenses—1928-29.....	690 00	
Game breeders' licenses—1928.....	60 00	
Fish breeders' licenses—1928.....	35 00	
Trapping licenses—1928-29.....	329 00	
Commercial hunting club—1928-29.....	1,075 00	
Commercial hunting club operators—1928-29.....	335 00	
Deer tag licenses—1928.....	20,142 00	
Total license sales.....		\$257,068 70
Other income:		
Game tag sales.....	\$6 30	
Court fines.....	21,368 44	
Fish packers' tax.....	30,055 77	
Kelp tax.....	48	
Fish tag sales.....	1,790 74	
Crawfish inspection.....	21 00	
Interest on bank deposits.....	1,353 07	
Miscellaneous sales.....	113 85	
Total other income.....		54,709 65
Total income.....		\$311,778 35

DEER KILLED IN 1927-1928, BY COUNTIES

County	Deer killed 1927	Deer killed 1928	Land area, square miles
Siskiyou.....	1,665	1,654	6,256
Mendocino.....	1,475	1,468	3,539
Lake.....	901	1,038	1,238
Tulare.....	744	939	4,856
Santa Barbara.....	669	851	2,740
Tehama.....	799	846	2,925
Monterey.....	757	830	3,330
Trinity.....	921	800	3,096
Humboldt.....	821	777	3,575
Fresno.....	592	763	5,950
Sonoma.....	751	753	1,582
Modoc.....	510	729	3,823
Shasta.....	612	603	3,858
Glenn.....	623	592	1,337
Plumas.....	551	586	2,593
Napa.....	442	569	783
El Dorado.....	535	548	1,737
Santa Clara.....	397	536	1,323
San Luis Obispo.....	394	450	3,334
Marin.....	367	444	529
Lassen.....	296	393	4,531
Los Angeles.....	425	369	4,115
Ventura.....	274	362	1,878
Placer.....	341	346	1,411
San Benito.....	217	320	1,392
Madera.....	260	300	2,112
Kern.....	218	295	8,003
Colusa.....	263	272	1,140
Alameda.....	220	263	732
Riverside.....	323	249	7,223
Inyo.....	173	239	9,991
San Diego.....	169	232	4,221
Tuolumne.....	213	213	2,190
Butte.....	228	212	1,693
Calaveras.....	149	191	1,027
Yolo.....	115	169	1,014
Nevada.....	125	140	974
Mariposa.....	95	134	1,463
San Bernardino.....	74	122	20,175
Stanislaus.....	91	115	1,450
Sierra.....	101	102	923
Santa Cruz.....	78	92	435
San Mateo.....	77	89	447
Amador.....	59	78	601
Orange.....	56	69	795
Merced.....	67	68	1,995
Alpine.....	67	66	776
Mono.....	36	55	3,030
Solano.....	45	52	822
Yuba.....	53	52	632
Del Norte.....	42	48	1,024
San Joaquin.....	21	14	1,448
Contra Costa.....	5	6	714
Imperial.....	1	4	4,089
Kings.....	3	3	1,159
Sutter.....	1	3	608
Sacramento.....		2	983
San Francisco.....			42
Totals.....	19,507	21,515	155,672

HUNTERS KILLING TWO DEER

County of residence	Number of hunters	County of residence	Number of hunters
Alameda	90	Riverside	29
Alpine	1	Sacramento	39
Amador	8	San Benito	35
Butte	42	San Bernardino	20
Calaveras	11	San Diego	30
Colusa	40	San Francisco	108
Contra Costa	26	San Joaquin	29
Del Norte	6	San Luis Obispo	68
El Dorado	24	San Mateo	23
Fresno	93	Santa Barbara	98
Glenn	49	Santa Clara	66
Humboldt	80	Santa Cruz	23
Imperial	2	Shasta	63
Inyo	28	Sierra	5
Kern	64	Siskiyou	120
Kings	13	Solano	29
Lake	49	Sonoma	102
Lassen	9	Stanislaus	19
Los Angeles	202	Sutter	20
Madera	14	Tehama	34
Marin	45	Trinity	31
Mariposa	6	Tulare	77
Mendocino	105	Tuolumne	10
Merced	7	Ventura	34
Modoc	7	Yolo	39
Mono	1	Yuba	9
Monterey	82	Iowa, State of	1
Napa	33	Oregon, State of	2
Nevada	4	Nevada, State of	1
Orange	37	Nebraska, State of	1
Placer	19		
Plumas	17	Total	2,379

STATISTICS ON DEER KILL, SEASON 1928—Continued

County where deer was killed	County of residence of hunter														Totals					
	San Mateo	Santa Barbara	Santa Clara	Santa Cruz	Shasta	Sierra	Siskiyou	Solano	Sonoma	Stanislaus	Sutter	Tehama	Trinity	Tulare		Tuolumne	Ventura	Yolo	Yuba	Non-residents
Alameda			14							1						1				263
Alpine			1							7										66
Amador										2										78
Butte			2							1							2	5		212
Calaveras			3	2						12										191
Columbia			2							1							28	4	2	272
Contra Costa																				6
Del Norte										1										48
El Dorado										4							2	1	2	548
Fresno			2	1						2										763
Glenn			8	3	5					10				84						592
Humboldt			9	6	2					1							44	8	1	777
Imperial			7							14										4
Inyo																				239
Kern																				295
Kings																				3
Lake			16	3						63										1038
Lassen			14	8						44										383
Los Angeles										1							27	2	2	369
Madera										5										300
Marin			2	1						4										444
Mariposa			2							14										134
Mendocino			41	1						18							5	3	1	1,408
Merced										5										68
Modoc			4	7						17							3	17	12	729
Mono										9										55
Monterey			9	2						30										830
Napa			5	7						5										569
Nevada			1							3										140
Orange										3										69
Placer										8										346
Plumas			10	1						17										586
Riverside			14	3						5							10	14	3	249
Sacramento										25										2
Sacramento										4										2
San Benito			13	14						1										320

County where deer was killed

County of residence of hunter

CALIFORNIA FISH AND GAME

DEER KILLED IN DISTRICTS 2-2½-3 AUGUST 1-SEPTEMBER 14, 1928

	Aug. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Alameda.....	42	14	10	13	15	4	1	2	4	1	3	8	2	5	4	3	2	3	15	5	1	2	3
Colusa.....	45	26	24	12	9	2	2	7	3	4	5	8	2	5	7	7	7	3	4	1	2	1	5
Contra Costa.....	15	7	43	2	4	14	2	15	1	7	11	2	4	7	1	3	1	2	2	2	2	1	2
Fresno.....	131	64	43	33	34	5	5	3	2	2	1	14	4	4	9	14	6	14	17	8	6	3	7
Glenn.....	10	4	1	3	5	3	1	3	2	2	1	2	1	1	1	1	1	2	2	2	1	1	2
Kern.....	10	4	1	3	5	3	1	3	2	2	1	2	1	1	1	1	1	2	2	2	1	1	7
Kings.....	168	69	1	44	46	15	17	14	11	16	15	30	12	18	10	12	10	18	22	7	7	7	6
Lake.....	37	8	13	6	34	2	8	10	9	4	10	27	4	3	5	4	2	6	23	1	6	5	2
Marin.....	181	89	94	68	55	19	31	25	24	30	28	18	24	22	18	18	10	28	32	0	13	10	17
Mendocino.....	11	6	1	1	5	2	1	1	1	1	1	6	1	1	4	1	1	1	1	1	1	1	2
Merced.....	94	44	50	29	27	13	16	9	13	10	12	16	13	11	7	18	11	9	32	7	5	9	12
Monterey.....	78	34	24	15	41	3	5	6	6	6	17	28	1	4	6	7	6	10	26	4	7	2	2
Napa.....	51	14	9	8	21	2	2	8	1	4	7	11	2	2	2	4	4	2	13	3	2	4	5
San Benito.....	7	19	11	19	20	4	10	3	3	2	5	20	7	6	5	3	2	7	1	2	3	1	4
San Francisco.....	54	19	11	11	20	4	10	3	3	2	5	20	7	6	5	3	2	7	1	2	3	1	4
San Joaquin.....	15	1	1	3	5	1	1	2	1	1	1	7	1	3	2	1	1	6	5	1	1	1	4
San Luis Obispo.....	149	63	32	39	52	20	11	11	13	9	13	24	9	8	18	17	15	14	24	7	8	13	9
San Mateo.....	72	22	15	15	33	4	3	7	8	6	8	23	6	3	4	5	3	10	17	4	1	3	4
Santa Barbara.....	13	9	4	1	6	1	2	1	1	1	1	11	1	1	1	1	1	2	4	1	1	1	4
Santa Clara.....	6	1	1	4	5	1	1	1	1	1	3	3	1	1	1	1	1	2	4	1	1	1	4
Santa Cruz.....	73	20	15	22	39	10	10	7	11	1	9	31	4	8	4	11	9	18	29	6	3	9	7
Solano.....	12	3	2	6	7	5	6	7	3	3	1	2	1	1	1	2	1	1	9	4	2	1	2
Sonoma.....	93	29	19	18	21	5	6	7	8	5	5	17	5	5	3	4	1	3	4	1	4	3	2
Stanislaus.....	26	4	4	4	11	2	1	1	1	3	4	5	1	2	4	1	1	3	4	1	1	3	2
Yuba.....	26	4	4	4	11	2	1	1	1	3	4	5	1	2	4	1	1	3	4	1	1	3	2
Totals.....	1,388	556	436	365	496	124	136	136	126	126	159	313	91	114	114	134	90	159	300	75	73	77	93

DEER KILLED IN DISTRICTS 2-2½-3 AUGUST 1-SEPTEMBER 14-Continued

	24	25	26	27	28	29	30	31	Sept. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	Totals	
Alameda.....																								
Colusa.....	1	2	13	2	2	4	3	2	2	7	3		1	3	3	5	13	3	5	8	11	11	263	
Contra Costa.....			8	1	8	5	3	3	8	7	3			4	1	4	6		2	4	9	6	272	
Fresno.....						1	1	1	1	3	7		1										62	
Glenn.....	4	4	7	7	3	3	7	3	6	10	2		5	5	6	5	8	6	3	4	5	4	592	
Kern.....		2							1	1									2	1	1	1	49	
Kings.....																							3	
Lake.....	10	8	24	6	17	8	9	4	40	34	6		11	9	8	20	44	21	11	37	29	36	1,038	
Marin.....	1	6	16	3	4	7	2	3	4	26	15	3	6	8	10	4	25	30	10	5	11	19	444	
Mendocino.....	18	22	34	10	14	12	21	23	19	50	24	12	14	16	16	29	63	38	29	42	42	56	1,468	
Merced.....	1	2	3		1	1	3	1	1	1	1		2			3	3		1	1	1	1	66	
Monterey.....	6	15	15	4	9	11	5	8	7	19	20	9	10	9	8	16	40	26	25	36	37	28	830	
Napa.....	1	11	25	2	5	3	4	2	5	24	15	3	7	6	4	11	30	11	9	7	20	24	569	
San Benito.....	3	6	11	3	2	4	3	4	2	12	5	1	3	4	5	8	14	14	2	11	9	11	320	
San Francisco.....																								
San Joaquin.....	4	7	14	5	6	7	7	2	1	1	2		1	2	6	8	28	11	8	1	28	29	450	
San Luis Obispo.....																							89	
San Mateo.....	1	1	2	1	2	1	3	4	4	5	5		4	5	9	1	1	5	9	13	2	2	851	
Santa Barbara.....	1	1	5	13	10	8	8	6	9	28	18	4	9	5	9	9	29	14	14	9	28	24	30	
Santa Clara.....	5	12	22	3	8	5	3	2	8	24	18	4	4	6	2	8	29	15	16	14	30	27	536	
Santa Cruz.....			6	1	1		3		1	6			1		2	2	5	1	1	3	1	5	92	
Solano.....			2			2		1			1				2	2	2	2	2	2	3	1	52	
Sonoma.....	5	12	31	12	8	5	7	12	11	35	24	6	8	9	13	18	56	30	10	17	23	36	753	
Stanislaus.....	2		1	1	2	1	1	1	1	1	1	1	3	6	2	1	6	3	3	3	5	10	108	
Ventura.....	2	6	13	3	4	2	5	1	5	9	1	1	2	6	2	5	3	8	6	3	6	6	362	
Yolo.....						1	2		7	2	1		2	2	2	5	9	8	5	11	6	17	109	
Totals.....	65	125	269	77	78	91	103	80	121	322	204	55	91	94	97	164	418	249	155	253	308	358	9,458	

DEER KILLED IN DISTRICT 1½ SEPTEMBER 1-OCTOBER 15, 1928

	Sept. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Del Norte.....	2	2	2	1	2	1	1	2	3	1	1	1	1	1	4	2	3	3	3	1	2	2	4
Humboldt.....	75	53	28	14	15	20	9	15	34	12	20	28	21	21	14	20	7	9	8	7	7	4	18
Siskiyou.....	206	110	71	47	34	46	40	41	67	28	26	44	16	15	24	48	22	21	22	17	24	14	28
Totals.....	283	165	101	62	51	67	50	58	104	41	47	72	38	36	42	70	32	30	33	25	33	19	50

DEER KILLED IN DISTRICT 1½ SEPTEMBER 1-OCTOBER 15, 1928—Continued

	24	25	26	27	28	29	30	Oct. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Totals	
Del Norte.....			1	1	1	1		1				1	13	21	5	1	1	15	30	31		2	48	
Humboldt.....	4	9	11	10	9	4	10	5	12	16	16	12	12	13	21	8	17	15	30	31	47	47	13	777
Siskiyou.....	11	32	21	22	22	13	36	11	19	18	28	31	28	43	21	32	31	34	44	48	55	43	43	1,654
Totals.....	15	41	33	32	32	18	46	17	31	34	44	41	41	64	26	41	49	49	74	79	104	56	2,479	

CALIFORNIA FISH AND GAME

DEER KILLED IN OTHER DISTRICTS SEPTEMBER 16-OCTOBER 15, 1928

	Sept. 16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Alpine.....	21	6	4	3	2	3	3	1	1	1	2	3	4	2	
Amador.....	17	4	2	4	3	2	2	9	2	1	3	4	4	1	
Butte.....	40	16	4	3	3	2	3	3	2	3	3	4	4	5	9
Calaveras.....	35	16	8	9	4	4	5	7	3	1	2	1	4	3	9
El Dorado.....	134	28	19	11	16	8	16	30	1	6	7	8	16	9	25
Fresno.....	123	61	52	36	34	13	21	23	8	8	5	13	16	13	12
Imperial.....	1							1						6	6
Inyo.....	45	13	10	11	7	6	7	10	2	3	1	4	2	4	10
Kern.....	49	14	13	9	4	1	2	12	3	1	5	3	2	4	4
Kings.....															
Lassen.....	56	21	25	23	11	17	7	18	10	8	8	10	5	6	15
Los Angeles.....	69	21	13	12	8	5	6	13	2	2	5	5	5	6	9
Madra.....	84	23	22	13	7	8	8	11	3	3	6	3	5	5	8
Mariposa.....	25	3	5	1		4	5	4	2	2	3	2	2	2	3
Merced.....	111	65	62	38	33	22	16	30	15	17	7	9	12	4	14
Modoc.....	18	1	2	2	1	3	2	3	2	2	2	1	2	1	1
Mono.....	18	5	4	5	3	3	4	9	1	3	4	3	2	3	0
Nevada.....	7	2	1	1	2	2	3	2	2	1	1	1	2	1	3
Orange.....	80	29	1	16	14	13	5	18	4	3	3	2	6	9	13
Placer.....	95	38	23	23	21	17	15	25	15	12	17	19	18	9	20
Plumas.....	24	13	13	4	4	5	8	7	1	4	6	4	1	6	7
Riverside.....															
Sacramento.....	21	7	4	1	1	1	4	4	1	1	1	1	3	5	14
San Bernardino.....	22	9	5	6	7	3	7	2	2	10	3	2	4	4	14
San Diego.....															
San Joaquin.....	77	23	32	17	18	10	14	31	12	13	7	11	6	16	21
Shasta.....	16	7	7	3	2	7	1	6	3	3	1	3	2	1	12
Sierra.....	2	1						1						1	
Stanislaus.....															
Sutter.....	84	53	38	39	32	21	24	10	14	10	5	23	21	14	23
Tehama.....	104	46	48	56	47	18	20	18	25	20	19	16	14	17	17
Trinity.....	230	105	62	44	43	28	32	21	16	18	12	7	5	12	14
Tulare.....	42	4	7	3	3	4	2	14	1	1	4	5	5	8	13
Tuolumne.....	9	2	1	1		2	1	4			1		1		3
Yuba.....															
Totals.....	1,661	638	518	394	329	231	246	352	147	155	132	159	160	166	305

CALIFORNIA FISH AND GAME

DEER KILLED IN OTHER DISTRICTS SEPTEMBER 16-OCTOBER 15, 1928-Continued

	Oct. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Totals
Alpine.....		2	1			2	1	1		2		1		1		66
Amador.....		1	3	1			3			1		2	3	6	3	78
Butte.....	4	5	2	6	2	7	15	4	5	4	7	7	12	16	9	212
Calaveras.....	4	2	1	4	3	1	14	1		7	4	5	5	16	7	191
El Dorado.....	8	9	12	9	9	9	25	13	14	12	14	13	21	43	23	518
Fresno.....	8	7	8	10	8	9	16	17	7	13	15	26	31	57	24	701
Imperial.....					1	1					3	4	18	19	12	239
Inyo.....	3	1	4	8	2	10	11	5	3	1	7	10	11	31	11	246
Kern.....	3	2	1	8	5	5	13	4	1	4						246
Kings.....																393
Lassen.....	12	4	14	9	10	8	15	3	3	8	11	14	11	14	15	369
Los Angeles.....	5	3	5	11	4	10	29	4	3	6	9	12	35	44	15	369
Madera.....	2	3	4	1	1	8	9	7	1	3	5	10	13	16	11	300
Madera.....	2	3	4	1	1	8	9	7	1	3	5	10	13	16	11	300
Mariposa.....	1	2	1	2	2	2	5	3	3	4	5	7	9	17	8	134
Merced.....																2
Merced.....	10	16	16	20	17	15	27	17	19	10	15	29	16	25	22	729
Mono.....			1			1	1				3	3	2	3	6	55
Nevada.....	7	2		1	2	3	6	2	6	1		4	7	16	10	140
Nevada.....																3
Orange.....	4	4	4	2	2	4	18	2	2	7	3	7	9	23	5	69
Placer.....	4	5	4	2	5	4	18	2	2	7	2	7	9	23	15	346
Plumas.....	4	16	20	17	14	11	26	13	9	8	11	16	14	22	9	586
Riverside.....	3	4	5	4	5	3	16	1	3	5	5	9	23	38	13	249
Riverside.....	3	4	5	4	5	3	16	1	3	5	5	9	23	38	13	249
Sacramento.....	1	1														2
Sacramento.....	2	1														2
San Bernardino.....	5	3														122
San Bernardino.....	5	3														122
San Diego.....			8	7	4	6	9	6	2	8	4	1	8	29	6	232
San Diego.....			8	7	4	6	9	6	2	8	4	1	8	29	6	232
San Joaquin.....	11	21	16	7	25	30	21	14	16	14	15	24	33	40	8	603
Shasta.....		5	2	1	3	2	1	1		2	1	1	4	7	2	102
Shasta.....		5	2	1	3	2	1	1		2	1	1	4	7	2	102
Sierra.....																3
Stanislaus.....																7
Sutter.....																3
Sutter.....	10	9	20	17	32	23	35	21	25	30	30	45	38	69	31	846
Tehama.....	5	19	15	18	28	23	24	12	18	24	20	28	20	44	18	800
Trinity.....	6	6	15	14	14	17	22	12	14	23	23	33	37	41	13	939
Tulare.....	1	1	4	2	6	3	10	5	6	7	10	6	4	23	8	213
Tuolumne.....	2	2			3	1	4		1	3	3		1	5	2	52
Yuba.....																2
Totals.....	118	168	179	181	202	219	390	166	161	214	231	326	418	688	324	9,578

STATEMENT OF EXPENDITURES

For the Period July 1, 1928, to September 30, 1928, of the Eightieth Fiscal Year

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Executive and legal.....		\$3,855 00	\$528 31	\$469 05	\$4,852 36
Clerical and office.....	\$219 78	4,463 38	901 02	2 75	5,586 93
Rent.....			1,687 26		1,687 26
Automobiles.....	60 45		27 74		88 19
Telephone and telegraph.....			1,177 33		1,177 33
Postage.....			1,092 08		1,092 08
Freight, cartage and express.....			944 32		944 32
Printing.....	507 60				507 60
Accident and death claims.....			652 18		652 18
Commissioners.....			96 94		96 94
Total administration.....	\$787 83	\$3,318 38	\$7,107 18	\$471 80	\$16,685 19
Education:					
Director and assistants.....	\$84 66	\$3,674 44	\$935 80	\$342 14	\$5,037 04
Pacific Southwest Exposition.....	1,020 01	248 75	1,329 82		2,598 58
Total education.....	\$1,104 67	\$3,923 19	\$2,265 62	\$342 14	\$7,635 52
Publicity:					
Director.....		\$825 00	\$90 64		\$915 64
State fair.....	\$212 21	357 00	731 21		1,300 42
Total publicity.....	\$212 21	\$1,182 00	\$821 85		\$2,216 06
Conservation and protection:					
Chief and assistants.....	\$39 55	\$2,175 00	\$527 22		\$2,741 77
Clerical and office.....	8 79	750 00			758 79
Rent.....			92 46		92 46
Automobiles.....	238 20		124 05	\$14 33	376 58
Captains and deputies.....	50 24	53,386 45	38,928 22		92,364 91
Patrol launches.....	325 53	525 00	248 81	139 00	1,238 34
Lion hunters.....		185 00			185 00
Coyote trappers.....		358 88			358 88
Lion bounties.....			1,070 00		1,070 00
Fish planting.....	553 71	630 00	1,363 58		2,547 29
Refuge posting.....	143 11	1,894 18	516 21		2,553 50
Fish reclamation and rescue.....		505 00	458 22		963 22
Total conservation and protection.....	\$1,359 13	\$60,409 51	\$43,328 77	\$153 33	\$105,250 74
Commercial fisheries:					
Chief and assistants.....	\$14 55	\$2,235 00	\$469 07	\$436 71	\$3,155 33
Deputies.....	19 75	6,399 68	2,125 29		8,544 72
Patrol launches.....	484 36	795 00	485 32		1,764 68
Statistical.....	5 18	1,675 00	101 61		1,781 79
Laboratory.....	261 81	9,931 93	1,984 10	65 09	12,242 93
Salmon tagging.....			26 00		26 00
Botulism.....			3,750 00		3,750 00
Automobiles.....	104 39		64 40		168 79
Carp eradication.....	618 55	500 00	155 35		1,273 90
Total commercial fisheries.....	\$1,508 59	\$21,536 61	\$9,161 14	\$501 80	\$32,708 14
Fish culture:					
Chief and assistants.....	\$7 18	\$1,050 00	\$75 50		\$1,132 68
Clerical and office.....	25 33	1,080 67	126 62	\$85 05	1,317 67
Rent.....			49 00		49 00
Automobile.....	1,252 52		594 65	52 55	1,899 72
Hatcheries.....	19,730 89	36,366 65	5,183 46	392 34	61,673 34
Hatcheries—additions and betterments.....				465 22	465 22
Special field investigation.....	1 50	2,265 00	1,227 12	7 18	3,500 80
Total fish culture.....	\$21,017 42	\$40,762 32	\$7,256 35	\$1,002 34	\$70,038 43
Hydraulics:					
Chief and assistants.....	\$101 73	\$1,410 00	\$402 25	\$38 50	\$1,952 48
Cooperative research work.....		750 00	123 98		873 98
Total hydraulics.....	\$101 73	\$2,160 00	\$526 23	\$38 50	\$2,826 46
Game propagation:					
Game farm—Yountville.....	\$2,400 84	\$2,398 44	\$681 24	\$90 75	\$5,571 27
Automobiles.....	32 55		55 71		88 26
Total game propagation.....	\$2,433 39	\$2,398 44	\$736 95	\$90 75	\$5,659 53
Research:					
Chief and assistants.....	\$10 31	\$3,240 00	\$451 98	\$70 00	\$3,772 29
License commissions:					
			\$11,624 35		\$11,624 35
Total division of fish and game.....	\$28,535 28	\$143,930 45	\$83,280 42	\$2,670 66	\$258,416 81

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JULY, AUGUST AND SEPTEMBER, 1928
Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	Del Norte, Humboldt.....	Mendocino, Sonoma, Lake ..	Marin.....	Solano, Yolo.....	Sacramento, San Joaquin....	Alameda, Contra Costa...	San Francisco, San Mateo.....	Santa Cruz.....	Monterey.....
Albacore.....							68,520		180
Anchovies.....									12,105
Barracuda.....								21	
Bonito.....				302	3,076	5,244		506	
Carp.....		1,959		553	49,728	34,039			
Catfish.....		37,710	240				130,336	18,606	17,422
Cultus Cod.....		7,720			65		109,102	15,549	411
Flounders.....		260					42,671	9,755	29,400
Grayfish.....							32,565	11,574	
Halibut.....	99,974	25,912					10,614	1,351	5,927
Hardhead.....			27				1,000		140
Herring.....							17,245	10,636	3,215
Kingfish.....							135	732	348,519
Mackerel.....									5,035
Mackerel—Horse.....									
Mullet.....	3,940		4,428				16,477	1,268	7,999
Perc.....									
Pike.....				100		15			
Pompano.....									
Rock Bass.....									
Rockfish.....	25,595	1,017	285				240,596	340,955	254,453
Sablefish.....	63,686	360					100,608	24,254	9,998
Salmon.....	920,816	1,018,490		103,732	128,309	211,370	568,458	26,722	32,549
Sandbars.....		1,040					74,688	1,418	
Sardines.....							223,466		
Scupin.....							4,932,301	233	93,805,736
Sea Bass—Black.....			7,800					763	100
Sea Bass—White.....							6,556	22,187	3,186
Stad.....									
Stad—Buck.....				6		5,242			
Stad—Roc.....				6	1,756	2,029			
Sheepshead.....					15				
Skates.....		1,170					59,462	15,013	15,285
Skipjack.....								1,104	
Smelt.....	4,353	235	29,844				20,578	68,981	19,439

Sole.....	2,399	4,286				1,875,399	473,149	60,375
Spittail.....						175		
Striped Bass.....					8,308	63,289		2,640
Swordfish.....								
Tomcod.....								10,223
Tuna—Bluefin.....								
Tuna—Yellowfin.....								
Turtot.....				391		5,075		
Whitebait.....	11,674	13,875		20		4,245		1,253
Whitefish.....								
Yellowtail.....	1,967	479						
Miscellaneous.....						23	3,015	3,721
Total fish.....	1,168,391	1,114,513	37,041	113,721	191,416	321,426	1,121,062	94,700,866
Crustaceans:								
Crabs.....	8,016							263,472
Shrimps.....			745,657					97,725
Mollusks:								
Abalones.....								814,300
Clams—Cockle.....		150	10,566					40
Clams—Mixed.....	2,656		305					37
Clams—Pismo.....								190
Clams—Softshell.....		134	25,637			13,059		2,986
Cuttlefish.....								
Mussels.....								
Oysters—Eastern.....								
Oysters—Native.....			61,675					68,080
Snails.....								11,500
Squid.....								
Totals.....	1,179,063	1,114,797	880,911	113,721	191,416	334,485	1,121,374	95,568,225

All amounts shown in pounds unless otherwise specified. Albacore and skipjack cleaned.

- * 334 dozen.
- * 280,342 shell oysters.
- * 10,978 dozen.
- * 264,000 shell oysters.

Sole.....	65,882	38,852	196	2,520,538	
Softtail.....				175	
Striped Bass.....				83,229	
Swordfish.....	46,741	243,234		289,575	
Tonoco.....				10,223	
Tuna—Bluefin.....	8,576,686	1,746,073	33	10,322,792	
Tuna—Yellowfin.....	68,609	5,185	49	73,843	2,514,198
Turbot.....				5,466	
Whitebait.....	70	18,805		31,067	
Whitefish.....	71	180,818	4,313	34,376	
Yellowtail.....	2,074	42,022	394	827,263	44,211
Miscellaneous.....				60,404	412,820
Total fish.....	258,535	24,917,039	444,540	140,279,527	6,403,583
Crustaceans:					
Crabs.....				627,488	
Shrimps.....				843,382	
Mollusks:					
Abalones.....	1,236			815,536	
Clams—Cockle.....				10,746	
Clams—Mixed.....		174		3,175	
Clams—Pismo.....	43,986			41,023	
Clams—Soft-shell.....				41,685	
Cuttlefish.....				4,852	
Mussels.....					
Oysters—Eastern.....				619,755	
Oysters—Native.....				11,500	
Snails.....					
Squid.....				39,876	
Totals.....	303,737	24,917,213	444,540	142,485,645	6,403,583
					4,012,653
					10,416,236

O

⁵ 11,312 dozen.

⁶ 544,342 shell oysters.

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 15

SACRAMENTO, APRIL, 1929

No. 2

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A BIOLOGICAL SURVEY OF LAKE TAHOE

By GEORGE A. COLEMAN.

To the biologist, Lake Tahoe and vicinity offer one of the most extensive and complicated studies of lake community life that can be found anywhere in the world.

The results of the U. S. Hydrographic Survey of 1922 and previous surveys have been brought together in chart form which is now available. This serves as a reliable basis for our biological explorations and for the subsequent charting of the plant and animal life of the lake.

This survey shows a series of shelves running nearly around the lake, *viz*, first, a comparatively shallow margin, 15 to 160 feet in depth, which usually has a fine sandy or gravelly bottom, except where the banks are steep, in which case the rocks extend for some distance out. The next shelf is at a depth of 500-750 feet; the third at 1000 to 1250 feet. Then the great bottom basin which covers three-fourths or more of the lake at from 1250 to 1645 feet, the greatest depth found in the lake.

The temperature of the water varies from 130° F. in the immediate vicinity of the Thermal Spring at Brockway to that of freezing, 32° F., and sometimes (notably this winter) the water in some shallow bays, such as immediately in front of Tahoe Tavern, freezes over sufficiently to allow skating. One winter, Emerald Bay was almost covered with such a film of ice. The water coming in from all the streams is ice cold up to June, when it begins to warm up a little, never getting



FIG. 28. Emerald Bay and Lake Tahoe, famous for the Tahoe trout.
Photograph by J. H. Sanders.

much above 55° F., however. It takes considerable circulation of the warm water of the northeast and southeast parts of the lake to warm it as a whole to any appreciable extent.

There is a wonderful color variation in different parts of the lake, depending largely on the character of the bottom: all the way from a light yellowish-green to an intense blue, and sometimes, notably at sunset or sunrise, all the colors of the rainbow can be seen.

The water is the clearest of any lake in the world. When it is perfectly quiet an ordinary white dinner plate can be seen on the bottom at a depth of more than 100 feet.

There is a comparatively short season in which one can work with any degree of safety, or comfort, *viz*, May 1 to October 1, and at any time during these months, one may encounter sudden wind, rain and hail storms. I have started out in perfectly calm, bright weather and have been driven to shelter in an hour's time by a violent wind and

hail storm. Working under such conditions, progress is necessarily slow. The great distances to be covered in a day's work is another factor to be considered in the progress of the work.

The method of conducting the biological survey so far has been to work out from a number of the resorts located around the lake, beginning with Bijou at the southeast end and working around to Brockway at the north end, thus covering all the lake on the California side. In this way, a comparatively narrow strip entirely around the lake has been explored and what we might call the shore fauna and flora studied. From the food standpoint, however, this study is fundamental, since the food of all species of trout inhabiting the lake consists of the various species of minnows and other small fish which inhabit and find their food in these shallow waters and upon their condition depends the condition of the trout in the lake. Considerable data have also been obtained by examining the stomachs of trout brought in during the season by fishermen at the different resorts.

The plankton net survey at various points shows a comparatively poor supply of zoo-plankton, only 1-1000 part as much per cubic foot as that of Clear Lake in Lake County, for example.

One curious thing, although it probably has a perfectly natural explanation, is that during one month, perhaps only one species of copepod will be very abundant. Early in April, for example, a brick-red species of *Diaptomus* is so abundant as to color the water in certain areas. Then it almost entirely disappears, to be followed by some other species.

Another remarkable thing is the daily depth fluctuation of these various species making up the zoo-plankton, some species going down to a depth of 75 feet or more during the day and reappearing at the surface at night.

All of this has a direct influence on the movements of the trout in the lake, since they follow the movements of their food in both their daily and seasonal fluctuation. The winter movements and habitat of the minnows have not yet been studied; all we know is that they disappear about November 1st from their summer haunts and we do not see them again until about May 1st. Where the young lake trout which are planted in the streams spend the winter is also a mystery. The streams in winter seem to be perfectly clear of them and yet they appear in the streams as soon as the high water is gone in the spring.

The causes for the lessening number of Tahoe trout in the lake have been many and various. The first, and perhaps the greatest single factor, was the commercial fishing which was carried on for a number of years, when they were shipped out by the tons. Then intensive sport fishing, both in the lake and in the tributary streams, took its heavy toll. As to just how heavy this was, may be noted by the fact that in the year 1900, our records show, 58,667 pounds of Tahoe trout were shipped from the lake itself, about nine-tenths of them being the real Tahoe trout (*Salmo henshawi*), which averaged about two pounds in weight.

In recent years, since the auto has replaced the pack animal as a means of getting to our mountain streams, the greatly increased fishing during the summer months has taken the young trout of the tributary streams just as fast as they could be planted, so none have been left to grow up to sufficient size to stock the lake.

However, notwithstanding all of these handicaps, the two trout hatcheries maintained at the lake by the Division of Fish and Game for the purpose of stocking these streams with young fry are getting results. This is attested by the fact that every year an increased number of eggs are taken from females caught in the traps, beginning about March 15 and continuing until June.

If all the tributary streams are closed to summer fishing for a few years, and these streams stocked heavily with nothing but Tahoe trout fry, undoubtedly the lake will be stocked with this native trout. This would also give us a chance to study the life of this native species in the stream under natural conditions and obtain some very necessary data as to its habits of life.

The Mackinaw trout, and steelhead which have been introduced into the lake are thriving amazingly, especially the Mackinaw, which is now the summer sport fish, forming about nine-tenths of the catches of the summer tourist, and a fine fish it is. It is a bottom feeder and subsists mainly on minnows, chubs and bullheads, with some aquatic insect food. It does not appear to be destructive to the young lake trout.

The steelhead is gaining a foothold and during the season of 1927, many two and one-half pounders were caught. Females of five to six pounds ready to spawn were quite often found in the shallow waters of Cornelian and Crystal bays.

A SPORTSMAN VISITS THE YOUNTVILLE GAME FARM

By F. W. LOCHNE.

If any lover of the sport of hunting with the scatter gun has any regrets over the increase of price of the hunting license, a visit to the California State Game Farm, near Yountville, will go a long way toward dissipating that feeling, and he must feel that at least a portion of his money is being wisely spent.

Situated at the upper end of the Napa Valley, the first impression on arrival at the Game Farm is one of intense pleasure. The setting is ideal for this enterprise—the latest effort of the State Fish and Game Commission to render to the sportsman a portion of the service which is his due.

Improved roads and increased facilities of travel have greatly reduced the discomforts and troubles of a day afield. Many, who formerly were too indolent or indifferent to accept the little plaguing privations and hardships, have changed their minds and are now enjoying a holiday by tramping the fields in company with the old timers and, perhaps, a faithful dog.

These extra guns and dogs have increased the casualties among the feathered flocks the old timer sought and to offset this, the propagation of game by artificial methods seems the natural sequence and remedy.

It does not take an expert eye to see that the Game Farm is living up to expectations. If the visitor is fortunate enough to arrive at a time when the superintendent, August Bade, can conduct him about the place explaining the salient features, he will find Mr. Bade a genial host, and the time well spent.

The farm, as a whole, covers roughly about two city blocks, all under wire, divided by passages, and has removable wire partitions between

the pens. It is irrigated by piping water from the creek above. The gravity pressure is sufficient to provide a gentle shower throughout all the pens if necessary or any part of the farm as needed. This is made possible by an arrangement of valves along the main passageways without unnecessary disturbance of the birds.

Undoubtedly the first things the visitor is impressed by on entering the enclosure are the ornamental varieties of pheasants—beautiful birds of every imaginable color and shade. Golden, Silver, Lady Amherst, Reeves pheasants and different crosses of all of these are present. Though timid and nervous by nature, the pheasant makes a splendid display bird. The males, with their brighter plumage, seem to take a delight in parading before the admiring gaze of the visitor. Endowed by nature with the habit and patience of taking great care of their plumage, they offer the suggestion of being capable of knowing well how to make excellent use of a vanity case.

Ring-necked pheasants are, of course, present in greater numbers. This is the bird that the sportsman is perhaps most interested in. Hence, this variety is being intensely propagated for the purpose of restocking the game covers of the state for the benefit of present and future generations of sportsmen.

The birds now being propagated are a distinct improvement on nature, for by judicious selection of the best individuals and by the crossing of the Mongolian and ringneck varieties, a decided increase in size has been attained. It is not unusual for birds one year old to weigh as much as four pounds. This applies to both male and female, although the male, on account of the longer tail and more brilliant coloring, appears larger than the female. The Mongolian and the ring-necked pheasants are two distinct varieties. The casual observer, however, would find some difficulty in discerning the different features which set them apart.

Still another variety, and a recent acquisition to the farm, is the Japanese versicolor pheasant. This is a handsome bird with mainly dark blue and green plumage. The superintendent seemed very joyous at possessing it for the reason that he thought the interbreeding of this variety would produce a smarter and more wary bird than the ring-necked pheasant. The protective coloration of this offspring is, further, thought to be more suitable for the cover in this state.

While admiring this beauty, we heard the call of a quail. After remarking to Superintendent Bade that it seemed somewhat peculiar, he took me over to the pen from which the call came and stated that these were desert quail, quite similar to our regular valley quail in appearance and size.

We next went to the pens of the Hungarian partridge. I long for the day to come when I can see my dog come to the point on one of these birds, when I may come up with the "old scatter" gun, flush this bunch of feathered dynamite and see him rise from cover with a speed which, I hope, will never cease to thrill me.

These partridges are larger than our quail, duller in plumage, and are not distinctively marked as to sex. Unlike the ring-necked pheasant, they are not polygamous. Superintendent Bade says that in mating they are persistent in their refusal to be artificially mated and make their own selection. If forced mating is tried, it only results in

the death of the male. Truly, this is another example of the "female of the species being more deadly than the male." In mating time the flock is allowed the run of several pens by removal of the partitions. The birds roam about at will in one large flock, but, when in due time, a pair have come to an agreement, they leave the main flock. By means of an ingenious device, the mated birds are captured and placed in a private breeding pen. Here they assume the duties and responsibilities of matrimony.

We next came to the pens containing birds from South America. If I remember rightly, they are called tinamous. Superintendent Bade seemed to be particularly delighted with them and stated that California has the only game farm having them of which he knew. These birds were in three sizes but are seemingly alike in all other respects. The largest is about the size of the prairie chicken, and very similar in appearance. Some new arrivals have a crest or topknot, which slopes backward instead of standing upright as it does in our mountain quail. The smallest bird is about as large as the western mourning dove, and the third about midway between the two. They represent an entirely new experiment, the results of which are, of course, uncertain, but assuredly, most interesting.

We were then conducted out of the main enclosure to an outside series of pens, where there was a small flock of wild turkeys, three hens and a gobbler. The gobbler, a recent arrival from Arizona, was a noble bird weighing nineteen pounds, although but a year old.

On returning through the main enclosure, Superintendent Bade called our attention to a pen containing ringneck doves, and also to some of our native doves, which, he explained, had become inmates in an unusual way. The Game Farm serves as an attraction to many varieties of birds and these native doves had voluntarily entered the pens. The wire mesh, being of good size, permitted them to pass through when their wings were folded, but was too small to allow them to escape when extended. When attempting to reach the outside, they invariably flew against the wind. Consequently they had become prisoners. They seemed perfectly contented, however, and were remarkably tame.

The poultry yard is somewhat removed from the main enclosure. Here the foster mothers for the young pheasants are produced. Bantams and their crosses make the best mothers. One desired type of small hen has been developed by crossing the Japanese Silkey with a selected variety of bantam.

In a separate enclosure there was a large flock of valley quail. Beautiful representatives of California's royalty, they are kings of the upland and the sportsmen's delight. The entire flock was near the part of the enclosure we were approaching, it being near feeding time. Probably alarmed by the presence of a stranger, they took wing and flew to the other end—a glorious sight. Superintendent Bade asked me for an estimate of their number, and, after a short pause, I placed it at 250. Now I tried to allow for natural extravagance in making this estimate, and thought, if anything, I underestimated. You may imagine my chagrin when informed the number was just half.

By this time, the afternoon was near its close. I got into my car and pursued my journey to the Sacramento Valley, accompanied by the most pleasant thoughts and anticipation of days to come.

SOME CRUISES OF THE ALBACORE

By PAUL BONNOT.

(With four photographs.)

One of the least known activities of the Division of Fish and Game is the sea patrol maintained by the Department of Commercial Fisheries. For the last few years this patrol has been carried on by the motor boat *Albacore*. The *Albacore* is 65 feet long and obtains her motive power from a 65 horsepower Diesel engine. There are comfortable accommodations for six men in the cabin. The territory regularly covered consists of the ocean waters south of Point Concepcion to the

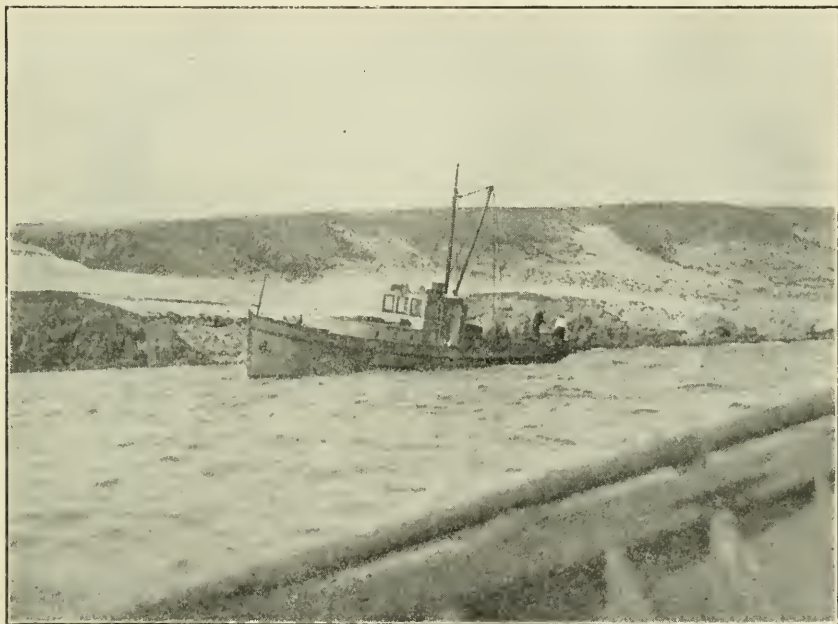


FIG. 29. Patrol boat *Albacore* in Tyler's Bight, San Miguel Island.
Photograph by Okeson Bonnot.

Mexican line. Besides her regular patrol the *Albacore* now and then is employed in scientific research in connection with commercial fisheries.

On June 3, 1927, the *Albacore* put to sea from San Pedro on a cruise for the study of marine mammals. The itinerary included the coast of the mainland of southern California and the outlying islands from Point Piedras Blancas in San Luis Obispo County to the Mexican line. The crew consisted of Captain Walter Engelke, a genial companion and a first class navigator; Max Tritch, the very capable engineer, and Fred Wack, steward and cook. My brother, Okeson Bonnot of Los Angeles, was official photographer and I was to learn all I could concerning marine mammals.

The first day out was not auspicious either for photography or the advancement of learning, inasmuch as the representatives of both these

departments did not enjoy their meals and were rather skeptical regarding their future ability to assimilate nourishment.

For three days we worked north along the coast looking for sea lions.* The sea was calm and we found good anchorages at night. The time passed very pleasantly. We arrived at Point Piedras Blancas about 10 a.m. It was clear and warm. After completing our work, the anchor was raised and we started for San Miguel Island. The screw had turned over only a few times when there was a tremendous jolt and a loud thumping under the stern. Investigation revealed the lower half of the rudder gone. We set a course for San Pedro and a drydock. It was 2.30 p.m. when we got under weigh and for twenty-two hours the little *Albacore* pounded out her nine knots an hour. We took turns at

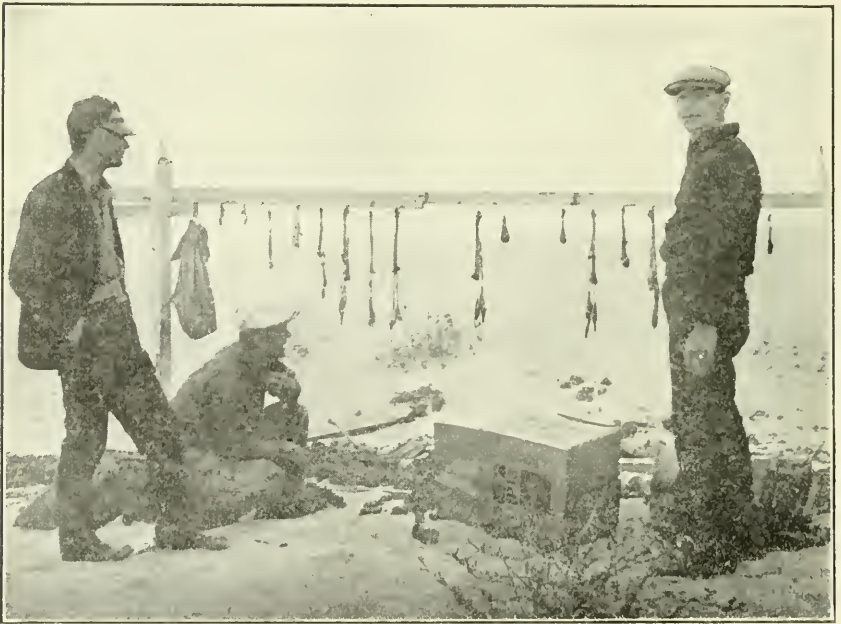


Fig. 30. Confiscated sea lion trimmings taken on San Miguel Island, where it is unlawful to kill any sea lions. Photograph by Okeson Bonnot, June 10, 1927.

the wheel and the cook kept the coffee pot hot. The fog shut down an hour from Piedras Blancas and we ran nearly the rest of the distance through a wet gray blanket which only lifted when we had Point Vincent abeam. We put her on the drydock at once and while the new rudder was being installed we cleaned and painted the bottom. Two days later we put to sea again. It was afternoon before we got away, and to save time we planned to run all night. By 11 p.m., when we were abreast Santa Cruz Island, one of the channel breezes began to blow and the *Albacore* began to understudy a submarine. We put in to Pelican Bay and went to sleep. When we rolled out the next morning

*The data relating to sea lions acquired on this cruise has been published. Bonnot, Paul. *The Sea Lions of California*. California Fish and Game, Vol. 14, pp. 1-16, 10 figs.

the sun was shining through the ports and we could hear birds singing on shore. The bay was as unbroken and serene as a pond and the boat lay without motion. A mile out in the channel, however, gray banks of fog were scudding before the wind.

We got under weigh at 6 o'clock and continued our course of the night before, running close to shore to gain as much shelter as possible from the wind. As we finish breakfast we determined to run through the channel between Santa Cruz and Santa Rosa islands, which would allow us to run west under the lea of Santa Rosa and San Miguel. The wind was from the northwest. The course was changed accordingly and she came about and into the trough; of course she began to bury her scuppers at once. The breakfast dishes were still on the table and the second roll deposited most of them on the cabin floor. The burst of profanity which came up the companionway was no doubt very relieving to the cook's feelings. We grinned at each other and kept to leeward of him the rest of the morning. At 2 p.m. we anchored in Adam's Cove under the west end of San Miguel. A heavy sea was running from which we were only partly sheltered and the boat rolled heavily. We were forced to remain here two days on account of the heavy sea which pounded the rocks and reefs about us. We put in the time exploring the island.

After two days enforced stay the wind went down somewhat and we cautiously began to investigate the outlying rocks. Huge beds of kelp concealed sunken reefs which would have broken us in two. A heavy ground swell ran through the kelp, which rose and fell with here and there the point of a black rock showing in the hollows. It made for jumpy work. One of us was always under the bows and we ran very slowly.

At nearly all the places we wished to work it was necessary to land on the jump. The captain or engineer handled the dory which they would back in against a likely looking rock. My brother or I would take the jump at the right instant and the boat would pull away until the next wave. When we were both unloaded the boat would remain in the vicinity until we were ready to embark again, when the same program would be gone through with. Only once during the trip did any of us get wet. This was at Flea Island, off the west end of San Miguel, when I slipped on a landing and went in to my waist, with a straight drop below into ten fathoms of water. I still had a hand hold and my brother above me on the rock reached me a hand so I avoided a swim.

From San Miguel Island we worked south to the rest of the islands. We had fine weather for the most part and were quite successful in obtaining data on sea lions and many fine photographs.

During May, 1928, the *Albacore* was ordered north to Eureka, to enforce the closed season on the outside trolling of salmon. When the season for salmon trolling opened on June 1st, we were to work south making another survey of sea lions. The weather was rather squally during the run from San Pedro to San Francisco. Everything was wet above and below and the crew all in. I boarded the boat at San Francisco and helped dry out the bedding and take on supplies. On the morning of May 5th we crossed the San Francisco bar and set a course north. The run up the coast was uneventful. In passing several of

the more prominent capes we encountered wind squalls, but they were of local intensity and for the most part we ran our nine knots over a smooth sea. We crossed the Eureka bar next morning (Sunday) at 8.30 a.m.

For a month we patrolled the coast from Shelter Cove to the Oregon line with Eureka as a base. The Humboldt bar, celebrated in stories of the Pacific coast, lived up to its reputation. It is smooth only in

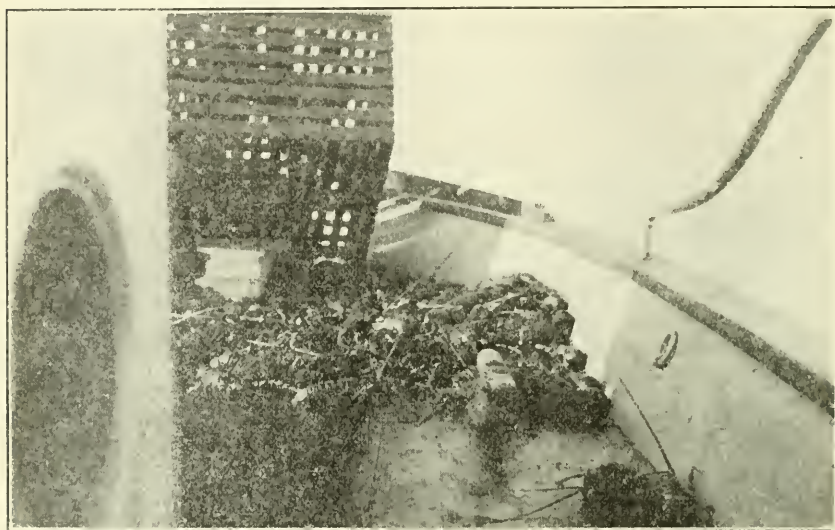


FIG. 31. Confiscated, undersized spiny lobsters, 125 in number, on deck of *Albacore*. These crawfish were confiscated from a lobster "receiver," picked up in the kelp beds of Redondo Beach. Photograph by Paul Bonnot, November 28, 1927.

extremely fine weather. Fortunately we were favored with a good sea each time we crossed and so met with no mishap.

One morning we crossed into a northwest sea which, though smooth, was decidedly high. The *Albacore* rose to an unusually high one, shoved half her length into very thin air, rolling to starboard at the same time and fell with a crash that put the bow under water and caused an explosion of wrath from below. The cook, Ernest Schmidt, was preparing lunch and, being below, had had no inkling of what was going on until she began to stand on her head. He came up the companionway breathing fire and slaughter. "It's not so pad ven de dum stew slides off the stove, put ven it yumps off," and so on. However, we were more disturbed when we discovered that the radio loud speaker had been thrown from its shelf despite its serews, and we were without music. The radio was our means of relaxing taut nerves. Many nights we lay in lonely windswept coves and passed several pleasant hours in playing "500" and listening to the music before rolling in.

The northern coast is cold even in summer and it was seldom that the ocean was not covered with a gray swirling fog. The coast line is

bold for the most part and there are outlying rocks in the most unexpected places, making inshore navigation a matter of extreme watchfulness.

We made seizures of illegally caught salmon. These were all made, perforce, inside the bay due to the danger of two boats approaching each other too closely outside in the heavy swell which is nearly always present.

On May 30th we left Eureka for the south. It was a clear day. The bar was smooth and we went out in good shape. As soon as we left the shelter of the jetties, however, we found that we had taken on something. There was a northwest wind that amounted to almost a gale. A huge sea was running, and before this we scudded all day. It made steering a matter of extreme nicety as the sea was quartering from behind and the boat slid stern first into the trough as each big sea passed under her. It would not have done to let her broach to and take a sea. She did take a small one about 3 p.m. Luckily the engineer had the aft hatches closed and little water was taken between decks. As it was, the water was knee deep in the alleys for a few moments. She responded sluggishly to the wheel until she shook herself free.

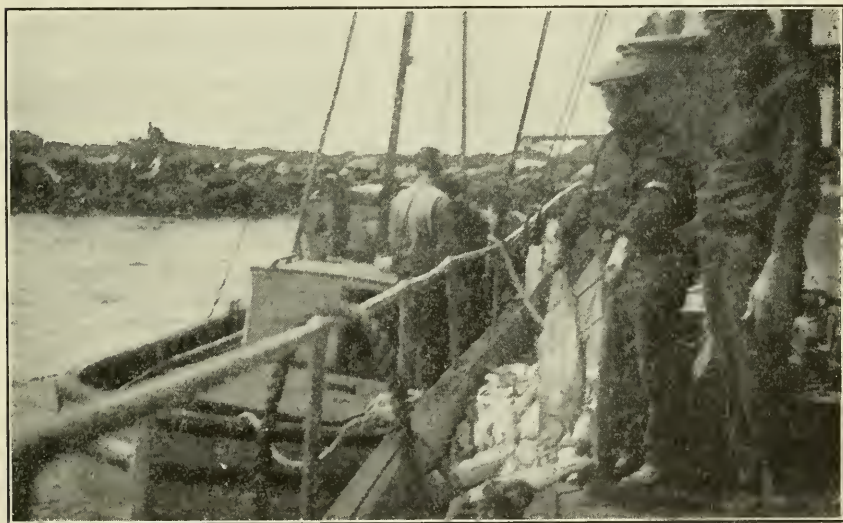


FIG. 32. The *Albacore* overhauls fishing boat with illegally caught salmon, in Humboldt Bay. This boat had several hundred pounds of small fish. Photograph by Paul Bonnot, May, 1928.

At 7 p.m. we rounded the buoy at Mendocino City and dropped the hook, tired out. To those who have not had experience on a small boat at sea it might be well to explain that the continual motion is very wearing. There is always an unconscious bracing and checking of the body muscles to counteract the rolling and pitching of the boat which leaves a bodily weariness at the end of the day similar to that caused by hard physical labor.

The next two days were fairly good running. Off the prominent points we generally had a puff of wind, but between it was usually smooth with a long, easy ground swell. We passed whistling bouys doing their duty nobly. To me there is something rather fine about a whistling buoy. Night and day, year in and year out, they lie on the same reef; straining at their anchors in roaring gales; washed and pounded by heavy seas, but always sending out through the fog and night their full throated bellow of warning.

During the fall and winter months the *Albacore* is very busy about the channel islands. One of her greatest troubles is the lobster fishermen. Lobsters are taken in traps about the islands and along the coast and are kept in live ears or "receivers" until a pick-up boat calls for them. The "receivers" are slatted crates of varying sizes which are anchored among kelp. They generally float on the surface. The legal size of marketable lobsters is from ten and one-half to sixteen inches. It is very difficult for the average lobster fisherman to throw back under or oversized lobsters and the *Albacore* is kept busy inspecting "receivers." Now and then a "receiver" is picked up which yields several hundred illegal lobsters. There are also the "sooners" who trap the crustaceans before the opening of the season and rush them in on the opening day, thus obtaining a top price. The traps must be buoyed so that the owner can find them again, and the patrol boat's crew are experts at distinguishing a trap buoy from a bit of drift wood. The traps of "sooners" when found are broken up. Two years ago eighty-six traps were lifted and destroyed along the coast just north of Point Loma in one afternoon. On the east side of Catalina Island, closed to any form of commercial fishing, eighty odd traps were broken up a few days before Christmas last year.

Those whose nautical experience has come to them through the perusal of charming tales of the sea may envy the lot of such men as Captain Engelke and his crew. Perhaps to deep water men the life on the patrol boat would be a holiday, but my experience has caused me to give thanks that I did not chose the sea as a means of livelihood. A month of it is all right. To a landsman there is a certain amount of novelty and a great deal to be learned, but as a steady occupation it loses its charm. After sleeping in wet bedding which could not be dried because of fog; eating at a table that was sometimes almost overhead and on which the china occasionally leaped agilely about, and sitting for hours braced in a corner, contemplating a heaving expanse of water while the boat plunged and quivered in a head sea, I have come to the conclusion that men who "go down to the sea in ships" must have that something in their makeups which permits them to sustain with patience and fortitude the capricious whims of their jealous mistress.

THE SPAWNING SEASON OF THE CALIFORNIA BARRACUDA*(Sphyræna argentea)**

(With six graphs)

By LIONEL A. WALFORD.

For the past two years, 1927 and 1928, the writer has made observations in the fresh fish markets of San Pedro on the California barracuda, a food fish of considerable importance to the fresh fish industry of the state. The work was initiated and the preliminary investigation was begun in 1926 by the International Fisheries Commission, United States and Mexico, but no data for that year are here included. This paper is published as one phase of the barracuda investigation, which will be reported upon fully at a later date.

Market observations in 1927 were not begun until June first, and 16,500 fish were examined during the remainder of the summer. In 1928, 18,000 fish were examined, and the work extended from March until October.

In studying the spawning season, the method employed was to make daily observations and records of the degree of maturity of each fish in samples taken in the markets, which degrees in the females were classified into the following four groups:

- Group *a*. Fish immature, or only partially mature, the ovaries revealing either few visible eggs or none at all.
- Group *b*. Fish in which maturity is well advanced, and in which the ovaries are full of opaque eggs.
- Group *c*. Fish with running spawn.
- Group *d*. Spent or partially spent fish.

The ovaries of the barracuda are approximately one-third the total length of the body, are paired, and in shape cylindrical, with tapering ends. The diameter of the ovary of immature fish is about one-fiftieth the length; of the mature fish about one-eighth. Ovaries of immature fish (group *a*) show no granulation, are pinkish in color, somewhat gelatinous in texture, rather translucent and slender in girth. As maturity approaches, the eggs appear as small, yellow granules, increasing in number until the gonad becomes considerably enlarged and full of yellow eggs, of which the largest average about 1.3 mm. (group *b*). This is the stage in which the ovaries are of commercial importance as roe, a valued table delicacy. At spawning time, the eggs lose their yellow color and become translucent, assuming the appearance of cooked sago (group *c*). They become enlarged until they average about 1.6 mm. and when the belly is pressed, the eggs flow forth freely from the gonoduct. At this stage, the gonads are of no value as food and lose their commercial importance. After spawning is completed, the remaining developed eggs are probably reabsorbed, and the ovary rapidly diminishes in girth; its substance becomes flaccid, its color pink, and finally its appearance and structure become the same as in the immature fish of group *a*. These stages in the spent fish appear only late in the season, and describe the condition classified

*Contribution No. 76 from the California State Fisheries Laboratory, January, 1929.

as group *d*. There is, however, no line of demarcation between spent fish (group *d*) and immature fish (group *a*) and the spent of the end of one season become the immature of the beginning of the next. With such simple and obvious classes of degrees of maturity, it has been an easy matter to make records each day in the markets while the fish were being cleaned by the market butchers.

The testes are approximately the same size as the ovaries, but differ in their shape, which is roughly prismatic. The classification of the males according to degree of maturity is somewhat more difficult and includes three divisions: immature, mature and spent.

The testes of the immature male are firm in texture, slender and pale brownish or greenish in color (group *A*). As the sperm mature, the gonads become larger in size, whiter in color, and less firm in texture (group *B*). When the belly of a mature male is pressed, the lactescent milt exudes through the gonoduct. After spawning is completed, the testes rapidly become spent (group *C*), diminishing in size and changing their color, until their appearance is the same as in the immature fish.

The method of recording was to tabulate each observation in its appropriate space on a prepared data sheet which was divided into sections for each classification in each sex.

The samples which were taken each day consisted of the first one hundred females with the accompanying number of males which we saw opened. If necessary, the samples comprised fish from several markets. The reader will of course question whether the samples were representative of the entire catch. It seems probable that if most of the fishermen make their catches in the same general localities fairly close to each other, as usually appears to be the case, daily samples consisting of the first several fish selected at random in the markets, might be a representative sample of the daily catch. Each day we asked the fishermen of as many boats as possible where their catches were made. In nearly all cases, the replies agreed with each other as to general location each day, and it would seem, provided the replies were truthful, that the boats are all inclined to fish together in about the same localities. Skogsberg, in recounting the shifting in places of capture of the barracuda¹ in 1922, obtained the same results as the writer² by questioning the fishermen, and this would seem to substantiate the reliability of the replies. There is, of course, the unavoidable danger of selection in the fishing, if, for example, the nets should gather only the fish in the top layer or only one edge of the schools; or perhaps in the sampling itself, if there should be a size selection by the market butchers, in which case sexual dimorphism might possibly detract from the significance of the data.

The barracuda fishery is carried on locally from April until September, and during the rest of the year the fishing occurs south of an extension of the international boundary line. Throughout the winter months we questioned the captains of the boats which brought up barracuda from the south, concerning the presence or absence of roe or milt in the fish. The earliest record of maturing fish which we have for 1928 is of March 22, when the *California II* landed a large load

¹ Skogsberg, Tage. Preliminary Investigation of the Purse Seine Industry of Southern California. Fish and Game Commission of California, Fish Bulletin No. 9, 1925, p. 34.

² Walford, L. A. Barracuda. Division of Fish and Game of California, Fish Bulletin No. 15, Pt. 9. 1929.

of cleaned fish, most of which had had roe or milt in them, according to the captain. On March 26, about a ton of barracuda was landed, only fifteen fish of which were not cleaned. These fifteen fish all seemed to be rather close to maturity. Beginning April 2, barracuda were brought in round (not cleaned), and from then on throughout the 1928 season, market observations were made daily or whenever

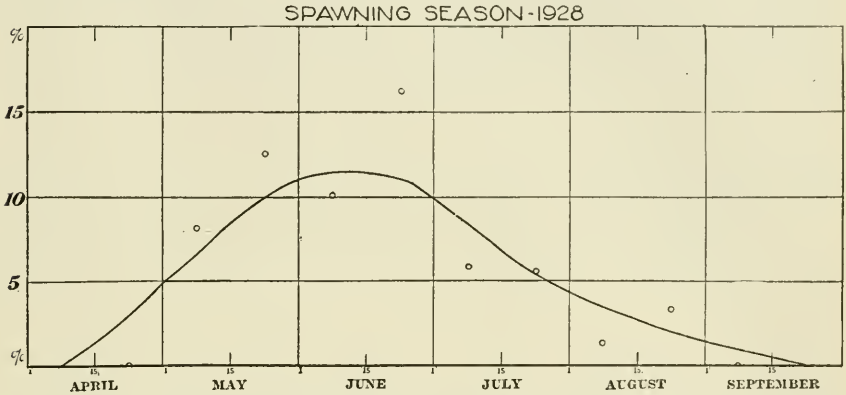


FIG. 33. Relation of the number of spawning females and the total number of females expressed in percentage. The observations are grouped in bi-weekly periods and represented by the small circles. The data are smoothed to show the general trend.

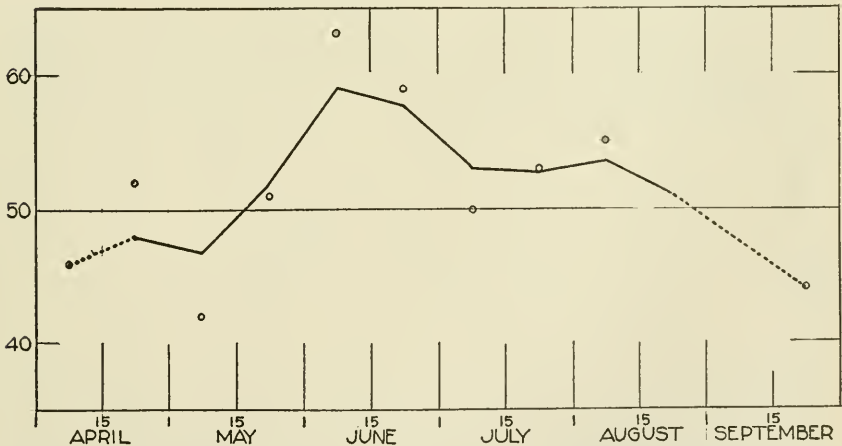


FIG. 34. Relation of the number of males to the total number of fish (1928) expressed in percentage. The observations are grouped in bi-weekly periods and represented by the small circles. The data are smoothed to show the general trend, which is represented by the heavy line.

fish were available. Figure 33 shows the relation between the number of spawning females and the total number of females expressed in percentage, by bi-weekly periods. The original figures, shown by the small circles, were smoothed to show the general trend of the season. The span of the season in 1928 was from between April 1 and 15 to between September 1 and 15. The height of the season occurred between May 15 and June 30.

An interesting and puzzling feature of the spawning season of the barraenda is that at no time of the year are all of the females spawning at once, according to our market observations. The relative number of spawning females changes from day to day, sometimes quite radically. The daily spawning season observations for 1927 are shown graphically in figure 35, in which the ratio of spawning females (group *c*) to all females is represented by the solid line. There is no apparent periodicity or regularity in the occurrence of the highest ordinates. After August 13, no more spawning females were observed.

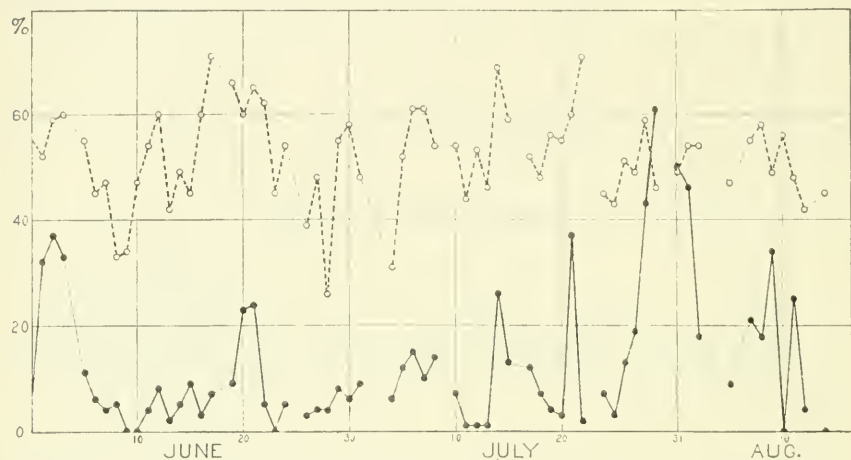


FIG. 35. Daily spawning season observations for 1927. The broken line represents the relation between the number of males and all fish, expressed in percentage. The solid line shows the relation between the number of spawning females and all females, expressed in percentage.

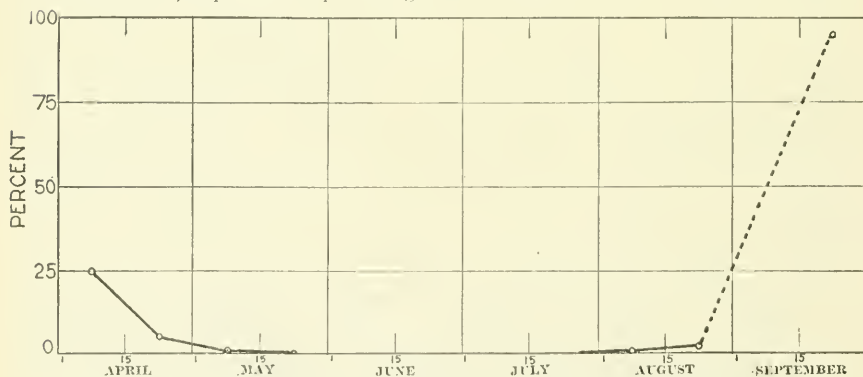


FIG. 36. The curve between April 1 and June 1 represents the relation between the immature females and all females expressed in percentage. The curve between July 15 and September 30 shows the relation between spent females and all females expressed in percentage.

In 1927, the first spent fish (group *d*) appeared in the markets on September 7 near the close of the spawning season. However, no samples had been taken since August 26, and it is possible that spent fish would have appeared sooner had fish been in the markets. In 1928, the first spent fish appeared in the markets August 13. Figure 36 shows the relation of immature females (group *a*) and spent females (group *d*) to all females in 1928. The fish classified as immature are

those which had not yet reached maturity that year, and occurred between the first part of the season and the last two weeks of May. Those classified as spent are those which apparently had already spawned that year. These appeared in the markets from about the first two weeks of August to the end of the season. It will be seen that in the beginning of the season only twenty-five per cent of the legal sized females were immature. After the first two weeks of May, no more immature fish (group *a*) were seen. In the latter part of July, the first spent fish (group *d*) appeared. Then the percentage of spent females rose rapidly, and by the time all of the females were spent the fish had apparently disappeared and the season was over.

The immature and spent stages of the males (groups *A* and *C*, respectively) occur during the same period as the corresponding stages in the females. If graphed, the relation of these stages to all males examined, as expressed by percentage would present a picture similar to figure 36. This fact is borne out in the following table:

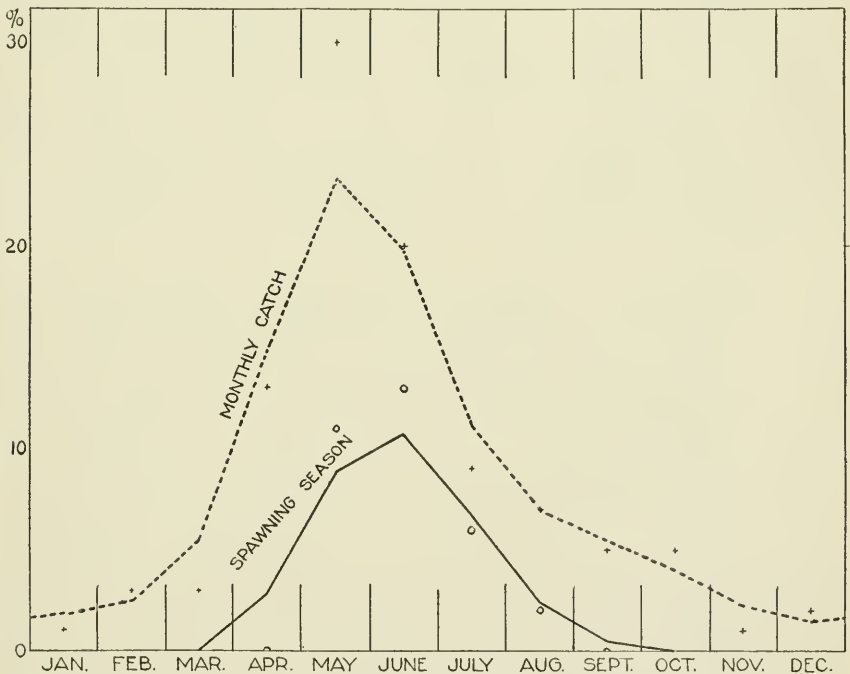


Fig. 37. Comparison between the monthly catch and the spawning season.

OCCURRENCE OF IMMATURE AND SPENT MALES

(The figures are percentages of the total number of males.)

Date	Immature males (Group A)	Spent males (Group C)
April 1-15	39	0
April 16-30	4	0
May 1-15	0	0
May 16-31	0	0
June 1-15	0	0
June 16-30	0	0
July 1-15	0	0
July 16-31	0	0
Aug. 1-15	0	1
Aug. 16-31	0	19
Sept. 1-15	no data	no data
Sept. 16-30	0	93

It is worthy of note that the barraenda fishing season is concurrent with the spawning season. Figure 37 compares the monthly catch of local fish delivered to Los Angeles and Orange counties, with the spawning season. The monthly catch is represented by the relation between the average monthly catch and the average yearly catch, expressed in percentage, averages being for the five-year period, 1923 to 1927. The spawning season is represented by the relation between the spawning females (group *c*) and all females, expressed in percentages. The spawning season observations are by monthly periods. The data were smoothed to show the general trends of the two curves. It will be noticed that the highest ordinates of both curves occur during the months of May and June, and that the rise and fall in the spawning season curve is reflected by a similar rise and fall in the monthly catch curve. Whether there is a causal relationship here, we shall not venture to say. The fact that no spent fish (group *a*) appear in the markets while the fish are spawning may be due to the fact that within the limits of the distribution of the barraenda, the regions where they are caught in greatest abundance becomes farther north as the season progresses.³ It might possibly be that in their advance northward, the fishermen leave the spent fish behind, which in the meantime disappear. Toward the end of the spawning season, the fishery is carried on mostly in the regions of the northern limits of the distribution (Point Conception), and the total catch diminishes as the spawning season closes. The fish brought into the markets at this period are almost entirely spent—the laggards in the post-season disappearance.

An interesting point for consideration is the fact that the relation between the number of males and the total number of fish changes from day to day in much the same manner as does the number of spawning females. During the course of the whole season, the sex ratio hovers around unity, with a distinct tendency for the males to preponderate. In 1928, of 18,005 fish examined during the entire summer, 55 per cent were males. In 1927, of 16,530 fish, 52 per cent were males. In 1922, of 1806 fish examined, 55 per cent were males.⁴ Of 9,000 young barraenda of the first year class, 49.5 per cent were males, or practically a unity ratio. This would lead us to believe that a preponderance of one sex is a later development, due possibly to a number of causes, among which are suggested differential mortality, spawning migrations, or different habits of the two sexes. Unequal sex ratios have been noticed in several other species of fish, sometimes with the males predominating as in the case of the true smelts,⁵ though more frequently with the females predominating, as of the California sardines, *Sardina caerulea*; California jack smelt, *Atherinopsis californiensis*; grunion, *Leuresthes tenuis*⁶; or in the European plaice, *Pleuronectes platessa*.⁷

There is a strong tendency for the ratio of males and all fish to vary as the ratio of spawning females and all females. This is illustrated

³ Walford. loc. cit.

⁴ Skogsberg. loc. cit., p. 37.

⁵ Kendall, William Converse. The Smelts. Bulletin, U. S. Bureau of Fisheries, Vol. XLII, 1926 (1927), p. 299.

⁶ From the records of the California State Fisheries Laboratory.

⁷ Hefford, A. A. The Proportionate Distribution of the Sexes of Plaice in the North Sea. Rapports et Procès-Verbaux, Conseil Permanent International pour l'Exploration de la Mer, Vol. XI. 1909, pp. 137-175.

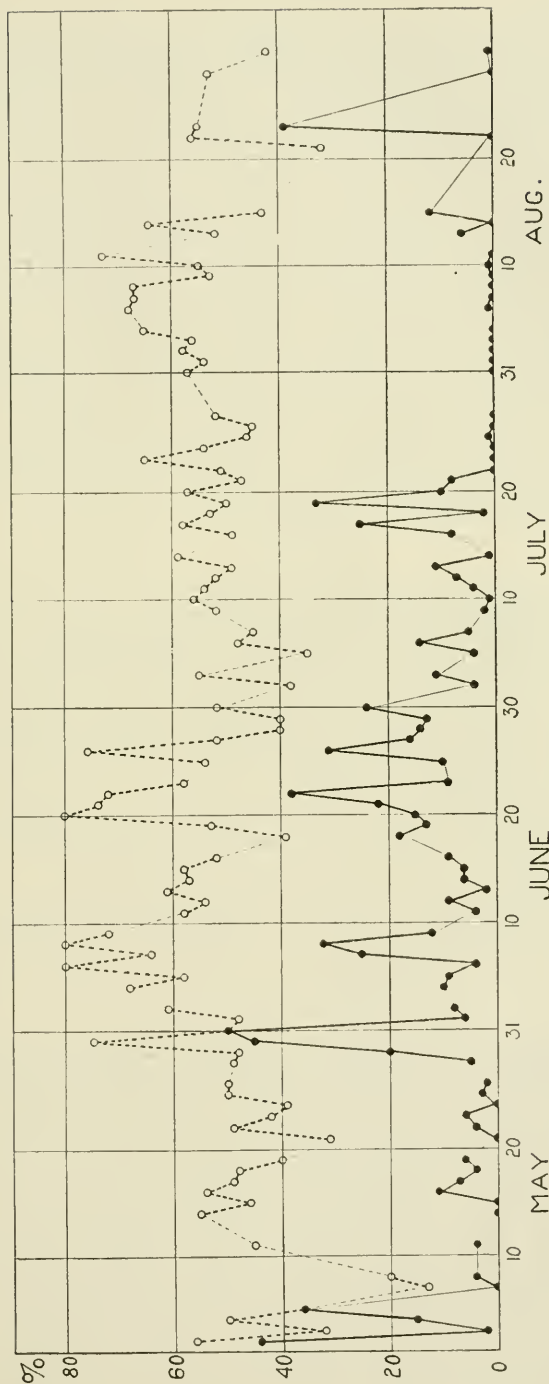


FIG. 38. Daily spawning season observations for 1928. The broken line represents the relation of the number of males to all fish. The solid line shows the relation of the number of spawning females to all females. Relations are expressed in percentage.

in figures 35 and 38, which graphically show the daily observations for 1927 and 1928, respectively. The broken lines represent the ratio of males to all fish, and the solid lines the ratio of spawning females to all females, expressed in percentage. In figure 34, the ratio of the males to all fish is represented, with the daily observations combined into bi-weekly periods for 1928. The tendency for a higher preponderance of males to occur while the spawning season is at its height is clearly suggested. If the data for the two seasons, 1927 and 1928, be combined, there is a coefficient of correlation (Pearson) between the ratio of spawning females to all females, and the ratio of males to all fish of $.304 \pm .047$. Since the coefficient is more than six times the probable error, we may consider it significant. If each variation in the curves be considered as unity, then the coefficient of correlation is $.394 \pm .049$. This is the "coefficient by concurrent deviations,"⁸ and merely shows that there is a tendency for the two curves to vary in the same directions without regard to the amount of variation. What is the significance of this sex ratio? Perhaps there is a back and forth migration to the spawning beds, but this is a supposition which must be substantiated by further investigation.

Summary

According to market observations made:

1. The barracuda spawn between the first part of May and the middle of August, with the peak of the season occurring during the month of June.
2. No spent or immature fish are landed during the period from the last two weeks of May to about the first two weeks of August.
3. The ratio of the numbers of spawning females to all females fluctuates sharply throughout the season.
4. There is a strong tendency for the ratio of the number of males to the total number of fish to fluctuate in the same direction as the ratio of the number of spawning females to all females.

THE SPANISH CERCO REAL OR "ROYAL BLOCKADE NET"

An Ancient Sardine Gear.

By GEORGE ROGER CHUTE.

Spain is at present experiencing a general rejuvenation and, as part of a broad scheme for renewing its ancient greatness, is seeking to better its utilization of one of its potentially most productive resources—the fisheries. It must be remembered that for several centuries Spain was the dominant naval power of the world. During that period maritime technology in all its branches was given the greatest forward impulse in all history. Merchant and military vessels, the art of ship rigging, new sail plans, knots, seamen's devices and shipboard appliances of all kinds were invented, many of these being known even yet—to the few sailing ship mariners that remain—by their genitive names of "Spanish bowline," "Spanish windlass," "Spanish reef," "Spanish burton," and many more. But though it is rather common knowledge that England became schooled in navies by what she learned from the

⁸ King, W. I. *The Elements of Statistical Method*. New York, MacMillan. 1919, p. 207.

navies of Spain, it is not realized to what extent the world is beholden to the Land of Pelayo for such other marine improvements as, for example, our many forms of specialized fishing nets. The humble art of ensnaring a fish being looked upon as unchivalrous and lacking that glamor which surrounds the battle maneuvers of thundering armadas, we have heard much less of the great successes won by Spain's remarkable "Royal Blockade Net" than of the fiasco of her navy's debacle in the Canal de la Mancha.

In the September, 1928, number of the *Boletín de Pesca*, published by the Spanish Institute of Oceanography through the General Fisheries Director of the Ministry of Marine, Madrid, there appeared the second of a series of writings by Señor Fernando de Buen, Chief of the Department of Applied Biology of Fisheries, in which he devotes himself to a study of that enormous fishing apparatus—developed during the time of Spain's famous military conquests and naval successes—the *Cerco Real* or "Royal Blockade Net." This tremendous gear was a sardine apparatus, and because America is concerned in bettering the means at present employed in prosecuting fisheries for that species, attempts by Spain to reestablish the *Cerco Real*, and put it into use again, will be observed with keen interest in this country, as well as elsewhere throughout the world.

According to its description given by Señor Fernando de Buen, the *Cerco Real* was in reality nothing more than a haul seine enormously enlarged. It was composed of a bunt or central section of small mesh and heavy twine flanked by two wings of larger mesh and lighter material. There seems to have been considerable graduation in both mesh and twine weight, the wings approximating the bunt itself in both of these particulars at their inner extremities, but gradually becoming quite dissimilar through having large meshes and light webbing towards the outer tips of the wings. The *Cerco Real* possessed one other feature in common with ordinary haul seines—its greatest depth was in the bunt; it gradually shoaled off towards the wing tips until the cork line and foot rope could be made fast to a towing bar, spreader, or "rooster's foot," as the Spanish called it. Long lines or warps were made fast to each of the two "rooster's feet," and with these the net was hauled in from far out at sea, and landed on the beach.

"The *Cerco Real* usually measured 900 to 1000 fathoms in length * * *" writes El Señor de Buen, "with a height varying between 18 and 24 fathoms, according to the point selected. It had a wing on both sides, each about 400 fathoms long. The central portion, more strong, of greater height, and called *cope* (bunt) was 100 to 125 fathoms in length.

"A vertical net, composed of innumerable pieces, it usually terminated at each end in a 'cock's foot' followed by 1,400 fathoms of line.

"In the *Cerco Real* the mesh of the wings measured an inch and a half to two inches, squared mesh,² and a half-inch in the *cope*.

"Corks were spaced along the head rope, leads not being affixed to the foot rope but stones and grapnels were used to keep the net distended when a pound was formed of it for the purpose of storing the

¹Contribution No. 78 from the California State Fisheries Laboratory, January 16, 1929.

²"Squared mesh" or "bar mesh" is exactly one-half as long as "stretched mesh"—the measurement usually used today. The "squared mesh" dimension is the distance between any two adjacent knots in webbing.

captured sardines for awhile so that they might be marketed at the most advantageous time."

The authority quoted does not fix the date of the earliest use of the *Cerco Real* in Spain, but gives the impression that it might have been at the climax of its history around 1700, or perhaps earlier. Since those were the days of the great tradesmen's guilds, then universally powerful throughout nearly all of Europe, it is not remarkable that fishing, and particularly this type of fishing, should have come to be a guild activity. Indeed, because machine-made webbing was unknown in those medieval times, and all netting had to be hand-knit from hand-laid twines twisted from hand-spun threads, the difficulties in the way of fashioning a seine nearly a mile long can be imagined, and it may be that except for the powers of organization possessed by the Maritime Guild, and the stimulus which it gave to a concerted, cooperative effort, the *Cerco Real*, most mammoth of all hand-made fishing tools, would never have come into being.

The construction and operation of the *Cercos* took on the character of a community enterprise. Just as on the coast of Maine, and in Fundy's Bay, the men of an entire small settlement join forces in gathering materials and creating a common property in the form of a herring weir, or in Nova Scotia seaside towns business people unite in building and outfitting a sailing vessel to be officered and manned by the seamen and youths of the place, so the Spanish fisherfolk, organized under their trade union officers, pooled resources and labor to the creation of a *Cerco Real*. Tons of cork floats, miles of rope, thousands of square yards of various sized webbing, and weeks of labor by large crews of experienced raekmen or hangers were necessary to the completion of one of these nets. The blocks of web were hand-knit by the women and girls of the ports, the wives and children of navy men absent on duty enjoying certain preference in the apportionment of this labor. Each net had its complement of officers, who evaluated the contributions of webbing by the women, and the work done by the men employed in hanging and in fishing the gear, kept a careful written record of the interest of each member or contributor, and saw to it that the catch was divided and apportioned upon that basis.

But the wars of the seventeenth and eighteenth centuries wrought havoc with the Maritime Guilds and with the *Cerco Real* associations. Spain's reverses at sea had cost the lives of thousands of her best mariners and fishermen. The cessation of commerce and the sieges of blockading squadrons of enemy craft had gone far to destroy the once flourishing and productive sardine enterprise. Fernando de Buen quotes from the *Ordenanza* of 1750, which provided regulations for the fisheries of the inlet of Pontevedra and all of the ports thereon:

"2nd. ITEM, that whereas formerly in this locality and estuary there were many *cercos* and *armaciones reales* for the fishing of sardines, which were caught in such abundance that the yearly product exceeded 80,000 ducats, because of continued wars, lack of trade, indolence of the people and other causes, said *cercos* were abandoned, and through their lack has come a decline to said locality and to other ports on the estuary because having no other maritime commerce than that which the fisheries provide. Special

care should be given to re-establish the *cercos*, for in addition to the great abundance of fish which is caught in them, and with less cost and fatigue, they admit, for their proper management, every sort of person, poor, rich, old people and youths, each one receiving his stipend or part from the fishery in proportion to his labor or to that extent in which he is interested in the net."

In 1768 the *Ordenanza* of the province of Pontevedra again refers to the desirability of renewing the *Cerco Real* activities, stating that none then existed. Indeed, the great "Royal Blockade Net" seems to have become entirely extinct excepting for a temporary revival of its use in the waters of Galicia. An organizer of ability and influence there succeeded in restoring the Fishermen's Guild, and a new blockade net actually was constructed and put into operation. The movement came to nothing, however, partly because of complaints raised by the priesthood of the port who were losers of tithes because of the operation of the big net, and partly because of quarrels and jealousies engendered between the fishermen themselves by reason of the revival of some of the ancient prerogatives of the *cerco*, which gave to it exclusive rights in certain waters, and forbade all other gears to encroach upon them. The movement presently was given over, and with the retiring of this net from the fishery, the last *Cerco Real* seems to have passed into history. There are none in existence today, says our authority.

With respect to the organization of the *gremios* or guilds, El Señor Fernando de Buen states that each association named by common agreement two managers or *aviadores*, two measurers or *carteleyros*, one shore captain or *maestre*, and one boatswain or *pollreyo*. Tenure was for one year, and service obligatory; refusal to accept office was punishable by severe fines except in instances where exceptionally good reasons were given.

The two *aviadores* were the actual managers of the enterprise. They made decisions concerning when the fishing should be done, they maintained contact with the priesthood and royal authorities, and they were the court for levying fines against members convicted of shortcomings by common consent, and for adjudicating differences arising within the organization. Their assistants were the two *carteleyros* or measurers whose duty it was to divide the fish caught, set aside a proper proportion of the catch for the support of the organization and the maintenance and repair of the gear and boats used, and evaluate contributions of labor and webbing from the members. The *maestre* was the captain of the largest boat or *galeón* used in setting the net, and the *pollreyo* was his officer or assistant, in charge of the crew carried aboard. Each of these ships' officers was a picked expert, and received a double lay or share.

Several boats were necessary to the successful prosecution of the *Cerco Real* enterprise. Usually there were two light and swift sailing boats that acted as scouts, tacking to and fro across the waters reserved to the use of their particular net, looking for fish. When schooling sardines were sighted agreed signals brought the big gear out from shore. The *cerco* was often carried on two large barges called *galeones*, these having neither mast nor sails but propelled by oars in the hands of 22 or 24 fishermen. The net was paid out to seaward of the fish, and

the long warps taken in to the shore, where they were received by the whole assemblage of persons interested, and hauled in.³

Sometimes the bunt was taken up on the beach, and the catch distributed at once, but it often occurred that the tonnage captured was so great as to make immediate disposal of so enormous a quantity impossible. When this situation arose it was the practice to moor the bunt of the net in the sea,⁴ where it was allowed to remain until the fish could be removed from it gradually, and cured.

Describing the *Cerco Real* fishery, and the laws under which it existed, El Señor Fernando de Buen quotes from the *Ordenanza* of 1750 (Province of Pontevedra) parts of which are here given liberal translation. The closed seasons, fines, forfeiture of gear, and restrictions governing the use of destructive apparatus of capture, set forth in these ancient laws of Spain—now almost three centuries old—should be significant and pertinent to present day problems of fishery regulation. They disclose it a historic principle, now long established, that a national resource should not be plundered to the enrichment of a few, and that the constant contest between private rapacity and the public good is as old as is the common ownership conception of resources. This early interest of ancient Spain in the preservation of her sardine fishery should afford the comfortable sensation of three centuries of precedent to modern exponents of reasonable marine husbandry and fisheries conservation.

La Ordenanza de la provincia de Pontevedra for 1750 reads, in part:

FIRSTLY, all of the seafaring men of said estuary and its ports are charged to employ the greatest of care in dedicating themselves to the catching of all sorts of fishes, and to curing and salting them for the provisioning of the dominions of this crown and for foreign commerce, because of the great interest that the royal exchequer has in the fishery, a utility which results in a common profit and betterment to the ports.

3rdly. ITEM, that if any of the ports of the estuary, for lack of means or of a sufficient number of people for the *cerco* are unable to establish it, the seamen of that port still wishing to engage in this business, it shall be obligatory that they be admitted to the work of the other *cercos* which may be in the other ports, the Admiralty Judge who shall be in the port at the time apportioning and distributing them with discretion and prudence, so that all may have an interest in the fishery which God may grant.

4thly. ITEM, that the *cercos* which shall be made or fabricated in the ports of this estuary shall not be permitted to be repaired or overhauled on shore before the sixteenth of August of each year, nor go to sea until after St. Bartholomew Day, since up to that time it is not considered that sardines are found sufficiently matured to warrant their capture with *cercos*.

5thly. ITEM, that the *cercos* of this community shall not go out to sea of a Monday without the men having first heard mass, which is celebrated for the faithful dead in the parochial church of *Santa María la Mayor*, and he who is missing from said mass shall pay a fine of fifty *maravedís*. But this shall be understood to mean only when the tides permit it, since as this village is a half league from the bar and at low water it is impossible to go out, the penalty shall not be imposed when it is necessary to take advantage of the tide.

6thly. ITEM, that the *cercos* shall return to their ports every Saturday before noon, and when one of the vicars of the Holy Body shall make a signal or raise a pennant or small flag, according to the ancient custom, the *cerco* which may remain in the sea and shall have its net outspread of a Saturday afternoon, shall forfeit

³ The immense sweep of the seine as it approached the land in crescent form perhaps gave rise to the name applied to it—*Cerco Real*. The term is a naval one, and signifies the royal blockade of an enemy port by an encircling squadron of men-of-war.

⁴ The net was prevented from being cast ashore by the surf by bending numerous lines to the head rope, these lines being run seaward and made fast to kedges, large stones, or other weights suitable for moorings.

the fish caught, which shall be divided among the *cercos* which have withdrawn and were obedient.

7thly. ITEM, that the *cercos* fishery must last only from the other day of St. Bartholomew to the end of the month of December; but since along this coast in some years it has been experienced that the principle and most abundant harvest of sardines is in the month of January, if this should happen, with permission of the Admiralty Judge who shall be in authority at the time, it shall be allowed to prolong the *cercos* fishing until the twentieth day of said month of January.

8thly. ITEM, that there being two or more *cercos* in the ports of the estuary, everything possible shall be done that between them there be union and cooperation, and thereby evade all sorts of altercations and dissensions, from which only inevitable losses result, and because of which the people do not dedicate themselves to the fishery with the application and industry which makes for the good of all.

9thly. ITEM, that should it be impossible to coordinate said *cercos*, so that there be observed among them the necessary equality, no *cercos* may go out to sea until after the one from the vicinity of this village shall succeed in passing over the bar, since through lack of water and tide it is not possible to go out or float at all hours, which obstacle is not experienced by the other ports; but as soon as said *cercos* of Pontevedra is discerned afloat outside the bar, and the other ports are advised of it, they also may then go out immediately with their *cercos* to the sea, and cast them where they may consider best.

10. ITEM, that the fish scouts who first sight sardines and signal for the net barge, shall be privileged before all others to set their net, and until it is all paid out and closed no other crew shall set its *cercos* in that locality, on penalty of 10,000 *maravedis* fine and indemnity for all of the damages and injuries to those who first came and set their net; but although the scouts shall have signalled for their net barge, if it arrives and tosses its oars or they order it to stop because the sardines have disappeared, in that case the call signal has no more effect, and the scouts of the other *cercos* are at liberty, seeing the sardines, to signal to their own barges and set their own nets under the same privileges as in the first place.

11. ITEM, that if any boat or *jeito* or fishing vessel of whatever other sort which does not belong to the outfit of any of the *cercos* shall signal or give notice to any *cercos* to cast its net, it shall be denied to do so until the scouts shall have gone to identify the fish and make the signal; and such boat, for having meddled in what is none of its business and for having done a thing that might occasion trouble and quarreling, shall pay a fine of 500 *maravedis*.

12. ITEM, that if there be many *cercos* in the estuary, and only two or three of them associate together, if the scouts of one of them, when they shall have gone to sea, shall espy sardines, and if their barge does not arrive, and they see one belonging to another *cercos* with which they are in partnership, they may signal to their associate barge and set its net without incurring punishment; but if after the net is set still more sardines are sighted, and if their barge arrives and they signal to it or to another associate to set behind the first net cast, second luck, this signal shall not have the effect of granting exclusive rights, and if any other *cercos* which finds itself close at hand should arrive first, it may set its net without incurring penalty.

13. ITEM, that there shall be no *cercos* in all of this estuary which is not as deep as the water and fifty seams⁴ to the side, with forty *cofes* in all, each seam being 85 meshes, and the *cope* of as many more, according to the pattern master who designs them for this Kingdom.

14. ITEM, it is declared that the locations or proper places for setting the *cercos* in this estuary are ten: two in the island of Tambo, one of them on the side towards the sea and named *La Nespera*, and the other inside on the estuary and called *El Boy*; another place known as *Area de Barca*; another in *Rajo*; another in *Porto-Celo*; another in *San Jorge de Mogor*; another in The Cave Between the Two Mountains, in *Goyra*; two on the long beach of *Bueu y Beluzo*; and another *La Arca de Menuina*, in *Aldan*.

15. ITEM, that from the day of San Roque, when the period begins in which the net of the *cercos* may be taken into the open to condition it, until the entire month of December has passed, no vessel, either by day or by night, shall go to fish *jeito* from the river *Misierio*, which is in *Samiera*, in a straight line from the

⁴ The Spanish apparently used the word *veta* to mean not exactly a "seam," but a width of webbing.

rock of *Batel*, which is situated to one side of *Marín*, towards the bar. But from said localities to the edge of the sea it shall be allowed to fish *jeito* during said time, never by day, but only from sunset until sunrise on the day following, penalty of 500 *maravedís* to him who shall do the contrary, and in addition to that the nets with which he is found fishing shall be confiscated, although it be night, if he be within prohibited limits; and they shall take him, that the Admiralty Judge may mete out his punishment.

16. ITEM, that neither by night nor by day, in no part of the estuary, shall it be permitted to fish for *jeito*, dragging the net across the bottom, because of the great injury which results, except only to six fathoms from *Sineira*, in each pair of trawl boats, and he who shall do the contrary shall have his nets confiscated and pay 1,000 *maravedís* of fine.

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June 14, 1929

"If we want fish we have to reserve some place for them to live."—Herbert Hoover.

FOURTH ANNUAL CONVENTION OF EMPLOYEES

Coming from all parts of the state, wardens and officials of the Division of Fish and Game gathered in San Francisco for a three-day convention on February 13, 14 and 15, 1929. The first morning was devoted to registration and conferences at the headquarters office,

510 Russ Building, San Francisco. An interesting pathological exhibit was on display and a special exhibit of books was arranged in the library.

The opening session was held in the Italian Room, Whitecomb Hotel, at 1.30 in the afternoon. Executive officer, Eugene D. Bennett, presided. First on the program were addresses by President Zellerbach and Commissioner R. G. Fernald. Mr. Fred G. Stevenot, director of the Department of Natural Resources, then explained certain relationships between the various divisions of the department. Other speakers included E. L. Macaulay, chief of patrol; John Spencer, in charge of Bureau of Hydraulics, and Mr. George Tonkin, federal game warden. Special features of the program were short talks by Senator Sanborn Young, chairman of the Senate, Committee on Fish and Game and Assemblyman Hubert Seudder, chairman of the Assembly Committee on Fish and Game.

An evening session was devoted to motion pictures. The Bureau of Education and Research presented some of the standard films used in educational work and also displayed for the first time several new reels which had just been completed. Of particular interest was one



FIG. 39. Fish and game commissioners hold meeting after the barbecue at Yountville Game Farm, February 15, 1929. From left to right, Commissioner George Clarkson, Executive Officer Eugene D. Bennett, Commissioner Reginald Fernald, President I. Zellerbach. Photograph by E. S. Cheney.

which portrayed the spiny lobster and the Pismo clam industries.

The session on Thursday morning began with an instructive address by Captain Sweet of the United States Army, who is training the San Francisco police department on the use of side arms. S. B. Show, district forester, and P. Paul Piage,

Eugene D. Bennett. The last hour of the session was devoted to discussion from the floor and a presentation of proposed legislation.

A special effort was made this year to avoid the usual banquet and apparently a worthwhile substitute was discovered. Friday, February 15, was devoted



FIG. 40. On the firing line during the pistol shoot held at the State Game Farm, Yountville, February 15, 1929. Photograph by E. S. Cheney.

president of the Associated Sportsmen's Clubs of California, discussed cooperation with their organizations. The work of the volunteer deputy was described by Walter Welch; publicity was discussed by F. B. Anderson and first aid by C. E. Dickinson, safety engineer of the Pacific Gas and Electric Corporation. Dr. K. F. Meyer gave an interesting address illustrated with lantern slides on the subject of "Certain Aspects of the Diseases of Fish and Game."

The afternoon session was devoted to talks by various department heads: Game Refuges and Game Census, by J. S. Hunter; Fishing Conditions in Lake Tahoe, by W. H. Shebley; The Commercial Fisheries, by W. L. Scofield; Conservation Fundamentals, by Dr. H. C. Bryant; Expense Accounts and Finance, by H. R. Dunbar, and The Library, by Bessie W. Kibbe. An interesting presentation on evidence in game cases was made by

to the pistol shoot, a barbecue, and inspection of the State Game Farm at Yountville. The men were taken to the Yountville Game Farm by means of large busses. A series of ten targets had been arranged. All entered the pistol shoot for the Zellerbach trophy with zeal. The first round ended with a tie at 96 points for Taylor London, J. H. Gyger and Major John Farley. In shooting off the tie Taylor London outdistanced his competitors, raising his score to 97. All agreed that the winner of last year's shoot was again the surest and steadiest shot of the entire force. At the 25-yard range he placed all five bullets within a two-inch area in the center of the bullseye. After the excellent barbecue, which consisted of shrimp salad, barbecued beef and beans, formal presentation of the trophy was made to Deputy London with second and third prizes going to Gyger and Farley. An interesting display of

bay and river gear and fishing nets was made by Captain Sellmer.

The day afield proved to be a fine get-together for the men and the demand for a similar occasion another year will be great. After inspection of the game farm, most of the men started for home.

Nothing has improved the *esprit de corps* of the organization as much as have these meetings. Furthermore, the programs which have been of purely an educational nature have assisted greatly in fitting the men for greater service to the state.

CONVENTION ADDRESSES

Fourth Annual Convention Employees
Division Fish and Game, San Francisco
February, 13-15, 1929.

ADDRESS OF I. ZELLERBACH, PRESIDENT
CALIFORNIA FISH AND GAME
COMMISSION

In offering the members of our official family a welcome to this, our fourth convention, which each year brings us all

Until we held these conventions three years ago, you boys had not the pleasure of getting together and exchanging your views, finding out what was happening in the various districts, and what the Commission was really trying to bring about. As each year passes and we hold these conventions, we learn to be more considerate of each other, and to cooperate together in thinking out the conservation problems that we are trying to solve. The efforts that you boys have made to cooperate with the officials of the commission, have brought about the respect of your community and the sportsmen of the state, so that I think I can safely say there is no department of the state government that is thought more of today than the Division of Fish and Game, or one that has the confidence and respect of the public to a greater extent. That is due to the whole-hearted cooperation we are receiving at your hands.

If we are to succeed, we must succeed as one large business family. As I told you before, and I am repeating it now,



FIG 41. Examining the targets during the pistol shoot, Yountville Game Farm. The man at extreme right is Patrol Chief E. L. Macauley.

closer together in the work that we are all engaged in, I want to tell you how happy the commissioners are, at the cooperation and the fine spirit that exists today in the personnel of our department.

we are operating a large business, a department of the State of California, and that business is the conserving of the wild life of our state. You boys, who are all outdoor men, are responsible for

the success or failure of this division. As I have often said, you are really dedicating your lives to the work, not for the monetary returns you get—as the salaries you receive can not be the motive, for in any other line of business you would probably be getting two or three times what you do—but because you love the work. Unfortunately, in public life we have not the means to always pay the salaries the positions warrant. I want to say that with the increased licenses, the Commissioners and officials in the department are always looking toward trying where we can to increase the salaries that you are getting, and if some of you don't get your salaries increased as fast as you think you ought, I don't want you to feel it is an oversight; we are doing the best we can. Progress is slow, is bound to be slow, but we are making progress, and each year shows us further along in the work that we are doing.

I want to just say a word regarding the transfer of some of our deputies from one position to another. I want you all to understand and to feel that the order that was issued at that time was not meant as any condemnation of the work that you were doing in your district, but we made the transfers for what we thought was the good of the service, and when an order of that kind is issued I want you all to understand it is done after a great deal of thought, and there is nothing personal about it at all. As good soldiers, be each and everyone of you ready to cooperate and take your part of the burden, because it is just as hard for the head of the division to turn down a request that you ask as it is for you to ask it, and I want you to feel that the commissioners and the executive officer are trying to make your work as light as possible and your job as pleasant as possible.

I want to say that for myself, and I can speak for the commissioners, the pleasure that we get out of the job we are trying to do is found in the association we have with you boys in the work, and also in the fine cooperation we have from the sportsmen of the State of California. We have their respect now and you boys have their respect, and not alone do we have that, but the work of the commission has the respect of the people of the community and of the State of California. In fact, we are looked upon with respect today all over the United States for the character of the work we are carrying on. One reason is that we are trying to eliminate any political influence in the operation of the commission. Conservation can not be carried on unless we

act as we are acting now, as one large business family, trying to build our organization on a sound foundation, always with the strict idea of cooperating with each other and thinking of just one thing—conserving the wild life of the State of California. That is our one thought.

We are not anxious to prosecute anybody. We are not anxious, as you know, to have technical arrests made, but we are anxious to prosecute wilful violations of the law, and we desire the respect and confidence of the judges and peace officers of the state, so we can make violation of the law a serious offense, and I am sure you will agree with me, we have accomplished that.

I know this meeting will bring about a great deal of good. I trust when you go home you will carry new thoughts that will build up our work, that will bring more progress, so each year we will have more cooperation and better results than we have in the past.

ADDRESS OF EUGENE D. BENNETT,
EXECUTIVE OFFICER

When one travels the length and breadth of this great state, back and forth across it, over the mountains and valleys, and sees the myriads of strange situations and possibilities that exist in almost countless numbers, it is both an inspiration and awe inspiring.

I did not realize, had no comprehension of what we had here, and if I told you a year ago that I thought I was facing a big job that I was ill-prepared to take, I feel that today it is even bigger.

It is said of a great Greek philosopher, probably the father of philosophy, Socrates, in the evenings when he would gather the youths around him and give his long dissertations on the new school of thought, questions would be asked and inquiries made. "Socrates, tell us the philosophy of this or that, what should be done. You know and we don't, we are seeking knowledge." Socrates said: "Gentlemen, I don't know what I know. There is only one thing I am sure I do know, and that is that I know nothing." In other words, that great thinker realized in his humble way he knew little indeed, and he called it nothing. For any man to take this position I have had and become its master, he is either an imbecile or an ass. I don't think the oldest one of you deputies, while you may have been deputies for years and know all about it, really down deep in your hearts will deny that there is a great deal left for you to learn.

Recently I was reading a book on American government, in which a professor of the university stated that conservation was unknown twenty-five or thirty years ago, it was really an unknown thing. We gave no thought to the conservation of the forests, saving of the wild life of the forests and streams; but as time has gone on, with the increase in population and all the other attendant circumstances and consequences, we realize this is a great field and a necessity, and that we are still learning.

I attended a convention of fish and game commissioners at Seattle, in company with Mr. Zellerbach and a number of the other bureau chiefs, members of our division, and we had congregated there the leaders of the conservation movement in the whole United States, men who have national reputations in the science and art of fish culture, men who are in touch with the best examples of game management. The thing that impressed me most was the fact that those men were all frank and honest, and admitted that there was a great deal more they did not know. We are just pioneering in this science and art of conservation.

Personally I don't pretend to be a scientist because I realize my limitations. I am not going to divorce myself from things I can do fairly well for things I am not fitted for. It is very essential that the scientific part of the work be executed with the very best thought that can be given it. I realize I have to depend on the men to run their end of it; I have to depend on the head of fish culture to handle that department; leave it to Dr. Bryant to run his, Mr. Scofield to run the commercial fisheries. There are unquestionably a number of people out in the field who can tell you all about quail propagation and quail restoration; men who possibly know more about the science and art of fish culture than Mr. Shebley or Captain Lambson and the various hatchery foremen. Perhaps the scientists are right with some of their conjectures where our men are wrong; but it is my duty, and it is the only way I have of carrying out the will of the director, to place a great deal of responsibility upon these men, nearly all of the responsibility, and simply see that that responsibility is properly executed. Otherwise you would have a one man commission, running around like a top, getting nowhere. That is why I have said during the past year that the responsibility comes under the head of those various bureaus. Only in that way is it possible to carry out this work.

I want to say further than what Mr. Stevenot has said, before things come to me, complaints and requests, they ought to first go to your immediate superior. Perhaps I have too much of the army idea, but there is a reason for that. In the army, a private would not go up to the captain unless he first spoke to the sergeant. They do not go to the head in some dispute. We are not running an army here, but the same system that prevails in the army prevails in Mr. Zellerbach's great corporation, and prevails here. There should be that element of responsibility passing all the way up the line and down again.

This morning I had a meeting with the captains of patrol. I endeavored as best I could to impress upon them the responsibility that we are placing directly upon their shoulders. They have done good work, and we believe they are going to do better work; but after all, Mr. Deputy, wherever you are stationed, we are looking first to your captain for the immediate proper functioning of his district. When you receive orders from your captain, it is an order from the executive officer, the commissioners, the director and the Governor. Perhaps you have had some one who has resented arrest, say, "You have no right to arrest me." That man possibly resented the fact that you, because your work was making arrests, yourself clothed with a little authority, dared to stop him and tell him he was under arrest. That individual was perhaps like one of us who might take pique from some order of a superior officer. You are not speaking to him as an individual, but with the majesty of the law, when you make an arrest. You are representing the sovereignty of the people of the State of California.

If you receive instructions from your captain or your executive officer, don't allow any personal feeling to enter into it. You are not taking instructions from John Doe, the individual, you are simply obeying the mandate of the sovereignty you serve. Unless a man can enter into that spirit, he is not fit to hold a position in any organization of this kind. Unless his mind is in the proper mental attitude to accept the spirit of the thing, and not the little personalities and other things that enter into those situations that have no place there, he cannot properly perform his duty. If you are spending all of your time worrying about what your captain is going to do, or what the chief of patrol is going to do or fail to do, you are not going to have any time to discharge your own duties down there in your little "bailiwick." Don't waste

your energy and your time, making your life miserable and unhappy, worrying about what the captain or somebody ahead, is going to do. That man has enough responsibility. As the responsibility goes up, difficulties increase. Keep your mind on your own ship. If you don't like the man who is placed ahead of you, forget it. Don't let your mind dwell on it. If he gives you an order, obey it. Try to do it the best you can, as willingly as possible. Try to place out of your mind these prejudices; but if you can't do that, and you seem obsessed with that spirit of ill will, forget it. If he has given you the order, and you have carried it out, consider the individual nonexistent. Consider you have received an order from higher authority that must be obeyed. Then of course, if the time does come when an injustice is done, some fraud or slight committed, you can come to me; but come to me through your Captain if possible, so we shall have no breaking down of the bars of discipline or morale. Don't be entirely discouraged when you have placed your case before the court of last resort, if you don't secure the results you think you should. We construct a magnificent temple of justice. We have a system of jurisprudence that is the heredity of the ages, and yet even today, with the splendid system of laws and administration the best that human mind can devise, we have here and there some case where justice may not land as it should. It is like the laws of nature, where sometimes the innocent and weak are crushed. These things must inevitably happen. More than likely, if you think it is wrong, it is just a case of personal viewpoint. I know perfectly well the commission does not want to do a thing that is unfair. The thing that is uppermost in their minds is what will accomplish the best results, what will render the best returns in this community that we are possibly able to give.

I can assure you where any action has been taken, where any move has been made, that would cause some personal inconvenience, some personal injury, that it does not lightly rest upon the shoulders of the commission. They have not forgotten the injury it may temporarily cause, but it is done with a sense of duty and responsibility to do their best.

The lives of every one of us are reaching out first in one direction, then we come to cross-roads and it branches out. One road seems lined with shade trees, it is a pleasant way to go, it is warm

and yet the sun does not scorch too hot; places to sit down and rest along the way; no hills to climb—an inviting way to travel, a tempting way. How often we are tempted to follow that easy course. But the other road, is hard and difficult, full of uncertainties and hardships, yet we know that at the end there lies success.

It is just the same with public officials administering a trust, the easy way would be to follow that road of least resistance. As human beings, we all like to be considered good fellows. I confess I should like to have every one of you throw your arms around my neck and tell me that I am the finest fellow in the world. I know half of you would not do it because you don't believe it. Just the same, I would rather have you think I am honest, a man who is true to my trust, and trying to do the right and honest and decent thing to the state I serve. That, gentlemen, is the spirit that should administer this division. It is the spirit I have endeavored to use during the past year. I only hope that whoever will continue in the years to come in trying in their humble way to head this commission, will continue likewise. In your own little district, your work is cut out for you, do it as well as you can, so that you can go home at night with a feeling of the utmost confidence and satisfaction, where you can say: "I have done my best. I can sleep soundly at night and feel satisfied when I awake in the morning." That is the greatest satisfaction a person can have out of life.

While from time to time things will happen to you in your official relationship, things you will not like, try to take them philosophically. We each have our separate sphere of work cut out. Try to help push the load instead of pulling it apart and adding weight to the burden. Try to do the very best that is in you.

There is nothing else I want to say to you today. You all know from our publications what our probable course is in the year to follow. We have a great deal of improvement to make. I feel we have made progress in this last year, but we have a lot more to make yet. We have a long way to go yet. We have to study and plan. I only trust that tomorrow and the following day will add to the knowledge and capacities of each and every one of us, so we can tackle this coming year's work better qualified, and I hope above all things else, with a better spirit.

ADDRESS OF SENATOR SANBORN YOUNG,
CHAIRMAN SENATE COMMITTEE
ON FISH AND GAME.

My interest in your work is so great, I feel every man here is my friend. It is a great privilege for a legislator to come here and meet and know men whose duty and responsibility it is to carry out the laws that we enact. I only wish every member of the legislature could have the benefit of the council and advice of you men that enforce the law, because no law is any stronger than its enforcement.

As I look back over the four years in which I have served on the Fish and Game Committee, I see great changes in the morale of the people of the State of California as regards conservation. If you will look at the upwards of 1800 bills before the legislature, 117 of which are fish and game bills, you will see that conservation is one of the outstanding fundamental factors in our bills and in the proposed laws. You will find bills dealing with the conservation of forests, conservation of water, conservation of wild life, conservation of natural resources, conservation of our men and women, conservation of our children, and you will realize that we have gone very far in the past four years toward conservation and restoration of our wild life, and I am very glad to be able to pay a tribute, and give a very great deal of credit to our Governor for the attitude he has taken toward our Fish and Game Commission and these men who have fought such a good battle, and who have done so much toward bringing us closer and closer to our ideals.

I do not mean we have not some very serious problems to face. We have some vicious bills. We have some bad proposed laws. I personally, will never rest and feel satisfied until certain conditions can be corrected. More and more we are reaching the point where the people of California are becoming awakened and aroused to this fact—that we do not own the wild life of the state to destroy, but to hold it only as trustees to pass on down undestroyed, to those who shall come on after us.

ADDRESS OF ASSEMBLYMAN HUBERT
SCUDDER, CHAIRMAN ASSEMBLY COM-
MITTEE ON FISH AND GAME

The furthest thought removed from my mind was that I would have to appear before any gathering and talk. I appreciate very much the fact, though, that

I am here and have the pleasure of meeting with you.

I realize the responsibility which Senator Young and I have assumed in endeavoring to work over these bills and trying to arrive at a proper conclusion as to their meaning and their fitness to be made into laws. The action of the committee chairman is very largely to advise the committees, because almost everyone on the committee is the chairman of some other committee, and it evolves upon them to familiarize themselves with the laws so they can pass on first hand information to the members of that committee. The committee might not always approve of the deductions the chairman makes, but nevertheless you have to assume the responsibility of telling them your idea of the bills that have been presented. If it is right, it is right. If wrong, you are wrong, and you get the blame generally.

I have felt the responsibility to such an extent that I wish to go into the matter of commercial fisheries, to meet with the Fish and Game Commission to get their angle on the different bills proposed, and the last few days have been very enjoyable to me, I assure you. I never knew so many fish swam the waters of the ocean as I saw in Monterey Bay. I believe the people generally do not realize the bigness of the fish and game industry in the State of California.

The thought that you men, the policemen of our forests, rivers and fields, can enforce the law with such a small number of deputies in the field, is almost incredible to me. I believe as time goes on your numbers should be developed in order to get any proper results from the laws we pass. I am very keen to see, or to be a part in trying to pass laws which can be enforced, and not laws which would make you run behind a tree when you saw a violation of that law.

I believe only those laws necessary should be made, and then those laws enforced as well as your man power can do it. I believe that by following out that plan and trying to put down laws that can be enforced, and as nearly as possible laws that are popular, that the people must realize the importance of conservation and the protection of our wild life, because we have to make our changes today and tomorrow in order to provide for the years to come. I heard a very large packer state this noon, that our salmon had been depleted through an extravagant waste that had been going on for years, and unless we take some means

to remove the waste that is always being inflicted upon our other fishes of the state, we will soon have a condition similar to that of the salmon industry.

Our game is being taken care of as best we can, and you gentlemen have upon your shoulders the enforcement of game laws. I am looking for advice and information regarding the legislation before us, and I would appreciate it, as we have bills come in from every district in the state, and you gentlemen represent different districts, if we could get your personal angle on some of the bills that affect the very districts you patrol, it would be a great help to the committee, and I trust and hope we will receive some letters and advice from you, or through the commission. If there are any personal angles that might come to your attention, I know Senator Young would appreciate it, and I assure you we would be glad to receive any angle upon propositions that affect your particular district.

NEW ADMINISTRATIVE OFFICERS

Two new men have been added to the headquarters staff. The new officials are John L. Farley, who became executive officer after the resignation of Eugene D. Bennett on April 1; and Edward L. Macaulay, newly appointed chief of patrol. Macaulay takes the place vacated by J. S. Hunter who was named as an assistant to the executive officer over a year ago. The work has been handled more recently in a highly creditable fashion by K. P. Alfred as acting chief.

Mr. Bennett accepted an attractive offer in connection with his chosen profession of law. Though relinquishing the position of executive officer, he does not leave the service, for he will be retained as attorney for the division. Thus, he will be able to continue the utilization of his knowledge of conservation matters and serve the cause in which he is so much interested.

Mr. Farley, first named as assistant to the executive officer and now filling Mr. Bennett's position, comes to the Division of Fish and Game with excellent training as an executive. After his graduation from the State Teachers' College in Wisconsin, he was principal of a high school. Following this work he returned to the University of Wisconsin, where he graduated from the college of engineering. After following this calling for some time he enlisted in the army at the outbreak of the war, and remained there when hostilities ended. Six years ago he resigned, then holding a commission in the Coast Artillery. He has traveled

extensively throughout the east and middle west and has lived in Virginia, Georgia, Hawaii and California. He is a native of Ohio. Since leaving the army, Mr. Farley has been actively engaged in the practice of his profession of engineering, having been connected with one of the large public utilities of the state. He has been active in the California National Guard and holds the rank of major in that organization. Mr. Farley likes to hunt and fish and is thoroughly interested in the conservation of natural resources.

E. L. Macaulay has resided in California for twenty-five years. For the past five years he has been connected with the office of the State Adjutant-General, in charge of the armory at San Francisco. At the start of the World War he enlisted and commanded a battery of the 67th Coast Artillery in France during the conflict. He left the service with an excellent record, and now holds the rank of captain in the National Guard. Macaulay is a member of the Sierra and the Alpine clubs, being greatly interested in all sorts of outdoor sports, not the least of which is angling. Due to his experience in handling men and his record for close attention to detail, Macaulay should make a fine chief of the field forces of the Division of Fish and Game.

FISH AND GAME DISTRICTS

It is interesting to find that an eastern state has discovered that conditions vary so greatly that fish and game laws can not be uniformly applied. According to reports, the Conservation Commission of Michigan will go before the legislature with a proposed law to divide the state into three zones with separate fish and game regulations for each zone. It will be necessary to repeal 140 laws now in the statute books in order to make the change.

California realized before 1902 that conditions in the different parts of the state required different laws. A constitutional provision was adopted in 1902 allowing the legislature to divide the state into fish and game districts and to enact legislation appropriate for each district. It was not until 1911 that this constitutional provision was taken advantage of by the legislature.

Periodically, there are those who demand uniformity of laws throughout the state. These have been but minor protests, for most hunters and fishermen are convinced that some flexibility in the law is a great advantage. As has been

pointed out many times, it would be difficult to set the opening of the deer season at such a time as to prevent the killing of deer "in the velvet" or the killing of deer during the rutting season if a uniform season were established. The zoning system allows the opening of the season in the coast range where deer have matured their antlers at an earlier time than in the Sierra, where maturity takes place at a later date. Most of those conversant with conditions in California are ready to admit that there has been a great advantage in the districting system. The courts have upheld the present law.

HUNGARIAN PARTRIDGES IMPORTED

Last fall a special order was placed for some 1500 Hungarian partridges to be imported from Central Europe. Commissioner George B. Clarkson personally superintended the purchase. In late January the first shipment arrived by boat direct to San Pedro. About 600 birds arrived January 25, 1929, in rather poor condition because of the long trip by boat. A. W. Elder, of the Yountville Game Farm, took charge of the birds and they were temporarily housed at a private game farm until properly acclimatized. During the first week in February, the larger proportion of the birds was liberated in various places in southern California. Some of the birds were sent to the Yountville Game Farm to be used as breeding stock. Another shipment of birds was received in March.

SARDINE LITIGATION

During the past three months sardine litigation has again been to the fore. Three cases, two in the superior court and one in the federal court, have been fought, with the Fish and Game Division taking the side of conservation in seeking to curtail the waste of food fish by canners in reduction plants.

The first case was tried before Superior Judge J. R. Welch, Santa Clara County, sitting in place of Judge Jorgensen of Monterey County, who disqualified himself, due to the fact that he had before taking his seat on the bench represented some of the defendants in court actions. This case tried at Salinas lasted three days. The defendants were the Monterey Canning Company, Sea Pride Canning Company, Carmel Canning Company and San Carlos Canning Company. All were charged with failing to pack during a stated period, the fifteen cases of sardines per ton of fish brought in to the plants required by the Commission.

The defendants were represented by B. D. Marx Greene, former executive officer and attorney for the Fish and Game Commission. Eugene D. Bennett, present executive officer and attorney, assisted by Ralph W. Scott, appeared for the people, and made an excellent case. At the close of the trial, Judge Welch continued in effect the temporary order granted at the first hearing, which provided that each of the defendant canners must pack fifteen cases per ton of fish brought into their plants until he rendered his decision. On March 13, Judge Welch decided in favor of the people and ordered the four plants abated for a period of three months, effective on March 15.

The case hinged upon the right of the commission to issue the fifteen case order, and on the definition of the word "offal" which the defendants defined as all fish not put in cans, while the state insisted the word meant only heads, tails and cleanings of fish. Much conflicting testimony was offered, and the case was a hard fought one. N. B. Scofield, head of the commercial fisheries department of the division, was the principal witness for the people, while well known canners from Monterey and San Pedro testified for the defense.

Shortly after this closed case, the Van Camp Sea Food Company of San Pedro filed suit for an injunction against the Commission, seeking to restrain its officers from interfering with their operations or bringing action to enforce the fifteen case order and twenty-five per cent reduction allowance. Judge William James of the federal court granted a temporary restraining order, and the hearing was set before Judges Henning and James of the Southern Federal District Court and Judge Rudkin of the District Court of Appeals. After a long hearing, also bitterly contested, the three judges dismissed the case against the Commission and dissolved the temporary order. The most interesting feature of this decision is found in the statement that the state has a right to legislate for the protection of fish within the state even though but a small portion of the fish caught may be taken within the state's jurisdiction.

The division then started action against the Van Camp Sea Food Company, Southern California Fish Packing Corporation and the Wedum Packing Company in the superior court of Los Angeles County. This case lasted for two weeks and finally was decided adversely, Judge Clair Tappan rendering his verdict in favor of the defendants, and declaring that canners

were allowed to use in reduction plants, twenty-five per cent of the capacity based on the capacity of can closing machines. This in effect means that for each can closing machine, which with packing tables, exhaust boxes and conveyors is a cannery unit, may divert 136.7 tons of sardines per calendar month to reduction plants.

Following this decision, the officials of the division have centered their attention on legislation which would eliminate the reduction allowance entirely.

house, and once it was passed in the house and failed in the senate. The main obstacles appeared to be those involved in a federal license fee and in a provision for public shooting grounds. Finally despairing of passing this bill, various friends of the measure united in supporting a new measure which eliminated the various objectionable features. Taking as the main viewpoint that game refuges are needed in order to help the waterfowl situation, and that the government should aid in establishing such



FIG. 42. Friends of a conservation measure. From left to right, Senator Peter Norbeck of South Dakota, President Calvin Coolidge, Dr. T. Gilbert Pearson, chairman of the National Committee of Wild Life Legislation, and Representative August H. Andresen of Minnesota. The President was urged by this delegation to sign the Norbeck-Andresen Bill, which provides for the government to expend about \$8,000,000 for inviolate sanctuaries. Photograph by International News Reel Corporation.

THE NORBECK-ANDRESEN GAME REFUGE BILL

It took a number of years of striving to attain the treaty with Canada and the resultant laws relative to migratory birds. Likewise it has taken time for conservationists to secure federal legislation relative to the establishment of game refuges. It will be remembered that a game refuge bill has appeared in congress for six years, that once it was passed by the senate and failed in the

refuges just as much as in building good roads, the new measure was drawn. With little opposition, the Norbeck bill passed the senate at the main session of congress.

The National Committee on Wild Life Legislation, an influential group of men representing practically every national conservation organization in America, was formed at Seattle during the meeting of the International Fish and Game Commissioners. This committee actively

espoused the measure and it was enacted into law by an unanimous vote of both houses and received approval of the president on February 18, 1929.

The bill, which is known by the short title of Migratory Bird Conservation Act, is designed to more effectively meet the obligations of the United States under the Migratory Bird Treaty with Great Britain by lessening the dangers threatening migratory birds from drainage and other causes; by the acquisition of areas of land and of water to furnish in perpetuity reservations for the adequate protections of such birds; and authorizes appropriations for the establishment of such areas, their maintenance and improvement.

A commission to be known as the Migratory Bird Conservation Committee, consisting of the Secretary of Agriculture as chairman, the Secretary of Commerce, the Secretary of the Interior and two members of the Senate and two members of the house of representatives is created and authorized to consider and pass upon areas of land, water, or land and water that may be recommended by the Secretary of Agriculture for purchase or rental as inviolate game sanctuaries. State approval must follow.

Proper financing of the project is accomplished by the authorization of \$75,000 which, if appropriated, is to become available on July 1, 1929, for use in preliminary surveys followed by a \$200,000 appropriation in 1930, \$600,000 in 1931 and \$1,000,000 for six successive years thereafter. Annual appropriations of \$200,000 are authorized to pay the cost of maintaining and patrolling the established refuges after the ten year period.

Undoubtedly this game refuge bill is one of the most important wild life conservation measures thus far attained. There is great satisfaction in feeling that congress recognizes the need for this aid to wild fowl and has been willing to authorize funds and proscribe a method of bringing about an improvement of conditions. The act definitely strengthens the arm of the Federal government in its constructive and progressive policy of bird protection. Legislation of this type guarantees a breeding stock of wild fowl for future generations of Americans.

TROUT FEEDING EXPERIMENTS

Every fish-culturalist these days is confronted with the problem of finding a suitable food for hatchery reared trout which will be less expensive than the long dependable beef liver. Experiments in eastern states have shown that trout can not thrive on any large percentage

of food other than beef liver. It has also been demonstrated that sheep liver is not to be compared in value with beef liver. California, confronting this problem, is now undertaking a series of experiments to determine whether or not sardine meal, dehydrated salmon eggs, shrimp meal and alfalfa meal can be successfully substituted even in part for the well known food. With the help of Dr. K. F. Meyer a series of four experiments have been planned to run simultaneously in five different hatcheries using a number of different species of trout. At least one-fourth of the food used in these experiments will consist of fresh beef liver, the substitute foods will be tried out to determine whether or not trout can be successfully reared when a portion of their food is made up of these other materials. Pathological and chemical analyses will be made in the first place to determine the bacterial content of the foods used and in some instances, treatment will be given to reduce the bacterial flora.

This series of experiments should furnish accurate information as to the extent to which substitute foods can be relied upon. A balanced ration perhaps can be determined upon that will satisfactorily furnish necessary requisites to growing trout. If it were found possible to substitute dehydrated salmon eggs or shrimp meal, such foods could be shipped in sealed cans in such a way as to improve sanitary conditions.

DISEASE INVESTIGATIONS

The Division of Fish and Game is now well equipped to study diseases of game birds and animals. A pathologist, parasitologist and chemist are employed. All specimens of sick birds or animals should be sent directly to the Hooper Foundation for Medical Research, San Francisco, California, where under the direction of Dr. K. F. Meyer, post-mortem examinations and complete tests for pathogenic bacteria are made.

Numerous sick deer from the coast range examined at the laboratory show infestation with lung worm, a common parasite in domestic sheep.

Experiments and blood tests are being continued in connection with the duck disease investigation.

BANDED DUCKS RECOVERED

The following interesting series of returns relative to ducks banded indicate widespread dispersals. Banding operations at Lake Merritt, Oakland, California, are apparently responsible for the interesting series of returns:

Species	Banded at	Date	Found	Date
Mallard	Moiese, Mont.	Nov. 1, 1928	Nr. Sebastopol, California	Dec. 14, 1928
Pintail	Irvington, Cal.	Jan. 28, 1926	Bear Island, California	Jan. 14, 1929
Pintail	Lake Merritt, Cal.	Jan. 17, 1928	Newark, California	Nov. 28, 1928
Pintail	Lake Merritt, Cal.		Tule Lake, California	
Pintail	Lake Merritt, Cal.		San Leandro Bay, Cal.	
Pintail	Lake Merritt, Cal.		Live Oak, California	
Pintail	Lake Merritt, Cal.		Lake Earl, California	
Pintail	Lake Merritt, Cal.		Butte Basin, California	
Pintail	Lake Merritt, Cal.		Emeryville, California	
Pintail	Lake Merritt, Cal.		Gustine, California	

A VICE PRESIDENTIAL PROCLAMATION

The whole of our business life takes root in nature. All of our progress and prosperity is predicated on the abundance of our natural resources and the manner in which we develop them for man's use. But nature is not inexhaustible. We can not continue to draw upon the resources of nature without giving something back to nature. The minerals we find in the earth can not be restored, but the riches we take from the fields and the forests and the streams can be replenished. Some day, and perhaps much too late, we shall learn the lesson of conserving and restoring these assets.

Qualities of mind and body can not be measured in terms of dollars, and yet we must credit much of the wealth and greatness of our country to the fact that so large a part of our people spring from sources that have been close to nature. All of us who spent our childhood in the fields and forests have the feeling that we want our children to have some of that contact with the out-of-doors. We can not help believing that the days we spent following a faithful dog, or sitting on the bank of a stream paying more attention to nature than to the bobber in front of us, put something into our minds and hearts that we want our children to have.

And yet, how scant are the out-of-doors opportunities for our children as compared with our own, and how much less must be the contact with nature, unless you make it your business and I make it my business not only to save what is left to us of the out-of-doors, but to restore that which we and our fathers have destroyed.—Charles G. Dawes, *Outdoor America*, January, 1929, p. 12.

ACCOMPLISHMENTS OF A VOLUNTEER SYSTEM

An examination of the reports of over 492 volunteer deputies constitutes one of the most conspicuous pieces of evidence that the regular patrol of the Division is being greatly assisted, and that the volunteer system has developed into an efficient, valuable unit. Nor should it be taken for granted that all the time and

energy of the volunteer force is expended in law enforcement work. Volunteer deputies have had a share in the job of stirring the people of the state to the penalty of squandering their heritage of fish and game and leaving but beggarly remnants for their children to enjoy.

Reports of these men over a six-month period ending the first of this year show that 421,016 miles of fields, streams, lake and bay shores were patrolled. These reports show a total of \$9,890 in fines collected and turned in for 219 arrests for violations of the fish and game laws. They also show that 14,717 hunting licenses, 10,308 angling licenses and 4837 deer tags were checked.

One of the most conspicuous cases was worked up by a volunteer deputy of Salinas, assisted by a regular deputy. The offense involved the killing of a doe at night with the use of a spotlight. The violator was an alien and had no license. He was fined \$600. Another case made by a volunteer deputy of Calistoga assisted by the regular force was for the slaying of a doe which, in this instance, was carrying two fawns. One of the defendants had the reputation of being a chronic offender and was fined \$500; the other paid a fine of \$250.

Federal forest rangers have been named volunteer deputies by the Division. The scope of their activities touches in a certain way the field of the regular patrol. What better proof can be offered of the good work the federal foresters are doing to aid fish and game conservation than the fact that they made sixty-four arrests and checked 10,672 angling and hunting licenses while on duty in the national forests between July, 1928, and January, 1929.

DEER HUNTING AND SPORTS- MANSHIP

With the decrease in abundance of game, methods which permit easy taking or wholesale destruction have been prohibited by law. In former days when deer were everywhere common they were shot at night with the aid of a torch lure, were ambushed in runways or driven into water and dispatched, sometimes with a knife.

Torch hunting at night was a most picturesque sport, but involved little expenditure of effort and still less skill. The curious and bewildered animal approached within very short range and was killed often with a load of buckshot.

Now hunting is one of the means of gratifying the desire for recreation and contact with the out-of-doors. Except in rare instances, game is not killed merely for its food value. In its highest expression as a sport, hunting has become a game of skill. Stalking deer, for instance, requires skill. It takes an immense

the Lassen National Park to their winter quarters and bag a considerable number of tame Lassen Park deer every season.

To the true sportsman such activity should be without interest or zest!

SOME VALUES OF GAME RESOURCES

The Canadian-Field Naturalist, January, 1929, prints a very able paper on "Moose in Nova Scotia," by Otto Schierbeck, the conclusion of which is reproduced here:

"The game of a country must serve



FIG. 43. Jay C. Bruce, state lion hunter, with a lion kill, decorating his fully equipped automobile. Lion hunter Bruce, although handicapped with the loss of one eye, is after lions again.

amount of patience and can be well done only after much practice and experience. A successful player of this game knows the habits and ways of the deer he seeks. He moves carefully and pauses often. He matches his wits with that of the animal sought. If he can drop the wary creature after a fair stalk, he can indeed take pride in his skill.

A first class sportsman would be ashamed to conceal himself on a trail leading from a park where deer have responded to protection and become quite tame. In such cases where deer are not educated to the gun, they cease to be crafty and hunting them involves no skill whatsoever.

Reliable reports have come that hunters lie in wait for deer migrating out of

two purposes. First, to provide pleasure for sportsmen and tourists and thereby, through licenses, give revenue to the government, and through the hiring of guides, buying of supplies, hotel trade, etc., give revenue to the population at large.

"Second, to the farmer who lives in the vicinity of the forest, the game provides a cheap winter food and the fur-bearing animals provide him with an income from trapping.

"The Canadian farmer has an ingrained love of liberty and strongly resents any restrictions, especially in regard to game. The old-time severe game regulations of the Old Country, inflicting heavy punishment upon poachers on the big noblemen's estates, were often the cause of

deportation of the offenders to the colonies, and one of the outstanding signs of freedom in the New Country was the entire absence of any restrictions in hunting rights.

"Effective game protection, however, can only be achieved if these two conflicting interests will 'bury the hatchet' and cooperate in a proper understanding. The sportsman must recognize the farmer's rights and the farmer will then see the advantage the sportsman furnishes him by giving him work as guide and creating a market for his products."

IMPORTANCE OF SCIENTIFIC RESEARCH

Daily those who are intimately concerned with the preservation and restoration of fish and game are coming to realize the fundamental place science is assuming in adjusting natural conditions to the progress of civilization. To be more specific, scientific research is becoming the solid means of assuring a supply of fish and game for the future. In an article entitled, "Conservation and the Handwriting on the Wall," *News Bulletin* No. 26 of the E. I. DuPont de Nemours and Company, L. W. T. Waller, Jr., writes as follows:

"Sportsmen, and conservationists desire one thing—perpetuation and increase of our wild life. This then is the 'progress' we are after, and its price is unquestionably 'research which alone assures the security of hunting.' * * *

"Example after example of the necessity of research in conservation matters could be piled up.

"A few plantings of foreign bird species in areas unfitted for their welfare with consequent loss of time, money and enthusiasm, yet who can say what the requirements of such areas are?

"Loss of literally millions of wild fowl from 'duck sickness'—why?

"Loss of (probably) millions of wild fowl in their breeding areas. What can we do about it?

"Steady decrease in native game, such as quail, in areas of intensive farming and overgrazed cattle areas. Can we bring these back by scientific planting?

"Loss of quail, grouse and rabbits from disease—why?

"Such examples could be prolonged far beyond the pages of this bulletin, but to what avail? We either see and can read the 'Handwriting on the wall' or we do not, and it is to be feared too many of us are modern Belshazzars. Millions of ducks and tons of game are dying or not reaching maturity every year, which

could be saved, while we haggle over relatively minor questions such as—seasons, bag limits of whether the game commissioner is a Democrat or a Republican.

"We can not legislate 'game on the hoof' and we have certainly demonstrated the utter failure of restrictive legislation; which, if it can not save game, surely can not restore it. Restricted legislation is necessary; bag limits and seasons are essential, both if anything more exciting, and all certainly more rigidly enforced, but we can not rest there. The big thing is scientific research, adequately planned, painstakingly carried out and the findings made use of by federal, state and sportsmen's organizations to insure the 'dividends' we want in the form of a continuing yearly game crop adequate to meet the needs (within reason) of the sportsmen of this country."

PENNSYLVANIA'S DEER PROBLEM

The Pennsylvania Game Commission has for several years felt that the deer herd of the state must be reduced in numbers. They were convinced that does were too numerous and after attempting many methods of improving the situation declared an open season on antlerless deer in 1928. This declaration aroused much antagonism. A recent Bulletin (No. 12) entitled, "The Pennsylvania Deer Problem," contains the following interesting conclusions:

"Now that the 1928 special open season on antlerless deer has passed, and we have had opportunity to study carefully some of the results, we have come to the following conclusions:

"First, that female deer are just as desirable as game animals as bucks. Many hunters who thought they could walk up to a doe as easily as they could approach a cow, went home without even having had a shot at a deer. After the first day or two of heavy shooting, the keen senses of the female animals asserted themselves to such an extent that thereafter very few does were killed. This proves that does are just as hard to bag as bucks.

"Second, that hunting accidents were less frequent than in the 1927 deer season.

"Third, that over-crowded conditions of the herd have resulted in the poor development of antlers among the young bucks.

"Fourth, that the breeding period of deer is so upset as a result of the unbalanced condition of the sexes that many fawns are produced too late in the season for them to compete with their elders in securing food during the winter.

"Fifth, that while deer observed in the fall appeared to be in a healthy condition because there was an abundance of food at that time, this fact has little bearing upon the food problems which develop, during severe winter weather, among young fawns.

"Sixth, that while no serious disease has been noted thus far this is no proof that a continuance of over-crowded conditions will not eventually induce such a disease.

"Seventh, that the Game Commission will continue to curtail the planting of

4. The percent of doe not reproducing fawns is apparently high.

5. There has apparently been some change in the estral period of the doe.

6. The unbalanced condition of sexes has been partially responsible for the change.

7. The present state of health in the deer herd is good, so far as communicable diseases concern them.

8. Barriers should be constructed to prevent the introduction of diseases of domestic animals.



FIG. 44. Captain William Lippincott and Sheriff John Runner with specially equipped gun for spotlight hunting of deer which was recently confiscated. The light was powerful enough to send a beam a thousand feet. Photograph by Humboldt Standard, January, 1929.

forest tree seedlings until they are certain these will not be consumed by deer which lack sufficient natural food during winter."

Further conclusions were as follows:

1. The Board of Game Commissioners is confronted with a problem relative to the deer situation that deserves further study.

2. The sportsmen should voluntarily desire an organized effort for such study.

3. There is an unbalanced condition of sexes in the deer herd.

9. Feeding material for the deer is becoming scarce and will be more so as the herd increases.

10. This year's doe season will tend to increase the size of the deer herd rather than reduce it.

11. Shooting of deer should not be confined to one sex after the proper sex balance is established and is indicated only as one or the other sex becomes too plentiful.

12. The deer season should not come in the season of repeated estrum.

13. The older bucks should be preserved for a time for breeding.

14. The relation of age to sexual maturity should be studied.

15. The herd should not be permitted to become sufficiently large to cause a food shortage."

THE DUCK SEASON

Reports from various sections of the state indicate that the past open season on wild fowl was the best in several years. An observer in San Diego County states, "I consider the duck season for 1928-29 in this county to be the best as far as numbers of different varieties of ducks for the past 20 years." Incomplete reports indicate that on the lakes of San Diego County, a total of 76,533 birds were bagged. On Lower Otay Lake the total amounted to 22,501; on Sweetwater Lake, 3473 pintail, 1070 canvasbacks and 6537 ruddy ducks were secured.

Most club hunters secured full bags and there was less complaint from the open shooter. Hunting in the San Joaquin Valley showed considerable improvement over recent years.

In spite of the fact that large numbers of geese were also killed, oldtimers in the Sacramento Valley are becoming convinced that geese are returning in greatly diminished numbers each winter. It will be remembered that not many years ago, no protection whatsoever was given to geese because of their depredations in grain fields. Now we find the same men who complained of damage, complaining that few birds are returning and that there is difficulty in securing limit bags. The limit now calls for but eight geese per day.

STEELHEAD FISHING CONDITIONS

The steelhead season, which closed on February 28, was one of the finest winter fishing seasons in years. The run of fish in the Russian River was a great one and fine sport was enjoyed by thousands of anglers. The holding off of the rains kept the river in excellent condition during most of the season. As an indication of the number of fish entering the river, the report of the ferryman at Markham's ferry following high water, was to the effect that a run of fish came in that took two hours to pass the ferry. After the big run was over, there were stragglers lying in the holes all up and down the river and many fish continued being caught. Reports from the Napa River are to the effect that many steelhead were caught there.

RIGHT TO FISH DEMANDED IN FEDERAL BILL

Senator Hiram Johnson has introduced a bill into congress which will safeguard the right to fish in various streams of the state. In recent years there has been a tendency for wealthy individuals or groups of individuals to purchase private land within national forests and then by exchanging private lands for government land along streams to prohibit fishing. Senate Bill 5462 provides as follows:

"Be it enacted by the senate and the house of representatives of the United States of America in congress assembled, That all patents hereafter issued to any public lands of the United States shall contain an express provision that the lands so patented shall be subject to the right of all persons to fish in any waters upon such lands in accordance with the laws and regulations of the United States and of the state in which such waters are situated, and to have access to such waters for the purpose of such fishing."

The measure does not affect private holdings along streams, but will prevent the closing to the fishermen government lands now open to fishing.

FINANCIAL STATEMENTS

For a number of years, financial statements of the division covering a three-month period have appeared in the Appendix to each number of CALIFORNIA FISH AND GAME. To obtain a statement for a six- or nine-month period, it was necessary to add figures together. It is now planned to furnish a continuous financial statement for each fiscal year. Thus, in the present number, there will be found a statement covering the first six months of the fiscal year. Where statements of the current three-month period are needed, it will be necessary to subtract. The new presentation has the advantage of giving the complete financial status of the division at each three-month interval of the fiscal year.

FISH RESOURCES IN LAKE ELSINORE

Several years ago, Dr. James G. Needham, of Cornell University, spent some time making a biological survey of Elsinore Lake. A report was published in the Journal of Entomology and Zoology, of Pomona College. After explaining that the lake lies in a shallow depression of the San Jacinto Basin filling a low spot in the line of an old geologic fault, a description is given of the main streams supplying the water to the lake. The largest of the streams is the San Jacinto

River which has its source in the lofty San Jacinto Mountains. During ordinary times, the San Jacinto River disappears in the sand of the plain. In flood time, however, it flows across the surface in a shifting, sandy, willow-bordered channel finally entering Elsinore Lake. The lake has no outlet except at times of long

crowded out the more valuable native fishes. Examination of the food of carp and of the sunfishes showed that practically all the free living animals of suitable size found in the lake had been taken. The carp especially the larger ones, had eaten much bottom mud containing organic residue and diatoms. The food of



FIG. 45. Albino deer taken near Chico by Floyd Earp of Oakland, Calif., a duck hunter. Judge George Reckers of Williams fined the violator \$500. North coast Indians celebrated a white-deer dance in which skins of albino deer were utilized. Albinistic forms are nevertheless of rare occurrence. Photographs by H. R. Christensen, January 6, 1929.

continued floods. Its waters are alkaline, but the degree of alkalinity varies with the rainfall. After a few dry seasons the water becomes concentrated by evaporation.

Carp, black bass and blue-gilled sunfish apparently occupy the lake. A single smelt (*Leurichthys orcutti*), less than three inches long, was picked up at the drift line. Bullheads, though not seen, are said to exist in the lake. Fishermen in their cross-meshed nets, take large carp. Supposedly, the carp, which is the one abundant fish of the lake, were planted in the Santa Ana River and came into the lake years ago at time of overflow. This fish has taken possession and has

the sunfishes differed chiefly in that they had eaten fewer blood worms and very little mud. Though the population of this lake is scanty in species, it is rich in individuals. The crop of plankton crustacea is exceedingly large and the chief beneficiaries of this high productivity under existing conditions are the carp and the pelicans.

TROUT RESCUED

February 27, 28 and March 1 and 2, Abe Woodard, net foreman, and a crew of fourteen volunteers assisted by State Forest Inspector Briggs of Oroville, rescued from Concow Creek, Butte County, below the dam:

Number.		Pounds.
500	Rainbow trout approximately 4 lbs. each -----	2,000
100	Rainbow trout approximately 3 lbs. each -----	300
1,400	Rainbow trout approximately 2 lbs. each -----	2,800
435	Rainbow trout approximately $\frac{1}{4}$ lb. each -----	109
2,435		5,209

The fish were stranded in two large holes below the Concow Dam which had been emptied to clean the lake. Great difficulty was encountered in removing large boulders so that the ponds could be netted. The fish were then raised 130 feet over the dam in cans with the loss of but one fish.

This device is designed to remove all floating trash from irrigation canals and also to prevent the entrance of fish into such conduits.

Its motive power is derived from a current water wheel and as its mechanism is geared to run slowly, it has great power. This enables the machine to remove with ease large objects from the stream in which it operates. Two men have been placed on the teeth that carry the trash from the water and at the same time men have stood on the cross bars of the carrier and this weight has not noticeably slowed down the speed of the machine.

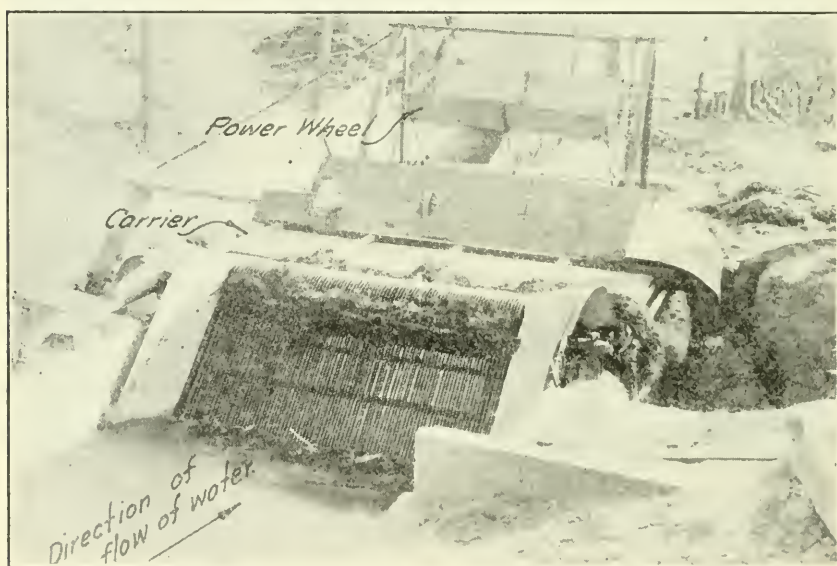


FIG. 46. A new type of self-cleaning fish screen invented by Francis Cuttle of Riverside, Calif. A circle of revolving teeth carry the trash on to a carrier which in turn deposits it in a pile at the side of the screen.

These trout would have become a total loss if allowed to remain as there was no stream flow.—George Neale.

SELF-CLEANING FISH SCREEN

A recent invention by Francis Cuttle of Riverside, originally designed for the removal of trash from canals is also an effective fish screen and meets an objection most often heard against their installation by divertors and users of water. Self-cleaning, parallel bar screens have been in use for many years in different forms. The screen is described as follows by Troxel & Waters, distributors:

The rack for catching the trash consists of steel bars, bent on a curve at the upper end, and are held in place to a cross bar at the upper and lower ends. The teeth for removing the trash are attached to a shaft which in turn is attached to sprocket chains actuated by a shaft attached to a spur shaft driven by the water wheel. Spacing of the bars may be arranged as required.

The teeth make one complete turn or round every two minutes on the machine shown in the picture, thus clearing all trash every two minutes. This speed can be varied if desired and as the motion of

the whole machine is very slow the working parts have very little wear.

The trash is deposited onto the carrier by the teeth which are then withdrawn by an upset arrangement at each end. The teeth disappear under the bar to reappear at the bottom at the next round. The teeth have successfully removed a piece of two by four twelve feet long and have also removed a section of railroad tie twelve by twelve. Birds, small animals and larger objects are removed without difficulty. The carrier deposits all debris at one side of the canal.

Naturally the length of bars and width of rack of the water wheel will vary with different canals but the gears, teeth, upset devices, in fact everything but the length of the bars and width of water wheel, will be of one design. The speed will be regulated by the size of sprocket wheels on the shaft of the water wheel and the spur shaft.

GUADALUPE FUR SEALS

In recent years it has become apparent that the fur seals of Guadalupe Islands are increasing in numbers. Correspondence between the Department of State and the Mexican government was undertaken last year with the view of considering what steps would be advisable for protecting this herd. In December, 1928, the American embassy at Mexico City advised the Department of State that the Mexican Ministry of Agriculture and Fomento had reported that, by a resolution adopted on July 6, 1928, the Island of Guadalupe and the territorial waters surrounding it were declared restricted with a view to the protection of the breeding grounds of fur seals situated off the coasts of Lower California.

The above-mentioned ministry has issued instructions to the Department of Fisheries in Lower California advising it to inform those shipping companies that send their vessels to fish in Mexican waters to order their captains and owners not to molest, nor to allow their crews and fishermen to capture, elephant seals and fur seals, nor to accept these animals for transportation when requested to do so by private individuals.

It is hoped that the effort the Mexican government is making to rehabilitate both the Guadalupe fur seals and the elephant seals will be successful, and that these herds will regain at least a good part of their former size.—Fisheries Service Bulletin No. 165, Department of Commerce.

THE COMMON CAT—BIRD KILLER AND DESTROYER OF WILD LIFE

The life history of the common cat is written in blood.

A conservative estimate of the number of cats in the United States is approximately 25,000,000.

Careful observers who have watched and protected birds for a number of years report individual cats killing from 2 to 12 birds a day.

Ornithologists estimate that from 50,000,000 to 75,000,000 birds in the United States are killed annually by cats.

The stray or half-wild cat kills more small game birds and game animals than any other destructive agency.

Experienced gamekeepers regard the cat as one of the most vicious of vermin and destroy it whenever possible.

Thousands of domestic cats revert to the wild state and prey upon game birds and animals.

A sportsman may kill only five upland birds per day in Montana, but the cat respects no bag limit.

Each year we restrict the killing of game birds and game animals, but the cat knows no closed season.—Izaak Walton League of America.

THE GAME-BIRD SUPPLY

With increasing population and its correlated activities, the felling of forests, the draining of marshes, and the numberless developments that accompany the more intensive occupation of the land, it is inevitable that there should be some reduction of our wild life. This is especially evident in the case of our game birds and notably during the past 25 years. The Department of Agriculture has endeavored to check this decrease as far as possible by education regarding the value of our wild life and by the encouragement of salutary legislation. No game birds are more important than the waterfowl. State, federal and international protection have helped stem the tide of destruction, but the real extent of our wild fowl resources is in doubt. It is now planned, however, by a nation-wide series of simultaneous observations to be made by trained volunteer cooperators, to gain a clearer view of conditions and enable the department to meet intelligently problems of game protection.—U. S. D. A. Bull. No. 1023.

RESEARCH BOON TO HAWK AND OWL

In the spring of 1927 the game commission of Yakima County, Washington, established a bounty on various creatures

supposed to be destructive to useful birds, especially upland game birds. The stomachs of 121 hawks and owls killed in the county and preserved for bounty were forwarded to the Bureau of Biological Survey for study. Examination by the bureau disclosed that all the birds had been preying chiefly upon ground squirrels, rabbits and mice—species so destructive in western states that the federal and state governments have been cooperating for years in campaigns to control them. As a result of the discovery that hawks and owls are really a protection rather than a menace to useful species, bounties are no longer paid on them in Yakima County.—The Official Record, Jan. 3, 1929.

NEW METHOD DEVELOPED FOR PLANTING BOBWHITE QUAIL

In the search for better methods in planting birds reared on the game farm, both European and American game breeders have hit upon a useful method applicable to partridges and bobwhite quail. The method is based upon the habit of the male birds of adopting a brood of young ones. In England, wild partridges are caught, caged near a brood of farm hatched birds, and after they show signs of adoption, the adult bird is liberated with the young.

In connection with the Cooperative Quail Investigations instituted by the U. S. Bureau of Biological Survey, this "adoption system" was used by five privately financed ventures in the vicinity of field headquarters. Eggs of bobwhite quail were obtained and incubated by the usual methods, but as soon as the chicks were hatched, they were taken from the bantams and given in batches of 12 to 15 to cock bobwhites that had previously been captured afield. The chicks were apparently adopted and cared for perfectly, and when a week old were released with their foster fathers. The system is proving to be an easy, workable one under conditions prevailing on southern quail preserves.

FEDERAL LEGISLATION ASKED ON INTERSTATE FUR SHIPMENTS

When furs have been removed from the jurisdiction of one state and commingled with articles of interstate commerce in another, usually they are not subject to state seizure. A bill has been introduced in the present congress to confer authority upon employees of the department engaged in enforcing the provisions of the Lacey act to seize illegal

interstate shipments of the dead bodies of wild animals or parts thereof.—Annual Report Bureau of Biology Survey, 1928, p. 31.

IMPORTED GAME BIRDS

Last year the importation of birds into the United States included 84,915 Mexican quail, 12,620 Hungarian partridges, several shipments of pheasants, a few waterfowl, and other miscellaneous game birds. For the first time in several years a number of pheasants were brought in from England, chiefly to introduce new blood. Many of the Hungarian partridges were imported by the State of New York and others were shipped to states in the west, where considerable interest in their introduction has developed.—Annual Report Bureau of Biology Survey, 1928, p. 32.

STRIPED BASS INTRODUCED IN JAPAN

When the Japanese steamer *Korea Maru* left San Francisco on October 10, 1928, she carried on her poop deck a wooden tank with circulating sea water which contained 721 striped bass. The fish were furnished by the Division of Fish and Game in exchange for shipments of Japanese fish. After a sixteen-day journey with worries to the man, Mr. G. Setow, in charge of the shipment, in the form of storm and oily water, the fish arrived at Yokohama with but a small loss of 114. Japan's experiment in introducing this fine American food and game fish will be watched with interest.

MONTANA DUCKS WINTER ON PACIFIC COAST

As reported in the annual report of the Bureau of Biological Survey, June 30, 1928, outstanding during the fiscal year was the banding of 5,000 mallard ducks at the National Bison Range, Moiese, Montana, returns from which show that birds from that section winter chiefly on the Pacific Coast, from Washington south to southern California. This is one of the many instances where significant information has been obtained regarding the movements of waterfowl. The percentage of returns to the total number of waterfowl banded should afford a basis for calculating the approximate numbers of these birds when reliable information is obtained. A manuscript on this phase of the work has been prepared for publication under the title "A Method of Determining the Annual Fluctuation in the Abundance of Waterfowl."

WISCONSIN WARDENS GIVEN RIGID TEST

The state of Wisconsin gives an examination to applicants for game warden positions. This examination consists of four parts: First, the application, in which the applicant states his general qualifications; many applicants are eliminated on the showing made in this portion of the examination. Second, a written examination which is conducted in the several county seats of the state and which consists of two hundred and fifty questions relating to conservation law, enforcement provisions of the law and similar information. Third, testing the applicant's knowledge of natural history by requiring him to classify thirty marked game and song birds, and approximately twenty pelts of animals, all native of Wisconsin. Mounted specimens and pelts are used for this purpose. Besides this the applicant must name and classify thirty-five varieties of fish from colored plates and sixty-five native birds and animals illustrated in the same way. Each applicant is also subject to an oral inquisition to determine his personal fitness and general qualifications. Physical fitness is also taken into consideration.

It can readily be seen from the character of the examination that men who qualify under such a rigid test should be able to give excellent service. As a result of this last examination in Wisconsin, twenty temporary wardens were added to the force and several permanent officers, the permanent force being increased gradually.—*American Field*, Jan. 12, 1929.

OUTDOOR MANNERS

1. Your outdoor manners tell the world what you are at home.
2. What belongs to the public isn't your own—play fair.
3. Respect the property of rural residents—ask before using it.
4. Save fences, close gates and bars, go around planted fields.
5. People, live stock, trees and birds were never meant to be target practice backstops.
6. Respect the law—catch enough legal fish to eat, then quit.
7. Protect public health—keep springs and streams clean.
8. Clean up your camp and don't litter the highways with trash.
9. Finish what you start—carelessness with fires is cussedness.
10. Leave flowers and shrubs for others to enjoy. Do your share to keep outdoor

America beautiful.—Compiled by Seth E. Gordon, Conservation Director, Izaak Walton League of America.

SCIENTISTS HELP SOLVE CON- SERVATION PROBLEMS

A large number of scientific papers having a direct bearing on conservation topics were read at the meetings of the American Association for the Advancement of Science, held in New York City. On the program were five papers dealing with the subject of fish parasites afflicting bass, bullhead, channel cat and other species. Four papers treated of the life histories of parasites, with a view to their control. One paper discussed the distribution of minnows in the Great Lakes drainage area. Other papers, numbering fourteen, gave consideration to studies of fish pests, the development of fish eggs, studies of structure, respiration, and the like. One timely paper dealt with nutritional requirements of brook trout and their rate of growth. A new vitamin, needed by young trout for normal growth, was discovered in raw liver by a group of biologists at Cornell University, and received the provisional name "Factor II." Of miscellaneous topics there were three dealing with the subject of pollution and one with the structure and growth of the horns of the deer. At no previous meeting has there been so great emphasis placed on studies directly related to the subject of fishes, though for the past few years an increasing interest has been noted in the number and character of papers presented dealing with conservation topics.—*The American Field*, January 26, 1929, p. 87.

THE POSSIBILITY OF TULAREMIA IN THE RUFFED GROUSE

An article on "Tularemia in Birds" occurs in the *Journal of the American Medical Association* for May 26, 1928. It seems to be a condensation of an article by R. G. Green and E. M. Wade of the Minnesota State Board of Health in "Proceedings of the Society for Experimental Biology and Medicine," April, 1928, which I have not seen. In speaking of the occurrence of tularemia in rabbits, they say that the decrease in the number of wild rabbits and of the ruffed grouse has occurred simultaneously in Minnesota during the past four years and that cases of tularemia in humans have appeared at the same time. Because of these facts and the discovery of tularemia in the blood of many rabbits, they think that the decrease in the ruffed grouse may be due

to the same cause. They have demonstrated that the rabbit tick is an important carrier of tularemia and that the parasite is found also in game birds. They have shown that the ruffed grouse can be experimentally infected with the bacterium *tularensis* as regularly as the rabbit, and think that the parasite may carry the disease from rabbits to the birds. Although no cases of human tularemia have been reported as the result of cleaning grouse, they think it probable that the grouse may be a source of infection and feel that the indications justify a careful search for tularemia in grouse dying from disease.—J. J. Murray, Lexington, Virginia. *The Auk*, Vol. XLVI, 1929, p. 110.

SPORTSMAN AND FARMER

The sportsmen of the country are a source of benefit and profit to the farmers. Probably no class of transients are freer spenders than the hunters and fishermen who come from the outside to our waters to enjoy their favorite sport. They must eat; they must sleep; they must buy gas, tackle and equipment; they rent boats; they sometimes hire guides. They make many demands which the resourceful farmer can capitalize. And it is a matter of common knowledge that every sportsman's organization favors the propagation of game and fish and their protection during certain seasons of the year. This helps the landowner who lives along the banks of the streams to be able to go out and fill his basket and satisfy his fish hunger whenever his fancy dictates. No question but the farmer owes something to the sportsmen.

It will be interesting to note with what success the committee meets in issuing the "Fishing Permitted" signs. The sportsmen are serious in the movement. Will the land owners take them at their word? We think they will.—*Pennsylvania Sportsman*, Vol. 20, No. 4, p. 9.

STRIPED BASS ON TRIAL

Opposition has developed to the extension of the striped bass into waters of Oregon, on account of the claim that this aggressive species is destructive to salmon and trout on account of its voracious feeding habits.

The striped bass is not a native of western waters, having been transplanted into the California coastal waters from the Atlantic a number of years ago and having furnished an example of very extraordinary success in introducing a new species.

The Oregon State Fish and Game Department is conducting an investigation to determine the facts with reference to this charge against the striped bass. The stomachs of a number of specimens taken in Coos Bay have been examined but no salmon were found. Other fish were found in their stomachs, including flounder. Agents of the commission who have been familiar with the fisheries of Coos Bay and have examined the contents of the stomachs of many striped bass testify they have not found them containing salmon; most of the fish found were of noncommercial species.

On account of the intensity of the controversy, the matter will undoubtedly be thoroughly sifted so that the status of the striped bass with relation to the salmon may be definitely known.

The striped bass is a splendid sporting fish and is taken extensively by anglers.—*Game and Fish Conservationist*, Richmond, Va., Sept.-Oct., 1928.

FISH DUCKS AND FISH

Sportsmen visiting streams in the northern part of the state have often seen mergansers, commonly called "fish ducks," catching fish. They usually accuse these ducks of destroying trout at random, and therefore classify the duck as an undesirable predatory species. Some actual evidence of the food of these birds is now at hand. George Tonkin, federal game warden, and J. E. Plaisted secured five American mergansers on Smith River, Del Norte County, a clear stream with a rocky bed, rapids and quiet pools. The stomachs of these birds were sent to the Biological Survey and examined by E. R. Kalmbach with the following results:

No. 179838, 179839, 179840, 179841, 179842.
Name: *Mergus americanus*, $\frac{3}{4}$ grown.

Locality: Smith River, Del Norte Co., California.

Where killed: Clear stream, rocky bed, rapids and quiet pools.

Date: July 11, 1928.
Hour: 4:30 p.m. to 6:30 p.m.

Collector: George Tonkin and J. E. Plaisted.

No. 179838.

Condition of stomach: Full.
Percentage of animal matter, 100; of vegetable, --; of gravel, etc., 35.

Contents: 1 nearly complete *Cottus* and remains of several others and spines of more than one stickleback (*Gasterosteus*), 85 per cent; crawfish remains and gastroliths, 15 per cent.

No. 179839.

Condition of stomach: Full.
Percentage of animal matter, 100; of vegetable, --; of gravel, etc., --.

Contents: 8 *Cottus* probably *C. asper*, 100 per cent.

No. 179840.

Condition of stomach: 2/3 full.
 Percentage of animal matter, 90; of vegetable, 10; of gravel, etc., 30.
 Contents: Fish remains including bones of sculpins (*Cottus*) and stickleback (*Gasterosteus*), 90 per cent; vegetable debris, 10 per cent. A mass of feathers also present, doubtless came from the bird's own body.

No. 179841.

Condition of stomach: Full.
 Percentage of animal matter, 100; of vegetable, --; of gravel, etc., 20.
 Contents: Fragments of gastroliths and other parts of crawfish, 5 per cent; remains of at least 4 *Cottidea*, 95 per cent.

No. 179842.

Condition of stomach: 2/3 full.
 Percentage of animal matter, 100; of vegetable, --; of gravel, etc., 15.
 Contents: A water strider (*Gerris* sp.), 1 per cent; at least 8 *Cottus* sp., 99 per cent; 2 *Gastroliths* of crawfish, trace.

REPORT ON BANDED WILD FOWL

Announcement is made by the United States Biological Survey that at the opening of the 1928 hunting season, between 15 and 20 stations were in operation for the banding of migratory birds. These stations extend from Maine and South Carolina on the Atlantic coast, to Washington, Oregon, and California in the west, with others in the Canadian provinces and in Alaska. More than 30,000 ducks and geese have been banded, and valuable information already has been received from the reports sent in by hunters. Sportsmen accordingly are urged to examine the ducks and other wild fowl they kill and report every band obtained.

The following records from the banding files of the Biological Survey will illustrate the character of the information that is being accumulated: A mallard banded at Leduc, Alberta, on October 23, 1926, was killed at Robertson Lake, Texas, on November 27, 1926. Two mallards banded at Browning, Ill., in November, 1922, were killed, one near Sacramento, California, in December, 1923, and the other in Glascock County, Georgia, in November, 1924. Another mallard banded in January, 1923, at Cuivre Island, Mo., was killed in June of the same year at Willow Lake, Mackenzie. A baldpate, or widgeon, banded in August, at Davidson, Saskatchewan, was killed near Houston, Texas, in December of the same year. A green-winged teal banded at Avery Island, La., in December, 1922, was killed in September, 1923, at Lethbridge, Alberta, and three others banded at the same time and place were recovered in the fall of 1923 and in

1924 from points in the Sacramento Valley, California. Another of these little ducks, banded on the Bear River marshes, Great Salt Lake, Utah, in July, 1926, was killed in November of the same year in the State of Sinaloa, Mexico.

The problems studied by this method of research chiefly relate to the mysterious migration of birds. New and pertinent facts are continually being brought to light through an intensive application of the banding method, and it is to aid these investigations that sportsmen are asked to cooperate by reporting all banded wild ducks and other species killed during the season.

HUNTING ACCIDENTS 1928

No computation of hunting accidents has been made since 1925. The computations were originally made to call to the attention of every hunter the need for care in handling a gun. It was thought that the long list of accidents might stir some to more carefully avoid such accidents.

There follows a tabulation of hunting accidents for 1928. Although the list is considerably longer than the one for 1925, yet we cannot definitely say that the number of accidents was really greater for the reason that during the past year, clippings relative to hunting accidents were ordered from one of the clipping bureaus. As a consequence, a fuller record has been available. The increased toll indicated probably shows the adequacy of the reports secured in former years. It has been impossible to verify the accuracy of the reports which have been taken entirely from newspaper clippings. Undoubtedly, as in past instances, there will be some reports of persons who have recovered, or whose injury was not as serious as indicated in the compilation.

Analysis shows a list of 43 persons killed; 26 of these deaths resulted from accidents where the hunter himself was responsible. The others were accidents where a companion was involved. Sixty-five different persons were more or less seriously injured; of these thirty involved a companion. Apparently but one person in the tabulation was killed as the direct result of being mistaken for a deer. As compared with former reports, this shows a worthwhile reduction in accidents of this kind. Apparently, the greatest danger is to be found in hunting from boats and from blinds, for the greater percentage of accidents for 1928 occurred in this way.

HUNTING ACCIDENTS, 1928—Killed

Name	Shot by	Date, 1928	Locality	Circumstances
H. L. Allison (18)	Companion	August 28	Chula Vista	Friend stumbled against gun which discharged, killing Allison.
Calvin Alvis	Self	December 21	Porterville	Fatally injured when gun exploded on being re-moved from machine.
Walter Barnes (30)	Companion	September 18	El Dorado County	Barnes and companion shot at same deer; he was in the path of cross fire, receiving full charge.
Robt. Davis (22)	Self	September 18	Nevada County	Victim leaving auto pulled gun toward him muzzle first, shooting himself through chest.
C. Dixon (23)	Self	February 20	Kern County	When unloading rifle, gun accidentally discharged, shot penetrating the brain.
Thos. Fleming (14)	Companion	December 15	Richmond	Was shot through neck when gun, friend was handing to him, accidentally discharged.
Fred Frazier	Drowned	October 22	Delta Section, Contra Costa County	Boat overturned while duck hunting.
Dr. E. D. Grandmason	Another hunter	September 20	Los Angeles County	Was mistaken for deer and fatally shot.
H. Grawbarger	A. E. Moon	September 13	Placer County	Gun thought to be unloaded accidentally discharged.
Elton Guest (20)	Companion	October 8	Riverside County	Companion stumbled and gun was discharged, vic-tim receiving entire charge.
Albert Gunn	Drowned	December 8	San Francisco Bay	Boat overturned while duck hunting.
Buster Hale (14)	Companion	February 12	San Diego County	Boys knelt down to shoot at ducks; victim rose quickly and was shot in head.
Ben Hauze (16)	Companion	July 31	San Diego County	Companion was walking behind victim when gun accidentally discharged, killing him.
J. D. Heuston (23)	Self	November 27	San Benito County	Gun accidentally discharged when it fell from rock.
Catherine Higgins (14)	Companion	June 26	Ramona	Victim was in back seat of car when gun held by hunter in front seat was accidentally discharged.
John Hitchcock	Companion	August 6	Colusa County	Knelt down to let companion shoot over head, received full charge.
Wood F. Hunter	Self	September 4	Visalia	Shot by accidental discharge of own gun.
Chas. Johnson (15)	Self	November 5	California City	Killed in body when gun exploded while getting into boat.
Orville Jones (28)	Self	January 15	Glenn County	Was climbing slippery bank when gun accidentally discharged.
H. Jorgensen (42)	Self	August 30	Lake County	While deer hunting, stumbled and fell, gun shoot-ing him in neck.
James Kruza (14)	Self	October 29	Eureka	Accidentally killed while duck hunting.
Mrs. R. Lindblom (25)	Husband	September 28	Mariposa	Ran in front of husband's gun when he was shoot-ing at deer.
Umbert Lippi (20)	Self	September 4	Amador County	Shot in neck when gun accidentally exploded.
Claude McClure	Emil Roar	May 5	Fresno County	Accidentally killed while rabbit hunting.
Phillip McHale (7)	Brother	August 10	Long Beach	Brother shot victim accidentally while hunting.
D. Mendenhall (14)	Self	December 1	San Diego County	While stepping from boat into duck blind, gun ac-ci-dentally exploded.

HUNTING ACCIDENTS, 1928—Killed—Continued

Name	Shot by	Date, 1928	Locality	Circumstances
Geo. Mitchell (15)	Self	November 16	Salton Sea	Was in boat when gun accidentally discharged, killing him.
V. S. Neils (62)	Self	October 9	Los Banos	While removing gun from car was fatally wounded in chest.
John Nice	Self	August 20	Los Angeles County	Gun accidentally discharged wounding him in chest.
Lloyd Noya (24)	Self	November 22	Fresno County	Stepped into hole while hunting; gun discharged.
R. H. Page (14)	Self	December 5	Willits	Gun accidentally discharged, bullet penetrating the heart.
Ralph M. Pray	Self	November 19	San Diego County	While climbing out of duck blind accidentally shot himself.
Jos. J. Psenner (26)	Self	October 22	Los Angeles County	Was shot through the head while cleaning gun.
Hugh Rigby (16)	Self	September 17	Weaverville	Victim was shot in chest by own gun when he tripped and fell.
A. B. Schuck	Self	October 19	Los Angeles County	Fatally shot by gun he was cleaning.
Aaron Shepard (28)	Self	December 1	Monticello	While taking gun from auto it discharged, shooting him through the neck.
C. B. Smith (14)	Companion	October 9	Shasta County	All fired at same deer; was killed by stray shot.
L. E. Stockton (10)	Companion	August 11	Ramona	Companion's rifle accidentally discharged while being cleaned, bullet piercing victim's chest.
Geo. Sunderland (47)	Drowned	December 3	Lassen County	Broke through ice while duck hunting.
V. Vandeventer (20)	Self	October 23	Contra Costa County	Gun accidentally discharged while duck hunting.
Frank Ward	Companion	August 3	Bakersfield	Was killed when companion fell and gun exploded.
Thos. C. Wishart	Self	January 9	Sonoma County	Gun resting in seat behind him exploded, shooting him in back.
A. M. Woerner	Carl Woerner	October 17	San Diego Bay	In shooting from rowboat, companion behind him shot too low, bullet entering victim's head.

HUNTING ACCIDENTS, 1928—Wounded

Name	Shot by	Date, 1928	Locality	Circumstances
James Alberti (25)	Self	October 18	Stanislaus County	Gun beside him in auto discharged, shot entering shoulder.
Carl Anderson (16)	Companion	December 17	Fresno County	Shot in hip when friend's gun accidentally exploded.
Edgar Archer	Another hunter	September 24	Shasta County	Shot in back by unseen hunter.
Kenneth Barton (15)	Companion	December 17	Santa Rosa	Accidentally shot in leg while hunting.
Win. Brick (19)	Self	November 13	Stockton	Shot through hand when holding it over muzzle of gun.
A. Burge	Self	November 8	Los Angeles County	Gun in bottom of boat accidentally discharged, shot entering foot.
Harold Campbell (21)	Self	September 15	Cherokee	Shot foot nearly off while cleaning gun.
Jewelyn Case	Another hunter	January 12	Santa Clara County	Shot by stray bullet while out hunting.
Chas. Collins (18)	Self	December 3	Nevada County	While beating through brush, gun discharged, shattering ankle.
John De Ross	Self	February 13	Merced County	Gun exploded, driving piece of steel into victim's neck.
Ernest Dulac	Companion	December 4	Sonoma County	Firing from opposite side of brush, companion's shot struck him in head.
Art Downhour (15)	Self	December 19	Monterey County	Dog knocked gun over, shot piercing chest.
Herbert Ellis	Self	October 9	Fresno County	Shot self through leg accidentally while hunting.
Frank Flux	Self	October 5	Lassen County	Gun struck rock, accidentally discharging, shooting victim in leg.
Kenneth Franklin	Self	June 9	Foot of Mt. Diablo	Shot in both legs accidentally while hunting.
L. L. Galbreath (48)	Self	December 12	Napa County	Dropped gun, shooting self in head.
Willie Giorzo (15)	Self	February 3	Stanislaus County	Fell while jumping over ditch, gun discharged, shot entering right side.
Eldon Hamilton	Companion	December 14	Klamath River	Friend aimed at quail but scattered shot struck victim in face.
L. H. Hanson (19)	Self	November 26	South San Francisco	Rested hand on muzzle of gun, shattering hand.
Leslie Heth	Ted Halton	December 13	Napa County	Received birdshot in body while in direct line of fire of companion shooting at ducks.
James Hemmingsen	Another hunter	December 20	Fresno County	A charge of birdshot hit telephone pole behind victim, bounced off, striking victim on lip.
Orrin Hurlburt (15)	Self	December 29	Turlock	Gun in back seat fell forward, shooting boy in arm.
Shirley Irvine	Self	June 28	Madera County	Shot through foot while handling shotgun.
Dr. Chas. Keith	Another hunter	October 6	Maxwell	Struck in face by stray shot while deer hunting.
Eddie Kent (16)	Companion	June 6	Redwood Canyon	Accidentally shot in foot while rabbit hunting.
Ardne Kirby (17)	Self	December 8	Riverside County	Was trailing gun over rocky slope when it accidentally discharged, shooting him in hand.
Henry T. Klaukens	Friend	December 16	Shasta County	Hunters were on opposite sides of thicket shooting at quail, shot struck him in eye.

HUNTING ACCIDENTS, 1928—Wounded—Continued

Name	Shot by	Locality	Circumstances
Chas. L. side	Brother	Alameda County	Shooting from opposite sides of duck blind, shot struck him in eye.
E. L. McCall	Self	Oroville	When examining revolver, gun slipped and fell, shooting him in shoulder.
James McLain	Companion	Orange County	While duck hunting, was accidentally shot by friend.
Peter Meghenasso	Self	Tulare County	Shotgun accidentally discharged, pellets striking him in face and hand.
Chas. Miller (19)	Self	Butte County	Fired gun while seated in boat, breech exploded, tipped boat over and cut victim's thumb off.
H. W. Nash	Self	Riverside County	Tripped and fell, gun exploded, shooting him in arm and ankle.
Dr. G. K. Nider	Self	Fresno County	While on horseback shot at coyote, horse reared and shot struck victim in leg.
Dr. L. H. Nielsen	Self	Monterey County	Gun barrel burst when fired, injuring his left hand.
Wm. Nunes	Companion	Stockton	Accidentally shot in eye by stray shot from friend's gun.
Pete Ondazzo	Companion	Atherton	Dropped gun, shooting himself in ankle.
Walter Orm	Self	Ventura County	Gun in seat of car exploded when car struck bump, shooting him in leg.
John E. Overstreet	Friend	Shasta County	Was shot in head as he rose from a clump of brush he had used as a "blind."
Emil Ott	Clark Yhaite	El Dorado County	Both fired at same deer from opposite points, bullet struck victim in the abdomen.
Mrs. G. Parkinson	Another hunter	Fresno County	Was in path of scattered shot which struck her in arm and face.
Thos. Partin (11)	Self	Merced County	Picked up gun by barrel, trigger caught, shooting him in abdomen.
Gregory Peck	Son	Los Angeles County	Was seated behind father in boat, shot low, striking victim in right shoulder.
Elwood Peters (19)	Brother	Oakland	Gun accidentally discharged, shooting victim in legs.
Ernest Phipps	Self	San Luis Obispo County	Reached for gun, trigger caught in pile of sacks, shooting him in hands.
Guy Polson (19)	Self	Los Angeles County	Motion of car jarred gun from seat, discharging shot which struck victim in head.
R. Posaneli	Another hunter	Monterey County	Was hunting on duck preserve when shot from another hunter struck him in eye.
Dale Pyle	Self	San Diego County	Shot in thigh by gun which he knocked from fence.
Cyrus Samuel	Self	Stanislaus County	Put finger in end of gun to remove dirt and finger was blown off.
P. Schleifer (15)	Companion	Alameda County	Shot in arm by friend when trigger of gun caught in sweater.

HUNTING ACCIDENTS, 1928—Wounded—Continued

Name	Shot by	Date, 1928	Locality	Circumstances
J. Scott (18)	Self	October 22	Alameda County	Gun in bottom of boat accidentally discharged, shooting off toe.
M. Shedden (15)	Self	November 6	Monterey County	Reached for gun in bottom of boat, gun discharged, shooting him in wrist.
Lawrence Shrum	Self	January 9	Stanislaus County	Injured by broken glass when gun fell from seat of car, bullet shattering windshield.
Everett Silva	Brother	April 12	San Luis Obispo County	In climbing over fence gun in brother's hand exploded, causing deep gash in victim's leg.
Rolla Smith	Self	January 13	Solano County	Was driving a tractor; had gun on trailer behind, barrel pointed towards him; going over bump gun discharged, bullet entering knee.
Clyde Stanley (14)	Companion	July 8	Napa County	Shot in thigh when he accidentally stepped in front of friend's gun.
A. D. Storek	Another hunter	September 20	Lake County	While hunting deer was accidentally shot in shoulder by stranger.
L. H. Taylor	Self	September 4	Siskiyou County	Accidentally shot off finger while deer hunting.
Roy Thomas (11)	Friend	December 24	Bay Farm Island	Shot accidentally in arm by companion.
W. Thornton	Companion	May 18	San Diego County	Friend's rifle accidentally discharged, bullet glanced from rock and struck victim.
Ray Tofanelli	Another hunter	October 8	Monterey County	Received a stray shot in eye while sitting in canoe duck hunting.
Geo. Wadsworth	Companion	January 17	Butte County	Was shot in hip and back when gun, friend was loading, accidentally discharged.
Mrs. J. W. Walker	Self	November 25	Shasta County	In placing rifle on ground gun accidentally discharged, shot entering thigh.
Dr. Fred Williams	Friend	December 6	Fresno County	Companion stumbled and fell, gun discharged, striking victim in groin.
Hugh Wrigley	Self	September 21	Trinity County	Accidentally shot himself in abdomen while hunting deer.

SUMMARY HUNTING ACCIDENT DATA, 1928

Number of persons killed -----	43	Weapons causing accidents:	
Number of persons wounded but not killed -----	65	Rifles -----	27
Number self-inflicted accidents:		Shotguns -----	68
Fatal -----	26	Revolvers -----	1
Nonfatal -----	35	Unclassified -----	12
Number accidents inflicted by others:		Where occurred:	
Fatal -----	17	In fields or on waters -----	63
Nonfatal -----	30	In forests -----	10
Occurred while hunting large game (deer, bear, etc.):		In conveyances -----	12
Fatal -----	9	Unknown -----	23
Nonfatal -----	5	Number injured or killed in mistake for game or other wild creatures, if known:	
Occurred while hunting small game:		Killed -----	1
Fatal -----	20	Wounded -----	0
Nonfatal -----	27		
Occurred while hunting unknown game:			
Fatal -----	14		
Nonfatal -----	33		

EXPLOITATION BAD POLICY

It can not be too often or too strongly emphasized that the current practice of advertising and exploiting the fishing opportunities on lakes and streams of the several states by tourists and recreation resort interests is a bad mistake. There is a strong sentiment against this among many resort owners themselves and many of them are now issuing beautiful and attractive advertising without making use of the disgusting fish hog pictures which formerly decorated all such publicity. Others not having seen the light still persist in this kind of advertising, which is bound eventually to have a very unfavorable reaction on their business.

The fish propagation departments of every state and of the United States are exerting their utmost efforts to meet the demand for restocking and all possible protection is given by law to fish in spawning time nearly everywhere but there is continued complaint that fishing is growing steadily poorer, notwithstanding the efforts that are made to maintain it. This being true, it would seem to be the height of folly to try to induce more people to take the choice varieties of game fish and thus hasten the depletion. Every state which maintains a tourist advertising bureau has an abundance of attractive features which can be exploited to attract visitors without telling them that the streams and lakes are overflowing with fish and that the fishing is exceptional. Such advertising is usually untrue and misleading as well as destructive. It ought to be discouraged by every sportsmen's club in America. This sort of exploitation is nothing more or less than commercializing a resource which demands greater protection and more encouragement by propagation if it is to be maintained.—*Game and Fish Conservationist*, Richmond, Va., Sept.-Oct. 1928.

LEARNING THE WAYS OF FISH

It is a sound theory, and more than that, which teaches that every fact learned supplants a guess. Thus, one feels certain, the California Fish and Game Commission is serving not only its own commonwealth, but the entire Pacific west, in its establishment of a fisheries research laboratory for the purpose of obtaining needed information as to fish supply. It will be determined, in so far as is possible, how heavily the numbers of each species may be drawn upon without danger thereto; while at the same time, as would follow, any changes occurring in the supply would be remarked, together with the point at which depletion manifests itself.

This is a large undertaking, and its objective will be reached only after years of observation, study and effort. Indeed, it will be a work that never is done, but whose every revelation must be beneficial. Little is known of the ocean habits of valuable anadromous fishes, such as the salmon. Much less is known of the food varieties that pass their entire period of existence in the sea. N. B. Scofield, to whose vision the project in large measure owes its beginnings, has taken thought of a need not heretofore unremarked but one that certainly has been subject to grave neglect.

To such movements there is always opposition. The scoffer laughs at the application of intelligence, of research, to problems which previously have been guessed at by minds attuned to muscular effort. Those directly identified with the industry probably will fear that they may not take and use all that they can capture, without thought of the future. But if the California commission discovers only a few facts each year concerning the habits and life histories of each of the many food fishes caught in the oceanic dooryard, the way to future conservation,

to preservation of species, will be more plainly blazed. Obviously these facts will be invaluable for the prevention of depletion of over-fished species, a depletion which might otherwise end in disappearance. The undertaking belongs to California, but the benefits will be felt by all the coastal fisheries.—Editorial from the *Morning Oregonian*, January 28, 1929.

VIRGINIA'S GAME WORTH MILLIONS

According to a report of the State Commission of Game and Inland Fisheries, game killed in Virginia during the 1927-1928 season is valued at over two and one-half million dollars. The survey of the commission reveals that the number of animals taken totals 1,638,163. Rabbits, squirrels, doves and quail are shown to be plentiful during the season; opossums, coots, turkey and deer were said to be "medium," and muskrats, minks, raccoons, otters, bears, woodcocks, ducks, geese, brants, gallinules, clapper rails, sora, snipe, pheasants were all classed as scarce.

Totals for the various kinds of game bagged are as follows: Rabbits, 409,491; squirrels, 530,408; muskrats, 68,000; minks, 12,266; opossums, 94,826; raccoons, 17,798; otter, 138; bears, 909; doves, 49,457; woodcocks, 4,190; ducks, 66,764; geese, 7,403; brants, 210; gallinule, 100; coots, 6,330; clapper rails, 1,315; sora, 20,000; snipe, 10,820; bob-white quail, 315,452; pheasants or grouse, 13,220; turkey, 8,219; deer, 687.

Similar computations for California are difficult as hunters are not required to report the game killed except in the instance of deer. The game census is coming to be looked upon as fundamental to wise administration of game resources.

NEW "WILDERNESS" AREAS ESTABLISHED

In order to insure the preservation, in their primitive condition, of typical mountain and forest areas of California, and to guard against their development and exploitation by modernized recreational features the United States Forest Service, announces the setting aside of fourteen separate tracts of national forest land, embracing a total of over one and one-half million acres, as "wilderness" areas for the use and enjoyment of all the people. These areas will be preserved in a "wild" state in the sense that they will not be developed by road building or opened to any form of permanent recreational occupancy under permit. The grazing of live stock will, however, be permitted, and in years to come, if eco-

nomie conditions warrant, some timber cutting or water power development may be allowed by the forest service.

The national forests of California contain a portion of the last frontier of the United States. Within their limits exist many areas still in much the same primitive state as when the first waves of settlement extended into the west. They embrace many of the mountain ranges and peaks that in the early days served not only as landmarks to the pioneers, but as spiritual symbols of a new world and a new life. For these reasons, the pioneers and their descendants have regarded these peaks and wild areas with a well nigh religious veneration.

We are now conquering and subduing these wild areas by highways and other mechanical means of transportation, and by the congregation of great numbers of people who bring with them all the social and mechanical devices of our present-day civilization. In so doing we destroy in large degree the attributes which make these areas unique of their kind and cause them to command the love and veneration of men.

It is because of these facts, and the growing desire of a large element of our population for pleasures and conditions that nature alone can provide, that the United States Forest Service has created special "wilderness" areas, with their well known inherent capacity to recreate physical and mental powers, to give pleasure and inspiration, to advance science and knowledge, and to preserve national characteristics and traditions.

The newly created wilderness areas in the national forests of California are located, for the most part, in the higher and more scenic regions of the Sierra Nevada, Coast Range, and mountains of southern California, where the timber resources and fire hazard are limited, and where there is no necessity for the building of roads for forest administrative purposes. They will present an excellent opportunity to all outdoor enthusiasts who wish to rough it in regions remote from automobile travel and conventional camp grounds and resorts, and who desire to enjoy primitive nature without touch of human influence.

The names and locations of the newly created wilderness areas are as follows:

Middle Eel-Yolla Bolla—200,000 acres around Yolla Bolla Mountain and at the head of Middle Eel River in the California and Trinity National Forests.

Agua Tibia—27,000 acres on the west end of Palomar Mountain in the Cleveland National Forest.

Desolation Valley—41,000 acres north of Echo Lake and west of Lake Tahoe in the Eldorado National Forest.

Salmon-Trinity Alps—130,000 acres at the headwaters of Trinity and Salmon Rivers in the Klamath, Shasta and Trinity National Forests.

South Warners—75,000 acres around Eagle Peak in the South Warner Mountains of the Modoc National Forest.

Hoover—23,000 acres west of Mono Lake in the Mono National Forest. Named after Prof. Hoover, formerly superintendent of the Bodie mines.

Dana-Minarettes—87,000 acres lying between Tioga Pass and the Devil Post Pile National Monument in the Mono and Sierra National Forests.

Murphy Hill—12,000 acres surrounding Campbell, Morris and Lotts Lakes west of Belden in the Plumas National Forest.

San Geronio—19,000 acres covering the San Bernardino and San Geronio range in the San Bernardino National Forest.

Telegraph Peak—7,500 acres around Telegraph Peak, in the San Bernardino National Forest.

San Jacinto—22,000 acres covering the high country east of Idyllwild and Keen Camp in the San Bernardino National Forest.

Ventana—52,000 acres of wild mountain land at the north end of the Monterey Division of the Santa Barbara National Forest.

Emigrant Basin—98,000 acres on the Stanislaus National Forest lying between Kennedy Meadows and the north boundary of Yosemite National Park.

High Sierra—700,000 acres along the High Sierra crest in the Inyo, Sequoia and Sierra National Forests, from Mount Whitney on the south to the Mammoth Lakes region on the north, a distance of some 75 miles, all of which is wild, rugged mountains, traversed in part by the John Muir trail.

INCREASE OF DEER RAISES GAME MANAGEMENT PROBLEM

The annual game census of the United States Forest Service indicates that the number of deer on the national forests is almost everywhere increasing. This is in spite of the fact that except on certain areas set aside as game refuges the only restrictions upon hunting are those imposed by state game laws.

The forest service holds that the logical remedy is the development of game management plans. The basic principle of these plans is to establish and maintain

a balance between the number of animals and their year long food supply.

A given land area under given conditions can grow only a certain quantity of game feed. The quantity available varies with the season. Thus when an excessive number of animals are seeking sustenance a short forage crop or an extra hard winter results in undernutrition, increased susceptibility to disease, and a struggle for life under which the weaker animals often succumb in large numbers.

At the present time the most acute situation on any national forest is on the Kaibab, in northern Arizona. The deer herd on this forest, containing more than 28,000 head, has outrun the food supply so far that fawns born the previous year have died, and many of the other animals as well. The forest service declares that acquiescence in this condition is both uneconomic and inhuman. A somewhat similar situation threatens the elk herds of the Yellowstone region.

Under a game management plan the aim would be to prevent overcrowding by finding out how many deer or elk the available land will carry permanently, and varying the amount of hunting permitted so that the herds of game will be kept at this number. Stable in place of fluctuating herds would mean a constant stock of breeding animals, would permit of utilizing the increase for food, and would prevent the decline in the productive capacity of the land which overgrazing—whether by domestic livestock or game herds—inevitably produces.

Rigid state game laws which make impossible the application of a flexible system may, however, create great difficulties for any rational management plan. This has been true in the case of the Kaibab deer. To the extent that wild life has a place in forest administration the forest service seeks to work in cooperation with the states for the development of the most favorable conditions.

An excessive number of deer not only means that they are subjected to undernutrition and are in danger of being killed off wholesale by starvation and disease but also, the forest officers say, results in serious injury to tree growth, since the hungry deer are forced to browse on anything they can reach, and thus destroy the forest reproduction. While deer normally subsist largely on browse, if the herds are kept within reasonable limits they can obtain an adequate food supply without curtailing the growth of the forest. As a first step toward introducing sound game management plans

the forest service is studying the conditions on the ground, locality by locality, in order to determine in each case what the limit should be.

SURPLUS ELK OFFERED BY GOVERNMENT

Surplus elk from the National Bison Range are being offered by the Biological Survey of the United States Department of Agriculture to anyone who will remove them without cost to the government. The National Bison Range is in western Montana near the towns of Moiese and Dixon. Because the elk there have increased beyond the carrying capacity of the range, it is necessary further to reduce their numbers, even though some of the surplus animals have already been disposed of by sale.

The National Bison Range is administered primarily for the maintenance of a fair-sized herd of buffalo, the original stock of which was supplied by the American Bison Society. It is the desire of the Biological Survey to make immediate reduction in the numbers of the elk so as to avoid feeding them hay during the late winter and early spring, which would otherwise be necessary, as well as to preserve as much forage as possible for the buffalo. The elk at this time are mainly valuable for exhibition purposes at zoos and for stocking game parks and farms. It is now too late in the season for the elk meat to be good.

Correspondence on the subject should be directed to Frank H. Rose, protector of the National Bison Range, Moiese, Mont. Telegrams should be addressed to him at Dixon, Mont.

EUROPEAN STARLING RAPIDLY SPREADING

The European starling, the alien bird that has spread from importations planted in Central Park, New York City, nearly 40 years ago, to most of the states east of the Mississippi, is rapidly spreading westward as a breeding species and is likely ultimately to be found throughout most of the area from southern Canada to the Gulf coast and westward to the Rocky Mountains, according to the United States Biological Survey, Farmers' Bulletin 1571-F, "The European Starling in the United States," just issued, sets forth the economic status of this bird according to results of the survey's studies, and Circular 40-C, "The Spread of the European Starling in North America (to 1928)," also just published, traces the history of the bird's extension of range, describes its methods of spread,

and predicts probable future extensions. The spread of the starling is also summarized in the Farmers' Bulletin.

An intensive study by the department of the starling's food habits was based chiefly on the examination of the contents of more than 2600 stomachs of starlings, a greater number than that used for similar studies of any other bird that have been published so far. This investigation led to the conclusion that most of the starling's habits are either beneficial to man or of an economically neutral character. Field observation has established the fact that the time spent by starlings in destroying crops, such as cherries, apples, and sweet corn, or in molesting other species of birds, is extremely short compared with the hours they spend searching for insects or feeding on wild fruits. It is pointed out that as a destroyer of the clover leaf weevil, the Japanese beetle, May beetles, cutworms, and grasshoppers—some of the farmer's worst pests—it is even more energetic than many of our protected native birds.

In spite of the fact that starlings in normal numbers exert an influence for good and may well be left unmolested when not inflicting noticeable damage, there are times and circumstances, say the investigators, under which they may become objectionable. To the city dweller, they say, the most conspicuous habit of the bird is its establishment of obnoxious winter roosts, which in eastern cities are sometimes of enormous size. Typical of such gatherings is the one that for years has occupied the trees and buildings on Pennsylvania avenue and other downtown streets in Washington, D. C. In spite of measures taken to drive them away, the birds have persisted and return year after year to the historic thoroughfare of the national capital. Methods used for eradicating starling roosts are given in the new Farmers' Bulletin, although, it is stated, no method at present in use assures lasting success, for if vigilance is not employed temporary eradication may be followed by reestablishment of the roost.

There is no doubt, according to the department, that there are local areas in which the starling is detrimental to agriculture and horticulture at the present time, but the factor of overabundance rather than pronounced tendencies for harm on the part of the individual bird has brought this about. There is no question, in view of its highly insectivorous food habits, it is concluded, that the influence of the European starling, in moderate numbers, in the United States is beneficial.

Copies of Farmers' Bulletin 1571-F on the economic status of the starling may be had free, as long as the supply lasts, on request addressed to the Office of Information, Department of Agriculture, Washington, D. C.

PROTEST AGAINST KODIAK BEAR PROTECTION ANSWERED

In line with the definite policy of the Department of Agriculture on predatory-animal control, which, while designed to safeguard farming and stock raising, is opposed to the extermination of any of the interesting species of the wild life of the continent, Secretary of Agriculture Jardine, in response to a lengthy petition presented through Congressional Delegate Dan Sutherland early in February, has explained their rights in the matter to residents of the Kodiak-Afognak Islands group of southern Alaska. The petitioners cited the growing agricultural activities of these islands and the losses connected therewith, particularly of stock raisers, through the depredations of the big brown Kodiak bear. This giant of the wild they consider the most vicious and dangerous of the carnivorous animals of Alaska. They asked that all protection be removed from the Kodiak bears, so as to permit all persons to kill them in any manner at any time of the year.

The present regulations allow an open season on large brown and grizzly bears from September 1 to June 20, with the proviso that these bears may be taken at any time when about to attack or molest persons or property, or when encountered within half a mile of a human habitation. The secretary in replying to the petition called attention to this fact, and he stated further that the Alaska Game Commission, after a careful study of the whole situation, has recommended a modification of the regulation that would doubtless accomplish all that the stock raisers and others ask. The new regulation, which is receiving favorable consideration, would give protection to these big bears as game animals as formerly, but with the further proviso that on Kodiak, Afognak, Rasperry, Spruce, and Sitkalidak islands any resident engaged in agricultural pursuits may kill such animals when they are con-

sidered a menace to persons, live stock, or property.

The secretary calls attention to the wider latitude thus afforded in control, and expresses his confidence that when ranchers on the islands learn of the proposed action, they will find they have sufficient leeway in necessary control measures against stock-killing bears. He also mentions the fact that preserving this species in the nonagricultural mountain area of the interior will serve to perpetuate what is known to scientists, sportsmen, and visitors to Alaska to be the largest carnivorous land mammal in existence.

The statement was cited of Paul G. Redington, who spent some time in the region in 1928, and of sportsmen who have come in contact with the species, that these giant bears do not relish the presence of man, and when unmolested rarely attack human beings. Their food consists for the most part of berries, alder roots, grasses, and other vegetation, with some fish, and while individuals may develop stock-killing propensities, they are not as a species inimical to agriculturists. The secretary states that the new regulation should be in effect by July 1, and expresses his conviction that the petitioners will thus obtain practically all they are asking for.

If the department should remove all protection from this notable species and thus open the way to its eventual extermination, there would be a heavy fire of justifiable criticism not only from the many organizations and individuals who have in the past derived both sport and pleasure from their contacts with the Kodiak bears, but from the people of Alaska as a whole, for the big-game animals of Alaska attract to the territory many people from the states and other countries and their expenditures for equipment, travel, personal service, and the like constitute what is by no means an inconsiderable contribution to the commerce of the territory.

The secretary assured the petitioners through Delegate Sutherland that the Alaska Game Commission and the office of experiment stations of the department will keep in very close touch with the situation to note the needs on the island in question.

DIVISION ACTIVITIES

Bureau of Patrol

A survey of the activities of the patrol bureau for the calendar year 1928 shows that \$92,020 were collected in fines for violations of the fish and game laws, 2525 arrests were made, and a total of 1825 days were served in jail by violators.

During the month of January, 1929, over 200 arrests were made on which fines in the amount of \$10,065 were imposed. Two violators were given jail sentences of 100 days each, four, sentences of fifty days each and four others, sentences ranging from 10 to 5 days.

A number of recent changes were made in the southern patrol force: Deputy L. W. Hare was transferred from Owensmouth, Los Angeles County, to Santa Ana, Orange County; Deputy R. J. Tepper, from Fawnskin, San Bernardino County, to Hemet, Riverside County; J. W. Thornburg, from Markleeville, Alpine County, to Brawley, Imperial County; Webb Talbott, from Santa Ana, Orange County, to San Fernando, Los Angeles County; and Cliff Donham, from Westmoreland, Imperial County, to Escondido, San Diego County.

K. K. Langford was appointed a deputy and will concentrate his activities in the mountain sheep district, San Bernardino County, which has been one of the most difficult areas in the south. It is hoped that the addition of this new man will improve conditions.

The new deputies added to the patrol department are proving to be efficient officers. They are obtaining the cooperation necessary from the people in their districts and this, in turn, is being reflected in their accomplishments.

Floyd Earp, of Oakland, was arrested near Maxwell by Captain S. J. Carpenter and a posse of seven deputies. Taken before Judge George B. Reckers, of Williams, Colusa County, he was fined \$500 and learned to his sorrow that deer meat in one's possession after the season closes is, indeed, costly.

Deputies J. C. Schneider and Fred Post located fifty pounds of spoiled deer meat

in a tank house on a ranch of Jerome Griffin, in Priest Valley, Monterey County. Arraigned before the court of Judge C. J. Giacomazzi, of Soledad, he paid \$5 a pound for the deer meat found in his possession.

Adolph Sousa, of Knights Valley, has a reputation for being a consistent violator. It is hoped that he came to the end of his trail in February when fined \$500 by Judge John Ellis, of Geyserville, for killing a doe, which, in this instance, was carrying two fawns. It is alleged that the defendant had crippled another deer which escaped.

Credit for this case is due to volunteer deputy B. B. Kettlewell, of Calistoga. Captain Henry Lencioni and Deputy J. H. Groves cooperated and lent their necessary support. Because Manuel Sousa, brother of the defendant, was an accessory in the case and in possession of the slain doe, he was fined \$250.

The efficiency and worth of the volunteer deputy system as an aid to the regular patrol was proved again when Jerry Oscar and W. I. McCullough, of Crannell, Humboldt County, were apprehended for having deer meat in their possession in closed season. Two volunteer deputies, Harold Ehreiser and Delbert Scott, arrested the defendants near Blue Lake. With the assistance of Captain William Lippincott, they brought the violators into the court at Eureka. The defendant Jerry Oscar was fined \$100; the other, however, refused to enter a plea of guilty and came to trial at a later date.

Feeding deer meat to the employees of the Horse Mountain Mine located near Eureka, in Humboldt County, has resulted in an increase, instead of a decrease, in the overhead of operating the mine. It was suspected that the employees of the mine were carrying deer meat in their dinner pails and on investigation, deputies R. J. Yates and W. J. Harp found fresh deer meat and fifty-one pounds of cooked deer meat in the mine cook house. R. E. Bonine, secretary of the company, assumed the responsibility for the offense and was fined \$150 by Judge Robert Allison, of Blue Lake. Both deputies are new in Humboldt County, but their prompt and efficient action in this case shows that they have their new district well in hand.

Ordinarily, hams do not cost a fabulous sum. It happens, however, that one taking the risk of shipping a ham of venison out of season, if caught, may pay a very high price. This discovery was made by Grant Donham living on a ranch in Callahan, Siskiyou County, when he shipped deer meat to a friend in Oakland. The meat fell into the hands of Deputy J. L. Bundoek who notified Captain Sam Gilloon, at Shasta City of the violation. The violator was apprehended by Captain Gilloon and Deputy Brice L. Hammack. Judge H. G. Reynolds, of Fort Jones, assessed a fine of \$100.

sufficient breeding stock is on hand to safeguard a supply for the future with protection accorded to does, fawns, spike bucks and a limit of two deer per hunter each season. However, if the laws affording protection to deer are not observed, it will be impossible for deer always to remain abundant. The need for severe fines for transgressions of these laws is more apparent when it is known that fourteen cases for possession of deer meat in closed season were made by deputies in December and twenty-two in January.



FIG. 47. Deputy C. H. Kunkel measuring Pismo clams to determine whether they are of legal size. Photograph by E. S. Cheney, November 26, 1928.

Soon after Deputy R. J. Tepper's transfer, he and Deputy Gyger secured the conviction of Charles Knight, Pine Knot, San Bernardino County, for killing a deer in a game refuge. Judge George R. Holbrook, of Ontario, fined the offender \$500 and imposed a jail sentence of 50 days. The jail sentence and \$250 of the fine were suspended, however, as this was the defendant's first offense.

Deputy J. H. Gyger, assisted by H. O. Langstaff arrested E. Forbes, of Corona, Riverside County, for killing a spiked buck and a doe; Judge H. C. Biggs, of Riverside, assessed a fine of \$500.

The legal kill of deer in California amounts to some 20,000 a year and a

Deputy Fred Post, assisted by volunteer deputy Wells Lorenson, Salinas, Monterey County, arrested a hunter for killing a doe at night with the aid of a spotlight. Judge Harry J. King fined the violator, W. O. Kada, \$500 and imposed an additional fine of \$100 for night shooting.

Frank Chambers was apprehended by deputies Roy Anderson and Lee Atkinson on the Pierce Ranch, in Colusa County, for killing twenty-one ducks under the shelter of darkness. Judge George B. Reckers of Williams, Colusa County, sentenced the defendant to serve 100 days in the Colusa jail.

Because of the unfair advantage which may be taken of game at night, night shooting has become an outlawed practice. Eternal vigilance is still necessary to curb it. This is proven by the fact that during December, twenty-seven cases were made for night shooting and eleven in January.

Shooting from power boats is another method which has been outlawed. Ten cases were made of this type in December and three in January.

The automobile is frequently employed by the violator and when this instrumentality is used with craft, apprehension is very often difficult. A practice commonly engaged in is where two individuals work together, one driving and the other doing the shooting. If a suspicious automobile or individual is sighted, the evidence is thrown out to be recovered later. Unless the deputy actually sees the shooting, it is almost impossible to make a binding arrest.

A fine of \$300 was extracted by Judge Donald Younger, of Santa Cruz, from Joe Batich, of Watsonville, for selling ducks on the open market. The case is accredited to Deputy J. P. Vissiere and volunteer deputies Hans C. Struve and Fred S. Wing.

Charles Bishop, a waiter in the Louis Grill, Mason street, San Francisco, was fined by Judge Joseph M. Golden, \$100 for selling ducks. Deputy Allan Curry and volunteer deputy C. Flugler made this case.

Records also show that twelve other cases were made during January for selling ducks.

Two cases are on record during December and one in January for over limits on geese; 13 in December of over limits on ducks.

Efforts to introduce the Chinese ring-necked pheasant in California will be barren of any satisfaction or success, if the nucleus of breeding stock planted in each area is persistently destroyed. Judge W. E. Everson, of Elk Grove, showed his sympathy for this thought when he fined William Brown \$100 or a jail sentence of 50 days and fined Joe Jacinto \$400 or a jail sentence of six months for killing three pheasants. The defendants were apprehended by deputies Nelson Poole and Charles Seibeck.

In southern California, deputies made seventeen arrests and convictions for ex-

cess limits of quail, during the first few days of the quail season. Before the end of the season, they made a total of twenty-two arrests and convictions for those who failed to stop when they had obtained the legal limit. Fines in the amount of \$700 were imposed by judges, ranging from \$25 to \$75.

Protected non-game birds are used by some cooks to make a sauce. Robins seem to be chiefly prized. However, Cæsar Bruschera operating the Louis Fashion Restaurant at 524 Market street, San Francisco, is now probably of the opinion that a sauce which he made from robins in February was too expensive to be served in the future. Deputies Allan G. Curry and E. V. Moody were instrumental in securing his conviction and Judge Joseph M. Golden imposed a fine of \$200.

Fifteen convictions were secured during December for killing and of possession of non-game birds; twenty-seven in January.

Records also show that four cases in December and two in January were made involving the killing of the protected band-tailed pigeon. Five offenders who killed whistling swans in January were also arrested and apprehended.

The spearing of salmon on spawning beds despoils breeding grounds and is altogether a very unwise use of the fish. Deputies are not unmindful of this and turned in three cases for salmon spearing in December.

In January, Captain Walter Sellmer and Deputy George Smalley brought an offender of the protection accorded to spawning salmon into the court of Judge Herman Rudolf of Novato. The fine was \$200.

Bureau of Fish Culture

Mount Shasta Hatchery started the season with the following trout and salmon eggs and fry on hand: Loch Leven, 3,522,000; brown trout, 2,192,000; eastern brook trout, 753,000; king salmon, 907,000.

Eggs have continued to be shipped from this hatchery to the various stations through the state. Shipments to February 1, have totaled 2,600,000 Loch Leven trout; 400,000 brown trout; 500,000 eastern brook trout and 50,000 king salmon. Reports show that a high percentage of these eggs are hatching and

that the resulting fry are all in fine healthy condition.

The outlook for the coming planting season is not encouraging at this date, as the long cold spell and light rainfall have caused the fish to be unusually late, and the indications at present are for a light take of eggs.

In line with the policy established many years ago, eastern brook trout eggs have again been imported. 2,000,000 eggs have been secured from a private hatchery in Rhode Island, and shipped to the various hatcheries maintained by the division. Of this number 330,000 were allotted to Mt. Shasta Hatchery.

is at present in a very unfortunate condition and every effort to stock the Sacramento system has a bearing on this important problem.

Almost all the eggs in the Mount Whitney Hatchery have hatched. Gull Lake has not supplied this hatchery with the average number of eggs owing to the fact that the lake was overfished last season. So far it has yielded but 425,000 eastern brook trout eggs. To offset this, 100,000 eastern brook eggs have been sent from the Mount Shasta Hatchery together with 350,000 Loch Leven eggs.

Previous to the receiving of these eggs, the hatchery troughs were painted and placed in first class condition. The intakes were cleaned out and brush cut



FIG. 48. New exhibition display pond recently completed at Yosemite Hatchery. Photograph by Guy Tabler, November 19, 1928.

Through arrangements made with the state of Connecticut, 100,000 eastern brook eggs have been received. The Pennsylvania Game Commission has also been instrumental in securing for the division, 150,000 eggs, and 50,000 were received from Massachusetts. In reciprocation, 50,000 king salmon eggs were shipped to Massachusetts; 100,000 brown trout eggs to Connecticut, and 150,000 Loch Leven eggs to Pennsylvania.

After certain dangers to young fish had been removed in November, 1928, 805,000 king salmon were liberated in tributaries of the Sacramento River. The salmon run of the Sacramento River

away from the ditches and dam. Much sage brush around the hatchery was also removed.

At Fall Creek Hatchery, the king salmon fry are reported to be in good health and making a vigorous growth. All the eggs have been hatched and the older lots of fry began feeding in January. There were on hand at the close of January, 3,603,000 king salmon at this hatchery.

The run of fish to the egg-collecting stations located on Camp, Bogus, Hornbrook, Beaver and Shackelford creeks was delayed due to the very cold weather.

Only a few stragglers were taken in the early part of the season. As was expected, however, as soon as the water of these creeks warmed up a fair run resulted and several hundreds of fish were spawned.

Work on all these stations has been carried on to the end of making them efficient for operations this season. Obstructions have been removed, racks and traps kept clean and constant vigilance exercised to have everything in readiness.

During January 1929, 666,750 silver salmon eggs were shipped from prairie Creek Station to the Fort Seward Hatchery.

Prairie Creek contains 62,300 Chinook salmon fry, 45,500 steelhead trout and 63,550 cutthroat trout. Tanks have been built at the Prairie Creek Station for holding Atlantic salmon. These tanks are 32' x 48' x 16".

Rainfall was below normal and the run of steelhead trout was late.

Scott Creek Egg-collecting Station is anticipating a good run of steelhead and salmon. A constant patrol was kept along this fish refuge, but due to the fact that few fish began running, only 37 steelhead and 319 salmon were taken up to the end of January.

The 298,000 silver salmon fry in the Brookdale Hatchery are reported to be in good condition.

Fingerlings being aged at the San Gabriel Station are showing a good growth. As these fish range in size from three to five inches during January, 1320 were planted in the waters close to the station. More were planted in February to avoid overcrowding. The object of planting at this time is to encourage the fish to scatter thus avoiding concentration, making possible catches of large numbers shortly after the season opens.

The fish at the Feather River Hatchery are lively and making favorable growth. These have been developed from eggs shipped from the Mount Shasta Hatchery and comprise 250,000 eastern brook trout and 250,000 Loch Leven trout eggs.

Due to the educational aspects of the Yosemite Hatchery the regular work has been varied with care of the trout in the aquaria and in the exhibition pond.

The 48,950 brown trout in the holding pond, 151,000 eastern brook trout (Rhode Island) eggs and fry, and 148,000 Loch Leven trout eggs are reported to be in good condition.

Feeding the eastern brook fry at the Tahoe Hatchery was commenced during the latter days of January. At that time this hatchery contained 600,000 of this variety, together with 100,000 Loch Leven trout fry.

Most of the 250,000 Loch Leven trout eggs at the Mormon Creek Hatchery hatched by January 27, 1929. Some 132,740 eastern brook (Rhode Island) trout fry are also swimming in the troughs of this hatchery.

The 199,255 eastern brook eggs in the Kaweah Hatchery were all hatched by January and the 98,395 Loch Leven eggs developed rapidly.

Decision has been made to locate a permanent hatchery on the Kings River and to supply Fresno County and those areas immediately adjacent to this country. This will avoid the long rail and truck trips and will insure less loss when fry need to be transported by pack animals to the High Sierran lakes and streams of Fresno and Tulare counties, where large numbers of people spend their summer vacations.

The temporary dam $1\frac{1}{2}$ miles below the junction of the north and south forks of the Kings River has been abandoned, since it was too frail to withstand the high water during the winter and spring. Work on the new diverting dam commenced on November 8, 1928. This dam is 200 feet long, of the rock-filled crib type and has a spillway forty feet wide in the center. It will raise the water level and permit the conveyance of water by means of a pipe line to a flat where the permanent hatchery will be located. At present the old tent frame, troughs, tanks and the like have been erected on this new site pending the coming season's operations.

The principal biological work has involved the study of food formulas. A plan of feeding four different formulas at different hatcheries to different varieties of fish has been worked out.

A study has been made of the fin and tail disease and emphasis placed, not so

much on control measures, as on methods of prevention.

Bacterial tests have been made of samples of eggs imported by private fish hatcheries. But so far no pathogenic species of bacteria has been discovered.

A biological study of the fish and fish food available in the Salton Sea has been inaugurated in order to determine the possibility of introducing fish into these waters. Special attention will be given to the varieties of fish now present in the Salton Sea and changes in topographic conditions, salinity of the water, absence or abundance of algae, plankton, crustacea and insect fauna will also be observed.

Bureau of Commercial Fisheries

Live Pismo clams and abalones, both green and black, were shipped to the Hawaiian Islands in November. This was made possible through an arrangement between the Division and I. H. Wilson, fish-culturist of the Division of Fish and Game of the Territory of Hawaii. This experiment is the result of a determination made by the Hawaiian commission to ascertain the possibilities of introducing these valuable sea foods in the islands.

Due to the fact that immature salmon are caught by trolling early in the season, efforts are being made to coordinate the regulatory measures being taken by the three Pacific coast states to bring about a uniform control of this phase of the fishery. Oregon proposes to introduce a bill in its present legislature to limit the trolling season for salmon to July, August and September. A representative of the Fish Commission of Oregon, Carl Shoemaker, during a recent conference with the Bureau, urged that California coordinate its legislation along this line with Oregon. The cooperation of the state of Washington is likewise being sought.

Theodore H. Scheffer, representing the United States Biological Survey, stationed at Puyallup, Washington, during a recent visit, complained of the indiscriminate killing of seals and sea lions along the Pacific Coast.

A few tuna and skipjack were landed at San Diego in January. The fishing

at Cape San Lucas, however, has not gotten under way and most of the fish landed were catches made by bait boats working out of San Diego.

A hydrobiological survey of Monterey Bay has been undertaken by the Hopkins Marine Station, assisted by the Division of Fish and Game. The work is under the direction of Dr. Tage Skogsberg of the Hopkins Marine Station. He is assisted by E. C. Scofield of the division. The patrol boat *Steelhead* is being used for this survey and has been equipped with a winch and cable for the handling of trawls and deep sea instruments.

Three fish bulletins have been completed for publication, one a "Report on the Seals and Sea Lions" by Paul Bonnot, the other two by the staff of the State Fisheries Laboratory. One of these, "The Commercial Fish Catch of California for the Years 1926-1927," shows tables of monthly catches, picturing in graphic form the outstanding feature of yearly catch records. The other bulletin deals with the life history of the jack smelt.

Another bulletin, in the course of preparation, is on the commercial fishes of the State. It will have photographs and popular descriptions of all the important commercial fishes.

Other work being carried on by the laboratory staff has to do with the development of sardine eggs to throw light on spawning habits.

A boat catch analysis of the striped bass of the Sacramento-San Joaquin river system is being made. This will include the relationship of striped bass to shad and salmon catches.

General patrol work has been carried on at the various centers of the commercial fishing industry. At Pittsburg, Deputy L. G. Van Vorhis has been active in sardine cannery inspection and has assisted the river patrol in an attempt to run down certain persistent striped bass law violators.

On December 5 Deputy Paul Bonnot arrested K. Katawa of the Maui Fish Market, Lodi, for violation of the Fishing Data Act. The defendant was charged with buying fish without making proper record in his fish receipt book. Judge J. H. Clancy, at Acampo, San Joaquin County, fined him \$100.

H. Shinozaki was also arrested by Deputy Bonnot at Walnut Grove for the same offense, and was fined \$100 by

Judge W. E. Everson at Elk Grove, Sacramento County.

At Monterey, Captain Ralph Classic and his assistants have been carrying on the regular work of checking canneries and general fisheries patrol about the Monterey district.

Deputy N. C. Kunkel has made a number of good cases at Pismo Beach, San Luis Obispo County, and has the clam and abalone situation well in hand. Good work has been done by cooperating with the deputies under Captain S. H. Lyons of the regular patrol.

Captain C. H. Groat and his men have concentrated their attention on the San Pedro sardine packers and, besides checking the plants, have kept a watchful eye open for violations in their entire district. Several cases were made on purse seine and lampara nets, and the possession of nets in the closed district around Catalina Island.

Bureau of Education and Research

Dr. H. C. Bryant, while attending the National Game Conference, at New York, enjoyed the opportunity of meeting the principal leaders in conservation and in gaining first hand knowledge of the most progressive ideas and methods. Further side lights on methods of wild life production and protection were obtained during visits to the Federal Bureau of Fisheries and the Bureau of Biological Survey, from officials of the Pennsylvania Game Commission, at Harrisburg, and other institutions visited.

On the evening of December 3, 1928, two recent reels of the Division were shown to those in attendance at the Conference. The mountain sheep and antelope picture, as well as that on shore birds, received much comment of a praiseworthy nature.

The chief of the bureau has attended a number of the meetings of the California Economic Research Council and is serving in the capacity of member on the Natural Resources Committee.

The problem under present discussion is centered in the need for topographical maps of the state. The federal government will be urged to complete the series of California maps.

Opportunity has again been afforded for broadcasting over KGO worthwhile information on game and nongame birds and their protection. In particular, the status

of the quail of California has been emphasized.

During January and February a variety of specimens received the attention of the laboratory conducted by Dr. H. Van Roekel at the Hooper Foundation for Medical Research.

Considerable deer trouble was reported, but the reports from different sources do not agree as to the seriousness of the trouble. However, judging from the observations reported and the specimens examined, the mortality is largely due to parasitism. The mortality is greatest among young deer. Communications with Dr. Iverson, state veterinarian, reveal that domestic live stock in the affected district are parasitized with similar parasites as found in the deer examined at this laboratory. Veterinarians in the affected locality expressed their view that the losses among deer were due to parasites. The following parasites were found in large numbers: Oestrus larvae in the nasal passage; lung worms; oesophagostoma in the cecum and colon; setaria labiatopillosa in the peritoneal cavity. Since decomposition is so far advanced in specimens when they arrive at the laboratory, plans are being made to examine fresh specimens in the field. A general and intensive survey will be made concerning the mortality of the deer.

Five blind deer were reported near Alturas; two affected deer heads were submitted to the laboratory for examination, but no definite cause was arrived at for the total blindness.

Reports on the duck sickness at Hollywood Duck Club, near Delano, were received January 15. An acute flare-up was observed on January 14, at which time more sick ducks were observed than any time previous during the course of the season. Weather conditions were reported as follows: cold and foggy, with little or no rain for a month. Game wardens were requested to send sick birds to the laboratory. Five sick birds were received for examination. The ponds in that locality are being drained since the close of the season, and few ducks are present.

Further feeding experiments relative to the duck disease investigations were conducted during January.

Five dead mud-hens from Coalinga were received for examination and found infested with flukes. Two pin-tail ducks were received, one of which died from an impacted crop and the other was unfit for examination.

From a game breeder at San Jose one quail was received which was infected with blackhead and crop worm.

The domestic poultry at the game farm were retested for tuberculosis and bacillary white diarrhea. But .54 per cent infection of the latter disease were found, while 7.44 per cent of the birds were infected with tuberculosis. It is hoped that these two diseases may be eradicated from the flock during the summer by repeated tests. Ten quail introduced onto the farm recently showed signs of disease. Blood examinations were made for haemoproteus by E. C. O'Roke, but found negative. Four of the surviving birds were killed and examined, all of which were infested with a capillarid that attacks the crop lining and anterior portion of the duodinum. One sick female Reeves pheasant was killed and examined and found to be infested with air-sac mites. Proper facilities and equipment are gradually being established which will make possible the institution of practical and effective sanitation.

During the last month five different specimens of fish eggs were submitted to the laboratory for bacteriological examination. No organisms pathogenic to fish were isolated. Two reports of mortality among fish in hatcheries were received. Diseased specimens from these hatcheries revealed that the malady is different from those of the past. Further study is necessary before any definite information can be given.

Considering the various disease conditions in materials which were submitted to this laboratory for examination, it is evident that this field merits the attention it is receiving. During the next few months the time and effort will be largely directed to the State Game Farm and the state fish hatcheries so that no disease epizootics can gain a foothold.

E. S. Cheney has secured additional motion picture film of tidewater fishing for steelhead and striped bass. Several feet of film were taken of salmon spawning in a coastal stream. Some good material was obtained of goose hunting in Lassen County, and of the annual census of Pismo clams made by the staff of the Commercial Fisheries Laboratory. As a climax to this quarter's work, a splendid film has been obtained of the antelope on winter range in the Mt. Dome section, Siskiyou County. This, together with the pictures of these rare game mammals secured in Lassen County, completes and rounds out the division's film on this subject.

Dr. H. Van Roekel and E. S. Cheney edited and titled a film shown for the first time at the Fourth Annual Convention,

entitled "Duck Disease Investigations." Rodney S. Ellsworth and E. S. Cheney edited and revised a film on the "Deer of California." This, together with three reels depicting various phases of the division's activities was assembled and also shown.

Cutting and titling of the motion pictures soon to be issued on the spiny lobster, Pismo clam and commercial fisheries patrol is well under way.

All negative in possession of the division has been segregated according to suitable subject, sealed in cans and treated to prevent deterioration.

Requests for loans of motion picture films has increased and shows that the library of films is being put to a continual use.

The demand for lectures has not abated. Dr. H. C. Bryant gave lectures in Los Angeles County in February and paid a visit to Lancaster and Palmdale in answer to an insistent request.

In December Rodney S. Ellsworth covered the principal farm bureau centers in Lassen County and had an opportunity of stressing the importance of adequate protection and respect for game resources in a county where game abounds and where residents are daily in intimate contact with wild life.

Donald McLean investigated the damage to irrigation ditches caused by muskrats, beavers and rodents in the Imperial Valley during December. Considerable complaint has been made of damage done and harmful effects resulting from the work of these rodents. In an effort to control them, the irrigation company has been paying a bounty of 25 cents on the tails of all muskrats brought in. Many requests for special permits for trapping these animals have reached the division.

Research on the natural history of quail is advancing. In January McLean commenced to investigate the quail situation in the Spring Valley Water Company's property in San Mateo County. Quail were especially abundant in this area in former times, when it represented one of the centers of quail population. Quail seem, however, to be on the decrease at the present time, in spite of the fact that hunters have been excluded and predatory animal control has been practiced.

Sixty magazines, popular, scientific and otherwise are received by the library each month. Many of these are publications

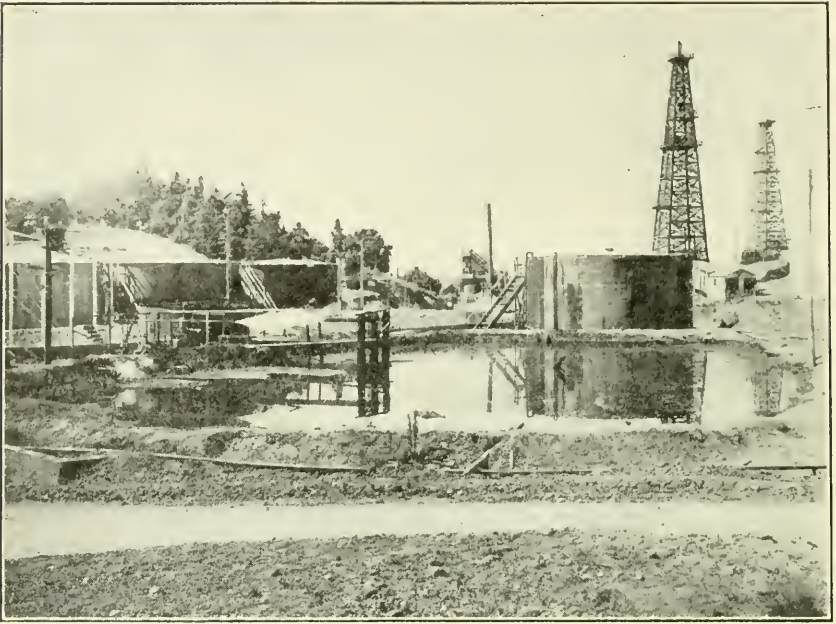


FIG. 49. Old type of individual oil sump with earth levees formerly used in preventing oil pollution.

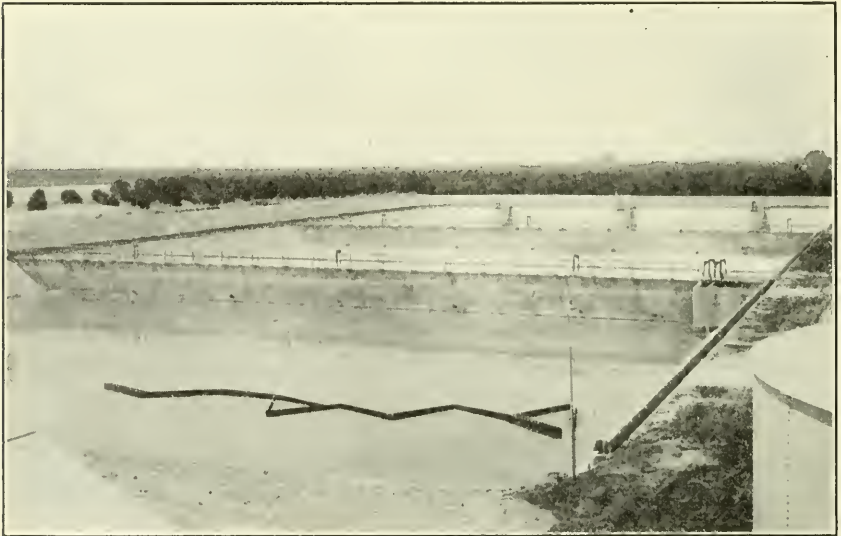


FIG. 50. New type of sump. Part of a cooperative reclaiming system costing about \$300,000 which is now in operation in southern California. By such prevention measures, the various oil companies are aiding in preventing pollution of state waters.

from other states, sporting clubs and conservation organizations. A plan is under way to make them available and useful to the field force.

Many important accessions have been made.

Bureau of Public Relations

During the three-month period, preparation of publicity, attendance at two hearings in the Monterey sardine cases, routine office work and trips to Eureka and various sections have occupied the time of the chief of the bureau.

Acting as one of a committee of three to arrange for the Fourth Annual Convention of Employees of the Division which was held on February 13, 14 and 15, much work was found to be done. The arrangements for the final day's barbecue was a man-sized job, but thanks to an efficient "K. P." force, and beautiful weather, this event was carried through without a hitch.

During the convention a daily bulletin of events was published, the "news" being handled before and after the sessions, and the bulletins distributed before the session closed each day.

Attendance at the three-day trial of the cases against three Monterey sardine canners at Salinas, Monterey County, was an interesting and busy session. Each day the story of the trial was "covered" for the *Salinas Daily Index-Journal*. The story was handled in regular metropolitan style, that is, new leads were furnished at the end of both morning and afternoon sessions. The managing editor, Rollin G. Watkins, saw to it that the division's side of the case was impartially handled, giving the real news of the trial.

Bureau of Hydraulics

A self-cleaning parallel steel bar screen has been invented by Francis Cuttle of Riverside. This device is primarily constructed to remove trash and drift from ditches, but works also as an effective fish stop. It will take care of ditches practically any width and four or five feet in depth.

An important installation of fish ladders on the upper and lower Twin Lakes in Mono County occurred during the

month of January. The bureau has worked on this problem since 1926. The installation is the result of a hearing and a number of conferences.

The next migration of fish up the Walker River will determine the effectiveness of a ditch constructed around the irrigation district dam just below Bridgeport, Mono County. It is expected that this "run around" will serve the purposes of a fish ladder and will permit fish to get above the district dam.

A 10,000 gallon tank and gravel filter has been installed by the Model Laundry Company at Susanville, Lassen County. This equipment will clean the laundry water and, it is anticipated, rid it of all substances deleterious to fish life before it enters Pinte Creek.

The Kern River Canal and Irrigation Company has installed a parallel bar screen across a canal seven feet in depth and forty feet wide.

A parallel bar screen has also been installed by the Farmer Stine and Anderson Canal companies on a jointly owned canal in Kern County.

The Kern Island Canal Company has also installed a parallel bar screen.

The Townsend Flat Water Ditch Company has installed a fish ladder which will permit fish to pass its Clear Creek dam in Shasta County. Records show that this dam has been an obstruction to migrating fish for many years.

United States Army engineers have reconstructed the fishway at Daguerre Point Dam on the Yuba River, Sutter County. The approach to the fishway has been improved by blasting away the rocks. This should render it more effective.

On the whole, the army engineers have displayed a real interest in conserving fish life and have been sincere in their endeavors to improve conditions.

Reports received from Lassen County show that five fish ladders have been repaired and placed in a proper operating condition.

An inspection trip in Trinity County shows that two fish ladders have recently been constructed and accepted by the division.

The Clover Valley Lumber Company has reinstalled a good fish ladder over the dam maintained by that company on Grizzly Creek, Plumas County.

The Walker Mining Company, operating in Plumas County, has constructed dams and by-passes which will prevent pollution from its mine operations.

Oil fields near Bakersfield have been inspected. A sump costing some \$63,000 is being jointly used by operators in this field and this will, no doubt, minimize possible pollution of the Kern River.

In general, conditions in the southern California oil fields are good. Very little pollution is now occurring.

Bureau of Lands and Game Refuges

Game census reports are revealing very interesting information on the fluctuations in game conditions throughout the state.

This season, quail were reported to be very plentiful. For instance, an observer at Redlands writes that "in some sections all of the desert abounds with both mountain and valley quail." Another report from the Jawbone Canyon and Kelso Valley districts, San Bernardino County, evinces the prevalence of quail in this section. Proof of this is borne out by the fact that deputies checked 336 licenses of quail hunters and 2,305 quail were killed the first two days of the season. Twelve limits and six near limits were checked in San Diego County by one individual.

The governor's committee on Game Refuges and Public Shooting Grounds has taken a deep interest in their work. Tentative areas have been selected in the San Joaquin and Sacramento valleys, the heart of the waterfowl country, and its recommendations that the commission consider these areas will be submitted shortly for final action.

The committee is apprehensive that conditions have varied greatly in California during the past fifty years and realizes the immediate need for providing adequate feeding and nesting grounds for migratory waterfowl.

A list of shooting clubs together with the area owned or leased and their relative efficacy in attracting ducks is being

compiled. This work is being carried on through the field forces.

Jay Bruce operated in southern California in February and March because conditions at this time of year are most favorable for lion hunting. During the period between October and January he was successful in bagging nine lions. He secured these in game refuge 1-J, Amador County, the Ice House country above Riverton, El Dorado County, Dorrington and Buck Ranch, Calaveras County and Grizzly Canyon, Santa Clara County.

In January, six lions were added to his credit. Two others were captured alive, one being a thirty-pound and the other a fifteen-pound kitten. Operations during this month were conducted in Santa Clara and Monterey counties.

Bureau of Game Farms

The 1928 distribution sheet shows that 6106* Chinese ringnecked pheasants were liberated in suitable locations throughout the state. Some 200 California valley quail were planted, as well as 125 Mexican bronze turkeys. Forty Hungarian partridges were liberated in Squaw Valley, Fresno County, and seventy-two display varieties of pheasants presented to city parks. In all, 6543 birds were sent out. These have a market value estimated at \$18,650.

The year started at the Yountville Game Farm with 995 Chinese ring-necked pheasants which will serve largely as breeding stock for the present season. There were still to be disposed of, fifty-four wild turkeys. A large number of the sixty-one valley quail were retained for further experimental purposes, both in disease and in propagation. Further propagation experiments will be carried on with thirty-five Hungarian partridges. Of the show varieties of pheasants, the stock on hand consisted of 53 silver, 27 golden, 12 Mongolian ring-necked, 12 Reeves pheasants and one Lady Amherst pheasant.

The turkey pullets began laying February 19. Last year the first eggs were gathered on February 20. This indicates that these birds are regular and dependable. The first pheasant eggs were gathered March 9 and 10. In each instance, it seems to be the pullets that first begin to lay.

The problem of quail administration is one, not so much of artificially producing

* See p. 184 for further details of these plantings.

individuals, as it is of taking care of the breeding stock already on hand in the natural habitat. Two recent instances where private individuals have established quail sanctuaries throw much light on this thought. They are suggestive of the good that can come where property owners are willing to cooperate with the division and allow their lands to be used, not only as places where birds may be trapped and transported to localities where they are needed, but also as areas where a breeding stock is safe-guarded, which serves as a natural center of dispersal for the surrounding area.

Last year over 650 quail were liberated in the Point Loma district at the request of landowners. Thousands are reported there now. The D. D. Wilder's estate, in Santa Cruz County, and the Clary Brothers ranch in Coachella Valley, in Riverside County, have been closed for a number of years and quail have multiplied amazingly. These places have ideal natural surroundings and are most suitable for permanent quail refuges. Thousands of birds can be reared each year at practically little cost.

In December, 1928, 100 California valley quail were sent to the Wilder estate for stocking purposes. The report of their liberation is worth quoting in part and is as follows:

"The birds arrived in fine condition, and we took two crates up a gully near the center of the ranch, where there is brush, trees and a running stream. We placed a crate near a good place, opened the door and stood back to watch. In just a few minutes, the birds in the crate commenced calling and the home birds answered. Soon the birds started coming out of the crate, one and two at a time. These started to feed and to call until the whole countryside was in an uproar. Those in the crate on the truck joined in the calls. We got such a thrill we sent back to the house for two more crates. We have not enjoyed anything so much for a long time."

The interest in wild turkeys is increasing judging from the number of inquiries and requests for information on rearing them. The plan of supplying a breeding stock to interested owners of suitable protected areas, instead of thousands of immature birds for liberation, has proved to be the most efficient policy. By having a number of selected localities in different parts of the state rearing and releasing young turkeys, it may be possible within a short space of years to have

good turkey shooting. Sportsmen's organizations are already showing a lively interest in this program. In particular, the Santa Barbara County organization is undertaking the rearing of turkeys. Stock was furnished them. Redding is another section that offered to help. So have the owners of the Hofschneider ranch in Sonora, Tuolumne County, of the W. J. Wallace ranch, Delano, Kern County and the Allen G. Hancock place, Santa Maria, Santa Barbara County.

Five turkeys were shipped from San Francisco on January 8, 1929, for the long thirty-five day ocean trip to the Argentine Republic. Through an arrangement made by George O'Connor, these birds were sent in exchange for additional varieties of the South American game bird, the tinamou.

A pair of golden and of silver pheasants were forwarded to the Governor of Arizona, George W. P. Hunt, during the first week of December. This shipment represented a token of appreciation for the part Arizona has played in supplying California with a breeding stock of turkeys.

Another exchange of six versicolor pheasants was made in November with the Washington State Game Farm for a two-year old male Reeves pheasant which now gives four complete breeding pairs of these birds. This will permit the rearing of a sufficient number of these birds to attempt their introduction in some of the higher altitudes of the state.

Thirty ring-necked pheasants have also been presented to the Jordan Game Farm in return for the chukor partridge. This bird has a wide distribution in western and central Asia under the name of Greek partridge. It has a reputation of being able to exist on the hottest and most barren of hillsides. It can not stand a situation of unbroken dampness, where the forest is dense and the rainfall great. It is anticipated that this bird may solve the partridge problem, due to its possibilities as a domestic breeder.

In February, 1929, a number of Chinese and silver pheasants, Hungarian and bamboo partridges were delivered to the Golden Gate Park aviary. An interesting experiment will be carried out to determine whether the two varieties of partridge will do better when given the liberty of a large pen. In return, other varieties of game birds were received at the farm and it is hoped that this new blood will improve the stock now on hand.

Goat Island, in San Francisco Bay, has become a refuge and received a plant of Chinese ring-necked, silver and golden pheasants and California valley quail. This plan is in line with the policy to supply parks with game birds for educational exhibits. Already parks located at Eureka, Napa, San Francisco, Santa Cruz, Fresno, Merced, Bakersfield, Santa Maria and Los Angeles have been supplied.

In the past two years, over 700 song and other non-game birds that spend their winters in the vicinity of the game farm have been banded. This winter many birds, previously banded on the farm, returned and the percentage was, indeed, quite high. Many of the banded birds are reported to nest as far north as Alaska.

Living conditions for the attendants have been greatly improved by the addition of a recreation room, another bed room, and a shower room having hot and cold running water.

Concrete floors have been placed in the domestic poultry houses. In other ways,

these structures have been improved so that they now conform with the best ideas of poultry men.

Plans for electric incubation and brooding for the coming season are going forward satisfactorily. A few minor changes have been made, based on last year's experiments in breeding bantams. More ventilation and moisture is needed in incubating game bird eggs and the incubators are being adjusted to meet this need.

Arrangements were made with the Hooper Foundation and the Bureau of Education and Research to test again all domestic hens used during the present season as foster mothers. Last fall, Dr. H. Van Roekel tested the bantam hens from which a hatch of over 800 chicks in electric brooders was obtained. Ninety-eight per cent of these were raised. This is evident proof that a clean brooding stock is of value.

The breeding stock of pheasants and quail may also be tested. So far, however, no blood infection has been found in pheasants, as it has been found in quail.

COMMERCIAL FISHERY NOTES

N. B. SCOFIELD, Editor.

ALBACORE IMPORTED FROM JAPAN

In 1927 a new source of supply was established when approximately 78,000 pounds of albacore were imported from Japan as an experiment and canned in the southern California plants. The Orientals prefer the darker meated varieties and for this reason the white meat of the albacore sold low enough to permit a trial shipment in ice to be made to the tuna canneries in southern California. The experiment proved successful and during the first six months of 1928 approximately 4,000,000 pounds were imported from Japan, while in June and August 20,000 pounds of albacore were brought from the Hawaiian Islands.

The tuna canning industry is becoming yearly more dependent on the supply of fish obtainable from distant fishing grounds and especially those to the south in Mexican territorial and extraterritorial waters and on the yet undeveloped marine regions even farther south along the coast of the mainland of Mexico and beyond the Socorro Islands in the Pacific. In the near future it is possible this fishery will be extended even to the waters of Central America. Boat building concerns in southern California are even now drawing plans for steel and wooden framed refrigerated fishing boats of sufficient size, fuel and water carrying capacity, to make the longer trips.

It is, therefore, to the best interests of both the United States and Mexico to closely cooperate in solving the problems of protection and wise use of the fisheries: The United States to protect a food supply for her people and a California industry involving large investments and the employment of many citizens, from failure through depletion of the desirable species or unreasonable duty requirements by other countries; Mexico to protect her marine life, to continue to hold the market for her unused raw materials and to assure the continued collection of revenue from her natural resources.

CONDITIONS IN THE SARDINE FISHERY AT SAN PEDRO

An investigation of conditions in the sardine fishery at San Pedro shows that sardines received the latter part of August, 1928, were in good condition. Those received during November and

December were in poor condition. In fact, were probably not in as good condition as those received in November of the preceding year. The reason given for this is that no local fish were caught during November and December, 1928. All the sardines came from Santa Cruz Island, San Nicholas Island and Osborne banks, in general, some eighty miles distant from the canneries. There was a good deal of rough water during November, and the weather was quite warm. The long haul under such conditions spoiled a good many of the fish. It is stated that the fishermen would catch a part of the load one day and wait over until the next day to fill out the load. The canners complained to the Division's inspectors that these loads would have good fish only on top and they would find that a large part of the load had to go into the reduction plant.

Another explanation for this poor condition is that the sardines were caught with purse seines. These are operated by larger boats than employed by ordinary lámpara seining outfit, commonly employed in seining sardines. Purse seine boats, furthermore, are not properly fitted to carry sardines long distances. The fish are put into the hold and many are crushed by the weight of a large mass of others on top. If the water is rough, they are badly mashed. This condition is made much worse when the weather is warm.

If purse seine boats are to be used to catch sardines for the cannery, they should be better equipped to take care of the fish. Certainly, the canners should require that the sardines be delivered to them in good condition.

TUNA PACKING IN TUNIS¹

African Cannery Methods—Preparation of Fancy Stock

California tuna packers will find interest in an account of methods and processes employed by competitive canners of their product operating in Africa. The Spanish *Boletín de Pesca*s has reviewed² investigation work undertaken by Professor A. Gruvel, who has reported his

¹ Contribution No. 80 from the California State Fisheries Laboratory, January, 1929.

² September, 1928.

findings in the bulletin of the *Station Oceanographique de Salammbou*. His treatise is broad in scope, and deals in detail with the extraordinary number of differing gears, nets, traps, and diving apparatus used in the varied fisheries of the Tunis coast. To the fishing come Spanish two-boat trawlers, Italian round haul seiners, English otter board outfits equipped with Vigner-Dahl patented tackle. Maltese in their high-proved sloops bent on sponge fishing, Sicilian net men, coral dredgers, squid jiggers, seiners of a dozen sorts, and gangs of native workers busy at building great

Following a consideration of the vessel types, Professor Gruvel discusses the apparatus of capture which, he says, "presents as great a variety as in the case of the boats." Two-boat drag nets, otter board gear, beam trawls, bagless drag nets, sweep gear that is shoal, and tangle bars and dredges for sponges and coral, commence his list. He discusses squid lure, anchovy seines, artificial baits; he tells of setting empty pots as traps for octopus, and finally pictures the great stationary tuna weirs and traps for which the region is world-famous.



FIG. 51. Deputy measuring spiny lobsters in the San Diego markets to determine whether they are of legal size. The spiny lobster is one of the only fishery products that has the distinction of both a maximum and minimum size limit. A legal spiny lobster is not less than $10\frac{1}{2}$ inches nor more than 16 inches in length. Photograph by E. S. Cheney, November 2, 1928.

floating traps, set nets, and tuna weirs. Professor Gruvel tells of the English steam trawler; he notes the tendency of the sailing *balancellas* to install oil engines; he describes the clipper bowed drag boats, square sailed and with triangular jib, "Sicilian in type but manned by Italians"; the fast sailing *corallines*, lateen rigged, thronged with coral divers; the little canottos, fifty footers, painted in brilliant colors. "And every one of these groups specializes in some particular fishery," he says.

"The tuna captured are taken ashore aboard scows towed by a small tug, and inside the factory are beheaded, eviscerated, and hung by the tail until the next day, to bleed them. Great care is taken in separating the spawn, which is used to make *poutargue*.

"When well bled the tuna are cut up, the pieces being carefully washed before proceeding to cook them in kettles containing water of 35 degrees salinity, Baumé scale.

"From the boilers the meat pieces are deposited upon a framework of cane to cool and drain.

"The pieces of tuna, cold and well drained, pass to the packing room; the cans are then filled with olive oil and finally sealed and sterilized.

"A part of the meat is treated by salting only. The scraps remaining are utilized in the manufacture of guano and oil.

"The roes of the mature tuna are salted upon a board from seven to eight meters long and slightly concave; they are afterwards washed in sea water and arranged on a new board, covered in turn by another board which bears its own burden of roes, and so on successively. To press them stones are placed upon them, and after this operation, they are dried in the open air, thus forming the product called *poutargue*."

This dry "tuna caviar" is said to be in ready demand at handsome figures, and contributes an appreciable profit to the African tuna business as a whole.—Geo. Roger Chute.

NIGHT FISHING WITH LIGHTS ON THE COAST OF AFRICA¹

An Italian Method, Long Proven Effective

Veteran fishermen of California sardine experience tell that in former times the seining of pilchards was a daylight operation. Monterey was the seat of the then infant industry, and the netting crews rowed out from shore of a morning to catch stock for the canner's use next day.

Actually, the first fishing was done with gill nets, but the obvious difficulties in the way of hand picking from tangled twine enough sardines to busy a cannery throughout a day soon compelled a change in the mode of capture, and the adoption of the purse seine. As has been said, the pursing gear was at first employed only in daylight hours, and therefore was not so successful as to satisfy its users. Accordingly in 1905, a progressive fisherman of European experience induced the operators to import an Italian gear. This foreign apparatus was so productive that it has since become common to all our ports, being known as the "lámpara net" or "lámpara." Indeed, its popularity became so great that it expanded to the practical extinction of the pursing gear. But a few years later northern fishermen, migrating southward, reintroduced the purse seine net, and by some modifications in the former methods of working it, made

their favorite tackle so effective that it has grown to be the dominant harvesting apparatus.

Both the "lámpara" and the purse seine are night nets; only for comparatively brief periods are they now used for daylight fishing. Seining operations conducted during hours of darkness are the present support of the industry.

But our sardine netting is done in utter darkness. Boats cruising the grounds show nothing but the minimum running lights prescribed by law. Not until the net is cast and hauling commences are deck lights of any sort displayed. It is interesting, therefore, to read that in the Mediterranean Sea an entirely dissimilar plan is used successfully and that there the sardine fishing is done at night also, but with the use of powerful illuminators to attract the fish.

In the September, 1928, issue of the *Boletín de Pesca*, official organ of the Spanish Institute of Oceanography, there appeared a review of certain fishery investigation conducted by the French in Argelia, Africa.

"The Director of the Laboratory of Castiglione,"² writes the Spanish editor, "is dedicating an extensive work to the methodical study of fishing with lights on the coast of Argelia. . . .

"In Argelia night fishing with lights was subjected to regulation in 1926, when it was authorized in depths greater than fifty meters, provided that at least five hundred meters distance separated it from any other fishing apparatus; and that if these others were the set nets or fixed gear called *almadrabas* or *almadrabillas* (the great Mediterranean tuna traps or pounds) and closed zone was increased to one kilometer.

"The 1926 regulation permits the carrying of only enough carbide for supplying the lamps. Also it forbids the use of lights submerged below the surface of the water, and authorizes the capture only of sardines, *alatxa* (a sardine-like fish), horse mackerel and other species of pelagic habits.

"As a preamble to his personal observations he gives a synopsis of the opinions of French and foreign investigators, all of whom are of accord in that fishing with lights, properly regulated, can be made to yield good returns. Professor Boutan sets forth in short paragraphs the estimates of the different authorities consulted:

¹Contribution No. 79 from the California State Fisheries Laboratory, January, 1929.

²Louis Boutan. "La pêche au feu sur les côtes d'Algérie et le transport du poisson bleu dans l'intérieur de l'Algérie." Station d'Agriculture et de pêche de Castiglione, 1927, primer fascículo.

'The only charge against this form of fishing is an argument in its favor: it is accused of too great efficiency, of permitting too abundant catches,' writes Dr. Fage.

'The fishery-with-light is a fountain of riches for Spain,' says Professor Odón de Buen.

'The fishing based upon the use of lights seems not to have produced any depletion in the coastal fishery,' says Professor Fédel.

'Fishing with lights, which has been carried on for more than thirty years in Italy, beyond doubt increases the quantity of fish captured from among the migratory species,' says Professor Sanzo.

'The quantity of fish caught each year indicates, with some variances, that the product of the fishery tends to increase rather than to decrease along the coasts of Sicily,' writes Professor Russo.

"On the coasts of Argel they do not always fish with the same number of boats and oil-burning lamps for producing light. They may employ three boats, each of which has one lamp; they may use two vessels operating in conjunction with a third acting as light carrier, or, in the third case, they may work with only one craft having with it an auxiliary boat of small size, this latter being

charged with the business of illuminating the water to attract the fish."

In this general connection it is of interest to note that the Spanish word for "lamp" is "lámpara," the same that is used by us as the name for the Mediterranean sardine net now employed throughout our domestic fishery. It is, therefore, the "lamp net." The Italian word for lamp is "lámpada," so it may be that their calling the net by the Spanish name is a direct adopting from that language, it being a fact generally admitted that many fishing appliances found in south European waters were originally of Spanish invention.

Americans habitually mispronounce the word "lámpara" and few if any have a correct notion of what meaning the name may have. But by combining the facts that sardine night fishing in the Mediterranean is done with lights, and that the gear we obtained from those waters is still known to us by the foreign name meaning "lamp net," it seems quite probable that we in America are now using, in our unlit night fishery for sardines, the same "lámpara" or "lamp net" now employed on the coast of Africa for fishing with torches or brilliant carbide burners to toll up and dazzle the schools of fish.—George Roger Chute.

LIFE HISTORY NOTES

PRONG-HORNED ANTELOPE IN CALIFORNIA

In pursuit of bird and animal films for the State Fish and Game Commission I have had very close contact with the antelope situation in northern California at various seasons during the last two years.

I find conditions in Siskiyou County are the most promising, and the bands ranging in the Mt. Dome section at this time are in better condition than those in any other place I have visited. There are but few, if any, sheep grazed in this section, and the feed and cover is excellent. While water is scarce during the dry season, it is still obtainable in sufficient quantities to maintain the herds.

In 1923 to 1925 there were reported a total of 118 antelope on this range. These have now increased to 400 or more, and represent the largest resident band now in California. In a single day's travel on foot in this region I encountered as many as four or five bands, some containing eighty-five or more animals. There is very little open range in this country, and as the antelope frequent the juniper forested table lands and plateaus, they are hard to locate. It was necessary in many cases to climb to the tops of the juniper trees to locate the animals, and it is quite possible that many bands in the neighborhood escaped my observation. The increase of young in the past season shows a very promising condition, as in some of the smaller bands the young considerably outnumber the older animals.

Comparing this section with Lassen County and game refuge 1Q, where the land is overgrazed and sheep camps monopolize most of the water holes, I found conditions quite the reverse. The bands are small and scattering, and the animals comprising them, very wild. There is a small band or two ranging in Modoc County in the neighborhood of Eagleville, but the big bands formerly ranging in Lassen County have migrated into northwestern Nevada, where they winter in the Black Rock Desert, and in summer range northward into eastern Oregon. In November, 1927, I found herds up to 500 or more in Washoe County, Nevada, watering at Swan Lake.

In 1928, I made five trips into the Lassen County antelope country and at no time did I see over thirty-five antelope in one day, and that was in February before the bands had broken up. During these various trips, I covered Grasshopper Valley, Madeline Plains, Spanish Springs,

Painter Flat, Smoke Creek, Skeedaddle Creek and other portions of the 1Q refuge, and it is my opinion that the big bands formerly ranging in Lassen County now range in Nevada, and that the Lassen County resident herds do not total over 250 animals at this time.—E. S. Cheney, Oakland, California.

SPECIMEN OF MILK FISH, *CHANOS CHANOS*, DELIVERED AT SAN PEDRO

A specimen of *Chanos chanos* was found in a San Pedro wholesale fish market on February 26, 1929. This fish, three and a half feet in length, was taken off the western coast of Lower California. As far as can be ascertained, this is the first record of the delivery of the species in San Pedro.

The fish belongs to the family Chaniidae, a group related to the herrings, and is known variously as milk fish, sabalo or awa. It bears a superficial resemblance to a mullet and was called a Mexican mullet by the dealer in the wholesale market.

These fishes, excellent for food, inhabit the warmer parts of the Pacific and Indian oceans, and are reported as relatively abundant in the Gulf of California.—Frances N. Clark, California State Fisheries Laboratory.

SOME NOTES ON THE BASKING SHARK

(Cetorhinus Maximus)

From time to time at San Francisco, and, more rarely at Monterey, fishermen bring in basking sharks (*Cetorhinus maximus*). As these sharks are generally of large size and are now comparatively rare, they attract much attention and, in some cases, are given space in the newspapers. Quite recently a large specimen was brought to San Francisco and on November 3, two large specimens were caught in Monterey Bay by fishermen. These were landed at a reduction plant and converted into fertilizer.

The basking shark was first described by Bishop Gunner of Norway. He published a learned dissertation attempting to prove that this was the species of fish which swallowed Jonah. The fishermen of the North Atlantic have known the basking shark for a long time under various names. In New England it is known as basking shark and sometimes as "bone shark"; in Ireland and Wales the name "sunfish" is applied to it; while

in Northern Great Britain it is called "snailfish" and in the Orkneys "hoe-mother."

Until recently the basking shark was considered a resident of only the north Atlantic and Arctic oceans. It has been recorded in the Atlantic as far south as Portugal and Virginia. There are records however in Australian waters. Sir Frederick McCoy records a specimen from Portland, Victoria in 1883, which was thirty feet six inches in length. He gives a very careful and detailed description and measurements. This is the first good description we have of the basking shark. The range, therefore, would seem to include both the Arctic and the Antarctic.

Our knowledge of the basking shark is rather meager. We have specimens of it and several accurate descriptions, but from all accounts, it seems to be a rather rare fish. It grows to be thirty-six or more feet in length with a girth of twenty-five feet. It is observed for the most part lazily wallowing in the trough of a smooth sea, evidently enjoying the warmth of the sun, hence, the name basking shark. The teeth are numerous, being 200 in a row. They are small and weak, however, and are probably not of much use in procuring food. The internal openings of the gill slits carry modified gill rakers which form a straining apparatus. The gill slits extend from the back nearly to the median line on the ventral surface. The long gill rakers have somewhat the same function as the baleen in the whalebone whale, hence the name "bone shark."

From the nature of the teeth and the modification of the gill rakers, it is reasonable to suppose that the basking shark feeds on much the same material as the whalebone whales, namely plankton, and perhaps shoal water organisms.

Although seemingly indolent and sluggish, even the old time whalers hesitated before driving the harpoon into the basking shark. The big fish will allow a boat to approach close enough to touch it, but when aroused to action, the shark has both speed and endurance, and can take out line more steadily and at a faster rate than a much larger whale.

In the past, the basking shark was taken in the north Atlantic for the yield of oil from the liver. Records show as much as twelve barrels of oil have been obtained from one fish. The average yield is about eight barrels. At the present time, the fish is taken more by accident than by design. There has never been any demand for shark oil on the Pacific Coast. The rarity of the

fish is another factor to be considered and a logical explanation why no fishery for them has been established. As they possess little or no commercial value and as they are inoffensive fish, never conflicting with any of man's commercial activities, they are seldom molested and go their way in peace. Occasionally, one of them accidentally becomes entangled in a net or is taken out of curiosity and we are then afforded an opportunity of seeing one of the largest of fish.—Paul Bonnot, Stanford University, California.

ALBINO SARDINE

A mature female sardine that apparently might be an albino was caught in Monterey Bay on September 18, 1928. The fish, instead of being the characteristic dark blue above, was a bright lemon-yellow color speckled with small blue and green dots. The large blue dots on the sides were lacking. It was a brilliant silver hue below the lateral line. The dorsal and the caudal fins were lemon-yellow margined in black; while the pectorals, the ventrals, and the anal were colorless. The peritoneum instead of being black, as is customary, was white speckled with small round black dots. Upon cursory examination, the fish appeared normal except for the unusual coloration.

On several occasions albino sardines have been observed in the past, but they are a rarity.—M. J. Linder, California State Fisheries Laboratory, Terminal, California.

HUGE SKIPJACK TAKEN AT SAN DIEGO

A skipjack that exceeds in size anything heretofore known to local experts was recently received at the San Diego Natural History Museum. The fish was caught by Manuel G. Rosa, a commercial fisherman, and was donated to the museum by the Van Camp Seafood Company. Measurements taken at the museum were: length 39 inches, depth of body, without fins, 10 inches, girth 27½ inches. The weight was declared by the Van Camp Sea Food Company average 8 pounds, the phenomenal size of this individual is evident. Mr. Gillette, the museum's taxidermist, dropped all other work in order to mount the specimen which will fit nicely into a new exhibit that has been contemplated for some time, showing the fish that are packed commercially in San Diego.

A BRIEF NOTE ON A GREEN ALGA ANKISTRODESMUS

The following brief account of a green alga deleterious to fish is offered as a

supplement to a short note in CALIFORNIA FISH AND GAME, July 1928. The note appearing in the "Department of Fish Culture," reported a fatal condition of infestation noted in a collection of steel-head eggs taken at Scott Creek, Santa Cruz County. It also referred to the water in the Yosemite and Kern hatcheries. The water coming into the Kern Hatchery was found to contain large quantities of blue-green algae. At the time this was observed the gills of the fry were heavily infested with a very minute algae identified as a species of *Ankistrodesmus* (*Ankistrodesmus*).

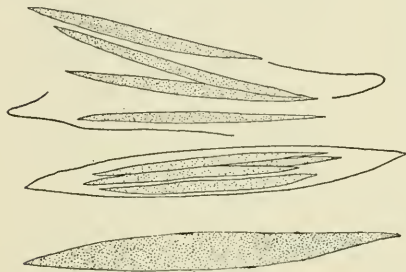


FIGURE 52. A diagrammatic representation of the method of reproduction in a solitary species of *Ankistrodesmus*.

The genus *Ankistrodesmus* is a well known member of the group of algae called the green algae. The great variety of minute plants known as the desmid, are also members of the green algae. But *ankistrodesmus* is not a desmid, as the note referred to above states, and is not related, except very remotely, to the desmids.

All of the twenty-five or twenty-six species and varieties of *Ankistrodesmus* known at the present time are long, more or less spindle-shaped, one-celled plants with sharp points at each end. Some of them are straight, others are slightly or greatly curved and crescent-shaped. Still others are greatly twisted near the center and are spiral-shaped. The first two types are usually solitary.

The last type, however, usually occurs in groups of a few to many cells. In these groups the cells are ordinarily interwoven near the center with the extremities free and pointing outward in every direction presenting a formidable appearance.

These plants reproduce in great numbers by a lengthwise division of the material within the cell wall. When each of them has divided into four parts, the old cell wall softens and becomes gelatinized and ruptures, liberating four new plants, figure 52.

The various species of *Ankistrodesmus* are distributed in all parts of the world. They have been collected from sluggish streams, small ponds and other bodies of freshwater near the sea, from mountain streams at 6000 feet above the sea and from all kinds of permanent and semipermanent bodies of freshwater



FIGURE 53. A single individual of *Ankistrodesmus spiralis* (Turner) Lemmermann collected from the lower part of the Salinas River, August, 1928.

between these extremes. Generally they are found with algae of other kinds. Occasionally they are found in almost pure stands.

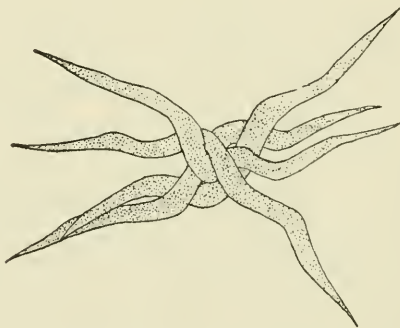


FIGURE 54. A characteristic group of individuals from the same collection. (Figures 53 and 54 magnified 950 times.)

An instance of this last kind that is of interest to persons concerned about fish culture in California happened in the summer of 1928. About August first a very nearly pure culture was taken in great abundance from the lower part of the Salinas River. The material found was the typical form of *Ankistrodesmus spiralis* (Turner) Lemmermann, figures 53, 54.—Fred Klyver, San Mateo Junior College, San Mateo, Cal.

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CONSERVATION IN OTHER STATES

FOOD PLANTED FOR MIGRATORY WATERFOWL IN OREGON

An effort has been made during the summer of 1928 to increase the food supply for migratory waterfowl by the planting of wild rice in several different sections of the state. In virtually all instances the experiments were a marked success.

Oregon is also experimenting on the introduction of sago pondweed, a favorite food of ducks, into western portions of the state. Although a common aquatic plant in lakes in eastern sections of the state, it has not been tried in coastal lakes.

This improvement of the food supply should be the means of attracting and holding large numbers of birds.

WISCONSIN SPARES THE HAWKS

The Wisconsin game commission takes exception to the theory that the only good hawks are dead hawks and declares in a circular to the public that only two kinds of hawks found in that state do any appreciable damage; namely, the Coopers and the sharp-shinned hawks. The commission protests against wholesale shooting of hawks and declares that the marsh, red-shouldered, red-tailed, and sparrow hawks are beneficial.

W. B. Grange, superintendent of game of the Wisconsin conservation commission, is authority for the classification of hawks in that state and takes the responsibility of advocating protection for all but the two kinds named above.

GUINEA FOWL TO BE TRIED IN OREGON

An experiment on the part of Mr. Simpson, superintendent of the state game farms, gives promise of success, and if it does the sportsmen of Oregon, after a few years, will hunt a new game bird in the guinea fowl. Several hundred of these birds are now being raised and plantings will be made during the coming year in the coast counties. The birds are prolific, as they start laying in February and continue until late fall. They are naturally a wild bird and can never be successfully tamed. Game departments of other states have had pronounced success with the guinea fowl.—Biennial Report of the Oregon Game Commission, 1927-1928.

MISSOURI SUPPORTS EDUCATION

Experience has shown conclusively that a large percentage of law violation is the result of ignorance. Not mere ignorance

of the laws but failure on the part of the violator to understand fully the great importance of conserving our natural resources and the emergency that exists in regard to the necessity of protecting and conserving our wild life, our forests and our streams.

To meet this condition the Protection Division has carried on an educational publicity program.

Waterproof cardboard posters setting forth the facts regarding open and closed seasons and the laws governing the same have been distributed at regular intervals to the wardens, who are instructed to post them in conspicuous places throughout their districts. The field wardens have carefully checked this line of work and have made reports on all posters observed in each district.

Wardens have reported the results of activities to the local newspapers so that all might be warned and be guided accordingly.

Special attention has been given to public meetings of sportsmen's and conservationists' organizations. When requested qualified speakers have been furnished for all such occasions. Representation has been given to many chapters of the Izaak Walton League, the Kiwanis Club, the Lions Club, the Rotarians, the Randolph County Hunting and Fishing Club, the Carthage Sportsmen Protective Association, the State Rifle and Pistol Association, the Missouri Fox Hunters Association, the Ozarkians, Commercial Clubs and many other clubs and associations interested in outdoor life and conservation.

Special attention has been given to educational radio talks and the voice of the Game and Fish Department has been heard many times from St. Louis and Jefferson City broadcasting stations.—*Missouri Game and Fish News*, Vol. 5, No. 2, Feb. 1929.

TEN-POINT BULL MOOSE LEGAL IN NEW BRUNSWICK

Guides and hunters in New Brunswick this fall will be in less danger from the bullets of over-enthusiastic fellow nimrods out after moose, for a new regulation now requires all hunters to count ten before shooting. And the ten they count must be reckoned in points on the antlers of their quarry, for it is now illegal to kill a moose in New Brunswick with antlers of less than ten points. The previous regulation permitted the shooting of six-point bulls.—*Science*, Jan. 18, 1929, P. xiv.

MINNESOTA ADOPTS REFUGE POLICY

Minnesota in planning a system of game refuges has determined upon the following policy relative to them:

1. Available.
2. Of sufficient area.
3. Correct as to climate.
4. Abundantly watered.
5. Rich in natural food conditions for a varied animal life.
6. Must not be depleted of wild life and breeding stock must be at hand.
7. Accessible.
8. Must present coordinate effort looking toward reforestation as well as wild life conservation.
9. Possibility of the reserve becoming self supporting or better.

The committee in charge also became convinced that:

1. Game laws, even where well enforced do not prevent game from disappearing and becoming extinct.
2. Settlement interferes with breeding grounds and cultivation of land destroys natural feeding grounds.
3. Large areas of unsettled land are ruined for breeding and propagation by ill-advised efforts to bring non-agricultural into agriculture.
4. State and national game preserves have demonstrated that when size, food conditions, and freedom of range exist, the natural multiplication of wild life not only fills the preserve but overflows scattering wild life into adjacent areas for hundreds of miles.
5. Species threatened with extinction come back with the game refuge.
6. Finally—states provided with game refuges large in area and suitable in nature protect their wild life while states not so providing must be content to read or hear some old settler tell about fishing in the Mississippi River, shooting deer in Renville County, and hunting moose at Pine City.

MICHIGAN BANDS TROUT

The state of Michigan is banding some of the different species of trout planted from their hatcheries. The tags are narrow strips of noncorrosive metal bent in the form of a triangle. A small slot is punched in one end and the other end forms a tongue to fit through this slot. A special tool resembling pliers presses the tongue through the tail or fin of the fish and fastens it firmly in the slot, forming the tag into a long flat band. These tags are placed on fish which have attained a size of $7\frac{1}{2}$ to 9 inches as smaller fish are unable to carry the tag successfully.

It is hoped that through this work information will be obtained as to where the trout migrate from the place originally planted; how fast they grow; how many survive the dangers of wild life in the creeks and rivers long enough to reach legal size; and whether some of them starve because their diet of ground liver has softened them and made them unfit to fare for themselves.

MICHIGAN OPENS SEASON ON PHEASANTS

Will the ring-necked pheasant in California fail to meet the test? Wise use of a new resource will be necessary if we judge by Michigan's experience. The opinion of the majority of Michigan sportsmen who went afield in the southern counties of the state during the seven-day upland hunting season which ended at midnight October 31, 1928, is that this bird failed to meet the test.

When the first season was opened on the ringnecks in the fall of 1925 it was generally believed that at last a variety of game had been found that would stand the gaff of hunting by the army of nimrods that takes the field each autumn now in lower Michigan.

Due to the fact that they could be bred by the thousands on the state game farm at Mason, that eggs from there could be sent out for hatching under domestic hens and the young birds released by farmers and sportsmen, and that the female could be protected, it was hoped the pheasant would escape the fate of the partridge under intensive gunning.

This fall, however, reports from almost every section of the pheasant country indicate the greatest scarcity of birds since they were placed on the open game list four seasons ago and there is every indication that the ringneck has not been able to withstand the strain imposed by Michigan's half million small game hunters.

WISCONSIN HUNTERS WARNED TO BE CAREFUL WITH LOADED GUNS

A boy's untimely death, caused by a rifle which had been carried in a car in an illegal manner, and the arrest of several hunters within a week for the same offense, recently brought a warning from the Conservation Commission of Wisconsin to hunters that it is against the law in that state to carry guns in cars unless they are unloaded and knocked down, or unloaded and in a carrying case.

An eight year old boy asked a passing motorist for a ride. When he reached his destination and stepped off the car, a loaded rifle which had been carelessly put

on the floor of the car was accidentally discharged and the bullet entered the lad's neck. He died shortly afterward.

The Wisconsin law prohibiting the carrying of loaded guns in cars is designed as much for the protection of the hunter as it is for the protection of game. Carrying loaded guns in cars is dangerous at any time, but it is particularly so in the winter when roads are rutty and rough.

BROADENED VIEWPOINT IN WISCONSIN

In the mind of the Conservation Commission of Wisconsin, conservation today means more than the propagation and distribution of game fishes, birds, and animals. It means more than mere sentimentality. To justify itself, conservation must mean the creation of conditions under which forests will grow, the restoration of our marshes and wild lands to attract bird and animal life, and the preservation of the beauties of nature which have made Wisconsin the most famous state in the middle west as a recreation and vacation land.

BEAVER PLANTING ON UPPER MISSISSIPPI RIVER

The attempts recently made to stock the Upper Mississippi River Wild Life and Fish Refuge with beaver colonies are beginning to show good results. The superintendent of the refuge, in a recent report to the United States Bureau of Biological Survey, which administers the new reservation, states that the beavers captured in northern Wisconsin last spring and liberated on the flats near Wabasha, Minnesota, are apparently doing well. Reservation rangers of the bureau recently discovered two fine new lodges constructed by the animals on a small slough near the place they were liberated. After seeing these, the superintendent stated that from the quantity of winter food collected by the beavers and submerged in front of the new lodges and from the extent the animals have cut the aspen and willow growth along the slough, there has been some increase from the pairs liberated. The fact that the beavers are remaining and building their lodges in the bottomland instead of following up some of the streams coming in from the hills, confirms the early opinion of the superintendent that the bottomlands are admirably adapted to beaver colonization. He considers it desirable to stock the bottomlands with beavers at various points along the three-hundred miles over which the refuge extends.

MISSOURI SHIPPED OVER 3,500,000 RABBITS TO NATION'S MARKETS FOR CHRISTMAS

Missouri supplied cities in every section of the country with rabbits for the Christmas trade this year. According to the Springfield Leader over 3,500,000 were shipped as far as New York, Boston and the Pacific coast cities. The value of these rabbits was \$450,000. These were all of them shipped from the hill country, the Ozark section.

The St. Louis Post-Dispatch carried an item dated December 10 from Laclede, Missouri, stating that as a result of a 48-hour drive by hunters in Linn County, 5000 rabbits were killed and shipped to Chicago.

Fifteen thousand live rabbits were shipped to New Jersey in December, to replenish the depleted supply of cottontails in that once great rabbit country. New Jersey had previously imported 58,000 rabbits which came from Missouri and Kansas.

It begins to look as though Missouri is going to be compelled to pass some sort of protective legislation for the rabbit. We can not forever keep on killing them off and exporting them and at the same time maintain the supply.—*Missouri Game and Fish News*, Vol. 5, No. 1, Jan. 1929.

WISCONSIN HUNTERS AND TRAPPERS MUST WEAR BUTTONS

Every hunter and trapper in the state of Wisconsin will have to wear a button this year, according to word just received from the state conservation commissioner.

The commission has received all of the 237,000 resident hunting buttons ordered earlier in the summer. Distribution of the buttons to the county clerks will be begun in time for the county clerks to issue buttons at the same time they issue licenses.

It is expected that the new button system will save bother for the hunters and work for the wardens. It will not be necessary for a warden to ask a button-wearing hunter to exhibit his license.

The hunting buttons for residents are green in color and have a white ribbon across the middle bearing the word "Wisconsin." Above the ribbon is the year and the number of the button, which corresponds to the number of the license. Below the ribbon is carried the description of the license. All trappers will have to wear buttons too. Theirs are blue in color. Nonresident hunting licenses are yellow. The buttons are about one and three-quarters inches across and can be seen for some distance.—*Fins, Feathers and Fur*, February, 1929, p. 38.

REPORTS

FISH CASES

October, November, December, 1928

	Number arrests	Fines imposed	Jail sentences (days)
Violations of Angling License Act.....	30	\$665 00	60
Violations of Commercial Fishing License Act.....	13	175 00	360
Trout: illegal spearing and netting.....	14	425 00	-----
Black Bass: undersized.....	2	130 00	-----
Night Fishing.....	1	25 00	-----
Fishing too near dam.....	2	50 00	-----
Striped Bass: over limit and undersized.....	25	880 00	-----
Salmon: untagged, closed season and spearing of.....	18	1,579 00	63
Clams: undersized and over limit.....	31	1,552 00	46
Lobsters: undersized.....	21	505 00	180
Abalones: undersized and over limit.....	33	1,000 00	-----
Halibut: undersized.....	1	50 00	-----
Crabs: closed season and undersized.....	8	325 00	10
Catfish: undersized.....	1	250 00	-----
Sturgeon: possession of.....	1	25 00	-----
Nets, traps, lines: illegal.....	8	325 00	-----
Failure to keep commercial fishing data.....	2	200 00	-----
Spotfin Croaker: possession of.....	1	50 00	-----
Totals.....	212	\$8,211 00	719

GAME CASES

October, November, December, 1928

	Number arrests	Fines imposed	Jail sentences (days)
Violations of Hunting License Act.....	106	\$2,085 00	95
Deer: spiked buck, doe, untagged, fawns; closed season.....	53	1,965 00	200
Wood ducks: killing of.....	5	100 00	-----
Ducks: over limit; closed season and selling of.....	25	1,530 00	-----
Geese: over limit.....	5	250 00	30
Sea gulls: killing of.....	2	30 00	-----
Swans: killing of.....	1	25 00	-----
Shore birds: illegal killing of.....	34	840 00	-----
Doves: closed season and over limit.....	16	340 00	-----
Quail: over limit and closed season.....	63	2,840 00	90
Pheasants: illegal killing of.....	6	-----	150
Nongame birds: killing of.....	56	1,465 00	60
Night hunting.....	55	900 00	90
Game refuge: shooting in.....	11	275 00	-----
Rabbits: closed season.....	8	161 00	37
Pigeons: closed season.....	6	175 00	-----
Squirrels (tree): killing of.....	4	235 00	-----
Fur trapping regulations: no license.....	22	482 00	19
Shooting from automobile—power boat.....	20	520 00	15
Dogs running deer.....	5	125 00	-----
Trespassing on posted land.....	18	395 00	-----
Possession of mountain sheep.....	1	300 00	-----
Totals.....	522	\$15,038 00	786

SEIZURES OF FISH AND GAME

October, November, December, 1928

Halibut, pounds	317
Sturgeon	2
Black bass	11
Striped bass	121
Striped bass, pounds	300
Calico bass	5
Trout	152
Trout, pounds	86
Abalones	120
Clams	1,200
Crabs	110
Catfish, pounds	300
Salmon, pounds	664
Lobsters	1,316
Lobsters, pounds	1,300
Spotfin Croaker, pounds	125
Pigeons	14
Shorebirds	139
Wood ducks	4
Ducks	934
Quail	738
Mudhens	4
Pheasants	9
Nongame birds	113
Sea gulls	2
Doves	214
Sage hens	3
Geese	52
Rabbits	12
Deer	17
Deer meat, pounds	346
Deer hides	5
Squirrels	1
Hides, furbearing mammals	211

PLANTS OF GAME BIRDS, STATE GAME FARM, FEBRUARY 1 TO DECEMBER 31, 1928

Ring Neck Pheasants

Location	Number planted
Red Bluff.....	150
Santa Maria.....	100
Willows District.....	452
Alturas.....	100
Cedarville.....	100
Modesto.....	150
Indio.....	100
Colton.....	200
Calipatria.....	100
Buelton.....	100
Lodi.....	200
Salinas.....	150
Sanger.....	387
Redding.....	350
Chico.....	110
Marysville.....	110
Roseville.....	100
Woodland.....	100
Weed.....	125
Healdsburg.....	190
Sonoma.....	103
Merced.....	138
Crows Landing.....	132
Los Angeles County.....	16
Gonzales.....	115
Soledad.....	110
Bakersfield.....	150
Tulare.....	131
Hanford.....	125
Orland.....	125
Rosemary Farm.....	100
Willits.....	100
Ferndale.....	100
Guadalupe.....	100
Oroville.....	100
Fall River Mills.....	100
Goat Island.....	10
San Bernardino.....	118
Ontario.....	100
Chino.....	100
Oro Grande.....	100
McCloud.....	190
Marin County.....	184
Napa County.....	131
Lake County.....	54
Total.....	6,106

Display Birds in Parks and Other Places

Location	Silver pheasants	Golden pheasants	Reeves pheasants	Ringneck pheasants	Peafowl
Eureka.....	2	2	2		
Merced.....	2	2	2	5	
Los Angeles.....	12	12			
Santa Maria.....	2	2		5	
Goat Island.....	4	2		10	2
Arizona.....	2	2			
Totals.....	24	22	4	20	2

California Valley Quail

Location	Number planted
Bakersfield.....	16
Santa Cruz.....	100
Los Angeles County.....	30
Napa County.....	40
Goat Island.....	14
Total.....	200

Arizona Turkeys (Mexican Bronze)

Location	Number planted
Eureka.....	20
Fort Seward.....	21
Kellogg (Sonoma County).....	20
Redding District.....	64
Total.....	125

Hungarian Partridges

Location	Number planted
Squaw Valley (Fresno County).....	40

Total number of birds liberated, 16,543.

STATEMENT OF EXPENDITURES

For the Period July 1, 1928 to December 31, 1928 of the Eightieth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Executive and legal.....	\$7,710 00	\$2 90	\$750 41	\$495 90	\$8,959 21
Clerical and office.....	11,302 65	570 93	2,729 14	398 21	15,000 93
Rent.....			3,225 43		3,225 43
Automobiles.....		171 57	185 25		356 82
Telephone and telegraph.....			2,416 84		2,416 84
Postage.....			1,976 03		1,976 03
Freight, cartage and express.....			1,419 11		1,419 11
Printing.....		2,656 90			2,656 90
Accident and death claims.....			1,478 75		1,478 75
Commissioners.....			96 94		96 94
Total administration.....	\$19,012 65	\$3,402 30	\$14,277 90	\$894 11	\$37,586 96
Education:					
Director and assistants.....	\$7,384 51	\$325 23	\$2,268 69	\$798 63	\$10,777 06
Pacific Southwest Exposition.....	248 75	1,014 06	1,349 13		3,611 94
Total education.....	\$7,633 26	\$1,339 29	\$3,617 82	\$798 63	\$13,389 00
Publicity:					
Director.....	\$1,650 00		\$243 13		\$1,893 13
State fair.....	357 00	212 21	730 71		\$1,299 92
Total publicity.....	\$2,007 00	\$212 21	\$973 84		\$3,193 05
Conservation and protection:					
Chief and assistants.....	4,350 00	39 55	1,097 47		5,487 02
Clerical and office.....	1,500 00	16 71			1,516 71
Rent.....			175 14		175 14
Automobiles.....		420 20	274 75	14 33	709 28
Captains and deputies.....	106,210 88	175 55	77,238 05	202 76	183,824 24
Patrol launches.....	1,050 00	903 76	817 41	285 00	3,056 17
Lion hunters.....	653 33				653 33
Coyote trappers.....	358 88				358 88
Lion bounties.....			3,150 00		3,150 00
Fish planting.....	1,260 00	801 88	2,317 58		4,379 46
Refuge posting.....	3,344 17	193 04	797 31	3 60	4,338 12
Fish reclamation and rescue.....	505 00		458 22		963 22
Total conservation and protection.....	\$119,232 26	\$2,547 69	\$86,325 93	\$505 69	\$208,611 57
Commercial fisheries:					
Chief and assistants.....	\$4,470 00	\$445 53	\$918 92	\$436 71	\$6,271 16
Deputies.....	14,919 61	51 64	4,111 80		19,083 05
Patrol launches.....	1,590 00	1,042 98	1,191 89	22 20	3,847 07
Statistical.....	3,175 00	7 08	160 78		3,342 86
Laboratory.....	18,443 39	695 80	3,388 89	205 63	22,733 71
Salmon tagging.....			39 50		39 50
Botulism.....			7,500 00		7,500 00
Automobiles.....		149 16	150 59		299 75
Carp eradication.....	1,485 84	315 10	240 35		2,041 29
Total commercial fisheries.....	\$44,083 84	\$2,707 29	\$17,702 72	\$664 54	\$65,158 39
Fish culture:					
Chief and assistants.....	\$2,265 00	\$7 18	\$226 07	\$26 50	\$2,524 75
Clerical and office.....	2,070 67	25 33	134 94	158 55	2,389 49
Rent.....			61 00		61 00
Automobiles.....		1,819 80	1,040 65	52 55	2,913 00
Hatcheries.....	67,640 33	34,675 73	10,991 00	4,586 65	117,893 71
Hatcheries—additions and betterments.....				493 27	493 27
Special field investigation.....	4,530 00	1 50	1,973 16	7 18	6,511 84
Fish reclamation and rescue.....	971 00	11 42	411 92		1,394 34
Total fish culture.....	\$77,477 00	\$36,540 96	\$14,838 74	\$5,324 70	\$134,181 40
Hydraulics:					
Chief and assistants.....	\$2,820 00	\$189 00	\$820 33	\$51 32	\$3,880 74
Cooperative research work.....	1,500 00		129 78		1,629 78
Total hydraulics.....	\$4,320 00	\$189 00	\$950 11	\$51 32	\$5,510 52

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1928 to December 31, 1928 of the Eightieth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Game propagation:					
Game farm—Yountville.....	\$4,745 44	\$4,321 92	\$1,297 68	\$836 12	\$11,201 16
Automobiles.....		56 66	55 71		112 37
Total game propagation.....	\$4,745 44	\$4,378 58	\$1,353 39	\$836 12	\$11,313 53
Research:					
Chief and assistants.....	\$7,095 03	\$220 29	\$956 94	\$70 00	\$8,342 26
License commissions.....			\$28,430 25		\$28,430 25
Total Division of Fish and Game.....	\$285,606 48	\$51,537 70	\$169,427 64	\$9,145 11	\$515,716 93

	Detail	Total
License sales:		
Angling, 1927.....	\$1,040 00	
Angling, 1928.....	250,549 20	
Angling, 1929.....	75 00	
Hunting, 1928.....	216,844 00	
Hunting, 1929.....	335 00	
Market fishermen's licenses, 1928-1929.....	28,120 00	
Wholesale fish packers' and shell fish dealers', 1928-1929.....	925 00	
Game breeders' licenses, 1928.....	102 50	
Game breeders' licenses, 1929.....	12 50	
Fish breeders' licenses, 1928.....	55 00	
Trapping licenses, 1928-1929.....	4,272 00	
Commercial hunting club, 1928-1929.....	2,025 00	
Commercial hunting club operators' licenses, 1928-1929.....	575 00	
Deer tag licenses, 1928.....	88,036 80	
Total license sales.....		\$592,967 00
Other income:		
Game tag sales.....	\$29 34	
Court fines.....	45,607 30	
Fish packers' tax.....	59,226 44	
Kelp tax.....	10 48	
Fish tag sales.....	3,162 27	
Crawfish inspection.....	21 00	
Miscellaneous sales.....	253 53	
Interest on bank deposits.....	2,952 98	
Total other income.....		\$111,263 34
Total income.....		\$704,230 34

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1928

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	Del Norte, HuHboldt.....	Mendocino, Sonoma, Lake..	Marin.....	Solano, Yolo.....	Sacramento, San Joaquin....	Alameda, Contra Costa...	San Francisco, San Mateo.....	Santa Cruz.....	Monterey.....
Anchovies.....							4,210		1,970
Barracuda.....									950
Bonito.....				193	7,396	1,981			
Carp.....				1,718	81,644	54,302			
Catfish.....		17,375					119,853	11,178	63,996
Cultus Cod.....	730	11,277	125				49,434	1,087	477
Flounders.....	400	7,590					234,177	8,130	25,850
Grayfish.....							21,747	1,730	
Flake.....							7,785	605	5,631
Halibut.....	43,549	257			23,067		74,300	125	
Hardhead.....			80,808			2,550			
Herring.....								6,009	18,185
Kingfish.....								889	290,892
Mackerel.....									21,658
Mackerel—Horse.....									
Mullet.....									
Perch.....	2,357		9,162					22	1,380
Pike.....				108	203	793			
Pompano.....									
Rock Bass.....								78,949	476,992
Rockfish.....	12,950	8,856					224,032	90,863	15,977
Salblefish.....	110,340						79,845		
Salmou.....	137,203			452	325	1,184		19,677	1,559
Sardines.....		5,200					238,270	250	47,009,406
Sardines.....							16,439,791	607	789
Sculpin.....									
Sea Bass—Black.....								160	304
Sea Bass—White.....									
Shad.....			10,274		245	3,976			
Shad—Buck.....				1,500	72	294			
Shad—Roe.....					16				
Sheepshead.....							133,616	4,455	33,004
Skates.....								82	
Stripjack.....	1,536							7,898	10,296
Smeit.....	53		7,066			631	6,787	251,233	26,595
Sole.....		44,210					1,891,529		

Spittail.....						52,534			
Striped Bass.....			3,000						
Swordfish.....			19,469						
Tomcod.....								1,450	
Tuna—Bluefin.....									
Tuna—Yellowfin.....								600	
Turbot.....								1,206	75
Whitebait.....									
Whitefish.....									
Yellowtail.....									
Miscellaneous.....		85						4,052	3,067
Total fish.....	309,203	95,935	107,599	13,515	140,455	118,161	19,549,179	484,640	48,009,059
Crustaceans:									
Crabs.....	19,336					812	475,1392	443,080	772
Shrimps.....			395,420				49,936		
Spiny Lobsters.....									
Mollusks:									
Abalones.....									321,350
Clams—Cockle.....			5,187						
Clams—Mixed.....	2,664							45	1,314
Clams—Pismo.....									
Clams—Softshell.....			17,096			12,285	9,448		
Cuttlefish.....							176		1,239
Oysters—Eastern.....							493,500		
Oysters—Native.....			183,616				5,050		
Squid.....									53,792
Miscellaneous:									
Turtles.....									
Totals.....	321,203	95,935	708,918	13,515	140,455	130,753	20,458,681	527,790	49,386,826

All amounts shown in pounds unless otherwise specified. Albacore and skipjack cleaned.

- 1 389 dozen.
- 2 834,620 shell oysters.
- 3 13 dozen.
- 4 31,308 dozen.
- 5 425,000 shell oysters.
- 6 1,785 dozen
- 7 3 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1928

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	San Luis Obispo, Santa Barbara, Ventura.....	Los Angeles.....	Orange.....	San Diego, Imperial.....	Total.....	Fish from South of the International Boundary brought into California via San Pedro..	Fish from south of the International Boundary brought into California via San Diego..	Total fish from south of the International Boundary brought into California..
Anchovies.....		4,415			10,595			1,174,766
Barbacuda.....	147	38,820	970	34,137	75,030	1,091,231	83,535	1,174,766
Bonito.....	112	24,997		5,780	30,889	642,790	21,937	664,747
Carp.....					9,570			
Catfish.....	20	145			155,039			
Cultus Cod.....		250			207,324			
Flounders.....		32,676			300,833			
Grayfish.....		46,700	135	8,633	23,497	1,123	17,058	18,181
Hake.....	53,195				166,490			
Halibut.....	80				28,067			
Herring.....		82,404	60	15,589	173,452			
Kingfish.....		1,167		1,167	112,417			
Mackerel.....	3,279	15,291,162	319,494	740,360	16,648,203	1,544	11,196	11,196
Mackerel—Horse.....		170,418			192,076			1,544
Mullet.....			11	1,945	1,956			10,302
Perch.....	1,101	19,056			41,575		100	100
Pike.....					1,104			
Pompano.....		245			245		606	606
Rock Bass.....	1,685	23,443	22,783	18,066	65,977	7,389	24,581	31,970
Rockfish.....	12,524	339,863	1,084	204,068	1,359,318		4,938	4,938
Sablefish.....		23	15		297,063			
Salmon.....					139,164			
Sandals.....		2,422			237,158			
Sardines.....	97	70,281,437	20	57,740	133,788,741			
Scupin.....		11,372	727	16,287	29,782			
Sea Bass—Black.....	220	8,990	9,970	27,415	46,595	8,648	79,161	87,809
Sea Bass—White.....	8,402	38,044	6,490	26,997	101,950	104,746	56,659	161,405
Shad.....					5,721			
Shad—Buck.....					366			
Shad—Roe.....					16			
Sheepshead.....	577	115,866	747	16,135	133,325	188		188
Skates.....		6,414		765	178,254			
Stripack.....	112	53,458		153,864	207,516	1,723,421	2,710,838	4,434,259
Stimt.....		86,571	67,029	4,677	194,218	1,092		1,092
Sole.....	26,580	10,051		1,665	2,251,936			

Solifital.....							3,000					
Striped Bass.....							81,637					
Swordfish.....							105,018					
Tomcod.....							1,450					
Tuna—Bluefin.....		55,443		487		49,088	1,027					
Tuna—Yellowfin.....		6,804				79						
Turbot.....							1,303					
Whitebait.....		36,095		339		33,605	70,039					5,547
Whitefish.....		37,907		49		151,883	189,839					522,581
Yellowtail.....		17,719		731			27,529					3,959
Miscellaneous.....												
Total fish.....		109,958	86,843,210	431,141		1,570,992	157,785,047	7,271,825	10,383,591	7,271,825	10,383,591	17,655,416
Crustaceans:												
Crabs.....							804,192					
Shrimps.....							445,356					
Spiny Lobsters.....		32,610	106,629	15,109		61,063	215,411	350			225,672	226,022
Mollusks:												
Abalone.....		4,359					325,709					
Clams—Cockle.....							5,187					
Clams—Mixed.....							2,689					
Clams—Pismo.....		23,715	25				25,074					
Clams—Softshell.....							38,829					
Cuttlefish.....							1,440					
Oysters—Eastern.....							927,116					
Oysters—Native.....							5,050					
Squid.....							53,792					
Miscellaneous:												
Turtles.....										155		155
Totals.....		170,642	86,949,864	446,250		1,632,055	159,783,047	7,272,175	10,609,418	7,272,175	10,609,418	17,881,583

* 33,508 dozen.

* 1,259,620 shell oysters.

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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 15

SACRAMENTO, JULY, 1929

No. 3

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HISTORY OF THE FISH AND FISHING CONDITIONS OF LAKE TAHOE

By W. H. SHEBLEY, In Charge Bureau of Fish Culture.

There has been considerable agitation during the last few years by the resort owners and a certain class of anglers that fishing conditions in Lake Tahoe are not as good as in former years and that something should be done to improve the conditions of fishing in this lake, particularly by the Division of Fish and Game.

Present conditions of Lake Tahoe are the result of a long chain of causes and effects. To have an adequate understanding of them, it is

necessary to review the events that have occurred in the past and the changes that have taken place since the advent of the first comers to the lake.

Lake Tahoe, or Lake Bigler, as it was first named, was discovered by General John C. Fremont in 1849. The first white men to explore



FIG. 55. Splendid catches of trout are still to be made in the deeper parts of Lake Tahoe during the summer months. Photograph taken in Meeks Bay by John Work, July 24, 1926.

around Lake Tahoe found it one of the most prolific of fish life of any body of water within the confines of the United States.

The area of the lake is 193 square miles. Its altitude (lake surface) during seasons of normal snow and rainfall is 6225 feet. It is the largest body of fresh water in the United States at such an altitude. Approximately three-fourths of the lake is in California and one-fourth in Nevada. There are 27 tributary streams flowing into it. In past years these streams furnished spawning grounds for the trout of Lake Tahoe. They ascended these tributary streams during the spawning season from March to August by countless thousands.

The outlet of Lake Tahoe is the Truckee River which empties into Pyramid Lake in Nevada. The same species of trout are found in Pyramid Lake as in Lake Tahoe. Before conditions were changed the run of trout during the spring months when the spawning season was on from Pyramid Lake and Mud Lake up the Truckee River, and as far as Lake Tahoe was beyond computation. Trout actually went up in the hundreds of thousands. They ascended even into Donner Lake, Donner Creek and entered the Little Truckee River and other tributary streams of the main Truckee.

With the opening of the Virginia City mines and the construction of the Central Pacific Railroad through this country, the streams were trapped. Market fishermen, both Indians and whites, operated on the lake and on its tributaries and took out hundreds of tons of valuable trout each year. Most of the trout taken were used in the construction camps of the Central Pacific Railroad Company and in the mining camps at Virginia City, Gold Hill and other places in Nevada. Some were shipped to San Francisco. After the opening of the railroad, shipments were made to all places where the fish could be delivered before spoiling. There were no means of control and operations were carried on without hindrance from anyone. There was no patrol system and when one was established, no one could be convicted. Fishing was continued throughout the year.

Permanent traps were constructed on the principal streams, such as Meeks Creek, Phipps Creek, McKinneys Creek, Blackwood Creek, Ward Creek, and in fact, wherever the traps could be easily installed. In some instances, the entire run was taken and shipped to the markets. In other cases, the run was used as food in the lumber camps that opened up around the shores of the lake. The fish were not only taken by traps, but by gill nets and seines and every other known device. By 1888, the abundant supply was exhausted and signs of depletion were not far off.

The sawmill owners built dams near Verdi, Nevada, and up to the outlet of Lake Tahoe in order to hold back the water to float the logs to the mills. These dams effectively broke up the run of fish that ascended the Truckee River to Lake Tahoe. The mills dumped all the slabs, saw dust, shavings and every sort of mill refuse into the Truckee River until an immense bar was formed at the mouth of the Truckee River. Composed of sawdust, this extended into Pyramid Lake for a mile or more and at a depth of several hundred feet. This destroyed the great run of fish in Lake Tahoe. The only streams that kept up the supply and prevented the entire lake from becoming depleted of its fish life were the tributary streams.

Early efforts of the Fish and Game Commission to restore the depleted waters of Lake Tahoe were futile. There was neither money for extensive hatchery operations nor for warden service. A small hatchery was constructed in 1880 by John Hurley under a permit from the commission. The hatchery was supervised by I. C. Frazier, at that time one of the leading fish-culturists of California. The small number of eggs that were collected and hatched, however, were ineffectual in restoring the depleted run.

In 1889, the commission managed to get an appropriation of \$5,000 a year from the legislature for fish cultural purposes. The commission decided to erect a hatchery and to see if they could possibly restore the run of fish in Lake Tahoe. This sum was not set aside for the specific purpose of propagating fish for Lake Tahoe, but for the entire State of California.

The Mt. Shasta Hatchery, then known as the Sisson Hatchery, had been completed the year before. Other hatchery work had to be carried on. The commission was busy introducing foreign species of fishes. Nevertheless, the commission concentrated its efforts, however feeble, at Lake Tahoe. The work was under the able supervision of John G. Woodbury, then superintendent of hatcheries who spent his money and time to carry it on. The writer, then an apprentice fish-culturist, with the assistance of E. W. Hunt, recently deceased, assisted in this work.

While the commission was making this effort to establish a hatchery, and restore the greatly depleted number of fish in Lake Tahoe, as well as to stock the barren lakes located in the glacial basins in the higher ranges to the west and southwest of the lake, the resort keepers, market fishermen and others, resisted as far as they possibly could. The lives of those who were engaged in the work were even threatened.

It was an almost hopeless task to do anything with the Truckee River. The sawmills had the river completely blocked with their dams and mill ponds. Nearly all the fish that came up from Pyramid Lake to deposit their eggs were destroyed by sawdust, slabs and the like. So great was this pollution of the river that the writer, as a boy, in the early eighties, saw the Truckee River in the summer months, practically colored white by the immense amount of sawdust coming down from the large mills operating on the river. He saw the remaining trout trying to force their way up through this deleterious mass almost as thick as mush. Very few survived and soon none could be seen except now and then in some little tributary stream of the Truckee River.

In 1883, a hatchery was established in Nevada County near the town of Grass Valley. This was on the line of the Nevada County Narrow Gauge Railway on the property of J. V. Shebley, one of the early fish-culturists of this state. He had a pond system on his farm which the Board of Fish and Game Commissioners thought was a suitable and desirable place to operate a small hatchery. Funds had been so limited and, as there was plenty of fish in other lakes and streams, particularly in the head waters where there was very little mining, very little real effort had been made to restore that which the pioneers had destroyed. This operation, therefore, marks the beginning to stock some of the depleted waters of the foothill streams that had been destroyed by mining debris. The pioneers had been after gold and cared not whether any fish survived or not.

James A. Richardson, an employe of the commission, was sent to Lake Tahoe early in June, 1883, to collect a number of black-spotted trout eggs. The plan was to hatch these eggs and the resulting fry were to be returned to Lake Tahoe, Donner Lake and other lakes that at that time were particularly in need of restocking. Richardson operated traps at Meeks Creek, Phipps Creek and in Incline Creek in Nevada state by a permit issued by General Carey, then Nevada fish commissioner, and the result of his season's operations produced not to exceed 250,000 eggs. This insignificant yield is an illustration of conditions in Lake Tahoe when the commission started its first work of restocking.

The great balance of nature had been destroyed. It is well known by biologists that when a balance of nature is once established in a river



FIG. 56. Tahoe Hatchery, near Tahoe City, Placer County. Photograph by M. K. Spaulding, August, 1920.

or lake, nature produces practically the same amount of food, aquatic plants and fishes each year. Otherwise, if there was a gradual increase of different life forms, at the expense of the rest, one species would soon predominate to the detriment of the others. When the balance of nature was established in Lake Tahoe ages ago, there was not in general more fish one season than in another. In other words, each pair of adult fish or mature spawners produced at the end of the life cycle, only one more pair to succeed them. All the others were removed by predatory animals or birds, and by their own kind, for trout are by nature cannibalistic.

When civilized man began his destructive methods and disturbed the balance, artificial means were necessary to offset the loss. In the state

of nature probably not over 3 to 5 per cent of the eggs are fertilized. Those eggs that become fertilized and hatch into living embryos and develop into fish are destroyed to the extent that by the time maturity is reached there is but one pair resulting from each pair as progenitors. Through the artificial process, 80 to 90 per cent of the eggs are fertilized, and the resulting young reared to suitable size. Because of this, the

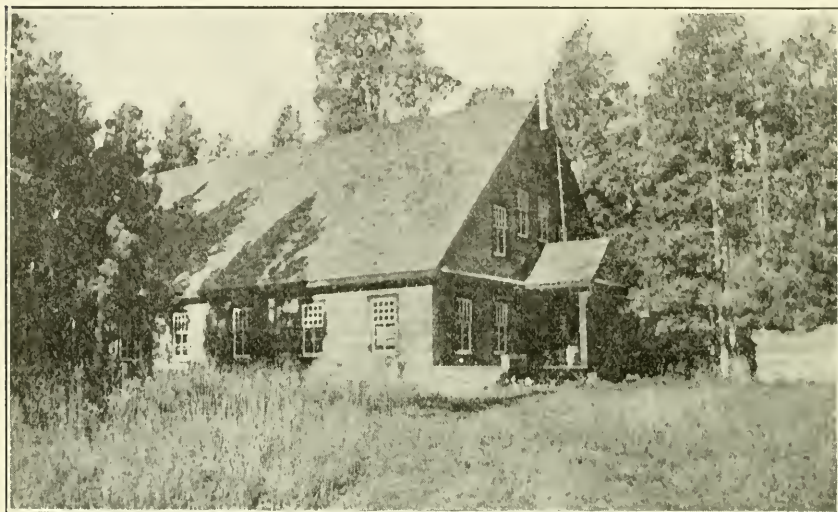


FIG. 57. Tallac Hatchery, at the mouth of Taylor Creek, near Tallac, El Dorado County.

artificial process multiplies the fishes many fold. If the hatcheries are properly handled, the eggs and fry kept free from disease and the fish properly planted, the balance of nature can be restored so that a great many fish can be taken from the run each year for human consumption and still enough remain to furnish the spawners for future generations. The greatest loss among artificially raised fish is caused by diseases. Where healthy fish are planted, they will certainly develop and produce adult fish. Fish culture, or aqua culture as called by some, is just as scientific a piece of food producing work as agriculture, or other means used by man in producing food and maintaining conditions so that the human family will have food enough to subsist on.

In 1889, when the Fish Commission started operations in the old Tahoe Hatchery, just north of Tahoe City, it faced a very discouraging problem. The chief obstacles were the market fishermen and others who persisted in the destruction of fish life in the Truckee River and the tributary streams of Lake Tahoe. For several years a continuous war was waged but without any results. The local courts were influenced by local sentiment and by owners of saw mills. They desired to stand in with the majority of the people, who, regardless of whether there would be any fish for the coming generations, cared not how many fish were destroyed as long as they themselves could reap the benefit. It was cheaper to dump the sawdust into the river than to burn it. It was easier for the market fishermen to catch the fish off the

spawning beds when the fish were trying to propagate. Since their whole energies are devoted to producing and fertilizing their eggs, fishes care not who approaches them at that time for their spawning instinct predominates over all other senses. They fall an easy prey to their natural enemies and particularly to man, who can easily spear, snag or trap them.

In the long struggle which ensued, the commission and its agents were criticized, threatened and charged with all kinds of misdemeanors. It was not until 1897 that the Fish Commission, through Attorney General W. F. Fitzgerald, succeeded in getting an injunction from the superior court of Nevada County to enjoin the Truckee River Lumber Company from dumping debris in the Truckee River. This decision was appealed to the Supreme Court of the state. In a decision rendered by Judge Van Fleet, the restraining order of the superior court of Nevada County was upheld and the milling interests were compelled to dispose of their refuse matter, sawdust, shavings, edgings

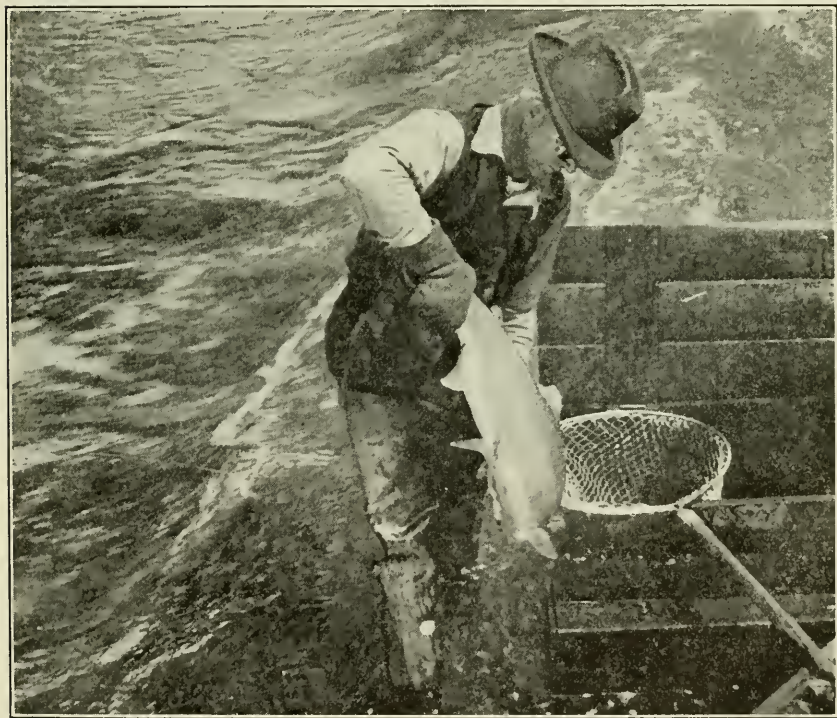


FIG. 58. Taking spawn from a ten-pound Tahoe black-spotted trout. Taylor Creek, El Dorado County. Photograph by Joseph H. Sanders, May 1, 1922.

and other mill waste and deleterious substances in some other way than passing it into the waters of the Truckee River. This was the first real victory in the battle to save the fish in Lake Tahoe and Truckee River.

Prior to this, the upper reaches of Truckee River had been stocked with a few rainbow trout that had been hatched at the I. C. Frazier

Hatchery under the supervision of the commission. These were planted above the worst of the polluted area and where a few of these fish could be found.

In the fall of 1889, the commission built the Tahoe Hatchery and began operations to increase the fish in Lake Tahoe by hatching as many eggs as possible. This was just after a year of great drought, 1889 being one of the driest seasons in the history of the state prior to the summer of 1924. In October, 1889, the water practically ceased running out of Lake Tahoe. All the water in the Truckee River had collected in small pools and percolated through the gravel from pool to pool. During the winter of 1889 and 1890, one of the deepest snows of many years fell, in fact, one of the deepest snows that there is any record of since the advent of white men in this country. There was an assurance of a bountiful supply of water for the summer of 1890. The creeks would all be booming and if there were any considerable number of fish in Lake Tahoe, they would ascend the streams in great numbers to spawn.

John G. Woodbury was at this time directing operations for the commission. The writer, accompanied by E. W. Hunt and a crew of five or six men arrived at the lake the latter part of March, 1890. Immediately the work of constructing traps was begun and arrangements made to collect spawning fish near the mouths of the different streams. Traps were constructed in Ward Creek, Blanchard Creek and Taylor Creek, and on Incline Creek in Nevada under permit issued by the Nevada commissioners. Seining crews operated at the mouth of Taylor Creek and off the mouth of Blackwood Creek. The work continued until August 23 and during the entire time less than 600,000 eggs were taken.

Owing to some biological reason, the fish did not ascend the streams to spawn or come near the shores in 1890, but there was a considerable number in the lake. A few were taken by market fishermen from very deep water in the center of the lake known as the "Pot Hole." In 1891, efforts were again renewed in an attempt to take eggs on the lake with better success. The market fishermen made statements that the fish were exterminated and that they could not be restored by any means.

The commission concentrated its efforts at Taylor Creek and from that time on, 1890 to 1895, there was an increase in the number of eggs taken. The largest number taken during this period was 2,500,000 in 1895. In 1896, 3,803,000 eggs were collected at the mouth of Taylor Creek. The maximum yield, however, did not come until 1909 when 6,130,000 eggs were collected. These eggs were hatched in the Tallac Hatchery and in the Tahoe Hatchery. The resulting fry were distributed in tributary streams of the lake and fishing increased in proportion. In 1914, the run of fish was still good, 5,549,000 eggs being collected. About this time the advent of the automobile brought thousands to the lake. They camped along the lake and streams. They caught the small fish before they descended to the lake.

As an illustration of how the artificial propagation and planting of fry maintained the run of fish in Lake Tahoe Basin, there were some 250,000 to 500,000 fry deposited in Taylor Creek each season and from these plants enough adult fish reached the mouth of Taylor Creek

each year so that with but very little effort, from three to five millions of eggs were collected annually for a period of twenty years. However, when the water of Fallen Leaf Lake was held back by a dam constructed at its mouth, the Taylor Creek station yield fell off rapidly. The fish were no longer attracted to the mouth of Taylor Creek and were compelled to search for other spawning streams.

There were from 80 to 115 market fishermen operating on the lake. The resort keepers and others during this time were diverting the water for domestic purposes and for irrigation. It is true, the large number of fish taken from the lake and the destruction of spawning beds in the tributary streams have all had a tendency to reduce the number of fish. Nevertheless, the most malicious agency in later years was the fishing out of the tributary streams. All the small fish were thus removed before they had attained the proper growth.

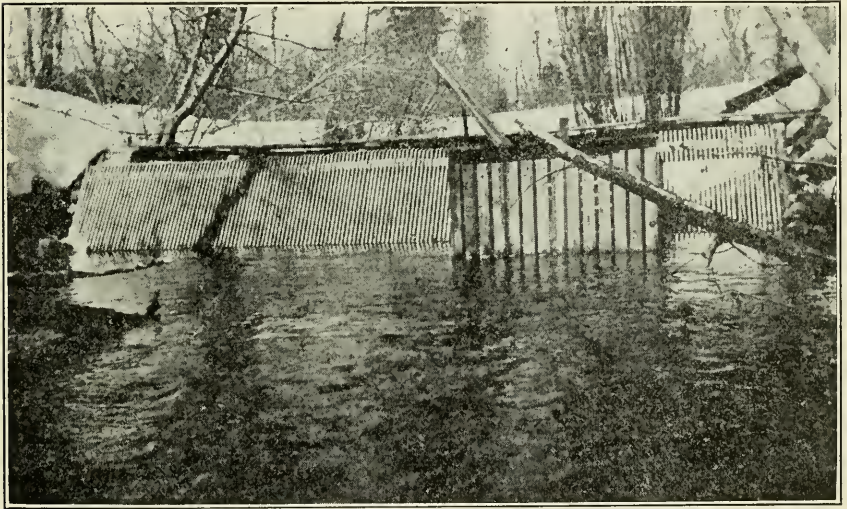


FIG. 59. Taylor Creek racks and traps for capturing spawn-bearing black-spotted trout, Taylor Creek, El Dorado County. Photograph by Joseph H. Sanders, April 1, 1922.

The native trout of Lake Tahoe do not feed near the surface during warm weather. They are not surface feeders at any time in fact. During the warm portion of the summer months, they descend to a considerable depth, following the plankton on which the minnows feed. This has been true of the lake ever since the fishermen began their operations. Only the old time fishermen who made a life study of the fish and on which they depended for a livelihood could find them during the warmer months of the year.

Since the nonsale of trout in California, the market fishermen have left these parts. Those who are engaged in fishing now are the tourists who do not take the time or have the patience to find the fish. There is, no doubt, a goodly number of fish in Lake Tahoe. Many fish could be caught if their feeding grounds during the summer months could be found by the average tourist. This fact is easily proven during the first few weeks of the open season when the water is still cold on the

surface and the creeks are running streams of icy water into the lake. Then fishing is very good for those who know how to fish. There never was any great fishing in the shallow waters on the west shore of the lake, particularly off Tahoe Bay and opposite Tallac where the water was shallow, but fish can be taken at Brockway, off Rubicon Point, Zephyr Point, Cave Rock and other places where the water is deep and where proper methods and tackle are used.

An effort to introduce surface feeding fish by the division has been made by planting steelhead and rainbow trout in Lake Tahoe. It is predicted that in a very few years, if this work can be increased to proper proportions fly fishing and sport fishing of every kind will be found on every part of the lake.

Resort keepers should bear in mind that every inch of water they take from the tributary streams for irrigation and domestic use is



FIG. 60. Fish trap on Wood Creek, El Dorado County. Photograph by Joseph H. Sanders, May 1, 1922.

that much water less in which the fish can be raised. Several creeks have been diverted entirely for the beautifying of the grounds around the resorts. This may be very attractive to the resorts, but it is very hard on the fish. If the resort keepers desire to have fishing in Lake Tahoe, they must unite with the division in an effort to prevent all fishing in the streams tributary to the lake at all times of the year. Fishing must be confined to the main lake or the higher lakes above Lake Tahoe. The tributary streams must be left to flow undisturbed and the fry planted in them left unmolested.

During the spring of 1928 all the streams tributary to Lake Tahoe on the California side, on the recommendation of the division, were by an executive order of the Governor through the endorsement of the Director of the Department of Natural Resources, closed to fishing. This action will in a few years restore the fishing in Lake Tahoe, providing the closed area is respected.

In the opinion of the writer, when the young of the trout are held in the ponds, tanks or the hatching troughs, until they are five to eight inches in length, they become domesticated, fat, less active and lose their wild instincts. As a consequence, they fall an easier prey to the predatory fishes than when they are planted at a smaller size. The stomach contents of the large lake trout of Lake Tahoe and other places, on examination, will furnish all the evidence necessary to substantiate this contention.

Considerable comment has been going on among anglers and others regarding the predatory habits of the Mackinaw trout and condemning the division for introducing this species. The Mackinaw trout were introduced into Lake Tahoe at the request of the resort keepers and market fishermen and recommended by the United States Bureau of Fisheries. The state of Nevada introduced the first Mackinaw trout into Lake Tahoe about 1890 or 1891. The California Commission planted one lot of Mackinaw trout in 1895 with the consent and recommendation of the United States Bureau of Fisheries, who are still introducing these fishes in the larger lakes of the northwest according to their reports. Mackinaw trout are not any more predatory or cannibalistic than any other species of large trout. A careful analysis of the stomach contents of the silver trout of Lake Tahoe, the same size as the Mackinaw trout, will show they will devour as many of the minnows and trout from four to six inches in length as do the Mackinaw.

The number of Mackinaw trout in Lake Tahoe is not great enough to make any appreciable decrease in the other species. They are gradually increasing and may become plentiful in Lake Tahoe if the spawning area in the lake for this species is large enough to accommodate the spawners. Mackinaw trout do not enter the creeks to spawn, but deposit their eggs on reefs, in from four to eight feet of water. Here the wave action causes the moving of the water over the nests and this action of the water cleans and aerates the eggs just as running water does on a riffle in a stream. There are very few places in Lake Tahoe for the Mackinaw to spawn. In the opinion of the writer, the number will always be limited unless there are more spawning grounds in the lake than are at present known. The Mackinaw is a very fine food fish. It does not rise to a fly and therefore does not afford sport fishing, except for bait and spoon.

THE WHALES OF CALIFORNIA

By PAUL BONNOT.

Many people, even today, think of whales as being fish. In fact, there are numerous misapprehensions in regard to the cetaceans. Whales are mammals. In other words, their young are born alive and are fed on milk from mammary glands. The body temperature is approximately the same as any other warm-blooded animal. Because of the environment in which they live, the whales have a much modified body form. The fore legs have changed to flippers; the hind legs have, according to some authorities, gone to make up the caudal fin or flukes. The hair which once covered the body (the embryos of some

whales are still covered with hair at certain stages in their development) has disappeared and has been replaced by a covering of blubber, or spongy tissue, which lies between the epidermis and the body and is impregnated with oil. This blubber varies in thickness from an inch to ten or twelve inches, depending on the species, the size and the condition of the whale. The whale breathes with lungs, of course, like any other mammal. The spout, which the ancient observers considered a fountain of water, is nothing but the exhausted air being expelled from the hot, moist lungs into the colder atmosphere. The spouts of different whales are characteristic, some spouting in a straight, tall column, others having a low "bushy" spout, and the spout of the sperm whale is at an angle of forty-five degrees. Most of the larger whales when traveling will spout quite regularly. They will spout from three to eight or ten times and then run submerged for ten minutes or so, and repeat. The question of the ability of whales to remain submerged has never been satisfactorily settled. It has been claimed that the larger whales can remain below for an hour or more. The sperm whale descends to enormous depths to find the giant squid and cuttlefish on which it feeds. It is so constructed that it can withstand the tremendous pressure in the submarine valleys where its prey is found.

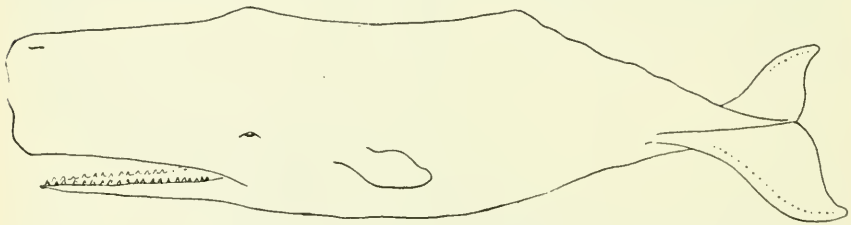


FIG. 61. Sperm whale (*Physeter macrocephalus*). (After Scammon, Marine Mamm. pl. XIV.)

In some popular science articles dealing with the little known animals, such as the whales and their possible ancestors, the extinct *Zeuglodonts*, the tendency is to produce animals of enormous size. The writers of these articles have apparently no conception of the physical difficulties which would embarrass an animal which outgrew its environment. No animal known to science has ever exceeded the size and bulk of the great blue whale (*Balaenoptera sibbaldii*) which is found in all the oceans of the world today. The blue whale grows to ninety or one hundred feet in length, with an approximate weight of one hundred tons. The only reason whales can attain such size is because of the supporting medium in which they live. At the other end of the size scale are the little dolphins, some of which are only three or four feet in length.

Whaling in California.

In 1787 four British whalers cruised for whales in the Pacific Ocean, presumably off the coast of South America. These were the first recorded whalers to enter the Pacific. Four years later, in 1791, seven American whalers rounded the Horn and worked along the coast of Chili. Six of these ships were from Nantucket and one was from New

Bedford. For many years thereafter the whalers gradually explored the Pacific. In 1838 the great Northwest Coast Grounds were discovered, and the whaling fleet working this area began to make its headquarters at San Francisco, in order to save the long and dangerous passage around the Horn. The oil was at first taken to the east coast by boat, but later the transcontinental railroad made it easy and convenient for the whaling fleet to use San Francisco as a base. Beyond furnishing ports of call for the whalers, California did not figure very much in the early whaling. In 1851 the first shore whaling station was established and shore whaling has continued spasmodically until the present day.

The old-time methods of whaling did not affect the California whales to any extent. The sperm and the bowhead were the chief species sought and they were found for the most part in the far north and on the other side of the Pacific. The most abundant whales on the California coast were the blue whales, the California gray whale, the finback and the humpback. These, for various reasons, were not molested by the old-time offshore whalers and the shore stations worked only a small, restricted area close to shore. The blue, California gray and finback whales are fast, hard-fighting animals, and generally destroyed more gear than they were worth, besides sometimes killing a few men. The California gray was taken in the lagoons of Lower California to some extent, and the shore stations also took those that were close to shore. The humpback was easily taken and was abundant, but the oil content was small and they were not considered a profitable acquisition. Until the latter part of the last century, the sperm and bowhead were fairly abundant and the whalers followed them, rather than the humpback.

As the more valuable whales were killed off and petroleum products took the place of whale oil, the old whaling methods became unprofitable and whaling was practically abandoned by the beginning of the present century. Tower, writing in 1907, in his "History of the American Whale Fishery," says: "Within the history of this country whaling has risen, passed its zenith and has now nearly sunk below the horizon of industrial importance."

For economic reasons, therefore, the whales had a short respite and were saved from extermination for a time. A short time before the European War, however, there was a revival of the industry. A young Norwegian named Svend Foynd invented an explosive harpoon which could be shot from a small cannon. This harpoon weighs about one hundred pounds, and in the head is a heavy charge of black powder which is exploded after it enters the whale's body. The gun from which this engine is thrown is a small brass cannon, mounted on the bow of a small steamer built especially for the work. The dead whales are towed to a nearby shore station or to a mother ship by the "killer."

In the old days, only the oil and bone were utilized and the carcass was cast adrift. Today, every scrap is used. Practically the whole body is steam cooked, to extract the oil, and the residue is made into meal which is used for poultry food and fertilizer. Even with improved methods, the profit is small and the large dividends declared in the last few years by the Norwegian companies working in the Pacific and

the Antarctic are only possible because of the large number of whales they are able to capture.

The whales which were considered too fast or too vicious to be taken in the days of the hand harpoon and whale boat are the species taken by the modern whale killer. Already the world population of whales is appreciably decreased, and it is only a question of a short time until whaling will be, very decidedly, a thing of the past. The

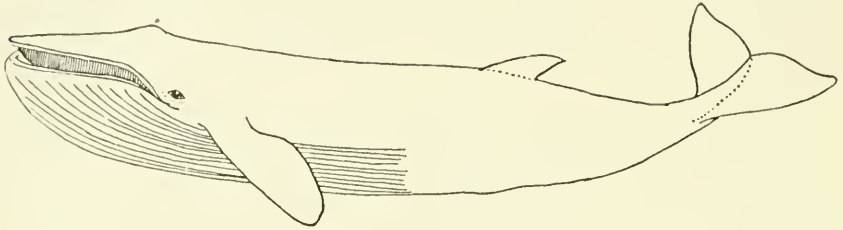


FIG. 62. The finback whale (*Balaenoptera velifera*). (After Scammon, Marine Mamm., pl. II.)

whalers' argument to the conservationist is that having become scarce enough to be commercially unprofitable, whaling will stop for lack of material, leaving the whales to "come back," which is true to a certain extent. Biologically, however, the thing has a different aspect. The whales breed slowly and such animals, after reaching a certain point, do not come back but disappear from the earth.

In dealing systematically with the whales found on the California coast, I have encountered the usual difficulty. Some of the species listed are based on descriptions and sketches, on single damaged skulls or a few bones, on minor color variations, trivial differences in external appearances and minor osteological irregularities, the result being that there are species which have no real existence at all and make trouble by cluttering the literature with a host of meaningless synonyms. Of the seventeen species considered by zoologists to be a part of the California fauna, I find that five may be synonyms of other species, and two have nothing to justify their existence except a written description and a few sketches. The remaining ten may be considered bona fide species. We place so much stress on the importance of taxonomy that we are content with our ability to manipulate Latin, forgetting the much more important things there are to be learned. We have allowed a convenient mechanical contrivance to become a dominating dogma.

CETACEA

Skull. Separation of the two parietals by the intervention of the supraoccipital, or their concealment by its overlapping. Overlapping of the muzzle generally by the premaxillae. Loose attachment between the various bones surrounding or connected with the organ of hearing. Absence or feeble development of the coronary process of the lower jaw.

Fore limb and girdle. Absence of the clavicle. Greater length of the radius and ulna than the humerus. Frequent presence of the typical number of bones in the wrist. Long and simple lungs. Unlobulated liver and complex stomach. Extraordinarily shortened but much convoluted brain.

"This combination of characters is found nowhere else among mammals, and indeed, the bulk of the peculiarities are confined to whales." Beddard, in his "Book of Whales," thus defines the order Cetacea.

Delphinidae.

The *delphinidae* or dolphins are whales of small or moderate size. They have numerous teeth in both jaws. Key to the *delphinidae* based on external characters.

Head with a beak which is usually distinctly marked off from the forehead by a constriction.

Dorsal fin absent—*Tursio*.

Dorsal fin present: falcate.

Beak distinct, short and rim-like—*Lagenorhynchus*.

Symphysis of mandible short:

Sides without longitudinal bands of color—*Tursiops*.

Sides with longitudinal bands of color—*Delphinus*.

Head without a beak, or with merely an obtuse ridge margining the upper jaw.

Crowns of teeth compressed; spade-shaped.

Dorsal fin present, triangular or slightly falcate—*Phocaena*.

Teeth conical, nearly or quite upright in the jaws.

Teeth in upper jaw deciduous; mandibular teeth few, confined to the regions of the symphysis—*Grampus*.

Teeth persistent in both jaws.

Pectoral fins very long and narrow; teeth confined to the anterior half of the rostrum—*Globicephalus*.

Pectoral fins broad, ovate; dorsal fin very high and prominent (especially in the male), size large—*Orca*.

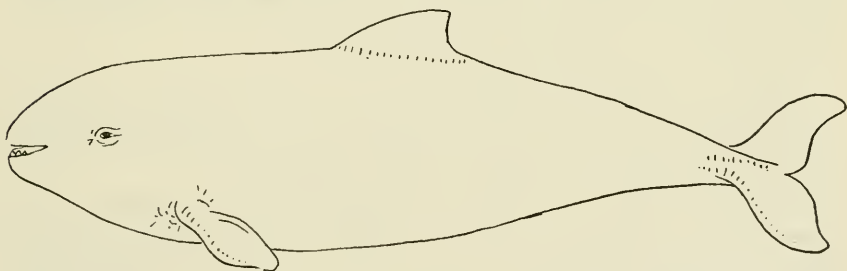


FIG. 63. Bay or harbor porpoise (*Phocaena phocaena*). (After Elliott, from photo, U. S. F. C.)

Tursiops gillii (Cowfish).

Dall, Proc. Cal. Acad. Sci., V. 1873, p. 13.

Scammon, Marine Mamm., 1874, p. 288.

This species is based on a single mandible from Monterey, California, and a skull from Lower California, both collected by Captain Scammon.

"Of the external appearance of this dolphin we know little. Scammon, from two 'momentary observations,' describes it as 'black all

over, lightened a little below.' ” “His outline resembles that of a *Tursio* except that the dorsal fin is narrower than is common in that species.” True admits *T. gillii* as a species because of certain small marks on the skull.

Delphinus delphis (Common porpoise).

Linne, Syst. Nat., 10 ed., 1758, p. 77.

There are about two dozen synonyms of this species, most of them because of the different localities in which the animals were observed. The porpoise is an animal of cosmopolitan distribution. The species attains a length of seven feet six inches. The form is slender. The forehead slopes gradually. The dorsal fin is narrow. There are from forty-six to fifty teeth. The color is extremely variable.

This is the dolphin which is found abundantly in the literature of the ancient writers and historians. Their contemporary readers not being critical, through lack of knowledge, they mixed a charming variety of fact and fiction concerning this, to them, mysterious “fish.”

The dolphin enjoys playing about the bow of a swiftly moving vessel, running at the same speed, sometimes for hours, without apparent effort.

Lissodelphus borealis (Northern Right Whale Porpoise).

Tursio, Wagler, Nat. Syst. Amphib., 1830, p. 34.

Delphinapterus borealis, Peale, U. S. Explor. Exp. Mamm., Ornith., 1848, p. 35, pl. viii, fig. 2.

Leucorhamphus borealis, Dall, in Scammon, Marine Mamm., 1874, p. 296.

I can find no valid reason why this porpoise should not be a *Tursio*. The range is given as “the west coast from Bering Sea to Lower California.” The form which occurs in the southern hemisphere, *T. peronii*, differs from *borealis* in only a few minor color variations.

Lagenorhynchus obliquidens (Striped porpoise).

Gill, Proc. Acad. Sci., Phil., 1865, p. 177.

There are several synonyms to this species, which seems a valid one. This animal is about seven feet in length. It is greenish black above, with lateral broad longitudinal stripes of white, gray and dull black; ventral surface white. There are thirty-one teeth.

This is a north Pacific species. Scammon has considerable to say regarding it. “They are seen in numbers varying from a dozen to many hundreds, tumbling over the surface of the sea or making arching leaps, plunging again on the same curve or darting high and falling diagonally sidewise upon the water with a spiteful splash, accompanied by a report which may be heard to some distance.” He also speaks of their gorging themselves with fish, thus earning the name of “sea pig” imposed on them by the whalers.

Phocaena phocaena (Bay or Harbor Porpoise).

Delphinus phocaena, Linne, Syst. Nat., 10 ed., 1758, p. 77.

Phocaena communis, Lesson, Man. de Mamm., 1827, p. 413.

The bay porpoise reaches a length of five or six feet. It is dark colored above and whitish below. It is gregarious and numbers of them

often ascend large rivers for some distance. When spouting these little whales roll smoothly, showing only a very small portion of the body. The spout is very rapid, generally only a single "Phist!"

The bay porpoise was much esteemed as a delicacy in Europe at one time and, being considered a fish, was eaten on fast days.

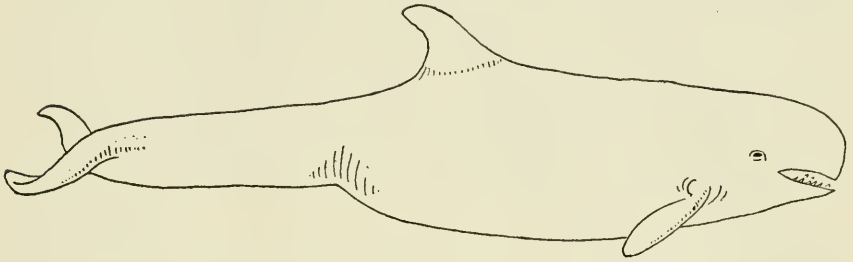


FIG. 64. The grampus (*Grampus griseus*). (After Elliott, from cast 12839, U. S. Nat. Mus.)

Grampus griseus (Common Grampus).

Grampus, Gray, Spic. Zool., 1828, p. 2, Zool. Erbus and Terror, 1846, p. 30.

Delphinus griseus, Cuvier, Ann. Mus., XIX, 1812, p. 14, pl. 1, fig. 1.

The grampus has no teeth in the upper jaw and but three to seven on each side of the mandible near the symphysis. It grows to a length of fifteen or twenty feet. The sides are slate colored, with irregular white markings. The grampus is a rare whale and, although of cosmopolitan distribution, is seldom seen.

Globicephalus scammoni (Scammon's Blackfish).

Cope, Proc. Acad. Nat. Sci., Phil., 1869, p. 22.

This species is based on one skull collected by Captain Scammon and from descriptions and drawings by him.

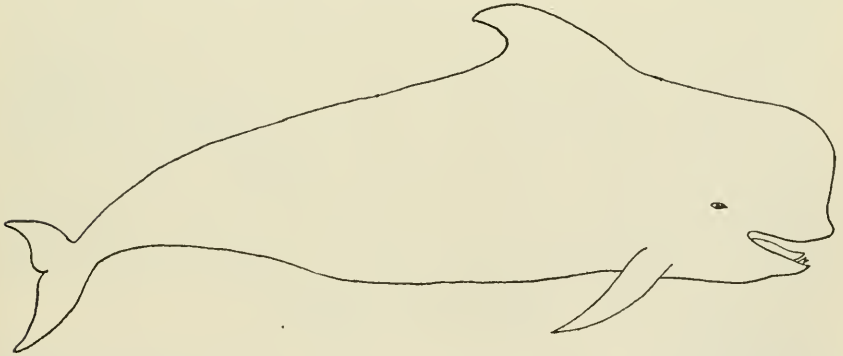


FIG. 65. The blackfish (*Globicephala melaena*). (From Trans. Zool. Soc., London, vol. 8, pl. 30.)

"The Blackfish was once abundant on the coast of Lower California. It grows to a length of fifteen feet. It is entirely black. There are eight teeth. They go in schools of from ten to one hundred, * * *. The food is squid. The oil content is small and dark in color."

Orca gladiator (Killer Whale).

Orca, Gray, Zool. Erbus and Terror, 1846, p. 33; 1866, p. 278.

Orca gladiator, Lacepede, Hist. Nat. des Cet., Paris, 1804, p. 302.

Orca ater, Gray, Sup. Cat. of seals and whales in the British Museum, 1871, p. 92.

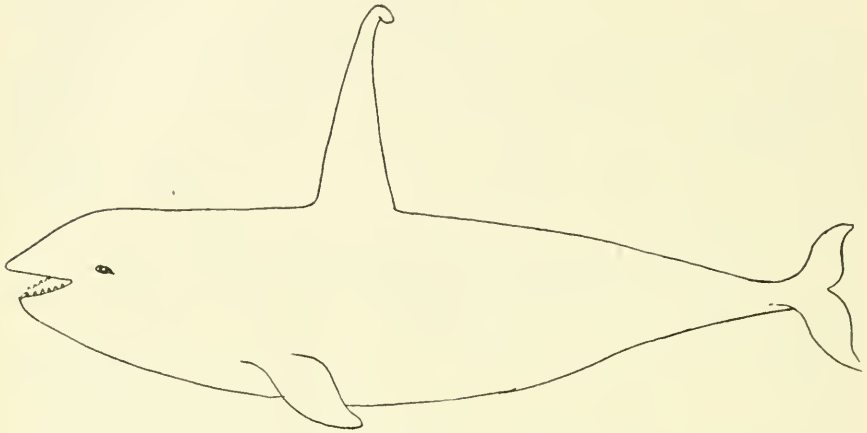


FIG. 66. The killer whale (*Orca gladiator*). (After Scammon, Marine Mamm.)

Orca rectipenna, Cope, Proc. Phil. Acad., 1869, p. 25.

O. ater, Gray, and *O. rectipenna*, Cope, are based on figures and descriptions by Captain Scammon. They are supposed to be north Pacific species. They may be simply individual variations of the killer.

The killer is a predacious whale, fast, powerful and savage. It attacks and kills the much larger baleen whales easily. It kills and eats the largest sea lion bulls, and, apparently, the only animals in the sea which do not fear it are the sperm whales and the full grown walrus bulls.

The killers grow to be twenty-five or thirty feet in length. The coloring varies but is usually some pattern of black and white. They have ten to thirteen strongly recurved teeth and a large, pointed dorsal fin.

Dr. Eschricht, in a paper read before the Royal Danish Society of Sciences May 9, 1862, describes an *Orca* (*Delphinus orca*) which came ashore dead in Jutland. This specimen was carefully dissected by Dr. Eschricht, who states that the stomach contained thirteen common porpoises and thirteen seals. He says that the seals were all flayed and the hides missing, from which he draws the conclusion that the skin, being first affected by the powerful digestive fluids, is removed by the muscular action of the stomach and regurgitated.

Physeteridae.

The *Physeteridae* or sperm whales may be defined as follows: All or most of the cervical vertebrae fused. Costal cartilages not ossified. Pterygoids thick and meeting in the middle line; symphysis of mandible long. Teeth found in both jaws, but those in the lower jaw alone functional, often very reduced in number. Pectoral fins small. Two or more throat grooves.

Physeter macrocephalus (Sperm Whale).

Linne, Sys. Nat., 12 ed., i, p. 107.

There are seven or eight synonyms for this species, based on observations of sealmen and in several cases on a few bones.

The sperm whale can be recognized at once. It has an enormous head, quite one-third of the body. The head does not taper as do the heads of all the other whales, but ends abruptly. The mandible is long and thin and studded with conical teeth. The blow hole is single and on the left side, at the end of the snout. The sperm whale grows to a length of eighty or eighty-five feet. It lives on cuttlefish and giant squid.

The sperm whale was first described by Clusius in 1605. It has a worldwide distribution. From about 1800 to the beginning of the present century, it was the basis of one of the principal industries of New England.

Primarily a whale of the open ocean, the sperm was rarely taken by the shore whaling stations but was the chief support of the offshore whaling fleets. Several sperms have been landed at shore stations in recent years by the steam killers. The sperm is a vanishing species; it is already extinct commercially.

Ziphiidae.

The *Ziphiidae* or beaked whales may be characterized as follows: Functional teeth limited to one or two pairs in the mandible only. The vertebrae not more than fifty in number. Ribs not more than ten pairs, sternal ribs permanently cartilaginous. The blowhole is crescentic with the concavity forward. The pectoral fin is rounded and not large. The dorsal fin present and falcate in form. At least one pair of folds on the throat.

Berardius bairdi (Baird's Beaked Whale).

Stejneger, Proc. U. S. Nat. Mus., vol. 6, p. 75, June 22, 1883.

This species is based on a skull from Bering Island. In October, 1904, a single male of this species came ashore dead at Ferndale, Cali-

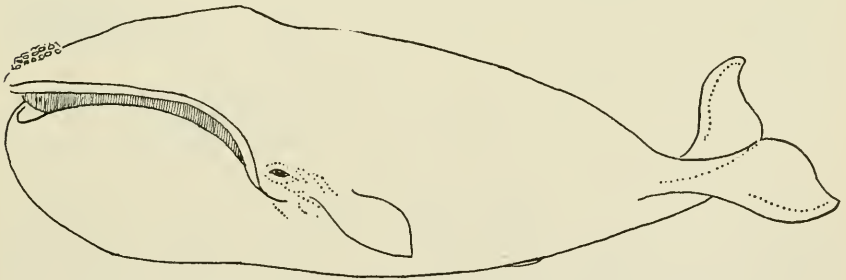


FIG. 67. The right whale (*Balaena sieboldi*). (After Scammon, Marine Mamm. pl. XII.)

fornia. This animal was forty-one feet in length. The skeleton and several photographs of it are in the National Museum. This is the only record of the species in California, as far as I know.

Balaenidae.

The *Balaenidae* are large whales which differ from the other families of whales in lacking teeth. The teeth are replaced by whalebone or

baleen; thin plates which hang from the roof of the mouth. The inner edge of the baleen is frayed out into coarse threads which strain out minute organisms from the sea water.

Balaena sieboldi (Pacific Right Whale).

Balaena mysticetus, Linn., Syst. Nat., i, p. 105.

Balaena, Gray, Cat. Br. Mus., 1866, p. 78.

Eubalaena sieboldi, Gray, Cat. Br. Mus., 1866, p. 97; 1871, p. 43.

There seems to be considerable doubt in regard to this whale. *Eubalaena sieboldi* is based on a drawing of a Japanese clay model.

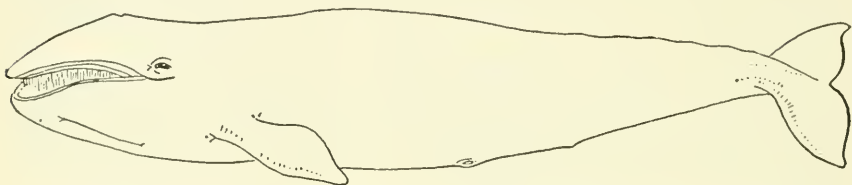


FIG. 68. The California gray whale (*Rhachianectes glaucus*). (After Scammon, Marine Mamm. pl. II.)

Scammon was the first to mention any difference in the Right whales of the North Pacific and considers this species distinct. There are no records of *B. sieboldi* since Scammon's time. By some it is considered a synonym of *B. australis*.

Rhachianectes glaucus (California Gray Whale).

Agaphelus glaucus, Cope, Proc. Acad. Nat. Sci., Phil., 1868, No. 3, June-Aug., p. 159.

Rhachianectes glaucus, Cope, Proc. Acad. Nat. Sci., Phil., 1869.

The California gray whale grows to be forty or forty-four feet in length. In color it varies from mottled gray to black. The baleen is fourteen to sixteen inches long, and light in color. As far as is known, the gray whale is limited in range to the Pacific Ocean. There is no dorsal fin, and the throat grooves are reduced to two.

This whale was the main support of the old shore whaling stations. It is a shallow water species and migrates regularly up and down the coast, to Bering Sea in the summer and to the warm lagoons in Lower California and Mexico in the winter. When the sperm fishery began to decline, a number of whalers fished the gray whale in the southern lagoons. This was an enterprise calling for considerable fortitude, as the gray is not timid and inoffensive as are most of its family. The grays will take the offensive when molested, and have earned for themselves the name of "Devil Fish." With the usual lack of foresight displayed by man in exploiting a natural resource, the gray whales were hunted until they were considered extinct. It is a rare sight to see one today on the Pacific coast. A few years ago Dr. Roy Chapman Andrews discovered a regular fishery for the gray whale in Japan. The Norwegians have taught the Japanese modern methods of whaling and they are now putting a last touch to the exterminating of this whale. There are a great many gray whales on the western side of the Pacific

and there is some speculation as to whether some of these are not California whales which have taken to the other side of the Pacific as a means of avoiding the continual persecution they received on our coast.

Megaptera versabilis (Pacific Humpback).

Cope, Proc. Acad. Nat. Sci., Phil., July, 1869, p. 17.

M. longimana, Rudolphi, Abh. Ak. Berlin, 1829, p. 133.

This species was named from descriptions and sketches by Scammon. There is no type specimen or any material. It is considered by some a synonym of *M. longimana*, the humpback of world-wide distribution.

The humpback is rather ungainly in appearance as compared with the more slender species. It is short and thick, with disproportionately large pectoral fins and flukes. The dorsal fin is represented by a low hump. There are a number of rounded "bumps" about the snout which generally support barnacles. The food consists of crustacea and small fish.

Until just recently the humpback was not molested to any extent by the whalers. The supply of oil obtainable from them is comparatively small and the baleen is short. As the more profitable species have decreased before the harpoon gun, the humpback is now taken. Although still fairly abundant they are rapidly decreasing before the onslaught of the steam whaler.

Balaenoptera velifera (Pacific Finback).

Cope, Proc. Acad. Nat. Sci., Phil., July, 1869, p. 16.

This species was named from some samples of baleen and from sketches and descriptions by Captain Scammon from a single whale. By some it is considered a synonym of *B. physalus* of Linneas.

The finbacks have always been known to the whalers as animals to be avoided. Though not pugnacious, these whales have speed and stamina,

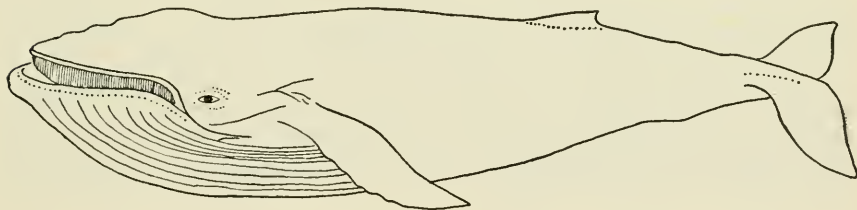


FIG. 69. The humpback (*Megaptera versabilis*). (After Scammon, Marine Mamm. pl. VII.)

as many lost whale lines and smashed boats entered the logs of the old whalers will bear witness. Many a young, inexperienced harpooner in the old days learned by bitter experience that the finback was not to be trifled with.

Balaenoptera borealis (Sardine or Sei Whale).

Lesson, Hist. Nat. Cetac., 1828, p. 342.

The sei whale has been the basis of an extensive fishery in the North Atlantic for many years. It was not known to inhabit the Pacific until, in 1912, Dr. Andrews found it common about Japan. It may be a rare visitor to California waters. It grows to be forty or fifty

feet in length. It is black above and white below. The dorsal fin is high and the vent is exactly below the hinder edge of the dorsal. There are thirty-eight to fifty-eight throat grooves.

Balaenoptera davidsoni (Sharpheaded Finner).

Scammon, Proc. Cal. Acad. Sci. 4, No. 20, Jan., 1873, pp. 269-270.

This species is based on a single specimen. This was a female whale twenty-seven feet in length containing a fetus of five feet six inches. The pectoral fins are pointed. The baleen is pure white. There is no other record that I know of.

Balaenoptera sulfureus (Pacific Sulphurbottom Whale).

B. (Sibbaldius) sulphureus, Cope, Proc. Acad. Nat. Sci., Phil., July, 1869.

This species is based on some baleen and descriptions by Captain Scammon. It varies from *B. sibbaldii* only in a few color variations.

The sulphurbottom or blue whale is the greatest of all whales and, as far as we know, the largest animal which has ever inhabited the earth. It has a world-wide distribution. It is occasionally taken by the steam whalers in California waters. It grows to a length of ninety-

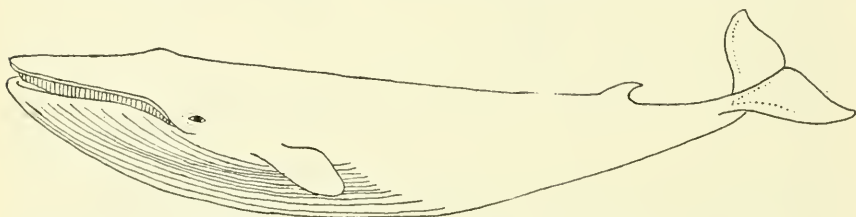


FIG. 70. The sulphur bottom of the Pacific (*Balaenoptera sulfureus*).
(After Scammon, Marine Mamm. pl. VIII.)

five to one hundred feet. The predominating color is a dark bluish slate above and white and yellowish below.

As the old time whalers regarded these whales as in the same fighting class as the finbacks, they were comparatively plentiful when the modern steam whalers began to work. A great number of them have been taken by the Norwegian companies in the last few years in the Pacific and Antarctic oceans.

Summary.

From a perusal of the literature and from personal field observations made at various times, it seems to me that the Ceteceans which can be included in the California fauna are as follows:

Balaena australis (*B. sieboldi*), a casual visitor.

Rhachianectes glaucus, a resident and migrant up and down the Pacific coast from Lower California to Alaska.

Megaptera longimana (*M. versabilis*), the most common whale today.

Balaenoptera physalus (*B. velifera*), a casual visitor.

Balaenoptera borealis, rare.

Balaenoptera sibbaldii (*B. sulfureus*), a casual visitor.

- Physeter macrocephalus*, a casual visitor.
Berardius bairdii, very rare, only one record in California.
Delphinus delphis, a common species offshore.
Tursio peronii (*Lissodelphus borealis*), doubtful even as a visitor.
Lagenorhynchus obliquidens, may be a visitor from the north.
Phocaena phocaena, a common species inshore and in the larger bays.
Grampus griseus, a rare resident.
Orca gladiator, fairly common.

The majority of the larger whales have a cosmopolitan distribution. The only exception to this that I know of is the California Gray, which is confined to the Pacific. As whales move about the oceans freely, there does not seem to be any necessity to divide them into different species merely on the strength of the geographical position in which they were observed, even in conjunction with color variations which might be individual peculiarities.

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WILD GOOSE SHOOTING IN CALIFORNIA TWENTY-FIVE YEARS AGO

By M. HALL McALLISTER.

Twenty-five years and more ago a visit to the plains of the Sacramento or San Joaquin valleys during the fall and winter months afforded a great sight to the sportsman and it was my pleasure for a number of years to make annual trips to these attractive grounds.

One of the best outfits to go with was that of Doc. Stuart who had with him Abe Krump and Claude Kagee. They made the best bunch of "goose callers" imaginable and would pull a bunch of "Mexicans" or "Cacklers" out of the sky for miles around.



For Real, Live Sport
Wild Goose Shooting

In Glenn County, Near
WILLOWS, CAL.

Cannot be Excelled Anywhere in
 California, or on Earth

I GIVE sportsmen a guaranteed wild goose shoot over wild live decoys.

HAVING resided in this section all my life, I know all the favorite haunts and feeding grounds of the birds.

I AM the only expert goose caller in California who has a complete outfit for this, the greatest of all wild fowl shooting; who is able to bring the game to you, and who has the enviable reputation of having the best sportsmen return season after season.

I POSITIVELY bring birds within easy shooting range by means of expert goose calling.

I HAVE every facility tending to make your time count to the very best advantage. I know the business from A to Z.

THE most prominent sportsmen in the West have enthusiastically enjoyed this sport with me. Ask some of them.

I GUARANTEE that wild goose shooting will open your eyes. If you have never tried a shoot with me — come along.

I HAVE an automobile at your service to convey shooters to and from the grounds.

RATES—\$10 per day per man for shoot. Write, 'phone or telegraph.

FRANK N. BURGI, Willows, California.

"The Doc. Stuart outfit" was first located at Maine Prairie about ten miles east of Elmira, Solano County and then they moved to near Norman, about twenty miles south of Willows, Glenn County.

In these years the duck season opened September 15. There was no law on geese and they were considered as vermin by the early day farmers. By the middle of December the best duck shooting was over on the Suisun marsh at the Cordelia and Ibis gun clubs and the goose shooting then started and continued through December, January, February and March.

The ground where the shoot was to take place was selected and the holes dug and arranged some days ahead. The operators then "rested" for a few days, so the geese would see no one around.

Going out just about daylight on a beautiful, clear morning with the winter cold stinging your face and making you shiver, one soon forgot the beauties of nature or the discomforts caused by the cold by the wonderful sight; as far as one could see were great clouds of geese leading in all directions.

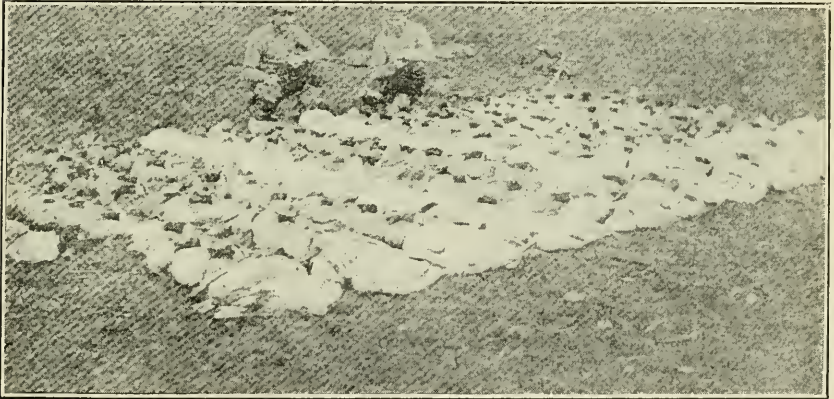


FIG. 72. A bag of about 150 geese during a morning shoot in Glenn County, December, 1904.

The shooting was before the days of live decoys. A few stuffed birds were staked on wires and as fast as the birds were bagged they were also "wired." Soon one had a fine showing.

It was all pit shooting; the holes in the ground being in a triangle and depending on the wind; the two front holes held the shooters and the rear hole, the callers. The birds were in such thousands that farmers were most glad to welcome shooters to drive the geese from their fields. As a consequence, bags were the desideratum tried for on all occasions.

The grand total for two morning shoots was 111 geese. These birds were all shipped to San Francisco and given away so that our friends had goose stew for a week. If there was a strong wind, as was generally the case, it was not easy shooting. The birds were remarkably active and keen and sometimes a bird killed clean in the air would be carried 100 yards by the gale and head shot birds frequently planed a quarter of a mile before falling with a thump. The geese, however, had little

chance as these blinds, if well made, were absolutely invisible 100 yards away.

The largest bags that I have reliable record of, but in which I did not personally participate, were made near Willows, Glenn County, in March, 1902. Four guns in two days shooting bagged 783 geese by actual count—an average of nearly 100 birds per gun per day.

The photograph herewith was taken in December, 1904, near Willows, shows 150 geese in one shoot by three guns; about 50 birds for each man.

My old record book, of my individual hunting trips, shows many shoots of several dozen geese. The largest shows 111 geese in two days for two guns. The friend with me on this shoot was Senor Carlos Herrera, who afterward became President of Guatemala, Central America.

The shoot was near Norman, Glenn County, the data being as follows:

December 4, 1905:

- 9 White geese, (*Chen hyperboreus*).
- 14 Grey geese (*Anser albafrons*).
- 20 "Mexicans" large brant (*Branta canadensis hutchinsii*).
- 28 "Cacklers" small brant (*Branta canadensis minima*).

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December 5, 1905:

- 4 White geese (*Chen hyperboreus*).
- 8 Grey geese (*Anser albafrons*).
- 22 "Mexicans" (*Branta canadensis hutchinsii*).
- 6 "Cacklers" (*Branta canadensis minima*).

40

Total, 111 geese.

A BIOLOGICAL SURVEY OF SALTON SEA

By GEORGE A. COLEMAN.

HISTORY

According to the geological records written in the rocks of the San Jacinto Mountains, bordering the present sea on the south, there has been at sometime a vast inland sea, extending from the Lower California coast to a considerable distance beyond the west end of the present sea.

"Tertiary deposits in these mountains contain great beds of fossil sharks teeth and univalves (oyster shells one foot in length), at 1000 feet above the present sea level."¹ Showing that there was a marine population equivalent to any great area of the Pacific Ocean at that time. The hydrogeological record as evidenced by the waterline marks still visible on the walls of the cliffs of these same mountains show a very changeful history.

The more recent written history, since the discovery of the sea by Captain Blake in 1853-54² shows that it has varied in extent from a body of water thirty-five miles wide, one hundred miles long and eighty-five feet in depth as reported by him to a dry salt bed which was

¹ McDougall, D. T. 1914. The Salton Sea. Carnegie Institution Publ. No. 193, p. 182.

² Blake, Wm. P. 1853. Lake Coahuilla. San Francisco *Commercial Advertiser*.

worked for many years for the salt it contained by the salt works at Salton. In the year 1907, this dry salt bed was again filled by the uncontrolled waters of the Colorado River making the present sea which is about seventeen miles in width at the widest point by forty-seven miles in length at the extreme ends. The depth has varied with the amount of rainfall, but has averaged probably forty-five feet at the deepest point near the geographical center.

Present Conditions—At various times during the years 1927 '28 and '29, the author has spent considerable time at the sea in a study of the water, plankton of the open sea, algae of the shoreline and water insects found therein including a collection of the fish at present living in the sea and tide pools in order to bring our knowledge of these conditions up to date and form a scientific basis for the introduction of the proper species of fish into the sea.

Sea Level—The existence and maintenance of an adequate supply of plankton, crustacean and insect life, especially in the shallow waters of the east end of the sea and the entire shoreline depends to a large extent upon the level maintained by the surface of the sea. Any material change in this level would greatly alter the character and quantity of this life, especially along the shoreline, upon which the species of minnows now living and breeding in the sea depend for food. Since any of the larger species of fish which we may introduce into the sea will necessarily depend largely upon the supply of minnows for their food, it is as well for us to know as far as possible what to expect regarding the sea level in the future.

With this idea in view, the author obtained from M. J. Dowd, chief engineer and general superintendent of the Imperial Irrigation District the records of the elevations taken since 1921.³

It is evident from these records that the level of the sea has raised almost three feet from 1921 to 1929. Since a variation of three feet would make but little difference in the character of the plankton and insect life, the author believes the division is perfectly safe in making a study of the present conditions—the basis for its fish introduction plans.

It is also shown that since the sea level has been under the control of the irrigation district it has been possible to keep it under control and to maintain an almost constant level. The variation of three feet being caused largely by an extremely heavy rainfall. Mr. Dowd assured me that it is their intention to maintain this level in the future.

³ Salton Sea Elevations. July, 1921, to January, 1929.

July 1, 1921—249.1 feet.
 January 1, 1922—249.2 feet.
 July 1, 1922—249.2 feet.
 January 1, 1923—249.9 feet.
 July 1, 1923—250.2 feet.
 January 1, 1924—249.1 feet.
 July 1, 1924—249.0 feet.
 January 1, 1925—250.2 feet.
 July 1, 1925—249.9 feet.
 January 1, 1926—249.2 feet.
 July 1, 1926—248.8 feet.
 January 1, 1927—247.8 feet.
 July 1, 1927—247.0 feet.
 January 1, 1928—246.4 feet.
 July 1, 1928—246.0 feet.
 January 1, 1929—246.5 feet.

CHEMICAL CONTENT OF THE WATER

Any study of the living organisms of the sea would be incomplete if it did not also include the chemical analysis of the water.

From 1907 to 1913, the United States Geological Survey made several



FIG. 73. Seining for minnows during biological survey of Salton Sea. Photograph by George A. Coleman, March 21, 1929.

analyses of the water. The Carnegie Report No. 193 for June 13, 1913, is most complete and is as follows:

Total solids.....	1,002.56
Water of occ. and hyd.....	32.6
Sodium (Na).....	323.08
Pot. (K).....	3.45
Calc. (Ca).....	19.75
Magnesium (Mg).....	16.22
Aluminum (Al).....	.125
Iron (Fe).....	.038
Manganese (Mn).....	None
Zinc (Zn.).....	None
Lead (Pb).....	None
Copper (Cu).....	None
Lithium (Li).....	None
Chlorine (Cl).....	473.89
Sulphuric (SO ₄).....	124.65
Bicarbonate (HCO ₃) (vol).....	15.74
Carbonic (CO ₂) Total (grms).....	11.28
Silicic (SiO ₂).....	2.18
Phosphoric (PO ₄).....	Trace
Nitric (NO ₃).....	None
Nitrous.....	None
Oxygen consumed.....	.110
Boric acid.....	None

In conversation with Captain Charles Davis at his Mullet Island residence on May 21, 1929, I learned that he assisted in taking the above sample for analysis and that they were all taken just off shore in the sea opposite Mullet Island, the shoreline at that time covering this island.

MUD POTS

Situated about one-quarter of a mile inland and an equal distance from Mullet Island, these so-called "mud pots" which form quite a series of boiling mud springs, furnish a never failing source of supply of various minerals which find their way into the sea and are no doubt the main source of the minerals found in the sea water.

MINERAL WELLS ON MULLET ISLAND

During 1927, 1928, and 1929, two wells were bored to a depth of 900 and 1400 feet respectively through the solid rock formation of Mullet Island, at which depths a continuous flow of boiling mineral water was obtained. On May 21, 1929, the author accompanied by Paul A. Shaw, toxicologist at the Hooper Foundation for Medical Research, San Francisco, visited these wells, saw them in action and with the kind assistance of Captain Charles Davis secured samples of the flowing water for analysis. Mr. Shaw's analysis is as follows:

<i>Ion</i>	<i>Grams per 100cc</i>	<i>pH = 6.5</i>
Carbonate -----		
Bicarbonate -----	0.03	
Ferrous Iron -----	0.005	
Chlorides -----	6.80	
Sulphates -----	0.02	
Calcium -----	1.60	
Magnesium -----	0.40	
Sodium and Potassium -----	2.04	
Nitrates -----	0.105	
	<hr/>	
Total solids -----	11.000	

The water flowing from these wells is allowed to run into a series of settling ponds where the minerals crystallize out and form a series of incrustations varying from white to yellow, green and purple, according to the mineral crystallizing. Here one can see nature's laboratory at work on a tremendous scale. When perfected, this system of settling ponds, will no doubt secure the most of the minerals contained in the water in a solid form leaving only a few unimportant ones in solution to pass into the sea.

Analysis of water of the open sea: On March 21, 1929, the author secured a sample of water near the geographical center of the sea and also from tide pools near Fish Springs where there is abundant evidence that the top minnow (*Gambusia affinis*) breeds.

Analysis of water from the open sea by P. A. Shaw, as follows:

<i>Sampled March 21, 1929</i>	<i>Grams per 100cc</i>
Carbonate -----	0.002
Bicarbonate -----	0.024
Chloride -----	1.63
Sulphate -----	.35
Calcium -----	.05
Magnesium -----	.15

Sampled March 21, 1929

Grams per 100cc

Sodium and Potassium	1.00
Total as analyzed	3.206
Borate	Positive
Nitrate	Negative
Total evaporated solids (105°C)	3.68
Total solids ignition at low red	3.32
Specific gravity at 20 degrees as compared to water at 4 degrees	1.033
Hydrogen-Ion Conc.	pH = 8.5



FIG. 74. Magdalena grass, food of the famous Salton Sea mullet.
Photograph by Charles Davis.

Analysis of tide pool water, same date as above, by P. A. Shaw, as follows:

	Grams per 100cc
Carbonate	0.00
Bicarbonate	0.03
Chloride	1.83
Sulphate	0.37
Calcium	0.09
Magnesium	0.08
Sodium and Potassium	1.20
Total as analyzed	3.60
Borate	Positive
Nitrate	Negative
Total evaporated solids (105°C)	4.08
Total solids, ignition low red	3.78
Spec. Grav. 20°-comp, to water at 4°	1.034
Hydrogen-Ion Conc.	pH = 7.3

To complete our knowledge of the chemical contents of the water running into the sea, the author secured from chief engineer Dowd, the analysis of the waters of both the New and Alamo rivers made at the laboratory of the irrigation district for a number of years past.

As these are too extensive to publish in full, only the latest of January, 1929, are given here, the balance being on file in our office for reference.

Analysis of water at New River, samples taken below Reeds Dam Irrigation District. Laboratory sample No. 4302 and No. 123:

Total solids.....	167 parts per 100,000
Loss on ignition.....	30 parts per 100,000
Sodium carbonate (Na_2CO_3).....	---
Sodium chloride (NaCl).....	95 parts per 100,000
Sodium sulphate (Na_2SO_4).....	66 parts per 100,000
Silt	157 parts per 100,000
Taken January 11, 1929.	

Sample from the Alamo River at North End Dam. Laboratory No. 4302 and No. 124:

Total solids.....	129 parts per 100,000
Loss on ignition.....	33 parts per 100,000
Sodium carbonate.....	---
Sodium chloride.....	57 parts per 100,000
Silt	182 parts per 100,000

The chemicals coming in from these two rivers are confined to a small per cent of sodium chloride which does not have any harmful effect on the growing crops where it is used for irrigation. For our purposes, therefore, these two rivers may be considered as fresh water streams.

SALTON SEA A REAL SEA

The chemical analysis of the water of the sea itself shows these waters to be comparable to that of the open ocean. Of recent years, biologists

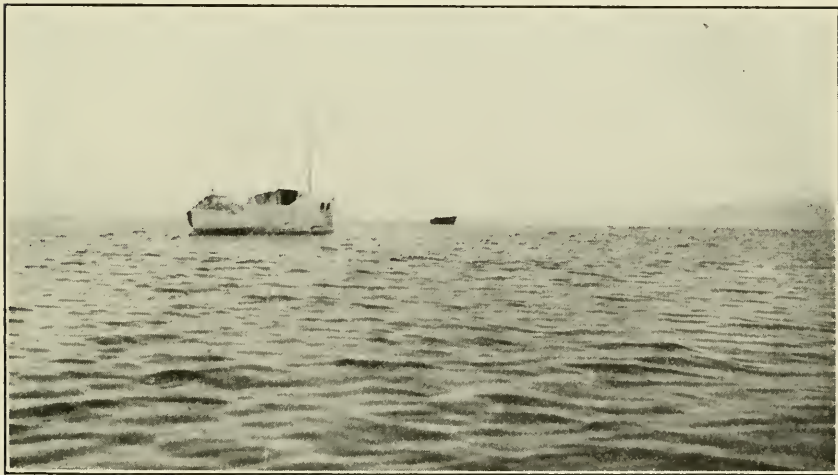


FIG. 75. Salton Sea fishing fleet now abandoned. Photograph by Charles Davis.

and biochemists have accumulated a large amount of experimental data upon the relation of the hydrogen-ion concentration of the water to the living organisms therein. So much real knowledge is now available on this subject that this reaction of the water (known for short as the pH value) may be taken at least at a predictive value upon which the biologist may prognosticate the forms of life which will flourish therein.

As shown by Shaw, the water of the open sea has a pH of 8.5 and the tide pools of 7.3. The author's own determinations at various times come very close to this, *viz.*, open sea = pH 8 -8.5 tide pools pH 7-7.8. It varies considerably during the season according to the temperature. According to Harvey ⁴ (pp. 72-73) "Sea water from the open ocean has a hydrogen-ion concentration of between 10^{-8} and $10^{-8.3}$ grams per liter, or pH 8.1-8.3." Hence the reaction of the waters of Salton Sea to plant and animal life could be expected to be very close to that of the open ocean.

However, owing to the small area of Salton Sea and its shallow depth, the winds which sweep it from end to end daily keeping the water in almost constant motion and circulation make it impossible for any extensive development of any pelagic plankton. We have, therefore, to depend upon the shallow water of the shoreline to produce the plankton, insect and crustacean life needed to support the fish life in the sea. Fortunately, this area is large in proportion to the area of open sea, especially at the east end where the Alamo and New rivers enter the sea.

SILTING UP OF THE SEA

According to estimates made by the United States Geological Survey of 1911-1913, the rate of silting up at that time would completely cover and eliminate the sea in eighteen years. To date only a very small area at the mouths of the New and Alamo rivers has been covered.

In order to protect the breeding ground of the forms furnishing food for young fish, the channels of these two rivers should be kept open directly into the sea, so that the silt coming down in the water does not spread out too soon and choke out the growth in the shallow water. At the author's recent visit this was not being done and consequently there was a great area in which the water was only a few inches deep and in which great numbers of pelicans and other fish-eating birds were feasting on the minnows and young fish coming down these rivers which would otherwise enter the sea and form food for larger and more desirable sport fish. Chief Engineer Dowd has assured me that these channels would be kept open in the future.

BENTHAL AREA

The area in which benthic organisms which include all forms that are attached to the shore and bottom, or to plants growing on the shore and bottom and a host of other forms, which, though free swimming are associated with the attached forms, covers the entire east end of the sea, especially at the mouths of the New and Alamo rivers. These areas may be roughly located by the growth of cattails and other coarse water plants. There are other limited areas at the mouths of small streams, springs which flow directly into the sea and small stream at the west end with artesian wells for their source. I would estimate that in all about one-eighth of the area of sea is so covered. We have, therefore, this area in which the food for support of the minnow population, upon which the larger sport fish must depend for food and for the support of such fish as may subsist directly on plankton, insects and

⁴ Harvey, H. W., 1928. Biological chemistry and physics of sea water. (Macmillan Company, New York, Ed. of 1928), pp. 72-73.

crustaceans. Any fish which we may introduce will therefore concentrate in this area especially in the younger stages and should be protected by not allowing any fishing in this area at any time.

FISH BREEDING AREA

The area to be so reserved is easily marked by township lines, *viz*, beginning at the northwest corner of township 11 south, range 11 east, San Bernardino Meridian, thence following township line to northeast corner of same; thence north on township line of township 10 south, range 12 east, San Bernardino Meridian, to the northwest corner of same, thence east on north line of township 10 south, range 12 east, San Bernardino Meridian to northeast corner of same. All sport fishing will then be confined to the open sea outside of this line. The area inside of this line, to, and including, the mouths of the Alamo and the New rivers as far as the first dams thereon to be set aside as a fish nursery for the express purpose of maintaining a supply of fish for Salton Sea.

If this is done we will have a basis to work on which will give us a reasonable assurance of being able to maintain a sufficient supply of sport fish in the sea to meet any demands made upon it by real sportsmen.

Commercial fishing in the sea, being now at an end as far as any profit in it is concerned, should be prohibited entirely.

FISH OF SALTON SEA

The first published account of the fish of Salton Sea, as far as I am able to find, is that of Dr. B. W. Evermann, in the *Copeia*.⁵

Dr. Evermann lists six species of fish as occurring in the sea at that time:

Common carp (*Cyprinus carpio*). The most abundant species at that time.

Bony-tail (*Gila elegans*). Said to be not uncommon. (I saw no specimens.)

Humpback sucker (*Xaurophen sypho*). Rather common. (I saw several specimens. They all had a starved appearance.)

Colorado River trout (*Salmo pleuriticus*). Although the water of the Salton Sea is quite brackish, strongly alkaline and very warm, this trout seems to thrive in it amazingly well. It is said to be fairly common. (I saw one fine example about 16 inches long. It was in excellent condition, albeit somewhat bleached in color.)

Common mullet (*Mugil cephalus*).⁶ Next to the carp the most common species. Numerous examples were seen. It is said to reach a large size (as much as 6 pounds) and to be unusually fine as a food fish.

Desert cyprinodont (*Cyprinidon macularius*).⁷ This interesting little fish was found in Figtree John Spring in a small oasis near the north end of the lake and some 7 miles southwest of Mecca. This spring, or

⁵ Evermann, Barton Warren. 1916. Fishes of the Salton Sea. *Copeia*, No. 34. pp. 61-63, August 24, 1916.

⁶ Thompson, Will F and Bryant, Harold C. 1920. The mullet fisheries of Salton Sea. CALIFORNIA FISH AND GAME, Vol. 6, No. 2. pp. 60-63, 3 figs. April 19, 1920.

⁷ This cyprinodont appears to be found in many of the isolated springs and water holes in the deserts of southern California. Only this week (June 1) Samuel Hubbard of Oakland, brought me 14 fine specimens from Saratoga Springs, Death Valley, where Mr. Hubbard says they are very abundant.

waterhole, was grown up thickly with cattails (*Typha latifolia*) and the surface of the water was covered with a thick coating of algae of various species. The water was only a few inches deep and quite warm, perhaps as warm as 90 degrees to 100 degrees on hot days. The fish, however, were active and in good condition. I caught a number of them and succeeded in bringing two alive to San Francisco. One of them died a few days ago—the other is alive and doing well.



FIG. 76. Fishermen examining nets used in taking mullet in the Salton Sea. Photograph by Charles Davis.

PRESENT STATUS OF FISH LIFE

In his several trips to the Salton Sea, the author has paid particular attention to checking up on the number of species of fish now found in the sea and their abundance.

The carp disappeared several years ago in what seemed to be an epidemic. Captain Charles Davis says they came up in shoals of dead fish on the shore at and near Mullet Island, the stench being almost unbearable for sometime. Most of these fish were carp, but there were other fish mixed with them.

The mullet have also almost disappeared. I interviewed the mullet fishermen while they were working this spring. They stated that they could find but one small school of large fish and they moved about all over the sea. They say what they do catch are all large fish and in the proportion of about one male to 100 females. They believe the mullet are not now breeding in the sea. In a trip of forty miles on the sea over their supposed haunts, I saw only one good sized mullet on March 21 of this year.

The Colorado River trout is occasionally seen near the east end of the sea.

The humpback sucker is reported as rather common.

The author, assisted by several deputies, during the trip in March, made quite an extended search for the desert cyprinodont and found it at nearly every point where we touched shore, from a spring about seven miles above the Hartley Salt Works on the north shore of the sea, around to Fish Springs and Figtree John Spring where Dr. Evermann

originally discovered it. We found it abundant in all these places, but especially so along the shore near the Hartley Salt Works. Here it thrives amazingly in the open sea water and Mr. Hartley states that it gets into their salt vats and will live in salt water up to 50 per cent saturation, at which point it begins to die. It evidently breeds in the tide pools and fresh water coming from these springs in among heavy growths of cattails.

While hunting for the cyprinodont at Fish Springs, the author discovered a small viviparous minnow breeding in the spring and also in tide pools of sea water along this shore. These were turned over to W. I. Follet, of Oakland, who has kindly identified them as *Gambusia affinis*, Baird and Girard. Since this time the author has found this minnow to be quite abundant at several points around the shore.

Mr. Follet also identified the cyprinodont collected as *Cyprinodon macularius*, Baird and Girard, or the same species listed by Dr. Evermann.

These two minnows are in sufficient abundance in the sea to form the food of a considerable population of sport fish since they are found all around the shoreline and seem to be able to maintain themselves against a horde of fish-eating birds of various species.

RECOMMENDATIONS FOR STOCKING

After a study of the present conditions and a fairly good knowledge of the habits of the striped bass, I believe if the young bass were introduced into the area designated as breeding grounds at the east end of



Fig. 77. Recession of the Salton Sea has left great shallow flats and made necessary this method of transporting fishing gear and catch. Photograph by Charles Davis.

the sea late in the season (October would be probably the best time) they would have a good chance to succeed. Since we have no precedent by example of introducing the striped bass into a landlocked sea, it will be in the nature of an experiment, but one which I believe to be well worth trying. Certainly no fish could be more desirable as a sport fish.

THE REPRODUCTION OF FISHES

By PAUL BONNOT.

From time to time inquiries are received by the Division of Fish and Game requesting information relative to the breeding habits of fishes. These inquirers range from students working on some problem of ichthyology to housewives who, on cleaning fish brought home by some angling member of the family, are surprised to find some of the body cavities filled with small replicas of the larger individual. The finding of such fish has led to the erroneous idea that some fishes swallow their young in time of danger, disgorging them when the danger has passed.

Among the cold-blooded vertebrates, there are three types of reproduction, which are termed oviparous, ovoviviparous and viviparous. There are fishes represented under each of these types. The eggs of an oviparous fish may be fertilized internally or they may be fertilized after they have been exuded into the water. The eggs of oviparous fishes contain a yolk, as a food supply for the young fish. The eggs "hatch" in the water. In the ovoviviparous type of reproduction, the eggs are fertilized inside the body of the female and are "hatched" there. The young fish are in some cases furnished with a yolk sac; in others they are attached to structures on the walls of the oviducts, analogous to the mammalian placenta. In either case, they are in a very undeveloped state when they emerge from the egg and must remain for a time in the ovary or oviducts, and are deposited in the water fully formed and able to provide for themselves. In the viviparous fishes, the eggs are fertilized internally—in some cases while still attached to the follicle. The eggs are not provided with a yolk. The necessary oxygen and nourishment are derived directly from the female, thus approaching the conditions found among the warm-blooded vertebrates.

The necessary contact between the eggs and spermatozoa is effected by various means. In most of the oviparous fishes the eggs are either set adrift in the water or attached to water plants and stones, or they are buried in sand, gravel or mud. The males exude the milt in the vicinity of such eggs and water currents bring about contact between the spermatozoa and eggs. In a few of the oviparous fishes the spermatozoa are introduced into the female by actual copulation and the eggs are fertilized previous to their exudation into the water. A few of the oviparous sharks and rays of this type enclose the eggs in a tough leathery shell, of a rectangular shape, with a long tenacle at each corner. In all the ovoviviparous and viviparous fishes the spermatozoa are introduced into the female and the eggs fertilized in the oviducts or ovary. The male intromittent organ is some modification of the ventral or anal fins. In the sharks and rays, there are claspers, a paired structure with corresponding grooves on their inner surfaces, which together form a closed tube for the transfer of the seminal fluid. In the top minnows and surf fishes, the modification generally takes the form of a tube between the elongated anterior rays of the anal fin.

In the ovoviviparous and viviparous fishes the fertilization of the eggs and the subsequent development of the embryos are very variable.

Eigenmann * found that in *Cymatogaster aggregatus*, one of the surf fishes, the following cycle occurs. Copulation takes place in June or July. The spermatozoa remain dormant in the ovary until December, when they become exceedingly active. The eggs mature and are fertilized between November 1st and February 1st, the eggs in larger fish being more numerous and maturing earlier than those in smaller fish. The young are liberated during May and June. The young fish are gravid in one year.

There are several different methods of providing the young fish with nourishment and oxygen during gestation. In some of the sharks, the embryos are attached to the walls of the oviducts by structures analogous to the mammalian placenta. In the surf fishes, the embryonic fish, as soon as the digestive tract is formed, consume the spermatozoa still remaining in the ovaries and are then nourished by material from the breaking down of the epithelia lining of oviducts and uterus. In most of the viviparous teleosts, or fishes having bony skeletons, the embryos obtain a certain amount of nourishment and oxygen through osmotic action between the surface of the small fish and the closely applied ovarian structures.

The following families of fishes are known to be either ovoviviparous or viviparous. All other fishes, as far as is known, are oviparous. There are species contained in some of the enumerated families which are oviparous. The rock fishes (*Scorpaenidae*) and surf fishes (*Embiotocidae*) are the only families in which there are no oviparous members.

Sharks and Rays—

- Carchariidae* (Blue Sharks)—Ovoviviparous.
- Sphyrinidae* (Hammerhead Sharks)—Ovoviviparous.
- Rhinidae* (Angel Fish)—Ovoviviparous.
- Galeidae* (Requiem Sharks)—Ovoviviparous.
- Spinacidae* (Spiny Dogfishes—(some) Ovoviviparous.
- Trygonidae* (Sting Ray)—Ovoviviparous.
- Myliobatidae* (Eagle Ray)—Ovoviviparous.
- Mantidae* (Bat Fish)—Ovoviviparous.

Top Minnows—

- Poeciliidae*—(most) Ovoviviparous.

Rock Fishes—

- Scorpaenidae*—(all) Ovoviviparous.

Blennies—

- Blennidae*—(most) Ovoviviparous.

Eelpouts—

- Lycodidae*—(most) Viviparous.

Surf Fishes—

- Embiotocidae*—(all) Viviparous.

The number of progeny produced under the different types of reproduction varies according to the degree of protection afforded the eggs and young fish. The oviparous fishes which deposit their eggs unfertilized in the water, produce comparatively large numbers of eggs. Only a small percentage of the fish that these eggs represent reach maturity. When the eggs are fertilized before being exuded into the water, one

* Bull. U. S. B. F. 1892 (1894) V XII, pp. 401-478.

element of chance is removed and the number of eggs is accordingly reduced.

Among the ovoviviparous and viviparous fishes, the eggs and young are protected through the period of greatest danger. The available space for growth is limited and, therefore, the number produced is comparatively small. Most of the oviparous fishes seem to have definite spawning periods at regular intervals. Such fish as sardines, striped bass and carp spawn regularly once a year. On the other hand, salmon spawn but once during a lifetime, when they are from four to six years old. The ovoviviparous and viviparous fishes which produce their young in small numbers seem to have a more or less continuous period of reproduction. In the ovaries of such fishes will be found minute immature eggs in conjunction with ripe eggs ready for fertilization. The eggs mature in small numbers and, as soon as the young fish are liberated, another set of eggs is ripe and ready to produce another brood.

*Number of Young Observed in Different Species of Viviparous Fishes.**

Rock Cod—

Sebastes—Many thousands.

Rose Fish—

Sebastes marinus—1000.

Top Minnows—

Gambusia patruelis—20 to 25.

Anableps gronovii—

female, 7 inches—4 to 5.

female, 10 inches—18.

female, 10 inches—7.

Surf Fishes—

Hysterothorax traski—16.

Hyperprosopon argenteus—7 to 12

Hypsurus caryi—8.

Ditrema jacksoni—8 to 60.

Phanerodon cuteralis—21 to 80.

Phanerodon furcatus—10 to 23.

Amphistichus argenteus—47 to 80.

ACETIC ACID AS A CONTROL AGENT FOR CYCLOCHAETE AND GYRODACTYLUS IN HATCHERY TROUT¹

By H. VAN ROEKEL.

During May, 1929, a disease outbreak among steelhead trout (*Salmo irideus*) in a hatchery was called to the attention of this laboratory. Upon investigation the following information was obtained.

HISTORY

The hatchery is supplied with water taken from a near-by stream, which in turn, is supplied with water flowing from springs found along

* Eigenmann, C. H. Bull. U. S. B. F. 1892 (1894) V XII, p. 404.

¹ Contribution No. 4 from Fish and Game Laboratories at The George Williams Hooper Foundation for Medical Research, University of California, San Francisco.

its channel. The amount of water received from these sources, however, is very small. Approximately one-half mile above the water intake for the hatchery, the stream also receives water from an electric power plant. This water is not as pure as that from the springs because it travels through a six-mile flume and an open reservoir before it reaches the power plant. A marked difference is observed in the clearness of the stream water above and below the point where the water from the plant enters the stream. Fifteen days prior to the date when the disease was reported, the power plant commenced to shut down during the night and no water would flow into the stream during this time. While the water was shut off at the plant, there would be an insufficient amount flowing through the hatchery. At this time the water became noticeably contaminated with barnacles. This condition may have some relation to the parasitic outbreak in the fish.

CAUSE OF THE DISEASE

Microscopic examination revealed that the fish were infested with skin parasites, namely: cyclochaete and gyrodaetylus. The former was found on all fish examined while the latter was observed on only a few.

COURSE OF THE DISEASE

The first sign of the disease, observed by the hatchery foreman, was a slight increase in mortality. The organisms, without doubt, had gained a firm foothold at this time. It is difficult to state when the fish first became infested. A rise of temperature (4 degrees Fahrenheit) occurred when the first mortality was observed. The May temperatures ran fairly constant, with a mean temperature never exceeding 59 degrees. A marked increase in mortality was observed four days after the first evidence of the disease. During a period of five days an approximate loss of 200,000 fish was experienced.

SYMPTOMS

In general, the fish appeared to be less active and greatly weakened. They inclined to rest near the surface of the water or lie on the floor of the trough. Due to weakness, the current of the water would hold them near the foot end of the trough. The outline of the fins appeared to be ragged which greatly interfered with the function of the fins, especially the tail fin. A short rapid side motion of the posterior third of the body was observed in fish with injured tail fins. The stronger fish would often attack the weaker ones which would result in a large number of bobtailed fish. Upon close examination with the naked eye, the parasites appeared as white pin-point specks on the fins. In heavily infested cases they were easily detected.

LESIONS

Microscopic examination revealed the parasites moving about on the fins and body proper. The organisms could be found on any part of the body, but in light infested cases they were generally confined to the fins. The structure of the fins was greatly injured. The rays appeared to be nude of skin and often broken at the border of the fin. This injury not only affected locomotion, but also resulted in a great loss of blood.

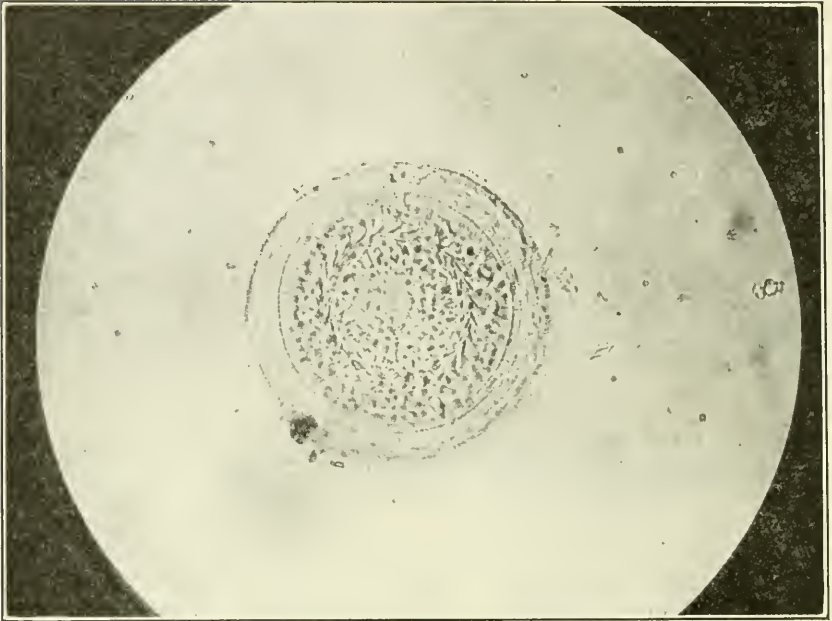


FIG. 78. Cyclochaetae. Skin and gill parasite isolated from two months' old steelhead trout. Enlarged 325 times.

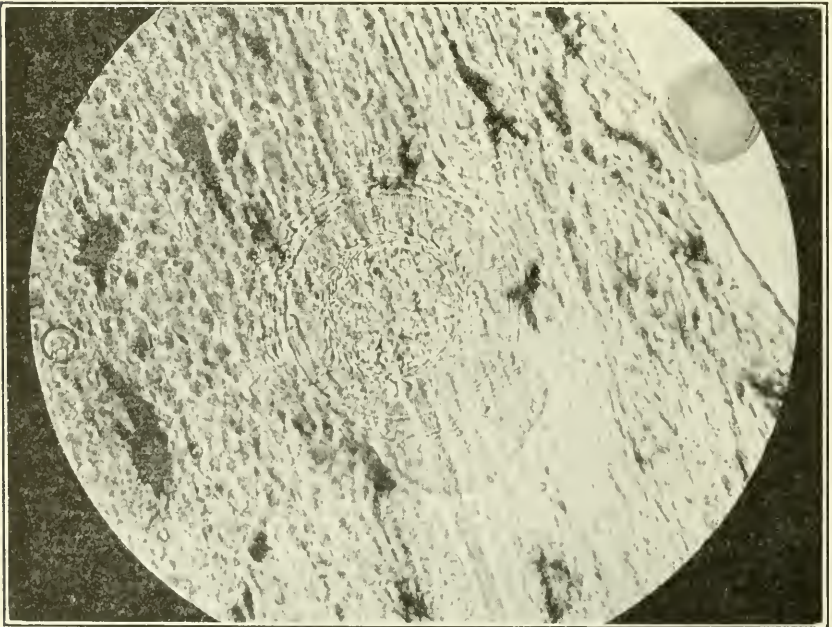


FIG. 79. Cyclochaetae attached to tail-fin of two months' old steelhead trout. Enlarged 325 times.

TREATMENT

In treating fish infested with parasites one must consider the type of organism to be eradicated, the efficacy of the agent on the parasite, duration and method of application, after effects on the fish and the cost of the agent. To obtain this information in an expedient manner, it is best to first treat a small number of fish. The strength of the agent and duration of the treatment are dependent upon the type of parasite and the size and condition of the fish. It is known that *gyrodaetylus* can be eliminated with a weak solution of acetic acid. Since no specific treatment for *cyclochaete* was known, several agents were considered. Acetic acid solution was first employed. It was observed that *cyclochaete* can be eliminated from two months old trout if bathed in a .15 per cent solution of glacial acetic acid for one minute. This strength of the solution and duration of the treatment did not produce any serious after effects on the fish. With a net the fish were immersed into a tub containing the acetic acid solution. Approximately 4000 fish could be treated at one time. A deep net as used in hatchery practice for transferring fish was employed. Every precaution was taken to keep the fish in constant contact with the acid solution for the required time. The upper portion of the net was also disinfected by dipping it frequently into the solution. If care is exercised few fish escape from the net. At the end of 45 to 60 seconds some of the fish will commence to show signs of distress and turn over on their side. The duration of the treatment should not exceed one minute in the size treated as it would result in a heavy loss. The loss is dependent upon the condition of the diseased fish.

After the acetic acid bath the fish were placed in troughs which had been cleaned and disinfected with a $2\frac{1}{2}$ per cent solution of formalin. The fish should be placed in the trough near the water inflow where conditions are most suitable. A large number of fish will fall to the floor of the trough and appear as dead, but within 20 to 30 seconds all will have recovered and appear normal. A slight increase in mortality was observed for some hours after the treatment. The dead fish were the weaker infested ones which could not survive in spite of any treatment. The mortality dropped down to normal about forty-eight hours after the treatment. The general condition of the fish improved rapidly. Frequent microscopic examination of dead and live fish revealed no *cyclochaete*. The treatment did not eliminate the *gyrodaetylus* completely, as this parasite was found on two different specimens of all the treated fish examined. Further treatment would be necessary to eliminate this organism completely.

Among other agents employed it was observed that a .25 per cent formalin solution would kill both *cyclochaete* and *gyrodaetylus* within $1\frac{1}{2}$ minutes. The net treatment was employed as with the acetic acid. Formalin, however, appeared to be slightly more toxic to small fish.

Methylene blue² (1-1000 of a saturated solution) did not kill the organism at the end of one hour. Experiments with lower dilutions were not attempted because the agent would be more expensive for general treatment than acetic acid or formalin solutions. Fish remained alive for at least twenty-four hours in a 1-1000 methylene blue solution without being aereated.

² Certified, Coleman & Bell, Northwood, Ohio.

Aeriflavine was also used in a very dilute solution (1-750,000). This agent can not be recommended because it did not kill the organism and proved injurious to the fish. The organisms were alive after five minutes exposure to the solution.

The action of the acetic acid on the organism is not definitely known. Acetic acid belongs to the group of simple acids which act as an external irritant.

SUMMARY

The acetic acid solution was found to be effective in the control of cyclochaete and gyrodaetylus and the least toxic to fish. Formalin, although slightly toxic, can also be recommended in the control of these parasites. Methylene blue and aeriflavine can not be recommended because the cost of treatment would be far greater than that of acetic acid or formalin if stronger solutions were employed.

All instruments and troughs can be readily disinfected with 2½ per cent formalin solution which has proved to be effective.

The strength of the disinfecting agent depends upon the condition and size of the fish and the organism which is to be eradicated.

Other agents such as dilute sulphuric acid, chloride of lime and copper sulphate were not employed which also may prove to be of some merit in eradicating these parasites.

The disinfecting solutions can be prepared by the fish culturist with little difficulty. The acetic acid should be 99 per cent pure and formalin should contain 40 per cent formaldehyde. These agents can be obtained from any chemical company. The dilute solution (.15 per cent) may be prepared according to the following ratio:

One part of acetic acid (99 per cent) + 658 parts of water.

One ounce of acetic acid (99 per cent) + 5 gallons and 18 ounces of water.

76 cubic centimeters acetic acid (99 per cent) + 50 liters of water.

THE NORTHWARD OCCURRENCE OF SOUTHERN FORMS OF MARINE LIFE ALONG THE PACIFIC COAST IN 1926

By CARL L. HUBBS AND LEONARD P. SCHULTZ.

While engaged in collecting and studying the fishes of the northwest coast during the summer of 1926, we secured some information on the occurrence during that season of certain forms of fishes and marine invertebrates well north of their usual range. According to general testimony and indications, the summer of 1926 was notable for this tendency of marine forms to stray northward along the coast.

Our observations of course were duplicated by those of some other naturalists, among them J. T. Nichols, of the American Museum of Natural History. He writes as follows in "Natural History" (Vol. 26, No. 6, pp. 611-612):

"Various unrelated bits of data tend to show that the present season (1926) was one where warm water conditions extended unusually far to the north along the coast. It was also one of a heavy take of salmon at False Pass (entrance to Bering Sea) and in the Bristol Bay area of Alaska * * *. In July and August the writer found comparatively warm water conditions prevailing farther north than he had

anticipated. Coming in southeast, west of the Queen Charlotte Islands, when about the 52d parallel of latitude was reached, there was a band of water several miles wide, thickly strewn with *Veleva*. The glistening sails of this little animal dotted the smooth blue surface of the sea as the falling petals of apple blossoms do the grass under apple trees. South of this line phosphorescent ctenophores flashed their sparks of blue light in the ship's wake at night. Again, farther southeast, a fragile pelagic stalked barnacle was numerous. Several of these barnacles float attached to a central globular mass seemingly of the same structure as that of their stalks. At about 50 degrees north, the steamer passed close to a sea sunfish three or four feet across, swimming in a vertical position, its upper fin projecting somewhat above the surface of the water."

We also found an ocean sunfish (*Mola mola*) north of its usual range, although not nearly so far north as Nichols' record. His fish

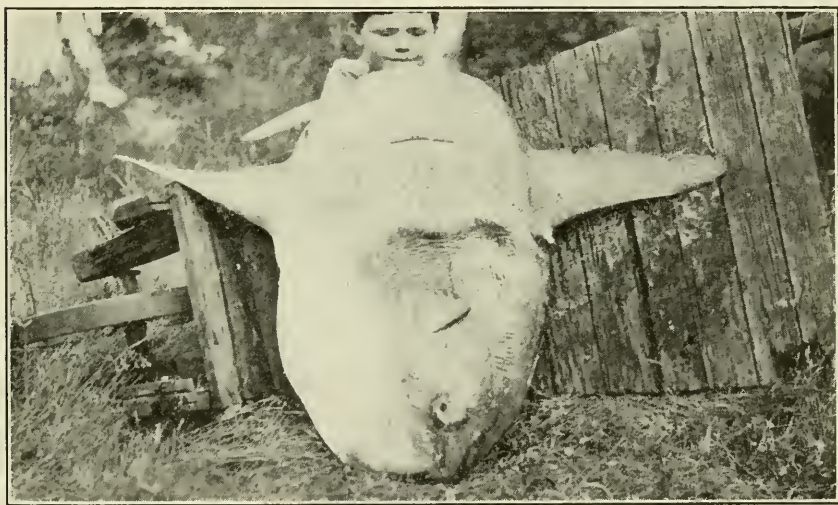


FIG. 80. Ocean sunfish caught far north of its usual range near Lapush, Washington, 1926.

was seen off the northern part of Vancouver Island, while ours (Fig. 80) was taken by a salmon troller near Destruction Island, off northern Washington. This odd fish created a considerable amount of interest when brought into the Indian village of Lapush, where we were staying at the time. Many of the fishermen as well as the Indians—a number of whom engaged in pelagic sealing—had never seen a sunfish in neighboring waters. It was obviously a stray from the southward. This specimen was caught on June 24. Later, during the first half of August, we found ocean sunfish common off Newport, Oregon, seemingly more abundant than usual. A halibut skipper, fishing off Yaquina Head, brought us in a fine example, of relatively small size.

This northward extension of the range of the ocean sunfish in 1926 appears to have been related to the unusual occurrence of the "Portuguese man-o'-war" (*Veleva*) far to the north of its usual range. Nichols, in the paper quoted above, mentioned seeing large numbers

of these little purple creatures sailing along at the latitude of 52 degrees (north of Vancouver Island). They also occurred generally along the Washington and Oregon coast during the summer of 1926, and everywhere were regarded as unusual if not quite strange. Near Lapush, Washington, these animals were washed ashore in windrows, during the latter part of June. The sunfish caught near Lapush had eaten heavily on *Veleva*, and on nothing else. It is probable that the sunfishes had followed the "Portuguese men o'-war" to the north.

Some other invertebrates were generally thought to be especially common northward in 1926. This was held to be true, for example, of a sea urchin (*Strongylocentrotus purpureus*), especially at Cañon Beach, Oregon.

Anchovies (*Engraulis mordax*) occurred in most unusual abundance in the summer of 1926—so much so as to receive frequent newspaper notice—in the mouth of the Columbia River. They were here mistaken by the salmon fishermen for sardines.

A thresher shark¹ (*Alopias vulpes*) was caught late in the summer of 1926 in Coos Bay, Oregon. This is far north of the usual range of this species, and the local fishermen did not recognize it. Although we did not actually see this thresher shark, its identity was made certain by the examination of a sketch and measurements of the fish, sent us by Ben Smith, a very observant fisherman of North Bend.

Mackerel (*Pneumatophorus diego*) also appeared, though rather sparingly, in the channels of Coos Bay, Oregon, during the summer of 1926. They were regarded by fishermen as new to this bay. They have, however, been taken at times in Puget Sound.

Jack smelt (*Atherinopsis californiensis californiensis*) were likewise sporadically common in the channels of Coos Bay in the same summer. Ben Smith, who for some years has made a living fishing for bay smelt (*Atherinops affinis oregonia*) in Coos Bay, and who has taken a keen interest in his catch, insists that he never caught the jack smelt before 1926 and that he noticed on first taking them they were different from the ordinary bay fish. He certainly distinguished clearly between the two, both as to habits and appearance, in 1926. Jack smelt were also taken in Yaquina Bay, Oregon, in 1926, but the less observant fishermen there did not distinguish them from the bay species.

The one previous record of this species from north of California, is for British Columbia, and is a very doubtful one.

Hake (*Merluccius productus*) were at one of their occasional high points of abundance in and near Yaquina Bay, Oregon, in early August, 1926. At such times of abundance many hake are stranded on the sand beaches of the adjacent surf or on the sand flats of the bay.

Two other fishes found in great numbers near the mouth of Yaquina Bay in August, 1926, were the slender smelt, *Allosmerus attenuatus* and *Spirinchus starksi*, species which make up much of the "white-bait" of the San Francisco market. But most of these smelt were killed by the blasting in the harbor mouth, and might not otherwise

¹ During July and August, 1926, members of the staff of California State Fisheries Laboratory noted an unusual number of hammer-headed sharks, *Sphyrna zygaena*, in the San Pedro fish markets. This is a notable northward extension of the normal range of this species as these sharks, inhabiting warm seas, are delivered but rarely to the markets of the Los Angeles region. —F. N. Clark, California State Fisheries Laboratory, April, 1929.

have been seen in numbers. It can not be stated with any certainty that these species were actually in unusual abundance in 1926.

We took in Oregon and Washington a number of other California types of fishes—certain surf fishes, sculpins and rock cods—which have not been reported in the scientific literature as occurring in these states. But in these cases we obtained no indications that these species were not normal and permanent residents in these northern waters. The fact that they have not been recorded so far northward is merely an index of the very meager amount of attention which has been given to Oregon and Washington by the collectors and students of fishes.

Another southern fish, the striped bass² (*Roccus lineatus*) occurred in commercial abundance in Oregon, especially in and about Coos Bay, during the summer of 1926. This species, however, appeared here first, in sufficient quantities to attract attention, to the summer of 1925 (as already noted in this journal by Seofield and Bryant, Vol. 12, 1926, p. 57).

Crawford has reported in Copeia (No. 160, 1927, p. 183) the apparent straying of the Japanese *Decapterus* into Alaskan waters in 1924 and 1925. Whether this movement was unusual, we can not say. He also reports the occurrence of the pomfret (*Brama raii*) and the torpedo (*Tetronarce californica*) north of Cape Flattery in September and October of 1925.

Just before we left the Oregon coast, to be exact on August 24, 1926, albacore (*Germo alalunga*) were caught off that state for the first time, so far as we could learn. Two salmon trollers, fishing between Coos Bay and the mouth of the Suislaw, each landed one of these fishes, strange to them, and one of them saw a small school. The fish was equally unknown to the other fishermen and the fish dealers of Marshfield, but an examination of the large head of one and the fishermen's clear description of the rest of the body, and particularly of the plain color and great length of the pectoral fin, left no doubt in our minds as to the identity of the fish. So far as we know, the northernmost of all previous records for the albacore is the somewhat doubtful one given by Thompson (CALIFORNIA FISH AND GAME, Vol. 5, No. 4, October, 1919, pp. 203-204), for northern California.

Like the striped bass, the albacore made its appearance in large numbers northward of its usual range in 1925 as well as in 1926. The occurrence of albacore in quantity off San Francisco and Monterey in late August and early September, 1925, has been duly recorded in FISH AND GAME (Vol. 11, 1925, p. 185). Whereas they probably ranged northward to central California in greater abundance in 1925 than in 1926 (see Table I), they are not known to have penetrated so far to the northward in the former year as in the latter. Furthermore, a much greater abundance in 1925 than 1926 is also indicated for southern California.

² The following notation has been made at the request of Dr. Hubbs:

The striped bass is now maintaining itself in sufficient numbers at Coos Bay, Oregon, to be of commercial importance. While definite figures are not available, the general opinion of the fishermen is that this fish is increasing in abundance in that region each year. It would seem that the movement of this species to the northward is the normal spreading out of the species following its establishment in the California streams. Its occurrence in numbers sufficient to attract general attention in 1925 and 1926 may have been coincident with, rather than dependent on, the unusual temperatures of these years. If the warmer temperatures played a part in the northward distribution of the striped bass, it has successfully maintained itself thereafter.—F. N. Clark, California State Fisheries Laboratory, April, 1929.

The statistics for the commercial catch of albacore for each quarter year from 1916 to 1926 (Table I), summed for southern and central California, respectively, emphasize the unusual abundance of the species in central California in 1925 and 1926. That temperature plays a part but not the only rôle in this apparent northward migration of albacore along the coast is suggested by the fact that the water temperatures in central California toward the end of the year, when the albacore appear, were higher than usual in 1925, but not consistently higher than in all years, notably 1923, when albacore were not taken in any large numbers so far to the northward (see Fig. 2). What the other factors may be must be left to the staff of the California State Fisheries Laboratory to determine. The run of albacore in central California in 1926 can hardly be attributed to high temperatures at the time of the run, because the water temperatures in the latter part of 1926 were low (Fig. 2). The 1926 run, may, however, have been a holdover from that of 1925, an hypothesis which finds strong support in the unseasonably high temperatures which prevailed over the winter and spring of 1925-1926.

TABLE I

Statistics of Albacore Catch in Pounds for Southern California (South of Pt. Conception) and for Central California (Monterey to San Francisco), for Each Quarter Year from 1916 to 1926, Inclusive)

Year	Southern California	Central California
1916	55 405,988 7,614,814 4,605,532	0 0 0 0
1917	68,945 2,592,597 25,689,255 1,812,296	0 0 0 0
1918	63,278 346,838 7,001,059 25,356	0 0 0 5,123
1919	378 652,966 12,224,470 675,130	0 0 0 81
1920	3,325 904,121 17,871,575 97,626	0 0 0 0
1921	45 2,844 14,751,228 520,411	0 0 0 0
1922	0 437,912 12,117,283 676,392	0 0 41 195
1923	1,064 207,797 11,908,316 370,873	0 0 0 149
1924	0 336,272 16,736,428 207,226	0 0 0 420
1925	0 1,331,012 19,684,727 209,374	0 0 79,997 379,832
1926	9,935 397,459 1,938,975 4,333	0 0 1,728 116,955

In seeking to determine what significance increased temperatures may have had on the unusual occurrence of southern species north of California in 1926, we find a regrettable lack of any serial records of water temperatures—such as those for Monterey Bay which have served as the basis for figure 2. For indirect indications we must rely on the weather records. In doing this, we assume some positive correlation between varying ocean and air temperatures. In a similar case Thompson has used the mean minimum temperature of the air of coastwise points as an index to the water temperatures (CALIFORNIA FISH AND GAME, Vol. 3, No. 4, October, 1917, pp. 153-159). That the air temperatures along the Oregon-Washington coast were unusually high in 1926 (and also in 1925) has been duly recorded by the U. S. Weather Bureau, in *Climatological Data*. We quote the following from the

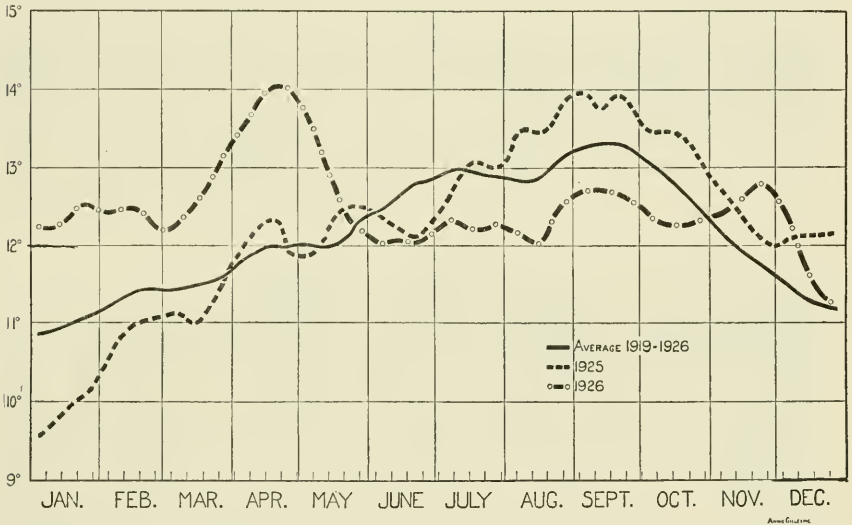


FIG. 81. Ocean temperatures from 1919-1926 in central California. Data taken at Pacific Grove by the Hopkins Marine Station and generously made available by the director, Dr. W. K. Fisher. The daily temperatures, taken off the rocky shore, are averaged by weeks. For the eight-year average the weekly averages are combined. All three trends are smoothed by a running average of five. Degrees centigrade are plotted on the vertical scale against weeks on the horizontal.

summaries as published in that journal. For Oregon, "The annual mean for the state, as shown by the records of 79 stations, was 52.2 degrees. The departure from the normal for 63 stations having ten or more years' record was + 2.5 degrees. For the Western Division the monthly mean was 54.2 degrees, a departure of + 2.6 degrees from the normal of 30 stations having ten or more years' record * * *." The mean average of all the stations in the Western Division, 54.2 degrees, is the highest since the inception of the records in 1891, and is higher by 1.1 degree than the next highest average, which was for the previous year, 1925. For Washington, the 1926 summary informs us that "The mean temperature of the year, 50.8 degrees for the state as a whole was the highest in 36 years of record. Every month except

August, September and December averaged above normal, and September was the only month markedly deficient in temperature. Following a warm December in 1925, the mildness of the winter was unprecedented in the 36 years of state-wide records, the average daily excess in temperature for the five months ending in April being 5.4 degrees for the state as a whole." The year 1925 was also unusually warm in Washington: "The year was remarkable for its high mean temperatures, * * * every month except August, October and November was warmer than the average of previous years, while the mean temperature of the year, 50.7 degrees, equalled the previous high mean of 1906." That these conditions prevailed along the actual coast-line, and it is shown that they did in Table II, is especially significant in indicating a high ocean temperature.

TABLE II

Monthly and Annual Departures from the Normal in the Mean Air Temperatures, in Degrees Fahrenheit, for Coastwise Stations in Oregon and Washington, in 1926 (from *Climatological Data*). Stations read South to North. Deviations are Plus unless Indicated as Minus

	Port Orford.....	Marshfield.....	Toledo.....	Astoria.....	North Head.....	Aberdeen.....	Forks.....	Port Angeles.....	Port Townsend.....
1925—January.....	1.0	1.9	2.4	3.3	1.3	2.6	3.1	3.2	2.5
February.....	2.4	1.9	3.4	3.9	2.4	6.5	3.3	4.2	3.6
March.....	0.2	-0.8	1.4	-0.6	-0.4	0.7	-0.1	1.7	0.4
April.....	1.4	0.3	1.5	0.5	1.1	1.1	1.2	2.1	1.7
May.....	2.0	1.7	3.4	2.4	2.5	2.7	2.9	2.8	2.6
June.....	1.4	0.7	2.4	-0.4	0.2	-0.8	-0.6	1.5	0.5
July.....	1.1	0.2		-0.5	-0.8	0.2	0.0	1.4	1.2
August.....	-0.9	-0.7	-1.1	-1.5	0.2		-0.2	2.3	1.2
September.....	-0.2	1.2	-0.5	0.3	1.6		-0.5	2.4	0.4
October.....	1.1	0.2	-1.1	0.4	0.9		-1.7	0.5	-0.7
November.....	0.4		-0.3	0.0	0.0	1.4	-0.2	2.3	0.8
December.....	2.8	3.0	3.6	3.8	4.3	4.0	6.0	4.5	3.8
Annual.....	1.1			1.0			1.1	2.4	1.6
1926—January.....	2.7	1.8	1.8	3.0	3.7	2.6	4.2	4.9	3.3
February.....	4.1	4.1	4.4	4.8	4.4	4.1	4.8	6.0	4.8
March.....	5.2	4.3	5.2	5.4	4.8	4.7	4.1	4.6	4.9
April.....	4.7	5.6	6.8	5.8	5.9	6.4	5.0	5.7	5.5
May.....	3.5	3.0	2.5	0.8	2.9	1.7	0.2	1.7	2.1
June.....		1.9	4.0	1.9	1.4	0.8	1.2	3.5	3.4
July.....		1.4	1.2	-0.5	0.8	0.9	0.5	3.6	2.1
August.....		2.1	2.1	-0.7	1.1	-1.0	-0.2	1.5	0.5
September.....		-1.1	-1.8	-2.4	1.5	-1.7	-2.9	0.4	-0.4
October.....		3.0	-0.7	0.6	3.3	1.4	1.3	3.6	3.1
November.....		4.4	2.3	2.2	3.4	0.7	4.0	4.1	3.4
December.....		0.6	0.4	-0.8	-0.1	-0.3	1.2	1.2	0.7
Annual.....		2.6	2.4	1.7	2.8	1.7	2.0	3.3	2.8

The warm temperatures in Oregon and Washington during the first half of 1926 were certainly not local, for temperatures above normal prevailed during this period over a considerable part of the country, in an area extending southeastwardly from the Northwest coast (see temperature maps in *Climatological Data* for 1926).

The unusually warm weather of 1926 along the coast almost certainly would reflect an increased ocean temperature—unless the wind direction was distinctly unusual. A tabulation of the prevailing wind direction during each month over the ten-year period ending with 1926, for the coastwise stations of Washington, shows in most cases a normal

or nearly normal direction was recorded, although in some instances prevailing winds from a warmer quarter than usual actually were recorded. Unfortunately, no air-temperature or wind-direction records are available for Monterey, where the ocean temperatures were taken. At San Francisco, however, the air temperatures were above normal in every month of 1926 through August, excepting January. In most of those months, the wind direction reported was that usually indicated for the ten years previous to 1926.

The midsummer coastwise air temperatures in 1926 were not unusually high; in fact were often below normal. The unusually warm temperatures covered the period from December in 1925 through May, 1926. During this period it is almost certain that the ocean temperatures were unseasonably warm in Oregon and Washington, just as they were at Monterey (Fig. 2).

The unusual northward occurrence of southern forms of marine life along the Pacific Coast in 1926 we think may be attributed to the warmth of the preceding winter and spring, following the rather warm summer of 1925. The southern forms which had wandered northward in 1925 were probably able to maintain themselves to an exceptional degree over the unprecedentedly warm winter of 1925-1926, and then rapidly spread northward during the spring, when the ocean temperatures were verily summer like.

RECENT LEGISLATION

The forty-eighth session of the California legislature had before them for consideration 120 bills relating to fish and game. Only 27 of these bills became laws. Practically no changes were made in the open seasons for the taking of game nor in the bag limits, the legislature apparently having concluded that in this respect our California statutes were satisfactory.

The following is a list of senate and assembly bills receiving the signature of the governor:

Senate Bill No. 27—Adds four new refuges:

1R in Tuolumne County; approximately 90,000 acres.

1S in Lassen County; approximately 40,000 acres.

1T in Humboldt County; 1,920 acres.

3H in Santa Barbara County; approximately 15,000 acres.

Senate Bill No. 49—Classes domestic cats as predatory animals in game refuges. Allows deputies and employees of Fish and Game Commission to kill any cats that are at large. Cats that are in the residence or upon the grounds of its owner are exempt from the provisions of the act.

Senate Bill No. 267—Allows the taking of fur-bearers by use of dogs.

Senate Bill No. 270—Provides that the Trapping License Act should not apply to Districts 2, 2½, 4 and 4½.

Senate Bill No. 287—Prohibits the use of saw tooth or spike jaw traps for taking fur bearers.

Senate Bill No. 317—Prohibits hunting of ducks, geese and jacksnipe in Districts 4, 4½, 42, 4c, 19, 20, 20a, 21 and 22, except on Wednesdays, Saturdays, Sundays, legal holidays, and the opening and closing day. Allows the hunting of waterfowl in 4a on these days only between 8 a.m. and sunset.

Senate Bill No. 393—The owner of growing or harvested crops that are being damaged by game can call in a regular game warden who shall, to the best of his ability, attempt to stop such damage.

If impossible to do so he may kill the animals causing the damage.

- Senate Bill No. 403—Strengthens the commercial gun club act by providing that the license may be revoked if the owner aids and abets or acquiesces in violations of the game laws on the part of his employees or guests.
- Senate Bill No. 434—Sardine Reduction Act.
- Senate Bill No. 572—Allows the use of crab nets in District 1½. Changes the season for barracuda from the 16th day of May to the 1st day of May.
- Senate Bill No. 585—Provides for the punching of a brand in the tail of domestic fish in lieu of the metal tag required in the old law.
- Senate Bill No. 731—Provides that a deer may be taken from an open into a closed district when the tag is countersigned by a Justice of the Peace, any fish and game deputy, notary public, postmaster, peace officer, or an officer authorized to administer oaths.
- Senate Bill No. 760—Changes the boundaries of many game refuges from section lines to ridges, streams and roads. Creates four new refuges: 1R, 1S, 1T and 3H. Moves Refuges 1F and 4F to better locations. Moves the east line of District 1½ from the east line of Siskiyou County to the Southern Pacific railroad and the Klamath River. Creates District 18A, a special district for Pismo clams, in San Luis Obispo County.
- Senate Bill No. 808—Allows the possession of venison for 15 days after the close of the season.
- Senate Bill No. 880—Grants to the government the right to establish waterfowl refuges in accordance with the new Federal Act.
- Assembly Bill No. 6—Changes trout season in District 4½ to open May 1st. Prohibits possession of any gaff, except a landing gaff, adds Eel River to District 2 to the streams which are to be fished during November, December, January and February. Allows the shipping of trout from an open to a closed district by having a statement countersigned by the agent of the company to whom offered for shipment. Prohibits sale of all steelhead in District 1½.
- Assembly Bill No. 59.—Changes crab season in Humboldt County waters to August 31st to December 14th, inclusive. Delays one month on both ends.
- Assembly Bill No. 60—Prohibits taking of any clams in District 18a in San Luis Obispo County. Puts limit of 15 Washington clams in District 10. Puts limit of 10 mussels per day in Districts 18 and 19. Puts a limit on abalones of 10 per day, 20 per week in District 7. Prohibits diving for abalones in District 7.
- Assembly Bill No. 284—Creates an invertebrate refuge of the property of the Scripps Institution of Oceanography, in San Diego County.
- Assembly Bill No. 303—Adds Districts 1½, 2½ and 4½ to the district in which it is unlawful to take game fish at night.
- Assembly Bill No. 320—Provides that the opening of the salmon season in District 5 is 15 days earlier and the closing of the season in this district is 30 days earlier. Provides a uniform trolling season for all outside ocean districts from the California-Oregon line to the northern boundary of Ventura County, with the season opening on June 1st and closing September 15th. Provides no change in the present law for tidewater of Klamath River, nor commercial fishing in Districts 12 and 12B, which take in the Sacramento-San Joaquin rivers. Prohibits the taking of fish in the ocean waters within 3 miles of the mouth of the Klamath River.
- Assembly Bill No. 325—Creates a quail refuge in and around the town of Bolinas, in Marin County.
- Assembly Bill No. 337—Adds crow and black-billed magpie to the list of predatory birds.

- Assembly Bill No. 421—Makes it unlawful to drive any game bird by means of auto, power boat or airplane over hunters with the intention that the birds shall be shot at.
- Assembly Bill No. 480—Prohibits the taking or possession of crayfish in District 4.
- Assembly Bill No. 646—Creates a game refuge around General Grant Park.
- Assembly Bill No. 1119—Allows the private stocking of streams and other waters by purchase of fry from private hatcheries under permission of Fish and Game Commission.

In addition to the above, there were two resolutions adopted by the senate. One, appointing a committee of three assemblymen to investigate fishing conditions on the Klamath River and to report to the next session on the advisability of the state purchasing the cannery at Requa, in order that commercial fishing might be prohibited upon this magnificent river.

The other resolution asked for the appointment of a committee to make a special study and detailed investigation of migratory wild fowl and the influences that affect the supply; and whether private sanctuaries are harmful or beneficial; and to gather information from federal and state sources regarding conditions in other parts of the United States and Canada and to report back to the next session of the legislature.

DISEASE PREVENTIVE MEASURES FOR GAME FARMS

Many game keepers have become discouraged in raising game birds because they have experienced great losses from diseases. To prevent and combat disease outbreaks, one must consider the predisposing factor which is faulty management. This includes the selection of weak and diseased stock, improper handling and feeding, and poor sanitation. The following measures should be employed in the proper manner which will help to maintain disease-free stock.

1. Select stock from a source which has a clean health record.

2. All new birds introduced onto the premises should be held in quarantine, and kept under close observation for manifestations of disease.

3. Only vigorous and healthy birds should be employed for breeders.

4. Breeding and rearing pens, brooder and rearing coops should be so constructed that they can be easily cleaned and disinfected at frequent intervals.

5. Overcrowding in the pens should be avoided.

6. A rotation system of pens should be practiced so that the ground can be disinfected, plowed and rested.

7. In using domestic hens, they should be selected from disease-free flocks because poultry diseases are often transmitted to game birds through domestic stock.

8. Domestic poultry maintained on the premises should be subjected to tests and treatments for such diseases as bacillary white diarrhea, tuberculosis, internal and external parasites.

9. With regard to handling and feeding game birds, one should consult an experienced successful breeder for information and advice.

10. Diseased or dead specimens should be sent for examination to the Fish and Game Laboratories, George Williams Hooper Foundation for Medical Research, University of California, San Francisco, California.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to H. C. Bryant, 510 Russ Bldg., San Francisco, California.

September 23, 1929

"Take only the natural increase; the interest is ours, but the principal belongs to posterity."

STREAMS CLOSED TO FISHING, 1929

A number of fishing streams were ordered closed to fishing last year as a result of action taken at the 1927 session of the California legislature. Vested with proper authority, Governor C. C. Young and Fred G. Stevenot, Director of the Department of Natural Resources, have taken similar steps this year. Consequently a number of additional fishing streams and lakes in various sections of the state are closed to all fishing.

This action was taken only after careful investigation to protect spawning areas in certain sections. It also came as the result of many requests by fish and game protective and sportsmen's organizations that certain other waters be closed to fishing as a conservation and protective measure.

The only streams closed last year that have been opened for fishing this season are Santa Rosa, Mark West and Salmon creeks in Sonoma County, Deer Creek in Tulare County, and Bear Canyon Creek in Los Angeles County.

The list of closed waters follows:

Coast Counties—

Humboldt County: Yager, Anderson and Dobbin creeks and all tributaries; Prairie Creek and all tributaries to its junction with Redwood Creek.

Lake County: Willow, Rice, Deer, Trout, Soda and Salmon creeks and all tributaries.

Santa Cruz County: All waters after August 1st, except tidewater.

Sacramento River Watershed—

Lassen County: Snag Lake and tributaries.

Shasta County: Grassy Lake and stream connecting with Snag Lake; Hazel and Shotgun creeks and tributaries.

Plumas County: Thompson, Tollgate, Blackhawk, Clear and Rock creeks and

tributaries, all in vicinity of Quincy; Red Clover Creek (a tributary of Indian Creek) and tributaries; Butt Creek between the Almanor Tunnel and Butt Lake. (Butt Creek, listed above, closed ONLY from Nov. 1 to May 29.)

Plumas and Sierra Counties—

Streams flowing into Gold, Grassy, Jamison, Smith, Long and Round lakes for a distance of 2,000 feet up stream from the mouths, the outlets of these same lakes for a distance of 2,000 feet from the lake and that part of the lakes within 300 feet of the outlet will be closed until August 1, 1929. All of these lakes are located in the Mt. Elwell country near Blairsden.

Siskiyou County—

Soda Creek and tributaries.

Eldorado County—

Rainbow, Grouse, LeConte, Waca, Pyramid, Gefo, Toem and Jabu lakes.

Placer County—

Bunker Lake.

Tahoe and Truckee River Watershed—

Martis (a tributary to the Truckee), Alder (a tributary of Prosser Creek), Sage Hen (a tributary to the Little Truckee) and all tributaries. Griffs, Slim Jim, Burton, Ward, Blackwood, Madden, McKinney, General, Meeks, Lonely Gulch, Rubicon, Eagle, Cascade, Taylor, Upper Truckee, Trout, Cold creeks and all tributaries; all of the above flowing into Lake Tahoe.

San Joaquin Basin Watershed—

Fresno County: All streams flowing into Shaver Lake. All tributaries to Dinkey Creek.

Tulare County—

McIntyre, Boulder, Bear creeks and tributaries. Coy Creek above Rogers Camp trail; Lost Meadow Creek above Loyd Meadow trail; North Fork of Tule above Redwood Crossing; Alder Creek (tributary of the North Fork of Middle Fork of Tule River); Kern River and big Kern Lake between Horse Trail Bridge and the outlet of Big Kern Lake; Brush and Tobias creeks and tributaries.

Southern California—

Los Angeles County: Devil's Canyon Creek and tributaries.

Orange County: Holy Jim Creek and tributaries.

Mono and Inyo Counties—

Middle Cottonwood Lake and stream connecting with lakes above and below. Reverse Creek and tributaries between June Lake and Rush Creek.

CONVENTION OF VOLUNTEER WARDENS

On April 27, 118 volunteer deputies of the division gathered in San Francisco at their own expense for intensive instruction and open discussion of conservation and protection problems. The occasion was the first state-wide convention of volunteer game wardens ever to be held, and it brought together men from as far north as Humboldt County and as far south as Los Angeles.

Following registration at headquarters of the division in the Russ Building, the volunteers gathered in the Merchants Exchange Building, the convention proper starting at 1.30 in the afternoon and operating on a strict time schedule until 4.30 when the meeting was thrown open to discussion from the floor. R. M. Grose, captain of the volunteers in the San Francisco district, presided. John L. Farley, executive officer of the division, greeted the men and praised their efforts. He was followed by E. L. Macaulay, chief of patrol; Walter R. Welch, captain in charge of volunteer deputies; S. B. Show, United States District Forester; and George Tonkin, federal game protector. Following a brief intermission when the men fraternized with one another, Dr. Harold C. Bryant, in charge of the Bureau of Education and Research, addressed the convention, after which short talks were given by Donald McLean, field naturalist, on hawks and owls; J. S. Hunter, assistant to the executive officer, on game refuges; and John Spencer, head of the hydraulic bureau, on screens and ladders.

The open discussion which followed brought out many interesting problems both as to law enforcement and the various things that come up in the work of a game warden. A fine spirit was shown and throughout the entire proceedings one could see that the volunteer force is cooperating fully with the regular patrol.

The convention closed with a banquet served in the Commercial Club where after a brief introduction Captain Grose turned the meeting over to Captain Welch who introduced Albert Lindley, well known conservationist of Stockton, California, who acted as toastmaster. Lindley proved to be the ideal man for the occasion and in an adept and happy manner put all of the speakers at ease and brought out many good laughs.

Those addressing the diners included: President I. Zellerbach, who praised the organization and expressed his appreciation of the work done; police judges J. L. Steiger and Sylvan Lazarus; Senator Sanborn Young, chairman of the Senate Committee on Fish and Game; Fred G. Stevenot, director of natural resources; M. B. Pratt, state forester; Executive Officer John L. Farley. Former Executive Officer Eugene D. Bennett, paid his respects to the men whose organization he had assisted in forming while chief of the division. All those speaking declared a full realization of the importance of the meeting and of the work

being done by this fine body of volunteer protectors of the wild life of the state.

CALIFORNIA'S FISH CATCH

California's fresh fishery products lead the world. The coast fisheries probably unknown to many, have been for many years the basis of one of the greatest of the industries of the Golden State, but it remained for the startling increase in 1928 to show world leadership with a production of over half a billion pounds of fish, 528,481,044 to be exact. This figure shows an increase over the production last year of 104,113,862 pounds.

Sardines, as usual, lead, with 420,269,665 pounds as against 342,275,289 during 1927. There was great increase in the production of mackerel due to the greatly increased activity in the canning of this fine food fish. The 35,251,298 pounds taken in 1928 place it in second place. This was an increase over 1927 of 30,522,395 pounds.

Third on the list is bluefin tuna with 13,700,870 pounds. In 1927, 4,898,386 pounds were considered an excellent record. Sole is in fourth place with 10,280,419 pounds; rockfish, fifth, with 6,414,971; salmon totaled 4,478,566; barracuda, 4,385,214; skipjack, 4,262,732; abalones, 2,066,243; bonito, 1,317,963; herring, 1,139,682; halibut, 1,308,053 pounds.

Pompano totaled 3295 pounds and pike 3780 pounds, while 1029 pounds of suckers were caught also. In the Sacramento-San Joaquin district 168 pounds of terrapin were taken, and eels with 227 pounds remained the smallest figure on the list.

The Monterey County district leads the state with 229,123,321 pounds of fish, due to the enormous sardine catches brought in, while the Los Angeles district with 217,466,068 pounds is second. This district produced 29,872,267 pounds of the big catch of mackerel. The San Francisco-San Mateo district with 44,294,407 was third; San Diego-Imperial, 20,024,176, fourth; Santa Cruz, 3,512,722, fifth; Marin, 3,068,040, sixth; Del Norte-Humboldt, 2,420,162, seventh; Alameda-Contra Costa, 2,377,250, eighth; Mendocino-Sonoma, 2,168,520, ninth; and Orange, 1,821,510, tenth.

The Solano-Yolo district was low, but accounted for 514,553 pounds of fish included in the record breaking total for the state during 1928.

The crabs taken numbered 148,927 dozen; Pismo clams totaled 125,205 pounds and shrimps 2,280,871 pounds.

In addition to this record California catch the total of fish brought from south of the International boundary into San Diego was 26,040,412 pounds. Another 23,730,871 pounds came into the port of San Pedro. Yellowfin tuna was the largest item in this catch, a total of 32,168,580 pounds coming into the two ports.

FEDERAL GAME DEPARTMENTS CONSOLIDATED

In the interest of efficiency and economy, the Division of Game and Bird Reservations has been consolidated with the Migratory Bird Treaty and Lacey Acts, Division of the U. S. Department of Agriculture, Bureau of Biological Survey. The new division will be known as the Division of Game and Bird Conservation. The division will have under its immediate direction the following major activities:

Enforcement of the Migratory Bird Treaty Act and regulations.

Enforcement of the Lacey Act, prohibiting the interstate shipment of common carrier of the dead bodies or parts thereof of wild animals which have been illegally killed or which are shipped contrary to the laws of the state from which shipped.

Enforcement of section 84, as amended April 15, 1924, protecting wild animals and birds and their eggs on federal refuges.

Maintenance of the federal big-game and bird reservations under the jurisdiction of the U. S. Biological Survey and the establishment of additional ones as they may be authorized from time to time by congress, including the Upper Mississippi River Wild Life and Fish Refuge authorized in 1924, and the Bear River Migratory Bird Refuge under the act of April 25, 1928.

Exercise of the functions delegated to the Biological Survey under the Alaska Game Law and cooperation with the Alaska Game Commission in its activities.

The official title of the head of the new division—Colonel H. P. Sheldon, Washington, D. C., will be U. S. game conservation officer. The title of each U. S. game warden will be changed to U. S. game protector and of each reservation warden to U. S. reservation protector.

BIOLOGICAL SURVEY FORMS NEW DIVISION OF LAND ACQUISITION

Secretary of Agriculture Hyde has authorized the creation in the Bureau of Biological Survey of a new unit, effective July 1, to be known as the division of land acquisition. This new activity is

authorized by an act of congress, approved February 18, 1929, known as the Migratory Bird Conservation Act. Its purpose is to meet more effectively the obligations of the United States under the Migratory Bird Treaty with Great Britain by lessening the dangers threatening wild fowl from drainage and other causes, through the provisions of areas of land and of water to furnish in perpetuity reservations for their adequate protection through acquisition by purchase, gift, or lease. The field of work will extend throughout the United States, including Alaska.

In order to carry out the purposes of the Act it is necessary to ascertain by examination of the numerous potential areas to be found throughout the United States those that are best adapted for refuges, to make appraisals in order to determine their character and value, and to conduct other activities incident to their acquisition with the funds made available by congress from time to time.

The units selected for migratory bird refuges must be of such character as will best serve the purposes contemplated under the act. Usually they will be more or less extensive areas of lowland, comprising marsh and woodland contiguous to or embracing water areas, or they may be areas that were formerly well suited as feeding and nesting grounds for migratory birds, but now useless by reason of drainage developments or evaporation and subject to restoration to their natural conditions. The Migratory Bird Conservation Commission created by the act will consider and pass upon all lands recommended by the Biological Survey for acquisition for refuge purposes. The Secretary of Agriculture is chairman of the commission.

In addition to having charge of the land acquisition under the Migratory Bird Conservation Act, the new division will supervise all other land acquisition and cadastral survey activities of the Bureau of Biological Survey, including the Upper Mississippi River Wild Life and Fish Refuge and Bear River (Utah) Migratory Bird Refuge.

The new division of land acquisition will be directed by Rudolph Dieffenbach, senior land valuation engineer, who has been conducting work incident to the acquisition of lands on the Upper Mississippi River Wild Life and Fish Refuge and elsewhere for the Survey since 1925.

STATES CONSENT TO ACQUISITION OF LANDS FOR FEDERAL MIGRA- TORY BIRD REFUGES

Since the approval of the Migratory Bird Conservation Act on February 18,

1929, two states, Kansas and Montana, have given consent to the acquisition of lands by the federal government for refuge purposes under the new law, according to information received by the Bureau of Biological Survey of the United States Department of Agriculture, which will administer the act. Section seven of the Migratory Bird Conservation Act provides that no deeds shall be accepted by the Secretary of Agriculture unless the state in which the refuge area lies shall have consented by law to the acquisition by the United States of lands in that state. The Kansas Enabling Act was approved on February 26 and the

quired, a draft of a suitable measure has been prepared for consideration by the state legislatures holding sessions this year.—*The American Field*, April 20, 1929.

FIRST DISCOVERY OF SARDINE EGGS

After a search which has extended over a long period of time, and covered the entire coast of California from Eureka to San Diego, E. C. Scofield, scientific assistant in the bureau of commercial fisheries of the division finally located large numbers of sardine eggs and larvae five miles off Point Vincent in southern California the first week of June, 1929.

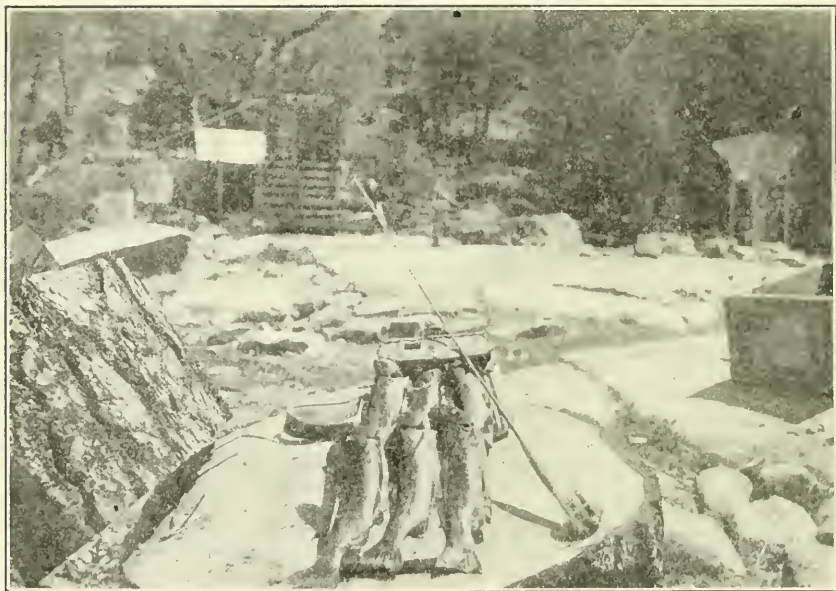


FIG. 82. A limit of rainbow trout taken in Lake Elinor, Yosemite National Park, opening day, 1928. Photograph by H. P. Walls.

one in Montana on March 1. These two states are the first to take special action in the matter, although it has been determined that existing legislation in the states of Arizona, Colorado, Connecticut, Georgia, Illinois, Iowa, Louisiana, Maine, Maryland, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Ohio, Oklahoma, South Carolina, South Dakota, West Virginia and Wyoming is sufficient for the federal government to proceed with the acquisition of areas for refuge purposes. State enabling legislation, however, will be necessary in all other states. In those states where legislation in harmony with the federal act is re-

The discovery is the first of its kind made in America. Its importance is far reaching and, no doubt, will lead to other discoveries that will give information regarding the spawning habits of the sardine. Aside from its scientific value, this knowledge will be of very practical benefit to the sardine canning industry.

Fishermen know that just before sardine eggs are ripe and the fish ready for spawning, the fish disappear. They have never been able to locate their spawning areas. After the eggs are deposited the sardines reappear and can be taken by the fishermen. Scofield found schools of sardines apparently spawning and was

able to secure eggs and larvae for scientific investigation. The eggs found were almost entirely transparent. Apparently, they hatch floating in the water, and the transparent condition is nature's method of protecting them from their natural enemies.

The discovery will always remain a feature of the hydrobiological survey. This survey is a cooperative investigation with the Hopkins Marine Laboratory of Stanford University and the Bureau of Commercial Fisheries of the division. Its objective is to assist the canners and fishing interest in learning something of the habits of the sardines and the effect of hydrographic conditions on the movement of the sardine in California waters.

VOLUNTEER DEPUTY INJURED

On Sunday morning, April 28, volunteer deputy Lee Straight was seriously injured. He was making an adjustment of the motor of one of the bay and river patrol boats preparatory to a search for illegal net fishermen. While thus engaged, his revolver fell from the holster and discharged a bullet, which entered the left side of his body passed through the intestinal portion and penetrated a lobe of the liver.

Volunteer deputy Straight has rendered invaluable service to the department and this accident was considerable of a shock to many of his friends and brother officers. It is a pleasure to record that he has passed the critical stage. The hope of a speedy recovery goes out to him from all associated with the division.

HUNGARIAN PARTRIDGES TRANSPORTED BY AIRPLANE

California was perhaps the first state to use an airplane in transporting game birds from the holding pen to the fields for liberation. This was made possible by Commissioner George B. Clarkson and the Standard Airways Company of Los Angeles.

On the trip from Los Angeles to Victorville, on April 8, an altitude of 8000 feet was reached and this is possibly the high altitude record for Hungarian partridges. The birds showed no ill effects of the trip or even the high altitude.

PERPETUATING A NATURAL RESOURCE

Modern methods of game administration look ahead and give heed to the needs and pleasures of generations to come. They recognize those means that best insure a continuous supply for the future. Gold and iron, oil and coal, represent a class of natural resources capable

to complete exhaustion with continuous use. Wild life resources, on the other hand, are able to reproduce themselves and typify a natural heritage that may be made perpetual. Any intense exploitation or over use of a wild life resource will, of course, result in its depletion, so that any prolonged or lasting benefit which it is capable of giving can only be gained by wise use over a long period of time.

The objective sought by the Division of Fish and Game is a system that will maintain the state's wild life resources in the face of a progressive civilization, but in harmony with the economic necessities and social requirements of a rapidly increasing population. The attainment of this object is dependent, first, upon husbandry of wild life in existing remnants of wilderness areas or adjustment in other areas where the natural environment has been changed or modified to bring about suitable conditions for wild life survival; second, replacement of depleted game covers and barren streams by thousands of artificially produced individuals.

Obviously only those methods which experience has proved effective should be employed to accomplish this object. Laws regulating the killing of game and the taking of fish represent one of the early methods used to conserve fish and game. As early as 1852, California gave legal protection to certain valuable game mammals. Through the years the state has continued to restrict hunting and fishing and to prohibit the use of methods whose practice has proved inimical to the preservation of wild life. At present the division has 122 regular deputies patrolling every section of the state to enforce fish and game laws. This regular patrol is considerably assisted in its work of protection by some 850 volunteer deputies.

Any system that would wisely conserve game mammals and birds must recognize that shooting is only one of the many factors responsible for the reduction of game. No species of animal life can endure without food, water, shelter, safety from enemies and adequate breeding grounds. It should seem self-evident that elk can not live in a country where the progress of agriculture has appropriated their natural pasture; neither can deer survive on land blackened and devastated by fire where food, water and cover are absent. Similarly, upland game birds can not reproduce their kind when their nest sites have been destroyed by destructive lumber or forest denudation. It is impossible for wild fowl to carry on when

reclamation projects have dried up their homes.

In other words, if the continuance of a species is to be made sure, these so-called "biological requisites" must be taken into account. Smaller bag limits, shorter seasons and other legal restrictions are not in themselves thoroughly effective remedies for disappearing game birds and mammals. In recognition of this fact the division has established a chain of game refuges extending throughout the length and breadth of the state. These 34 state game refuges embrace about 2,372,350 acres of forest lands where natural conditions are modified to the least possible degree by human influence and where natural food and breeding sites suitable to the type of game conserved are available.

The new hunting license act provides that one-third of all the revenue from hunting licenses must be spent in the acquisition of land for game refuges and public shooting grounds. Already the division is availing itself of the opportunity to obtain sanctuaries for migratory wild fowl to equalize the condition caused by the loss of feeding and loafing grounds through the drying up by reclamation of former flooded areas.

Besides employing effective and advanced methods of protection the division is actually engaged in the production of game fish and game birds. It owns and operates twenty-six hatcheries and twelve egg-collecting stations. Its fish-cultural equipment enables it to plant yearly from twenty to thirty-five million trout and salmon in the 26,000 miles of fishing streams in the state. The hatchery at Mt. Shasta is alone capable of producing 10,000,000 trout.

The division maintains at Yountville, Napa County, a ten-acre game farm where pheasants, quail and partridges are raised for liberation in depleted covers. In 1928, 6106 Chinese ring-necked pheasants were liberated in suitable areas. Another game farm, now built in southern California, will make possible the liberation of many more thousands of pheasants.

In short, the division is vigorously putting into practice a system of game management embodying those methods which best insure its object to make hunting and fishing an asset to be enjoyed for all time in California.

SALMON CONSERVATION

One of the chief matters of interest to the International Pacific Salmon Investigation Federation is the effect of trolling on the salmon supply. Large

numbers of salmon have been caught and tagged. The most interesting result of the tagging experiment is that salmon from streams in Washington and Oregon, and even from the Sacramento River, seek feeding grounds in the north Pacific. These are caught by trollers operating off British Columbia.

For the last eighteen years, attempts have been made in British Columbia to accord protection to sockeye salmon in the Fraser River which are being overfished in Puget Sound. If this treaty is entered into which will safeguard the salmon of the Fraser River, Canada will be in a position to give more attention to the need of restricting trolling. For this reason, the division is much interested in the treaty now before the Canadian Parliament. This treaty is between Canada and the United States and proposes to establish an international commission with power to investigate and to make restrictions in an attempt to reestablish the once great runs of salmon of the Fraser River and Puget Sound.

The treaty has been signed by the state departments of both governments. Its ratification by the Canadian Parliament will remove a very definite barrier and pave the way for further measures to be taken to conserve the salmon of the Pacific coast.

WHO OWNS THE GAME?

The ownership of game often affords a lively topic for argument. Probably the most familiar theory advanced is that the owner of land, since his property supplies the necessary requisites for the existence of game, has a proprietary interest. At times this interest approaches a claim of almost complete and absolute ownership. A second popular holding is that game belongs to the sportsman. This contention arises because the sportsman can trace the fee which he pays for the privilege of hunting and fishing and can say that it is his money which is used to produce and protect game.

A recent decision by a supreme court in Missouri on this question concurs with the accepted theory of most states. The court in this case again asserted that game belongs to the state. It belongs to no individual until it has been reduced to possession by taking in the manner prescribed by law.

Montana Wild Life for March, 1929, quotes pertinent paragraphs from this decision, *State of Missouri vs. Savage*: "The ownership of wild animals so far as they are capable of ownership is in the state, not as a proprietor but in its sovereign capacity as the representative

and for the benefit of all its people in common. It is therefore the duty of the legislature to enact such laws as will best preserve the subject of the trust and secure its beneficial use in the future for the people of the state.

"The license issued to the defendant authorizing him to hunt and kill, subject to the regulations and restrictions of the law. This is a reasonable police regulation to prevent evasions of and for the effectual enforcement of the act; the defendant had no interest whatever in the quail that he may have taken; he simply had a privilege to kill or have in his possession a limited number on any one day. He has accepted his license under the terms, restrictions and limitations of the law and consented in advance that the game warden might at any time count the quail in his possession and that such inspection and count of quail in the defendant's possession is not an unreasonable search and seizure and such requirement is a reasonable and necessary regulation for the enforcement of the statute."

Further quotation from the decision: "The defendant by taking out a license to hunt and kill game, the title to which was in the state, acquired a mere privilege to hunt, subject to the restrictions and limitations of the statute; that the statute requiring him to permit the game commissioner or his deputies to inspect and count the fish, birds, animals and game in his possession to ascertain whether the requirements of the statute were being faithfully complied with, is a proper and necessary police regulation to discover and prevent easy evasions of the statute. The statute being of general application to all persons alike, is not repugnant to the due process and equal protection clauses of the constitution. By accepting a hunter's license he waived the constitutional rights involved so far as applicable to the facts in this case."

PROPOSED CHANGE IN OPENING OF TROUT SEASON UNSATISFACTORY

For many years past, anglers have complained that the fish caught in Inyo, Mono and Alpine counties at the first of the season were full of spawn. An attempt was made to give safety to spawning fish by means of a later opening of the season. A change from May 1 to May 30 would have caused great dissatisfaction, though giving protection to the fish in a section rapidly growing in favor as recreation grounds. So adverse was sentiment that the bill failed to receive sanction.

FISH RESCUE AND RECLAMATION

A most constructive conservation measure has been undertaken by the division recently in the establishment of a Bureau of Fish Rescue and Reclamation. Its purpose is to rescue and reclaim the millions of young and adult game and food fishes annually lost to the state by becoming stranded in the flooded areas adjacent to the many streams and lakes, and from streams that would become dry by reason of a minimum of snow or rainfall.

Heretofore, owing to the lack of funds, but little effort was made to rescue but few of the millions of fish lost in this way.

In addition to the salmon, trout and nongame catfishes there are six species of fresh water game fish for which a state license is required to take them. They are the striped bass, black bass, crappies, sunfishes and perch. None of the above with the exception of the Sacramento perch are native to California but of great commercial food value. They are natives of New Jersey, Vermont, Michigan, Illinois and midwestern states. They are known as the spinous or spiny-rayed fishes and unlike the salmon and trout, do not require flowing current of water to hatch their spawn, with the possible exception of the striped bass. These fishes seek ponds, sloughs, lakes and overflowed areas containing weeds, grasses, moss and other aquatic growth in which to spawn and which furnish algae for the young and protection against some of their predaceous parents.

Like some of the trout species transplanted into our waters from other states and foreign countries they have proved very adaptable to the aquatic conditions of California. The numerous streams, and lakes furnish an abundant food supply for them. This together with the mild winters enable them to reach a larger size than in their native waters from whence they came.

The flooded lands adjacent to the streams of the valley, particularly the San Joaquin, Kings, Cosumnes, Mokelumne, Sacramento and American rivers furnish many thousand acres of natural spawning grounds so necessary for their propagation, but which become dry in the early summer. Their propagation costs nothing. Their hatcheries are the swamps and sloughs. They require no feeding as do artificially hatched fish, no buildings or attendants, no watchful eye of fish-culturists. Nature does it all, except that when nature has completed its wonderful work, the young and adult

fish must be removed to permanent waters and not allowed to remain a prey to the numerous predatory birds and animals. This is the purpose of the bureau.

Heretofore few replacements have been made, while millions have been lost every year. Even the few that have been planted can in no sense replace those taken out by the angler. There is no better food or game fish than the spiny-rayed tribe named above, and it is of much importance that a supply be maintained.

An idea of the importance of this new venture, from an economic point of view is shown by the following. In the three months from August 7, 1928, to Novem-

ber 7, 1928, this bureau saved to the state 862,251 fresh water fishes and returned them to the water alive. Of these, 122,475 were striped bass from four to six inches in length. In one year, these fish will weigh approximately 16 ounces and when they attain the size of three pounds each, would sell for 25 cents or 30 cents per pound. This species grow to as much as 50 to 75 pounds in our waters. In addition to the game fishes rescued the bureau has saved 278,260 catfish, not classed as a game fish but of extreme commercial value, and will sell for the same price as striped bass.

When the anglers of California appreciate the value of the spiny-rayed fishes

ANNUAL DEER CROP

Minnesota claims the largest bag of deer in the United States for the year 1928. Sportsmen there made a record kill of 27,335 legal bucks. Pennsylvania had an open season on does which were very abundant and even then did not

exceed this kill in Minnesota. California ranks third with a kill of 21,515.

The deer kill in three of the most densely populated eastern states is quite remarkable from a certain point of view. Contrary to popular opinion, it is not necessary to repair to the wilder and less settled parts of the nation to find certain types of game fairly common. In fact, some game species seemingly thrive in the face of modified conditions brought about by the encroachment of civilization. They possess a ready adaptability and are quick to avail of advantages. Partial encroachment in the east seems to have created conditions highly favorable for the survival of white-tailed deer. For



FIG. 83. A three-pound Lake Almanor rainbow trout. Photograph by E. S. Cheney, May 15, 1929.

instance, New York, New Jersey and Pennsylvania have a population of 25,000,000 people or 243 person to the square mile. Yet statistics for 1928 show that hunters legally bagged 7029 male deer in New York, and 1415 in New Jersey, while in Pennsylvania 25,097 females were legally taken.

The area of California is twice as great as these three states combined. However, it must be borne in mind that the black-tailed and mule deer are the predominating species in the state. These species, as yet, have not succeeded in holding their own where the encroachment of civilization has modified the old natural order. So far the range of the white-tailed deer covers but a small area of the Modoc region. In a sense, it is but a winter visitant, for it is not definitely known that the animal breeds in the state.

SAFETY OF MIGRATORY FISH THREATENED

In recent years a critical situation has arisen in the western states. Power dams at first largely restricted to the upper reaches of streams in the mountains are now being built at lower points. There is dependable evidence that migratory fish, as salmon and steelhead, are blocked from reaching their spawning grounds as a result of these insurmountable obstructions. No satisfactory fishway has yet been devised which will allow fish to pass beyond a 200-foot dam.

The general public, although seldom realizing the grave danger, has made two shows of strength when legislation was necessary. In California, Klamath River was made a fish preserve and high dams are prohibited. In Oregon this past winter, a strong showing was made in the attempt to keep four of Oregon's principal fishing streams free from artificial obstructions.

The 1929 legislature of Oregon passed a law which saves the Rogue River as a fishing stream. The state engineer may no longer grant permits for water appropriation without first taking into consideration the safety of the migratory fish.

Although it seemed that the Klamath River controversy was satisfactorily settled by the referendum, the power company concerned continues to be active. As a further means of putting an end to this agitation, a committee was appointed by the California Development Association. The problems to which the Klamath River Study Committee will devote its efforts are: (1) The harmonizing, if possible, of the views of the

various groups concerned, and (2) the development of a program of future uses of the river that will serve the best interests of the state. After making a thorough inspection of the area in question, a series of public hearings have been held. There has been evidenced a fine spirit of fair play to both sides and a worthwhile report is to be expected.

TROUT FOOD

A novel method for securing natural food for baby trout was used in the vicinity of Clear Lake, Lake County, California, last summer. The device constituted an insect trap designed in the form of a funnel-shaped cloth sack over which was suspended an electric light. These traps were hung near the water and the light left burning during the entire night. Several hundred pounds of insects were gathered each week in this manner and collected and fed to the young trout in the Cold Creek Hatchery near Ukiah.

J. W. Ricker, who carried on the experiment, reports that the captured insects afforded splendid food, providing other types of food were supplied. The young trout appeared not to do so well unless their diet was varied.

SAN DIEGO COUNTY PAYS BOUNTY ON MOUNTAIN LIONS

On September 1, 1928, the San Diego County Board of Supervisors passed an ordinance to pay a bounty of \$75 for the killing of mountain lions in San Diego County, regardless of sex. Since September nearly twenty-five lions have been killed in the county and there are reports that still some lions are at large.

J. B. Thompson, who had been hunting for the Biological Survey in New Mexico, heard of this county bounty, in addition to the state bounty, and came to San Diego County with his family. He has killed ten lions since May 20 this year, shooting them from trees or other points where they have been driven by the hounds. His dogs are trained for lions, will run nothing else and are skilled in the lion hunting business.

The Goswick brothers from Texas were attracted by this bounty and have four lions to their credit. They have lion dogs, too.

The balance of the lions have been taken by resident hunters anxious to avail of the county's offer.

PHEASANTS HELP FARMERS AND HORTICULTURISTS

Another use has been found for the Chinese ring-necked pheasant. The board

of game commissioners of Pennsylvania has announced that proof has been found that the ring-neck pheasant feeds on Japanese beetles, one of the most serious insect pests found in the eastern United States. The stomachs of numerous birds which have been killed have been examined and found to contain hundreds of these destructive insects.

It has also been shown that the starling, an otherwise unpopular introduced alien bird, feeds on the Japanese beetles. The skunk has also been observed eating the same insects.

The Japanese beetle, brought to America in some imported Japanese plant, has become established in certain parts of the east and has grown to be a most dangerous pest to agriculturists and horticulturists. Its devastations include orchards, vineyards, gardens, shade trees and all manner of useful plants.—*Game and Fish Conservationist*, Richmond, Va., March-April, 1929.

AIRPLANES AND FEEDING OF GAME

As contrasted with the unwise use of the airplane in hunting or the distribution of poison, we are glad to note that the airplane is coming into usefulness as a means of carrying a needed supply of food to starving game birds and mammals.

Riverside County suffered a disastrous brush fire during the dry season last year which burned over thousands of acres of land. Many game birds and some mammals were destroyed. After the fire, it was observed that the quail which escaped faced another dilemma—starvation. The Riverside Chapter of the Izaak Walton League of America fostered a plan to distribute grain by airplane. The funds to carry out this project were raised by popular subscription and actual relief was administered to the birds in the stricken area.

A report from Hillsboro, Oregon, is to the effect that last winter Dr. E. H. Smith, an aviator, rigged a hose attachment to the fuselage of his plane and spread grain over an area one mile wide by two miles long. The report states that quail, pheasants and other birds flocked in and took advantage of this needed food supply.

EDUCATION ONE PRIMARY NEED

The Wisconsin Conservation Commission has inaugurated a department of education and publications. A recent bulletin from that bureau briefly recounts the progress made during the past year and calls attention to an enlargement of its scope of operation to include con-

structive and educational measures in addition to the propagation and distribution of game fishes, birds and animals.

"To justify itself," the bulletin states, "conservation must mean the creation of conditions under which forests will grow and the restoration of our marshes and wild lands to attract bird and animal life."

The Wisconsin Commission declares that forestry and reforestation must provide the background for all true conservation work. Forests provide cover and food for our game population and also act as watershed, which provides constant springs, clear streams and lakes which harbor fish and waterfowl.

The adoption of uniforms for conservation officers during the year is declared to have been a great help in securing respect of the people of the state for the conservation laws. Conservation officers carry on continuous propaganda of education instead of devoting their entire time to the apprehension of petty offenders. Notwithstanding this policy, 1513 arrests and convictions were secured during the year for violation of the fish and game laws, resulting in fines amounting to \$54,000.—*Game and Fish Conservationist*, Richmond, Va., March-April, 1929.

IDENTIFICATION OF DEER MEAT NOW POSSIBLE

Years ago, chemical tests were developed for distinguishing deer meat from other kinds of meat. Game wardens often confiscate dried meat which the violator maintains is goat rather than deer meat. Consequently, a satisfactory means of determining venison is desirable. Dr. H. Van Roekel, pathologist for the division, has manufactured the proper serum and is now in a position to analyze deer meat properly. In times past, court cases have been won by a demonstration of this test.

STRIPED BASS TO BE PLANTED IN SALTON SEA

The chambers of commerce in various cities in Imperial County have continually requested a survey of Salton Sea to ascertain whether fish resources might not be improved in that body of salt water. During March, George A. Coleman, biologist for the Bureau of Fish Culture, was sent to Salton Sea to make an investigation and to determine the suitability of this lake for sporting fish. An attempt was made to secure all the different kinds of fish found in that body of water at the present time, to secure invertebrate forms of life that might furnish a food supply

for fish, and to secure samples of the water for chemical analysis.

As a result of investigations, decision has been made to experiment with the introduction of striped bass. The stocking will be attempted next fall. Should the introduction of the striped bass in Salton Sea succeed, attempts will be made to stock other alkaline lakes.

SCIENTIFIC COLLECTING PERMITS

Under an amendment to the federal regulations approved April 23, 1929, holders of scientific collecting permits are restricted in the taking of migratory game birds on any day to the period from one-half hour before sunrise to sunset. It has always been understood that holders of state collecting permits would observe the ruling imposed upon all game bird hunters. The California Division of Fish and Game is glad to establish this ruling.

MEXICAN QUAIL SENT TO ITALY

The recent shipment of 2928 Mexican quail to the University of Bologna, Bologna, Italy, for restocking purposes, was the first large consignment of such birds made to a European country, according to the United States Biological Survey. The quail were brought in from Mexico at Brownsville, Texas, and were shipped through an American importer on February 28, 1929.

AUTOMOBILES A MENACE TO WILD LIFE

The increasing number of automobiles being driven over improved highways at higher average speeds are becoming a growing menace to wild life. Better servicing facilities and more liberal speed regulations are responsible for the increasing deaths of living things that chance near the highways.

According to the Automobile Club of Southern California, a member of the State Department of Agriculture recently made a count of carcasses passed while on two motor trips covering 632 miles. In all 255 bodies were counted which had been crushed by speeding automobiles. These represented 29 species, including 43 mammals, 144 birds, 40 reptiles and 28 domestic fowl.

SALMON DISCUSSED AT MEETING

The Fourth Annual Conference of the Pacific International Salmon Investigation Federation was held at Vancouver, B. C., on April 5. Mr. Henry O'Malley, United States Commissioner of Fisheries, presided.

Much attention was given to the subject of power dams and their effect on salmon

streams. Salmon packers and conservation officials stressed the menace to salmon streams as a result of hydro-electric projects. There was outspoken criticism of the alleged antipathy of power companies to the dangers involved. The same viewpoint was expressed in a paper by N. B. Scofield, in charge of the Bureau of Commercial Fisheries, whose paper was read by Prof. J. O. Snyder, Stanford University.

DEPUTIES THWART NOVEL METHODS OF VIOLATORS

The increased efficiency of the patrol department, with its large force of deputies, has brought about improved systems of law evasion by the insistent violator of the fish and game laws. He has been forced to use the best illegal methods and to scheme and plan for the purpose of devising some system which is new and different in order to avoid detection and apprehension.

In the region comprising San Francisco and San Pablo bays this very thing is being experienced. Formerly, it was the custom of deputies, among other things, to search for commercial fishermen who operate beach seines in districts 12 and 13. Very few of these nets have been confiscated in these districts for some time, due to the fact that fishermen using them have been hounded so thoroughly. It was thought for a time that the beach seine problem had been overcome. However, a recent discovery disclosed that some of the old offenders were using a drift gill net in the fashion of a beach seine. The position of a gill net is lawful in the above districts, but becomes unlawful when used within 300 feet of the shore, and is defined as a beach net when hauled from the water for the purpose of taking fish.

As a rule, set nets are placed straight across a stream. Here again the persistent violator, in order to effect his purpose, has made a severe departure from the established form. Set nets are now found in streams or sloughs up and down stream, or at angles to the stream. A great difficulty is experienced in finding nets so placed, and unless the area is traversed in a zigzag fashion with grappling hooks, the nets escape detection. These nets are usually set below the surface of the water and can be found by hooking onto them.

Deputies operating in fields and forests are experiencing the same difficulties and must always have their wits about them to be successful in detecting novel types of violation. Violators are seldom seen nowadays along the roads and highways;

they perpetrate their deeds back off the mainly traveled thoroughfares where they believe deputies will not find them.—Walter B. Sellmer.

FORCE AND PERSUASION

Force has been effective in staying the hands of the greedy and unprincipled. Those, for instance, who will not be moved by appeals for the conservation of game because of its inspirational and recreational values, must be brought into line by laws that command and threaten. However, for those who possess that obedience which yields to an enlightened understanding, fines and punishments are not altogether appropriate remedies. In an attempt to reach every type of individual and to make conservation popular with everyone, a county game warden in Washington places the following sign in a conspicuous place while on patrol when conditions do not prescribe secrecy or concealment.

"The Whitman County Game Department is making every effort to furnish plenty of good sport for every good sportsman, whether he be local or transient. We ask you to play the game square. Respect our game laws, especially bag limits, and by all means respect the rights of our landowners and leaseholders. Do not shoot near or in the direction of any live stock, nor toward any farm buildings. Don't be a game hog. Bring only good sporting blood into the field. Assist us in keeping this a good place to hunt, you may wish to come back some day."

SOCKEYE SALMON SUCCESSFULLY INTRODUCED

Efforts to stock a number of landlocked lakes in Flathead County, Montana, with sockeye salmon (*Oncorhynchus nerka*) have proved successful, according to the February number of *Montana Wild Life*. Initial plantings were made in 1916. The parent stock were landlocked sockeye salmon acclimated to a lake in Washington. These fish had adjusted themselves to fresh water conditions and were propagating. Some 200,000 eggs constituted the original shipment to Montana.

It is reported that 30,000 eggs were secured in the fall of 1928 by Montana fish cultural operators from fish in the south end of Flathead Lake. It is expected that with improved equipment and better knowledge of conditions that next year the number of eggs secured will reach a higher figure.

Experiments with the true silver salmon and Chinook salmon have proven

that the sockeye salmon is the better fish for their purpose. The former seldom, it is claimed, reach three pounds in weight in Montana waters, and so far no practical way has been discovered to secure their eggs for replanting. In a number of the Montana lakes where the sockeye salmon have been planted, they have made a good growth and have proven a real asset. They take a trolling spoon or fly and when hooked, put up a grand display, sometimes leaping out of the water three or four feet.

TULAREMIA IN SIBERIA

Tularemia, one of the new diseases which until now has been apparently limited to this country, has just appeared in Siberia. A short time ago it was recognized for the first time in Japan. Now a specimen of blood serum from a guinea pig was recently received by the Hygienic Laboratory in Washington with a request to examine it for tularemia. The examination was made and showed that the blood came from an animal infected with the disease.

The specimen had been sent from the Sanitary and Bacteriological Institute of Sverdlovsk (Ekaterinburg) in the Ural region of Asiatic Russia.

Tularemia was recognized in this country only during recent years. It made its appearance first in the west. Hunters and others who handled rabbits were suffering from a strange new illness. Dr. Alec Francis, one of the U. S. Public Health Service, discovered that the disease was caused by an organism found in rabbits or other rodents which transferred it to men by their bites. Also, merely handling the infected animals, as in the case of butchers dressing rabbits, was a source of infection.

Until the report of a case in Japan a few months ago the disease had not occurred, or at least had not been recognized, outside of the United States. Dr. Francis, who has done all the pioneer work on tularemia and is an authority on the subject, thought the disease was traveling from west to east. The New England states have not had any cases so far and it has only very recently appeared in New York state. Whether it has jumped clear over to Siberia in its eastward course or whether it has always been there, though unrecognized, is a question.

A single chance remark, dropped by Leon Trotsky in one of his articles now being printed in a number of American newspapers, has given a hint to American public health authorities of the possibility

of a widespread and severe epidemic of tularemia, or "rabbit fever," in European Russia. Speaking of the desolation of the countryside near Kursk, where the train bearing him into exile was held up for a number of days, Trotsky said, "Crows and ravens came in flocks to feast. There were no hares, because all had died of a terrible epidemic during the winter."—*Science*, March 8, 1929.

BEAVER THRIVES IN FORMER RANGE WHERE STOCKED

In the early trapping days the greater part of the Mississippi Valley was swarming with beaver. Beaver skins were almost the only important item in the trapper's catch; other furs were of little value and were only taken incidentally. The beaver, like the buffalo, were swept away by commercial greed. Having been restored to certain limited areas in northern Minnesota, Wisconsin and Michigan, they are gradually, under protection, extending their range again.

A number of beaver were liberated last fall on the upper Mississippi River Wild Life and Fish Refuge near Wabasha, Minnesota, and they have since been observed to have erected lodges and collected food for use during the past winter. The favorite food of the beaver in that region is the bark of the aspen or poplar and willow, an abundance of which is found along the bayous and sloughs bordering the Mississippi in the refuge. It is the belief of Superintendent W. T. Cox that the bottom lands being so well timbered and watered are well adapted to the restoration of beaver.—*Game and Fish Conservationist*, Richmond, Va., March-April, 1929.

PUBLIC SENTIMENT AND CONSERVATION

All of the remedies for the decreasing fish and game that have been printed would stock a library. The magazines are full of them. We speak about conservation, we urge law after law for this purpose. We want bag limits, we want game farms and fish hatcheries. But most of all we want laws.

What good will laws do us? Not one bit of good. The salvation of game and fish in this country rests squarely on the sportsman. If the sportsmen of this country do not want conservation, will not practice conservation, then all of the laws in Christendom would do not one bit of good.

We can not legislate game back, nor can we legislate more fish. But if the sportsmen really want conservation, they can have it, and they can have it even if

there is not one single law on the statute books of their states.

Conservation is a matter of public sentiment. If public sentiment is for it, it will become a fact. If public sentiment is opposed to it, all the king's horses and all the king's men can't haul it into actual existence.

Public sentiment is swinging to conservation of our outdoors. Of that there is no doubt. It means the salvation of our game birds and animals while there yet is time to save them. It means that we will do more for those that come after us than those who preceded us did for us. Which, after all, is largely the fundamental law of civilization.—*Examiner*, Bartlesville, Oklahoma.

BIG GAME COUNTED FROM AIRPLANE

The value of the airplane has again been demonstrated—this time as a means of counting and observing big-game animals. On a recent flight over the Big Delta region southeast of Fairbanks, Alaska, according to one of the game protectors of the Alaska Game Commission, an official of an Alaska airways company saw about 500 caribou and 9 moose, and three days later near the Toklat River counted 20 moose, 12 of them in pairs, 3 in one bunch, and 5 in another. The reactions of the moose and of the caribou to the airplane and its noise, says the protector, were quite opposite. The moose paid practically no attention to the strange machine, lifting their heads now and then to look at it but usually not becoming frightened. The caribou, however, became considerably alarmed and ran away. The tracks and trails of the animals were plainly visible from a considerable height. It is illegal to hunt game animals of any kind in the Territory from an airplane, and persons so doing are subject to fine or imprisonment, or both.—*The Official Record*, United States Department of Agriculture, April 11, 1929.

IT TAKES FOUR YEARS TO PRODUCE ONE POUND OF TROUT

It requires four years to produce one pound of trout. These figures have been arrived at by experts in the fish division of the Michigan Department of Conservation, who are giving their best efforts to keep the supply of fish in Michigan streams at the point where it will equal the demand. The next time you sit down to a dinner with five pounds of trout as the principal item on the menu, try to realize that it took Mother Nature many years to provide the delicacy. While the growth of fish varies greatly as to species

and natural conditions imposed by nature during their growth, it is estimated that the average fish may be legally taken after two years of growth. Water temperature and the vigor of the individual are the two principal factors that determine the growth of a fish. For instance, one trout may be treated to ideal con-

ditions of land service in which the inspirational, spiritual, and recreational potentialities of lands under the control of the federal government and their rapidly increasing importance and value to the people of the nation would be recognized and safeguarded.

"The area involved" continues one of

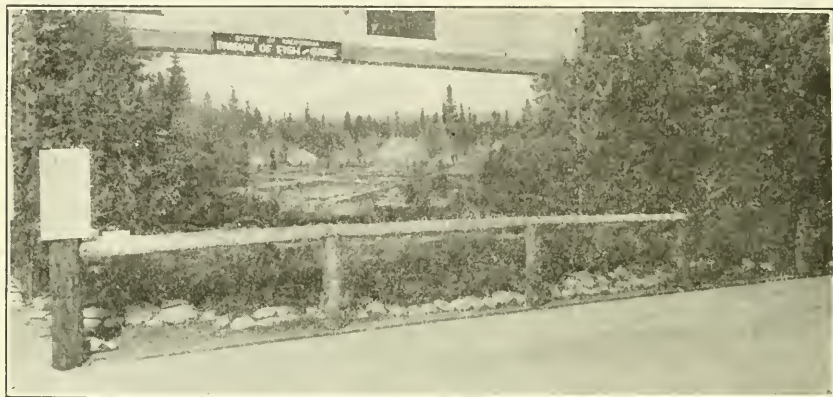


FIG. 84. Exhibit of brood pond system at the Mt. Shasta Hatchery. Pleasure Boat Show, Civic Auditorium, San Francisco, April 27 to May 4, 1929.

ditions and grow so rapidly that he will be ready for the pan in eighteen months, while another may meet with reverses and not attain legal length until he is three years of age.

If you pull out an eighteen-inch bass, you may safely guess that the old boy is seven years of age. Again a blue gill that measures nine and one-half inches is probably from four to five years old. As a general thing the blue gill requires three years before he is considered eligible for the hook by the law. Experts who have handled fish and watched their growth for the Department of Conservation in Ohio maintain that fish grow one-twenty-fifth to one-fiftieth of an inch per day. There is a wide degree of variation even in these figures. Some fishermen become impatient with efforts being made to restock the streams and lakes of Michigan, but if they will pause to consider how long man must wait on nature to complete his work many of the arguments fade into thin air. —*The American Field*, March 2, 1929.

MINNESOTA RECOGNIZES A NEW LAND SERVICE

The State of Minnesota on March 8, 1929, memorialized congress to pass the Shipstead-Newton Bill. The bill, it is claimed, "if enacted into law, would give legislative sanction to a new conception

of the authors of the bill, "is closely related to large centers of population. As population grows it will have increasing need for such areas as described in the bill to moderate the strain of modern existence, for the regeneration of its spiritual, mental and physical vigor.

"The testimony submitted to the committee," states Senator Shipstead, "has established the fact that the potential water power resources of the lands described in the bill are of considerable extent, but that their realization necessarily would involve considerable modification of water levels markedly destructive of the present scenic beauty and inspirational power of a large part of the region and possibly of great detriment to the fish and animal life with which the region now abounds."

Because of the importance of this act, the resolution is reproduced herewith in full.

WHEREAS, There has been introduced, and is now pending before the congress of the United States, introduced in the Senate by Senator Henrik Shipstead, as Senate Bill, S. No. 3913, and introduced in the House by Congressman Walter H. Newton, as House Bill, H. R. No. 12780, that certain bill now commonly known as the Shipstead-Newton bill, which prohibits any and all further al-

teration of the natural water level of any lake or stream within or bordering upon the area now known as the Superior National Forest, and all other public lands of the United States situated north of township 60 north in the counties of Cook, Lake, and Saint Louis, in the State of Minnesota, including the natural shore lines of Lake Superior and of the lakes and streams forming the international boundary so far as they lie within this area, which will result in flooding lands of the United States therein, without the consent of congress, and places restrictions upon logging and upon all forms of entry or appropriation under the public land laws of the United States in such area; and

WHEREAS, This region, a part of the fourteen thousand five hundred square miles covered by the Rainy Lake watershed, lying in Ontario and Minnesota, and the immediately adjacent lands and waters constitutes the only remaining vast wilderness area in the central part of North America; and

WHEREAS, This region contains the only remaining extensive coniferous forests in the Middle West with unusual potentialities for the development of a future continuous supply of forest products; and

stock, and increase various species of wild life of invaluable economic and aesthetic importance to both nations; and

WHEREAS, This region is now a great and beautiful pleasure ground for lovers of nature and wild life, visited annually by ever increasing thousands of recreationists; and

WHEREAS, The unrestricted development of this region may destroy or substantially injure the said forests, lakes and streams for recreational purposes, and may hinder the enactment of proper regulatory legislation for the development of this region consistent with the general purposes of such recreational area; now, therefore be it

Resolved, by the Senate of the State of Minnesota, the House of Representatives concurring, that the congress of the United States be memorialized that it is the sense of the members of the legislature of the state of Minnesota that such bill should be enacted into law, and such action be taken before the adjournment of congress now sitting.

Be it further resolved, That the secretary of the senate forthwith transmit a copy of this resolution to the President of the United States, to the Secretary of the Interior, to the Secretary of Agri-



FIG. 85. Exhibit of propagation of game birds, State Game Farm. Pleasure Boat Show, Civic Auditorium, San Francisco, April 27 to May 4, 1929.

WHEREAS, This region is blessed with precious historic values, rare scenic qualities and unique recreational facilities within easy reach of one hundred million residents of both Canada and the United States; and

WHEREAS, This area affords an unusual opportunity to preserve, perpetuate, re-

culture, to the United States Senate, to the House of Representatives, to the Senate Committee on Agriculture and Forestry, to the House Committee on Public Lands, and to each Senator and Representative in Congress from the State of Minnesota.—*Outdoor America*, May, 1929.

AGE AND MOVEMENTS OF ELK STUDIED

An elk killed on Big Sahara Creek a tributary of Fish Creek in the Gros Ventre Valley, Wyoming, on November 20, 1928, was found bearing an ear tag (No. 7) put on at the elk refuge at Jackson, Wyoming, on March 4, 1925, by a field investigator of the Bureau of Biological Survey. The animal had a six-point head of fair size. This is one of a considerable number of young elk that were tagged to determine their age and movements as they are encountered during succeeding years. Usually the tags are attached to the newly born fawns on the summer range. This tagging of elk is a part of a detailed study now in progress to obtain complete and reliable information regarding the habits of these animals, their numbers, movements, food supplies, and other conditions affecting them. The work is being done by the Biological Survey in cooperation with the Forest Service, the National Park Service, the State Game Department of Wyoming, and other agencies.—*The Official Record*, United States Department of Agriculture, April 11, 1929.

FEEDING OF GAME

A bulletin urging the feeding of game has been prepared largely from data and suggestions submitted by game refuge keepers and other field officers of the Pennsylvania Board of Game Commissioners, who have had considerable experience in feeding upland game. It is hoped that through its publication Pennsylvania sportsmen and all other wild-life enthusiasts will have a better understanding of practical and inexpensive methods of feeding game, particularly in winter. An ample supply of food is essential to the conservation and increase of our valuable wild-life, and the cooperation of all interested forces is necessary if this food supply is to be properly maintained.

No attempt is made in this bulletin to discuss feeding of wild waterfowl, as this subject was fairly well covered in a bulletin prepared several years ago which is now available upon application. The title of that bulletin is "Wild Waterfowl Foods and How to Grow Them."

Since feeding upland game during severe cold spells is one of the most important phases of conservation work, this bulletin treats of winter feeding fully, but the planting of trees and shrubs which produce game food should not be overlooked and this permanent phase of the game feeding program is briefly discussed.

A great variety of feeding shelters have been experimented with on game refuges and elsewhere, but in this bulletin only the more practical types are described, and most of these lend themselves to innumerable variations suitable to different conditions and depending on materials available for construction. Sketches were made by L. A. Mackey, draftsman in the Bureau of Refuges and Lands.—More Food for Upland Game, Bull. No. 11, Board of Game Commissioners, Pennsylvania.

EXPLOITATION BAD POLICY

It can not be too often or too strongly emphasized that the current practice of advertising and exploiting the fishing opportunities on lakes and streams of the several states by tourists and recreation-resort interests is a bad mistake. There is a strong sentiment against this among many resort owners themselves and many of them are now issuing beautiful and attractive advertising without making use of the disgusting fish hog pictures which formerly decorated all such publicity. Others, not having seen the light, still persist in this kind of advertising, which is bound eventually to have a very unfavorable reaction on their business.

The fish propagation departments of every state and of the United States are exerting their utmost efforts to meet the demand for restocking and all possible protection is given by law to fish in spawning time nearly everywhere, but there is continued complaint that fishing is growing steadily poorer, notwithstanding the efforts that are made to maintain it. This being true, it would seem to be the height of folly to try to induce more people to take the choice varieties of game fish and thus hasten the depletion. Every state which maintains a tourist advertising bureau has an abundance of attractive features which can be exploited to attract visitors without telling them that the streams and lakes are overflowing with fish and that the fishing is exceptional. Such advertising is usually untrue and misleading, as well as destructive. It ought to be discouraged by every sportsmen's club in America. This sort of exploitation is nothing more or less than commercializing a resource which demands greater protection and more encouragement by propagation if it is to be maintained. *Game and Fish Conservationist*, Richmond, Va., September-October, 1928.

ECONOMIC IMPORTANCE OF THE GREAT HORNED OWL

A study of eggs of the great horned owl in Manitoba, by Ralph D. Bird, which in-

cluded many stomach and pellet examinations, led to the following conclusion:

"By this study of the great horned owl in a well settled district it was found that the bird is decidedly beneficial. Although the nests were not far from farmyards, only one domestic fowl was found to have been taken. Apparently there is no danger if the fowl have access to sheltered roosts at night. True, some game birds are taken, but these do not average as many as two per nest and we can easily spare this number in return for the amount of good that is done. The number of other birds that they destroy has no economic significance.

Probably the greatest benefit to man by this owl is the destruction of enormous numbers of moles, gophers and mice,

until the end of the season shooting was very spotted. After the season closed, the birds arrived in numbers, but it was then too late. Whatever sport the shooters missed because of the lack of birds last season they have been more than compensated for this past year. The owners of blinds from the southern end of San Francisco bay to Suisun declared that it was one of the best seasons for this type of shooting in many years.

Canvasbacks and bluebills were plentiful, and many limit shoots were made. In some places, the pond ducks, including sprig, worked into the bay shore blinds. This sport is becoming one of the most popular types of duck shooting. Because of the fact that any hunter who will work for his sport may enjoy it, it



FIG. 86. Liberation of game birds reared at Yountville Game Farm on Snyder Ranch, Sonoma Valley. Photograph by Joe Baccaglio, November 13, 1928.

whose depredations to the grain crops are only too well known. Of not such direct significance, but nevertheless of great economic importance, is the destruction of rabbits which are often very abundant, extremely injurious to young trees, and second only to fire as a factor in checking the spread of the forests."—*The Canadian Field Naturalist*, April, 1929, p. 83.

BAY SHORE HUNTERS HAVE BETTER SPORT

During the 1927 season, bay shore duck hunters had a very poor year. There were a few canvasbacks on the bay in the early season, but from the first few days

is the "poor man's" type of shooting. There is no expensive club to keep up, no keepers to pay and no baiting to be done.

QUAIL AND ORANGE TREE FUMIGATION

A letter from the orange belt, near Dinuba, reports the gassing of considerable numbers of quail as a result of fumigation. This is not the first time that reports of this sort have reached the division. It certainly is true that quail prefer thick foliage trees for roosting at nights and that they will travel considerable distances from brush areas to an orange grove in order to find good shelter.

It is also true that when careless workmen throw a tent over an orange tree, it often entraps a number of birds and that quail in some numbers are thus killed with the poisonous fumes.

There is little excuse for such destruction of wild life, for, with a little precaution and extra work in beating the trees first, birds are driven out and thus saved. In most instances, county agents and horticultural commissioners see to it that reasonable care is utilized in fumigating orange orchards in order that bird life will not be destroyed. Since enormous amounts of poison are now scattered broadcast in the state for the destruction of rodents and predatory mammals, it is becoming more and more necessary that the utmost care be utilized in protecting the innocent from destruction with the guilty.

STEELHEAD FISHING IN CALIFORNIA

As in the case with other coastal regions, California has many rivers and streams which receive one or more runs of steelhead, but the farther south one gets the less water is carried by the streams, until finally, in the southern part of the state, the rivers are completely dried up for a considerable part of the year. Besides the rivers specially mentioned below, steelhead are taken in season from the Mattole River, near Petrolia; from the Big Lagoon and creeks near Orrick; from streams in the vicinity of San Francisco, and farther down the coast. It is largely winter fishing, however, if large steelhead are sought; the season opening December 15 and closing February 28, with fishing restricted to tidewater. January steelhead of 10 pounds will be taken from the lagoon of the Ventura River by casting large spinners, and the Santa Ynez River runs it a close second. The fly fishing streams of consequence follow:

Klamath River. A justly celebrated steelhead river, practically on a par with the Rogue River and longer than the latter. Near Hornbrook and at Klamath Hot Springs, Alger and vicinity, the September fishing is claimed by many to be unequalled on the continent. From here, down to Requa at its mouth, during August, September and October, unusual fly fishing is certain, though during October, the lower reaches are likely to be made murky by mining operations above. (An effort is being made to have the mines remain closed until some time in November.) The upper Klamath remains good throughout the season. The best lower waters are between Klamath Glen and the mouth of Blue Creek

(reached by motor boat from Requa), with exceptional fishing in Blue Creek for rainbow and cutthroat trout. Royal Coachman, Brown Hackle and McGinty, sizes 4 and 6, are recommended.

Eel River. North, Middle and South forks. Ferndale, Alton, Fortuna, and Loleta regions have pools which are much sought during season—July to November, inclusive. Sizes 6 and 8 flies are generally used, mostly salmon patterns, containing red, yellow and white—Jungle Cock patterns predominating. Fishing is excellent for small trout and those up to 5 or 6 pounds.

Smith River, town Smith River. Has no summer run. Small October and November fish take a fly, same patterns as Eel River. On a spinner they run to 5 pounds. January and February see the heaviest runs and largest fish. Take a spinner best. (Winter fishing above tidewater prohibited.)

Navarro, Noyo, Mad, Ten Mile and Guala rivers all afford fly fishing in their lower waters after first rains to the close of season. Fly fishermen also take steelhead from the Russian River and riffles up the valley of the Sacramento River, using in both No. 2 spinners, copper and nickel.

Note.—Lest any confusion arise, the compiler wants to make it positive and definite that fishermen, planning on coming considerable distances for the principal purpose of fly fishing for steelhead, should consider first the Rogue and Klamath rivers. Then, but only as alternatives, the Eel and North Umpqua. The first two are so far superior to all others that no question of doubt exists.—*Out-door life*, April, 1929.

INFORMATION FOR FUR FARMERS

Fur farming is not the "get-rich-quick" kind of business that many persons have come to believe it to be, according to the Bureau of Biological Survey of the United States Department of Agriculture. Many who inquire about fur farming have the notion that they can fence in a rugged piece of land, turn loose some fur bearers and collect large profits with little effort, but the Survey advises prospective fur farmers with little experience to obtain employment on a fur farm where they may familiarize themselves with the principles involved before engaging in the business themselves. In a new publication, Leaflet No. 27-L, "Recommendations to Beginners in Fur Farming," just issued by the department, recommendations to beginners in fur farming are outlined, and particular attention is called to the popular misconceptions regarding the enormous profits to be realized. The leaflet also

contains general information on how to make a start in the business, on areas suitable for fur farming, where to obtain breeding stock, what it takes to make a good fur farmer, and species suitable for propagation. Foxes, fishers, martens, minks, otters, skunks, raccoons, opossums, beavers, muskrats and rabbits are the kinds of fur-bearing animals treated. A copy of the leaflet may be obtained by writing to the United States Department of Agriculture, Washington, D. C.

THE WISDOM OF DOE KILLING

The controversy brought about by Pennsylvania endeavoring to reduce the number of female deer has brought out the following statement in support of the buck law, a well established custom in most states.

E. Raymond Hall, of the University of California, writing in the *Canadian Field Naturalist*, in March, states that he champions the protection of the female at the expense of the male in the case of deer and in any species of American game where polygamy exists for the obvious reason that cases of potential mating are not diminished if one-half the population of males be eliminated, whereas an elimination of one-half the female population would cause a potential decrease in mating of the same amount, namely, one-half.

FREE SHOOTING VERSUS CLUBS

In America, where the wild game is the property of all the people, the theory that the privilege of taking game should be enjoyed equally by all has become firmly established. Free shooting, however, is by no means general and fully enjoyed, because it frequently comes in conflict with the rights of landowners.

The development of shooting clubs in this country has in many places given rise to extreme resentment and prejudice. This is evidenced very strongly in the northwestern states, particularly the Dakotas and Minnesota. Laws have been passed in the Dakotas discriminating against shooting clubs and for the purpose of giving the public access to desirable shooting places.

In recent session of the Minnesota legislature, according to the American Game Protective Association news service, this feeling was expressed in a bill intended to do away with all monopoly or special privilege in shooting by a provision prohibiting any owner of land from shooting on his own property unless he permitted the public the same privilege. Such an act would destroy private shoot-

ing clubs. It would prevent the farmer from shooting on his own ground unless he permitted others to do the same. Naturally, the bill attracted both strong support and violent opposition and did not become a law.

Such measures indicate a problem which exists and which must be solved. Some advocate abandoning the theory of free shooting in America and reversion to the European theory that the game goes with the land. It is believed, however, by advocates of the democratic idea that a system can be devised whereby the landowner can be protected from invasion of his rights and at the same time a monopoly of sport can be prevented. It is to be desired that the health-giving recreational privilege of field sports shall not be confined to the privileged few.—*The American Field*, May 11, 1929.

BROWN TROUT THRIVE IN RUSSIAN RIVER

A late and earnest endeavor has been made to furnish a non-migratory trout that would thrive in the lower reaches of the coastal streams. During the summer seasons, coast streams teem with small steelhead trout, but sizable trout have gone to sea and are not obtainable. In furtherance of the desire for the improvement of fishing conditions in these streams, black spotted trout have been planted in Humboldt County. In 1927, a fine load of brown trout which had been held in holding ponds were liberated in the Russian River. A year later, some fine large brown trout were secured. Most of them average from seven to twelve inches. Another stocking of this river with brown trout was made in 1928.

NEW DISEASE AMONG FISH

The first widespread outbreak of rickets among fish has been recognized in the so-called "knothead" carp of the middle Illinois River. According to Dr. David H. Thompson, of the Illinois Natural History Survey, rickets in human babies and in the lower animals is due to a lack of vitamins. The symptoms in the carp are a small, deformed head, which gives the disease its name, together with swollen gill coverings, defective skeletal parts, and drooping fins without the normal number of notches. The scales, skull bones and vertebrae have numerous secondary growth rings which make age determination difficult.

Carp with extreme development of knothead are somewhat softer-fleshed than normal and have a slight tendency to a "gassy" taste. Although the meat is not known to be unwholesome, such specimens

are thrown out by fishermen and do not find their way to market.

TUNA SCARCITY

It is not only "longer between bites" for the angler, but it is a "greater distance between hauls" for the commercial fishermen. Over 15,000,000 pounds of albacore were taken off the California coast in 1921. Since then the catch has dwindled year by year to less than 4,500,000 pounds. Other tuna now are more widely utilized. To maintain the pack cannery are building larger boats with a greater cruising radius. Recently the *Hermosa* went over a thousand miles to get a catch of tuna. The round trip was 2100 miles. On the coast of Salvador, Central America, this boat secured a record catch of 200 tons. These fish brought \$120 per ton. The future will see operations extended in wider and wider circles. Here is a situation that needs careful attention. Prevention of depletion is better than continually extended operations!

MIGRATORY BIRD CONSERVATION COMMISSION APPOINTED

Secretary Hyde will be chairman of the Migratory Bird Conservation Commission, as provided by the Migratory Bird Conservation Act, to pass upon the purchase of lands recommended by the Biological Survey for refuges to be established under the act. The other members of the commission will be as follows: From the president's cabinet, Secretary of Commerce Robert P. Lamont and Secretary of the Interior, Dr. Ray Lyman Wilbur; from the Senate, Senator Peter Norbeck, of South Dakota, and Senator Harry B. Hawes, of Missouri; and from the House of Representatives, Ernest R. Ackerman, of New Jersey, and Sam D. McReynolds, of Tennessee.—U. S. Bureau of Biological Survey.

ELABORATE PLANS FOR BANDING OF DUCKS

An elaborate plan for duck banding operations is being worked out by A. D. Trempe, Michigan sportsman, who stayed in California over the winter. It is the intention of Mr. Trempe to place a series of banding stations along the Pacific Coast from Mexico to Alaska. Already traps have been placed in many suitable places in the state, and when the work is finished up in the northern part of the country a more pretentious plan will be started. This plan calls for an expedition into the region where the ducks nest, including Northern Canada and Alaska, to band the birds on the breeding grounds.

This northern expedition is being planned for a future date and funds are now being obtained for the work. When this work is done a record of the actual nesting grounds of birds that winter in the United States will be nearly complete. Casual captures of birds in the north that have been banded in the state are too meager for a basis on which to base any definite theory of breeding grounds.

RETURNS ON BANDED BALD EAGLES

Two bald eagles banded in Michigan during the spring of 1928 were killed in January this year in Kentucky and Tennessee. The first bird was killed January 11 at Lexington, Kentucky, by W. Funkhouser, and the second January 31 at Reelfoot Lake, Tennessee, by G. Hite.

Although more than four hundred thousand birds in the United States and Canada now wear bands, very few of this number are eagles. Records show the first bald eagle to be banded in Michigan was the sixth ever to be banded in the United States. Three were banded in the spring of 1927 and at least eight in the spring of 1928. So far returns have come in from the above two mentioned birds only. These indicate that probably many eagles reared in Michigan spend their winter in the south. There has been considerable speculation as to whether the bald eagle of the Michigan region joins the smaller birds on the fall flight.

BUFFALO SHIPPED TO ALASKA REPORTED IN GOOD CONDITION

The introduction of buffalo into Alaska is an experiment that is being watched with much interest by wild-life conservationists. Twenty-three of these animals were shipped from the National Bison Range, Montana, to the Territory by the Alaska Game Commission in June, 1928, through an appropriation made for the purpose by the Territorial Legislature. Nineteen of them were liberated near McCarthy, Alaska, and four were held at the Reindeer Experiment Station of the United States Biological Survey at Fairbanks for experimental purposes.

In a recent report stated that up to January 9 the buffalo were located on Jarvis Creek, not far from where they were liberated, and were feeding to a large extent on wild vetch. They seem to have adapted themselves to the country and to be doing well. On February 18 the herd was reported on Clear Water Creek, nine miles from McCarthy, a stream that has open water throughout the winter and a good growth of brush and grass. The Alaska Game Commis-

sion has hay stored at McCarthy for feeding the buffalo if necessary, but up to mid-February the animals were finding sufficient food and were in good condition, although there had been some unusually heavy snowfalls.

The buffalo retained at the reindeer station are each fed at the rate of 15 pounds of hay a day, and are in excellent condition—round and fat. The winter has been unusually mild at the station, but during one brief period when the temperature ranged from 30 to 40 degrees below zero with high humidity—it was noted that the animals were covered with hoarfrost, and as soon as they finished feeding at the corrals each morning they would immediately seek an upper sheltered hollow in the middle of one of the pastures or the top of a warmer adjoining ridge. During warm weather the buffalo remain near the feed troughs at the corrals. On the range, when not grazing, they seek shelter in the forest.

MULE DEER OFFERED FOR SALE

A considerable number of surplus mule deer, or black-tailed deer, are being offered for sale alive by the United States Biological Survey from the National Bison Range in western Montana. The animals are offered at the price of \$15 each as they run on the range, the purchaser paying all expenses in connection with capturing, crating and removing the deer, which it is estimated will not exceed, on the average, \$20 an animal.

The Biological Survey does not recommend these animals for stocking ranges in the south or east, particularly in areas already frequented by deer, but say they should do quite well in most of the western portion of the United States. Where these deer are intended only for exhibition purposes they would, of course, stand a fair chance of surviving in the East.

As the Survey desires to remove the animals from the reservation at the earliest possible date, persons interested in obtaining them should communicate with Frank H. Rose, protector in charge of the National Bison Range. His post-office address is Moiese, Montana, and his telegraphic address is Dixon, Montana. Any orders accepted for delivery of the animals are contingent upon the possibility of their capture at the time desired by the purchaser.

BIRD REGULATION AMENDMENTS

Amendments to the regulations under the Migratory Bird Treaty Act, under which the game and other birds that migrate between the United States and Canada receive protection in this country,

adopted by Secretary of Agriculture Hyde on April 20, were approved by President Hoover on April 23, 1929. The nature of the amendments has been briefly summarized as follows by the Bureau of Biological Survey, which administers the law and the regulations:

Hunting migratory game birds from automobiles is prohibited, and the closed season is continued on greater and lesser yellowlegs. In addition, certain further restrictions are made on scientific collecting, including a provision that restricts the taking of migratory game birds by scientific collectors to the period on any day from half an hour before sunrise to sunset. This change, in the opinion of the Biological Survey, will not be a handicap to legitimate collectors.

Taxidermists engaged in receiving and mounting migratory birds are now required to keep accurate records of all transactions.

PROTECTION OF SWANS NOT TO BE DIMINISHED

Explaining why no open season on swans had been provided in the recent amendments to the regulations under the Migratory Bird Treaty Act, Paul G. Redington states that he considered that to recommend an open season in the United States at this time on these beautiful and comparatively rare birds would be a violation of this country's obligations under our treaty with Great Britain. Many requests had come to the United States Biological Survey to allow limited shooting of swans, the plea being made that they were destroying wild fowl food plants by pulling them up by the roots in such quantity as to menace the future supply for other waterfowl. Answering this charge specifically, Mr. Redington said that investigations made by the Biological Survey do not show that swans destroyed wild fowl food to any greater extent than do other species of waterfowl. In fall and winter they take the parts they like, but leave sufficient seeds, fragments of rootstock, tubers, etc., to insure reproduction of the food crops the next season. "If this were not true," he stated, "swans would be compelled to abandon their favorite wintering grounds, and the fact that they do not do so, but instead return to them year after year is really a guarantee that their feeding habits are not so pernicious as is believed."

Swans have been given complete protection throughout this country, Mr. Redington explained, for two reasons. In the first place the total number of our two species combined is not large, and in the

second place, as practically all the swans of eastern North America winter in a limited area in the Middle Atlantic States, irreparable damage to the species would result if shooting were permitted. "Of the two species of swans," he said, "the trumpeter swan has been for years near the verge of extinction. Owing to the fact that it is impracticable to expect the

average gunner to distinguish between the trumpeter and the whistling swans, it has seemed necessary to give all swans close protection. The Biological Survey has given the situation the most careful consideration, which it greatly deserves, since an error at this stage might very well result in the total extermination of a rare and valuable species."

DIVISION ACTIVITIES

Bureau of Patrol

During the month of February, fines were imposed amounting to \$4,500 and 138 arrests made. One violator was given a 100-day jail sentence for the possession of deer meat in closed season; two men were given 30-day sentences, one for the possession of small Pismo clams, the other for the possession of crabs; and two other men were forced to serve 25 days apiece, one for the possession of ducks in closed season, and the other for having deer meat.

The total amount collected in fines made a slight drop to \$3,665 during the month of March and total arrests were 133. One violator was given a 50-day jail sentence for the possession of a bird net and another 100 days for using an illegal net.

A total of 125 arrests was made during April and \$4,755 collected. Long jail sentences are conspicuous for this month. One violator was given a 500-day sentence.

California can boast of having about one-fourth of the deer in the national forests of the west. Efforts to perpetuate her splendid supply will become less and less effective, if violations go unchecked. Sportsmen who believe in game laws and who obey them will be glad to know that deputies are vigorously enforcing the rules imposed by the legislature that regulate the killing of deer. A total of 22 convictions was secured for the possession of deer meat during the months of February, March and April. Some record prices were paid by violators for possessing this meat. Many patients in county hospitals were enabled to vary their regular diet and had an opportunity to enjoy choice cuts of venison.

Clifford Almy, city superintendent of streets, of a fashionable Alameda County suburb, concealed deer meat in his office in the basement of the city hall. The meat was seized over five months after the season closed.

Rumors reached the San Francisco office that the Piedmont Fire Department had a supply of deer meat on hand and were planning a banquet. Considerable time and very careful following of clues was required in working up the case.

Finally, when they were sure of themselves, Assistant Chief Milton Clark and Deputy Alan Curry walked into the city official's office and asked, "Where are those two deer?" Almy maintained an expression of complete innocence and declared that there was some mistake. Upon suggestion that a search be conducted, his attitude changed and he assumed defensive tactics. Deputy Curry, at Clark's order, ascended a ladder leading to a small room over Almy's desk, and shortly brought down three hams and three shoulders of venison in fine condition. The city dignitary was taken into the court of Judge Jacob Harder, Jr., at Hayward, and upon his plea of guilty was fined \$150.

Patients of the San Francisco Relief Home were served the venison. Indeed, few patients at the Home ever have a chance to hunt deer, while a fireman can always enjoy the sport when the season is open.

Shooting a 50-pound buck in May and having the same in his possession, cost William Singleton of San Jose also \$150. Deputy I. L. Koppel apprehended him at the Harney Ranch near Mt. Hamilton and conducted the violator to the court of Judge Chester Moore at San Jose.

Patients at the Eureka County Hospital feasted on forbidden deer meat because F. H. Farnsworth of Weott was apprehended by Deputy William Kaliher at Rainbow Ridge. The carcass of the deer was still warm when the offender was caught. Farnsworth paid \$100 in the court of Judge George W. Yuill of Scotia.

At Low Gap, west of Ukiah in Mendocino County, Deputy Earl Macklin found a buck and a fawn in the possession of Harold Cook, George Hinckley and John Kinney, all of Fort Bragg. The trio were informed that it was somewhat unsportsmanlike, as well as contrary to law, to have deer meat in possession during March. They were booked to appear before Judge George Golden at Fort Bragg and were fined \$75 apiece.

Near Eureka, at a place called Rainbow Ridge, deputies William Kaliher of Loleta and R. J. Yates of Eureka, ar-

rested C. C. Estes with two hams of deer meat. The hams weighed 25 pounds and Estes was fined \$100 when he appeared before Judge Frank E. Niskey at Eureka.

A fabulous price for deer meat, and spoiled meat at that, was paid in Sebastopol early in May by Frank Sorento of the Occidental district. Fifteen pounds of venison were found in his cellar by Deputy Victor Von Arx and Captain of Patrol Henry Lencioni. Judge H. McCormack at Sebastopol established a fancy price for the meat when he fined Sorento \$250.

Deputies everywhere focused their attention on the apprehension of those who were unable to resist the lure of whipping trout streams until the season opened. Records show 34 arrests for having trout in possession and 17 arrests for angling without a license during the two months preceding the opening of the trout season. After May 1, they continued watching anglers and brought to justice many who were overgreedy.

Two fishermen had 99 trout when accosted by Deputy Fred H. Post on Church Creek, Monterey County. Taken into the court of Judge Ray Baugh at Monterey, they paid a fine of \$50 each. One offender had 46 fish, which is 21 over the limit, the other, his brother, Roy Likins, had 53, which is just 28 too many.

C. C. Harshner of Oakland fished on April 28 on Mark West Creek, Sonoma County. It was two days ahead of the official opening. However, Captain Henry Lencioni and Deputy Victor Von Arx trailed him carefully for seven hours, saw him catch fish, and hide them with his tackle. He had forty trout, beauties, too, and when he appeared before Judge Frank A. S. Opper at Windsor he admitted his guilt and was fined \$100. Costly trout, those.

Deputy L. E. Mercer and Volunteer Deputy J. J. Elliott arrested H. S. Clark of Reno, Nevada, on Sierra Creek in Sierra County. He had 39 trout, just 14 more than the law allows. Judge Loren L. Palmerton at Loyalton imposed the regular \$25 fine for an overlimit and \$1 apiece for the 14 extra fish.

Judge R. H. Shannon of Georgetown fined Alvin Waddle of Auburn \$25 for

fishing without a license, after Captain L. T. Ward of Sacramento found 17 fish in a basket belonging to Norman Andregg, a 16-year-old boy.

Deputy W. C. Blewett arrested C. B. Naylor of Los Angeles on Santa Rosa Creek, San Luis Obispo County, when he failed to show his license on demand. Judge A. S. Gay of Cambria fined him \$25.

Deputy Forest McDermott of Santa Cruz caught Gus Mallett of Zayante in the act of attempting to spear trout in Zayante Creek. Mallett acknowledged his guilt before Judge Donald Younger, who fined him \$50.

On a plea of guilty, J. Newell Chase of Brookdale arrested by Deputy Forest McDermott for fishing before the season opened, was fined \$75. He was fishing without a license and had six trout when arrested. Judge Donald Younger levied the penalty.

In March, Joe Renna was apprehended near Mendota by Deputies Ray Ellis and H. E. Black, assisted by Ted Holliday, for shooting ducks out of season and having two ducks in his possession. Since Renna had a bad reputation for disregard of the fish and game laws, Judge Meyer of Firebaugh, Fresno County, imposed a severe fine. The violator, however, was unable to pay the \$300 assessed and was committed to jail for 150 days.

The use of traps in taking valley quail constitutes a serious threat to the preservation of this valuable game bird. W. Lee Weeding of Los Angeles is now aware of the serious nature of this offense. He was apprehended by Deputy Charles Towers and Captain LeRue Chappell of the Los Angeles force. Hailed before Judge H. E. Billings at Sherman, Weeding pleaded guilty to the charge of taking the birds in the hills back of his home, and was fined \$250. The justice suspended \$200 of the fine, however, and collected but \$50. Since only ten birds were trapped this fine amounted to a charge of \$5 for each bird. As the officers liberated the quail, they remarked that Weeding had paid dearly for the privilege of confining them for a short time.

Fred E. Bennett of Long Beach said he was guilty after Deputy Charles Towers

of Los Angeles arrested him for buying, selling and trading valley quail. Judge H. E. Billings of Sherman placed his fine at \$50.

The lone dove that Ernest Johnson of Turlock shot on May 19 cost him a goodly sum. Arrested by Deputy G. W. Magladry for shooting doves in closed season, he admitted his guilt. Judge Dan Kilroy of Turlock assessed a fine of \$50.

Undersized abalones in possession often prove to be the undoing of a number of those who seek this delectable table delicacy. Four violators were arrested by Deputy R. C. Marshall on the famed Seventeen-Mile Drive, near Monterey, and nine by Deputies M. F. Joy and McPherson Lough at Pigeon Point. One of these, K. Umino of Pescadero, paid a fine of \$100 to Judge A. W. Woodhams of Pescadero. The other eight were fined \$25 each.

Deputy Fred Post of Salinas turned in \$571 on April 16 as the fruits of his activities during the week end. Deputy Post caught H. Sugimoto, a native of Japan, near Salinas, with ten valley quail. The Japanese pleaded guilty in the court of Judge D. W. Rohrback of Pajaro and paid a fine of \$400. The quail were taken to the county hospital at Salinas.

W. S. Hubbard of Moss Landing was next. He had an overlimit of Pismo clams and on his plea of guilty, Judge Rohrback said \$100 or 50 days. Hubbard spent two days in the Salinas County jail and then decided to pay the balance due of \$96.

C. Schornick of Newman at Moss Landing was found with Pismo clams not in their shell. He was fined \$25 by Judge Harry J. King of Salinas.

Four abalone seekers, T. Tagani, Frank Yonekaura, A. Shibayama and John W. Sprague, were not careful regarding the size of those which they pried off the rocks along the coast in Los Angeles County. All paid fines of \$25 each to Judge H. E. Billings at Sherman when brought into court by Deputy R. J. Sadler.

Taking Pismo clams during the closed season at Palm Beach cost H. G. Redman \$50. Judge Donald Younger at Santa Cruz first fined the defendant \$100, but suspended \$50 of the assess-

ment. Deputy J. P. Vissiere arrested Redman.

Frank G. Pulis of Tracy caught 414 catfish in a fyke net in the San Joaquin River, near El Soyo ranch. He was overhauled by Deputies George Magladry of Modesto, C. L. Gourley of Gustine and Captain J. E. Newsome of Newman. He went into the court of Judge Hawkins at Modesto and paid \$150. Stanislaus County Hospital patients ate the catfish.

Found in possession of a fish spear, Adam Metzler was arrested on the San Joaquin River by Deputy H. E. Black and paid a fine of \$25 when taken before Judge Myer of Firebaugh, Fresno County.

During the month of April the launch patrol seized more than 16,000 feet of illegal net.

For some time Captain Walter Sellmer and his men had been seeking to apprehend a gang operating beach seines in the restricted territory of Richardson Bay. After an all night vigil, they succeeded in surprising the fishermen in a cove near Burnett's Island just as dawn was breaking. While Deputies Charles Bouton, Harry Christiansen and George Smalley patrolled the water adjacent to the place of arrest, Captain Sellmer and Deputy Lee Straight came in from another direction in a skiff and the posse closed in on the violators. The fishermen had a large quantity of fish, including 75 pounds of striped bass. Gus Marvis, an old offender, was given 500 days by Judge H. De La Montanya of San Rafael. George Nichols was sentenced 200 days, and E. B. Yows, considered the least mischievous of the three offenders, was given a sentence of six months. This was suspended for two years, but becomes effective if Yows violates any of the fish and game laws.

It may be that over in sunny Nippon the taking of fish from streams on dip nets attached to long poles is regarded as the real sporting thing to do. In Sonoma County, the act is unworthy of a disciple of Izaak Walton. So much so that it cost T. Nagihara, S. Fugihara, S. Ikeyami, R. Yokoyama and Y. Yokoyama, all of Forestville, a \$100 each for a days outing. The money was paid to Judge H. McCormick at Sebastopol after Deputy Victor VonArx took them into custody at Hilton on the Russian River. Each man had about twenty pounds of fish.

Catching twenty-five striped bass in a noncommercial district on the Mokelumne River cost C. Torabehino or Isleton an even 100 days in jail due to the vigilance of Deputy William Hoppe. Judge W. E. Everson, at Elk Grove, gave the violator the alternative of serving 100 days in jail or paying a \$100 fine.

M. J. Duart, of Sacramento, paid \$250 for fishing with illegal nets, having undersized striped bass in his possession and fishing without a license in the Sacramento River. Deputy Charles Sibeck arrested Duart and Judge W. E. Everson, of Elk Grove, assessed the fine. The undersized bass seized were given to charity.

One black bass taken in closed season, cost S. Nakijian of Selma, Fresno County, \$40 as a result of his arrest by W. L. Hixon, a volunteer deputy of the Division. Nakijian was taken before Judge R. A. Watrous, at Dinuba.

Romy Yapo, of Rio Vista, was arrested by Deputy William Hoppe for having 20 striped bass in his possession. Judge F. J. Kalber fined the offender \$50.

Stephen Hall, of Hopland, will pay \$100 on the deferred payment plan for using a gill net to take game fish. Deputy Earl Macklin found Hall at the mouth of Phalis Creek on the Russian River operating the illegal net.

"Taking of game fish in this way is mighty poor sportsmanship," said Judge J. Hoffman, of Ukiah when he levied the fine.

John Luddington, of Weitchpec, Humboldt County, was arrested by Deputy Ray Diamond at Martins Ferry for trapping without a license. He was taken before Judge Thomas J. Nix at Weitchpec and given an alternative of paying \$100 or serving 100 days in the county jail.

The General Petroleum Company operating in the Lincoln Oil Fields, near Ventura, were fined \$200 for polluting the waters adjacent to their operations. Deputy R. E. Bedwell brought the offenders before Judge Edward Henderson.

Deputies working in Tulare and Kern counties made an excellent showing the past few months. Twenty-six arrests

and convictions were obtained between November and March, and a total of \$1,025 was collected. One violator was sentenced to 100 days in jail for killing a doe. Possession of deer meat in closed season in another case and over limits of ducks brought fines of \$100. Eight arrests were made for over limits of quail and ten for hunting without a license.

In addition to this fine record, the deputies in Captain O. P. Brownlow's district have also been active in fish planting and fish rescue. They have reported on the location of areas where game birds may be liberated and conducted investigations of game conditions.

Deputy C. J. Towers arrested a violator for killing game out of season in Riverside County. Unable to find the nearest judge, he started for Murrietta and on the way passed the ranch of a judge he knew. He found the justice plowing and court was held by the roadside, the judge never even leaving his plow. After taking an extra chew of tobacco, the deputy reports, the judge accepted the plea, fined the culprit the limit and sent him on his way. He then called to his horses and resumed his plowing.

Fishermen reported good fishing at the opening of the trout season in the basin of the San Gabriel River. This improved condition was due to the splendid efforts of deputies under Assistant Patrol Chief Charles S. Bauder. Some 200,000 fingerling trout, measuring over six inches in length, and almost ready for the frying-pan, were planted by the southern patrol force early in the spring. The fingerlings were raised in the new Goldbrook Camp Hatchery, and the plant involved many obstacles in an almost inaccessible country.

This spring Deputy Walter I. Long of Westwood rescued many fish ranging from one to six pounds in weight from holes in the stream bed running into Duck Lake, Lassen County. The waters of Duck Lake served as a municipal supply for the town of Westwood and a new channel cut last summer has left the old stream-bed dry.

The summary report of Captain H. W. Ehrscher of Humboldt County shows that between February 1, 1928, and February

1, 1929, the volunteer deputies of that county patrolled 30,738 miles of field and streams; that they checked 3433 hunting, angling and deer tag licenses; that in coordination with the regular patrol they made and assisted in making 29 arrests and collected \$625 in fines.

Bureau of Fish Culture

Shipments of 1,220,000 rainbow trout eggs were made from the Mount Shasta Hatchery during the month of April to six hatcheries located in various parts of the state. The Mt. Shasta subsidiary egg-collecting stations supplied over 1,795,000 rainbow eggs during this month. Five hundred seven thousand steelhead trout eggs were received from the big Creek Hatchery. These are reported to have been in good condition. On May 1 the fry and eggs on hand consisted of 3,288,000 Loch Leven, 2,192,000 brown, 714,000 eastern brook and 304,000 rainbow trout. There were also on hand 570,000 steelhead and 898,000 Quinnot salmon.

Fish cultural work at the Mt. Shasta Hatchery has involved the spawning of the trout from pond fish, the shipping of eyed eggs, the picking out of dead eggs in hatchery troughs, cleaning troughs and the general care of the fry and the preparation of fish food. The outside crew did a great deal of sorting of fish maintained in brood ponds. Many ponds were cleaned and new pond screens installed.

In general, the take of eggs in the Klamath stations, subsidiary to Mt. Shasta, has been disappointing. The water has remained very cold. There has not been sufficient precipitation to raise the creek and cause the trout to leave the Klamath River and run up tributary streams in normal numbers.

During March, a total of 853,000 rainbow trout eggs were collected at the Camp Creek station, making a total for the season of 1,049,000 eggs.

The total number of eggs taken at the Hornbrook Station was 1,440,000. At first, it appeared as though this station would do better than it has in the past few years. The lack of rain, however, induced the farmers to start irrigating earlier and the water in the creek was lowered unfortunately just at the time when the trout were running their best. The creek became so low that the fish were unable to reach the trap and the station was closed on April 30; the racks

were removed and piled for use the next season.

May found the trout run still going on in Beaver Creek Station and operations will continue just so long as the trout continue to reach the trap. Up to the end of April, a total of 1,011,000 eggs were taken.

The amount of eggs obtained from the Shackleford Creek Station was disappointing, in view of the fact, that the first part of the run held promise of a very excellent yield. During March, 467,000 eggs were taken, and during April but 440,000. The total take for the season was 982,000. As a rule, the greatest difficulty encountered at this station is high water. This year, the opposite was true.

In order to carry out an experiment to prove whether the Atlantic salmon will thrive on this coast, a shipment of 28,000 eggs was secured from New Brunswick. The Atlantic salmon is essentially a cold water fish. A very serious effort will be made, nevertheless, to determine whether this species can be propagated in the state to advantage. It has been claimed by some that if the fish succeeds in acclimatizing itself to California waters it will prove more of a sporting fish than the native steelhead.

Another shipment of 25,000 Atlantic salmon has been received from the Bureau of Fisheries, East Orland, Maine. These will be taken care of at Cold Creek Hatchery, Mendocino County. The New Brunswick shipment is being cared for at the Prairie Creek Hatchery.

The 1,807,000 rainbow trout eggs received from Pocatello, Idaho, have been shipped to various hatcheries. The first lot of these Idaho eggs produced fish that were weaklings and losses were considerable. The Idaho people have replaced those fish lost in transit as a result of poor packing.

Eastern brook trout eggs received from the American Fish Culture Company, Carolina, Rhode Island, are reported to have developed into healthy and active fry.

At the Mt. Whitney Hatchery, Inyo County, some 350,000 Loch Leven and 525,000 eastern brook trout eggs and fry were in the course of development by the end of April.

The Rush Creek Spawning Station considerably augmented the number of eggs being cared for at the hatchery by shipments of 1,065,000 black-spotted trout eggs during April. Indications are that

Rush Creek will yield probably 4,000,000 eggs.

Fern Creek Hatchery has on hand 560,000 black-spotted trout eggs supplied by the Rush Creek Station. This hatchery also received 45,000 rainbow trout eggs from the station on the Walker River.

At the Fort Sewart Hatchery, Humboldt County, there were 1,496,870 steelhead trout being developed. These came originally from the Cold Creek Hatchery. There were also 132,680 steelhead trout from the Prairie Creek Station and 79,390 rainbow trout from Pocatello, Idaho.

Silver salmon to the number of 825,170 were planted near the hatchery in April and constituted the remainder of the fish received from the Prairie Creek Station earlier in the year. These fish were of good size and had every appearance of being strong and vigorous.

The latter part of the usual steelhead spawning season at the Prairie Creek Station passed with practically no movement of fish to the racks. The few light showers and the absence of storms failed to cause sufficient rise of water in Prairie Creek to bring about a good run. Only 98,500 steelhead trout eggs have been taken. These have been procured from occasional fish that have managed to reach the racks.

Burney Creek, Shasta County, had 301,245 eastern brook, 196,160 Loch Leven and 313,660 rainbow trout on hand the beginning of May. Over 15,000 rainbow trout eggs were taken at Ballard's Reservoir in April. This reservoir indeed holds forth the prospect of proving a splendid station for the collecting of rainbow trout eggs when properly stocked and negotiations are under way to effect these ends.

At the Big Creek Hatchery, Santa Cruz County, all the 1,592,000 steelhead eggs and fry are reported to be in fine condition. Water in the creek was as low in April as it usually is in August and there was less water in it than any other April during the past twenty-two years. From the egg collecting station at this place, 2,575,000 steelhead eggs were shipped to other hatcheries.

Steelhead in the Brookdale Hatchery, Santa Cruz County, have started feeding and are doing well. Besides these 150,000 steelhead, there were at this hatchery 248,000 silver salmon.

The latter part of April found the fish in Bear Lake, San Bernardino County, entering the streams to spawn and indications are that the Bear Lake Hatchery and its subsidiary stations will be supplied to capacity with eggs.

At the Feather River Hatchery, Clito, Plumas County, there were on hand 180,000 eastern brook, 248,000 Loch Leven, 262,000 rainbow and 295,000 steelhead.

At the Yosemite Hatchery, Mariposa County, the 48,130 brown trout fingerlings in the holding tanks are reported to be making a sturdy growth. 500,000 steelhead eggs were received from the Big Creek Hatchery and 150,000 rainbow trout eggs from Mt. Shasta Hatchery. These shipments, together with those on hand, make a total of 698,130 eggs and fry now being developed for stocking the streams and lakes in Yosemite National Park and adjacent territory.

At the Tahoe Hatchery, Placer County, the 600,000 eastern brook, 100,000 Loch Leven and 200,000 steelhead are reported to be hatching in goodly proportion and the resulting alevins are strong. The 150,000 rainbow trout eggs from Pocatello, Idaho, are clearing up.

There is a good flow of water in the upper Truckee and the fish are moving in good numbers. The yield from the Taylor Creek trap and the Blackwood traps has so far been satisfactory.

At the Tallac Hatchery, in Eldorado County, the steelhead alevins are doing well and the rainbow trout eggs are hatching.

In April, 61,500 eastern brook trout that had attained a size from two to four inches were planted in the waters adjacent to the Mormon Creek Hatchery, Tuolumne County. Weather conditions are of the best and the water is holding up well. In fact, the fish are doing so well that there is a danger of their becoming overcrowded and another plant will be necessary shortly.

At the Cold Creek Hatchery, Mendocino County, May 1 found 775,000 steelhead, 184,000 Loch Leven, 287,000 brown trout in the course of development. The 24,000 Atlantic salmon will be placed in two large tanks near this hatchery as soon as they become overcrowded in the troughs in which they are now developing.

Snow Mountain Station closed on April

2 with a total take of steelhead eggs amounting to 2,875,000.

There were on hand at the end of April at the Kaweah Hatchery, Tulare County, 188,000 eastern brook, 95,000 Loch Leven and 437,000 steelhead trout. The rainbow fry from the 116,000 eggs obtained from Idaho have hatched and the fry started feeding on April 29.

A large sign has been donated by the Visalia Sportsmen's Club and has been erected at the approach of the hatchery near the state highway. The sign reads, "Kaweah Fish Hatchery. Visitors Welcome."

Due to low water, but 21,500 rainbow trout eggs have been taken so far at the Clear Creek Hatchery, Lassen County. A total of 170,000 rainbow eggs were obtained at the Mud Creek Station and placed in the Clear Creek Hatchery.

The Warner Creek Station has so far supplied 615,000 rainbow trout eggs to the Domingo Springs Hatchery.

Butt Creek Station was open during April, but it was not possible to commence operations until the end of this month.

At the Kings River Hatchery, Fresno County, some 600,000 eastern brook, 400,000 Loch Leven, 77,000 rainbow and 250,000 steelhead trout are being cared for.

There were on hand at the Yuba River Hatchery, Sierra County, the first of May over 196,000 Loch Leven, 72,000 eastern brook and 298,000 steelhead trout.

The entire series of trout food experiments are now well under way. Steelhead trout at the Brookdale Hatchery are being fed various varieties of food, such as shrimp meal, dehydrated salmon eggs, sardine meal and alfalfa meal. Percentages of waste in each of these food materials have been worked out with Loch Leven trout at the Mount Shasta Hatchery. The experiment has not been carried to sufficient lengths yet to make any report on the results from feeding these foods.

Two trips were made by George A. Coleman up the Napa River for the purpose of determining if certain reclamations of land would interfere with the breeding of striped bass. It was decided that dredging operations in the main channel of the river above Cutting's Landing constituted no very great inter-

ference with reproduction of this fish. Observations made show that striped bass from ten inches and up are very plentiful in the river.

Particular emphasis is being placed on investigations of the food supply of striped bass. While it is known that adults will eat almost any variety of small fish, they seem to be more plentiful where certain varieties of minnows flourish. It is hoped to obtain, in the very near future, sufficient information to determine whether striped bass prefer these minnows above other types of food.

Elkhorn Slough, above Moss Landing, in Monterey County, has been the subject of considerable study to determine conditions affecting striped bass existing in a strictly salt water area. Elkhorn Slough has no fresh water supply and is directly connected with Monterey Bay. Striped bass are found there in abundance.

All forms of plant, algae, plankton, crustacea and insect life tending to produce food for these fish are being studied.

Bureau of Commercial Fisheries

On February 8, Captain Walter Engelke and Erol Greenleaf, commercial fisheries deputies aboard the *Albacore*, arrested Messrs. Takahashi, Frank Sorgan, A. B. Smith and Anton Bosavich, all of San Pedro, for operating in a closed district at Catalina Island. The four men were brought before Judge Ernest Windle of Avalon. Takahashi admitted his guilt and was fined \$100; while the other three posted \$100 bail each which they later forfeited.

On February 12, the commercial fisheries patrol found Jim Larsen of Santa Barbara with oversized lobsters in his fishing boat. Judge Pool, of Santa Barbara, assessed a \$25 fine.

Charles Gunderson, of Santa Barbara, was caught with abalones out of season. He paid a fine of \$25 when taken before Judge Pool. C. Larsen, of Balboa Island, was also apprehended for possession of abalones and was fined \$25 by the Santa Barbara justice.

The International Pacific Salmon Investigation Federation met in Vancouver, British Columbia, April 3 to 6. Owing to press of legislative business, N. B. Scofield was unable to attend. The Division was represented by Dr. J. O. Snyder. This federation is composed of officials of the fisheries departments of the United States, Canada, Washington, Oregon,

California, Alaska and British Columbia. Its object is to perpetuate and build up the Pacific salmon fisheries to the end that their productiveness may be maintained, and, if possible, increased.

During April, J. B. Phillips was put in charge of the work of collecting evidence at the intake of the Glenn-Colusa irrigation canal near Chico. The object of the investigation is to determine whether fish go through the battery of pumps which take the water from the river. It has already been found that young salmon are going through in fairly large numbers.

The Division and Stanford University are jointly engaged in a hydrobiological survey of Monterey Bay. The patrol boat *Albacore* was stationed at Monterey during April and was used for the survey. Several offshore trips were made in attempts to take the eggs or larvae of sardines. Although a great deal of valuable information was acquired on different fishery subjects, the efforts of the investigators, E. C. Seofield and M. Lindner, failed to obtain any data on the sardines. The *Albacore* left Monterey for Eureka at the end of the month. Lindner made the trip up the coast and made tows at different places along the entire coast in an endeavor to obtain evidence of sardine spawning.

A boat has been chartered as the necessity arises to patrol the markets and fish landing places in southern California and crush the traffic in undersized barracuda and halibut. The islands and coasts were watched to prevent the catching and landing of illegal sized lobsters.

In response to the need for research in California's commercial fishes, the State Fisheries Laboratory, Terminal Island, is giving attention to sardines, albacore, barracuda and striped bass. Some work is being done with other species of minor commercial importance. Concentration on certain species is necessary to avoid dissipation and superficial treatment. Permanent and valuable results can come only after careful and painstaking investigations and require much that is exacting. Yet, such work, in the end, justifies the effort put forth and the time consumed.

Histological work in developing sardine eggs has been carried on by C. B. Andrews. This information has been needed

to supplement the studies by means of egg measurements of sardine spawning being conducted by Dr. Frances N. Clark.

Studies are being made of the ear bones of the sardine to arrive at an understanding of the rate of growth. H. C. Godsil's work on the subject is showing encouraging results.

Bureau of Education and Research

In keeping with the policy to avoid requests for lectures at distant points and much duplication of travel, educational work was centered in a number of important areas. Dr. H. C. Bryant gave a lecture in February to the Franklin High School, Los Angeles. This was so successful that requests from five other high schools in Los Angeles followed. It was possible by concentrating efforts to reach in a limited amount of time over 6000 students and to impress them with the values of fish and game resources and the need of their preservation. A number of important illustrated lectures were given before annual meetings of fish and game protective associations, the Division in almost every case being given the feature part of the program.

Through the good efforts of Captain O. P. Brownlow, Rodney S. Ellsworth was enabled to carry out an intensive schedule covering the schools and service clubs of Tulare County. Lectures were also given during this trip before schools and business organizations in Fresno and Madera counties. L. W. Cooper, county clerk of Madera County, sponsored and arranged the program in that county. He arranged for a very worthwhile meeting before the Alpha Center Farm Bureau.

For some time the bureau has entertained a desire to reach all of the principal centers in San Joaquin County. Engagements for both lecturers of the bureau in the county made possible the carrying out of this plan.

A summary of lectures given for the past fiscal year is as follows:

Organization	No. of lectures	Attendance
High schools-----	59	37,115
Grammar schools-----	36	13,940
Universities and colleges--	7	595
Civic and public service clubs-----	27	1,562
Civic and Public-----	27	2,850
Masonic and other lodges--	21	2,410
Fish and game protective associations-----	19	2,134

Boy Scouts, Camp Fire		
Girls -----	5	587
Radio -----	4	-----
Miscellaneous -----	26	3,218
	231	64,411

Plans for the summer educational work were inaugurated. Dr. H. C. Bryant spent the last two weeks of May in Yosemite National Park where the ranger force was given a course of instruction which placed emphasis on conservation of fish and game and natural resources.

Official photographer E. S. Cheney secured some motion pictures of steelhead

ably the only pictures of their kind that have ever been taken of this very interesting bird.

A meeting of horticultural commissioners was held at Merced on March 26. Considerable discussion centered on damage done to agriculture by birds. Discussion showed that little real or concrete evidence could be advanced to substantiate claims of reported damage. A splendid spirit of cooperation between the different state and federal departments was displayed at this meeting.

Field naturalist Donald McLean made



FIG. 87. Little brown cranes wintering in the San Joaquin Valley. Photograph by E. S. Cheney, May 24, 1929.

fish ascending the fish ladder at Carmel River dam, Monterey County, and later, of trout ascending a ladder on the South Eel River, Mendocino County.

He obtained some excellent and unique pictures of little brown and sandhill cranes wintering in western Fresno and Merced counties. Some lively scenes of the courting antics of the birds were taken. The material was sufficient to make a complete reel and has been received with much interest and commendation.

Motion pictures of the mountain plover, a bird which migrates east and west rather than north and south, were obtained during March. These are prob-

ably the only pictures of their kind that have ever been taken of this very interesting bird. A meeting of horticultural commissioners was held at Merced on March 26. Considerable discussion centered on damage done to agriculture by birds. Discussion showed that little real or concrete evidence could be advanced to substantiate claims of reported damage. A splendid spirit of cooperation between the different state and federal departments was displayed at this meeting.

Field naturalist Donald McLean made

Dr. H. Van Roekel kept a constant watch on operations at Swanton, Santa

Cruz County, in order to forestall any recurrence of the dangerous disease furunculosis. Laboratory work during March was largely occupied by examination of fish eggs sent in for this purpose.

A disease epidemic among the eastern brook trout at one of the hatcheries was investigated. Laboratory examinations of fish from this hatchery revealed no pathogenic bacteria or parasites. The trouble seemed to arise from an excess of vegetable matter in the water which was identified as floating duck weed.

Investigations on duck disease have been continued. Samples of soil collected near Buena Vista Lake and the Hollywood Gun Club were analyzed with the view to gain from these analyses, conditions of soil and water, both in places, where the duck disease is likely to appear, and in places, where it has never been known to occur.

Alkali feeding experiments have resulted in production of toxic symptoms. Several deaths have occurred as a result of these feeding experiments and work is in progress specifically to determine what particular component of alkali is the most toxic. This work has been carried on largely by Paul A. Shaw.

The quail disease investigation is in progress. Dr. E. C. O'Roke had little difficulty in reproducing the disease in healthy birds by feeding intestinal contents of dead and infected birds. Three types of organisms have now been isolated, two of which are very difficult to grow in artificial media. However, attempts to reproduce the disease with the isolated organisms have as yet been unsuccessful.

The executives of the First Annual Pacific Coast Pleasure Boat Show held at the San Francisco Civic Auditorium, April 27 to May 4 made possible the installation of a splendid exhibit. This was a simplification of the Division's exhibit maintained last summer in cooperation with the Forest Service, at the Pacific Southwest Exposition, Long Beach. Painted backgrounds were utilized to set off foregrounds depicting the cycle in fish culture and game bird propagation. The central set depicted, in a realistic manner, the harm forest fires do to fish and game. Paul J. Fair, of the Forest Service, cooperated with the Division in installing the exhibit. Acknowledgements are also due to the Steinhart Aquarium

for supplying a number of large calico bass and black bass. These fishes materially enlivened the foreground of the fish cultural display, together with many smaller ones supplied through the courtesy of the Bureau of Fish Culture and Reclamation.

Bureau of Hydraulics

An event of the highest importance and general interest occurred during the month of March. The occurrence marks one of the real achievements in the control and prevention of pollution. Two plants, representing an expenditure of over \$700,000 and an annual operating cost of at least \$50,000 were formally opened on March 20. One is located at Santa Fe Springs and will be operated by the Santa Fe Waste Water Disposal Company; the other, at Fullerton, will be operated by the Water Disposal Company, of Orange County. Over 200 state, county, city and oil company executives attended the formal opening.

At Santa Fe Springs an ingenious system of baffles and an aerator breaks up the sludge material. The water, containing the broken particles of oil, runs through tanks and over baffles made of concrete and is finally filtered through excelsior. Numerous laboratory tests show that when the oil enters the system, it contains 466 parts of oil to a million parts of water, and when it leaves averages 16 parts of oil to a million of water. In fact, the water as it leaves the system and enters into the sea is remarkably clear and free from deleterious matter.

The Orange County system consists of a settling tank arrangement. The tanks are built of concrete and by a unique use of wind and water flow, the oil is diverted so that it may be skimmed off in a narrow channel. This carries it into a settling basin for final treatment. Tests show that the percentage of oil removed by this system is as good as that of the Santa Fe Springs. The two systems are capable of handling about 100,000 barrels daily.

These systems conclusively demonstrate what can be done to eliminate oil pollution and serve as a splendid example of the highest type of effort to correct serious menaces to fish and plant life. They are an illuminating instance of the ready willingness of the oil industry in general, to cooperate with the division. Although their operation will amount to a large sum yearly, nevertheless, it is hardly possible to estimate the real benefits which will result.

The complaint against two of the four concerns originally named for oil pollution at Summerland, Santa Barbara County, was dismissed in April. The Seaside Company and J. E. Lillis have so improved their properties as to make this act possible. Assurance has also been given by these operators that they will continue to cooperate and maintain their premises in a satisfactory condition.

The other two companies, the Submarine Oil Company and G. F. Becker, were brought into the Superior Court of Santa Barbara County where Judge H. S. Gans, of Tehama County, was presiding. As-

suspended for two years pending no further pollution occurs.

The South Mountain property of the Texas Oil Company near Santa Paula, Ventura County, was inspected. No evidences of pollution could be noted and on reliable information it is known that effective measures were taken by the company during a recent storm to prevent any oil from escaping. This was in accord with their promises and desires and another worthy instance of cooperation on the part of the oil industry.



FIG. 88. Official inspection of opening of Santa Fe Springs Waste Water Disposal Company, March 20, 1929.

sistant attorney Ralph W. Scott and Clarence S. Ward, district attorney of the county, successfully prosecuted the case, and Judge Gans enjoined the defendants from future pollution of the waters of the state. The court gave the defendants 90 days to clean up their property.

A complaint was filed against the superintendent of the Marland Oil Company, of Seal Beach, Orange County, for permitting oil to escape into the San Gabriel River. The defendant was brought into the court of Judge Cook in March and fined \$200, \$175 of which was

Inspections have been consistently made of fish screens. In a number of instances, new screens have been installed as a result of efforts of the bureau, and old ones caused to operate more efficiently.

A new screen was installed by the Pacific Gas and Electric Company at the point of their diversion on North Battle Creek, Siskiyou County.

A fish screen was installed by the Deer Creek Irrigation District, Tehama County, on its ditch diverting water from Deer Creek.

The Santa Rosa Water Works has installed a fish screen on its diversion from Santa Rosa Creek, Sonoma County.

Inspections of fish ladders maintained by large operators throughout the most of the area adjacent to the San Joaquin Valley have been conducted. Several of the ladders in the northern and southern parts of the state have also been examined.

The Folsom Dam and fish ladder on the American River has been examined. Assertions have been made that fish do not and can not use this ladder. Nevertheless, authentic reports are on file that fish have already ascended the ladder this season.

The Lassen Irrigation District has installed a fish ladder on its dam maintained in the Susan River. This will permit fish hereafter to reach breeding grounds in the waters tributary to this river.

Bureau of Publicity

During the past year the bureau has functioned along the lines prescribed at the time it was established. Gradually, a sentiment favoring the intelligent conservation and protection of fish and game has been built up throughout the state, and the fine support given this bureau through the press associations and newspapers has had much to do with the public's appreciation of the need for this program of progress.

In addition to sending out numerous publicity stories regarding activities of the division, arrests, convictions and the notable cases made by field forces, numerous visits have been made to other sections of the state, where it has been found that fish and game laws are rapidly becoming more popular.

An average of twenty-one stories per month are broadcast to newspapers. Clippings show the ready response given fish and game matters, as over one-third of the fish and game stories used in the various newspapers in the state are those sent out by the bureau.

Bureau of Game Refuges

New legislation passed by the forty-eighth session of the Legislature revises the fish and game district act. Wherever possible, natural boundaries, instead of section and township lines, have been selected. Three new areas are set aside as game refuges; two existing refuges that

time and adequate investigation have proved badly located are released.

The boundary line of fish and game district 2½ has been reposted by survey made by A. D. McLellan. Some of the refuges near San Francisco have also been posted as well as the Stanford Refuge 3G.

The Governor's advisory committee on game refuges and public shooting grounds has been considering the purchase of waterfowl refuges in the San Joaquin and Sacramento valleys, and a number of tracts have been examined with the view to their purchase. The committee plans to visit the southern part of the state to give consideration to areas that have been recommended.

A more exact knowledge of the nature and extent of breeding grounds for waterfowl in the state is necessary. It is known that several species of duck, and at least one goose, nest in California. In many parts of the state, particularly in Siskiyou, Modoc and Lassen counties and in the Sacramento and San Joaquin valleys, there are quite extensive areas, but it is not known definitely how many nests there are to the square mile in these areas. When such information as this is obtained, it will be possible to regulate the kill better.

During February, 38 claims for the bounty paid by the Division on mountain lions were made. Nine of these lions were killed by official lion hunters of the state.

Operations were carried on in southern California during this spring, due to the fact that in the summer months the heat and dry conditions make it impossible for the dogs to work. Between January 1 and April 12, mountain lion control in southern California has been more effective than ever before. Twenty-nine lions have been killed in Los Angeles, San Diego and San Bernardino counties. In Los Angeles County, during the 22 years that the Division has been paying a bounty on lions, only 89 have been killed and 71 in San Diego County. Since January to April 12, 130 have been submitted for bounty, 49 of these being killed in March alone.

The average number of lions killed since 1907 has been 235 a year. During the first three months of this year claims on more than half this average number have been paid.

During April, 36 claims on lion hides

were made. There were twelve males and twenty-four females.

Counties where most of the lions have been killed, January 1 to April 30, are as follows: Trinity, 22; Madera, 20; Los Angeles, 18; Lake, 15; San Diego, 14; Shasta, 10; Humboldt, 10; Mendocino, 10, and Tehama, 8.

Bureau of Fish Rescue and Reclamation

The installation of the large retaining tanks at Elk Grove, Sacramento County, is progressing rapidly. There are five double tanks of two units, 14 feet long, 48 inches wide and 30 inches deep, sufficient to hold and maintain 15,000 fry and as many adult fish. Each of the species will be kept separate as in a trout hatchery, ready for distribution.

The location of the holding tanks is within a radius of from three to fourteen miles from where 75 per cent of all the spiny-rayed fish were rescued last season. It is also within a short distance from the railroad depot where the fish distribution car takes on the shipment on its regular trips north and south, thus obviating the necessity of holding the car over while the fish are being caught.

So far this season, none of the streams have overflowed their banks. This means very little rescue work will be necessary from the usual areas as would be the case in a season of heavy rainfall. However, there are many lakes and sloughs that will become dry should but little rain fall, and consequently plenty of fish to rescue.

Bureau of Game Farms

The laying season commenced this spring about ten days previous to that of any former year. The first Chinese ring-necked pheasant egg was picked up on March 7. Fine weather, coupled with adequate means and attention, caused the hens to lay more eggs this spring than ever before during operations at Yountville. The last week of March, 1928, showed but 253 Chinese ring-necked pheasant eggs incubated. At the same time in March this year, the incubator contained 1016 pheasant eggs, and there were on hand 334 eggs awaiting to be set.

Mongolian pheasants and silver pheasants commenced laying the middle of March. The first week of April found the valley quail producing eggs. The week following, the Chukor partridges laid six eggs and initiated the season for this class of birds.

During the week of April 12, the first Chinese ring-necked chicks made their appearance. This hatch totaled 25 birds. Tests made of 4907 Chinese ring-necked pheasant eggs being incubated showed that the percentage of fertility was running very high and averaged about 74 per cent.

The first week of May found a total of 10,002 Chinese ring-necked pheasant eggs on hand and 8062 incubating. Some 1300 chicks had hatched and were being cared for by artificial brooders or domestic mothers.

The second consignment of Hungarian partridges arrived at San Pedro March 8. This shipment brings the number of birds brought in this season to 588 pairs. The importations are in large part due to the enthusiasm of Commissioner George B. Clarkson.

Persistent efforts to comply with the most scientific and modern improvements has resulted in the trying out of an electric brooding system. This consists of nine compartments, 8 feet by 13 feet. Completely equipped with heating units and constructed according to the most up-to-date standards, these brooders have been the focus of much attention and interest. If successful, they will solve many problems which have made for difficulties in the past and will permit better results to be gained.

Tests were first made with bantam chicks. The first hatch of Chinese ring-necked pheasants to be tried came through in fine shape. Only three birds out of a lot of 407 died. A second hatch was placed in the new brooders during the last week of April. These passed through the critical stage successfully. The mortality with this second group of birds was exceedingly small and the young pheasants' development was normal. Other tests, however, are necessary before the effectiveness of these brooders for pheasants will be definitely assured and plans for their use on a more extensive scale can be carried out.

The brooders seem to be equally useful with wild turkeys. One batch placed in them made an excellent showing.

The site of the new game farm for southern California, near Chino, San Bernardino County, was surveyed in March, the farm laid out and the ground leveled. Actual work has been started by the Department of Public Works.

Every attempt will be made to rush construction in order to have the pens available for birds in commencing operations this season.

The wooden pipe which supplies water to the state's holdings in Napa County has been replaced by a new steel line. The wood of the old conveyor had so deteriorated that little water could find its way through it. The new line, besides affording a good supply of water for domestic use, affords greater protection against fire. Indeed, a recent visit of the custodian of state property brought compliments concerning the special attention which is being paid on the farm to safeguard against fire.

A case containing 360 Chinese ring-necked pheasant eggs was shipped late in April to the Fish and Game Commission of Hawaii. This was in fulfillment of a promise made to a member of the commission paying a visit to the farm last winter.

Shipments of wild turkey eggs have also been made to the Upland Game Bird Committee of the local sportsmen's association at Oroville. The birds when hatched are to be reared and released by the association.

Chinese ring-necked pheasant eggs have been supplied to the Fitzhugh Ranch at McCloud, Siskiyou County. The birds raised last year on this place were well cared for and the venture eminently successful.

These shipments to individuals in California are departures from the general plan. The state has undertaken to rear large numbers of pheasants within a

definite area under technical and uninterrupted supervision. However, every private effort to increase the output of game birds for liberation in upland covers is deserving of recognition and encouragement. On a few occasions (when there has been a surplus of eggs) assistance has been rendered those who possessed the facilities and had adequate means for hatching and rearing birds.

Requests for information on game bird farming are becoming numerous and insistent. These attest an increasing interest over the entire state. One of the oldest duck clubs in the Sacramento Valley is rearing pheasants this year. The Westwood Rod and Gun Club have purchased 300 eggs from a private farm in Silverton, Oregon.

Five pens of exhibition birds were supplied for the game farm set of the Division's exhibit maintained at the San Francisco Pleasure Boat Show, April 27 to May 4.

A breeding pen of Chinese ring-necked pheasants and one of California valley quail demonstrated the two upland game birds in which sportsmen are most interested. The other three pens, however, came in for the most attention. Due to the universal interest in young life, the enclosures containing week-old Chinese ring-neck pheasants and two week-old wild turkeys with their domestic mothers never failed to attract the crowds. The fifth pen proved a source of much amusement. Here, for the edification of the spectators, a mother mallard reviewed all the defense tactics employed by her species and with nervous, jealous care shepherded her eighteen ducklings about the safer parts of the pen.

COMMERCIAL FISHERY NOTES

N. B. SCOFIELD, Editor

AN ACT REGULATING THE PACKING OF SARDINES IN MAINE

On April 13, 1929, the State of Maine passed an act to regulate the quality of sardines packed in that state. The act requires that canners be licensed and pay a fee of fifty dollars for each group of buildings constituting a packing plant, for the season from April 15 to December 1, and gives the State Commissioner of Agriculture regulatory power. He is empowered to make uniform regulations to insure that the sardines are packed in conformity with the provisions of the Federal Food and Drug Act and the Food and Drug Act of the State of Maine, and are thus labeled. He may suspend or revoke—subject to previous hearing and subsequent appeal—licenses for violations of any of the regulations. Violations of the regulations concerning packing or operating without a license make the violator subject to a fine of five hundred dollars and imprisonment in jail for not over six months for each and every offense. Municipal courts shall have jurisdiction over this matter.

The Commissioner of Agriculture shall employ inspectors in sufficient numbers to insure adequate inspection. The duties of an inspector are defined and the packers must pay monthly 1 cent for each case of sardines packed as a part of the license fee, to defray the cost of inspection. Provision is made for inspecting sardines packed previous to the time of this act so that they may be labeled under its provisions.

For the purpose of this act the term "sardine" shall be held to include any small, canned clupeoid fish being the fish commonly called herring, particularly the *Clupea harengus*. The minimum count of fish per one-quarter size keyless can shall be five fish. The minimum quantity of oil shall not be less than four pounds per case of one hundred one-quarter size cans. The oil shall be a grade not less than "prime summer yellow." The minimum count for one-quarter mustard pack shall be four, and the quantity of sauce eight pounds per case. Tomato sauce must be 1.035 specific gravity; eight pounds are required per case. On all one quarter size cans there shall be used a compound lined gasket or other adequate gasket, or such other adequate device as will hermetically seal the container. Packs not conforming to these regulations

must be plainly and conspicuously marked that they do not conform to the regulations. In such cases they shall not be deemed misbranded under the Maine Act.—*Fishery Science and Trade*, Vol. 1, No. 5.

STEELHEAD TROUT APPEARING IN SOUTHERN CALIFORNIA

The Torrance *Herald* of April 27, 1929, records the catching of a steelhead, erroneously called a salmon, by a Los Angeles angler, from a barge off the coast at Redondo Beach. The article remarks on this unusual catching of steelhead in this locality, however, stating that there have been six taken at the barge during the period, April 21 to 27.

Captain Larson, a fisherman of many years' residence at Redondo, stated, when questioned about the catches of steelhead trout, that last year a great many of this species were taken at the barges and several this year. Captain Larson said it has only been in the last three years that steelhead trout have been caught in this region. According to Captain Larson, these fish are taken with hook and line, using anchovies and sardines as bait, this being the same method as is used when fishing for barracuda, mackerel and halibut.—G. Houghton Clark, California State Fisheries Laboratory.

OYSTER CULTIVATION ON PUGET SOUND

On the coast of Puget Sound, in the state of Washington, oysters are now successfully raised from seed imported from Japan. The seed is planted in specially dyked flats. Near Bellingham, Wash., tide-flat operators of oyster beds harvested bivalves at the rate of \$500 worth a day. These Japanese oysters grow as much in three months on the shores of Puget Sound as an Eastern oyster grows in four years. They have to be picked early, because consumers do not fancy grown ones. Choice specimens gathered recently measured ten inches long, and weighed in excess of one pound each. It has recently been discovered that the imported oysters will spawn in the waters of Puget Sound, and it is therefore probable that in a few years the industry will be carried on entirely in American waters.—*National Industrial Review*, San Francisco, Vol. 3, No. 29, May 11, 1929.

CANADA TO STUDY PACIFIC PILCHARD AND HERRING INDUSTRIES

A commission appointed by the Dominion and Provincial governments will shortly make an investigation of the pilchard and herring fishing industries in British Columbia, according to information furnished the Department of Commerce by American Consul H. S. Tewell at Vancouver, B. C. Comparatively little is known concerning pilchards, and since the government granted permission to use this species in the production of fish oil and meal in 1925, large quantities have been caught for use in building up a fish reduction industry on Vancouver Island whose annual production is valued at \$2,000,000. The total catch of pilchards in 1924 amounted to 2,748,500 pounds and in 1928, 141,580,300 pounds. Fear has been expressed that at this rate the supply of pilchards may become depleted, and for the protection of the fish reduction industry it has become necessary to procure a more scientific knowledge of the fish upon which the industry depends. Herring have been used in the manufacture of fish oil and meal since 1927, the catch devoted to this purpose in 1928 being 10,064,500 pounds. In view of the food value of this species, it appears to be desirable to know something more of the probable size of the source of supply, and pending an investigation, permission has been withdrawn to use herring in the fish reduction industry.—“Foodstuffs 'round the World.” *Fishery News*, May 17, 1929.

SEA LIONS AND FISHERMEN

The following rather jocose letter, dealing with sea lions and their relationship to fish, appeared in the *Leeside* column of the *Los Angeles Times* of May 3, 1929:

“*Leeside*: I see that the commercial fishermen want to slaughter all the sea lions because they are ‘destroying \$100,000 worth of fish daily.’ Also that the Legislature wants to put a curb on the fish canneries because so many tons of the larger size sardines are being made into fertilizer daily, to which the canneries retort that the fertilizer business is no menace whatever to the fish supply.

Also that State Fish and Game Commission figures show that in one month approximately 50,000,000 pounds of commercial fish came in over the fish wharves at San Pedro alone. It is appalling to think that in only 10,000 to 50,000 years the sea lions, natives of these waters, have so depleted the supply that now the commercial fishermen, who are not natives but mostly came here from foreign lands only a few years ago, can catch only a meager 50,000,000 pounds of fish monthly. So I think it high time the sea lions were destroyed, as, at the present rate, they might seriously diminish the tonnage of fish in southern California waters in another million years or so. And also to save these native sea lions from the sad fate of being starved to death by the foreign fishermen.”

Although written in a sarcastic vein, the writer has hit one of the substantial points regarding the position of sea lions in the natural balance. Not so many years ago the principal food fishes were numbered by millions where there are thousands today. During the same period there were ten thousand sea lions where one exists now. The old state of affairs ran a smooth course for many thousands of years, until man discovered that fishing was profitable. It is rather inconsistent, therefore, to blame the sea lions for the decrease of the fish. A more logical supposition is that man has caused the decrease of both fish and sea lions.

An observation made some years ago at the mouth of the Klamath River is very much to the point in this regard. Several sea lions were killed in the Klamath River estuary during the height of the salmon run. On opening them the stomachs were found to be filled with lampreys. It is a proven fact that lampreys are detrimental to other fish, killing great quantities of them in some places. That sea lions eat salmon and other food fish is a fact which can not be questioned; but that they also destroy vast quantities of fish and other organisms which are detrimental to these same food fish is also becoming to be accepted by scientific men.—Paul Bonnot.

LIFE HISTORY NOTES

WEED BURNING AND TULE LAKE
PHEASANTS

The bulk of the pheasants in the Tule Lake region, both California and Oregon, make their first setting of eggs on the weed covered ditch banks in late March or early April. The surrounding fields are bare and void of protective cover for any nesting ground birds. At this time of year (late March and early April) the United States Reclamation Service starts its ditch riders with a helper or two cleaning ditches. Dry weeds are fired.

them out, and then, if they nest again on a check, the mowing of the first crop of alfalfa destroys the nest. By this time there is sufficient cover on the ditch banks so they can eventually raise a brood. In short, the destruction of settings or partial settings is enormous. It amounts to possibly 75 per cent of the total settings.

All this can easily be avoided if the ditches are fired early in March. However, the Reclamation Service ditch riders are temporary employees. May 1 is the official date for turning water into the

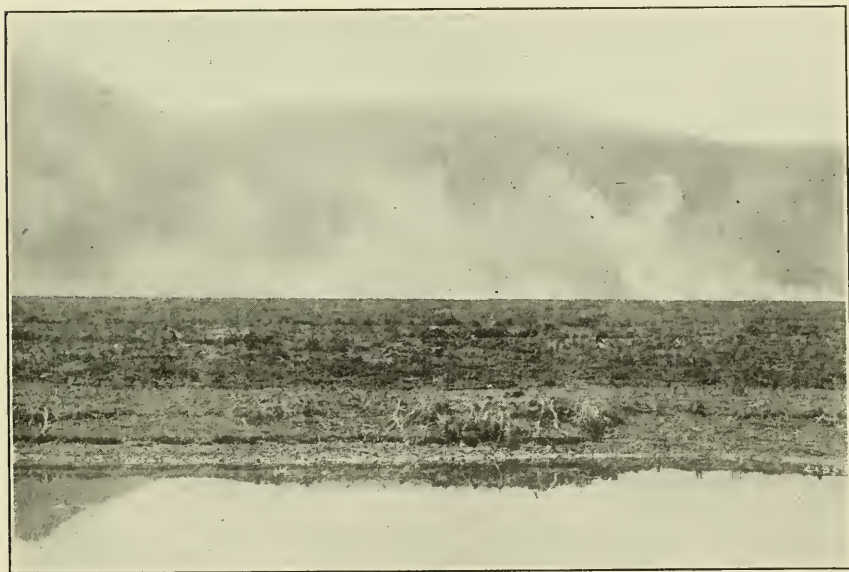


FIG. 89. Burning off hundreds of acres of unharvested grain affording excellent cover for Chinese ring-necked pheasants, Tule Lake, Modoc County. Photographed by E. S. Cheney, May 12, 1929.

Weeds in the water are dragged out on the bank and fired after drying.

Pheasants that nest early and before there is any growth in the fields of new grain or alfalfa are burned out. Their nest sites are destroyed sometimes two or three times when they persist in nesting on unburned ditch banks. If they double back and nest in a weed patch that has escaped fire they are in the clear. If they keep getting driven away from the nest sites on the ditch banks until the fields have enough crop growth to furnish cover, irrigation in May will usually drown

ditches of the Klamath Project. Actually this date varies from the first or the last week in April to the end of the first week in May, according to conditions of soil moisture. Now the ditch cleaning job consumes at least a month. Therefore, the ditch riders are employed one month ahead of the time their water patrol duties commence and continue on until the water is shut off late in the fall.

In many instances private owners burn the weeds on their property earlier than the Reclamation Service. Because of this pheasants nesting on their property have

more favorable chances of bringing forth a brood.

In 1925, on one side of the ditch on the Dalton Ranch, I counted twelve burnt settings in one and one-quarter miles of ditch bank. In 1926, along the main canal from Malin to the highway, I counted ten destroyed settings within a distance of two miles on one side of the ditch. In 1927, along the ditch that serves the farms east of Lost River and nearest to it, I counted eight destroyed settings in less than three-quarters of a mile of ditch, and last year in the same place, nine destroyed settings. All these settings showed signs of being burnt. None showed evidence of having been ruined by cats, dogs or predatory animals.

Burning started last week this year, but had to be abandoned on account of storms which have so wet the weeds that they will not burn. It will be continued as soon as the weather clears. Consequently, my count for this season is yet incomplete. On the whole this procedure effects an utterly useless loss of potential game and economically useful birds. Furthermore, the loss is entirely avoidable if the Reclamation Service could be induced to burn the weeds earlier.—Fred R. Starr, Maedoe, California, April 7, 1929.

SOME EARLY PLANTINGS OF TROUT

The Sierra Club planted eighty-one trout in Moraine Lake, Tulare County, during July of 1908. These trout were taken from the Kern River and were the Kern River variety of rainbow trout. They averaged six to eight inches in length. In 1912, trout were caught in Moraine Lake which were unquestionably these same fish. They weighed from six to eight and one-half pounds. The largest one caught was twenty-eight and one-half inches in length. These fish were identified as being the same fish by Prof. C. A. Kofoid of the University of California, who had a special high-powered microscope and who came along on the trip especially to study the age of trout. The fact had just been established in connection with salmon fisheries that the age of fish of this character could be determined by the annual growth of their scales as indicated by groups of rings under the microscope. The largest fish I caught was eight years of age. The first four years showed a comparatively small growth annually, and the last four years, a very exaggerated growth. This was the period of time the fish were in the lake and indicated that conditions in the lake

were highly favorable for the growth of trout.

Four years later, or in 1916, we again visited Moraine Lake and although we saw one or two very large trout, which were evidently the same ones we had planted in 1908, we were unable to catch any. We did, however, find a trout in the shallow part of the lake that had evidently been dead for two or three days. It weighed between eleven and twelve pounds. The remaining fish we saw in the lake seemed to be about the same size. We observed these fish and they seemed to be feeding on small larvae found in the water, many of which were evidently mosquito larvae.

In 1908, the club planted golden trout of about ten inches in length, taken from Rock Creek, Tulare County, which we planted in an unnamed lake near by. In 1912, four of us visited this lake and we each caught two of these golden trout. The largest one which I caught weighed three and a half pounds and was about eighteen inches in length. It was a very heavy, chunky fish. The meat was reddish pink in color. Dr. David Starr Jordan told me that the meat of any trout will turn pinkish or reddish if it has a superabundance of food, this being an indication that the trout is very fat. That is why salmon that are fresh run from the ocean and in perfect condition have very red meat. This gradually fades until it is almost white when the fish reaches the upper Sacramento. Salmon cease feeding as soon as they leave the ocean and by the time they near their spawning beds have lost all their fat.

These large golden trout had changed color somewhat, and were reddish instead of golden. They also had the same absence of scales which characterizes the golden trout, and were great fighters.—Wm. E. Colby, Mills Building, San Francisco, California.

PELICAN SWALLOWS LARGE STRIPED BASS

On the morning of November 27, 1928, Deputy William Armstrong and myself were returning to Deputy Armstrong's ark in Goodrich Slough in the patrol boat *Hunter*. Upon rounding the point below what is called "Sixth Reach" Slough, we saw a large white pelican struggling in the water as if wounded or in distress. We observed that the bird had caught and was trying to swallow a good-sized fish. It tried to fly as we drew nearer, but the excessive weight of the fish pulled the bird's head down. The bird apparently was utterly without power to lift itself into the air while in

this position. After each attempt it seemed quite exhausted and was unable to keep its head from sinking into the water.

Finally, after several violent efforts it succeeded in swallowing the fish. It was about to make off as I shot it. On cutting the pelican open we found that the fish was a striped bass, which we removed and took to Vallejo where it was weighed. The fish tipped the scales at four pounds eight ounces.—Charles F. England, Vallejo, California.

ANTELOPE IN KERN COUNTY

In 1859, my father hauled hay from the plains south of Bakersfield to Fort Tejon, where it was sold to General Albert Sidney Johnston, later killed in the Civil War at the battle of Shiloh. The hay consisted of alfilaria (*Erodium*), which the Indians cut with shovels. It brought \$75 per ton, delivered by ox teams at the fort. The wild oats grew everywhere, shoulder high, but were not used for hay.

The little creek which spread out in the plains below the fort ran water at night, but soon dried up under the sun's heat. Antelope, by the hundreds, came trooping in from the plains to this water. This opportunity was too tempting to an old trapper and hunter, who accordingly placed a brush ambush close to the watering place, and during the days following slaughtered over 5000 antelope.

The hides only were taken, and the carcasses left to rot.

Grizzly bears were also very numerous and savage. It was not safe to travel certain trails after dark, as the bears would sometimes attack men even on horseback. The last grizzly has long since been killed. I am told that the automobile is responsible for chasing almost the last of the surviving antelope to death.

Antelope still survive in portions of California, from which other herds could be built up if proper protection were afforded. Could not the Sutter Buttes, in the center of the Sacramento Valley, an area without agricultural future, be reserved as an antelope refuge for all time?—W. W. Mackie, College of Agriculture, University of California, Berkeley, California.

LACK OF FOOD CAUSES LOSS OF DEER

I was patrolling in the Bishop Creek country recently and the deer are there by the hundred. I noticed at least a hundred dead ones, but no fresh ones. I am of the opinion that the feed was short there during the winter and that accounts for most of the dead. The feed is getting good there now, but the deer are keeping it down close. The deer are not wild at all, they even come to one's camp to get salt.—C. L. Brown, Mariposa, California, May 13, 1929.

CONSERVATION IN OTHER STATES

LOUISIANA BEGINS FISH CULTURE

In states like Louisiana, where water temperatures are uniformly high, fish culture is impractical according to methods used in cold water hatcheries of the north or colder latitudes. However, pond culture of the warm water nest-building fishes is being practiced very successfully in the south.

The Conservation Department of Louisiana has just announced the planting of 2,500,000 game fish reared during the past season in the Cool Coosa fish culture station of that state. The success of this project during the first year of its operation far exceeded the expectations of the department. Of the fish reared and planted 2,000,000 were bream or sunfish, sometimes called perch in the south; 400,000 were large-mouthed black bass and 100,000 crappie and barfish or white bass. The

production was over 200,000 fish to the acre, the pond in which they were reared comprising twelve acres. It is of interest to fish culturists to know that such a large number of fish can be reared in a pond of that size and retained until over nine months of age. Some of these fish had attained quite remarkable size; for instance, some of the bass weighed as high as a pound and a quarter each.

A new accomplishment of this station was the rearing of white bass successfully under hatchery conditions.

The fish in this hatchery were not fed artificially, but by providing certain fertilizer encouraging the growth of plant life and natural insect food, the natural supply of food was maintained in abundance. The project cost the state only \$3,550 for construction and the cost of its operation during the year was nomi-

nal. It is entirely probable that the success of this enterprise will result in the establishment of numerous other similar ones in other parts of that state and elsewhere.

MICHIGAN MAKES IMPORTANT PURCHASE

The Michigan State Department of Conservation has been authorized to spend \$20,000 of its game protection fund for the purchase of 5000 acres of land in Otsego and Cheboygan counties to block in the Pigeon River Forest and Otsego Game Preserve. The purchase of this land will give the department control of nearly twelve miles along the Pigeon River, one of the state's finest fishing streams.

NEW YORK'S NEW GAME SANCTUARY

"Conservation Commissioner Alexander Macdonald has entered into a contract and sent to the Department of Law for title examination for the purchase of a tract of approximately 2000 acres for additional demonstration forest and game refuge purposes to be known as the East Hill Demonstration Forest and Game Refuge.

The tract in question lies in the towns of Ossian, Nunda and Grove, in Livingston and Allegany counties, and is located generally on the ridge between Sugar and Canaseraga creeks, approximately six miles northwest of the village of Canaseraga and about the same distance southeast of the village of Nunda. The elevation ranges from 1700 to 2000 feet. Approximately one-half of the area is abandoned farm land. The remaining portion is covered with second growth forest. Included within the area under contract is a three-year-old plantation of white pine approximately 60 acres in size. It is expected that other adjacent lands will be acquired at a later date.

This purchase area is the fifth purchase area to be established for demonstration forest and game refuge purposes outside of the so-called Forest Preserve counties.—Dupont *Promotion News Bulletin*, No. 29, March 14, 1929, p. 9.

A GAME CENSUS IN NORTH CAROLINA

In order to obtain information regarding the amount of game in the State of North Carolina, its distribution, and for the solution of game problems, a census of game killed the first year of enforcement of the law was taken in 1928.

Return cards were mailed to the 139,170 hunters, and on the basis of replies from approximately 40 per cent, it is

estimated that the value of flesh and furs of birds and animals killed annually in the state amounts to approximately \$2,000,000. The total estimated kill of birds and animals for the year was 4,529,590.—*Conservation and Industry*, Raleigh, N. C., p. 4.

GEORGIA STILL LACKS ANGLERS' LICENSE

Georgia is one of the very few states in the union that does not require a license for fishing in her public streams. The fishermen of the state do not contribute one penny to be used for protecting and propagating fish. Practically every cent of revenues collected by the Game and Fish Department is paid by the hunter through the purchase of hunting licenses.

PUBLIC SHOOTING GROUNDS FOR ILLINOIS

In view of the fact that practically all the available shooting ground along the Illinois and Mississippi rivers is leased by gun clubs or private individuals, state conservation officials of Illinois recognized the need of land for the use of public shooting grounds and upon which anyone could hunt. The Illinois Department of Conservation has started two such places, one at Sparland, covering 760 acres of land, and one across the Illinois River from Rome, covering 1720 acres of land. These tracts represent the first example of the state's taking over this kind of land which seems to be more valuable for its game resources than for agriculture, especially with the high drainage taxes, and it is planned from time to time to create additional areas upon which sportsmen can feel free to hunt and fish.

MICHIGAN CONTINUES ITS "CREEL CENSUS"

The Department of Conservation will continue the "creel census" during the present year in connection with its program for assembling definite information on various matters relative to inland fisheries. Conservation officers are supplied with creel census cards, and it is expected that the sportsmen will willingly cooperate with the "census taker" in furnishing reliable information on which to base reports. The cooperation received during the past two years in this work has been most gratifying to the department.—Michigan Department of Conservation.

NORTH CAROLINA BREEDING FUR-BEARERS

With fur-bearing animals having been added to the breeding stock at the State

Game Farm, near Asheboro, North Carolina, the field of operation of the institution is being extended.

The latest comers at the State Game Farm are twelve muskrats, six brown and six black. For several weeks the force at the game farm has been busy preparing pens, twelve for the muskrats, four large pheasant pens, twenty-one for quail, and fifty setting boxes for the last named birds.

Muskrat breeding at the farm will serve the purpose of providing stock with which to rehabilitate animals in sections where they have been depleted and to demonstrate the practicability of breeding fur-bearers in captivity in North Carolina. If this experiment proves successful, it is contemplated that mink may be added to the stock at the farm, and later perhaps other animals, including the beaver and otter, two of the most valuable of all fur-bearers.

Special attention is to be given by game authorities to building up the fur industry in North Carolina, and it is believed that several million dollars can be added to the income of trappers annually by this program.—*Conservation and Industry* (North Carolina Department of Conservation and Development), Vol. 6, No. 7.

BEAR REGARDED ASSET IN WYOMING

Wyoming is one of the few states that requires a license for shooting bears. That state regards the bear as a game animal and a distinct asset. In 1927 Wyoming sold 392 resident bear permits and 53 nonresident permits. During the 1928 season 465 resident bear permits were sold and 51 nonresident.

A game census is taken annually in Wyoming, the result of the last census disclosing the following number of the principal game animals in the state: Moose, 5061; elk, 33,240; mountain sheep, 2635; antelope, 21,690; deer, 21,650; bear, 1595. The quantity of game killed during the season of 1927 is reported as follows: Elk, 1191; deer, 1254; bear, 77; mountain sheep, 22; antelope, 307; grouse, 7180; sage hens, 88,783.—*The American Field*, April 20, 1929.

PHEASANT SURVEY

The University of Nebraska has announced that it will conduct a twelve months' investigation on the feeding habits of the Chinese ring-necked pheasant. It is planned to observe the birds during a period of twenty-four hours for two days each month. At specified times specimens of killed birds will be for-

warded to the university laboratory for examination and analysis of stomach contents. This survey will also make a study of the relation of the pheasant to other game birds and to domestic fowl.

QUESTIONNAIRE OF GAME CONDITIONS IN NEW JERSEY

Protector J. M. Stratton sent a questionnaire to the wardens respecting game conditions for the following game: Rabbits, pheasants, quail, ruffed grouse, woodcock, squirrels, ducks, geese, brant, Wilson snipe, yellow-legs, rails, Hungarian partridge, the questions being as follows:

Was there good supply of each at beginning of season?

Was there increase or decrease in each killed over former years?

Were hunters pleased?

Were there many cases where bag limit was secured for each?

Was there good hunting for each throughout season or only first few days?

Is each increasing or decreasing? (Give special attention to woodcock and Hungarian partridge.)

Amount of each left over.—Annual Report of the New Jersey Board of Fish and Game Commissioners, for the fiscal year commencing July 1, 1927, and ending June 30, 1928.

OKLAHOMA STATES PLANS

The Game and Fish Commission of Oklahoma plans for the succeeding biennium:

1. A new state fish hatchery to serve the northwestern tier of counties.

2. Purchase of additional lands for state park and game preserve purposes.

3. Creation of additional game refuges upon which can be placed sufficient quantities of wild game for breeding and restocking.

4. Publication of a department magazine or news sheet.

5. Construction of more than 100 local fish hatcheries and nursery ponds.

6. An enlargement campaign in cooperation with the Federal Government, to rid the state of predatory animals.

7. Purchase and distribution of bob white quail and other wild game in as large quantities as finances will permit.

8. Establishment of a state park system to keep pace with modern recreational demands.

9. To urge passage of such laws as will correct defects which may have existed during this biennium and adoption of such rules and regulations as will make more popular the great work now being conducted.

10. More rigid enforcement of existing game and fish laws where such may be necessary.

11. Cooperation with organized groups of sportsmen and creation of local advisory boards in each community, to aid in a more successful administration of department laws, rules and regulations.

12. Improvement of hatchery properties, game preserves and recreational centers to the end that pride and pleasure may be realized by the citizens of Oklahoma and by the visitors who enter her borders, as well.—Report State Game and Fish Commission, State of Oklahoma, Bienium, July 1, 1926, to June 30, 1928.

WISCONSIN GIVES PUBLICITY TO VIOLATORS

The Wisconsin Conservation Commission has recently decided to give publicity to successful prosecutions for violation of the fish and game laws of that state. It has been found in several states where this policy has been followed that publicity tends to reduce the number of violations as many who do not experience any compunction of conscience or feel a monetary penalty dislike very much the unfavorable notoriety which attends the publication of facts in connection with their prosecution.

Wisconsin will publish not only the name and address and the character of the violation in each case but the "pedigree of the violator, giving his previous record in connection with violations, if any, also facts with reference to his membership in sportsmen's clubs.

This policy will doubtless reduce the number of repeaters.—American Game Protective Association.

NEVADA ANTELOPE TO BE STUDIED

Since the acquisition, some time ago, by the Audubon association of a tract of land in Nevada to be used as a sanctuary for antelope, it has seemed desirable to make an intimate study of the habits of these animals, particularly with respect to their numbers, enemies and migratory movements. It has long been known that there is quite a divergence between their summer and winter ranges, but apparently no definite information exists on the subject with respect to antelope of this particular region. In order to obtain exact data the association through the generosity of two of its members, Dr. John C. Phillips and Childs Frick, has been enabled to employ a field man who has begun a year's intensive study of the antelope inhabiting north-eastern Nevada. He is equipped with both a horse and a motor car and in this

way will be able to follow the antelope in all their movements. Careful counts are being made and more than 1000 antelope have been thus far reported. It is hoped to acquire a fund of information which will be of very great value in determining the character of administration the sanctuary should receive. Mr. Emerson, the agent, has also been made a game warden by the state conservation authorities. The area inhabited by the antelope is also the heart of the sage-hen country, and observations are also being made concerning the status of this interesting and picturesque grouse. Emerson states that he has found abundant evidence to show that ravens are very destructive to the birds. The Last Chance Ranch and its environs is controlled by the Audubon association, with an option to purchase.—*The American Field*, March 23, 1929, p. 282.

PHEASANTS ON INCREASE IN NORTH DAKOTA

The State Game and Field Commission of North Dakota has been more than enthusiastic over the results obtained in the propagation of Chinese pheasants. The southern part of the state is well stocked and the Commission contemplates trapping a few thousand in that locality for shipping and distribution all over the state. The stock from 7000 pheasants released from 1913 to 1917 increased to such a number that ten years later in 1927 over 2,000,000 pheasants were killed with no noticeable decrease. This remarkable fact is due, no doubt, to the climatic conditions of the state, the severe winters eliminating the weaklings and leaving only the strongest birds for breeding stock. Our state has practically the same climatic conditions as South Dakota and the geographic features are very similar, giving us ideal conditions under which to propagate this bird.

In planting the pheasant it is very desirable to have a locality where there is plenty of water and some protection. It is a good plan to have some farmer feed and encourage the birds to inhabit the place of their original planting and to let them gradually spread out through the surrounding country as they multiply in number.

There has been much argument pro and con as to whether the Chinese pheasant is desirable for the farmer. When these birds were first released many complained, saying that they were destructive. The corn fields were said to be damaged as the birds seemed to inhabit them in preference to other fields. This caused the Commission to hesitate some in the

encouragement of the propagation of this species until thirty pheasants were killed in the corn fields in the spring under special permit and it was found that only two had corn in their crops and that the remainder had been feeding on cut-worms. Since that time the farmer has learned for himself that the presence of the pheasant is a benefit rather than a detriment and in the majority of cases, he is now encouraging their propagation.

In a few years North Dakota will be stocked with Chinese pheasants, a fine "table" bird and one excelled by few in giving real sport to the hunter.—Tenth Biennial Report State Game and Fish Commission of North Dakota.

WASHINGTON TAKES INVENTORY OF WATERFOWL AREA

No merchant can be certain that his business is operating at a profit unless he knows the amount of his stock of goods and its condition. Similarly, it is necessary to take an inventory of game and game conditions in order to gain a knowledge of its actual status.

The Division of Fish and Game of Washington is applying this principle in attempting to arrive at a more satisfactory solution of its migratory waterfowl problems. It is making a survey of the present and former known areas resorted

to by migratory waterfowl as loafing, feeding and breeding grounds. The information considered essential to the success of the survey is outlined as follows:

- I. Present waterfowl areas.
 - A. Location and acreage of county-owned areas.
 - B. Location and acreage of state-owned areas.
 - C. Location and acreage of privately-owned duck club areas.
 - D. Nature of natural feed in each area.
 - E. Species of waterfowl frequenting areas.
 - F. Decrease or increase noted in numbers.
- II. Areas no longer used by waterfowl but which might be restored.
 - A. Location and acreage of county-owned areas.
 - B. Location and acreage of state-owned areas.
- III. Areas formerly waterfowl lands but reclaimed for agricultural purposes.
 - A. Location and acreage of each.
- IV. Ideas for the development of areas.
 - A. Under this caption include any information which, in your opinion, has a direct bearing on the survey as a whole.

REPORTS

SEIZURES OF FISH AND GAME

January, February, March, 1929

Abalone, pounds.....	561
Abalone.....	902
Barracuda, pounds.....	3,394
Bass, striped.....	33
Bass, black.....	6
Catfish, pounds.....	20
Clams.....	1,628
Crabs.....	248
Cockles, pounds.....	110
Halibut.....	3
Lobsters, pounds.....	1,862
Bluegill, Crappie.....	125
Perch, Sunfish, Smelt.....	62
Salmon roe, pounds.....	300
Sturgeon.....	1
Trout, pounds.....	454
Deer meat.....	1,003
Ducks.....	523
Geese.....	64
Mudhens.....	17
Non-game birds.....	117
Pigeons.....	3
Quail.....	18
Rabbits.....	4
Squirrels, tree.....	3
Sea gulls.....	2
Shorebirds.....	43
Swans.....	6
Bird nets.....	8
Dip nets, set lines.....	16

VIOLATIONS OF FISH AND GAME LAWS

GAME CASES

January, February, March, 1929

Violation	Number arrests	Fines imposed	Jail sentences imposed (days)
Violations of Hunting License Act.....	83	\$1,650	-----
Deer meat: closed season.....	40	2,001	362
Deer: fawn, doe; closed season.....	10	1,534	120
Ducks: overlimit; closed season; selling of.....	31	1,230	25
Geese: overlimit.....	1	40	-----
Quail: closed season.....	3	125	-----
Pigeons, doves: closed season.....	3	60	-----
Swan: illegal killing of.....	6	255	-----
Shore birds: illegal killing of.....	3	75	-----
Non-game birds.....	46	1,525	-----
Pheasants: illegal possession of.....	4	500	-----
Mud hens: closed season.....	8	75	-----
Rabbits: closed season.....	4	100	-----
Squirrels, tree: illegal possession of.....	6	150	30
Night shooting.....	9	125	100
Shooting from power boat and auto.....	5	180	-----
Firearms in game refuge.....	3	75	-----
Bird nets, traps: illegal.....	3	100	-----
Fur trapping regulations: no license.....	9	175	-----
Refusal to exhibit game birds.....	1	300	-----
Trapping game birds.....	1	25	-----
Totals.....	279	\$10,300	637

FISH CASES

January, February, March, 1929

Violation	Number arrests	Fines imposed	Jail sentences imposed (days)
Violations of Angling License Act.....	11	\$160	-----
Violations of Commercial Fishing License Act.....	9	195	-----
Abalone: closed season; small.....	79	1,727	5
Barracuda: small.....	4	125	-----
Bass, black: closed season.....	3	65	-----
Clams: small; closed season.....	63	1,460	50
Crabs: small.....	15	270	60
Lobsters: small; oversized.....	12	295	10
Trout: closed season; selling of.....	37	1,055	55
Sturgeon: illegal possession of.....	1	250	-----
Sunfish, catfish: closed season.....	4	70	-----
Cockles: small.....	5	80	-----
Eel: small.....	2	20	-----
Nets, traps, lines: illegal.....	21	1,325	100
Spears, gaff hooks: illegal.....	9	315	-----
Pollution of bay.....	3	425	-----
Night fishing.....	5	100	-----
Totals.....	283	\$7,937	280

STATEMENT OF EXPENDITURES

For the Period July 1, 1928, to March 31, 1929, of the Eightieth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Executive and legal.....	\$12,084 99	\$2 90	\$2,461 84	\$565 75	\$15,115 48
Clerical and office.....	17,224 23	866 78	4,021 89	454 69	22,567 59
Rent.....			6,640 60		6,640 60
Automobiles.....		199 07	200 44		399 51
Telephone and telegraph.....			3,451 97		3,451 97
Postage.....			2,881 81		2,881 81
Freight, cartage and express.....			1,741 57		1,741 57
Printing.....		7,752 85			7,752 85
Accident and death claims.....			5,014 42		5,014 42
Commissioners.....			411 98		411 98
Total administration.....	\$29,309 22	\$8,821 60	\$26,826 52	\$1,020 44	\$65,977 78
Education:					
Director and assistants.....	\$10,515 38	\$363 19	\$2,898 07	\$1,728 01	\$15,504 65
Pacific Southwest Exposition.....	242 75	1,014 06	1,349 13		2,611 94
Total education.....	\$10,764 13	\$1,377 25	\$4,247 20	\$1,728 01	\$18,116 59
Publicity:					
Director.....	\$2,475 00		\$509 62		\$2,984 62
State Fair.....	357 00	\$212 21	730 71		1,299 92
Total publicity.....	\$2,832 00	\$212 21	\$1,240 33		\$4,284 54
Conservation and protection:					
Chief and assistants.....	\$7,524 99	\$39 55	\$1,679 63		\$9,244 17
Clerical and office.....	2,125 00	49 90			2,174 90
Rent.....			265 70		265 70
Automobiles.....		766 45	423 80	\$14 33	1,204 58
Captains and deputies.....	159,647 88	176 29	115,593 88	802 96	276,221 01
Patrol launches.....	1,575 00	1,174 41	1,190 33	422 61	4,362 35
Lion hunters.....	2,332 69				2,332 69
Coyote trappers.....	358 88				358 88
Lion bounties.....			6,280 00		6,280 00
Fish planting.....	1,260 00	801 88	2,317 58		4,379 46
Refuge posting.....	4,736 75	241 17	973 45	3 60	5,952 97
Fish reclamation and rescue.....	505 00		458 22		963 22
Total conservation and protection.....	\$180,066 19	\$3,249 65	\$129,182 59	\$1,243 50	\$313,741 93
Commercial fisheries:					
Chief and assistants.....	\$6,705 00	\$454 77	\$1,521 93	\$499 71	\$9,181 41
Deputies.....	26,401 75	82 46	6,344 67	65 53	32,894 41
Patrol launches.....	2,121 45	1,355 92	1,907 70	22 20	5,407 27
Statistical.....	5,590 00	228 11	341 47		6,159 58
Laboratory.....	27,408 39	1,169 21	5,247 88	812 99	34,638 47
Salmon tagging.....			41 00		41 00
Botulism.....			11,250 00		11,250 00
Automobiles.....		241 37	214 25		455 62
Carp eradication.....	1,485 84	315 10	240 35		2,041 29
Total commercial fisheries.....	\$69,712 43	\$3,846 94	\$27,109 25	\$1,400 43	\$102,069 05
Fish culture:					
Chief and assistants.....	\$3,315 00	\$8 18	\$226 07	\$26 50	\$3,575 75
Clerical and office.....	3,060 67	34 97	218 44	158 55	3,472 63
Rent.....			79 00		79 00
Automobiles.....		2,431 93	1,288 95	52 55	2,773 43
Hatcheries.....	94,843 66	40,024 69	13,793 64	5,656 25	154,318 24
Hatcheries—additions and betterments.....				2,070 02	2,070 02
Special field investigation.....	6,795 00	1 50	2,518 83	7 18	9,322 51
Fish reclamation and rescue.....	2,021 00	71 38	678 17	164 37	2,934 92
Total fish culture.....	\$110,035 33	\$42,572 65	\$18,803 10	\$8,135 42	\$179,546 50
Hydraulics:					
Chief and assistants.....	\$4,305 00	\$264 44	\$1,345 31	\$51 32	\$5,966 07
Cooperative research work.....	2,250 00		134 13		2,384 13
Total hydraulics.....	\$6,555 00	\$264 44	\$1,479 44	\$51 32	\$8,350 20

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1928, to March 31, 1929, of the Eightieth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Game propagation:					
Game farm—Yountville.....	\$6,995 44	\$5,668 18	\$1,982 82	\$1,936 96	\$16,583 40
Automobiles.....		127 46	66 71		194 17
Southern California Game Farm.....			4 80		4 80
Total game propagation.....	\$6,995 44	\$5,795 64	\$2,054 33	\$1,936 96	\$16,782 37
Research:					
Chief and assistants.....	\$9,090 03	\$422 24	\$1,063 28	\$70 00	\$10,645 55
License commissions.....			\$44,439 35		\$44,439 35
Hungarian partridges.....				\$5,678 30	\$5,678 30
Salinas River channel.....				\$98 37	\$98 37
Total eightieth fiscal year.....	\$425,359 77	\$66,562 62	\$256,445 39	\$21,362 75	\$769,730 53

STATEMENT OF INCOME

For the Period July 1, 1928, to March 31, 1929, of the Eightieth Fiscal Year

License sales:	Detail	Total
Fish breeders' licenses, 1929.....	\$300 00	
Angling, 1927.....	1,040 00	
Angling, 1928.....	357,988 20	
Angling, 1929.....	12,420 00	
Hunting, 1928.....	459,821 50	
Hunting, 1929.....	22,207 00	
Market fishermen's licenses, 1928-1929.....	31,320 00	
Wholesale fish packers' and shell fish dealers' licenses, 1928-1929.....	985 00	
Game breeders' licenses, 1928.....	102 50	
Game breeders' licenses, 1929.....	627 50	
Fish breeders' licenses, 1928.....	55 00	
Trapping licenses, 1928-1929.....	6,479 00	
Commercial hunting club licenses, 1928-1929.....	2,025 00	
Commercial hunting club operators' licenses, 1928-1929.....	575 00	
Deer tag licenses, 1928.....	103,116 80	
Kelp licenses, 1929.....	10 00	
Market fishermen's licenses, 1929-1930.....	10,060 00	
Deer tag licenses, 1929.....	2,518 00	
Total license sales.....		\$1,011,650 50
Other income:		
Game tag sales.....	\$35 58	
Court fines.....	73,463 19	
Fish Packers' tax.....	144,392 01	
Kelp tax.....	31 54	
Fish tag sales.....	5,656 54	
Crawfish inspection.....	21 00	
Miscellaneous sales.....	624 89	
Interest on bank deposits.....	4,344 63	
Contributions from importers.....	407 18	
Total other income.....		\$228,976 56
Total departmental income.....		\$1,240,627 06

CANNED, CURED AND MANUFACTURED FISHERY PRODUCTS OF CALIFORNIA FOR THE YEAR 1928

(Compiled by the Division of Fish and Game, Bureau of Commercial Fisheries.)

Canned

Species of fish	Size of cans	Northern California district, cases	Monterey district, cases	San Pedro district, cases	San Diego district, cases	Total cases
Abalone	1-lb. tall		255			255
	1/2-lb.		80			80
Albacore	1-lb.			8,544	7	8,551
	1/2-lb.			84,977	637	85,614
	1/4-lb.			1,736	14	1,750
	1/4-lb. (96 to case)			3,836		3,836
Bonita	1-lb.			1,417	131	1,548
	1/2-lb.			12,410	3,258	15,668
	1/4-lb.				1,654	1,654
	1/4-lb. (100 to case)					
	1-lb.			30		30
Fish cakes	1-lb.			2,101		2,101
	1/2-lb.			10,984		10,984
Mackerel	1-lb. tall		1,030	357,136	25,110	383,276
	1/2-lb.			4,717	208	4,925
	1/4-lb.				270	270
Salmon	1-lb. flat	461				461
	1/2-lb. flat	4,124				4,124
Sardines	10-lb.		263			263
	1-lb. oval		1,511,535	945,676	39,755	2,496,966
	1-lb. tall		4,569	9,652		14,221
	1/2-lb. oval		43,754		671	44,425
	1/2-lb. square		159		725	884
	1/4-lb. square		2,232		30,540	32,772
	6-oz. tall (100 to case)		80,252	143,724	1,823	225,799
Shad	1-lb. tall	7,475				7,475
Shad roe	1/2-lb. oval	2,883				2,883
Squid	1-lb. tall		2,056			2,056
Tonno	4-lb. (12 to case)					
	1-lb.			903		903
	1-lb.			45		45
	1/2-lb.			14,592	221	14,813
	1/2-lb. (50 to case)					
	1/4-lb.			3,502		3,502
	1/4-lb. (100 to case)			426		426
Tuna, bluefin	1-lb.			86,570	11,562	98,132
	1-lb.			9,929	1,669	11,598
	1/2-lb.			55,411	37,095	92,506
	1/4-lb.			18,535	7,584	26,119
	1/4-lb. (96 to case)			726		726
	1/3-lb. (96 to case)			1,393		1,393
Tuna, flakes	4-lb. (12 to case)			49		49
	1-lb.			1,726	1,086	2,812
	1/2-lb.			4,728	7,282	12,010
	1/4-lb.				788	788
	1/4-lb. (100 to case)					
	1/4-lb. (48 to case)			405		405
Tuna, striped	1-lb.			669		669
	1-lb.			6,664	11,740	18,404
	1/2-lb.			45,924	90,160	136,084
	1/4-lb.			11,473	28,530	40,003
Tuna, unclassified	1-lb.			2,147	4,455	6,602
	1/2-lb.			42,595	49,195	91,790
	1/4-lb.			2,209	7,905	10,114
Tuna, yellowfin	4-lb.			1,081		1,081
	1-lb.			28,682	24,015	52,697
	1/2-lb.			228,395	162,758	391,153
	1/4-lb.			18,023	39,442	57,465
	1/4-lb. (96 to case)			30		30
	1/3-lb. (96 to case)					
	1-lb.			516	301	817
Yellowtail	1-lb.			386	526	912
	1/2-lb.				3,928	3,928
	1/4-lb.					
Totals		14,943	1,646,185	2,175,325	595,045	4,431,498

CANNED, CURED AND MANUFACTURED FISHERY PRODUCTS OF CALIFORNIA FOR THE YEAR 1928

(Compiled by the Division of Fish and Game, Bureau of Commercial Fisheries.)

Salted, Smoked and Dried

Species of fish	Size or quantity	Northern California district, cases	Monterey district, cases	San Pedro district, cases	San Diego district, cases	Total cases
Anchovies	2½-lb. cans (12 to case)		32			32
Anchovies, salted	10-lb. kits	95				95
	25-lb. kits		13			13
	280-lb. bbls.		29			29
Bismarck herrings	10-lb. pails	460				460
Herrings, smoked	Pounds	28,110				28,110
Mackerel, salted	10-lb. kits	3,020				3,020
Mackerel, smoked	Pounds			23,192		23,192
Mixed fish, dried	Pounds	114,459				114,459
Mixed fish, salted	Pounds				258,143	258,143
Rollmops	10 lb. kits	675				675
Sablefish, smoked	Pounds	110,193				110,193
Salacchini	10-lb. cases		325			325
	50-lb. cases		4,155			4,155
	100-lb. cases		50			50
Salmon, mild cured	Tierces	1,874				1,874
Salmon, salted	Pounds	4,380				4,380
Salmon, smoked	Pounds	46,125				46,125
Sardines, salted	25-lb. kits		1,156			1,156
	50-lb. bbls.		78			78
	100-lb. bbls.		43			43
	280-lb. bbls.		201			201
Sardines, smoked	Pounds	20,202				20,202
Sardines, sirloins	8-oz. jars (24 to case)		98			98
Shad, mild cured	Tierces	196				196
Shad, smoked	Pounds	5,000				5,000
Shrimps, dried	Pounds	85,918				85,918
Squid, dried	Pounds		154,600			154,600

Miscellaneous Data

Fish flour	Tons		525			525
Fish meal	Tons	220	12,355	12,923	2,367	27,865
Fish oil	Gallons	11,847	2,444,869	1,268,518	24,068	3,749,302
Estimated value of pack		\$708,415	\$7,712,747	\$12,263,151	\$3,894,543	\$24,578,856
Number of employees		432	1,898	3,090	1,289	6,709
Value of packing plants		\$1,075,420	\$2,369,400	\$4,865,891	\$1,117,175	\$9,427,886
Number of plants		27	15	18	8	68

NOTE.—Sardines packed and fish meal and oil produced at Pittsburg included with Monterey.

Shad—Roe.....					1,994	12,029			
Sheepshead.....								375	3,192
Skates.....									
Skipjack.....									
Socel.....	35,837	13,756							265
Sole.....	18	81,640							11,320
Spittail.....									
Striped Bass.....					5,655				
Suckers.....					30,500				
Swordfish.....					4				
Tomcod.....									
Tuna—Yellowfin.....									
Turbot.....									
Whitebait.....	54,704	3,017							
Whitefish.....									
Yellowtail.....									
Miscellaneous.....	659	390			83				
Total fish.....	423,827	265,527	325,868	27,896	119,620	120,886	9,977,160	309,065	99,052,422
Crustaceans:									
Crabs.....	110,248		11,968						
Shrimps.....			259,079						
Spiny Lobsters.....									
Mollusks:									
Abalones.....									
Clams—Cockle.....			18,237						367,215
Clams—Mixed.....	4,503		2,468						
Clams—Pismo.....									
Clams—Softshell.....									
Cuttlefish.....			24,614						
Oysters—Eastern.....		1,084							
Squid.....									
Totals.....	444,578	266,611	732,320	27,896	119,620	128,099	10,781,676	333,702	99,509,342

All amounts shown in pounds unless otherwise specified. Skipjack and albacore cleaned.

1 677 dozen.

1 82 dozen.

1 454,935 shell oysters.

1 47 dozen.

1 29,550 dozen.

1 930 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1929—Continued
Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	Complied by Division of Fish and Game, Bureau of Commercial Fisheries					Total	Fish from south of the International Boundary brought into California.	Fish from south of the International Boundary brought into San Diego.	Fish from south of the International Boundary brought into San Pedro.
	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial					
Anchovies		17,337				21,897			
Barracuda		287,199	540	3,604		291,343	40,303	444,884	
Bonito		6,274	9	2,493		8,827	3,727	50,333	
Carp						25,448			
Crabfish						59,474			
Cultus Cod			244			349,301			
Eels						10			
Flounders		752	14			146,801			
Grayfish		26,352	84	24,290		273,714	33	33	
Hake						321			
Halibut						454,969	38	22,911	22,949
Hardhead		115,530	16,192	67,236		25,957			
Herring						745,421			
Kingfish		84,955	430	396	346	117,317			
Mackerel		5,230,901	415,475	852,499		6,703,308			
Mackerel—Horse		105,875	50			107,551			5,338
Mullet		1,150	133	748		2,031	13,749	5,037	18,786
Perch		34,288	405	10		110,580			214
Pike						1,393			
Pompano		291				324		958	17,825
Rock Bass		10,908	28,281	6,212		47,710	389	27,319	27,708
Rockfish		521,997	1,587	468,223		1,919,225	1,606	24,762	26,368
Sablefish		861				337,168			
Salmon						5,307			
Sandbars		2,476	26			197,022			
Sardines		155,907,635		2,440,693		261,813,353			
Sculpin		13,790		15,036		31,818			
Sea Bass—Black		9,033	2,812	24,282		34,337		61,270	74,976
Sea Bass—White		118,869	982	1,095		131,122	13,706	21,482	31,821
Shad			10,357			282	10,339		
Shad—Buck						25,245			

Shad—Roe.....	902	92,470	132	7,807	19,618	239	3,366	3,605
Sheepshead.....		9,080	984	3,247	101,311			771,408
Skates.....					149,029			567
Skipjack.....								
Snelt.....	16,899	98,459	874	7,049	203,973	67,172	704,236	
Sole.....	35,211	4,611	1,706	6,695	3,060,861	567		
Spittail.....					90,081			
Striped Bass.....					393			
Suckers.....					170			
Swordfish.....					3,957			
Tomcod.....					254			
Tuna—Yellowfin.....		244	10		937,476		3,184,315	4,121,791
Turbot.....					138			
Whitebait.....					58,107			
Whitefish.....	145	26,361	19	30,474	56,989	4,131	5,673	9,804
Yellowtail.....		884		3,082	3,906	43,323	130,045	173,368
Miscellaneous.....		15,573	586		214,208	1,694	16,084	17,778
Total fish.....	164,271	162,733,175	481,952	3,965,687	277,987,356	1,568,068	4,251,488	5,819,556
Crustaceans:								
Crabs.....					7749,904			
Shrimps.....					348,813			
Spiny Lobsters.....	14,387	32,150	5,483	31,030	83,040		662,357	662,357
Mollusks:								
Abalones.....					369,263			
Clams—Cockle.....	2,048				18,237			
Clams—Mixed.....					6,971			
Clams—Pismo.....	27,852				31,720			
Clams—Softshell.....					34,285			
Cuttlefish.....					6,831			
Oysters—Eastern.....					8100,086			
Squid.....		87,572			172,935			
Totals.....	208,558	162,872,897	487,435	3,996,717	279,909,451	1,568,068	4,913,845	6,481,913

731,246 dozen.
 s 454,935 shell oysters.

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION."

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No. 4

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DISEASES OBSERVED IN GAME BIRD RAISING*

By H. VAN ROEKEL

(With seven photographs by the author)

Game bird raising is becoming more extensive through the increased interests of those who realize and feel that game birds have a commercial and aesthetic value. The operation and management of a game farm is by no means free from discouraging difficulties. Such phases

* Contribution No. 5 from the Game Laboratory, George Williams Hooper Foundation for Medical Research, University of California, San Francisco.

as feeding, selection and mating of breeders, hatching, brooding and rearing of chicks, all require a thorough understanding of what is necessary for game birds. In many respects, poultry management may be applied to game bird raising. However, there are certain fundamental important differences that one should not overlook. Experienced game bird breeders should be consulted on these phases.

In establishing a game farm, one often neglects to consider the sanitary aspects which may later cause disease outbreaks. It is less difficult to prevent diseases than to control or eradicate them. One should attempt to provide for ample space, practice a rotation system of pens, and install equipment which can be readily cleaned and disinfected.

Probably one of the greatest sources of disease is brought in through the employment of domestic hens for hatching and brooding. These birds are often selected at random and they may be infested with parasites or other diseases that are transmissible to game birds. Artificial incubation and brooding will do away with this danger to a large extent. Several breeders have found artificial incubation and brooding quite successful, and they feel that it will become the practical method for raising game birds. It will increase the production at less cost. However, one should guard against sacrificing sanitary and hygienic measures for the sake of a large production. For instance, overcrowding should be avoided and the rotation of pens should be practiced.

During the past year, several diseases were observed in game birds raised in captivity. More trouble was experienced among the young birds than the mature birds.

COCCIDIOSIS

Coccidiosis is an infectious disease caused by a micro-organism which is found in the digestive tract. Investigators have reported this parasite to be present in chickens, geese, ducks, pheasants, grouse, turkeys, quail and other game birds. Different strains of coccidia have been identified among the organisms isolated.

An outbreak among young pheasants was observed at one of the game farms. The disease was first diagnosed in pheasants two and a half weeks old. A mortality of approximately 25 per cent was experienced within eight days. The infected chicks revealed a droopiness, slight diarrhea, loss of appetite and general weakness. These symptoms were observed only a short time prior to death. Autopsy revealed a slight congestion of intestines, contents fluid, and cecal contents dark in color and of dry consistency. Smears from any portion of the intestinal tract would contain coccidia. From the history obtained it was learned that a 35 per cent mortality had occurred in six to eight weeks' old pheasants which had previously occupied the same pens. Later coccidiosis broke out in several pens of fifteen-day-old pheasants. An examination of the birds in general revealed that the infection had disseminated through the entire premises. Since domestic birds were employed for hatching and brooding, it is likely that the infection gained entrance through that source. The hens had been purchased from small poultry flocks in which one often finds disease. Due to lack of space and facilities, isolation methods could not be carried out. After the rearing

season when the pens were vacated, the ground was rested, thoroughly cleaned, plowed and seeded with grain and kale. The pens were rested approximately six months. During the 1929 season the disease has not been observed on this farm. Artificial incubation and brooding will be an aid in combating this disease in game-bird raising.

One duck club reported a heavy loss among young mallard ducks. Laboratory examination revealed a heavy infection with coccidia. An acute inflammation of the eyes existed, together with marked secretion. An accumulation of thin pus was observed in cases where eyelids were glued together.

In one adult quail, coccidiosis was responsible for death. The bird manifested a droopiness, ruffled feathers, drowsiness and general weakness. Death occurred four days after the first symptoms were observed. Post-mortem examination revealed the small intestine and ceca to be distended with gas and food. The liver was slightly congested. Intestinal smear revealed large numbers of coccidia.

BLACKHEAD

This disease was observed in wild turkey poults and one adult quail. It is caused by a parasitic micro-organism which may be found in the liver and intestines. According to certain investigators the cecal worm and cecal worm eggs play a role in the transmission of the causative organism. Birds may pick up the infection from the soil, feed and water which has been contaminated by droppings of infected birds.

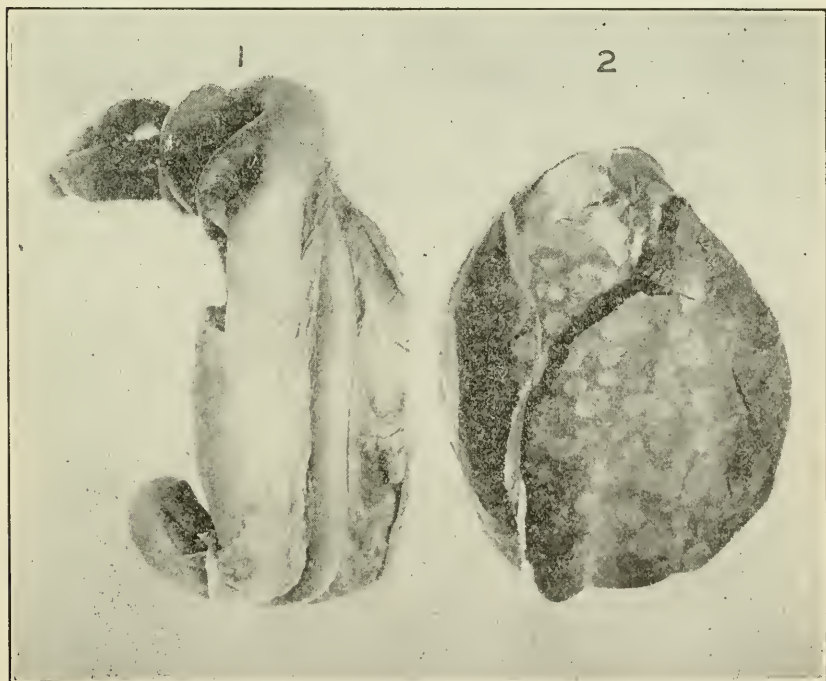


FIG. 90. Blackhead lesions in liver and caeca of wild turkey.

(1) Enlarged caeca. (2) Liver.

Young birds (four weeks to six months old) are most susceptible. The greatest mortality occurs during this age. A mortality of approximately 10 per cent was experienced in the turkeys. The birds were raised with domestic hens. When eight to ten weeks old, the hen was removed from the pen. No open range or rotation system was practiced to control the disease. The lesions were limited to the intestinal tract and liver. Circumscribed yellowish-gray depressed areas were found on the liver. The walls of the ceca or blind pouches were thickened with lining often necrotic and foul smelling. As yet no successful treatment has been established in the control of blackhead. Artificial hatching and brooding, followed by rearing on clean ground with frequent rotations may prove successful.

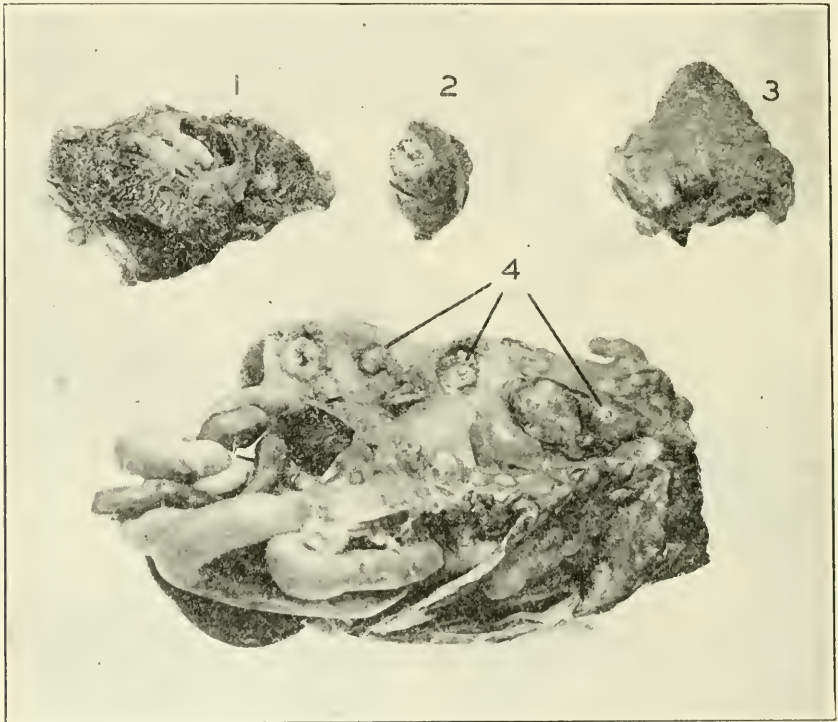


FIG. 91. Internal organs of pintail duck affected with *Aspergilliosis*. (1) Lung. (2) Kidney. (3) Heart. (4) Mold colonies on peritoneum of abdominal organs.

ASPERGILLOSIS *

This disease was observed in wild pintail ducks held in captivity. In this case, it was caused by *Aspergillus fumigatus*, commonly known as mold infection. This variety of mold is common in nature, but not all strains are pathogenic. It may be picked up with the feed, water, soil and even from the air. The mortality in this case was rather heavy. In certain birds, death was due to secondary infection with bacteria.

* The species of *Aspergillus fumigatus* was identified by Charles Thom, mycologist, Bureau of Chemistry and Soils of the United States Department of Agriculture, to whom we feel greatly indebted.

The spores of the mold enter the respiratory tract and may pass to the air sacs. In heavy infection, the pathological changes are extensive involving the lungs, liver, intestines, kidney, peritoneum and sometimes the heart. In most specimens, the lungs were greatly affected. Grayish-

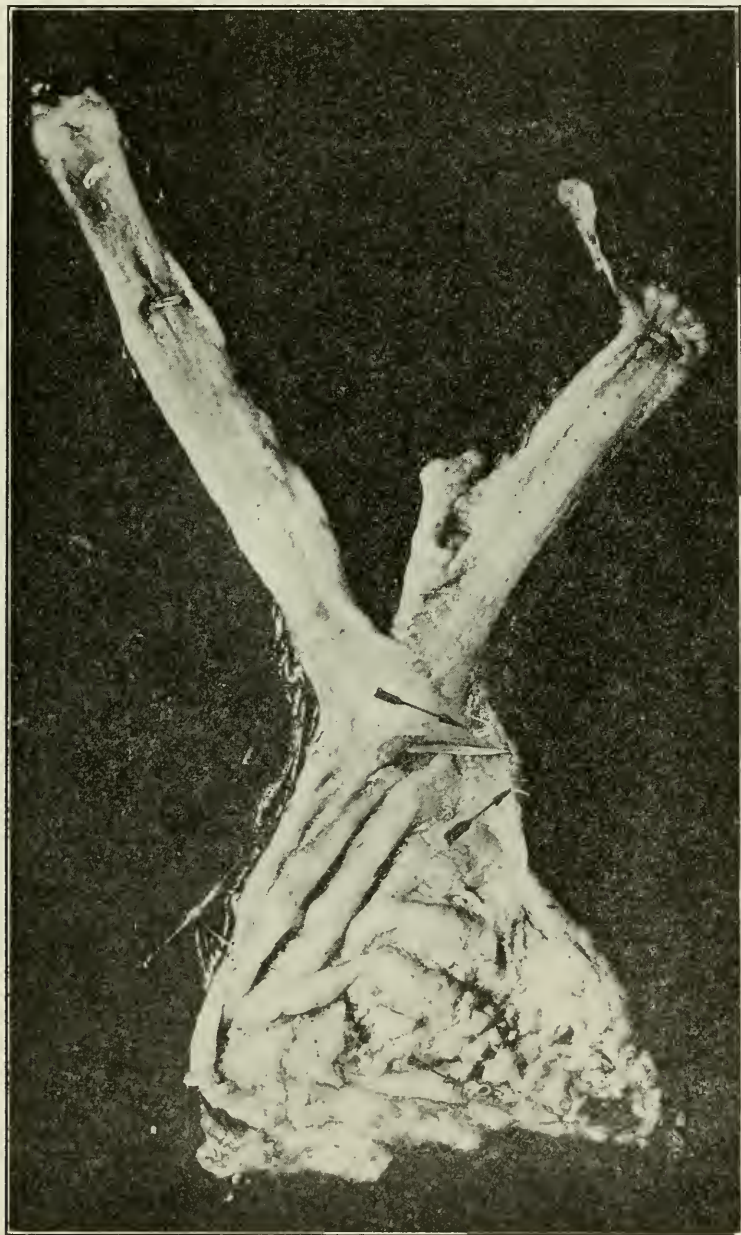


FIG. 92. Crop of California valley quail infested with *Capillaria contortum*. Note thick fibrous lining. Arrows point to worms. Enlarged 1.5 X.

white mold colonies were found on the air-sac walls, in the bronchi, bronchioles and lung tissue. The symptoms manifested were drowsiness, a tendency to sit down, retraction of head and neck, loss of appetite, difficult respiration and general weakness. Death occurred two to three days after first symptoms were observed.

The disease was controlled in a short time after the birds had been moved to a clean pen with uncontaminated feed and water.

Aspergillosis was observed in two pintail ducks in nature while investigating duck sickness last fall. Both specimens were generalized cases.

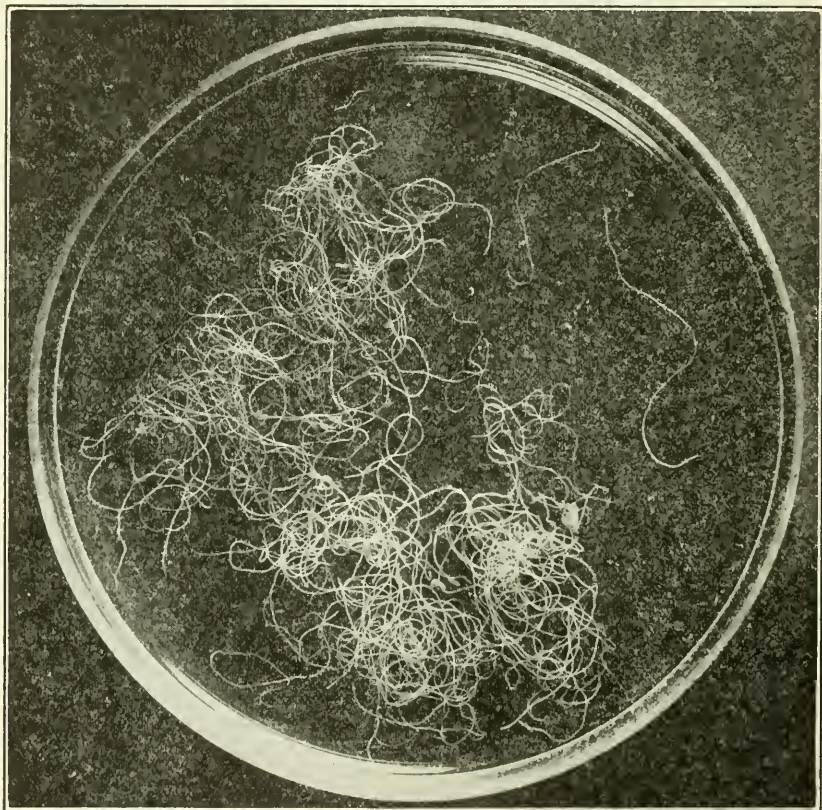


FIG. 93. *Capillaria contortum* removed from the crop lining of California valley quail. Slightly enlarged.

NEMATODE INFESTATION*

A small threadlike worm, *Capillaria contortum*, found interwoven in the lining of the crop may be responsible for mortality in quail. Birds infested with this parasite manifest a general physical disturbance, loss of weight, and general weakness. This parasite when present in large numbers causes great destruction to the mucous lining and underlying structures. A thick, white, rough membrane forms on the crop lining which interferes with the function of the organ. The structure

* This worm was identified by the Zoological Division, Bureau of Animal Industry, United States Department of Agriculture, to whom we wish to extend our thanks.

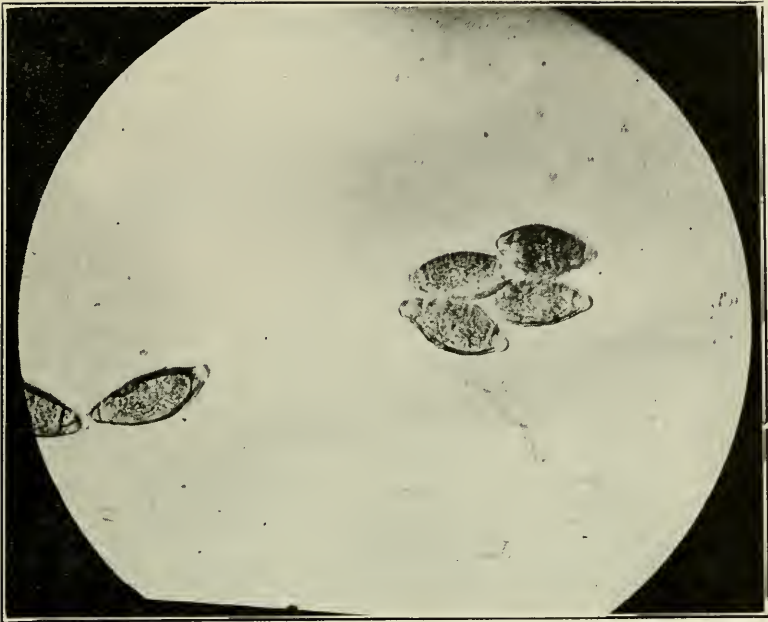


FIG. 95. Eggs of the cropworm (*Capillaria contortum*).
Enlarged 325 X.

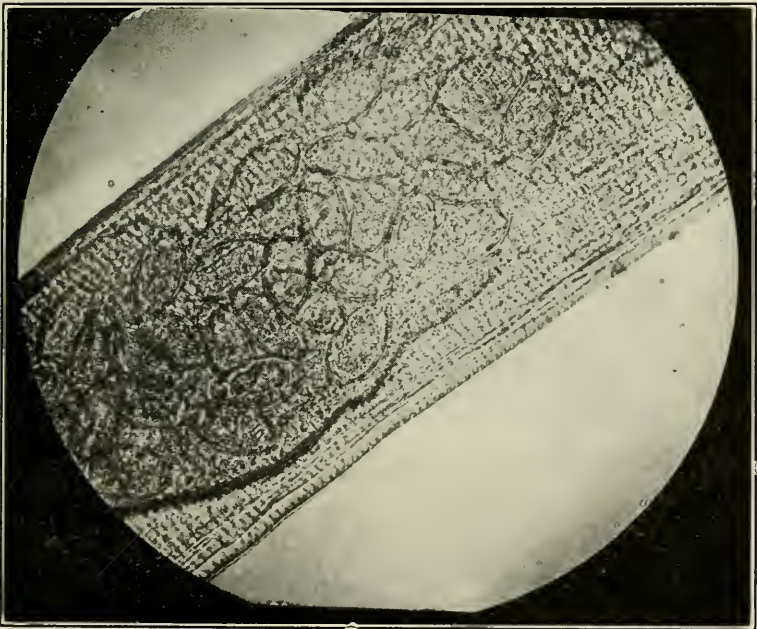


FIG. 94. Portion of cropworm filled with eggs.
Enlarged 325 X.

of the mucous lining proper is greatly altered. The worms can be extracted from the lining with a pair of forceps. In heavily infested cases the mucous membrane is almost solidly interwoven with the small, threadlike worms. Large numbers of double operculated eggs may be found in the intestinal contents. Little is known about the life history of this parasite. Other capillarids have been reported to be of pathological significance in chickens, turkeys and grouse.

Intestinal round worms and cecal worms are quite common in game birds and may lower their resistance and general health.

MISCELLANEOUS

Tuberculosis has been observed in wild turkeys but other birds appear to be less susceptible. One silver pheasant was found infested with air-sac mites. Symptoms were reported as sluggishness, loss of weight and general weakness. No gross lesions were observed and it is doubtful whether the mites were the direct cause of death.

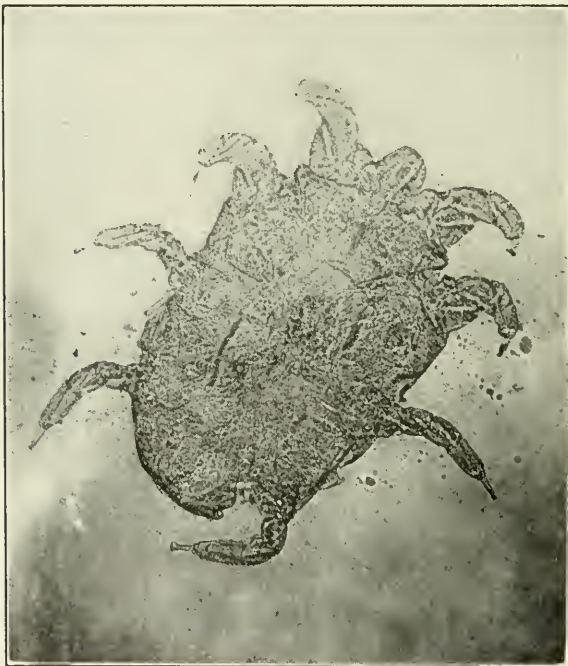


FIG. 96. Air-sac mite (*Cytolcichus nudus*) found in abdominal air-sac of silver pheasant. Ventral view. Enlarged 105 X.

Quail are frequently infested with head lice. Large numbers of eggs may be found attached to head feathers. They may not be the primary cause of disease but may be a predisposing factor.

The prevention, control and treatment of diseases in game birds is similar to that of poultry. In case disease troubles arise specimens should be sent to the laboratory for diagnosis and treatment given according to diagnosis.

PARASITISM IN DEER *

By H. VAN ROEKEL

(With six photographs by the author)

According to past records concerning deer mortalities in California, it is evident that parasitic infestation is of some significance. Numerous

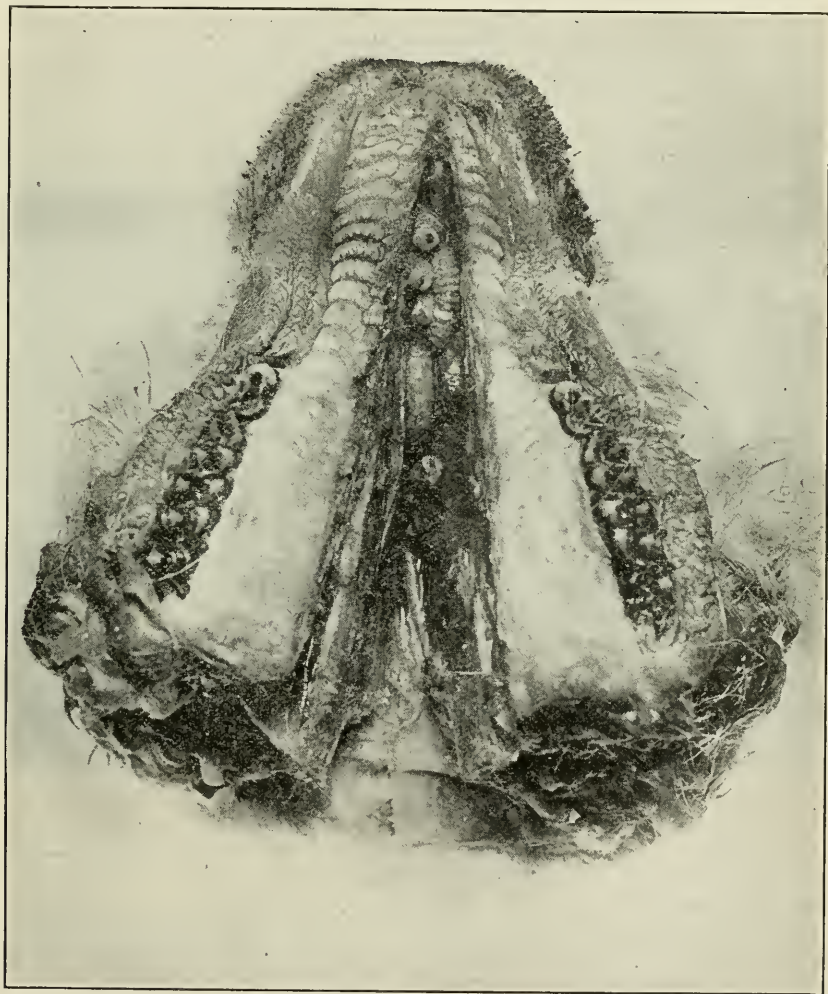


FIG. 97. Deer head cut through the median plane, demonstrating larvae of *Cephynomyia* sp. in the nasal passage.

case reports from certain localities, namely the northern counties, reveal that many deer are lost each year. The losses are generally reported to occur from December to April. Inadequate and poor food

* Contribution No. 6 from the Game Laboratory, George Williams Hooper Foundation for Medical Research, San Francisco, California.

supply accompanied by severe winters are often said to be partly responsible. The estimated mortalities are at variance in many cases.

Clarke¹ in 1912 made an investigation of deer parasites and found that all deer examined were parasitized. Some were more heavily infested than others. Some were infested with a number of species of parasites. The symptoms described were emaciation, diarrhea, general weakness and exhaustion followed by death. Young deer were found to be affected more often than older deer. The trouble was found largely in open country where the deer were feeding. Poor feed and adverse weather conditions were said to be predisposing factors.

During the past year reports similar to those received in former years were sent to this laboratory. From a few localities dead deer were submitted to the laboratory for examination. Our findings revealed that parasitism, poor food and unfavorable weather conditions were



FIG. 98. A subsiding ulcerative keratitis in deer, with a corneal scab and opacity of the cornea.

responsible for the mortalities reported. No thorough investigation was carried out, and the parasites reported in this paper were found in the few deer examined at the laboratory.

Dipterous larvae, *Cephenomyia* sp. were present in all deer examined. The larvae were found attached to the mucous membranes of the sinuses, nasal passages, pharynx, pharyngeal pouches and larynx. In heavy infestation there was considerable irritation manifested by the hyperemic and congested mucous membranes.

One locality reported five deer to have an eye infection which terminated in blindness. Two heads were sent to the laboratory for examination. The specimens were infested with *Cephenomyia* sp. No extensive gross lesions were observed except a subsiding ophthalmia, which had

¹Clarke, F. C. Parasites of the blacktail deer. Thesis. University of California Library. May, 1912.

or would terminate in complete opacity of the cornea. Ulcerative keratitis was seen in one case which appeared to be in a more acute inflammatory stage. Bacteriological examination of the cornea, aqueous and vitreous humors were negative. Three months later, a similar infection was reported in a herd of sheep in the same locality. One specimen was sent to the laboratory for examination with lesions confined to the sinuses, turbinate bones, olfactory portion of brain and the eyes. The maxillary sinus was partially filled with serous fluid and the mucous lining thickened and infiltrated. The frontal sinus and nasal passages contained *Oestrus larvae*. The ethmoid turbinates and olfactory stalks were congested and hemorrhagic. Both eyes had opacity of the cornea.



FIG. 99. Deer lung infested with lung worms, *Dictyolcaulis hadweni*. Bronchioles are filled with worms. (Natural size.)

The history of the specimens examined reveals that the trouble was not infectious in nature. Although no direct conclusive lesions suggest that blindness was the result of nasal larvae infestation, it appears that the infestation may be partly responsible for the total blindness in the animals thus affected. Further investigation will be necessary to confirm this observation. Walker¹ in 1929, reports that sixty deer died at Gunnison, Colorado, during late winter from being infested with *Cephenomyia* sp.

Lung worm infestation is also very common in deer. This parasite, *Dictyolcaulis hadweni*, was present in all cases examined. In heavy infestations it may produce a bronchitis and pneumonia. The bronchioles

¹ Walker, C. R. *Cephenomyia* sp. killing deer. Science, Vol. LXIX, No. 1799, June 21, 1929. p. 646.

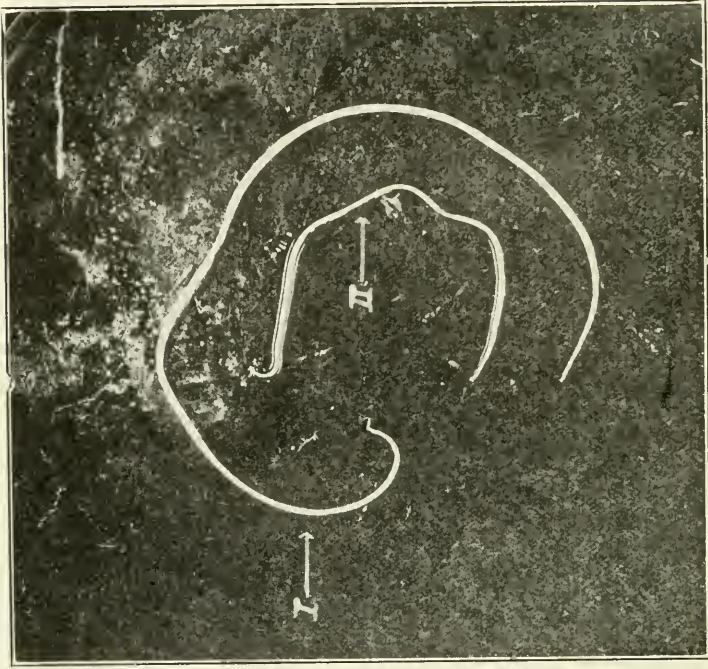


FIG. 101. *Setaria labiato-papillosa* of deer.
(1) Female, (2) Male. Natural size.

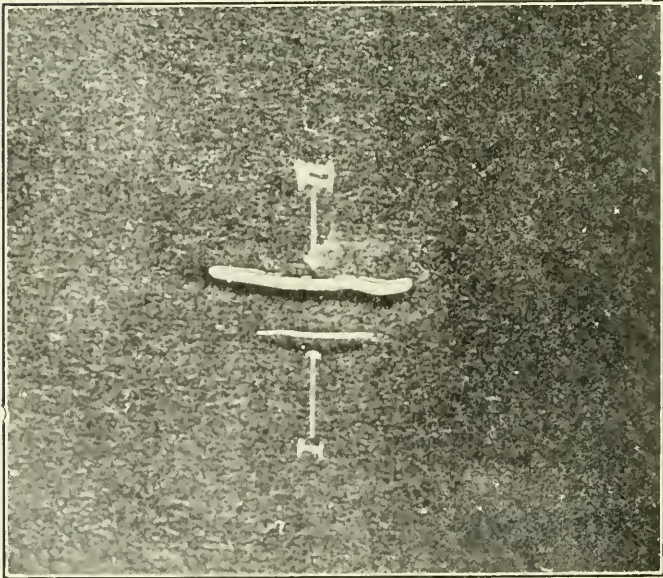


FIG. 100. *Oesophagostomum venulosum* of deer.
(1) Male, (2) Female. Enlarged 1.8 X.

are often occluded with worms, eggs and sanguinous muco-catarrhal exudate. The mechanical obstruction and inflammatory changes which are present may produce signs of atelectasis.

Oesophagostomiasis was also observed in specimens examined. *Oesophagostomum venulosum* may be found in the terminal portion of the small intestine, caecum and colon. This parasite has been reported to infest sheep and goats in Europe. The adult parasite was free in the intestinal tract.

The peritoneal round worm, *Setaria labiato-papillosa* was observed in two cases. It is found lying free in the peritoneal cavity on the intestines, stomach and liver. Little or no visible changes are produced

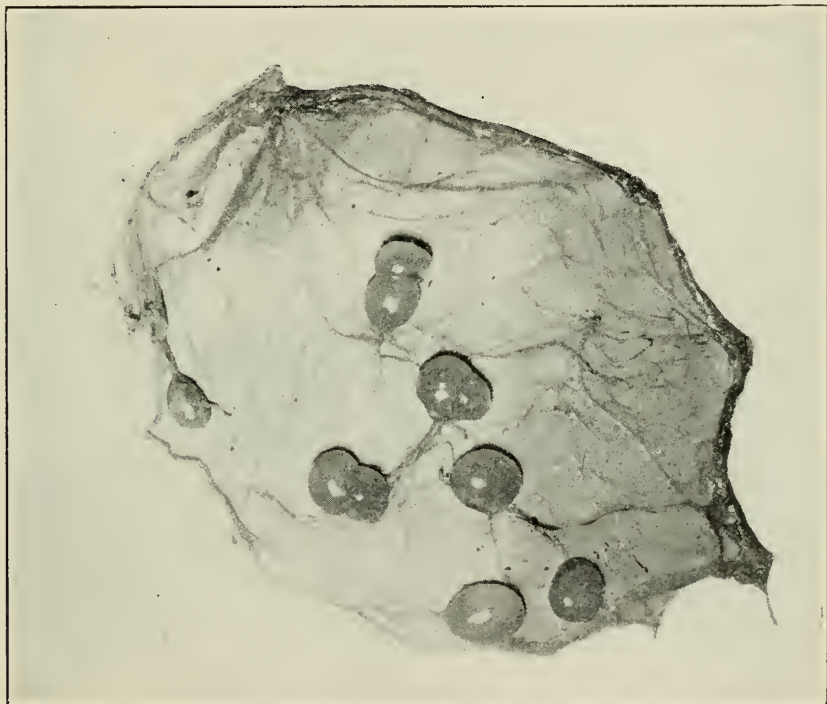


FIG. 102. Encysted cysticerci of bladder worm in the peritoneum of deer. Natural size.

in the abdominal cavity by this parasite. It is not considered very harmful.

Cysticercosis of the liver and peritoneum is often found in deer. The disease is better known to the layman as "bladder-worm" disease. It is a larval stage of a tape-worm, and may be found encysted in a connective tissue capsule filled with fluid. These cysts may be found in the peritoneum and on the liver. In 1911, a large number of deer in Franklin County were reported to have died from this disease.

There are other parasites such as lice, ticks and fleas which may be detrimental and injurious to the general health of deer.

Parasitic infestation in deer no doubt plays a role in the preservation of deer and is of significance from the standpoint of parasitic

eradication in domestic live stock. A thorough systematic investigation among deer losses in this state should be conducted to determine definitely how seriously parasitism affects the deer population and what relation deer parasites have to domestic live stock.

The parasites mentioned in this paper were identified by the zoological division of the United States Department of Agriculture, to whom we feel greatly indebted for their courtesies and services.

AN EXPERIMENT IN RESTOCKING A BASS LAKE WITH TROUT

By A. MUEHLEISEN

There is considerable controversy as to the practicality or economy of caging and raising fingerling trout for a period of time before liberation into the large lakes and streams of our state. It is the opinion of the writer that this system is both sensible and economical,

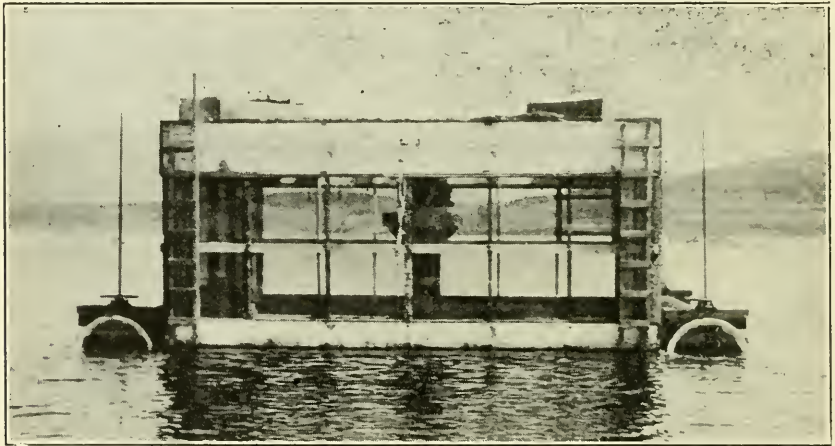


FIG. 103. A floating tank used as a nursery for trout in Otay Lake, San Diego County. Photograph by A. Muehleisen.

and the statement is based upon definite successful experiments conducted in San Diego County waters. The following facts may be of interest to both sportsmen and game officials of the state. Lower Otay Lake, one unit of the impounding system of the city of San Diego, covers an area of about 1300 acres, and has at the present time a capacity of approximately nineteen billion gallons of water. Lower Otay Dam was completed in September, 1919, but the first water impounded by February, 1919, true to custom in San Diego County, was immediately invaded with sunfish.

The sportsmen of San Diego County were, however, anxious to make a trout lake of Otay, so beginning in October of 1919, steelhead and rainbow trout were introduced annually up to and including 1925. By this time a total of 588,000 trout had been planted in the lake.

In October, 1921, Upper Otay, then a flourishing bass lake, overflowed its capacity, carrying down a generous supply of bass into Lower Otay. Following this occurrence, only an occasional trout was caught, and in the spring and summer of 1925 not a single trout was taken out

of Lower Otay, which by this time had become one of the best bass lakes in southern California. Certainly by now it looked as if Lower Otay as a trout lake was a decided failure. It is more than probable that the fingerling trout released through the period of years mentioned became food for the sunfish and bass during the first few days after liberation.

Keenly alive to the loss of these thousands of fry to San Diego sportsmen, the writer, serving as chairman of the Fish Committee of the San Diego County Fish and Game Protective Association, with the cooperation of the local state game wardens, Webb Toms and E. H. Glidden and other local sportsmen named to assist in the project, met with R. C. Wueste, superintendent of the city's impounding system, and other city officials to discuss the situation. As a result of this meeting, in the fall of 1825, a floating tank, twenty feet square and ten feet deep, was constructed. (See figure 103.) Besides this, a cement pond or small reservoir was also built, which was sixty feet long, thirty feet

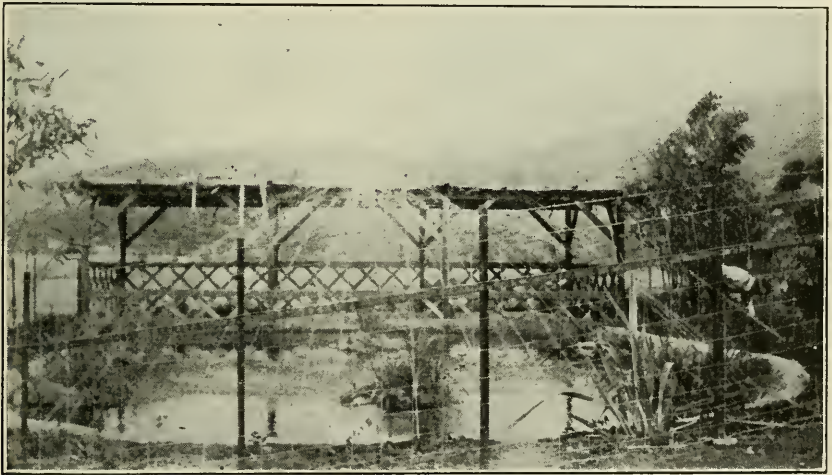


FIG. 104. Holding pond for trout at Otay Lake, San Diego County, California. Photograph by A. Muehleisen.

wide and five feet deep. A pergola was built across one end, vines and shrubs planted, and the pond was supplied with a continuous flow of water in the form of a spray. (See figure 104.)

On October 21, 1925, about 8000 small rainbow and steelhead fry were liberated in the two units. These were fed every day until July 15, 1926. At this time we had for liberation into the lake a conservative estimate of 2200 trout averaging about six inches in length. The loss seemed to average about the same in tank and pond.

This experiment was a new game to all of the committee. Several mistakes were made which again could easily be corrected, but as a whole, certainly this showing could be termed a successful experiment, and it was voted to continue on a larger scale. Another floating tank was therefore constructed, the same size as tank No. 1. On September 25, 1926, 32,000 trout (by actual count) were placed in the two tanks and cement pond, and these were fed daily.

During April, May and June, 1927, the committee liberated 9940 brown trout averaging eight or nine inches in length.

This year, 1929, several limits of brown trout weighing from two and one-half to five pounds have been caught in the lake, and the sportsmen are distinctly enthusiastic. If the same efforts had been put forth in a strictly trout lake, the results would have been augmented many times.

This story demonstrates that if trout are held in a receiving pond or tank a reasonable time before planting, it is possible to have both bass and trout in the same waters. It is an undeniable fact that both the trout and bass are cannibals, and prey on the small trout fry.

If the method outlined in this article is followed when receiving fingerlings to be planted in our lakes and streams, it is the belief of the writer that the supply of mature trout awaiting the sportsmen would be increased ten fold.



FIG. 105. A catch of large trout from Lower Otay Lake, San Diego County, California. Photograph by A. Muehleisen.

MONTEREY SQUID FISHERY

By RALPH F. CLASSIC

The squid fishery is the second largest fishery at Monterey, having taken its place next to the sardine industry since the time when salmon fishing at Monterey began to decline. The squid fishery, as described by W. L. Scofield, in the October, 1924, issue of CALIFORNIA FISH AND GAME, was started many years ago by the Chinese. In recent years, a Chinese merchant by the name of Wing Chong has increased the demand for dried squid in the Oriental markets, until the fishery has reached its present status. Several new firms have in recent years become interested in preparing squid not only for the foreign markets, but for local consumption. Consequently, several thousand cases of squid were canned in one-pound and one-half-pound tall cans by three companies in 1926 and 1927. The bulk of the canned squid is exported to Greece, where it is considered a delicacy. Two small canneries at Monterey, which are owned and operated by Japanese, are canning squid for their people in this country. A large eastern fresh fish company during the last three years froze several hundred tons of the

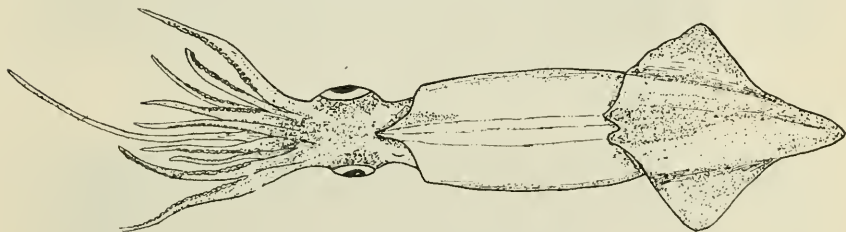


FIG. 106. Squid (*Loligo opalescens*).

fish, which were sold in this country. Fresh squid when well prepared is very tasty, especially when fried in pure olive oil.

The squid fishing at Monterey generally begins in April, a month after the sardine season terminates, and ends during the first part of July. During the past season, the squid fishing has declined as shown in the figures given below:

1926	1927	1928
2,101,052 lbs.	5,208,050 lbs.	935,590 lbs.

Squid are caught with lampara nets in the same manner as sardines. The fishermen make all of their catches at night and close in shore. From fifteen to twenty-five tons for one boat crew is considered a fair night's catch, although as high as forty tons have been caught at one time. Fishermen formerly received \$11 per ton for their squid. This price was increased to \$15 during the present season, due to the scarcity of fish. Five men make up a fishing crew and about fifteen boats operate during the squid season at Monterey.

All of the squid catch at Monterey is unloaded at the Fishermen's Wharf, where the fish are hoisted from the boats into hoppers and drained. Trucks then haul the squid to the fresh fish markets, the canneries or the drying fields.

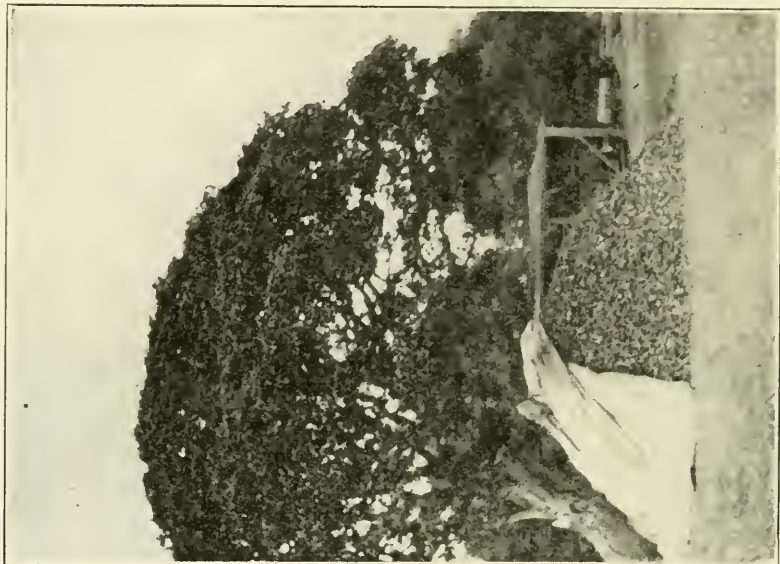


FIG. 108. Squid in large pile before cleaning and packing.



FIG. 107. Squid after drying in fields are raked into piles.
Area shown is about ten acres.

Eighty per cent of the squid received is sun dried for the Oriental markets. All of the drying is done in fields adjacent to Monterey, where ten or more acres of land are used. The process of sun drying is simple and rapid. Squid lose 75 per cent in weight during the drying process which, under ideal weather conditions, takes from five to six days. It is a simple process because the squid are spread and scattered on the ground and turned each day to expose all surfaces



FIG. 109. Squid cleaning machine showing squid going through shaker process.

of the flesh to the sun. After drying, the squid are raked into piles, as shown in figure 107, and carried in baskets to one large pile, as shown in figure 108. They remain in the large pile for nearly a week and undergo what is termed a "sweating" process. The squid, after drying, pass through a cleaning machine as shown in figure 3, before bundling and packing. This machine consists of a shaker, which cleans

the squid of dirt and grass gathered while on the fields. The squid, after cleaning, are pressed into bundles and wrapped in burlap. These packages weigh from 200 to 210 pounds each. The market value of this product is 8 cents per pound at San Francisco. Artificial drying of squid has so far been unsuccessful. The sun dried squid, although poorer in appearance, weigh more than squid dried by artificial heat and bring the same market price.

METHODS USED BY STATES TO COLLECT FISHERIES STATISTICS¹

By GENEVIEVE CORWIN

In order to get an accurate idea of the work done in fisheries statistics by other states, the writer sent a questionnaire to the Gulf, Atlantic, Great Lakes and Pacific states. As a result of this inquiry, it was found that ten of the twenty-one Atlantic and Gulf states collect no statistics whatsoever: Maine, New Hampshire, Rhode Island,² Delaware, North Carolina, South Carolina, Georgia, Alabama, Mississippi and Texas.

The following seventeen states use some sort of blank form for recording information: Massachusetts, Connecticut, New Jersey, Maryland, Virginia, Florida, California, Oregon, Washington, New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Wisconsin and Minnesota.

The U. S. Bureau of Fisheries is largely responsible for the rather uniform and complete records taken by the states bordering the Great Lakes. The fishery there has decreased alarmingly, and in 1927 the bureau started a cooperative plan to increase the efficiency of collecting statistics which might prove helpful in improving the situation. New York, Pennsylvania, Indiana, Illinois and Michigan (that is, all but Minnesota, Wisconsin and Ohio) make provision for recording each day's catch and all are analyzing their statistics to determine the net results of the units of fishing effort. Minnesota collects statistics for each fishing season, and Wisconsin annually. Other states that keep annual records only are Connecticut, New Jersey, Virginia and Florida. Massachusetts and Louisiana are the only states collecting statistics each month, while Washington and Ohio collect at four-month intervals. Oregon and California keep daily records of catch.

California, then, is numbered among those states that collect fisheries statistics in a thorough manner, getting the information as fast as the fish are brought in, with all the necessary items in connection—amount, kind and price of the fish, with the name of the fisherman and dealer and locality where it is caught. The basis for the study of units of gear is now being worked out in tracing the ownership of boats and gear through the registration numbers. At present the work has gone only far enough to give an idea of what each boat brings in, but further studies are to be made to determine the results of each unit of gear. California is one of the few states that publish an annual report of the yield of the commercial fisheries.

¹ Contribution No. 82 from the California State Fisheries Laboratory, May, 1929.

² A bill for collecting lobster statistics is now pending.

COMPARISON OF ENGLISH AND UNITED STATES FISHING PORTS, 1926-1927 ¹

By GENEVIEVE CORWIN

People are rather generally interested in the relative importance of the fishing ports of California as compared to other ports of the world. The accompanying table is intended to convey the essential points and to give definite information on a subject that calls forth a deal of speculation from some quarters.

The six ports included in the comparison were chosen because of availability of statistics, and because the information was given in a comparable form. The figures for Grimsby and Hull, the two most important English ports, were obtained from the Monthly Return of Sea Fisheries, England and Wales, published by the Ministry of Agriculture and Fisheries. The Statistical Bulletins of the U. S. Bureau of Fisheries were consulted to determine the most important ports of the United States, outside of California, while the information for this state was obtained from the records of the California Division of Fish and Game.

Seattle (producing approximately 16,000,000 pounds a year) might be thought a possible rival, but is far below any of the six mentioned. Gloucester, Massachusetts, is far behind also. Some other European ports may be important enough for consideration, but for the present purpose they are not considered on account of lack of statistical information.

1926

<i>Ports</i>	<i>Pounds</i>	<i>Value</i>
Grimsby, England-----	339,000,000	\$18,800,000
Hull, England-----	263,700,000	10,300,000
Portland, Maine-----	238,000,000	9,000,000
Boston, Massachusetts-----	167,300,000	7,000,000
Monterey, California-----	163,700,000	1,300,000
Los Angeles, California-----	157,700,000	3,000,000

1927

<i>Ports</i>	<i>Pounds</i>	<i>Value</i>
Grimsby, England-----	356,100,000	² \$18,500,000
Hull, England-----	292,100,000	10,300,000
Portland, Maine-----	263,800,000	9,400,000
Los Angeles, California-----	200,400,000	3,800,000
Boston, Massachusetts-----	195,000,000	7,400,000
Monterey, California-----	186,000,000	1,400,000

Grimsby, Hull, and Portland, Maine, in the order named, are the largest fishing ports for both 1926 and 1927, from the point of view of both pounds and value. Boston maintains fourth place for both years in value, but Los Angeles in 1927 comes up from sixth to fourth in pounds. Monterey keeps sixth place both years in value but in number of pounds is lowered from fifth to sixth in 1927.

¹ Contribution No. 83 from the California State Fisheries Laboratory, May, 1929.

² The decrease may be due to lower price.

LEGISLATION PLUS EDUCATION EQUALS CONSERVATION

By WALTER R. WELCH

During the early days when I was actively afield with rod, gun and dog, I always considered October as being the sportsman's month, for in my opinion no other month of the year presents to the sportsman so many attractive features, nor offers so many advantages as does October.

"It is the brilliant autumn time, the most brilliant time of all,
When the gorgeous woods are gleaming and the leaves begin to fall,
When the pippin leaves the bough and the sumac fruit is red,
And the quail are calling loud from the pastures where they fed,
When the crops have all been housed, and the farmer's work is done,
And the woodlands are inviting the sportsman with his gun."

In brown October the ground is strewn with painted leaves, the migrant ducks, geese and shorebirds are working gradually southward, and the squirrels and chipmunks are busy storing nuts and acorns against the winter days to come.

The dense foliage of the forest shows traces of frost and the game cover has thinned sufficiently to afford the sportsman more than a mere glimpse of his scurrying quarry. Game birds and animals, as well as game fish native to the State of California, are in the finest possible condition. Quail, ducks, geese and other game birds are strong of wing and fit marks for the sportsman's aim. Deer, bear, rabbits and squirrels are fat and sleek, and trout and other game fish are in a fit condition to test the skill and tackle of the angler.

In short during the month of October all objects of the sportsman's quest are at their best. The weather is glorious, the days short, fresh and bracing, the nights long and frosty and the sky clear and blue as steel.

May success attend those who go afield with rod and gun during October, whether their chosen stamping ground be in the deep forest, along the bank of some rushing river or stream or lake on sodden marsh, or over chaparral covered hills!

May their sight be clear and true, and the rifle show no tremor, may the twin barrels leap to shoulder and the feathers fly from, and not with, the birds, and may their skill, and tackle when pitted against battling trout, bass, or salmon, meet with success!

In view of the strenuous efforts that are at this time being made to protect and conserve, if not increase, the pitiful remnant that remains of the once bountiful supply of fish, game and wild life that inhabited the state, I am wondering if a brief review of the history of fish and game protection in California would not be of interest to the present day sportsman.

Although the word "abundance" alone describes the supply of fish and game to be found in California by the early day pioneers, as early as 1850 it was realized that certain species of game were in need of protection. Therefore, the state legislature in 1852 enacted a law protecting elk, antelope, deer, quail, mallard and wood ducks for six months during each year.

In 1872 by an act of the state legislature, a State Board of Fish Commissioners was created, and in 1878 the jurisdiction of this commission was extended to include game.

Between 1872 and 1882 laws were enacted prohibiting the trapping of quail, establishing a closed season for trout above tide water and affording protection to salmon and some of the other species recognized as being game fish, birds and mammals.

In 1883 elk, antelope, mountain sheep, does and fawns were afforded perpetual protection, and in 1895 the transportation of game out of the state and the killing and sale of certain nongame birds for millinery purposes was prohibited.

The collection and sale of wild birds' eggs was prohibited in 1896, and in 1901 the sale of deer meat and hides, quail and certain shore birds was prohibited and a daily and season bag limit adopted as follows, viz: duck and doves, fifty per day; quail and Wilson snipe, twenty-five per day, and three male deer per season. Night shooting was also prohibited.

In 1905 a daily creel limit of fifty was placed on trout; swan and all shore birds (*Limicolar*) were protected, the sale of doves and all shore birds prohibited and the bag limit of doves reduced to twenty-five.

A hunting license system was adopted in 1907, and the daily bag limit of ducks reduced from fifty to thirty-five. State game refuges were established in 1909, the sale of trout and black bass prohibited and the daily bag limit of ducks and black sea brant reduced to twenty-five in 1909.

In 1911 the state was divided into six fish and game districts, dealers in wild game were required to secure a license and keep a record of all game received by them and in addition to the daily, a weekly bag limit of game birds was adopted. An angling license system was adopted in 1913.

The killing of spike bucks was prohibited in 1915, a daily and weekly bag limit of honker geese and black sea brant adopted, the daily bag limit of dove, quail and snipe reduced to fifteen, and wild pigeons afforded protection.

In 1917 the sale of wild ducks and geese was prohibited and in 1927 a duplicate deer tag system was adopted, the hunting and angling license fee increased from \$1 to \$2 per year, and the Division of Fish and Game, Department of Natural Resources, created.

In 1895 and 1896, from an examination of the books of the game dealers in the cities of San Francisco and Los Angeles, made by the Fish Commission, it was ascertained that during these two years there were sold in the open markets of these two cities, 177,366 quail; 254,227 wild ducks, and 62,958 wild geese and shorebirds.

These figures do not include quail, ducks, geese and shorebirds sold in other cities and towns within the state, nor the birds killed and consumed by hunters, their families and friends.

The 177,366 quail sold for \$15,160.08, or at an average price of less than 10 cents apiece, and the 337,185 ducks, geese and shorebirds sold for \$62,363.01, or an average price of less than 12 cents apiece.

When it is considered and realized how valuable wild life is at this time, and how it is now being commercialized in the interest of all of the people, and not in the interest of any privileged few, these figures

should certainly furnish sportsmen of the present generation with food for thought.

In 1900, realizing that the supply of fish and game was rapidly decreasing, and recognizing that some effort should be made towards the enactment by the legislature of laws providing for the better protection of fish and game, at the suggestion of Governor Henry T. Gage, a statewide convention of sportsmen was held.

This convention of the sportsmen of the state was called by the then state fish commission and was held at the rooms of the California Jockey Club, on Kearny street, San Francisco, on the twenty-fourth day of May, 1900.

The delegates who attended this convention were composed of two men from each county within the state, selected by the board of supervisors within their respective counties, and a great number of delegates at large selected by the fish commissioners.

The purpose of this convention was to discuss, consider, draft, and recommend for passage at the session of the legislature to be held in 1901, such laws as were considered to be necessary for the proper protection of fish and game, such as bag and creel limits, nonsale and laws for the protection of fish and game during the recognized breeding and spawning seasons.

A large number of delegates representing many sections of the state attended this convention. Judge Hughes, of Sacramento, was selected to act as chairman of the convention, and Andy Ferguson, of Fresno, was selected to act as secretary.

The first matter to be given consideration by the delegates was an open season and a bag limit for ducks. The first recommendation along these lines was that the open season be from October 1 to February 15, with a daily bag limit of 150 ducks. The convention held a three-day session, and after much discussion and various recommendations in regard to the daily bag limit of ducks, it was finally agreed, but not finally settled, that the daily bag limit of ducks should not exceed fifty, but a motion to recommend the passage of a law to that effect failed of adoption.

A motion to prohibit the sale of wild ducks failed to receive a second, and a motion that the sale of quail be prohibited was supported by only five of the delegates who attended the convention and was lost by a large majority.

At the close of the convention, which had been in session for three days, a few sportsmen assembled around a table in the convention hall and hurriedly formed an association known as "The California State Fish and Game Protective Association" and elected Harry T. Payne, president, and G. H. T. Jackson, secretary.

During the next succeeding five years, this association became a statewide organization with not less than 100 affiliated county associations and having a membership consisting of many thousands of sportsmen located in all parts of the state.

At that time, viz, in 1900, the state appropriated the sum of \$3,750 per annum to be used for game protection. In 1903, this sum was raised to \$7,500 per annum, which was all the money available for game protection in California until the adoption of the Hunting License Act in 1907.

I believe it can be readily realized how little could be accomplished with the sum of only \$3,750 available for use in the protection of game in a state as large as California, a sum far less than is now expended every year by many duck and other clubs within the state.

Upon the convening of the state legislature in 1901, a conference was held by Governor Gage, H. W. Keller, president of the State Fish Commission, and H. T. Payne, president of the California State Fish and Game Protective Association. At this conference it was agreed that the following bills be introduced and their passage by the legislature recommended, viz: That the open season for quail, partridge, grouse, sage hens, wild ducks, rail, curlew, ibis and plover be from October 1 to February 15; that the open season for male deer be from August 1 to October 1; that the open season for tree squirrels be from August 1 to February 1, and that the open season for trout above tide water be from April 1 to November 1; that the daily bag limit of quail, partridge, snipe, curlew and ibis be twenty-five; that the daily bag limit of wild ducks and doves be fifty; that the daily bag limit of rail be twenty, and that the bag limit of male deer be three per season, and that no hunting would be permitted a half hour after sunset and a half hour before sunrise.

It was also determined: That the sale of quail, partridge, sage hens, grouse, ibis, plover, deer meat and deer hides be prohibited, and that the sale of trout of less than one-half pound in weight be prohibited; that the open season for black bass be from July 1 to January 1, and that black bass be taken on hook and line only; that the closed season for striped bass be from May 31 to July 1, and the sale of striped bass of less than one pound in weight be prohibited, and that no striped bass be taken in nets of less than seven and one-half inch mesh.

These bills being what might be termed "administrative measures," having the support of the governor, were passed by the legislature and became effective early in 1901.

The passage of these laws is considered the first real constructive move to have been made by the sportsmen of California for the protection and conservation of fish and game in this state.

It will thus be seen that prior to 1901, with the exception of laws that provided for short closed seasons, there were no laws for the protection and conservation of fish and game in California.

Prior to 1892, with the exception of elk and antelope, there was no very noticeable decrease in the supply of fish and game and very little real effort was made by the sportsmen of the state for its protection.

Following the enactment of these laws, their enforcement was defied by market hunters, commercial fishermen and others and soon after the opening of the duck and quail shooting season in 1901, it was found that hunters were endeavoring to evade the bag limit and nonsale law by shipping ducks, quail and other game in concealed packages such as butter boxes and kegs, suit cases, trunks, rolls of blankets, green cow hides, coal oil cans, boxed demijohns, egg cases, etc.

In the efforts made by the fish and game dealers of San Francisco to restrain the fish commissioners and their deputies from performing their duty in enforcing the fish and game laws, damage suits and suits for injunction were undertaken against the commissioners, with the

result that it was necessary to take many cases into the superior and supreme courts in order to establish the constitutionality of the laws.

Prominent among these cases are those entitled *Duprat vs. Board of Fish Commissioners et al.*; *Ex parte S. Kenneke*, *Ex parte Knapp*, and *Ex parte Maier*, with the result that the constitutionality of the fish and game laws were upheld, that the courts declared that the "wild game of a state belongs to the people, in their collective sovereign capacity and is not subject to private ownership except in so far as the people may elect to make it so, and that they may, if they see fit, absolutely prohibit the killing of it, or traffic or commerce in it. That its taking, possession, and the disposition thereof is subject to legislative enactment," and that the fish commissioners and their deputies could not be restrained in the performance of their duty in the enforcement of the laws.

With the \$7,500 per annum appropriated by the state for game protection, coupled with the money received from fines imposed upon fish and game law violators and the sale of commercial fishing licenses, the fish commissioners to whom were entrusted the enforcement of the laws were not able to maintain in the field for the enforcement of the fish and game laws to exceed ten regular salaried deputies and a few volunteer deputies.

The organization of the California State Fish and Game Protective Association in 1900 was the beginning of the state-wide organization of sportsmen in California. This association was composed of individual membership, and the affiliation of county associations and clubs located in various sections of the state. The association was active until about 1912, and to it is due the credit for the enactment of laws prohibiting the sale of deer meat, deer hides, quail and other game, trout and black bass, the adoption of bag and creel limits, hunting and angling licenses and other important fish and game laws. In 1912, the association disorganized and was reorganized as the "California State Fish, Game and Forest Protective League." For several years following its organization, the league was active, but about 1916 it began to decline and about 1924, went out of existence.

In 1912, an organization known as "The Great State Fish and Game Protective Association" was organized. This organization went out of existence within two years and was succeeded about 1923 by an organization known as "The California Conservation League." This organization was also short-lived.

In February, 1925, an organization known as "The Associated Sportsmen of California" was founded. This organization is still active, and at the present time is composed of individual membership, and the affiliation of about 125 county and local fish and game protective associations and clubs representing many thousands of sportsmen located in all sections of the state. During its existence, this organization has accomplished much for the protection and conservation of the fish, game and wild life of the state, and at the present time bids fair to continue actively in the work for many years to come.

While it is conceded that fish and game protective associations and clubs, both state-wide and local, working in harmony and cooperation with the state fish and game commissioners, *can and do* accomplish much good for the protection and conservation of fish, game and wild

life of the state it appears that without harmonious cooperation and the direction and supervision of interested and active sportsmen as their officials the average life of such organizations seldom exceeds three years.

For some years past it has been generally admitted that the days of fish and game abundance in this country have gone by—*never to return*. I am impressed by that fact. Consequently it is necessary for sportsmen all over this state to become interested in the work now being done for the protection of fish and game, and that they take an active part in the efforts being made to restock the depleted game fields and public waters.

If it is worth while to protect and conserve wild life of the state, and it certainly is, then it is the duty of every sportsman who loves the great out-of-doors to take up his share of the burden and assist those now on the "firing line with the army of defense."

The essentials necessary to accomplish the problem successfully are the enactment of sane, simple and scientific fish and game laws. In substance, these laws should be few as possible, brief in language, simple in terms, supported by scientific facts regarding the habits and breeding seasons of the various species of fish and game, and devoted to fundamental regulations respecting open and closed seasons, bag and creel limits, possession, nonsale, etc.

The education of the people as to the value of a supply of fish and game and the necessity for fish and game laws is undeniable. Those who are capable of being educated as to the importance of protecting fish and game should be trained along these lines and the others should be impressed by the stronger process of strict law enforcement, and the imposition of severe penalties for violating the laws.

The enforcement of the fish and game laws is both onerous and disagreeable, particularly in communities where public sentiment is adverse to such laws, nevertheless it is a duty that someone must undertake unless we are ready to concede that our whole theory and system of wild life protection is a failure.

Perverted public sentiment in regard to the fish and game laws can be changed by education and lined up on the side of the laws and their strict enforcement. However, education must be the handmaid of law enforcement and not assumed to precede the latter, for in that event it may arrive too late and only when the supply of wild life has been exterminated.

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DECEMBER 15, 1929

"Research in game problems is a comparatively new idea. Scientific investigation often involves much time and expense. Results are not always tangible or apparent to the layman. It is never spectacular or thrilling. It involves patience and skill. But it discloses facts."

WESTERN COMMISSIONERS MEET IN SAN FRANCISCO

The ninth annual meeting of the Western Association of State Fish and Game Commissioners was held at the Palace Hotel, San Francisco, August 23 and 24. President I. Zellerbach presided at the opening. The address of welcome was given by Fred G. Stevenot, director, Department of Natural Resources, State of California. A number of splendid papers were read. David H. Madsen of Utah discussed game management and the new Bear River Migratory Bird Refuge. E. L. Perry, State Game and Fish Warden of New Mexico, emphasized the importance of furnishing proper environment if a supply of game is to be maintained. There were two papers on the economic value of birds and several papers dealing with fish propagation and stream pollution. Paul A. Shaw of the California Division of Fish and Game presented a summary of the work accomplished in duck disease investigations. Forest Service cooperation was discussed by W. J. Nelson, Acting District Forester, and Biological Survey cooperation by George Tonkin, United States game protector.

On the last afternoon a resolution favoring the fifteen duck limit was passed. This led to considerable discussion pro and con.

E. L. Perry of New Mexico was elected president, Bruce Nowlin of Wyoming vice president, and Clinton W. Rowley secretary and treasurer.

Among the resolutions passed were the following:

WHEREAS, The ninth annual convention of the Western Association of Fish and Game Commissioners, assembled in session at the Palace Hotel, San Francisco, have been entertained and discussion has brought out several important principals concerning conservation in western states; therefore be it

Resolved, That the most fundamental need looking toward better game management is more knowledge of life history and habits of game species and that every encouragement should be given to scientific research by various game departments leading to accurate statistics and useful data which will aid in the solution of the many important problems which confront the western states; and be it

Resolved, That duck sickness is a serious menace to wild fowl in western states and that additional investigations prosecuted and special endeavor should be made by the states concerned to prevent further outbreaks; and be it

Resolved, That in view of the need for additional feeding and breeding grounds for wild fowl that a committee be appointed to investigate and report on the feasibility of reflooding Lower Klamath Lake.

The sessions closed with a splendid banquet held in the French Parlor of the Palace Hotel. The entertainment was furnished by well-known radio artists.

CIVIL SERVICE EXAMINATION GIVEN WARDENS

Ever since 1913 the deputies of the Division of Fish and Game have been under civil service. Periodically examinations are given, and this past summer more than 300 men took the written examination. Of this number, 129 passed it. About 70 men who passed both the written and the oral test are now on the certified list.

A particularly fine group of men presented themselves for the examination. The oral tests were held in a number of different parts of the state. Usually a National Forest Service official, a Civil Service official and a Division of Fish and Game official comprised the examining board. By depending upon this method of selection, the general tone of the patrol service has been raised and political appointments avoided.

RESEARCH PROGRAM DELAYED

Again it has been shown that the state does not pay sufficient salary to hold scientific investigators. During the summer two of the ablest men conducting research for the Division of Fish and Game have been tempted to eastern positions by higher salaries. Dr. Henry Van Roekel, who for nearly two years has acted as pathologist in connection with

investigations of disease of game birds and animals, has resigned to accept a splendid position as head of the veterinary laboratory of the Massachusetts Agricultural College at Amherst, Mass. Dr. E. C. O'Roke, who discovered and explained a strange malady which attacks quail, resigned on September 1 to accept a position as assistant professor of zoology in the College of Forestry and Conservation of the University of Michigan, where he will continue investigations similar to those he prosecuted here.

In times past the better qualified men at the State Fisheries Laboratory have been tempted to eastern positions by offers of higher salaries; this time an important research program relative to disease of game birds and animals will have to be delayed until men can be found to fill the places of these investigators.

DUCK SICKNESS

During the past winter a number of experiments have been carried on to determine the toxicity of samples of alkali secured where duck sickness has appeared in years past. These experiments at Hooper Foundation for Medical Research have indicated that relatively small concentrations may cause death.

The major work this past winter has consisted of a series of chemical analyses of soil samples collected in places free from disease and in those places where disease is prevalent. Samples have been secured at regular intervals and the result should show variation in concentration from month to month as well as indicate the main differences between the concentrations at danger points and those places where disease is not prevalent.

With the outbreak of the disease at the Bear River marshes at Great Salt Lake in August, Paul A. Shaw was sent to the area to continue investigations in the field.

An earnest endeavor is being made to solve this important problem related to the conservation of waterfowl.

SUMMER RESORT EDUCATIONAL PROGRAM

As in past summers, the Bureau of Education and Research has made an endeavor to reach summer vacationists with an educational program. The chief of the bureau spent two months in Yosemite helping with the nature guide program and in directing and training a group of students attending the Yosemite School of Field Natural History.

As formerly, the number of students in the school was limited to twenty, and this

year ten men and ten women received training. These students will go back to teaching and other vocations and in many different sections will pass on conservation ideas to others. This seems to be a fundamental means of reaching numerous people throughout the state.

Yosemite National Park rangers were given special training this past summer and aided in the educational work. Camp fires were held in two of the public auto camps, and here a ranger-naturalist talked each night. In addition, outpost educational work was established at Mariposa Grove of Big Trees, Glacier Point and Tuolumne Meadows. As a result of these developments a larger number of visitors was reached than ever before.

Two representatives of the division conducted a splendid educational program in California State Redwood Park. An innovation this year was the addition of illustrative materials in the form of lantern slides and motion pictures, used in connection with lectures at the camp fire.

During the month of July more than 14,000 persons came in contact with the service by accompanying a party afield, or listening to an evening lecture. The grand total for the month of August amounted to 12,617.

By making contacts with summer vacationists the citizens of the state are led in an easy and natural way to understand and take an interest in natural resources.

PHEASANTS LIBERATED ON SANTA CATALINA ISLANDS

William Wrigley has been financing a sizeable game farm on Santa Catalina Island. Though largely a show place, a number of pheasants reared on the farm have been liberated recently near Avalon in an attempt to stock the island with this game bird. Special publicity has been given this liberation in order that citizens may give the birds proper protection until they have become established.

ENVIRONMENTAL CONTROLS

Every game crop is the resultant of two forces: (1) the breeding habits of the species, and (2) the environment in which it lives.

Breeding habits are constant. Environment is the variable.

If the environment is favorable there will be a crop; if unfavorable there is no crop, and even the capital stock may decline.

Environment is the summation of many factors—food, cover, predators, hunting, disease, etc.

Bird lovers, by and large, have made the mistake of seeing only one of them—hunting.

Sportsmen, by and large, have made the mistake of seeing none of them. They insist on turning out stock without regard to whether the environment is fit to receive it. If the environment were improved the constant planting of stock would be unnecessary. It is often cheaper to improve environment than to constantly plant game.

Foresters are taught from the outset the futility of planting in unfavorable environments. They are schooled from the outset to the broad idea of environmental controls. Foresters can render a great service to game conservation by helping to work out a technique of environmental controls for game.

No state stands in greater need of such work than Iowa. The prairie chicken has been crowded out of the state, probably by reason of the elimination of residual patches of prairie cover. The quail is being slowly but surely reduced by the grazing out of woodlots, the revegetation of creek banks and drainage channels, and the elimination of fence-rows. Waterfowl are shrinking before the advance of drainage. The only basic remedy is environmental control.

Most thinking conservationists realize this. What they do not realize is that favorable game environments in the past have been accidental, whereas from now on they must be built by human hands and brains, for the deliberate purpose of raising a game crop.

Here enters the mission of game research. It takes more knowledge to put together than to take apart. Just how do we build a quail range? How much cover, and what kind, must be put into this gully to make it produce a covey every year? How can that cover be arranged to give minimum interference to the adjacent crop and maximum erosion control to the adjacent ploughland? What cover plants produce food as well as cover for the quail? What kinds and numbers of predatory species can be allowed to inhabit it? What supplementary winter feeding is necessary? When? What mechanical arrangement will prevent winter feed from being covered by snow or sleet, or eaten by less valuable species, when worst needed by the quail?

The exact answers to such questions must be worked out for each species and each region, just as analogous questions are being worked out for each species and region in forestry. Some think a guess is good enough, but foresters know from experience in their own field that technique based on guesses is expensive in

the long run. There is a best way. Foresters can help find it.

Agriculturists as well as foresters can help find it. The technique of environmental controls for game production must be dovetailed to both farming and forestry at every point, else it will never be practiced. Game is essentially a by-product of farming and forestry. If the system of raising the by-product interferes with the main crop, the by-product will not be produced. If it does not interfere, but actually benefits the main crop, economic as well as altruistic forces will eventually bring about its adoption. Most game crops can be made to benefit the main crop. "Environmental Controls—The Forester's Contribution to Game Conservation," by Aldo Leopold. *Du Pont Promotion News Bulletin*, No. 35, May 24, 1929.

A NATION BEGINS BUT ONCE

"In a hundred and fifty years a virile, restless, acquisitive people have swept our country from the Atlantic to the Pacific coast. From Jamestown and Plymouth they have pushed the frontier before them until it has disappeared. The wild turkey vanished before the domestic hen. Sheep replaced deer. The buffalo gave way to better beef breeds; grains and fruits have been substituted for nuts and wild berries. The Conestoga wagon, the canal, the steam railway, the automobile, and the airplane have followed each other in rapid procession—all within the memory of father and son. Towns and cities have been built, many of them among the world's largest, and more than half our people live in them. We win wars for other nations and lend them money with which to mend their wrecked fortunes.

"We are admittedly the richest, most powerful nation in the world and we took this power of wealth out of the ground. Now, we must invoice our resources and determine how we should proceed from here. For a nation begins but once." Hubert Work, Secretary of the Interior, "Foreword" in "Our Federal Lands" by Robert Sterling Yard, 1928.

ELECTRIC BROODERS USED AT GAME FARM

Efforts to improve production at the Yountville Game Farm have resulted in the use of an electric brooding system. Many difficulties were encountered last season with domestic hens, chief of which was the transmission of disease to young birds. Hence, it was decided, if possible, to eliminate the objectionable hen and to rear Chinese ring-necked pheasants entirely by artificial processes.

A small electric brooding house was constructed during April, consisting of nine compartments each completely equipped with heating apparatus. Bantam chicks were first tried in order to test out the general plan of the new unit. The first incubated batch of pheasants to be placed in them made a splendid growth and only three of 407 died. The mortality of the second group of brooded pheasants was unusually low.

It is now believed that the electric brooding unit has solved a very real and perplexing problem. Continued broodings have permitted healthy, well developed birds to be transferred to the rearing pens. Losses have remained small. For instance, a report for the week of May 24, on four brooders, shows a loss of but fourteen birds out of a lot of 160; of twelve out of a lot of 156; of eleven out of 150 and thirty-five out of 105. The greater loss for the last brooder enumerated is explained by the fact that pheasants ordinarily classed as seconds were placed in it. Under normal conditions, such misfits would not be used. In this case, the electric brooder permitted a very good percentage of the birds to be salvaged.

It has been maintained that pheasants electrically hatched and brooded lose somewhat their wild instincts and are much tamer than hen-brooded birds. Observations thus far made do not substantiate this, for these pheasants that have never known a domestic mother are extremely wild and difficult to handle.

Another innovation, a different method of feeding, has been productive of excellent results. Pheasants fed on dry mash and given no water, save tomato juice, have grown rapidly.

STATISTICAL REPORT ON FRESH AND CANNED FISHERY PRODUCTS

No other state or country so far as is known keeps so complete a record of fishery products as does the State of California. Every packer of fish has to report monthly to the Division of Fish and Game the amount of fish received and the amount of fish packed. This report must be rendered by all persons packing any species of fish, mollusk or crustacean by any method. As a result of this requirement, it is possible to compile a statistical report of all of the fresh and canned fishery products.

Circular No. 3, published in June, 1929, gives the statistics for the year 1928. This circular is available on application to the Division of Fish and Game, San Francisco.

Among the more interesting figures are the following:

Total cases of canned products, 4,431,498; the total catch of fish, 517,746,166 pounds; abalones, 2,066,243 pounds; sardines, 420,269,665 pounds (more than three-fourths of the total catch); salmon, 4,478,566 pounds; tuna, 13,783,536 pounds; albacore, 283,321 pounds. Thirty sardine canneries were in operation during the year.

NECESSARY FACTS

At conventions it is common to hear advocated the need for more dependable information on the life history and habits of game species. Any who may have scoffed at the scientist, now usually admit that solution of difficult problems comes more often from the laboratory than from the discussion room. Though the need for scientific research may have been apparent to only a few in the past, it is being appreciated now by the many.

Try to gather evidence on any controversial subject—How many fish will a mile of typical stream support? How many quail are killed by hawks? What is the cause of duck disease?—and one is astounded at the paucity of reliable data. Data useful to engineering problems is much more accessible than that on biological subjects. Admittedly, biological questions are more intangible, but that is not the only reason for lack of data. In part, at least, the reason is to be found in the lack of support for research problems in connection with game. It has been more simple to get appropriations for killing campaigns than for research as to the economic value of the species concerned. It has been easier to establish a bounty fund than to secure money to find out if a species is useful or detrimental.

It now appears that interest in getting the necessary facts by research is growing. Organizations other than universities are now supporting research on game. In addition to governmental research, various states are instituting research programs. New York has a stream survey in progress. California is investigating duck disease, studying the fisheries, Washington is gathering statistics on fur-bearing animals. A new era is near at hand when new projects will be undertaken only after proper knowledge secured by experts is at hand. This kind of advance assures better care of natural resources and increases ability to predict results.

THE NEW LOS SERRANOS GAME FARM

California's second game farm, where various upland and other game birds will be propagated for distribution in the game territory of southern California, will soon be functioning. The pens and rearing field have been completed and the construction of help's quarters and feed and incubator houses is nearing completion. The buildings are of Spanish style architecture and harmonize with the buildings nearest the farm.

The new farm is located on a twenty-nine acre tract close to the Los Serranos Country Club, a few miles from Chino, in what is considered ideal surroundings for the raising of game birds.

The enclosure for the birds is 270 feet wide, 312 feet long and contains 122 pens. These pens are 24 feet square and 7 feet high. All fencing materials such as posts, rails and gates are of steel, and heavy galvanized wire is used to cover the sides and tops of the pens. The only wood used is three eight-inch boards that are placed at the bottom of all pens, and the frames used for the removable partitions.

At the first farm at Yountville, wood construction was employed, but in the new farm a more permanent type has been used, the first of its kind on the Pacific coast. Though patterned after the Yountville farm, the new one will have a large rearing field. In September the farm was ready to house the heavy shipment of 1500 pheasants that August Bade, superintendent of game farms for the Division of Fish and Game, sent to stock the new farm.

The estimated cost for the living quarters for single and married help, feed and incubator houses, grading, the erection of the wire enclosure, and the installation of the unique sprinkling and watering system such as is used at the Yountville farm, is \$20,000.

CALIFORNIA'S DUCK KILL

There have been many estimates as to the actual number of ducks killed by hunters each open season. Not many of these are based on actual statistics. It is, therefore, worth while to call attention to the series of figures gathered by Colonel Edward L. Munson and published in an article on "Why Lower the Duck Bag Limit?" which appeared in *Outdoor Life* for August, 1929.

"* * * Let me give you some facts of my personal knowledge! I shot on the second day of the 1928 season at a commercial club, the manager of which said that more than 900 ducks had been

brought in on the previous day, included in which were nineteen limits of twenty-five birds each. I was informed of a private club in which twenty members brought in twenty limits on the same day—and after these 500 birds were brought in the keepers went around with retrievers and picked up 100 more. One of my friends, who is a persistent hunter but does not consider himself an expert shot, told me that he bagged 403 ducks in the season of 1928, and 432 in 1927.

"I have in my possession the official statement of a certain duck club in the San Joaquin Valley. There are eighty-seven members of this club, of whom about sixty shot at various times during the 1928 season. The birds bagged were reported by days, varieties and numbers. There were thirty-one open days and an average of thirty-eight shooters on each open day. The total number of birds bagged at this club during the season was 16,545; which, with the modest estimate of one duck lost to each five bagged, would reach a grand total of 19,845. The average number of birds bagged by the average shooter, for the entire season, was 435. On October 1 there were seventy-two shooters, who bagged 1006 ducks; on December 30, seventy shooters bagged 1456 ducks; on January 6, seventy-two shooters bagged 1488 ducks. On this club there are 280 sunken barrels, so that wherever the duck flight may shift, the gunners have concealment under it.

"* * * On opening day, 1928, two commercial clubs in the San Joaquin Valley (names furnished on application) had 302 limits of twenty-five birds each brought in, or the vast total of 7550 birds. This did *not* include the bags of hunters who brought in less than twenty-five birds each, nor did it include a probable additional 20 per cent of crippled or lost birds. If a limit of fifteen instead of twenty-five birds had been in effect, there would have been a saving of 3200 ducks for this one day, from these two clubs alone. Take another club—a commercial one—on Salton Sea, in southern California. Its records for the season of 1928 showed that 83 per cent of all its patrons killed limits of twenty-five birds each."

WHAT IS CONSERVATION?

"Not so long ago the general public was laboring under the delusion that a conservationist was a fellow equipped with a long face, sideburns, an unlimited supply of 'don'ts' and an ambition to prevent sportsmen from enjoying themselves in hunting and fishing.

"But as the idea of game restoration spreads over these United States, as the

teachings of the necessity for the preservation of wild life resources are being broadcast, the general public is beginning to say to itself, 'After all there must be something in all this talk about conservation.'

"Conservation is no strange, new cult. It doesn't demote the hardy gunner to a pacifist or cause the ardent angler to scrap his tackle and quit the streams and lakes he loves.

"Conservation doesn't mean restriction. It means common sense preservation. It contemplates more sport for all decent sportsmen. It means taking no more than the game laws say you may take, or, more sensibly, what your own sense of a grub supply and fair play tells you is enough. Conservation means simply the old Golden Rule applied to game and fish and your fellow man. It revives the flavor and romance of the spirit of hunting.

"The conservationist, therefore, is the fellow who is thinking about such matters and trying to interest others in them. He isn't standing around and 'letting George do it.' He is taking an active part in improving conditions in his neighborhood or district. There is absolutely nothing mysterious about conservation."—*Dupont Promotion News Bulletin*, July 29, 1929.

SALMON SEEK HOME STREAM

It has long been recognized from casual observation that the different species of Pacific salmon resort to certain streams for spawning purposes. Proof of this homing instinct of these fish has been demonstrated by experiments by the Division of Fish and Game in California and additional evidence is now furnished by the United States Bureau of Fisheries as the result of tagging experiments on Chinook salmon in the Columbia River, extending over a period from 1916 to 1927, as related in a recent bulletin of the American Game Protective Association. During that period many thousands of young salmon were marked in the various tributaries of the Columbia and liberated. Many of these marked fish were taken in the sea off British Columbia and southeastern Alaska but it is a significant fact that none have ever been taken in any stream except the Columbia and its tributaries.

It has been an open question as to whether the homing instinct of these fish was a purely hereditary matter or whether it was determined largely by the early environment of the fish. Results of the experiments tend to discount the hereditary theory because only a small percentage of marked fish returned to the tributary where eggs were taken but a

large percentage were recovered in the tributaries where the fry had been liberated and where the young fish spent a portion of their early lives. It is not believed, however, that environment is the sole governing factor but hereditary instinct figures to a limited extent.

A striking instance of the return of fish to the home stream has been found in a tributary called Spring Creek. This creek is so extremely small that it is difficult to see how the salmon could find it at all, yet 82 marked fish were recaptured therein as adults, while only four were taken elsewhere. This is taken as definite evidence of the validity of the home stream theory.

It has also been developed that the homing instinct is disturbed by transplanting the eggs from one tributary to another. This is a matter of considerable importance in fish cultural operations, particularly in cases where attempts are made to rehabilitate runs by transplantation from other streams.

So far as experiments have gone, they indicate that the better practice is to stock each stream with eggs native to that stream.

CONSERVATION BEGINS AT HOME

There are those everywhere who believe that the mere purchase of a hunting and fishing license and the discharge of duties imposed by law completes their obligation. They have no part to play in the actual work of conservation. This view point is most unfortunate. In a very fundamental sense the future of fish and game rests with every citizen and not alone with the state. If those who have the means and the time will devote themselves to the improvement of conditions, will act as game breeders and game keepers for some favorite cover in their own locality, better hunting and fishing conditions will result.

The rancher has in his hands the power to put conservation on a decided improved basis. Living on the land, he is in intimate touch with wild life and "controls the latch string to the hunting fields." He already knows the value of the out-of-doors. Next to food, sunshine and outdoor recreation are the best body builders. The rancher has known this all his life. And because of the obvious presence of health giving opportunities, he fails to justly evaluate them. The same is true of game. It is so close to him that he does not realize that its presence actually increases the value of his land.

One of the stock contentions of the rancher is that conservation is for the benefit of the city man who goes to the country to hunt and fish. Unfortunately,

the rancher has failed to recognize that he actually benefits financially by this. The city man spends money in the country. He must pay for what he eats and where he sleeps. Often he pays for the privilege of hunting on the rancher's land and employs the rancher as guide. Sometimes he builds a hunting lodge and thus creates taxable values. Assuredly, the rancher needs to consider more thoughtfully the very real economic value of the game on his land and the personal losses he will sustain if he neglects to take a direct interest in its conservation. In a sense, the exhaustion of game resources is well nigh impossible if the home guard takes a constructive stand.

TEMPERATURE AND TROUT

Hundreds of millions of young trout have been planted in the streams of the northern states which never developed into mature fish. Blame has been usually placed on predatory fishes and various other unfavorable influences; but according to Jan Metzelaar, biologist of the Fish Division of the Michigan Department of Conservation, much of the fault can be ascribed to unfavorable water temperature.

It is well known that the average temperature of streams throughout the northern states has been raised by the cutting down of the timber which formerly shaded the streams, opening them up to the heat of the sun; and it has been the general belief that the colder the water the better for trout. This is not necessarily true. The trout of our northern waters would thrive no better in streams of arctic temperature than they do in the heated, sluggish waters of lowland rivers. They shun extremes of both heat and cold.

It has been found that trout do best where conditions are such that the day maximum temperature doesn't exceed 68 degrees and the daily variation is not great. In hot weather, when the temperature rises above that in the main streams, the trout seek protected holes where spring seepage comes in. Spring holes frequently lack a sufficient supply of food, however, so that the trout are obliged to seek the warmer water or starve.

The biological study of the streams of Michigan which is being made by Mr. Metzelaar discloses a vast amount of information important to fish culturists and, incidentally, the angler. The varying temperature of streams is of more fundamental importance than almost any other factor, it is believed, and is something which must be brought under control in order that streams may maintain a maximum fish population.

The control of temperature involves the planting of a fringe of brush or small trees along the banks of small streams which are barren, in which the cooperation of landowners is necessary. One of the chief objectives in the control of temperature is to avoid extreme changes.—*Field and Stream*, Aug., 1929.

PREDATORY ANIMAL CONTROL

In view of the numerous letters received by the division protesting against the poison campaigns directed against predatory animals, readers should be interested in the following paragraphs taken from a defense of work of this kind by Paul G. Redington, chief of the U. S. Bureau of Biological Survey:

"From the very inception of the Biological Survey's cooperative work in predatory animal control, the interests of fur bearers have been carefully considered, both in planning and in conducting the field operations, because it was the desire of the bureau to keep the destruction of such animals down to a negligible minimum. Because of the great abundance of coyotes, the serious losses occasioned by them to the live stock industry, the fact that they are carriers of rabies, and because of their prolific breeding, it was early realized that if control was to be effected with any degree of success in those areas of heaviest infestation, poisoning operations would have to be resorted to. Consequently, after years of experimentation, there has been developed an effective poisoning system, the use of which in cooperation with those most vitally concerned is slowly but surely bringing coyotes under control in many of the western stock ranges. The ultimate control of the coyote, however, will call for persistent cooperative action for many years to come.

"In carrying out these poisoning operations against coyotes, the utmost care is exercised at all times to prevent careless or indiscriminate use of the poison. Any fear, therefore, that this organized work may open the way to the indiscriminate distribution of poison on the part of persons who are unskilled in its use, or who are careless or wholly unqualified, is without foundation.

"Poisoning operations under the system followed by the Biological Survey are not undertaken on any area where there is the least danger of poisoning fur bearers, but instead, trapping methods are used there. Records on file in the bureau and statements from stockmen on whose ranges poisoning work has been conducted, do not support the contention that many hundreds of fur-bearing animals are killed to every coyote that is destroyed by the

poison bait. Nor has there been any concrete proof presented, other than unsubstantiated written charges, or brought to our attention, in spite of our many requests for proof, that any appreciable damage to fur bearers is resulting because of the application of poison methods.

"Many complaints that minks, martens, fishers and other valuable fur bearers were being destroyed through poisoning operations have been carefully investigated, only to find them without adequate foundation. Trappers making such complaints have been requested to produce evidence in support of their claims, but they have failed to do so. It is very seldom necessary to resort to coyote control by the poisoning methods in the habitat of the true fur bearer."

METHOD OF WHOLESALE CONTROL UNWISE

"More and more those who have studied vermin control are voicing the warning that extermination is a pruning device to be used with care and caution. Vermin play a necessary role in 'nature's eternal economy' and examples are no longer rare where their wholesale destruction over widespread areas was later regretted and uniformly condemned.

"Localities differ in their myriad interdependent relationships, and methods of control effective in one area may be tragic in another. For this reason the problem is essentially a local problem, requiring not a hasty and indiscriminate slaughter, but a careful investigation or interrelations and an accurate understanding of the amount of harm species injurious cause to those beneficial."

BUREAU OF LAND AND GAME REFUGES

One of the most important projects undertaken by the Division of Fish and Game in recent years is concerned with the purchase and development of game refuges. At the 1927 session of the state legislature the Hunting License Act was amended to provide for one-third of all moneys collected annually from the sales of hunting licenses to be expended in the purchase, lease or rental, and the development, improvement, maintenance and administration of land, or land and water, or land and water rights therefor, suitable for game refuges or public shooting grounds, or both, within the State of California.

A committee was appointed to assist in selecting areas. Now that actual purchases are being considered, it is important that all of the work connected with these new refuges, and with some

thirty already in existence, should be placed under the control of a separate bureau. Such a bureau has been established, and J. S. Hunter, who has supervised this work for some time, is now officially in charge of all the refuges of the state.

HYDROBIOLOGICAL SURVEY CONTINUED

The hydrobiological survey of Monterey Bay will be continued for at least another year by the division through its Bureau of Commercial Fisheries, in conjunction with the Hopkins Marine Station at Stanford University, located at Pacific Grove on Monterey Bay.

The survey is of great value and importance scientifically and will benefit the commercial fisheries of the state. It will permit more knowledge to be gained about ocean currents, temperatures and changes in sea water. It will give an understanding of the fluctuations in the abundance of the minute animal and plant life of the sea upon which so many fishes of commercial importance depend for food. An understanding of these variable factors is believed to be necessary. It is expected they will serve to explain the sudden disappearance and equally as sudden appearance of sardines.

Already the eggs and larvae of sardines have been discovered. This is expected to lead to a better understanding of the areas in the open sea where sardines spawn and of the spawning migrations of the adults. It is the opinion of the investigators that comparative observations of each year's spawning of sardines will throw light on the abundance of each yearly increase so that predictions can be made several years in advance of good canning seasons.

It is also expected that the survey will help to solve the very interesting question whether excessive fishing at Monterey has an effect on the abundance of sardines at San Pedro or if the supply at Monterey in any way is modified by the amount of fishing at San Pedro.

SIZE LIMITS IMPORTANT

The establishment of a size limit in the taking of fish, shellfish and crustaceans is being given a fair trial in California. It seems reasonable that a size limit is an effective means of assuring a breeding stock. In the case of the spiny lobster there is both a maximum and minimum size limit (10½ and 16 inches). This law gives protection to the young and also to the oldest and heaviest egg layers. In the case of the Pismo clam, the minimum

limit of five inches protects these shellfish until they have spawned at least once. It seems difficult to see how a species so protected could ever actually be exterminated.

THE DEER SEASON

The deer season did not open as auspiciously this year as in the past. Hunters reported having more difficulty in finding bucks. Scarcity was also evidenced in the lighter returns of deer tags.

The importance of accurate aim by the hunters was evidenced in Marin County when a fine three-point buck was reported seriously wounded. Volunteer Warden Mrs. Walter B. Sellmer investigated and put the animal out of its misery. It had been shot through the left ham, the wound had become badly infected and fly maggots were at work.

In contrast to the adverse reports on abundance of deer this year has been the flood of complaints of damage to crops. Deer are accused of destroying alfalfa, fruit trees and even gardens in such populous centers as Ross, Marin County.

BOUNDARIES OF GAME DISTRICTS DEFINED

In order that whatever confusion may exist in the minds of hunters and sportsmen in Siskiyou County, boundaries of the fish and game districts and changes made in the law at the last session of the legislature were explained by Division of Fish and Game officials here.

The portion of Siskiyou County south and east of the Klamath River from the Oregon line to the Southern Pacific Railroad bridge near Klamathon and east of the Southern Pacific tracks from this bridge to the south line of the county is in fish and game district one and three-fourths, except that all incorporated cities and towns through which the Southern Pacific tracks pass are included in fish and game district one and one-half. All other portions of Siskiyou County, including the incorporated cities and towns mentioned above, are in fish and game district one and one-half.

Each fish and game district carries with it the bag limits and seasons prescribed by law in that particular district, which means that in district one and one-half the deer season opened on September 1st and the limit is two bucks, no fawns, does or spiked bucks allowed in possession, and sale of venison or deer skins prohibited.

In district one and three-fourths the deer season opened on September 16th and the limit is one buck, but no does, fawns, spiked bucks or forked-horn mule

deer are allowed in possession, while the sale of deer meat and deer skins is prohibited.

FOREST FIRES AND GAME

While certain problems concerned with game management may be little understood, almost everyone is familiar with the relation of forests to game. It is common knowledge that forests are not mere collections of trees, but afford food and safety for animals. Useful to man and serving as places for relaxation and inspiration, forests create and regulate conditions indispensable for game. Wholesale destruction of the forest effects a mass change of the environment of animals and directly influences their living and breeding.

Yet in spite of the widespread understanding of the menace of forest fires, man-caused forest fires continue in California to head the list. Smokers and incendiaries were responsible in 1928 for 50 per cent of all the fires that occurred in the state, for 68 per cent of the total area burned and 71 per cent of the total damage done.

Figures issued by the United States Forest Service and the State Division of Forestry show that during the last nine years 24,123 fires have raged in California, burning 7,255,979 acres. It is estimated that the cost of preventing and suppressing these fires totaled a staggering figure of \$7,705,475.

Despite federal regulations prohibiting smoking in national forests and state laws against the throwing of lighted cigarettes and matches from automobiles and other moving vehicles, those who are out of doors continue to discard lighted matches, cigarettes, cigar and pipe heels in forest, brush and grass areas with the same unconcern as they do on paved streets. Surely Californians and sportsmen in particular, need to develop a "smoker's conscience."

THE CREEL LIMIT ON TROUT

Anglers have requested an interpretation of the law governing the creel limit on trout. Section 632 (a) of the fish and game laws reads: "* * * Bag limit not more than twenty-five trout or more than ten pounds of trout and one trout in any one calendar day * * *."

This means, according to the Division's ruling, that an angler may take exactly ten pounds of fish or less and still be entitled to another fish. However, in case he has either one, two or more fish and the weight is more than ten pounds, he is not entitled to another fish, but has his limit for that day.

Suppose an angler catches a fish weighing five pounds, and another weighing five and a half pounds. Is he entitled to another fish? Not according to the ruling of the Division. The two fish already caught make up his limit for that day. He violates the law if he catches another fish.

Anglers are also advised that the limit on golden trout is not more than twenty trout or more than ten pounds and one trout, and the size limit is not less than five inches.

OUR MEN ON PATROL

Too often it is the belief of men who hunt and fish for pleasure that the men who patrol the woods and streams for the Division of Fish and Game are actuated solely by an ambition to make arrests. Too often, it can be said, but, happily, that is not the belief of every man who seeks pleasure with the rod and gun. Many there are who cooperate gladly with the men on patrol, and the number is growing annually, as the tenets of the creed of these patrolmen become more generally known. More and more they are coming to be known as protectors of the wild life of a great state.

What does the public they serve think of them? Does the work to them seem like most other jobs—a matter of dollars and cents? Ask them, and they will tell you quickly and honestly that their incentive is of a vastly different nature.

The older men of the force, their hair shaded with gray, their faces weather-beaten and grim—marked by exposure and strain—they will tell you they have given the best in their lives to the work—and not for dollars. They love the work, and few of them resign.

The younger members of the patrol go about their work of protecting the wild creatures, little realizing, as time glides along, that they, too, are giving their lives to a great cause. They are found trudging fearlessly and hopefully toward a goal that will assure the preservation of our fish and game for all time. That is the big thing in their work—the theme and motif of their activities. The arrest of those who wantonly and unlawfully destroy the lives of the dumb creatures who have as much right to life as their slayers is but an incident in the big campaign. The life holds the patrolmen, and from the time they assume their duties until the end of their employment, for whatever reason, they give everything and ask nothing but a living, that they may pursue their work.

They talk, think and dream of their work. They may be found at all hours

of the day or night, often cold, wet, tired and hungry, on duty, watching patiently for hours for a man who is trying to circumvent them and the law by killing a protected animal, or "getting" more than the fixed limit. There is danger. Patrolmen have been slain in the performance of their duty. But the others go on, impelled by their sacred obligations and the desire to accomplish the end which should be the goal of every man, woman and child who has a spark of love for creatures that have been placed here for us to protect.

And there is a thrill, also, in their work. That thrill is compensating and necessary to success. To one who gives a listless attention to the affairs of his district, there is but one end. He fails. Without a love for his work, his usefulness has been outlived. The earnest, honest and square patrolman finds cooperation among the earnest, honest and square sportsmen, and their admiration is mutual. Working together, they can attain the end desired by both—a respect for the law, and an innate sense of fairness to the creatures that look to man for a square deal, that they may be with us while man remains.—W. B. SELLMER, Fairfax, California.

WHALES COMMERCIALY EXTINCT ON CALIFORNIA COAST

For the second time in history, there are not sufficient whales along the California coast to support a whaling industry. In 1865, there were eleven whaling stations located on the coast of California. A sizable fleet of ships was employed in the whaling operations. Writers often mentioned seeing fifteen whales at one time in one place. One writer states that "hundreds of them can be seen spouting and blowing along the entire coast." In 1886, the number of whaling stations had been cut to five: those at Monterey, San Simeon, San Luis Obispo, Point Conception and San Diego. By 1890, practically no whaling was possible along the coast although San Francisco was still the base port for a considerable number of whaling ships. Their field of operation, however, was far from the coast. The decline in whaling became particularly noticeable about the year 1880. The California gray whale was one of the first to become scarce, although in 1853 it was estimated that "fully 30,000 California gray whales visit the California coast annually."

Beginning in 1919, commercial whaling was again undertaken at Monterey Bay. Large steam whalers with a hundred mile cruising radius were utilized. Instead of a harpoon, a brass gun was used to shoot

a bomb which nearly always proved fatal. In these more recent operations only four or five California gray whales were taken. On the other hand, 781 humpbacked whales were secured inside of three years. After less than ten years of operation, the Moss Landing whaling station has been dismantled and operations abandoned because of a lack of whales. The whale is a slow breeding mammal, and if certain species are not already extinct and therefore impossible to reestablish themselves it will take any species many years of total protection to recuperate. It is perhaps a fortunate thing that demand is not sufficient to endanger still more greatly the breeding stock. No laws have yet been enacted in this state which curtail the catch or give other protection to whales.

In spite of depletion everywhere whales are being killed at the rate of 30,000 per year. In many places the world around certain species are already on the verge of extinction and the scarcity of others is becoming alarming, all because the annual kill is greater than the natural increase. The young are born only every other year; consequently, natural recovery is slow.

International action is required to secure the measures of protection that are necessary, which include absolute protection of certain species, protection of all species on their breeding grounds, protection of nursing females, compulsory utilization of the entire carcasses (much now being wasted), prohibition of whaling in tropical areas, prohibition of the use of airplanes in whale hunting and an international system of supervision of pelagic whaling.

The American Society of Mammologists has instituted a movement to secure international action by the creation of a council for the conservation of whales and other marine mammals with headquarters at Johns Hopkins Medical School, Baltimore, Maryland. On this council are representatives of all the conservation organizations of this country concerned in preservation of wild life, besides individuals who have a special interest in this particular movement. The advisory board of the council includes the names of Glover M. Allen, president of the American Society of Mammologists; Madison Grant, president of the New York Zoological Society; Gilbert C. Grosvenor, president of the National Geographic Society; David Starr Jordan, president emeritus of Stanford University; Vernon L. Kellogg, National Research Council; John C. Merriam, president of

Carnegie Institution of Washington; Henry Fairfield Osborn, president of American Museum of Natural History; and many others equally prominent and influential.

Plans for the creation of an international advisory board to carry on the campaign in all countries concerned are being worked out and encouraging response is being received from other countries. The American Game Protective Association has accepted appointment of its president as the association's representative on the advisory council.

NEW DANGER THREATENS WESTERN DEER AND ELK

A number of reports have come to the American Game Protective Association of the death of mule deer in the West which has been attributed to head maggots. Inquiry of the U. S. Bureau of Entomology elicits the information that there are two or more distinct species of nose flies that affect deer and elk in this country. The life history of these is not well understood but presumably the young are deposited as minute active larvae in the nostrils of the deer. These larvae immediately work up the nasal passages and attach in the nose, throat and sinuses of the head, where they complete their development in about a year and drop out as full grown spiny larvae about two-thirds of an inch in length. These in turn transform on the ground to flies which, after mating immediately, begin to attack the hosts. The presence of these larvae in the heads of the animals causes irritation and sometimes pus formation is induced. These larvae would naturally tend to lower the resistance and condition of animals affected so that they might die from other causes.

What can be done to bring these insects under control is a question which can not be answered until they have been more carefully studied. Post mortem examinations of deer which died in the Gunnison forest last winter showed that head maggots were possibly a contributing factor in these losses. Animals so affected lose their appetites, become emaciated and fall easy prey to any adverse factors such as severe weather and feed shortage.

It is said by those who have made investigation that the species of fly which infests the deer is not the same that attacks domestic sheep. So far as known the species found in deer does not attack sheep but it has been identified as the same species that attacks the reindeer of Alaska.

WATER FOR QUAIL

For several years R. J. Little of Banning, deputy of the State Division of Fish and Game, has been impressed with the loss of game birds, especially quail, in the desert sections of Riverside and San Bernardino counties, through lack of water. Recently he found two new and enthusiastic Izaak Walton chapters in the section looking about for a place to expend their energy and their money, and filled with a thirst for "conservation." On his

Consequently, for the first time in California, troughs have been built at The Tanks, Quail Springs, Warrens Wells, and the Pipes Wash Well, on the desert east of Morongo Valley, for the convenience of the game birds, by the San Geronio and Redlands chapters of the Izaak Walton League. The troughs are oval in shape, made of cement, with shut-off valves to prevent waste, and will hold about one and one-half inches of water. Special attention was paid to placing

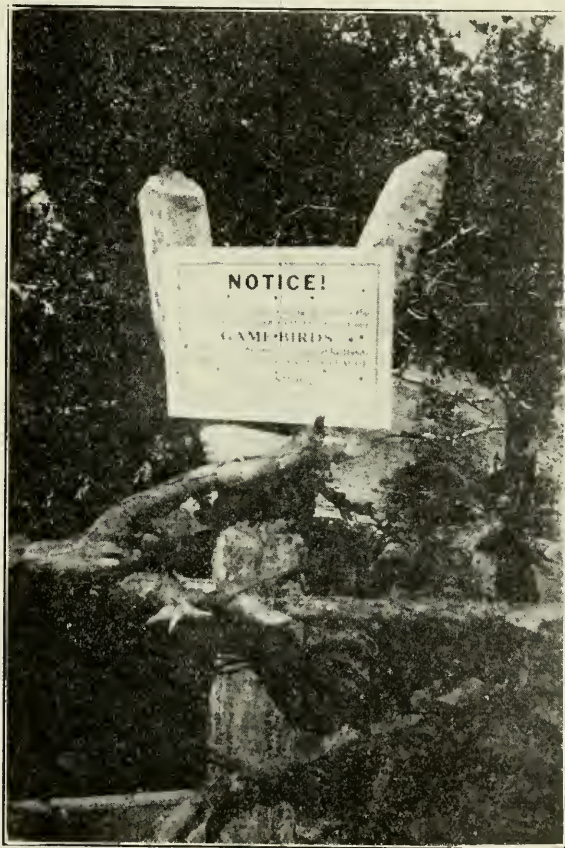


FIG. 110. Watering place for quail at "The Tanks."
 Photograph by R. J. Little, May 12, 1929.

trips to the desert in the past years Game Warden Little has found hundreds of young quail either drowned in the larger cattle troughs, where they have been attempting to drink, or dead for lack of water. These tiny denizens of the wilds were sacrificed to the fact that there had been no overflow in the desert watering places since the "dry years" have prevailed. Mr. Little saw a splendid opportunity to turn enthusiasm into action.

them under bushes or under a built shelter so that "Old Man Hawk" can not swoop down for his "daily dozen" as the small birds are drinking. The troughs are also fenced to keep cattle from destroying them. The hearty cooperation of Talmadge Brothers, large cattle ranch operators in the desert section, and of other property owners there, has been secured for this unique project. The members of the San Geronio Chapter of

the Izaak Walton League, which includes citizens of Banning and Beaumont, and members of the Redlands chapter are watching the outcome of their conservation project with much interest.

At each trough this sign is placed:

"NOTICE!

This Water Trough was placed here for the Convenience and Protection of our

GAME BIRDS

Courtesy of the San Geronio and Redlands Chapters of the

IZAAK WALTON LEAGUE.

BE A SPORT

Do not shoot or disturb birds at this trough."

According to Game Warden Little, these watering places should be the means of saving thousands of birds in a few years. Moving pictures and stills were taken of the troughs which are proving most interesting to lovers of wild life everywhere.—Mrs. R. H. Combs, Banning, California.

THE VALUE OF THE WILDERNESS

The value of the wilderness must be judged ultimately by its contributions to social welfare. We have no better criterion. What, therefore, are some of the benefits? First of all let us turn to our own history for a few suggestions. Our American public first learned of natural conditions during its pioneer history. Historians have shown us how much our American democratic institutions have been a direct outgrowth of our pioneering, and how this has tended to encourage independence, self-reliance and other traits which have contributed so much toward our institutions and our ideals. There is a whole literature built upon this phase of our national life. Without question this background and our public domain, out of which we could, with relative ease, set aside national parks and national forests, have been dominating influences in acquainting Americans with the charm of the wilderness. Our first and greatest champion of all this was John Muir, who exemplified the benefits derived from the appreciation of the wilderness. He was a naturalist, an artist, and from the wilderness he derived

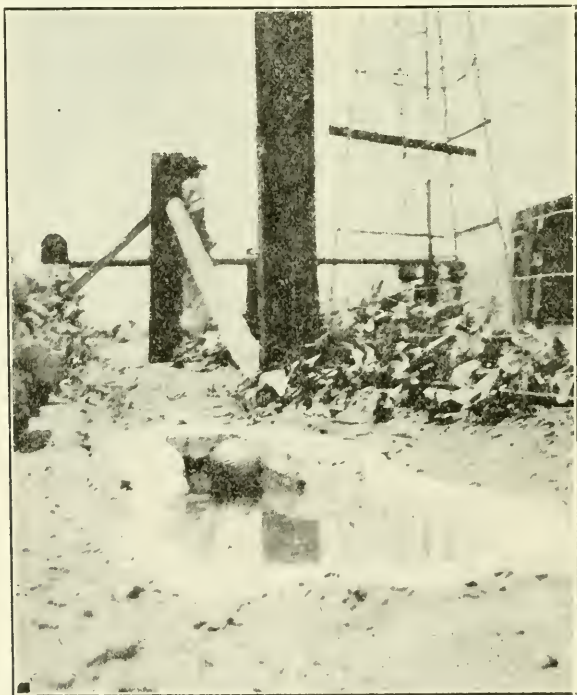


FIG. 111. Watering place for quail at "Warren Well."
Photograph by R. J. Little, May 12, 1929.

science, art, education, recreation, producing a literature which is a wonderful blend of all these. He thus exemplified the social uses of the wilderness at its best. This great contribution could not come from one dominated by economic ideals. A whole nation is now becoming educated to the Muir ideal and, as has been said, this is one of America's large and original contributions to the use of the land, as a definite land policy. This is a policy which has since spread to the Old World and seems destined to have a great future there.

We may briefly summarize the value of natural conditions under the following heads: artistic, scientific, educational, recreational and economic, bearing in mind, of course, that these groups grade imperceptibly into one another in various directions.—The Importance of Preserving Wilderness Conditions, By Charles C. Adams, New York State Museum Bulletin 279, 1929.

SEA LIONS WRONGFULLY ACCUSED

Commercial fishing interests have for a long time denounced the colonies of sea lions which exist on the coast of southern California claiming that they are very destructive to fish and are injuring the fisheries interests. An investigation of this claim has been made by authority of the California Division of Fish and Game and it has been found that the charges against the sea lions are greatly exaggerated. Two extensive counts were made of the sea lions on the California coast, as well as a survey of their habits and food requirements. It was found that there are about 6000 sea lions of two species on the entire coast of California between Oregon and Mexico. While fishermen claim that sea lions consume about 50 pounds of fish each day, records of feeding these animals in captivity indicate that they eat from eight to 16 pounds a day. It is also found that most of the fish they consume are not of the more desirable species but consist chiefly of so-called rough fish of little commercial value. They also feed upon other organisms that are of no value and some of which are injurious to fish, and it appears from the investigation that the sea lions may be of more benefit to the fisheries interests than otherwise.

Reports and records compiled for a period of years indicate that the colonies of sea lions are growing smaller in numbers annually.—Bulletin of the American Game Protective Association.

LION BOUNTIES INCREASE

For the fiscal year ended June 30, 1929, there were turned in for bounty 333

lions. This is 18 more than for the year 1927-28, and 103 more than for the year 1926-27. During the first seven months of 1929, 222 lions have been submitted for bounty—97 males and 125 females. If the kill is average for the last five months of the year, the total for 1929 will be 331, well over the average number turned in annually for bounty.

COMMITTEE APPOINTED TO ADMINISTER MIGRATORY BIRD CONSERVATION ACT

The commission provided for under the migratory bird conservation act passed by the last session of congress includes three members of the President's cabinet, who serve ex officio, and include the Secretary of Agriculture, who is chairman of the commission, the Secretary of Commerce and the Secretary of the Interior. In addition, two members of the senate and two members of the house of representatives are made members of the commission to be named by the vice president and the speaker of the house. The two senators appointed are Peter Norbeck, South Dakota, who was the author of the senate migratory bird refuge bill, and Senator Harry Hawes, of Missouri. The house members appointed are Congressman Ernest R. Ackerman, of New Jersey, and Congressman Sam McReynolds, of Tennessee, says a bulletin of the American Game Protective Association. The duty of this commission is to pass upon the purchase of lands selected by the Bureau of Biological Survey as suitable for migratory bird refuges. It is anticipated that two or more refuges will be selected for each state, due consideration being given to the areas frequented by the birds for wintering and routes taken by them in their migratory flight. The migratory bird act provides for the expenditure of an appropriation of more than \$7,000,000 to be expended over a period of ten years."—*Science*, vol. 69, p. 620.

FORT SEWARD HATCHERY TRIES NEW FISH FOOD

For some time there has been carried on at the Fort Seward Hatchery a trial of salmon offal (intestines, internal organs, etc.) as food for trout and salmon. This food has been obtained from the Gold Beach Packing Company at a cost to cover overhead, which will be less than 5 cents per pound landed at the hatchery. The product is frozen the same day that it is removed from the fish at the packing house. A report will be made later as to the results, but already it is believed to be of value, for it contains many necessary elements, both chemical and organic. It

has an especial value in that the vitamine content, which is large, and in a medium that the fish recognize as food. Also, the many hormones of the endocrine system, which are present, are extremely valuable for growing fish.

STATEMENT OF THE AMERICAN MUSEUM OF NATURAL HISTORY IN REGARD TO A PAMPHLET ENTITLED A CRISIS IN CONSERVATION.

The attention of the American Museum authorities has been called to a privately issued pamphlet entitled "A Crisis in Conservation." Two of the three signers of this document are members of the scientific staff of the Museum and this connection has led a number of people to inquire whether the Museum approves of the views to which this pamphlet gives expression. The Museum wishes, therefore, to put itself on record in a manner which will leave no doubt of its attitude toward this publication:

First.—The Museum was wholly unaware that this pamphlet was in course of preparation and had no knowledge of its existence until it was issued.

Second.—The Museum not only does not approve of this pamphlet but believes that it will convey a wholly false impression of the existing state of affairs in the conservation of bird life, and by discrediting the efforts of organizations whose records of achievement are unquestioned and worthy of all support, it feels that this pamphlet may do much harm.

After making careful inquiry, the authorities of the Museum find that, with the exception of the two signers of this pamphlet, the members of its staff whose experience and sources of information entitle them to an opinion, agree that there has never been a period in the history of bird protection when our laws were more far-reaching, better enforced or more strongly endorsed by public opinion. It is inevitable that some species of birds must vanish as the advance of an increasing population demands their haunts. But never before have such large sums been expended or such widespread efforts been made to stay the destructive agencies of the day. The Museum is, therefore, of the opinion that the alleged "Crisis in Conservation" exists largely in the minds of the authors of this pamphlet.—(Signed) Geo. H. Sherwood, Director.

AIRPLANE "SMOKES" MENACE CALIFORNIA FIELDS AND FORESTS

The fields and forests of California, which are yearly swept by hundreds of conflagrations started by careless motor-

ists, campers and sportsmen, today face a new and startling menace in the form of burning tobacco thrown from airplanes, according to the United States Forest Service. Information has already been received this season by the State Division of Forestry of a number of large grain and grass fires in the interior valleys of the State that were reported to have been started by cigarettes or cigars thrown from airplanes and which resulted in serious loss of range feed and farm crops.

Many people, who evidently fail to appreciate the fire hazard occasioned by high temperatures, low humidity and dry winds which occur during the summer months in the valley and forest regions of the State, have expressed doubt that a cigar or cigarette butt thrown from a swiftly moving airplane would continue to burn until it reached the ground, claiming that the propeller blast and air currents would snuff out the fire.

To secure reliable information on the subject, the United States Forest Service recently made a series of experiments at the Spokane, Washington, airport, using a regular forest patrol plane with a pilot and two observers, and ordinary cigars and factory-made cigarettes with plain paper tips. Tests were made at altitudes of 500 to 1000 feet on a clear day with a temperature of 75 degrees Fahrenheit, relative humidity 34 per cent, and wind velocity 7 miles per hour. To enable the ground observers to trace the cigars and cigarettes thrown from the plane, a bright colored cotton streamer two to three feet long and about one inch wide was attached to each "smoke." Employees and students of the Mamer Flying Service and officers of the Forest Service were present as witnesses to the tests.

The Forest Service reports the results of the tests as follows: Cigars: Six dropped; five recovered. All burning when picked up from the ground. Cigarettes: Seven dropped; six recovered. Four burning when picked up; two out.

The time which elapsed between the dropping of the "smoke" and its recovery on the ground varied from one to three minutes. Within this relatively small range the time element appeared to have no significance. Neither did it appear that increasing the altitude from 500 to 1000 feet was an important factor. No fires were started by the cigars and cigarettes as the tests were made on an airport field with a sparse cover of green vegetation and at a time when the relative humidity was high (34%).

These tests, Forest Service officers claim, prove rather convincingly that at alti-

tudes up to 1000 feet a large percentage of "smokes" thrown from airplanes will still be burning when they land on the ground, and that with favorable fire weather conditions lighted cigars and cigarettes thus discarded may cause serious forest, grass and grain fires.

All air mail, commercial and passenger-

carrying aviation companies will be requested to adopt strict measures to prevent the throwing of burning tobacco from their planes, since such action is not only a serious fire menace but is also a violation of California laws prohibiting the throwing of burning or inflammable material from any moving vehicle.

DIVISION ACTIVITIES

Bureau of Finance

Deer tags to the number of 150,000, valued at \$150,000, were distributed starting the early part of July. Due to their shape and the fact that each has a metal eyelet in order to attach to one-half of tag to a deer when it is killed, they were very difficult to handle. However, the tags were sent to the various branch offices and to the county clerks in ample time for sale before the opening of the season in Districts 2 and 3.

H. R. Dunbar and Leslie Rust both testified in the Mendocino superior court in the case against W. H. Prather, former county clerk, indicted by the grand jury for failure to account for fish and game funds received for the sale of fishing and hunting licenses for 1928 and 1929. Prather was convicted and sentenced by Judge Preston to serve from one to five years in San Quentin. His attorneys have appealed the case.

It appears from figures in the finance department that the sale of hunting licenses, deer tags and angling licenses for 1929 will exceed the sale for 1928.

Bureau of Patrol

During the first three months of the last quarter 656 arrests were made for violation of the fish and game laws. Court action in these cases resulted in fines totaling \$20,239 and ten men were sentenced to 438 days in jail.

The opening of the deer season on August 1st, increased the work of the department extensively, and a heavy force was thrown into the field before the hunters started the annual bombardment.

Numerous arrests were made, many for failure to properly observe the provisions of the deer tag law, and some for the killing of does, fawns and spike bucks.

In Santa Cruz County a deputy learned after the season opened that a doe had been killed on July 31. Working quietly he located three men, one of whom admitted killing the doe, while the others pleaded guilty to pursuing the deer. The first was fined \$150, one of the others \$200 and the other \$250.

Another deputy in the same county arrested a violator with six sprig ducks and in court this offender paid a fine of \$300. An overlimit of salmon found in Fresno County was responsible for a fine of \$100, while there were numerous heavy fines for over the limit on trout. The possession of Pismo clams in District 17 cost the offender \$300.

June and July each had fifty violations of the abalone law that were brought to book. In May, thirty-four were arrested for the same offense. This appears to be the most popular violation. Violation of the angling license act caused 108 arrests in the three months named.

Five deputies who failed to pass their civil service examinations were released from the service on July 31.

Ten deputies have been supplied with new Ford coaches and reports indicate the cars are giving good satisfaction. The cars have been supplied at Yuba City, Sutter County; Stonyford, Colusa County; Truckee, Nevada County; Mt. Shasta, Siskiyou County; Eureka, Humboldt County; Rocklin, Placer County; Fresno, Fresno County; Sebastopol, Sonoma County; Alturas in Modoc County and at Independence, Inyo County. This test will determine whether it is more economical for deputies to use State owned or privately owned automobiles for patrol work.

The following men have been added to the patrol force at the places named: Frank A. Carillo, Angels Camp; Harold R. Botts, King City; Walter Goff, Paso Robles; Floyd Jones, Merced; Charles R. Love, Redding; Joseph L. Ahart, Crockett; C. Scott Feland, Fortuna and Vernon R. Sutton, Kernville. Charter R. Peck, San Francisco office.

Acting as an observer of fire conditions from an airplane, fighting fire, working as dispatcher in the United States Forest Service, assigning men and supplies, also taking care of his own duties, gave Deputy A. A. Jordan of the Fish and Game Division, a few busy days starting July 22d.

On this date the Fandango fire broke out near Alturas in Modoc County, which is Jordan's territory. The deputy imme-

diately reported for service to the forest headquarters and was given the various duties mentioned above.

For three days Jordan worked day and night, but he also had time to take a look at fish and game conditions, as his weekly report shows that his observation and information gathered from eye witnesses indicates that over 100 deer, mostly fawns, perished in the fire which swept over 9000 acres in less than five hours, where the young deer were an easy prey to the fire demon due to heavy undergrowth which covered the section in the path of the flames.

A brief summary of the monthly reports received from the volunteer deputies between January 1 and July 1, 1929, indicate that during the past six months they have patrolled 294,701 miles of fields, streams, coast line and bay shores, checked 9419 hunting and angling licenses, and made and assisted in making 105 arrests, for which fines in the sum of \$4,219 were imposed.

With the opening of the deer season, volunteer deputies assigned for duty with the regular patrol cooperated in excellent fashion, and as a result of this work a number of good cases were made; in one case a fine of \$600 was assessed against violators run down by a regular deputy assisted ably by a volunteer.

Bureau of Commercial Fisheries

The first month of the sardine canning season at Monterey has closed with conditions between the canners and the division in full harmony. The canners have had many problems to solve, but have been packing the full amount of fish called for and are assisting every way to enforce the law adopted at the last session of the legislature.

Two new canneries have been constructed at Monterey and started operation shortly after September first. They are the Customs House Packing Corporation and the Monterey Sardine Products Corporation. Phil H. Oyer, former employee of the commission is an official of the Customs House Corporation which has put up a fine plant. The main building is 325 by 100 feet and two stories in height. A 60 by 100-foot warehouse has been built across the street connected by a bridge. This plant adjoins the Carmel Canning Company establishment.

All canneries have made extensive improvements this season. All of the plants hope to lessen the cost of packing by the installation of labor saving devices and the latest in modern machinery. Suction unloading tubes are in operation at several of the plants.

This season there are a number of purse seine boats operating for Monterey canners, in addition to the lampara fleet. The purse seiners can handle a much larger catch and the canners anticipate no trouble in getting enough sardines to carry on operations throughout the season.

The first albacore was taken off San Diego on July 4th. The catch throughout the month, however, was light, 700 or 800 pounds being high boat for the day's catch. The fish average in weight from 17 to 18 pounds and the price to the fishermen has been \$300 per ton.

Mackerel are being packed at most of the San Pedro and San Diego plants.

The salmon catch at Monterey was light during July, fishermen averaging about 100 pounds to the gig boat.

The *Albacore* was hauled up for repairs on the sixth day of July. She was in commission again on the fifteenth and left immediately to carry on work planned for the laboratory, after completion of which the boat was used in patrol work in the northern part of the district around the islands and in the vicinity of San Diego.

During August thirteen cannery inspectors were working at Monterey, checking the weights of the canneries to see that the law passed at the last session of the legislature was complied with, regulating the use of sardines in reduction plants.

On July 31st, Captain Dollard of the American steamer *Makawao* reported that while approaching San Francisco about 100 to 150 miles offshore he encountered thousands of dead fish floating belly up. It was difficult to distinguish the species of fish, but they appeared to be salmon ranging from 2 to 2½ feet in length. By arrangement with the Coast Guard service, a special trip was made in the Coast Guard boat *McLane*, with E. C. Scofield aboard. The area was completely encircled where the fish had been reported seen but only one dead fish was found,

and that could not be recovered. However, much was learned about ocean temperature. It was found that there is a cold body of water extending out about thirty-five miles west of San Francisco, and that beyond that point the water is about seven degrees warmer. The cold inshore water is caused by the upwelling of abysmal water, due to the action of the winds. It is believed that the fish were killed by suddenly running from warm water into the cold, as it is well known that fish do not stand a sudden change from warm to cold water.

Bureau of Fish Culture

During June and July fish planting was started in real earnest. Fish cars operating from the Shasta Hatchery worked day and night to transport fry to various points in California for distribution in selected places.

This season the fish planting is being done through the cooperation of the fish-culture department and the patrol department with the assistance of hundreds of members of sportsmen's organizations and other citizens interested in the stocking of the streams of the state.

For the two months figures show that a total of 15,691,645 fry have been planted throughout California. The fish planted are as follows: Eastern Brook, 1,623,050; Loch leven, 3,137,095; Rainbow, 3,888,000; Steelhead, 4,344,000; German brown, 582,500; Black Spotted, 1,052,000; Cutthroat, 65,000; Large Lake, 1,000,000.

George A. Coleman has made an extensive biological survey of various streams, in order to determine what fish should be placed in these streams, and to gather data regarding feed and other conditions.

At the start of the season it was found that salmon fry on hand available for distribution numbered 6,283,920.

The foreman of the Prairie Creek hatchery, J. C. Lewis, reported a serious epidemic among the Atlantic salmon which were being reared at that station. Though the loss was heavy, the 3,000 remaining after the epidemic ceased have grown rapidly and are in prime condition for planting.

It appears from this report that these fish are not resistant to the organisms existing in western waters. Great care was exercised in the handling of these

fish from the time the eggs were received, but it was difficult to check the epidemic after it got a start.

In July, it was reported that water conditions at the Bear Lake district are very poor and the lake is falling rapidly. It has lowered about three feet since the first of May. Most of the streams of southern California are very low this year, and some trouble will probably be experienced in planting the fish. Due to so many streams drying up this fall, trout will have to be planted in streams where there will be water enough to support them.

Bureau of Education and Research

Through the aid of the bureau, a class of twenty students in Yosemite was given a complete training in natural history and conservation and sent back to their homes to help build up a favorable conservation sentiment. A larger number of vacationists than ever before attended the lectures and the field trips given. Special camp fires were started in two of the public auto camps and each night a nature guide gave a talk to the groups assembled. Better opportunity to receive instruction was afforded visitors at such outpost stations as Mariposa Grove of Big Trees, Glacier Point and Tuolumne Meadows. The new aquaria at the Yosemite Hatchery have added greatly to the educational possibilities of this fish propagation plant.

H. L. Bauer and Miss Nancy Yerkes handled a splendid educational program in California State Redwood Park. During the month of July over 14,000 visitors were served. Attendance on field trips mounted to over 1500 adults and 273 children. During August the total attendance was 12,617.

Emphasis on certain mountain counties where residents are in intimate touch with game has been given in the lecture program. Early in May, through the good efforts of Mr. D. Fricot, of Angels Camp, opportunity was given to reach the principal centers of the Mother Lode. Addresses were made by Rodney S. Ellsworth before the San Andreas Progressives, the Angels Camp Boosters, and a meeting sponsored by the Amador Chamber of Commerce. Later, in June, a number of schools in Tuolumne County were covered and a lecture given before the annual meeting of the Tuolumne County Chamber of Commerce.

During July the principal resorts in the Feather River region and all the important centers of population were reached. Two special programs were arranged for the benefit of the employees of two large lumber companies. The Plumas Sierra Fish and Game Protective Association sponsored the lectures.

Donald McLean has been trying hard to solve some of the problems connected with the relation of big game to agriculture. In Santa Cruz County he has had a difficult problem in attempting to protect gladiola gardens from deer. Numerous repellents were tried out with poor success in that deer are practically domesticated. A trip to Del Norte County showed that less damage was being done by the elk in the vicinity of Orick.

The less strenuous days of summer have given E. S. Cheney, official photographer, time to cut and assemble films. The new film on the little brown crane has attracted a great deal of attention. Several splendid additions have been made to the film on shore birds. Work this fall will be concentrated on making a two or three reel feature on "Division Activities."

On August 25, Paul A. Shaw left for the Bear River marshes in Utah to study conditions existing during the present outbreak of duck disease. Four days were spent on the marshes, in making field tests and conducting feeding experiments. A number of samples were collected for more detailed laboratory study. Valuable data for comparison with California conditions were obtained. The preliminary study that has been made indicates the probability of "alkali poisoning" as the cause of the sickness in this area. Conditions in this area reported much better than in August, chiefly as the result of scaring the birds out of the territory by frequent shooting.

Bureau of Game Refuges

Refuge 1-T consisting of about 2000 acres in Humboldt County, a new refuge, has been posted. This is in excellent game country, well stocked with quail and deer. There are also quite a number of grouse in its boundaries. The refuge is well bounded; a creek on the south; fences on the east and west, and high ridges on the north. It is all in one holding and as far as is known there were no objections to its creation,

Lion hunter Jay Bruce worked during the entire month of June in the headwaters of the Mokelumne River in Amador and Calaveras counties. He was successful in securing one adult female and three young lions. Bruce reports deer and game conditions as very good. Hunter C. W. Ledshaw secured two lions in Tuolumne County. H. L. Bevans, in Lake County, bagged four. During July, Bruce worked in Plumas County and Ledshaw was sent into Humboldt and Del Norte Counties.

In all there have been turned in for bounties, seventeen scalps for June, ten females and seven males. This brings the total number submitted for bounty during the first six months of the year to 203 and during the fiscal year 333. In the first six months of the past four years the record has been:

1926	-----	147
1927	-----	128
1928	-----	202
1929	-----	206

Bureau of Publicity

During the past three months, work of the publicity bureau has gained in the number of stories released, and the amount of space given to work of the division has also increased materially.

Stories on the need for securing deer tags, arrests for violation of fish and game laws, when the case was an aggravated one and the penalty imposed was heavy, came in for general publication. Details of the season's fish planting also were widely printed.

The director of the bureau assisted Mr. J. S. Hunter in arranging for the convention of the Western Association of Fish and Game Commissioners in San Francisco on August 23-24. Entertainment of the delegates was superintended, and the convention pronounced a success.

Service bulletins were issued each month, and field trips made to Monterey and Los Angeles, where publicity releases were issued regarding local conditions at Monterey and in southern California.

A summary of the work done indicates that the newspapers are taking more of the division stories than ever before, and are in most cases using the "copy" sent them without change.

Bureau of Hydraulics

In the early part of July, a submarine pipe line of the Associated Oil Company at Ventura broke, letting about 600 barrels of oil escape, which lodged on the beach north of Ventura. Portions of the beach were cleaned for a distance of nine miles. Request was made of the company to clean up and a large force of men, teams and trucks removed the beach sands that were covered with oil, with the result that no evidence of the break is now apparent. As a result further protective devices have been installed by the company on the submarine pipe and probably there will be no recurrence for some time to come. As far as known this is the first break in submarine oil lines for some years.

The Pacific Gas and Electric Company has installed a fishway on its intake dam on the South Fork of the American River above Placerville.

An injunction suit is pending in the Superior Court of Mono County to compel the Cain Irrigation Company to install fish screens and a fishway. A criminal action brought in the justice court at Bridgeport, for which the defendants asked a jury trial, resulted in a disagreement. The trial was on for three days.

Total fish screens operating to date is 111. Fishways in operation reported to be 66.

Two ladders have been repaired since the last report was filed.

Bureau of Game Farms

A census of the bird life of the state game farm at Yountville shows 29 different species made up of pheasants, partridges, quail, turkeys, ducks, doves, grouse and geese. At some time during the season most of these birds have laid eggs. However, we find the dependable egg producers to be as follows:

Pheasant—

Ring-necked-----	23,626
Silver-----	197
Golden-----	221
Amherst-----	22
Reeves-----	173
Turkey-----	328
Valley quail-----	749

A great deal of the food for birds at the game farm is raised on the farm. Superintendent Bade has a splendid garden, and raises lettuce, kale, tomatoes and

various other vegetables that go into the feed of the birds. Work in connection with the garden, as well as all of the construction work on new brooder houses, pens, and various other improvements is taken care of by the regular force at the farm.

Eugene D. Platt, who has been employed at the Yountville farm for two and a half years has been transferred to the new Los Serranos game farm which the division expects to have in operation very soon.

Thirty-seven Mexican bronze wild turkeys were hatched in an electric incubator and brooded for 30 days in an electric brooder. They are now out in the rearing pens and there are still 37 at this writing. Their development has been normal and they seem to be good birds in every way. At present they are further developed than other birds hatched earlier and brooded by domestic hens.

The results of hatches of pheasant eggs sent out to clubs and individuals show very well. Out of 360 eggs sent Salvatore Bilotti, foreman on the Fitzhugh Ranch, at McCloud, 282 birds were hatched. The same number of eggs sent to George N. Peltier, Westwood, Lassen County, produced 250 birds. Mr. Peltier says the sportsmen of his locality are more than pleased with their success. They also purchased 300 additional eggs from an Oregon breeder. Their plans for this next year are now being formed so that they can hatch and rear a large number. In all about 2000 eggs were sent out and the check up in most cases is satisfactory.

Bureau of Fish Rescue and Reclamation

Using one of the Division of Fish and Game fish cars for the purpose, a large number of bass have been planted in Lancaster Lakes in Los Angeles county. The fish for this planting were rescued by the Fish Rescue and Reclamation Bureau of the Division.

Holding bases near Elk Grove have been established for bass and other fish that are rescued from many areas in the state and at this point shipments will be made. Thousands of fish have been rescued this year, including black bass, crappie, bluegill and green sunfish, Sacramento and yellow or ring perch, calico bass, striped bass and catfish. These fish will be distributed to places where they will be able to thrive and be appreciated.

LIFE HISTORY NOTES

THE ANTELOPE OF LASSEN COUNTY

Probably the largest herd of pronghorned antelope in California range in Lassen County over some 1400 or 1500 square miles of tablelands and desert country. In winter this herd of antelope ranges inside of Game Refuge 1Q, with the exception of about 35 head which winter on the south side of Big Valley in the Windmill Flat section.

that they moved over on the California side to get away from the sheep. I do not believe that this is true because very reliable men who have ridden that range for the last forty years tell me that this herd of antelope never did range over into Nevada any great distance, except in case of a hard winter when deep snows force them into the desert of Nevada.



Fig. 112. Sagehen nest and eggs, Schaffer Mountain, Lassen County. Eggs were brought in and set to hatch under domestic hen to be sent later to State Game Farm for experimental purposes. Photograph by C. O. Fisher, April 28, 1929.

The antelope have shown a very marked increase during the last few seasons. During the season of 1928 I believe that the herd increased about 50 per cent, for during the season mentioned I thoroughly covered the antelope range and found to my surprise that with few exceptions all the does had twin fawns. The does and bucks seem to be about half and half on the range.

I have heard that this herd of antelope in years gone by ranged more in Nevada than they did in California and that the sheep grazed their range off so closely

About one-half of the herd migrate in the spring, about the middle of April, after having their young. Some of these antelope go as far west as Harvey and Grays valleys in Lassen County, which are about four or five miles from the Shasta County line. They must travel about seventy or eighty miles, going west in the spring and east in the fall. Just after the spring migration the bucks and does separate, later banding together about the first of November and migrating to the winter range, where they stay in large bands throughout the winter.

I believe that nearly all the fawns are born in Game Refuge 1Q, and this, I believe, is the only time that the sheep bother them. In the southern end of Game Refuge 1Q, known as Skedaddle Mountain section, a number of large bands of sheep lamb in the spring in the particular places where the young antelope are born. Prong-horned antelope seem to be well able to protect themselves and their young from coyotes and other predatory animals.

Very seldom is an antelope killed by violators, as it is understood that the fine will be \$500 or more. A few have been killed by hunters sneaking in through the back door from Nevada and a few by fly-by-night travelers passing through from

THE ANTELOPE NEAR FRESNO

In the winter of the year 1878 my husband and I came to Washington Colony, six miles south of Fresno, as bride and groom to establish our home.

As soon as the warm days of spring came on, the antelope came in from the river bottoms seeking food and seemingly in a period of migration.

The following year, 1879, the construction of the Church canals was started. As soon as the water in the canals was ready for distribution the colonists planted alfalfa. This furnished a real treat for the antelope. They came in hordes, from forty to fifty in a band. All night long they fed on the alfalfa. The first alfalfa was cleaned off by these lovely



FIG. 113. Antelope and sagehen range looking south to Skedaddle Peak in Game Refuge 1Q. Photograph by E. S. Cheney.

Klamath Falls, Oregon, going to Reno, Nevada.

The ranchers living in the antelope country, as well as the cowboys that ride that range, are cooperating in protecting antelope. Any number of incidents can be cited showing that residents in the antelope country are cooperating in protecting the animals. Antelope are unlike many of our game animals, for they cause no damage to the farmer, but years ago the sheepmen killed great numbers of antelope in order to save the feed on the range for their sheep.—C. O. FISHER, Susanville, California.

creatures. During the day they sought the shade of the north banks of the canals. Here they slept until the next evening, and then back to the alfalfa fields. These harmless, graceful animals were not wild. The settlers never abused them, even though they were destructive to the alfalfa and vegetables of the early pioneers.

The coyotes were the worst enemies of the antelope. However, a full-grown antelope could easily outrun a coyote. Occasionally a stranger might try to shoot an antelope, but the colonists soon let it be known that the antelope were not

game. Sheep could be bought for \$1 a piece, so it was not necessary to have antelope for food.

To save the alfalfa it was necessary to drive the antelope off, so dogs were trained to drive them away. One day a little lamb, too small to follow the herd, was left in the alfalfa. My husband and I found the little thing and brought it to the house. We fed it milk from a bottle and it grew to be of good size. It was very tame and romped around with our dogs. At night we opened our door, and it came in to snuggle down in its little box behind the kitchen stove.

A very large strange dog attacked our pet one day and killed it. It had never known the fear of dogs, and, for this reason, it made no attempt to run from this savage marauder.

As the country was settled and the land was planted, the antelope gradually disappeared. Strays were seen around us for about five years along the edges of the colonies around Fresno. In later years, in crossing the plains, we saw herds of them near Firebaugh. I noticed the antelope we saw there were not the gentle pets we had known. They were very wild and we could see them only in the distance. Hunters had taught them to fear mankind. Gradually they left the floor of the valley and sought refuge in the foothills of the coast range. About twenty-five years ago my son spent some time in the foothills of the coast range. A herd of about fifty antelope was sighted near the mouth of Salt Creek, near Panoche Pass and around the Joaquin Murrietta country.

We had many interesting experiences with the gentle creatures. They were playful, tame and harmless, except to vegetation. They were beautiful sights in the moonlight, their white rumps showing a silver line as they raced across the plains. Our acquaintance with them in our daily life helped to break the monotony of our loneliness. The younger generation today little appreciates the affection we, as early settlers, felt for our graceful fleet-footed friends of the early days.—MRS. HENRY LARSEN, Route 5, Box 121, Fresno, California, May 13, 1929.

TUNA SEEN OFF VANCOUVER, B. C.

We are indebted to C. B. Tendick of the U. S. Bureau of Fisheries for a memorandum of the occurrence of tuna off Vancouver Island. On the morning of June 4, 1929, the first mate of the steamer *Ixion* observed some fifteen or twenty groups of tuna consisting of four or five fish each. This was just off the entrance

to the Strait of Juan de Fuca. Fish were observed during a period of two and one-half hours, but the species could not be told except that the tuna seemed too large to be albacore.

There have been occasional reports of tuna having been caught off Cape Flattery and the west coast of Vancouver Island, and the secretary of the Seattle Halibut Exchange informed Mr. Tendick that tuna were occasionally delivered by halibut fishermen and that two or three such fish were delivered in September or October of 1928. Other markets in the Vancouver and Seattle regions have reported an occasional delivery but have been unable to identify the species of tuna.

The *Pacific Fisherman* of August, 1915, reported on page 14 "a tuna" four feet long and weighing about thirty pounds, which was caught during the early part of July, 1915, in a trap on the west beach of Whidby Island, Puget Sound.—W. L. SCOFIELD, Terminal, California, July 5, 1929.

BIG-EYED BASS (*XENISTIUS CALIFORNIENSIS*) AND DOLPHIN (*CORYPHÆNA HIPPURUS*) CAUGHT OFF SAN PEDRO.

During the month of August, 1929, two species of fish found in warmer seas but uncommon in the waters off San Pedro, have been landed at this port. On August 21, one hundred pounds of big-eyed bass, *Xenistius californiensis*, were taken off Point San Juan. This fish is rather common in Mexican waters and at times is reported in some abundance off San Diego, but is rare in the San Pedro region.

The dolphin, *Coryphæna hippurus*, normally a frequenter of more southern waters, has also been taken in some numbers in the San Pedro area. On August 16, between three and four hundred pounds were caught in local waters and landed at San Pedro. Again on August 22, about one hundred pounds of this species were caught off Oceanside, and delivered to the San Pedro markets.—FRANCES N. CLARK, California State Fisheries Laboratory, Terminal, California, August 23, 1929.

A RACIAL COMPARISON OF CALIFORNIA, HAWAIIAN AND JAPANESE ALBACORE (*GERMO GERMO*).

During July and August, 1929, a preliminary study of possible racial differences between California, Hawaiian and Japanese albacore was made by the California State Fisheries Laboratory. Since fish from these localities were delivered to the canneries at Los Angeles

Harbor during the summer months, an unusual opportunity was offered for the study of racial characters of the albacore from these three, distant regions. Speculation has been rife concerning the albacore population of the Pacific. Scientists at present are agreed that albacore from Japan, Hawaii and California all belong to the same genus and species, *Germonermo*. This throws no light, however, on the question of local races or of a possible mixture of populations. With the hope of contributing some facts to the solution of this problem, this study was undertaken.

The limitation of available time and the detail required by such a study confined the observations to twenty California, thirty Japanese and twenty-one Hawaiian fish. Such small numbers preclude the possibility of drawing definite conclusions, but indicate lines along which future work can be conducted. With this purpose in view, this brief report has been drawn up.

All measurements on Japanese and Hawaiian albacore were made at the cannery of the Coast Fishing Company at Wilmington. The extreme courtesy of the employees of this company, and especially of Mr. E. H. V. Avery and Mr. Stanley Livingston in giving the laboratory notice when fish were received, rendered the work much less difficult. The California fish were measured at various canneries at Fish Harbor, San Pedro. In the study, fourteen measurements were made on each fish to ascertain whether or not the body proportions, such as length of head or depth of body, differed for fish from the three localities. Counts were also made of the number of rays in the dorsal, anal and pectoral fins and of the number of gill rakers on the lower arm of the first gill arch. Such characters are frequently influenced by the environment which surrounds the egg and larval life of a fish population. If albacore from California undergo the early period of their development in different surroundings than fish from Hawaii, the number of rays in the fins would presumably differ between individuals from these two localities. The above measurements and counts were made by the writer and recorded by other members of the laboratory staff.

The most striking difference between Hawaiian, Japanese and California albacore was the range in size. California fish were the smallest of the three, Hawaiian the largest, and the Japanese about midway between the other two. For the fish measured, the California albacore ranged from twenty-nine to thirty-

five inches in length from the tip of the snout to the middle rays of the tail; Japanese, from thirty-four to thirty-eight inches; and the Hawaiian, from thirty-nine to forty-six inches. These sizes refer only to albacore delivered in California from Japan and Hawaii. Whether or not they represent the range in size of all fish found in these localities is doubtful since a publication by Kishinouye (*Journ. Coll. Agr. Tokyo*, Vol. 8, p. 434-437, 1923) indicates that smaller sizes at least are taken in Japan.

Again the state of maturity of the sex organs differed for the Hawaiian fish as compared with those from the other two regions. All of the Hawaiian albacore examined were practically mature and ready to spawn, while the fish from both Japan and California showed no indication of an approach toward a ripe condition.

Because of the discrepancy in size-range, no adequate measure could be made of the differences in body proportions for the fish from the three localities. Since the relative body proportions change for individuals with an increase in length, body proportions can be directly compared only for fish of approximately equal lengths. Such material was not available in this study. The relative body proportion measurements for the Japanese albacore did, however, occupy an intermediate position between those for California and Hawaii. This is the result that would be expected if the fish had all come from the same population, since the size of the Japanese fish was intermediate between the other two.

Fin ray and gill raker counts are more satisfactory for racial studies as these numbers apparently do not change with increase in size. For this reason statistical measures of the reliability of the results can be applied. In this study, no certain differences could be determined for the fin ray and gill raker counts between albacore from California and Hawaii, or between fish from Japan and Hawaii. On the other hand, the differences between California and Japanese fish must be considered valid according to the usual measures of reliability. However, differences between two groups of California fish were greater than the differences between all the California and the Japanese fish. This throws the usual measures of reliability of a result open to question as applied to these figures, and we are forced to conclude that more data are necessary to demonstrate positively the presence or absence of racial differences between California, Hawaiian and Japa-

nese albacore. Future racial studies should stress, therefore, the accumulation of information on the number of fin rays in fish from the three regions, since these data at present give the greatest promise of fruitful results.—FRANCES N. CLARK, California State Fisheries Laboratory, Terminal, California, August, 1929.

COMMERCIAL FISHERY NOTES

N. B. SCOFIELD, Editor

NEW PATROL BOAT PLANNED

Preliminary plans and specifications have been drawn up for a new fisheries patrol boat for southern California to take the place of the *Albacore*, which will be transferred to northern California. This is necessary on account of the rapid expansion of the commercial fisheries. The new boat will be used for both patrol work and scientific research work of the State Fisheries Laboratory. It is hoped this new boat will be completed and in service within the next six months.

ALBACORE AT SAN DIEGO

On account of the albacore run showing up at San Diego, there was somewhat of a stimulus in license sales both at the San Diego and Terminal offices. The deputies have been kept busy in the southern section overhauling boats for licenses and boat registrations. On hearing of the albacore run at San Diego a number of Monterey salmon fishermen went down to try their luck on albacore.

The first albacore was taken off San Diego on July 4. The catch throughout the month was light, however, 700 to 800 pounds being high boat for the day's catch. The fish average in weight from 17 to 18 pounds. The price to the fishermen has been \$300 per ton.

BIBLIOGRAPHIES

As the published literature is rather extensive for certain fisheries, it is a large task for each staff member to work up a bibliography that is reasonably complete. We consider that the one who is in charge of the library should be familiar with the research work of each staff member and should assist each worker by calling his attention to current publications of significance, and also by compiling general bibliographies to cover the subject as a whole. Each piece of work naturally should include a special bibliography compiled by the worker himself. Such requirements in library work necessitate a zoologist rather than a librarian. We have, fortunately, a trained and capable zoologist in Miss Genevieve Corwin. She has during the past year, in addition to routine library work, prepared for publication an extensive list of

references to the tuna, the industries, methods, and gear, as well as investigations concerned with the tuna. This we expect to have published this fall. In addition, Miss Corwin is now preparing a similar bibliography for sardines. Each of these is to be catalogued separately as to author, title and subject matter. Her next work will probably cover the mackerel fishery.—W. L. S.

SARDINE SEASON OPENS

Thirteen established canneries began operation at Monterey on August 1.

Two new canneries which will operate this year are, the Custom House Packing Corporation and the Monterey Sardine Products Company, both new companies with the latest in modern and sanitary equipment.

Most of the canners have abandoned the fry pack and will pack with the pre-cooked raw method, which eliminates, in some cases, the dryers as well as the fryers. Some packers will continue with the fry pack, but have made vast improvements in methods and expect to turn out a fine product.

This season looks to be one of great promise. With a new law in effect the canners were well organized, started operations August 1st, and sardines seemed to take the center of the fishing industry stage. The Division of Fish and Game is vitally interested in a successful canning season on sardines and particularly in the improvements, which should assure a fine pack and do much to popularize the California sardine throughout the world.

NEW PUBLICATIONS

Three types of publications dealing with commercial fisheries have been tentatively agreed upon:

1. A series of annual bulletins presenting the catch figures in popular form as well as in tables of monthly catch. This has the merit of presenting the otherwise unpublished monthly figures.

2. A bulletin establishing official common names and presenting photographs with brief descriptions of each commercial species.

3. A series of articles and bulletins describing each fishery as to gear used, methods employed, and history of the development of the industry. Such work on a fishery is a necessary accompaniment to a boat catch analysis, and in addition, creates more general interest in our fisheries.

Some live publications are in course of preparation or are nearly ready for printing. A report covering the drag net fishery: the sardine fishery at Monterey; white sea bass; southern halibut, and barracuda. In addition, the mackerel fishery will be described and this work pushed to early completion.

THE TUNA FISHERY IN WESTERN SPANISH SAHARA

Liberal Translation from the Spanish¹

"Under the above title the *Vasconia Industrial y Pesquera* publishes a very interesting article by Don José Masqueira Manso. It refers to the tuna, or, at least, to a species very similar to it.

"The tuna lives widely dispersed throughout its geographical range when it is pursuing prey, and during the time of its active feeding its voracity permits of its being caught with a hook. At spawning time it congregates in great schools, because all of the mature (ripe) individuals are looking for the best location, where the temperature of about 20 degrees will permit them to effect fertilization.

"In Atlantic waters a spawning area has been discovered off the coasts of Cádiz; in the western Mediterranean, which is bounded by Africa on the south, and on the west by the coasts of Spain, France and Italy, the breeding area lies between Sicily, Cerdeña and Tunis. Both districts are suitable for 'Almadrabas' or giant tuna traps.

"The tuna which go to spawn in front of Cádiz and which our gear catches, when they disappear, where do they go? Large specimens are taken along Cantabria and even as far north as the coasts of Norway. But we see, as Señor Pesqueira points out, that the fish average in weight about 40 kilos, which does not agree with the average size of the tuna caught in the traps of the south of Spain—which exceeds 100 kilograms each.

"We select the most noteworthy paragraphs of the article:

"During the last few years—it is only recently that the Spanish trawl-craft have gone below the latitude of Cape July—great quantities of tuna have been found on the hake banks between the parallels

of 24 degrees and 27 degrees, north latitude, at depths ranging between 100 and 400 fathoms.

"The crews of these trawlers have noticed that on lifting their drag nets the tuna gathered astern of them in great schools, devouring the fishes that escaped through the mesh of the trawls, and manifesting a distinct predilection for jurel and red sea bream.

"It was decided to fish for the tuna, but to do so with trolling tackle, such as is used for bonito and albacore, was not feasible, owing to their size. Then someone conceived of an apparatus composed of the following: A sisal rope 14 to 16 millimeters in diameter, a tough wire leader, a strong hook having an eyed shank, and a pole. One end of the rope is made fast aboard; to the other end the wire leader is bent on, the leader terminating in the hook.

"When the apparatus has been prepared in the manner described, a lashing or loop of twine is bent on about one fathom from the hook. Ready, now, to fish, the loop is rigged to the small end of the pole with which are commenced movements sufficiently rapid, up and down, the baited hook entering and leaving the water in such a way that the tuna fails to discern the deception, and is hooked. Once hooked it is natural that he commences flight, and this movement bends the pole and unships the loop. The hook is baited with a red bream, which are taken abundantly by the trawls. The hook is of ordinary form, having a shank 10 centimeters long and an opening of 5 centimeters. The steel stock from which these hooks are made is of 8 to 10 millimeters in diameter.

"In that area of sea comprised between the 24th and 27th parallels of north latitude and the 14th and 17th meridians of west longitude, the Spanish trawlers are at present catching tuna. Last November several small sailing vessels from the Canary Islands were fishing tuna along the 24th parallel in less than 50 fathoms. They transferred the fish that they caught to another vessel of larger tonnage which lay anchored near them; there the catch was salted.

"The tuna begin to appear in July—in some years, during the last fortnight of June—and disappear in January, or during the first two weeks of February."—GEO. ROGER CHUTE, California State Fisheries Laboratory, Terminal, California.

PURSE SEINE BOATS

In the past the canners at Monterey have had to depend on lampara fishermen for their supply of sardines. It has not been practical to use purse seine boats as

¹ Boletín de Pesca (issue of April, 1927, p. 108), published by the Spanish Institute of Oceanography, Alcalá 31, Madrid.

it is not safe for them to unload at the canneries which are located on the rocky shore. Two or three seasons ago the K. Hovden Company employed two small purse seine boats. To do away with the danger of unloading, experiments have been made with a suction unloading tube which enables the boat to unload some distance off shore. This method has been quite successful. This season there will be thirteen or fourteen purse seine boats, and possibly more, operated at Monterey. The lampara fishermen claim the purse seines destroy hundreds of tons of sardines which they can not deliver to the canneries. They claim they often get a catch of sardines which is double the capacity of their boat, and the surplus sardines which are turned loose are all dead.

Last season, Paul Bonnot of the Division, made a special investigation of the operations of the two purse seine boats at Monterey. It is evident from this investigation that the purse seines have on occasion destroyed more sardines than they could take on their boats. Mr. Bonnot is convinced, however, that this loss is due more to the lack of care by the fishermen than to the type of net used, and that the opposition to the nets is the old prejudice that manifests itself when any improved method is developed that

temporarily throws men out of employment. The lampara net may be just as destructive, in proportion to its size, as a purse seine.

Trouble is likely to develop between these two types of fishermen this season. Already there is talk of a general strike of lampara fishermen, and the canners say they will put in suction unloading tubes and employ purse seines exclusively, if the threatened strike develops.

UNLOADING OF SARDINES SIMPLIFIED

A brand new method of bringing fish into a cannery has been developed at Monterey by one of the leading packers of sardines, and has been adopted by five others. Sardines will be unloaded from the fishing boats by suction, through an eight-inch pipe, a powerful pump supplying the motive power. The force of the salt water driving the fish through the pipe will remove the scales and when the sardines arrive in the cannery, they will be ready for cutting, and putting into cans. Thus time will be saved, fish will be saved, and the expense of a scaling machine will be eliminated. A suction system of this exact type has never been used for this purpose before, but elaborate tests have shown that it works, and that it will provide for greater efficiency and speed in the canning of sardines.

STATEMENT OF INCOME

For the Period July 1, 1928, to June 30, 1929, of the Eightieth Fiscal Year

License sales:	Detail	Total
Angling, 1927-----	\$1,040 00	
Angling, 1928-----	370,314 20	
Angling, 1929-----	73,903 00	
Hunting, 1928-----	461,412 50	
Hunting, 1929-----	40,339 00	
Market fishermen's licenses, 1928-1929-----	31,320 00	
Wholesale fish packers' and shell fish dealers', 1928-29	950 00	
Game breeders' licenses, 1928-----	102 50	
Game breeders' licenses, 1929-----	717 50	
Fish breeders' licenses, 1928-----	33 00	
Fish breeders' licenses, 1929-----	333 00	
Trapping licenses, 1928-1929-----	6,479 00	
Commercial hunting club, 1928-1929-----	2,025 00	
Commercial hunting club operators', 1928-1929-----	575 00	
Deer tag licenses, 1928-----	105,634 80	
Kelp licenses, 1929-----	10 00	
Market fishermen's licenses, 1929-1930-----	30,970 00	
Commercial hunting club licenses, 1929-1930-----	25 00	
	<hr/>	
Total license sales-----		\$1,126,297 50
Other income:		
Game tag sales-----	\$37 56	
Court fines-----	86,780 28	
Fish packers' tax-----	175,805 85	
Kelp tax-----	50 28	
Fish tag sales-----	7,047 63	
Crawfish inspection-----	21 00	
Miscellaneous sales-----	699 89	
Interest on bank deposits-----	5,170 21	
Contributions from importers-----	407 18	
	<hr/>	
Total other income-----		276,019 88
		<hr/>
Total departmental income-----		\$1,402,317 38

STATEMENT OF EXPENDITURES
For the Period July 1, 1928, to June 30, 1929

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Executive and legal.....	\$16,109 99	\$2 90	\$3,114 19	\$571 65	\$19,798 73
Clerical and office.....	23,475 03	1,234 83	5,286 83	580 10	30,576 79
Rent.....			9,045 88		9,045 88
Automobiles.....		289 70	356 44		646 14
Telephone and telegraph.....			5,006 57		5,006 57
Postage.....			4,121 66		4,121 66
Freight, cartage and express.....			2,210 23		2,210 23
Printing.....		12,189 80			12,189 80
Accident and death claims.....			8,425 43		8,425 43
Commissioners.....			637 12		637 12
Total administration.....	\$39,585 02	\$13,717 23	\$38,204 35	\$1,151 75	\$92,658 35
Education:					
Director and assistants.....	\$13,932 56	\$688 94	\$3,851 92	\$2,418 22	\$20,891 64
Pacific southwest exposition.....	248 75	1,014 06	1,349 13		2,611 94
Total education.....	\$14,181 31	\$1,703 00	\$5,201 05	\$2,418 22	\$23,503 58
Publicity:					
Director.....	\$3,300 00		\$693 14		\$3,993 14
State fair.....	357 00	\$212 21	730 71		1,299 92
Total publicity.....	\$3,657 00	\$212 21	\$1,423 85		\$5,293 06
Conservation and protection:					
Chief and assistants.....	\$10,700 02	\$39 55	\$2,233 84		\$12,973 41
Clerical and office.....	2,875 00	66 86		\$10 50	2,952 36
Rent.....			381 19		381 19
Automobiles.....		993 58	615 30	6,474 02	8,082 90
Captains and deputies.....	211,017 26	254 08	156,513 32	840 46	368,625 12
Patrol launches.....	2,085 00	1,591 73	1,807 11	488 61	5,972 45
Lion hunters.....	3,968 69				3,968 69
Coyote trappers.....	358 88				358 88
Lion bounties.....			8,500 00		8,500 00
Fish planting.....	1,385 00	1,016 75	2,324 51		4,726 26
Refuge posting.....	6,111 78	366 19	1,246 32	35 78	7,760 07
Fish reclamation and rescue.....	505 00		458 22		963 22
Total conservation & prot.....	\$239,006 63	\$4,328 74	\$174,079 81	\$7,849 37	\$425,264 55
Commercial fisheries:					
Chief and assistants.....	\$9,691 34	\$798 07	\$2,197 21	\$499 71	\$13,186 33
Deputies.....	32,751 77	110 17	9,141 52	65 53	42,068 99
Patrol launches.....	3,321 45	2,378 46	2,290 04	97 48	8,087 43
Statistical.....	7,395 00	240 40	744 40		8,379 80
Laboratory.....	35,954 06	1,567 51	7,172 44	958 41	45,652 42
Salmon tagging.....		224 34	41 00		265 34
Botulism.....			15,000 00		15,000 00
Automobiles.....		491 23	301 17		792 40
Carp eradication.....	1,485 84	315 10	240 35		2,041 29
Biological sur. of Monterey By.....			1,500 00		1,500 00
Total commercial fisheries.....	\$90,599 46	\$6,125 28	\$38,628 13	\$1,621 13	\$136,974 00
Fish culture:					
Chief and assistants.....	\$4,730 00	\$8 18	\$469 87	\$26 50	\$5,234 55
Clerical and office.....	3,290 67	82 48	314 43	153 65	4,541 23
Rent.....			105 00		105 00
Automobiles.....		3,564 53	1,658 21	52 55	5,275 29
Hatcheries.....	12,878 31	62,853 37	18,597 89	7,168 63	217,498 20
Hatcheries—Add'ns. & Bett'ms.....				2,070 02	2,070 02
Special field investigations.....	9,060 00	1 50	3,716 06	7 18	12,784 74
Fish reclamation and rescue.....	3,271 00	327 31	1,126 13	176 87	4,901 31
Total fish culture.....	\$149,929 98	\$66,837 37	\$25,987 59	\$9,655 40	\$252,410 34
Hydraulics:					
Chief and assistants.....	\$5,790 00	\$441 60	\$2,039 34	\$176 72	\$8,447 66
Cooperative research work.....	2,704 33		137 90		2,842 23
Total hydraulics.....	\$8,494 33	\$441 60	\$2,177 24	\$176 72	\$11,289 89
Game propagation:					
Game farm—Yountville.....	\$9,546 44	\$8,527 84	\$3,012 93	\$2,097 44	\$23,184 65
Automobiles.....		151 37	69 46		220 83
So. California game farm.....			4 80		4 80
So. Cal. game farm—Additions and betterments.....				1,954 18	1,954 18
Total game propagation.....	\$9,546 44	\$8,679 21	\$3,087 19	\$4,051 62	\$25,364 46
Research:					
Chief and assistants.....	\$11,435 03	\$592 72	\$1,595 63	\$70 00	\$13,693 38
License commissions.....			55,291 48		55,291 48
Hungarian partridges.....				5,678 30	5,678 30
Salinas River channel.....				98 37	98 37
Total eightieth fiscal year.....	\$566,435 20	\$102,637 36	\$345,676 32	\$32,770 88	\$1,047,519 76
Prior year.....					5,418 61
Grand total.....					\$1,052,938 37

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF APRIL, MAY AND JUNE, 1929
Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Anchovies							52,085		70,906
Barraouda									
Barracuda									
Bonito				3,199	6,339	10,347			
Carp			2,867		76,754	47,422			
Catfish							75,893	18,526	14,959
Cultus Cod		41,948	255		232	175	137,723	127	214
Flounders	27,686	13,000				100	21,481	1,250	64,451
Grayfish	77						91,174	9,125	230
Hake		130					17,997	568	4,529
Halibut	153,016	13,785	91				13,000		15,361
Herring		681	540				25,700	15,661	24,784
Kingfish		30						37	5,413
Mackerel									
Mackerel—Horse									
Mullet									
Perch	8,058	2,999	19,284					11,344	24,226
Pike					311	435			188
Pompano							250	31	
Rock Bass							152,129	73,071	232,220
Rockfish	14,653	48,358					85,669	68,748	5,714
Sablefish	162,350						118,932	248,376	567,303
Salmon	334,295	66,256		21,229	37,112	108,239	395,685	24,414	255
Sandlabs		4,290					302,170	77,860	198,777
Sardines								204	336
Sculpin									
Sea Bass—Black									
Sea Bass—White									
Shad			31		232	12			24
Shad—Buck			71,801		46,703	436,933		29,224	
Shad—Roe			138,420		82,478	648,115		50,448	
Sheepshead								43,976	
Skates									
Skipjack								750	64,525

Smelt.....	32,959	40,833	6,988	908	31,829	41,785	16,814
Sole.....	2,024	.....	.....	100	2,304,136	269,918	53,367
Solihail.....	.....	.....	.....	.....	.....	.....	.....
Striped Bass.....	.....	.....	8,292	61,224	9,869	.....	.....
Swordfish.....	.....	.....	.....	.....	5,522	.....	.....
Tomcod.....	.....	.....	.....	.....	.....	.....	.....
Tuna—Bluefin.....	.....	.....	.....	.....	.....	.....	.....
Tuna—Yellowfin.....	.....	.....	.....	.....	.....	.....	.....
Turbot.....	.....	.....	598	.....	.....	.....	.....
Whitebait.....	71,196	19,546	155	.....	50,464	30	7,989
Whitefish.....	.....	.....	.....	.....	.....	.....	.....
Yellowtail.....	.....	.....	.....	.....	.....	.....	.....
Miscellaneous.....	23	835	10	70	9,243	1,279	2,551
Total fish.....	806,337	252,691	27,928	1,313,990	4,125,484	863,199	1,374,836
Crustaceans:							
Crabs.....	24,912	.....	.....	.....	252,120	4,080	24
Shrimps.....	.....	.....	487,887	.....	149,108	.....	.....
Spiny Lobsters.....	.....	.....	.....	.....	.....	.....	.....
Mollusks:							
Abalones.....	.....	8,401	.....	.....	.....	.....	1,052,595
Clams—Cockle.....	.....	.....	16,463	.....	.....	.....	.....
Clams—Mixed.....	1,544	.....	221	.....	.....	.....	.....
Clams—Pismo.....	.....	.....	.....	.....	.....	.....	1,504
Clams—Softshell.....	.....	.....	19,234	8,910	1,738	362	25,871
Cuttlefish.....	.....	2,272	.....	.....	4,858	.....	100
Mussels.....	.....	.....	.....	.....	.....	.....	.....
Oysters—Eastern.....	.....	.....	41,414	.....	.....	.....	.....
Oysters—Native.....	.....	.....	22,434	.....	27,885	.....	2,781
Squid.....	.....	.....	.....	.....	445	9,389	3,241,105
Miscellaneous:							
Turtles.....	.....	.....	.....	.....	.....	.....	.....
Totals.....	892,798	263,304	615,581	1,322,900	4,562,451	877,030	5,698,816

1 1038 dozen.
 2 188,248 shell oysters.
 3 10,505 dozen.
 4 126,750 shell oysters.
 5 170 dozen.
 6 1 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF APRIL, MAY AND JUNE, 1929
Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	San Luis Obispo, Santa Barbara, Ventura.....	Los Angeles.....	Orange.....	San Diego, Imperial.....	Total.....	Fish from south of the International Boundary brought into California via San Pedro.....	Fish from south of the International Boundary brought into California via San Diego.....	Total fish from south of the International Boundary brought into California.
Anchovies.....		36,347	300		159,628			
Barracuda.....	383	1,655,424	85,046	446,001	2,186,851			79,350
Bonito.....		54,761	3,194	120,635	178,550		19,650	
Carp.....					19,885			
Catfish.....	194		659		127,043			
Cultus Cod.....		360	321		180,120			
Flounders.....	185	57,056	337	22,921	172,229			
Grayfish.....					167,801			
Hake.....	58,604	129,345	6,865	18,310	403,130	6,903	61,907	68,810
Halibut.....					41,221			
Herring.....		98,026	486	218	155,482			
Kingfish.....		10,937,109	1,082,533	3,606,925	15,601,412			
Mackerel.....	24	39,619	617		45,649			
Mackerel—Horse.....		3,461		10,742	14,203	2,320	7,227	9,547
Mullet.....		19,547		6	91,334			
Perch.....	5,370				746			
Pike.....					2,044	1,642	1,830	3,472
Pompano.....	820	1,358		217	125,119	4,079	4,513	8,592
Rock Bass.....	26,475	52,157	24,652	47,481	1,390,550		1,690	1,690
Rockfish.....		350,270	8,131	485,213	323,336			
Sablefish.....		190	665		1,501,742			
Salmon.....					429,129			
Sardines.....		4,347	188		13,140,908			
Sardines.....		12,244,304		317,767	32,389			
Sculpin.....	14	25,948	321	5,566	39,000			
Sea Bass—Black.....	5,183	2,691	2,691	30,901	43,660	3,106	40,554	43,660
Sea Bass—White.....	6,867	183,519	9,452	78,165	278,122	69,900	36,318	106,218
Shad.....					29,499			
Shad—Buck.....					605,885			
Shad—Roe.....					912,989			
Sheepshead.....	2,690	29,959	651	533	33,836			
Skates.....		1,649	92	373	147,774			
Skipjack.....					933,901		1,417,116	2,351,017

Smelt.....	17,809	107,833	10	2,014	258,979	-----
Sole.....	42,944	1,348	800	1,002	2,716,372	-----
Spittail.....	-----	-----	-----	-----	110	-----
Striped Bass.....	-----	4,578	-----	126,117	142,837	-----
Swordfish.....	-----	-----	-----	-----	130,695	-----
Tomcod.....	-----	-----	-----	-----	5,322	-----
Tuna—Bluefin.....	-----	2,568,683	-----	698,112	3,266,795	-----
Tuna—Yellowfin.....	-----	-----	-----	-----	4,553,008	-----
Turbot.....	-----	-----	-----	-----	598	-----
Whitebait.....	-----	-----	-----	-----	149,080	-----
Whitefish.....	277	22,645	-----	28,427	287	287
Yellowtail.....	-----	30,843	225	78,550	29,745	94,838
Miscellaneous.....	-----	36,935	711	-----	65,093	73,231
Total fish.....	162,890	28,702,894	1,178,910	6,126,226	45,495,174	12,014,999
Crustaceans:	-----	-----	-----	-----	-----	-----
Crabs.....	-----	-----	-----	-----	7281,136	-----
Shrimps.....	-----	-----	-----	-----	636,995	-----
Spiny Lobsters.....	-----	-----	-----	-----	114,948	114,948
Mollusks:	-----	-----	-----	-----	-----	-----
Abalones.....	8,445	-----	-----	-----	1,069,441	413,294
Clams—Cockle.....	-----	3,138	-----	-----	19,601	-----
Clams—Mixed.....	-----	-----	-----	-----	1,765	-----
Clams—Pismo.....	24,236	-----	-----	-----	25,740	-----
Clams—Softshell.....	-----	-----	-----	-----	29,882	-----
Cuttlefish.....	-----	-----	-----	-----	33,363	-----
Mussels.....	-----	-----	-----	-----	913	-----
Oysters—Eastern.....	-----	-----	-----	-----	869,299	-----
Oysters—Native.....	-----	-----	-----	-----	25,215	-----
Squid.....	-----	-----	-----	-----	3,250,939	-----
Miscellaneous:	-----	-----	-----	-----	-----	-----
Turtles.....	-----	-----	-----	-----	-----	2,158
Totals.....	195,571	28,706,032	1,178,910	6,126,226	50,839,463	12,545,399

7 11714 dozen.
 8 314,998 shell oysters.

CORRECTION

In the California Fresh Fishery Products Report for the months of January, February and March, 1929, which appeared on page 296 of *California Fish and Game* for July, 1929, Vol. 15, No. 3, the sardine catch at Monterey should read 99,405,081 pounds. This addition of 1,315,626 pounds should also be added to the total sardine catch and to the totals for Monterey District and for the state.

SEIZURES OF FISH AND GAME

April, May, June, 1929

Abalone	pounds	1193
Barracuda	pounds	6505
Bass, black		185
Bass, striped		253
Bass, striped	pounds	68
Bluegill, perch, crappie		973
Catfish	pounds	424
Clams		2450
Crabs		301
Grunion		182
Halibut	pounds	270
Lobsters	pounds	471
Salmon		11
Sturgeon	pounds	83
Trout		592
Trout	pounds	107
Deer		2
Deer meat	pounds	562
Doves		3
Ducks		25
Mudhens		1
Nongame birds		42
Pheasants		1
Pigeons		3
Quail		20
Rabbits		62
Shorebirds		3
Set lines		1

GAME CASES

April, May, June, 1929

	Number arrests	Fines imposed	Jail sentences (days)
Violations of Hunting License Act	15	\$280 00	--
Deer; closed season	17	1,000 00	--
Quail; closed season	7	725 00	40
Nongame birds; killing of	9	185 00	--
Snipe, plover; closed season	1	75 00	--
Pigeons; closed season	1	25 00	--
Mudhens; closed season	4	40 00	--
Rabbits; closed season	15	470 00	--
Doves; closed season	2	100 00	--
Pheasants; closed season	1		160
Night shooting	2	25 00	--
Firearms in game refuge	4	25 00	--
Trapping License Act	3	20 00	--
Shooting from automobile	2	40 00	--
Bird nets; possession of	1	50 00	--
Totals	84	\$3,060 00	200

FISH CASES

April, May, June, 1929

	Number arrests	Fines imposed	Jail sentences (days)
Violations of Angling License Act	99	\$1,642 00	7
Trout; closed season; selling of	71	1,829 00	1
Clams; undersize; overlimit	49	1,301 00	45
Striped bass; undersize; overlimit	32	1,175 00	25
Abalones; undersize; overlimit	123	3,288 00	--
Sunfish, crappie; overlimit	14	370 00	--
Black bass; small	27	540 00	--
Crabs; small; female	12	350 00	--
Catfish; closed season	1	25 00	--
Lobsters; closed season	1	50 00	--
Barracuda; small	10	175 00	10
Small fish	1	25 00	--
Illegal nets; set lines	33	2,210 00	--
Violations of Commercial Fishing License Act	20	1,090 00	60
Pollution	3	200 00	--
Night fishing	11	410 00	--
Illegal fishing apparatus	8	200 00	--
Perch; overlimit	5	95 00	--
Grunion; closed season	15	155 00	--
Salmon; overlimit	6	575 00	--
Sturgeon; closed season	1	50 00	--
Eels; small	1	25 00	--
Fishing too near fish ladder	4	50 00	--
Shad; selling of in closed season	1	50 00	--
Totals	548	\$15,880 00	148

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Number 3



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San Francisco, California

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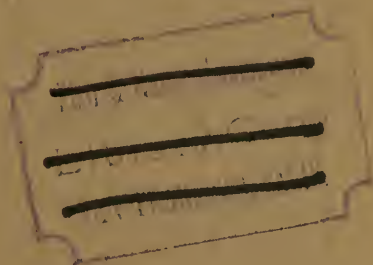
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