CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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CALIFORNIA FISH AND GAME

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Volume 6 SACRAMENTO, OCTOBER, 1920 Number 4

CONTENTS.

DISTRIBUTION OF THE GOLDEN TROUT IN CALIFORNIA.

By S. L. N. ELLIS and H. C. BRYANT.

Fishermen and nature lovers who frequent the wild, rugged climes of the southern Sierra are now, most of them, familiar with the golden trout, *Salmo roosevelti.* This fish is known to excel any other species of trout in beauty, not only because of its well-proportioned form, but more particularly because of its exceptionally brilliant and rich coloration.

There are three recognized species of golden trout: the Little Kern golden trout, *Salmo whitei*; South Fork of the Kern golden trout, *Salmo agua-bonita,* and Roosevelt trout, of Volcano Creek, *Salmo roosevelti.* The Kern trout, *Salmo gilberti,* is the parent species from which the three, afore named, were probably derived; and, so far as is

known, all four species are native to the head waters of the Kern River.

The distinctive characteristics of these diversified types is more readily appreciated if the geographical isolation of their habitat is understood. It has been stated that the Kern trout, *Salmo gilberti,* is the parent species of the golden trout, and as may be inferred from the name, is native to the Kern River. This river is of considerable

FIG. 37. Agua-bonita Falls on Volcano Creek, the stream which is the original home of the golden trout. Photograph by W. Y. Kellogg.

width and flows through a most inspiring, deep, rugged, high Sierran canyon, and in ages past, when the glacial period wrought its stupendous changes, the Kern River trout, native then to not only the Kern River but to its tributory streams—Volcano Creek, South Fork of the Kern and the Little Kern and Soda Creek—became isolated in these different streams by the formation of unsurmountable barriers, and each group being acted upon by the influences of its own peculiar environment, with no opportunity for interbreeding of groups, resulted,

quite naturally, in each one developing in its own distinctive, characteristic way.* And the golden trout, *Salmo roosevelti,* of Volcano Creek, the most radiantly beautiful of them all, became the most individual.

But the changes which Volcano Creek underwent were far more enduring and much more complicated than the changes which occurred in the other streams, for aside from the impassable falls, formed by the wearing down of the stream beds, Volcano Creek, formerly called Whitney Creek, underwent volcanic changes of a more or less unique character, which accentuated the deepening characteristics of the stream, and in all probability temporarily cut it off entirely from the Kern River.

Volcano Creek rises south of Cirque Peak. Several small, clear, mountain streams, having their sources at an elevation of from 10,000 to 13,000 feet, thread their way through picturesque, grassy meadows to the point of confluence. For a distance of about eight miles the creek flows in somewhat of a southerly direction until it enters Toowa Valley, then it turns west in a widening course and joins the Kern River about opposite Soda Spring. The South Fork of the Kern River has its source near that of Volcano Creek and it enters Toowa Valley at about the same place, and in the days when this section of the southern high Sierra was first traversed by white men, the idea was conceived of joining Volcano Creek and the South Fork of the Kern by a tunnel. This was quite possible, for a small ridge less than a hundred yards wide, in parts, and scarcely fifty feet high divided the streams. No doubt at one time the South Fork of the Kern was a natural tributary of Volcano Creek. The tunnel which was made caved in, but in the course of experimentation some of the golden trout escaped into the South Fork. The cut filled up and the two streams again became entirely distinct. Above this tunnel, which is at an elevation of 8600 feet, Volcano Creek flows through meadowy country, the creek bottom being granite sand and gravel; but below the tunnel for a distance of eight miles or so, to the point where the creek enters the Kern River, and at a drop in elevation of 2300 feet, the stream bed is of volcanic character and the stream itself very turbulent. It is not, however, due to the rapids, but to the three falls—Agua-Bonita, with a small fall known as Surby Fall between it and Stewart Fall (second), and the third, Shields—that the trout are barred from traveling from one body of water to the other; and in fact, such natural barriers as these are the cause of fish isolation in the several streams, and of even entire lack of fish in some, where volcanic action and other forces were at play—the streams and lakes are barren, many of them despite a good supply of food.

The value of distributing the golden trout can hardly be overestimated. First, it has saved these beautiful fish from the complete extermination with which they were threatened. Secondly, the trout are being planted in heretofore barren streams and lakes, and therefore they will furnish added fishing grounds for the angler. Too, the fish, without the possibility for interbreeding, will remain the pure type. And third, they are a prolific fish, and, to the delight of all sportsmen, are extremely gamey.

*"The Golden Trout of the Southern High Sierras," by Barton Warren Evermann, 1906. U. S. Bureau of Fisheries Bull. 25, pp. 3-51, 16 pls., 1 map.

The earliest record we have, of the transplanting of the golden trout to streams other than those of their natural hibitat, was in the year 1876. The two Stevens brothers, who had built a small sawmill on Cottonwood Creek, were anxious that the stream be well stocked with fish for their own use. They went over to Mulky Creek, in Mulky Meadows, and procured what in all probability were the *Salmo agua-bonita,* or South Fork golden trout, and planted them in Cottonwood Creek.

In the summer of 1876, Mr. S. L. N. Ellis says: "I was at Mineral King and Mr. Arthur Crowley, former assessor of Tulare County, showed me a single large trout in the creek at Mineral King. He told me that 'uncle' Wiley Watson had brought some trout from the Little Kern via Farewell Gap and had planted them in this stream." The first plant made by Watson reproduced rapidly and furnished the supply for the fishermen at Mineral King until 1894, when the later plants were made. Mr. Ellis caught fish at Mineral King in 1887, while he was out on a hunting and fishing trip in that region. This work was very important for it was the move which undoubtedly interested others in fish planting, and which caused others, later on, to try and accomplish similar plants.

After a lapse of some nine years, G. W. Cahoon contributed his share to the transplanting of the golden trout. Mr. Cahoon was a cattle rancher who during the summer carried butter by pack from the head of the South Fork of the Kaweah over the pass to Inyo County. On his way back he caught the golden trout, *Salmo whitei,* in Soda Creek at Quinn's Horse Camp and planted them in the South Fork of the Kaweah, at Evelyn Lake, where there were no fish.

In 1887, two years after Cahoon had made his plant of *Salmo whitei,* James McIntyre, a sheepman, procured some of the same species of trout at Rifle Creek and planted them in Coyote Creek, a tributary of the Kern.

Again there was a period of trout planting inactivity, but in 1892 Cottonwood Lakes were planted by E. H. Edwards and two friends. Edwards, who was a storekeeper at Lone Pine, desired to improve the fishing conditions in his vicinity, so with James Moffitt and B. H. Dutcher he obtained a catch of *Salmo agua-bonita,* the same variety which had been planted by the Stevens brothers in Cottonwood Creek in 1876, and planted them in Cottonwood Lakes. This plant was apparently very successful, for in 1906 Cottonwood Lakes were reported by the storekeeper of Lone Pine as being unusually well stocked with golden trout.

The year 1892 is especially memorable in the history of the planting of the golden trout in that it was during this season that the first hatchery propagation of the species was undertaken. Too, it was during this year that they were first exhibited to the public. Members of the Visalia Sportsmen's Club had long been desirous that the propagation of this splendid game fish be undertaken, and it was through the interests and efforts of the club that S. L. N. Ellis, equipped with four coal oil cans fitted with baking powder can lids, made a trip to Volcano Creek and procured about a hundred of the fish. These he carried to Lower Funston Meadows. At Funston Meadows he met Lieutenant Deane with a detachment of soldiers patrolling the

Sequoia National Park. Lieutenant Deane detailed two of his men, Sergeant Moffitt and Private Scholberg, to take the fish to Mineral King. There the party was met by J. Sub Johnson and M. L. Weaver, who were members of the club and residents of Visalia. These two men took the fish in a spring wagon to Visalia, and from there they were shipped by train to San Francisco and were delivered to the Fish and Game Commission. The plan was to send the fish to the hatchery at Sisson. However, before the trout were sent on the last lap of their journey, they were exhibited not only at the Midwinter Fair but at Golcher Brothers store in San Francisco. Thirty-six fine specimens were finally shipped to the Sisson hatchery, twenty-one reaching their destination in good condition, but the experiment was not considered satisfactory.

In 1896, the first plant of the true golden trout, *Salmo roosevelti,* was made. All previous plantings had been either of the *Salmo agua-bonita* or *Salmo whitei* variety. During the summer of this year Mr. S. L. N. Ellis, accompanied by his son, L. L. Ellis, and a friend, F. J. Hill, planted the North Fork of the Kaweah—known as Dorst Creek—with fish taken from Volcano Creek, the original home of *Salmo roosevelti.* In the same season, Mr. Ellis in attempting to carry some of the fish from Volcano Creek to the North Fork of Kaweah, found that the trout were not standing the trip well and so decided to plant some of them in the Kaweah near Mineral King, and about twenty-five others, which were sick, in Silliman Creek and Willow Meadow. Nothing was ever heard of the latter plants. When in Mineral King, Mr. Ellis met the artist, Petrie, and showed him the golden trout, which were the first that the painter had seen. He was so charmed by their rare beauty that he soon afterwards used the fish as the subject for a painting.

The following year an unsuccessful plant of the golden trout was made by Mr. J. M. Nelson, in Nelson Creek, a tributory of the Tule River. Also some cattle men carried fish from Whitney Meadows and planted them in Rock Creek. Another plant of trout was made in Rock Creek in August, 1900, by Mr. M. W. Buffington, county surveyor of Kern County. He wrote Major George W. Stewart of Visalia that he and a party of other men carried the trout in small lard cans—about seven in each can—to Rock Creek and turned some of them loose; the rest they carried to the trail crossing and placed them there.

From 1897 to 1908 no authentic information regarding the planting of golden trout seems to be available, and that regarding the seasons of 1897 and 1900 seems to be rather incomplete. However, it was at this time that the government became actively interested in the protection of the golden trout. In 1903, according to Dr. Barton W. Evermann, Stewart Edward White, impressed with the possibility of the extermination of these trout, wrote to George M. Bowers of the Commission of Fisheries and to the President of the United States calling their attention to the matter, and on July 13, 1904, Barton Warren Evermann, Assistant in charge of the Division of Scientific Inquiry, Bureau of Fisheries, with a party outfitted at Redstone Park, Tulare County, left for the Whitney country to investigate the trout of the Kern River region. As a result of the investigation, the true golden trout of Volcano Creek was recognized as a new species, and was

named after the naturalist, Theodore Roosevelt, who at that time was president of the United States.

The United States Bureau of Fisheries made an extended study of the trout, and in 1905 an attempt was made to establish a temporary hatchery station on Volcano Creek in order that the eggs of the golden trout might be obtained. But the spawning season was over before operations could be started. Two hundred and sixty-four trout were taken during the season to the Lewis and Clark Exposition at Portland, but as the result of an accident the entire lot was lost. Aside from the year-round, closed seasons for the golden trout adopted at a later date, the general program suggested was as follows: (1) The catch of golden trout should be limited to less than the number allowed for other trout. (2) Fish culture should be promoted, and (3) the limits of the Whitney Military Reservation should be extended to include the whole of Volcano Creek.

That the fish is a hardy fish seems to have been rather well demonstrated in 1906. In March of that year the Fish and Game Commission undertook to collect some specimens of the fish for exhibition purposes at the "Forest, Fish and Game Exhibit," held in San Francisco. About fifty specimens of the trout, *Salmo agua-bonita* were taken from Cottonwood Creek, a stream the temperature of which is about 38°, and were transferred to water which was about 60° in temperature. They lived in their new environment for some two weeks or more. But at the end of the exhibition period, when the fish were sent to the Sisson Hatchery, about three-fourths of them died, evidently due to the added travel and the more or less depleted condition of the fish. Another instance of their adaptability and hardiness was reported by A. D. Ferguson. In 1913, he investigated a plant made by Deputy Bullard, in 1911. Bullard had stocked a small creek at Traweeks, in Fresno County, with golden trout. The stream is at an elevation of 3500 feet and the temperature during the summer months reaches about 75°. Mr. Ferguson says, "I found golden trout of various sizes in considerable numbers in this creek. A specimen some twelve inches in length, I judged to be one of the original plant."

In 1908 the Sierra Club did some splendid work. The club in making their plants used two ten-gallon Buhl cans with airholes in the covers. On July 7, they caught 110 trout with hook and line, the trout ranging in length from four to six inches. They were secured at the head of Long Meadow on Volcano Creek and were packed for about three hours to a lake in Rocky Basin. Only one fish was found to be dead and that was due to the way in which it had been hooked. On July 15, the head Sierra Club packer, Mr. J. Robinson, and his family caught 54 trout in Rock Creek averaging from 10 to 12 inches in length. They had undoubtedly been planted in the creek several years before. These were taken to a lake at the head of one of the branches of Rock Creek. The third plant, made under the supervision of Mr. Wm. E. Colby, Deputy Fish Commissioner, was of 50 trout from the above named creek. They were planted in Whitney Creek.

According to Mr. A. H. Hogue, forest supervisor of the Inyo National Forest, 600 golden trout from Little Whitney or Long Meadows were taken to Gardner Creek during the same season.

It was in the year 1909 that the Fish and Game Commission first took charge of the planting of the golden trout. Previous to this time the work had been done by sportsmen or clubs at their own expense. After the Commission took hold of the work, improved pack cans were provided and the loss of the fish in transportation was much reduced. The work of distributing the golden trout on the east slope of the Divide was carried on by Deputy E. H. Ober, who in the face of many difficulties successfully transferred 1500 trout, ranging in size from two to seven inches, to Independence, over the Hockett trail. There the outfit was divided, half went over to Kearsarge Pass via Lake Charlotte to Gardner Creek and Gardner Lakes, and the other half went to Grouse Meadows on the head waters of the Middle Fork of the Kings River, via Bishop and South Lake on Bishop Creek. The fish for this plant were obtained by diverting the creek at Long Meadows from its course.

District Deputy A. D. Ferguson of Fresno, assisted by Deputy S. L. N. Ellis in the field, directed the work in the Kern River, Kings and Kaweah basins, on the western slope. Mr. Ellis says in regard to his experience:

"On my return trip from Whitney Meadows, I brought back three mule loads of golden trout for planting in Roaring River and nearby streams with scarcely any loss. This was partly due to improved pack cans, but more especially to the fact that I had learned that the fish can not stand too long a trip. Prior to this time I had made eleven or twelve hours a day and had lost as many as 75 per cent of my fish. On this trip I learned from observation that by making short trips—say of five or six hours a day—a much greater percentage of the fish could be saved. Up to seven hours the fish can keep away from the sides of the cans, even though the trail may be very rough, but after this time they become exhausted and are bruised by striking against the sides of the containers. During the stops made, the cans were set in a creek and fresh water allowed to flow over them. Prior to this time my idea had been to hurry the fish to their destination as quickly as possible."

The following year Mr. Ellis' party took 183 adult *Salmo roosevelti* caught with a seine at Whitney Meadows and planted them in the watershed drained by the tributaries flowing in to Roaring River. They lost only six of the trout although they travelled for six days over 100 miles of extremely rough country. Mr. Ober and his assistants, Sam McMurray and George Hall, in the same year covered about 115 miles and stocked Center Basin and Bench Lake as well as the head waters of the South Fork of the Kings. This made the total plant for July and August, 1910, more than 1800 large golden trout distributed among twenty-three lakes and streams in which no fish had previously existed, but which were rich in fish food. In a recent letter Mr. Ober says, "I felt that the waters I had selected would be ideal for fish, and my judgment seems to have been good, for in 1918 I took two golden trout out of Bench Lake that weighed three pounds each."

The following summer Mr. Ellis and Mr. Ferguson, with a group of friends and assistants, secured over 1300 *Salmo roosevelti,* by changing the course of the stream at Little Whitney Meadows and by hook and

line. Ferguson at this time procured twelve or thirteen *Salmo agua-bonita* golden trout from Cottonwood Lakes and Creek. All of the trout were delivered to the Fish and Game Commission's fish car at Lone Pine and were shipped to the Sisson Hatchery. A few of the *Salmo agua-bonita* were exhibited in Sacramento. Deputy Bullard, who had helped with the pack, took, in the course of the return trip, a hundred trout from Volcano Creek, which he planted in the North Fork of the Kaweah, Indian Basin and Traweek Creek.

Those who visited this great wonderland of the southern Sierra Nevada began to find not only the ordinarily beautiful trout, but in previously uninhabited streams they saw darting forms of gold and silver, and the fishermen rejoiced. However, in order that the pleasure of golden trout fishing might be better assured to the ever-increasing numbers of fishermen, the law which is incorporated in the penal code is as follows:

"633. Every person who, at any time between the first day of October and the thirtieth day of June of the succeeding year, takes, catches, kills, destroys, or has in his possession, any variety of golden trout; or who, at any time, takes, catches, kills, or destroys, any variety of golden trout other than with hook or line; or who, at any time, takes, catches, kills, destroys, or has in his possession, during one calendar day, more than twenty golden trout, or has in his possession any variety of golden trout of less than five inches in length, is guilty of a misdemeanor. Every person found guilty of any violation of any of the provisions of this section must be fined in a sum not less than twenty dollars or be imprisoned in the county jail, in the county in which the conviction shall be had, not less than ten days, or be punished by both such fine and imprisonment, and all fines collected for any violation of any of the provisions of this section must be paid into the state treasury to the credit of the fish commission fund. Nothing in this section shall prohibit the Fish Commission of this state from taking at all times such golden trout as they deem necessary for the purpose of propagation or for scientific purposes."

In 1912 the packhorse distribution work was confined to Madera and Tuolumne counties, so that it was not until 1913 that Deputies Ellis and Smalley, with a splendidly equipped pack train, proceeded with the program for the transplanting of the golden trout. On September 1, Ellis and Smalley left Whitney Meadows with 821 *Salmo roosevelti* to plant Roaring River and tributaries. It had been an unusually rainy season in the mountains, and all during their previous golden trout plants they had been handicapped by finding trails obstructed and streams swollen. The fish, too, were difficult to catch. But undaunted they left Whitney Meadows with the 821 trout, descended the Kern River Canyon, crossed the Kern-Kaweah Divide to Mineral King, ascended Timber Gap, descended again to the Kaweah Canyon, and on over the Kings-Kaweah Divide via Elizabeth Pass to Roaring River. Some of the trout had been in the cans fourteen days, yet despite the hard travel and circuitous route only five trout were lost. At the close of the season 87 plants had been made of the species and with no exception the species used by the Commission in the golden trout plants had been the *Salmo roosevelti*.

About 5000 adult golden trout, *Salmo rooseveltí,* were taken with hook and line in 1914, and were transplanted to barren waters. Thus the range of the trout was extended for more than 150 miles along the summit of the Sierra from Volcano Creek.

One thousand nine hundred seventeen marked a new step in the distribution of the golden trout. In that year it was decided to undertake the propagation of the golden trout. Cottonwood Lake, though situated in an inaccessible part of Inyo County, was decided upon for the spawning station, and despite the difficulties which had to be surmounted 500,000 eggs were taken and were successfully transported by pack animal to the new Mount Whitney Hatchery. At the hatchery they were "eyed" and afterwards were distributed in the waters of that section. It is from the Mount Whitney Hatchery that the more recent plants have been made, and Mr. Ober reports that during September and October of 1919, he made plants of the trout in two beautiful lakes at the head of Woods Creek, Little Pine Creek and South Fork Lake on Big Pine Creek. Several plants have also been made in Yosemite National Park.

FIG. 38. Spawning golden trout at Cottonwood Lakes. Photographed by N. M. Scofield.

Thus it is that through long endeavor and splendid cooperation this marvelously beautiful golden trout, a fish that appeals to every sportsman, has been protected, and distributed in one of the most inspiring sections of the Sierra Nevada Mountains.

TABLE SHOWING PLANTS OF GOLDEN TROUT.

Date planted	Lake or stream	By whom planted	Source of supply	Species
1876	Cottonwood Creek	A. C. Stevens, S. V. Stevens and Thos. George.	Mulky Creek in Mulky Meadows	*Salmo agua-bonita*
1876 or 1875	East Fork of the Kaweah at Mineral King.	Wiley Watson and others	Upper Little Kern	*Salmo whitei*
Late 70's	Lady Franklin Lake	Arthur Crowley, W. A. Ward, Wiley Watson.	Little Kern, "over the divide"	*Salmo whitei*
1880	Upper and Lower Monarch Lake and Mineral King Creek.	Mark Lavelle and "Nick" Wren	Little Kern, "over the divide," or Farewell Gap.	*Salmo whitei*
1885	Head of South Fork of the Kaweah near Evelyn Lake.	G. W. Cahoon	Soda Creek at Quinn's Horse Camp	*Salmo whitei*
1887	Coyote Creek (tributary to Big Kern)	Jas. McIntyre	Rifle Creek	*Salmo whitei*
1892	Cottonwood Lakes	E. H. Edwards, Jas. Moffitt, B. H. Dutcher.	Cottonwood Creek	*Salmo agua-bonita*
1892	Wet Meadows (head of South Fork of Kaweah).	G. W. Cahoon	Little Kern	*Salmo whitei*
1892	Exhibited in San Francisco; taken to Sisson Hatchery.	Caught by S. L. N. Ellis; delivered at Lower Funston Meadows to Sergeant Moffitt and Private Scholberg; Mineral King, M. L. Weaver and J. Sub Johnson.	Volcano Creek, above bridge	*Salmo roosevelti*
1896	North Fork of the Kaweah (known as Dorst Creek).	S. L. N. Ellis, L. L. Ellis and F. J. Hill	Volcano Creek	*Salmo roosevelti*
1896	Marble Fork of the Kaweah(?) Siliman Creek.	S. L. N. Ellis	Volcano Creek	*Salmo roosevelti*
1897	Nelson Creek (tributary of the Tule River)	J. M. Nelson	Volcano Creek	*Salmo roosevelti*
1900	Rock Creek	M. W. Buffington	Volcano Creek(?)	*Salmo roosevelti*
1906	Exhibited in San Francisco; taken to Sisson Hatchery.	R. W. Requa	Cottonwood Creek	*Salmo agua-bonita*
1908	Whitney Creek	Sierra Club	Whitney Meadows	*Salmo roosevelti*
	Crabtree Meadows	Sierra Club	Whitney Meadows	*Salmo roosevelti*
	Rock Creek	Sierra Club	Long Meadow	*Salmo roosevelti*
	Lake at head of Rock Creek	Sierra Club	Rock Creek	*Salmo roosevelti*
1908	Gardner Creek	George Hall, Ben Ransom	Little Whitney Meadows	*Salmo roosevelti*
1909	Gardner Creek (South Fork of Kings)	E. H. Ober, Geo. Hall, Ben Ransom, Frank Lenott and Sam McMurray.	Little Whitney Meadows	*Salmo roosevelti*
1909	Grouse Meadows and lakes in vicinity	E. H. Ober, Henry Bell	Whitney Meadows	*Salmo roosevelti*
1909	Crabtree Fork of Big Kern	S. L. N. Ellis	Whitney Meadows	*Salmo roosevelti*
	North Fork of Kaweah	S. L. N. Ellis	Whitney Meadows	*Salmo roosevelti*
	Whitney Creek	S. L. N. Ellis	Whitney Meadows	*Salmo roosevelti*
	Guitar Lake	S. L. N. Ellis	Whitney Meadows	*Salmo roosevelti*

	Rock Creek	S. L. N. Ellis	Whitney Meadows	*Salmo roosevelti*
	Lakes on Rock Creek	S. L. N. Ellis and J. H. Shallenberger	Whitney Meadows	*Salmo roosevelti*
1910	Waters flowing into Big Kern from east; Lake South America; Rock Creek; Perrin Creek; Table Creek; Guyot Creek; Lake Monotha; Monotha Creek; Lake Bernice; Neds Lake; Lake Aldula; both branches East Fork of Big Kern; Crabtree Creek; Lone Pine Creek; Kaweah Deadman's Creek.	S. L. N. Ellis, E. C. Ferguson, Ray C. Ellis.	Whitney Meadows	*Salmo roosevelti*
1910	Clover Creek; Boggy Meadows; Freeman Creek; Lloyd Meadows; Peppermint Creek in five places.	A. D. Ferguson, S. L. N. Ellis, Ray C. Ellis.	Little Kern	*Salmo whitei*
1910	Headwaters of the South Fork of Kings River, upper basin; Bench Lake, center basin; head of Bubbs Creek, East Vadette Meadows	E. H. Ober, George Hall, Sam Murray	Volcano Creek	*Salmo roosevelti*
1911	North Fork Kaweah; Indian Basin Creek; Traweek Creek.	F. A. Bullard	Volcano Creek	*Salmo roosevelti*
	Sisson Hatchery	Jack Broad, K. L. Hughes, S. L. N. Ellis, F. A. Bullard, A. D. Ferguson	Volcano Creek	*Salmo roosevelti*
1913	Unnamed lakes and small streams of Kern River; watershed lying west of Whitney Divide and drained by Tyndall Creek, Whitney Creek, Crabtree and East Fork of Kern.	S. L. N. Ellis, E. W. Smalley	Big Whitney Meadows	*Salmo roosevelti*
1913	West Fork of Roaring River (tributary to South Fork of Kings River) and streams and lakes tributary to Deadman's and Sugar Loaf creeks.	S. L. N. Ellis, E. W. Smalley, F. A. Bullard	Whitney Meadows	*Salmo roosevelti*
1914	Desolation Lake; unnamed lakes on south side of Piute Creek; Piute Creek; French Canyon Creek.	S. L. N. Ellis, E. W. Smalley, A. D. Ferguson, P. G. Redington, F. A. Bullard, O. P. Brownlow and others.	Whitney Meadows	*Salmo roosevelti*
1914	Heart Lake; Marie Lake; headwaters of Bear Creek; Shadow Creek.	F. A. Bullard, O. P. Brownlow	Whitney Meadows	*Salmo roosevelti*
1914	Shadow Lake; Garnet Lake; streams in vicinity of Thousand Island Lake, tributary to South and Middle forks of San Joaquin; Middle Fork of San Joaquin at Agnew Meadows.	F. A. Bullard and O. P. Brownlow	Whitney Meadows	*Salmo roosevelti*
1914	Tributaries of upper Big Kern; lakes in vicinity of Mount Geneva; Craig Ericson; Cliff Creek; Middle Fork of Kaweah; Lone Pine; Meadow Lake; Tamarac Lake.	Carl Westerfeld, R. D. Duke, A. D. Ferguson, S. L. N. Ellis, F. A. Bullard, O. P. Brownlow and others.	Whitney Meadows	*Salmo roosevelti*

Date planted	Lake or stream	By whom planted	Source of supply	Species
1914	Horse Corral Creek; Lewis Creek; Wildman Creek; Slide Creek; Kennedy Creek and tributary lakes; lake at head of Lost Canyon; Grizzly Creek at Burns Meadows.	F. A. Bullard, Walter Williams	Whitney Meadows	*Salmo roosevelti*
1917	Vicinity of Mount Whitney Hatchery	F. A. Shebley	Spawning station to Whitney Hatchery (station is on Cottonwood Lakes).	*Salmo agua-bonita*
Sept., 1919	Head of Little Pine Creek; South Fork Lake on Big Pine Creek.	E. H. Ober	Mount Whitney Hatchery	
Oct., 1919	Two lakes at head of Wood's Creek; Southeast Fork of Kings.	E. H. Ober	Mount Whitney Hatchery	

THE GROWTH OF THE SWELL SHARK WITHIN THE EGG CASE.*

By Helen M. Edwards.

On March 17, 1920, a young shark in the egg case was received from Mr. Kiati Nasu, secretary of the Southern California Fishermen's Association, through the kindness of Mr. E. M. Nielsen, of the Fish and Game Commission at San Pedro, and of Mr. Lingle, of the Bureau of Fisheries, who brought it to Hopkins Marine Station, Pacific Grove. The development of the fish has been watched with much interest, because the species was unknown and the process of development had not been seen in any of our western sharks.

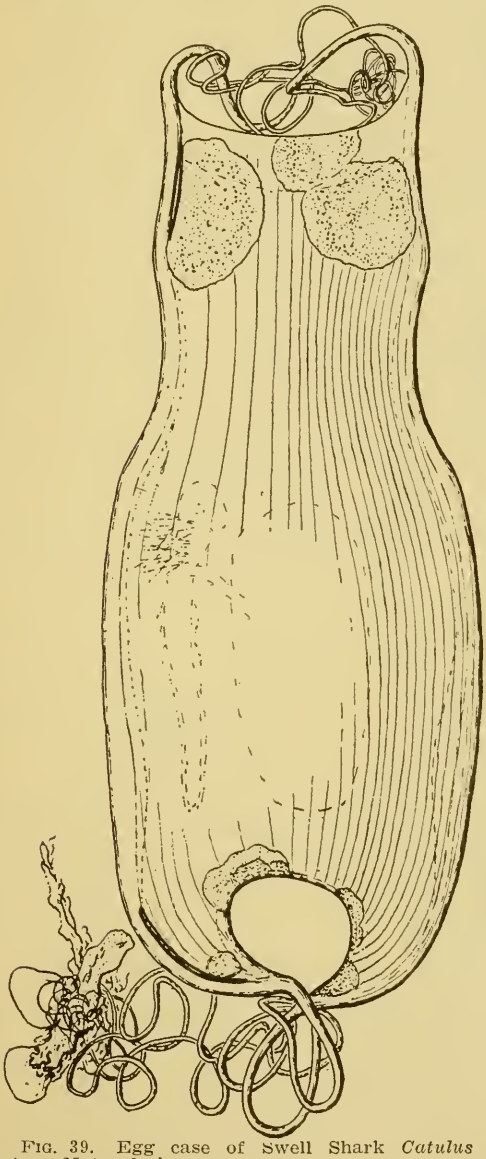

Fig. 39. Egg case of Swell Shark *Catulus uter*. Natural size.

Upon receipt of the shark it was placed in a small salt water aquarium with running water, where it was kept during its development. At various times the aquarium was out of order, which made it necessary at such times to change the water on the fish two or three times a day or to move it into another aquarium. It is a question whether or not the process of development was retarded or hindered in any way by these disturbances. We are under obligation to Stanford University and to Dr. W. K. Fisher, the director of Hopkins Marine Station, for the use of the aquarium.

The case, as shown in the accompanying drawing, was 116 mm. long and 49 mm. wide. One end, comprising about one third of the length of the case, was considerably smaller, and of a different shape from the larger end. The acute angles of the latter met and continued in long slender tendrils, for the purpose of attaching to seaweed, while similar tendrils were also given off from the angles

*California State Fisheries Laboratory, Contribution No. 20.

at the smaller end. The position and size of the fish and yolk, as seen through the opaque, dark brown, leathery case, are indicated in the drawing by broken lines. The fish was probably very young, for its length at the time of receiving was 43 mm., which exceeded the yolk by only 3 mm. The egg case had growing on it at each end colonies of bryozoans, which died and had soaked off by the end of four months.

At first there were no apertures in the case which could be detected, although each end contained two slight grooves, shown in the figure, situated on opposite sides of the case. To one facing the egg case, with the smaller end up, one groove was visible at each end on the left hand side. The other two grooves could not be seen without turning the case over, which would bring them on the left hand side. Those at the larger end were about 20 mm. long, and those at the smaller about 11 mm. On April 3 a small air bubble was visible inside the case, which proved the presence of an aperture. Upon examining the case and squeezing it gently it was found that water squirted out through a small slit at the larger end, which was one of the grooves beginning to open. By April 15 the other groove at the larger end and on the opposite side had opened. A little carmine was placed with a pipette near the apertures, but no marked current was visible. By May 20 both of the grooves at the smaller end had opened. These apertures, when completely opened, were about 1 mm. wide.

Attempts were made to measure the fish, but the results are only approximate on account of the opacity of the egg case, and of its constant activity, especially at first. The measurements were not taken at regular intervals, but the following table will give some idea of the rate of growth:

Date—1920	Length of Fish	Width of Head
March 17	43 mm.	
April 15	60 mm.	
April 29	67 mm.	
May 20	81 mm.	
May 25	87 mm.	16 mm.
June 7	104 mm.	19 mm.
June 17	115 mm.	22 mm.
June 24	123 mm.	25 mm.
July 6	130 mm.	26 mm.
August 19	155 mm.	27 mm.

Measurements were also taken of the yolk, the diminution of which is shown by the following table:

Date—1920	Length of Yolk Sac	Width of Yolk Sac
March 17	40 mm.	
April 15	37 mm.	
April 29	37 mm.	
May 20	35 mm.	
May 25	31 mm.	20 mm.
June 7	27 mm.	17 mm.
June 17	24 mm.	13 mm.
June 24	20 mm.	12 mm.
June 28	17 mm.	
July 1	14 mm.	
July 6	10 mm.	
July 17	5 mm.	
July 28	3 mm.	

Up until April 15, the yolk, though shortening, had kept the same general oval shape. At this time it became narrower and somewhat

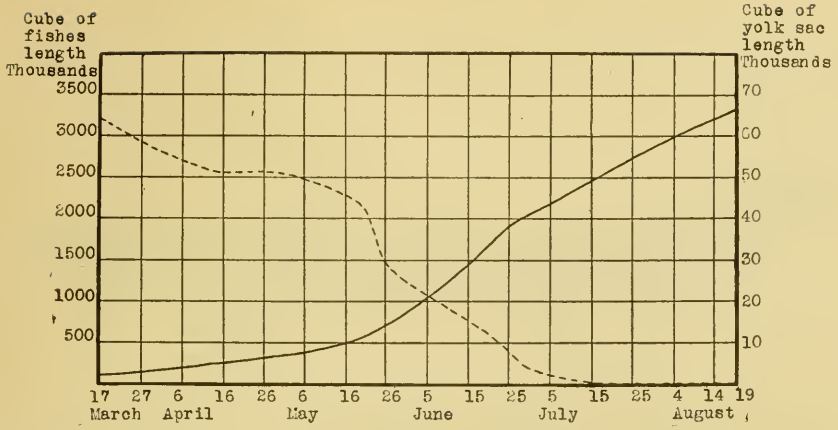

FIG. 40. Rate of growth of body and diminution of yolk of Swell Shark.
———— Bulk of fish according to cube of length.
– – – – – Bulk of yolk according to cube of length.

irregular in outline, but resumed the more oval appearance about May 25. By July 17 the yolk seemed to be entirely absorbed, leaving only a small round sac at the end of the umbilical cord, which was only about one-half of its original length, and by July 28 was reduced to less than an eighth of an inch and gave the appearance of a tiny knob on the ventral side of the fish. After hatching the only evidence of the cord was a little spot about the size of a pin head.

The rate of growth of the fish and the diminution of the yolk are shown in the accompanying chart. It will be noted that after the external yolk had been absorbed, about July 17, the fish continued steadily to grow, due probably to an internal supply of yolk. (See diagram.) Note also that from April 15 to 26 there was no change in the yolk shown in the curve, probably due to the fact that at this time the yolk was changing in shape somewhat and becoming narrower, while the length remained constant.

By May 20 the gill filaments, which were long and kept in constant motion by the movements of the fish, had entirely disappeared. They had been present in each gill slit and in the spiracles. Subsequent to this the breathing motion of the mouth was observed.

The color of the fish in the early stages was a uniform whitish. On May 25 a few dark spots were observed on the fins and by June 7, over ten weeks

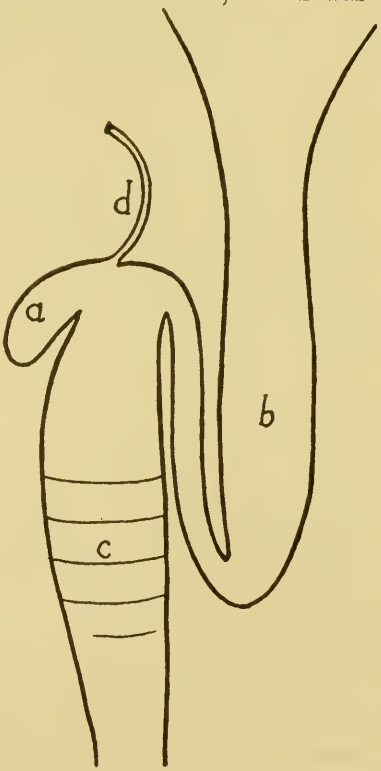

FIG. 41. Diagram showing internal attachment of so-called umbilical cord. *a.* Solid body filled with yolk. *b.* Stomach. *c.* Spiral valve. *d.* Umbilical cord.

before hatching, nearly the whole body was covered with about eight or nine pairs of black bands. At the time of hatching this distinct band effect was somewhat destroyed by the round black spots scattered on the bands.

The fish showed extreme activity at first, wriggling constantly and rhythmically, so that the taking of measurements was quite difficult. The most persistent motion was the back and forth movement of the tail, but occasionally the fish would curl itself into a tight knot and sometimes exhibit such violent activity, wriggling, squirming and flopping about, that it seemed likely to wrench itself loose from the yolk. Such violent activity usually lasted only a few seconds. Most of the time the movements of the tail back and forth were quite regular, while at other times they were very irregular and jerky. These were counted at various times and under various conditions. They seemed to be fewer and more regular in the shade than in sunlight. The experiments were as follows: when the fish was put in a shallow pan and placed in the shade, the tail moved very regularly back and forth from 60 to 70 times per minute; then when placed in the sun the motion became irregular and the count increased to as many as 120 per minute; the fish being placed in the shade again they were irregular and many at first, then dropped down to 78 per minute and became very regular; the pan being again placed in the sun, the movements were only 63 and very regular at first, but soon increased to 115 and were irregular; put back in the shade they decreased to 94. The probable purpose of the movements of the tail was to aerate the water by keeping it in circulation. By May 25 the fish did not show such constant activity. There would be long intervals of very little movement, if any, but at this time when the tail was in motion there were 110 movements counted per minute.

The night of May 25 the fish was left in the shallow pan on the table over night, on account of the failure of the water supply, and the next morning the sun had been shining upon it for some time until the water was almost hot. The fish was stretched out on its back with its mouth wide open, and showed no signs of life whatever. The water was cooled gradually, and within an hour the fish was as active as ever.

As the shark grew larger the activity decreased decidedly. By June 7 it was very inactive. Immediately after it was transferred from the aquarium into a glass jar, there were counted 125 movements per minute of the tail, and then all motion ceased until the fish was placed in the sun, when the activity was resumed. The light of the sun seemed always to increase the activity. When the egg case was handled or poked the fish would curl its tail around the yolk, then remain quiet. By June 17 the tip of the tail when curled around the yolk would reach the tip of the snout. During the last two months of its existence in the egg case, the fish was most inactive and the mouth movements were not always perceptible. At such times it was doubted if the fish were still alive. It was usually, however, with the exception of the last two weeks, sensitive to a jar of any kind. There was evidently more activity than was observed, for the head of the fish was not always in the same end of the case.

The evening of August 19, five months after having been received, the egg case was hanging perpendicularly in the water with the smaller end up, and the head of the fish toward this end. During the night the shark struggled up through this small end, splitting it entirely across the top, freed itself from the case, and was found the next

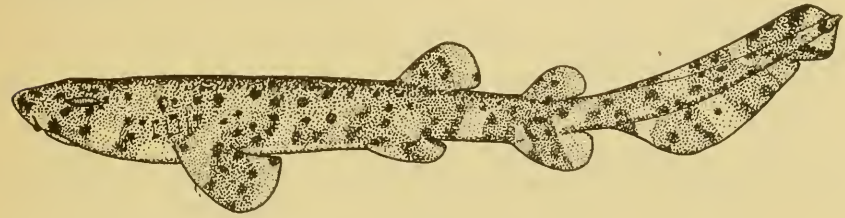

FIG. 42. Swell Shark, *Catulus uter*, the day after hatching. Natural size.

morning reposing on the bottom of the aquarium. The egg case was then examined and it was found that beyond this opening through which the fish had slipped the case was unbroken. One of the slits at this end had aided in making the exit a little larger. The shark was very inactive and remained in one place for a long while, only occasionally moving the fins or tail slightly. During the day it moved about somewhat on the bottom of the aquarium. The next day it was taken out and identified as *Catulus uter*, Jordan & Gilbert.

Figures showing the egg case and the fish immediately after hatching accompany this article.

NOTES ON DRY-FLY FISHING. No. 5.

By R. L. M., California.

SCENE: Camp fire in front of the hotel.

TIME: Evening of the day described in the July issue of California Fish and Game.

Dramatis personæ:

ANGLER.
TOURIST.
MRS. TOURIST.
SECOND TOURIST.
THIRD TOURIST.

Tourist: Here comes Angler. He promised to come around after supper. Angler, let me introduce you to my wife and the rest of our party.

Mrs. Tourist: Those trout we had for supper were delicious. They were so very much better than those that we caught at Pine Lake. I wonder why?

Angler: The fish we caught were stream fish and were in the pink of condition, for they had been feeding on insects, which is the best kind of food for a trout. Furthermore, they were in their natural

environment. On the other hand, the fish in Pine Lake were Steelhead trout that, due to the formation of the country, can not run to the sea. The result is that their natural period of spawning is delayed, and I expect you saw the fish that you caught were not so plump as the stream fish were.

Second Tourist: They did not seem to put up much of a fight when hooked. They just gave one jump and then were brought in without any further struggle.

Third Tourist: Don't the fish in Pine Lake ever get into good condition?

Angler: In about six weeks time there will be a great change in them. It takes time for them to recover from spawning, particularly so as they have to get back into condition in a fresh water lake, rather

FIG. 43. Proper method of holding dry-fly rod. Photograph by R. L. M.

than in their real environment, the sea. Early in the season they are good, but they begin to fall off about the middle of June, and it is not until the latter part of August that they become fit again.

Mrs. Tourist: My husband has been telling us of the wonderful sport you had today. I wish we had been along instead of going over that rough road to the lake.

Second Tourist: Why didn't you begin to fish as soon as you reached the river? Tourist tells me that you waited for nearly half an hour before you began fishing.

Angler: When trout are not feeding on the surface it is very difficult to induce them to rise to a dry fly. One or two authorities on the art have stated that when the exact position of a fish is known, it can sometimes be coaxed to take a dry fly, if the fly is floated over it

a number of times. In order to be successful, it is necessary to cast as many as twelve or more times over the fish. Each cast has to be letter perfect and the fly should not be lifted off the water until there is absolutely no chance of frightening the fish. One mistake spoils everything. If the suspicions of the fish are once aroused, he loses all interest in the proceedings.

The theory is that by making a number of casts over the fish, you create in his mind the belief that there is a hatch of some fly coming on, and so long as no mistakes are made, the effort may eventually be successful. The fish in this river, however, seem to feed mainly on grasshoppers, and during the time that the grasshoppers are present in large numbers they pay very little attention to anything else.

Third Tourist: Don't the fish feed in the evenings, when there are generally lots of flies on the water?

Angler: Not during the time of the harvest of 'hoppers. You will notice a lot of small fish and some chubs feeding on these flies; but the larger fish are resting while their heavy meal of 'hoppers is digesting. Whenever you happen to be fishing in a stream where you know there are good-sized trout and you catch nothing but small ones, you can make up your mind that the big fellows are not feeding. When they do feed the little trout keep out of the way.

Second Tourist: Then as I understand it, when the fish are not feeding on the surface, a dry fly is not much good.

Angler: That is correct with one exception—there is of course the possibility of getting an odd fish by creating an artificial rise of fly. When the dry fly does not produce results, then we change over and fish with a wet or sunk fly and quite possibly get some fish.

Third Tourist: Why didn't you fish with a wet fly while you were waiting this morning?

Angler: First of all, I knew it was only a question of a comparatively short time before the 'hoppers would begin to fly. Then, again, these fish are shy. They are very wary and not easy to catch, as the result of the continual fishing that goes on day after day throughout the entire open season. I considered it best not to add still further to their education by raking the water with a wet fly when I was so sure that they would soon be feeding on the top.

Tourist: You remember speaking about "drag"? Should a dry fly always float with the stream and never move at all on the surface?

Angler: In general, yes. But there are times and occasions when a deliberate drag, that is, a drag produced by the fisherman himself, may get a fish to rise, when possibly if no drag had been made, he would pay no attention to the fly.

Second Tourist: This sounds interesting. Can you give an example from your own experience where a forced drag was successful?

Angler: Yes. A few weeks ago I was fishing farther north. During the latter part of the afternoon a lot of small sedge flies hatched out and got onto the water. These flies belong to a different family than that to which the majority of the flies that we see belong. The sedge flies light on the surface; fly up a short distance and light again. When they are on the surface, they frequently move, sometimes even

running along the top of the water for a short distance. In olden times the antics they performed earned them the name of "caperer." On several occasions on this trip I placed my fly over a rising fish without any result. The fish was not "put down," because it went on rising. Finally, I decided to see what effect it would have if I made my fly copy the motions of the flies on which the fish were feeding. I had already cast three times for the particular fish that I was going to experiment on. However, I cast and as soon as the fly got near the place where the fish was feeding, I deliberately made the fly move slightly on the surface of the water. Well, the fish fell for it and I got him all right.

The same scheme worked again successfully once or twice, but until it has been further tested, it can not be regarded as a standard tactic to adopt. There will always be the doubt, "would not the fish have taken the fly without the artificially-produced drag?"

The fish in that section were harder to catch than the fish here in the river.

Second Tourist: Well, all I can say is—they took "some" catching if they were harder to catch than these boys here. Yesterday I fished for fully two hours, and never got a single bite. At home, I can always get a mess of trout without any trouble at all.

Third Tourist: Back where we come from, we never see as many people fishing as we have seen here. I expect that has something to do with it.

Second Tourist: You spoke of "drag" just now. I don't quite get you. What does it mean?

Angler: "Drag" is a term used to define the unnatural movement of the artificial fly on the surface of the water. The duns and spinners, Ephmeridæ, do not move on the surface, they merely float quiescent. Now, if an artificial fly that is intended to represent one of this family should suddenly start across the water leaving a wake behind it, the suspicions of the trout would be aroused at once and it would undoubtedly let "that queer acting fly" pass on. If they are very wary, they stop feeding for awhile, or as the expression goes they are "put down," which means that they gently sink to the bottom of the stream and do not come up again for some time.

The water, where I experimented with a forced drag, was very slow moving, so much so that to all intents and purposes, there was no current at all. The surface was like polished glass. Unless there is a breeze to ruffle the water the fish are always difficult to approach under such conditions. The forced drag was successful when there was no air stirring. As I remarked before, the fish were feeding on a small sedge fly. I had only one fly of this type with me, namely, "the Welshman's button." The fly was so totally unlike the natural one that I did not expect to do any good with it. However, I had lately been reading a book by "Red Quill" (James Englefield), who is an authority. He stated that he fished an entire season with only one pattern of fly, namely, the "red quill." He used it rain or shine, when the fish were rising to duns or spinners, and also when they were feeding on sedge flies. Thinking of his success I put on a small red

quill and had some very satisfactory results from it. I also tried a Wickham's fancy, and was not exactly disappointed with what took place.

Third Tourist: But tell us, what causes "drag" and how can you prevent it?

Angler: There is not much danger of a "drag" where the surface currents are steady. But if the stream is faster or slower at the spot where the feeding fish lies than it is between that spot and the place where you are standing, there is bound to be a drag if your line falls straight across the water.

Third Tourist: But why?

Angler: Because as soon as the line begins to float down, the swifter portion of the surface makes the line belly out. This causes the fly at the end to move toward the belly of the line, in other words, to "drag" on the surface. This can be corrected, to a certain extent, by causing the line to fall in a curve, either up or down stream, as the current requires.

Second Tourist: But how can you make the line fall as it should?

Angler: By making the cast in a horizontal plane—side stroke—instead of a vertical plane, or overhead stroke.

Third Tourist: Tourist tells me that you hold your reel with the handle pointing to the left. Don't you find it rather awkward to wind up the line with the left hand?

Angler: Not so that you would notice it. I have brought some of my junk along and by using it to demonstrate with, I may be able to explain why I do this. Incidentally, I might remark that professional opinion tells me that my method is the right way, or as an authority recently told me, it is "academically the right way to fish."

Mrs. Tourist: What do you call "professional opinion?"

Angler: The expressed views of some of the leading manufacturers of fishing tackle.

Now, here is my rod with the reel on it. (See Fig. 43.) You will observe that I hold the line with my second finger. It has the longest reach and consequently I can, without moving the rest of my hand, get hold of the loose line and secure it with less trouble than any of the other fingers. To release the line, when I have hooked a good, gamey fish, I merely straighten out my finger for a moment. If I use the reel in this manner I am never bothered with slack line, for as soon as the fly is delivered, I wind up any line that may be hanging in a loop. The second finger reaches out and hooks onto the line and brings it down to the hand grasp as you see now. If the handle of the reel stuck out to the right I could not do this, unless I had a third or supplementary arm and hand on the right side. I will admit that with one exception all the angling writers advocate the handle of the reel to the right, but anyone who has tried the other way and learned how to wind with the left hand, which is extremely easy to do, never goes back to the other position.

Third Tourist: There is something in that. But don't you find that you lose more fish your way?

Angler: My experience has shown me that adopting my method produces just the opposite result. For instance, I was fishing in a place where the fish, although they were large, were few and far between. One day I kept careful count of the rises I had. They totalled exactly three; not thirty-three, but three. How many of those rises do you suppose I hooked?

Tourist: One out of three would be a fair average. Two out of three would be remarkable. How many did you hook?

Angler: All three. Two of the fish were landed; the third got off by coming a few feet towards me and darting off under a sunken log. I couldnt keep him out because the only possible method would have been to push him away with the line, which was impossible.

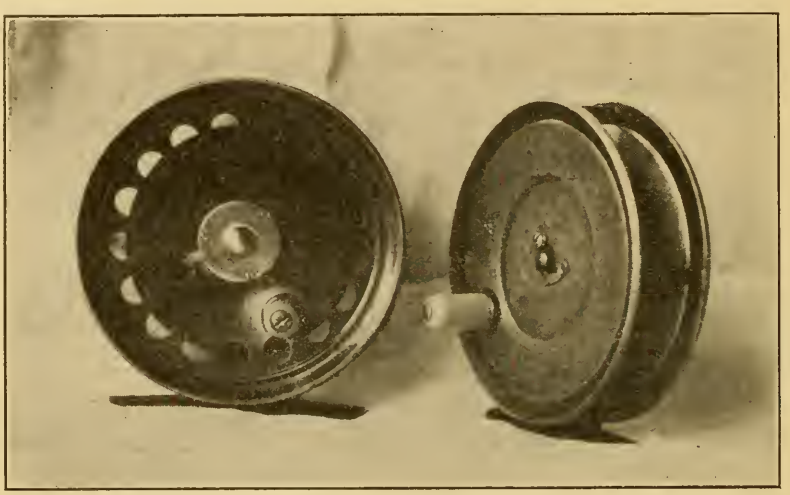

FIG. 44. A good type of reel for a dry-fly rod. Photograph by R. L. M.

Second Tourist: Won't you show us the rest of your paraphernalia?

Angler: Here are a couple of modern fly reels. (See Fig. 44.) They are short length spools of large diameter. Consequently, you can wind up line very fast with them.

Third Tourist: Did you ever use an automatic reel?

Angler: No. I do not think that they are satisfactory. The reel, besides being used as a device to care for the spare line, acts as a counter weight and balances rod. The weight of an automatic reel is so great that it overbalances any normal fly rod.

Here is an old-time fly box. This is known as the "Houghton" fly box and has been made for a number of years. I have had this particular one ever since 1899, but it is still in fair condition.

Tourist: Why the "Houghton"?

Angler: It is named after a famous old fishing club of that name. Ever since 1822, the club has leased or owned riparian rights on the

Test, a river in the south of England, which is noted for its trout fishing and more particularly for the dry-fly branch of that art.

Mrs. Tourist: You have quite a nice collection of flies in that box. I notice that they seem to be graded from quite dark flies to some that are nearly white in their general makeup. Is it necessary to have many different kinds of flies?

Angler: Not absolutely. There are twelve different patterns there. As a general rule, there is sufficient variety in such a collection to find the right fly for the fish. The grasshopper fly is not there, but

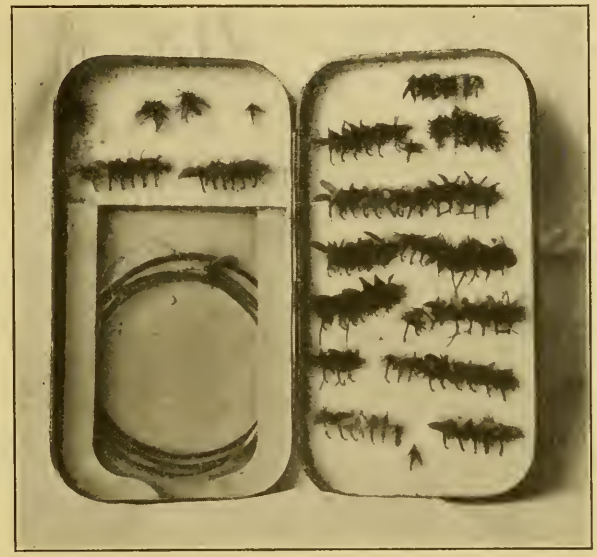

FIG. 45. Fly box and dry flies. Photograph by R. L. M.

that fly is more or less a purely local pattern. By that I mean, it would be worse than useless, unless, the fish were feeding on 'hoppers.

Mrs. Tourist: What are the names of your flies?

Angler: Well, here I have the red quill. These are Wickham's fancies. For a very light-colored fly, I use this, which is called Kingsley's cocktail spinner. The opposite, or the prince of darkness, is this one, which is known as Greenwell's glory. This is the medium olive dun, and this one is the witchurch dun. Then here is that old standby the hare's ear. This fly won distinction, for it was with it that the largest trout ever caught with the dry fly was hooked.

Third Tourist: How big was it?

Angler: It weighed twelve and three-quarters pounds and took one hour and a quarter to land. Its fortunate captor was the Reverend S. E. V. Filleul of Wareham.

Third Tourist: Some fish, I'll say so!

Angler: This fly is the whirling blue dun, and here we have the pink lady, the invention of Mr. George M. La Branche of New York. This animal with no wings is Tup's indispensable, which is supposed

to represent the fly just at the moment it reaches the surface, before it has gotten rid of its outer skin and put its wings out. Finally, here we have the "whole dam dun family" and the "blood relation" or "first cousin" to the "dam dun family."

Second Tourist: Why such a name for a poor inoffensive fly?

Angler: This fly is intended to be a composite portrait of all the duns. Its cousin is a slight variation with woodcock wings and is very useful when the march brown fly is on the water. These two are my own design.

Second Tourist: Are they any good?

Angler: Well, the first time I used "the family" I got hold of a big trout that escaped by promptly getting down between some rocks and sawing off my leader. The next day at almost my first cast with the same fly I got a three-and-a-half-pound fish and long before it got dark or even the cows came home, I had caught the limit.

Mrs. Tourist: Which is your favorite fly?

Angler: The grasshopper, when the fish are feeding on it. But when they are feeding on small flies I have no first choice. The fact of the matter is that one fly is as good as another provided the size is right. The most important thing is to have confidence that the fly you are using is the one and only fly to use. If you can attain to this degree of perfection then you will catch fish. However, we are human and we have our doubts and in order to be on the safe side it is just as well to have a variety of flies along, even if you do confine yourself to only one or two patterns.

Mrs. Tourist: Well, we have had a most delightful visit, and if ever you come our way you must certainly come out to the ranch and have some fishing where there will not be so many people fishing all around you.

Angler: Here are a few grasshopper flies that may be useful in the future.

Tourist: Many thanks. And good luck to you.

CALIFORNIA FISH AND GAME

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OCTOBER 28, 1920.

It cannot be expected that wild life resources, if left to themselves, will continue to yield food and sport indefinitely. A constant supply can only be maintained through carefully planned protection and propagation, and the necessary expense involved in such an undertaking is justified by any results which are as outstanding as those of fish and game.

COMMISSION'S DUTY TO PROTECT FISH AND GAME.

We often hear unjust criticism of the Fish and Game Commission, because of the wrong attitude taken by many sportsmen. There are many persons who seem to think that the hunter or fisherman is better qualified to dictate as to what the law should be than the Fish and Game Commission. They fail to realize that they view questions from rather a selfish point of view. The members of the Commission are in a better position to know conditions and to judge as to needs than any individual or group of individuals, for it is their business and not simply their hobby. The Fish and Game Commission must stand as a barrier to protect fish and game. It takes into account the safety of the different species more largely than the desire of the man who hunts and fishes.

SUMMER RESORT EDUCATIONAL WORK.

The educational work in the Yosemite National Park carried on under the joint auspices of the National Park Service and the California Fish and Game Commission this past summer proved to be very popular and very much worth while. The work was designed to bring useful information regarding wild life and the methods of conserving it to the summer vacationist. The term "Nature Guide Service," applied to it, but partially explains the different fields of endeavor. In addition to the scheduled field trips for both adults and children, formal lectures and campfire talks were given at the various resorts. Such game birds as the band-tailed pigeon, mountain quail, Sierra grouse and spotted sandpiper encountered on the different field excursions gave splendid opportunity for the discussion of the present status and the methods for the conservation of these different game species. Wild life films and stereopticon slides were used to illustrate the lectures. An office hour held at the National Park Service office gave Yosemite visitors a chance to have questions answered. A total or nearly 1400 persons, a large number of whom were children, were given first hand information regarding birds, mammals and fish through the medium of field trips, and over 25,000 persons through the medium of lectures. Thus does the plan grow for making "conservationists out of summer vacationists."

THE GRIZZLY.

In the Conservationist for August, 1920, Mr. Enos Mills has contributed a short appeal on behalf of the vanishing grizzly. The need for the protection of this splendid animal in California was not appreciated soon enough. California, where the grizzly was but a short time ago found in considerable numbers, is now without a single representative, and it is to be trusted that the people who live in the sections of our country where he is still to be found will not be so short-sighted.

Mr. Mills says: "The grizzly is distinguished by keenly developed senses, alertness, sustained curiosity, and superior mentality.

"Although the grizzly in not ferocius, and although he does not eat human flesh, most people unfortunately believe the contrary. One is as likely to be assaulted by a jack rabbit as by a grizzly, and far more likely to be chased by a tame cow or a civilized dog.

"The grizzly destroys many pests—rats, mice, rabbits and grasshoppers. Most of his food habits are economically beneficial to mankind. Exceptional grizzlies have turned cattle killers; but cattle or big game killing is confined to exceptional individuals and not to exceptional doings of all grizzlies.

"The grizzly has courage, loyalty and individuality. * * * Our race loses if the grizzly goes. He is the master touch to arouse the imagination, to perpetuate the strange primeval memories, to give the wilderness its supreme spell."

We hope that the conservationists who are interested in the protection of this monarch of the wilds will be successful in spreading the gospel of their conservation and that early attention will be given the black bear that it may not follow the grizzly.

BEAVERS INCREASE IN THE ADIRONDACKS.

A careful study of the beaver in the Adirondacks has shown that this fur-bearer is now so abundant that an open season is not only safe but necessary to prevent too much damage being done to timber and cultivated crops. In the day of the trapper the annual exportation of beaver pelts from New York State alone amounted to 8,000. This was in the days of the beaver hat, in the year 1663. By 1820 beavers were so reduced in numbers that they probably numbered a little more than 1,000 in the Adirondacks. In 1895 it has been estimated that there were not more than five or ten animals left in this same region. About this time efforts were made by sportsmen to not only protect the beaver, but to restock some of the streams. In 1906 some actual restocking took place, 34 beavers in all were released during the restocking period, and at the present time, 14 years later, the beaver in the Adirondacks are easily estimated at from 5,000 to 10,000. Beavers are now so abundant that considerable damage is caused by flooding timber areas and obstructing navigation.

The simple remedy for the conditions as they now exist is to ask the New York Legislature to open the season on beavers, and this will be done.

This is another case similar to that of the deer in Vermont, where restocking proved eminently successful. Wild animals have wonderful powers of recuperation and if given a chance will quickly restock the area. Better, however, than restocking is the conservation of a sufficent breeding stock.

STATE FAIR EXHIBIT.

The exhibit at the State Fair which drew so much favorable attention last year was remodeled and improved for the 1920 fair. The observation platform was moved farther away, additional foothills were added and a miniature electric train, with bridges and tunnels, was installed and better lighting effects supplied. It will be remembered that the exhibit is a cyclorama, showing the Sierra from Mount Shasta on the north to Mount Whitney on the south, with miniature hatchery buldings in the foreground, and still nearer in the foreground a large lake containing live trout. Of particular interest this year were the added cloud effects. While changing colors which light the mountains show the change from day to night, clouds sweep across the sky and later the stars appear. This is followed by the rosy tints of morning.

Visitors to the fair unhesitatingly stated that this exhibit was not only the finest exhibit on the fair grounds but the finest ever shown in the West, even exceeding any of those shown at the Panama-Pacific Exposition.

As in previous years there was a splendid aquarium display of food and game fishes, including the famous golden trout.

LAW LEGALIZES CARRYING OF GUN IN CLOSED SEASON.

At the last session of the legislature jack rabbits were placed on the predatory mammal list, thus not only allowing killing at all times but allowing the killing of them without a hunting license. Granting that the jack rabbit is a pest and needs no protection at the present time, yet this law gives the alien hunter and violator a chance to carry a gun the year around, thus making law enforcement particularly difficult. More and more it becomes evident that the carrying of a gun during certain seasons of

the year should be sufficient cause for arrest. Otherwise, on the plea of hunting jack rabbits, the violator has a chance to be in the field during the closed season for quail and other game. All sportsmen should be alive to the danger if this law continues to stand on the statute books.

MORE TRAINED CONSERVATIONISTS.

That there is increased interest in wild life is clearly shown by the educational opportunities offered in institutions of learning. Cornell University has been offering splendid courses on game propagation and more recently there has been formed at McGregor, Iowa, the American School of Wild Life Protection and Propagation. The aim is to establish an institution that will not only fill the interest and needs of the individual student, but one which will at the same time further the discussion and elucidation of large questions, such as water supply, despoliation of forests and the indiscriminate draining of lakes. It will be remembered that there has been considerable agitation for a national park in the near vicinity of McGregor, consequently the location of this school is ideal. The faculty will be made up of noted scientists connected with Iowa State University, Morningside College, Cornell College and Iowa State College.

With a new fisheries college established at the University of Washington and the two institutions mentioned above, there should be no lack of trained men to fill situations connected with our conservation departments. It is to be hoped that there will be a larger body of trained men and that other institutions will be forced to offer work of a similar nature.

MUD-HEN STEW "HUNTER STYLE."

Many a hunter having bagged a mud-hen throws the bird away because he does not realize its food value. When properly cooked the mud-hen is delicious, only surpassed in flavor by the better ducks. Mr. W. W. Richards offers the following recipe, which has been used for many years at "Green Lodge", his duck preserve on the Suisun marshes:

Mud-Hen Stew.

Mud-hens.
½ pound salt pork.
1 medium sized onion.
Potatoes (as desired).
½ dozen cloves.
Half a bay leaf.
Salt.
Pepper.
1 teaspoon curry powder.
2 tablespoons flour.

Skin the birds—*do not* pick them—and soak them a few hours, or all night, in water to which has been added a little salt. Then remove the birds from the salt water and put them in a kettle containing sufficient water to cover them. Let the water come to a boil, then pour the water off; add half a pound of salt pork, cut in dices; cover with hot water, and let boil about one hour. Then add half a dozen whole cloves; one medium sized onion cut up fine; half a bay leaf; salt and pepper to taste; and peeled potatoes as desired.

Mix one teaspoon of curry powder and two tablespoons of white flour with enough water to make a smooth paste, and add this to the stew and let it cook about half an hour longer before serving it.

Serve with boiled rice as a side dish, if desired.

MAKING CONSERVATIONISTS.

What more unpleasant reflection could be made on the sportsmen and the people of the United States generally than in the statement quoted: "Though game protection in the United States is now more than two hundred years old, it has not protected the game?" As early as 1709 there was a closed season placed upon deer, wild turkeys, heath hens and partridges, in the state of New York, with a fixed penalty for violations of the law; and today the most important game animal in New York State is the rabbit. The wild turkey and heath hens are extinct and the deer and partridges are maintained only under the protective measures of the State Conservation Commission. However, such demoralizing evidence is of inestimable value if it makes the people of each and every state think of its own wild life and the best

ways and means of affording it protection. New York has arisen to its responsibilities and can well be a splendid example to most states. Mr. Pratt of the Conservation Commission of New York believes that the crux of the whole problem is to be found in having laws, based on exact knowledge and biological investigation, carried out by an efficient game protective force.

There is no doubt that the value of having an intelligent, efficient, nonpolitical body of men as game wardens can hardly be overestimated. But of what lasting value was the Prussian military system without the united support of the entire populace? Of what value is any system without cooperation? Of major importance is the development of moral force, and this is accomplished through the education of the people. If the state game wardens can stand as educators of the people then, indeed, they can be even more justly proud of their worth. Make it the people's affair, the people's interest, the people's pride to protect the wild life in the state, and the people, not a small struggling minority, will protect the wild life of the country.

New York is visualizing the cause by an emblem designed for permanent use, a small celluloid card interpreting the emblem being given with each one. The cause is becoming popularized, and the creed is one which we should all stand for:

"I believe that 'God has lent us the earth for our life. It is a great entail. It belongs as much to those who are to come after us as to us, and we have no right, by anything we do or neglect, to involve them in any unnecessary penalties, or to deprive them of the benefit which was in our power to bequeath.'—Ruskin.

"That, in a great democracy of free people, the protection of wild life and the preservation of all other natural resources, which underlie national prosperity and happiness, must depend, finally, as does the stability of the government itself, upon the support and willing service of every citizen.

"I therefore declare my adherence to these principles, and have enrolled myself as an active Conservationist of the Empire State."

When the people carry this creed in their hearts rather than on a celluloid card in their vest pockets, the conservationist will have won his hard earned struggle. M. K.

PRESERVATION OF INLAND MARSHES.

Mr. E. W. Nelson, Chief of the United States Biological Survey, has recently pointed out the importance of furnishing migratory waterfowl with places where they can stop to rest and rear their young. Certainly one of the most important factors in the decrease of waterfowl is the reclamation of swamp land, which has furnished a food supply and safe breeding place for these birds. In the propagation of domestic birds we all know that the most necessary things are food supply, shelter and safe breeding sites, and it is not hard to see that wild birds are dependent for their existence on these same three things. The desire of the American people to commercialize absolutely everything is leading to the reclamation of marshes which in reality are more valuable as breeders of waterfowl than as agricultural producing areas. As Mr. Nelson has pointed out, the marsh lands under intelligent management will yield abundant returns to the community, as indicated in the following summary of their productiveness:

1. Production of food and game fishes.
2. Wild fowl, shot for sport and food.
3. Furs, from such fur-bearers as the muskrats, skunks, and raccoons which frequent their borders.
4. A natural ice supply.
5. A definite and invaluable help in maintaining the underground water level in various parts of the state, and in helping to hold back the runoff of rainfall to prevent excessive erosion.
6. Opportunities for healthful and interesting recreation for the citizens of the state.
7. Where such water areas are included in state parks or reservations, they lend themselves admirably to educational uses, and help interest the people of the state in out-of-door life and in the natural resources of the state in the form of plant and animal life.

That some states are becoming alert to the danger, arising from the demand to drain many bodies of water, is shown by the fact that the Conservation Commission of Iowa is working out plans

which will permit the saving of desirable water areas from ill-considered drainage, and Minnesota recently, under the decision of the state courts, has saved water areas from drainage, on the ground of their value to the public in their natural state.

It is high time that California should be aroused to the danger which threatens the wild life of the state by the continuous drainage of water and marsh areas. Discussion along this line is timely and immediate effort must be made, if suitable areas for waterfowl are to be maintained.

ANOTHER SPORTSMEN'S CREED.

1. I deem it a point of honor never to shoot a sitting bird (except cripples). I will not pot-shot, and I will not stand for it in my party.

2. I will measure the success of my day afield not only by the size of my bag, but by the number of cripples I leave behind me. I would rather get a mess of game with no lost cripples, than to kill the limit and leave the woods full of lost game. Accordingly, I will shoot to kill, and *I will not shoot out of range.*

3. I am against "piecing out" the other fellow's limit. I am against the "dummy license." The legal limit applies to the man, not to the party. If I can't kill my own game I don't want anyone else to kill it for me, and I expect my hunting partners to look at it the same way. If they don't, they don't need my company.

4. I will not clean out a covey. "Leaving some for seed" is one of the first principles of sportsmanship.—"*The Pine Cone*," July, 1920.

THE AIRPLANE VIOLATOR.

Not long after the invention of the airplane, it was found that a man-made machine could easily overtake flying waterfowl and that hunting was thus made easy. Hunting from an airplane has grown in popularity and more than one state has found that some restriction must be placed in the game laws to prevent too great a toll being taken. Game law violators who ride in airplanes are difficult to apprehend, as are also the automobile violators. It will be remembered that at the last session of the legislature California prohibited the shooting of game from airplanes, automobiles, and sailboats, as well as from power boats while in motion. Of no less importance than hunting from an airplane, is the stopping of the shooting of hawks and other birds from an automobile. Not only are many hawks and other valuable birds killed by the man desiring something to shoot, but persons traveling along the same road are endangered.

FRANCE DEMANDS GAME REPARATION.

France is awake to the fact that part of the reparation owed her by Germany is to be found in the game destroyed in the regions where heavy fighting took place and in that which Germany took to augment her diminishing food supply. An association of French sportsmen have demanded that Germany repay the gunners of France by restocking the game reserves so entirely depleted by German invasion, rather than by making reparation with money. The sportsmen were so insistent in their demands that they convinced the reparation council of the importance of their stand, and France is now to demand from Germany and Austria live game to the value of 35,000,000 francs. Germany and Austria must each furnish, in four half-yearly installments, 250 stags, 1000 hinds, 200 male and 400 female roe deer, 200,000 male hares and 400,000 female and 3,000,000 brace of partridges. In addition, Austria must furnish 1,000,000 pheasants. The greater proportion of the game will be liberated immediately upon arrival, under the supervision of experts. The balance will be held on game farms as breeding stock, these farms to be controlled and operated by the French government.

FACTS OF CURRENT INTEREST.

Salmon have been caught on hook and line as far up the Sacramento River as Sacramento this season. It seems probable that the exceedingly low water, combined with an invasion of salt water far up the river, has had something to do with the unusual catch.

Angling interests have been threatened owing to the drying up of many trout streams and lakes during the past summer. It has been impossible to stock many streams which have heretofore been stocked annually, because of the lack of water.

Hunting is growing more and more popular as is evidenced by the report of the sale of hunting licenses.

The Fish and Game Commission's State Fair exhibit proved to be the most attractive one of the 1920 fair. The one complaint was that people were unable to see the exhibit owing to the crowds.

Live golden trout were displayed again this year at the State Fair.

A new state fisheries laboratory is now assured, as the city of Los Angeles has furnished the Fish and Game Commission a long-time lease on a site at Fish Harbor, San Pedro.

The normal kill of deer has been made during the past open season, and reports show that deer are on the increase in many sections.

Twenty-five to fifty persons registered daily at the Tahoe camp ground this past season.

The new Tahoe Hatchery constructed at Walker Springs at the north end of the lake has been completed and is ready for occupancy.

HATCHERY NOTES.

W. H. Shebley, Editor.

TROUT DIE IN BEAR LAKE.

As is the case in most dry years, there has been a great loss of fish due to the drying up of lakes and streams. Stocking operations in many streams have had to be suspended this year because the streams were absolutely dry. Anglers in southern California have been justly disturbed over the death of thousands of fine large trout, many from three to ten pounds in weight, in Big Bear Lake in the San Bernardino Mountains. What the future of fishing in this lake, which has heretofore been the mecca of most of the anglers of Los Angeles and nearby counties, will be, remains to be seen. Many are the theories advanced as to the cause underlying the destruction of fish. No matter what the immediate cause, whether bacteria or chemical poisoning, the underlying cause is doubtless to be found in the dearth of water.

SMALL TAKE OF EGGS.

Low water in the streams where spawning operations are carried on has prevented a large take of eggs for the hatcheries. In many instances streams were so low that fish were unable to proceed up stream far enough to reach the spawning station. At the Snow Mountain egg collecting station, where a large take of steelhead eggs is usually made (from 4,000,000 to 6,000,00) less than one-fourth of the usual take was secured—750,000.

GOLDEN TROUT LACKS HARDINESS OF OTHER TROUT.

Although golden trout eggs are being successfully hatched and the fry reared in our hatcheries, yet the adult golden trout appears to be a difficult one to keep in breeding ponds. Several attempts have been made to keep the golden trout at the Mount Shasta Hatchery but without success. Golden trout exhibited at the State Fair at Sacramento last September were moved to Sisson, but all died. Just why this species should succumb while others thrive is a mystery, as shipments from Inyo County come through in good condition and no trouble is experienced in keeping them in aquaria at the State Fair.

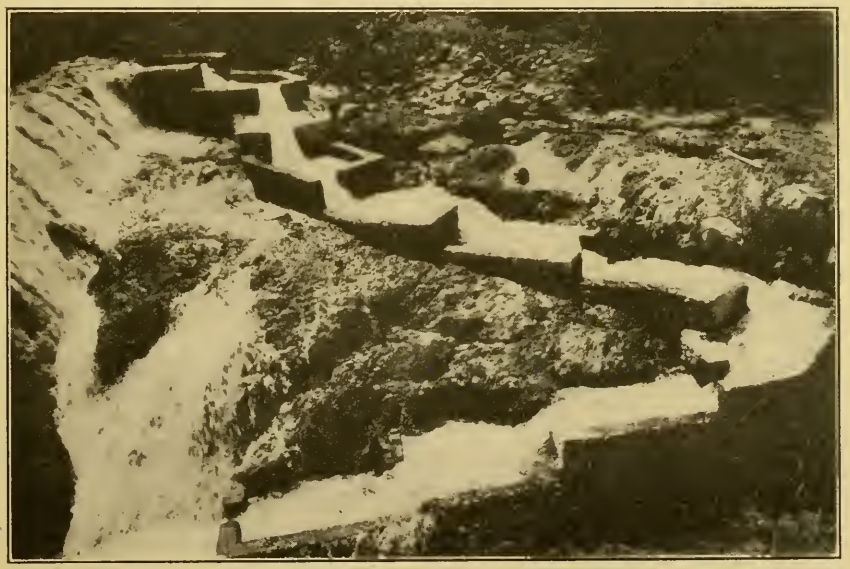

Fig. 46. A fine type of fish ladder. Inskip Dam, South Butte Creek, Tehama County, California. Photograph by A. E. Culver.

THE TAHOE HATCHERY.

The new Tahoe Hatchery is now completed and ready for occupancy. It has become more and more evident for several years past that the supply of water at the old hatchery site was entirely inadequate, and several years ago property about one mile east was secured, together with the water rights to Walker Springs. In fact the site secured is the only one available at the present time. The springs furnish a purer and colder water supply than any stream flowing into the lake. Furthermore, a supply of water from springs is more dependable than that from a stream, in that there is less danger of lack of water during a dry season. The new hatchery contains sixty-four troughs and will have a capacity of about two and a half million trout. Provision has also been made for breeding ponds and nursery ponds. A superintendent's cottage is being built.

This new hatchery is made the more necessary because of the lack of water at the Tallac Hatchery during the past few years. The new Tahoe Hatchery is of sufficient size to handle practically all of the black-spotted trout operations.

The old hatchery building will be utilized as a laundry and community center in connection with the camp ground.

THE OLD AND THE NEW.

In 1888 the Mount Shasta Hatchery consisted of one building, forty by sixty feet, containing forty-four troughs. Its capacity was a few hundred thousand trout and salmon. At the present time the Mount Shasta Hatchery comprises seventeen acres with five large hatching houses containing 450 troughs, together with superintendent's cottages, spawning house, kitchen, barn, sheds and garage. Fifty large rearing ponds for trout and three larger ponds for salmon complete the equipment. The hatchery output averages more than 10,000,000 trout and salmon per year.

FOOD FOR TROUT INTRODUCED.

The Department of Fisheulture is endeavoring to conserve the fish supply by introducing new trout food in the lakes of the southern Sierra and Tahoe basin. Insects, such as salmon flies; crustaceans, such as gammarus; and aquatic plants are being introduced.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

THE STATUS OF THE TUNA.

The Fish and Game Commission recently received a letter from one of our leading sporting magazines calling attention to the fact that a seaplane had been used at San Pedro in locating schools of tuna. They also sent this Commission a letter which they had received from a Californian protesting against this "contemptible practice" as they called it, and stating that the "fish canning companies of the state by this method are destroying this wonderful Pacific Coast fish, the tuna."

As this is the kind of opposition which any new method of fishing receives whether it is actually destructive or not, the reply made is appended:

The tuna has been recognized as a commercial fish for many years in Europe. The only reason it has not been recognized as a commercial fish on the Atlantic and Pacific coasts of the United States is because we have not appreciated its value as a food fish. So far the tuna, which we call here the blue-fin or leaping tuna (*Thunnus thynnus*), has been taken in commercial quantities only a couple of years, and we are quite sure that the species is in no immediate danger of being exterminated or of being seriously depleted.

The albacore, which the United States Bureau of Food and Drugs permits our canners to label as long-finned tuna, and which is the whitemeat tuna found in the markets, has been taken commercially in large quantities for the last seven or eight years. The albacore is taken with hook and line only but the quantity taken in one season has been as high as thirty million pounds, or six times the weight of blue-fin tuna taken in any one year.

This Commission has been employing fisheries investigators for the past three years to make a thorough investigation of the albacore to determine if it was being overfished and likely to become seri-

ously depleted in numbers. At the beginning of this investigation three years ago, there was available accurate data of the catch for three years preceding, so that now we have had six years accurate data of the catch upon which to pass an opinion as to whether it is being overfished. The evidence is quite conclusive that the albacore is not in danger of being depleted and we consider that it needs no protection as yet. The tuna which is mentioned in your letter is a closely related fish belonging to the same genus and it is not at all likely that it will be taken in large enough quantities to seriously deplete the supply for at least several years to come.

This state is collecting accurate data of the catch of each commercial species of fish and this data shows not only the total catches of each variety but the catch per unit of fishing gear. By means of this data we are keeping a better watch on the fisheries than is any other state and we will be able to detect depletion of any species before such depletion has advanced beyond the danger point. We are not taking it for granted that the resources of the sea are inexhaustible; we are going on the assumption that any species may be exhausted if we catch it in large enough quantities. We are watching the tuna fisheries as well as our immense sardine fishery very carefully and we wish to assure you that there is no cause for alarm in the fact that an occasional seaplane is used to locate schools of tuna.

As yet there is no demand in the markets for the canned blue-fin tuna, in fact, there is not the demand there should be and it is not likely that the fishing for blue-fin tuna will need restricting until the public do come to appreciate it as a valuable food product.

We do not consider the use of seaplanes in locating schools of fish as a "contemptible practice." This method of locating fish has been used but little on this coast. On the Atlantic coast, as you may know, the United States Government, with the sanction of the United States Bureau of Fisheries, is aiding the fishing industries to locate fish by this means. Seaplanes were used last fall at San Diego in locating schools of sardines. These seaplanes were furnished by the United States Navy and had the sanction and assistance of the State Fish and Game Commission.

BUREAU CHIEF INSPECTS CALIFORNIA FISHERIES.

Dr. H. F. Moore, Deputy Commissioner of Fisheries, made a tour of inspection of California fisheries and the United States Bureau of Fisheries' Preservation Laboratory at San Pedro during September on his return from the Pan-Pacific Science Congress at Honolulu. This is Dr. Moore's first visit to this coast for several years. A full week was spent on a survey of the fisheries, this being occasioned by the recent rapid growth of our fisheries and more especially by the fisheries conservation work now being done by the State Fish and Game Commission. Dr. Moore has expressed himself as being very favorably impressed with the conservation work under way in this state.

TUNA FISHERIES INVESTIGATED.

A recent visitor to this coast is Dr. Kamakichi Kishinouye, of the College of Fisheries, Tokyo Imperial University, Japan, who is making a special study of the comparative anatomy of the Scombroid fishes, or in other words, the fishes of the mackerel family. He finds that the yellow-fin and the blue-fin tunas have a remarkable set of blood vessels which surround the liver and extend into the strip of dark meat along the side of the fish, which strip is so noticeable in the fishes of the mackerel family. The albacore, or long-finned tuna, does not show this unusual development, at least in such a marked degree.

The remarkable part of this is that this particular arrangement has never been described by anatomists or fish investigators. It is believed to have some direct bearing on the fish's ability to withstand cold water.

Dr. Kishinouye is spending some time in southern California in order to make a study of this structure in the three species of tuna found in those waters, *i.e.*, blue-fin, yellow-fin and long-fin tuna. He also wishes to determine if these three fish are of the same species as those found in Japan. He suspects, from work he has already done on the anatomy of these fishes, that the Japanese blue-fin tuna is a different species from the one found in the Mediterranean Sea. Heretofore these two, as well as the blue-fin tuna found in California, have been considered the same species.

In Japan the blue-fin and yellow-fin tuna are caught by immense trap nets placed rather close inshore. The long-finned tuna, or albacore, cannot be caught in this manner as they do not approach the shore, living only in quite deep water. The albacore is taken to some extent in

gill nets but the principal method of catching is by the use of long lines, similar to the lines used by the California Fish and Game Commission in its experimental fishing for albacore in southern California waters a year or so ago. They have found this the most successful way of catching albacore and the most economical. The principal bait used is fresh squid. The method of using hand lines and lines on short poles, as employed in California, is used only to a limited extent in Japan. It is his idea that the use of the short poles, which is known to our fishermen here as the "Jap pole method," is only successful at times when the albacore are very plentiful. The long lines, he states, are most successful in catching albacore in the spring and fall of the year, and these are the times when the albacore catch is the largest.

It may be of interest to note here that the experimental fishing done by this Commission some time ago demonstrated the fact that by the use of long lines the albacore may be taken at times when they are not feeding at the surface and consequently cannot be taken by surface fishing methods such as the use of short hand lines and the "Jap pole method." The blue-fin tuna also takes the long line and hooks quite freely.

UNITED STATES BUREAU OF FISHERIES, SAN PEDRO LABORATORY.

The work of the United States Bureau of Fisheries Preservation Laboratory at San Pedro is being temporarily continued by the Fish and Game Commission until funds can be obtained by the Bureau. There is hope that the bureau will get an appropriation which will enable it to continue the laboratory from the first of January and to reimburse the state for what it has spent; although this last, while possible, is hardly probable. The bureau continues virtually to direct the work although the state, in order to get due credit, appears as the operator and will publish the preliminary reports of the work. The Commission entered into this arrangement believing that by so doing it would aid in the expansion of our fisheries and would prevent the almost total loss of the laboratory's preceding year's work. It was believed that by so doing the fish canners of the state would be pleased and all others interested in the wellfare and development of the fishing industry.

In helping to this extent there was the desire to aid a federal bureau which stands for the development and conservation of the fisheries as does no other bureau—a bureau which for many years has carried on fisheries conservation work in this state and which it is hoped will continue to carry on in the future.

The laboratory, a year ago, undertook fish canning experiments which for good and sufficient reasons were scheduled to continue over a period of two years before their completion. It was necessary to continue this work for the bureau in order to tide it over a temporary financial depression and thus preserve to the state the bureau's well-equipped laboratory and the bureau's inclination to continue this valuable line of research work. If we had not done so the years' work would have been lost as well as the $20,000 already expended.

The United States Bureau of Chemistry has established a laboratory at San Diego for work similar to that which is being done in the preservation laboratory of the United States Bureau of Fisheries at San Pedro. There is plenty of work for both laboratories and each should receive encouragement. The Commission is doing all it can to prevent duplication of work by the two bureaus and to bring about a correlation of their activities. Mr. Almy, who will supervise the work of the laboratory of the Bureau of Chemistry, and Dr. Alsburg, head of the bureau, have assured the Commission that they desire to cooperate to a sufficient extent to avoid unnecessary duplication of work.

OCTOPUS FISHING IN JAPAN.

Recently several octopi were brought into the San Francisco markets which had been caught by the local rockcod fishermen on rockcod gear. In a recent visit from Dr. Kamakichi Kishinouye of the Tokyo Imperial University, Japan, some very interesting information concerning the methods used in fishing for octopus in Japan was gained.

One method used is as follows: Long lines are let down to which are attached earthenware pots or vases of the right size to accommodate the octopus for which

they are fishing—we should judge these pots would average 1½ to 2½ feet deep and from 8 to 14 inches in diameter. Some of these pots are suspended with the mouth down, others suspended with the mouth up from the long horizontal line. Each pot has a small hole in the bottom to let the water easily escape when the pots are raised. The pots are not baited, and since it is the habit of the octopus to find a hiding place in the rocks, they crawl into the mouth of the pot and remain there until they are pulled out. The pots are set one day and pulled the next; one boat will handle about 200 pots. Ordinarily buoy floats are not used to locate the lines but they are picked up with a grappling hook, for it is believed that the floating buoy disturbs the pots and prevents the octopus from entering.

They are also caught by means of hook and line. In this method the fisherman baits the hooks, several of them on a long line, and when they have lowered them until they come in contact with rocks, they continually jerk the lines. The octopus, in feeding, reaches out its arms to get the bait with its sucking discs and the jerking of the hooks catches the arms or tentacles.

SILVER SALMON AT MONTEREY IN 1920.

Since the last two seasons in California have shown relatively poor catches of king or Chinook salmon there is an increased interest among fishermen and packers in the other possible species of salmon that might serve to fill in the breach, especially during bad years. The most abundant of the lesser species is the silver salmon, a fish of lower oil content than the king and therefore less desirable for canning, although it sells readily on the fresh markets. Along our northern coast it forms a large per cent of the salmon catch. The southern boundary of commercial salmon fishing (Monterey) seems to be almost out of the range of the silver salmon. The salmon investigation now being conducted by the Commission has gathered some information as to the relative abundance of the two principal species and from time to time further notes on their occurance, seasons, abundance and worth on the markets will be published.

In a recent number of *California Fish and Game* (Oct. 1919) it was noted that the silver salmon in 1919 did not appear at Monterey, just for a few days, but that they were caught in small numbers over a period of eleven weeks with a heavy catch on four or five days during the period. Detailed notes were kept in the 1920 season's run in Monterey Bay and it was found that the appearance of silver salmon in small numbers extended over a longer period this year and that they were not caught in great numbers during any four or five consecutive days as was true in 1919. At no time this year did they outnumber the king salmon. In 1919 the first silver salmon was noted on May 10, while in 1920 the first was caught on April 19. During the remainder of April, 1920, a few were caught each day averaging between four and five pounds apiece. For instance, on April 23, the silvers made up 4.4 per cent of the catch in number of fish and 1.6 per cent in weight, the rest of the catch being kings. During May there were very few silvers caught at Monterey, but on June 1, they formed about one-fifth of the catch. On June 2, the silvers were 18 per cent in number and 8.2 per cent in weight of the catch and averaged a little less than 7 pounds apiece. June 3, and 4, the silver catch was somewhat less and from the fifth to thirteenth of June there were only a few silvers caught. On June 14, the silvers picked up to 15.3 per cent in number of fish and 7.7 per cent in weight in the catch. By June 17 they were 24.2 per cent in number and 17.5 per cent in weight in the catch and averaged 7.8 pounds each. From June 18 to 21, the silvers averaged about 7.9 pounds but the per cent in the catch dropped off. On June 22, the silvers in the catch were 19 per cent in number of fish and 8.8 per cent in weight with an average weight of 7½ pounds and the average weight dropped to 7 pounds for the following week. By this time the king salmon season was about over so that the silver salmon caught, although few in number, formed a relatively higher proportion of the catch. For example, on June 24, the silvers in the catch were 33 per cent in number and 22.8 per cent by weight. June 25, the per cent of silvers dropped to 18 and from then on for the remainder of the season there was only an occasional silver salmon caught. W. L. S.

OCEAN AND STREAM SALMON CATCHES.

Frequently the question is raised as to the relative importance of trolling and stream netting for salmon in California so that a summary of the figures of total salmon catch may be of general interest. The 1920 figures are not yet complete. The following figures, in round numbers, represent yearly total salmon catch of the state in pounds of fish in the round.

	River caught.	Ocean caught.	Season total.
1919	5,987,000	7,158,000	13,145,000
1918	7,173,000	5,920,000	13,093,000
1917	5,493,000	5,563,000	11,056,000
1916	5,342,000	5,501,000	10,843,000

There are three chief trolling regions: (1) Shelter Cove, (2) vicinity of San Francisco, (3) Monterey Bay. The two chief netting regions are the Sacramento river and the northern coast streams such as the Eel, Klamath, and Smith rivers. The 1919 salmon catches for these regions expressed in percentage of the total catch of the state are as follows:

Region.	Per cent	
Ocean—		
Shelter Cove	22	
San Francisco	11	
Monterey Bay	22	55
Stream—		
Sacramento River	35	
Northern Rivers	10	45
	100	100

The salmon caught at Monterey, outside San Francisco, and in the Sacramento River are generally classed together as a unit since it is assumed that they result from spawning in the Sacramento. At present a possible restriction of the trolling and netting of salmon is being discussed. A contrast in the catch by these two methods is shown by the following table of catch in round numbers of pounds:

				(Taken with nets)
	Mont. Bay.	Outside S. F.	Troll fish.	Sac. River.
1919	2,816,000	1,443,000	4,259,000	4,529,000
1918	2,893,000	1,929,000	4,822,000	5,938,000
1917	3,880,000	1,280,000	5,160,000	3,971,000
1916	5,231,000	263,000	5,494,000	3,451,000

There are changes from year to year in the importance of the salmon fishery of any one locality. For example, the catch at Monterey has dropped off while the Noyo-Shelter Cove catch has been steadily increasing due to the recent development of the industry at those northern trolling points. In 1917 the total from the Noyo-Shelter Cove region was less than a half million pounds, in 1918 over one million and in 1919 only a little less than three million pounds. A minor item of interest is that each year a few salmon are caught by trolling and netting along the coast of the southern counties far to the south of Monterey. Last year 10 pounds were reported, in 1918 one thousand and in 1917, 2000 pounds. W. L. S.

THE SALMON SEASON AT MONTEREY.

The Monterey salmon season of 1920 was even poorer than last year. The catch is roughly estimated at one-fourth of the normal or about one-half of last year's catch. In round numbers the Monterey catch (exclusive of Santa Cruz) was 1,290,000 pounds, this year as opposed to 2,316,000 pounds in 1919. The early season's catch this year was better than a year ago, but there was not the customary large run during the latter half of May and the first two or three weeks of June. The season practically ended in June, but there was a small catch on two or three days near the end of July. The local trolling fleet was about quadrupled by the addition of boats from northern points, but the poor catch was so discouraging that many fishermen returned to San Francisco during the middle of the season.

In spite of the fact that each year has seen a steadily increasing number of boats trolling for salmon in Monterey Bay, the yearly catch has been dropping off, as shown by the following figures, in round numbers, of pounds of salmon caught in the bay.

1919.	1918.	1917.	1916.
2,816,000	2,893,000	3,879,000	5,231,000

As stated above, the 1920 catch is little more than half that of 1919.

W. L. S.

NOTES FROM THE STATE FISHERIES LABORATORY.*

WILL F. THOMPSON, Editor.

THE FISHERIES LABORATORY AND ITS WORK.

At the time these notes go to the editor, considerable progress has been made toward the establishment of a permanent laboratory building for our work. The most encouraging advance in that direction has been the granting by the city of Los Angeles to the Fish and Game Commission of a long-term lease to a site at Fish Harbor, San Pedro. It is situated at the intersection of Seaside avenue and Tuna street, and will be most accessible to all canners and fishermen who may be interested.

A description of the site and the discussion of the plans for the building, of which rough sketches are at hand, may await the time when the plans are in finished condition, but it will be well to state now as clearly as possible those ideals to which the Commission is planning to dedicate a unique institution. Such a statement may save misunderstanding and opposition, and should give to those interested an appreciation of the underlying purposes such as will enable them to comprehend the reasons for the choice of site and for the plans adopted. The site was chosen because of its proximity to the canneries and the fish wharves, making it possible to follow easily the progress of the fishery. The plans adopted are intended to give good working room for a statistical and biological study of the fisheries for the purpose of conservation and adequate utilization and at the same time to allow an exhibit to those interested of the purposes of the work and its relation to the fisheries.

That the primary purposes of the investigations of the California Fish and Game Commission are conservation and adequate utilization has been stated many times. But such purposes have been repeatedly avowed by investigators, whose programs when adopted have betrayed a primary interest in general natural history, and have shown little relationship to the problems to be solved. The scientific program of the Commission has, however, been planned very specifically to meet the problems which are involved in governmental control of the fisheries, and are adapted to meet the responsibilities of the state as legal guardian of those natural resources. The machinery for the execution of this program is, in fact, already operating in part, and its purposes are stated very clearly in the laws of the state as duties of the Commission. Section 1 of the particular law referred to is as follows:

"It shall be the duty of the Fish and Game Commission to gather data of the commercial fisheries and to prepare the data so as to show the real abundance of the most important commercial fishes; to make such investigations of the biology of the various species of fish as will guide in the collection and preparation of the statistical information necessary to determine evidence of overfishing; to make such investigations as will bring to light as soon as possible those evidences of overfishing as are shown by changes in the age groups of any variety of fish; to determine what measures may be advisable to conserve any fishery, or to enlarge and assist any fishery where that may be done without danger to the supply."

The law then goes on to make provisions for the statistical system now in use as one of the bases for the scientific work. This system is to the best of our knowledge one without parallel in any country, and it has already proved itself superior to any statistical system we are acquainted with. It registers the catch of every boat, leaving its record for subsequent study by scientists in conjunction with other records by which changes in apparatus and economic conditions may be discounted, in order that there may be obtained a measure of the fluctuations in abundance of fish from year to year. It will be inevitable, in the future, that any scientific program carried on by the possessors of such complete records as by this law we shall eventually have, will be a program designed to discover the meaning of such records in terms of abundance and scarcity of fish. That there are faults in the system must be granted, but the faults are infinitesimal compared to those of statistical systems depending

*California State Fisheries Laboratory, Contribution No. 21.

upon estimates and hearsay. The laboratory will provide for the filing and the study of these records.

But this statistical work is only a part of the program, and in formulating both this and the biological, which is in a way the more important, the Commission has had before it the several programs adopted during the last two decades in other countries, notably in those bordering the North Sea and our North Pacific, and from these programs and their results it has been possible to decide within somewhat narrow limits what knowledge is necessary to competently legislate for our fisheries. The failures and successes of others during the recent great advances in fishery science have profited us. And in this fact is seen the reason why the program for the proposed laboratory will be a really vital one, *dealing with questions which actually face the legislator and the men interested commercially.* It will lack the vagueness of random natural history investigations, and it will avoid the limitation in value of technological research. In the future we may justifiably hope that the investigations carried on in the new laboratory will further define and clarify the many problems to be met with.

And in thus reviewing the work in other fields perhaps the most obvious fact has been the absolute necessity of access to the vast store of specimens and data to be furnished by the commercial fisheries. No agency could afford to duplicate this store, despite its vital importance to any investigations. And this has, in fact, determined the location of the laboratory and dominated in the construction of its plans. Another obvious conclusion to be drawn from the work of others has been the necessity of obtaining popular support by exhibiting to those interested the purposes of the work, and its achievements, as well as by showing graphically the necessity for it. Because of this there has been planned an exhibit room.

The great scientific value of this work may not be immediately obvious to the scientist who is interested in some of the more basic laws of biology. It may appear too practical. Yet this definition of aim, and practical trend actually heightens the value of the work from the standpoint of general science. The problems faced by the legislator are, in striking degree, the same as those in which the student of geographical distribution, and of evolution is or should be interested, and the material offered by the commercial fisheries far exceeds in extent that which can be obtained through other sources. The degree of isolation of different races and the extent to which it leaves its traces on the morphology or habits of the species is of great importance to one pondering the value of protection to a species overfished in a particular locality, just as it is to the man interested in the formation of races and species. The rapidity of growth, the distribution of pelagic ova or larvæ by currents, the response of the species to changes in surrounding conditions, all affect both the conclusions of the naturalist and those to whom the apparent abundance of fish is vitally important. Above all, however, our program will be most vital to the progress of hydrographical science in its relation to the food supply of man, through what is in reality the most essential purpose of our work—the measurement of the actual abundance of fish in the ocean. The effect of hydrographical conditions on fish can not be measured without a knowledge of the real abundance of fish, of the rate of growth, and the habits. So, in addition to being dedicated to the service of competent legislation for conservation and utilization, the laboratory will be in a very real way an essential part in the progress of more general scientific knowledge.

W. F. T.

PROGRESS OF THE ALBACORE WORK.

During the past summer Mr. Thompson has been pursuing in so far as possible the study of the albacore, with particular reference to its age and rate of growth. Mr. Rich and Mr. Sette have been stationed since June at San Diego and San Pedro for the purpose of collecting for Mr. Thompson certain measurements and statistics bearing on the various problems.

The study of the age has progressed to a point where the results are being prepared for publication. The age marks on the scales being illegible save in part, a special technique was necessary in order to decipher them. This was the more necessary in that serious questions have arisen in some quarters regarding the ac-

curacy and care with which age readings have been made in the cases of other species—and indeed, well-known biologists have openly challenged the fact that scales and otoliths actually do show age. The work on the age of the albacore has demonstrated clearly and unmistakably the absolute correspondence of the actual age of the fish and the marks on the scales by a method entirely free from the influence of the worker's personal judgment. Painstaking and time-consuming as the work has been, it has proved entirely worth while, and is the first direct knowledge we have of the age of any of the species of the mackerel family on this coast.

These results show the albacore to be a fast growing species, with all that implies regarding the effect of commercial fisheries upon it. Their discussion must await the final publication. But attention may be called to the fact that with their aid conclusions have been tentatively reached regarding the migration of the albacore. It is believed that the species shows a gradual migration to the northward through a period of years, but that the migration of any one year class is in general limited. The seasonal migrations are the most prominent and striking.

The summer's work has also continued to add to our material bearing on the migrations and the fluctuations in the run of fish and on the relationship of catch to temperature or some allied factor, thereby placing certain facts beyond dispute. These can not be treated very fully here, and it is hoped that as soon as the work on the age is out of the way, attention may be turned to these data, which will, it is believed, prove highly interesting. The data at hand are exceedingly extensive, perhaps more so than the data available for any other fishery, as the records for the whole industry from its beginning have been collected. The results are already well defined, but remain to be placed in shape for publication.

It will be recalled that we have analyzed the relative abundance of fish during past years (see Pacific Fisherman Year Book, 1919) and found a steady fall in the catch of the same unit of gear from year to year. We ventured to say, however, that this fall was not, judging from various things, due to depletion, and the events of this summer have reassured us in this regard. The catch has shown an increase and the reappearance of younger classes of fish, both encouraging signs. The possibility that overfishing may occur is not, however, eliminated.

W. F. T.

PROGRESS OF THE CLAM WORK.

Since April, 1919, F. W. Weymouth has been devoting a portion of his time to the completion of a survey of the shellfish of the California coast commenced several years previously by Will F. Thompson. A report is now ready for the press embodying all the collected data. The primary purpose of the survey has been to put on record the number and abundance of the species of commercial importance and the location and condition of the beds at present being utilized. The scope of the report has been extended by the inclusion of descriptions and figures, together with a key for ready identification of some forty species of present or possible commercial value. Heretofore no such key has been available, and it is hoped that by this publication, campers and amateur clam diggers can be made acquainted with the edible bivalves of the coast. Besides the description and range of each species an account of its habits has been included. Though many collections of attractive and interesting "shells" have been made, there are few observations on the varied habits of these animals and it is hoped that those recorded in this report may lead to more study of the remarkable ways in which the bivalves are adapted to the diverse conditions of life under which they are found.

In connection with this survey certain important points have developed. One is the need for a more detailed study of the life history of at least some of the more representative and important species. At present, though several of the eastern species have been carefully investigated, no facts concerning the age or rate of growth of a single native Pacific species are known.

In an attempt to remedy this lack, data have been collected throughout the year on the Pismo clam, one of the most important California species, and these are now being carefully studied. The preliminary work indicates the main features of the age and as soon as it can

be completed it will be put in form for publication. It appears that the growth is less rapid than has been supposed and that a considerable age is reached by the larger specimens met with.

A careful survey of the coast has forced the conclusion that few of the native species can be materially increased by artificial means, but that in certain suitable bays the "farming" of the introduced soft shell or long clam might be made very profitable. Its culture has passed the experimental state on the eastern coast and profiting by this experience many acres of otherwise barren tide flats might be made to yield as sure and valuable a crop as a wheat field. It is hoped that in the future the question of the control of suitable tide lands may be put on as secure a basis as is the management of existing oyster lands, thus making such clam farming a practical possibility.

F. W. W.

PROGRESS OF THE SARDINE WORK.

The investigation of the sardine fishery is being continued along lines laid down in previous publications in this magazine (Volume 6, No. 1, pp. 10-12), and in Fish Bulletin No. 2. Mr. Elmer Higgins has, during the past season, been made responsible for the carrying out of the program at San Pedro, while Mr. O. E. Sette has been, until this last June, responsible for the same at Monterey, both under the direction of Mr. W. F. Thompson for the present. Mr. Sette, who is leaving this fall for a resumption of his college work, will continue his sardine work while at college. The principal attention of both of these workers has been concentrated on the discovery of the rate of growth through a study of the frequency of occurence of various sizes of fish, and the following of fluctuations in average size, sex, maturity, quality, etc., during the fishing season. In view of the importance of the sardine industry, somewhat more attention is given to an exposition of this work than is the case with the other fisheries with which we are dealing.

The program under which the work has been done contemplates (1) the discovery of depletion if it should occur; (2) the discovery of any great natural fluctuations in abundance or quality other than those due to overfishing; (3) the foretelling of these fluctuations, which in other fisheries have at times caused great damage; (4) the deciphering of those habits of the species which are of importance to the canner and fisherman, such as migration, and (5) a knowledge of such facts as will aid the legislator. The absolute completion of this program is without doubt well removed, but contributions to it of great value will be made in the very near future, enabling us to make at least provisional answers, a thing impossible now. Among these we may list the age and rate of growth, the breeding season, and the degree of independence of the sardines in different regions. That the foretelling of fluctuations is not visionary may be seen from the work of the Norwegian fishery authorities on the herring. The other elements of the outline given are dependent entirely upon the records we obtain—and we are acquiring the very best possible.

A certain amount of preliminary work had been done by Mr. W. F. Thompson, assisted by A. W. Warnock and others before the inauguration of the present investigations a year ago. In this preliminary work the breeding season had been observed at San Pedro (as mentioned by Mr. Higgins below), a series of scales collected for the study of the age, and a set of careful observations made on the differences between the sardines from San Diego, San Pedro and Monterey. The latter observations, as bearing on the possibility of the interdependence of the sardines in different regions, have been completed by Mr. Higgins in addition to his own work and reports on the conclusions may be expected in the near future.

PRESENT STATUS OF THE SARDINE INVESTIGATION IN THE SAN PEDRO DISTRICT.

In the study of the sardine fishery, as distinct from that of the fish itself, the course of the run at San Pedro—the abundance or availability of the fish from day to day throughout the season—has been studied by analysis of the daily average boat catch. This was determined by tabulating and averaging the individual catches of each boat day by day, the data being obtained from the filed carbon copies of the original fish receipts issued by the canners to the fishermen at the time of

delivery. This tabulation and analysis of the average boat catch, including the records of some 110 boats, is in course of completion. Careful consideration, however, has been given such artificial factors as market or labor conditions in arriving at a conclusion as to the daily abundance of the species and an effort has been made to take them into account.

The character of the season's run has been studied by taking a twenty-pound sample of the fish from the individual boat loads day by day at the time of unloading at the canneries, together with data on the locality and time of the catch. To date, 182 such samples have been taken from boats unloading at seven canneries in San Pedro and Wilmington, and from them the average weight, average length of the fish in each boat load, the size or age groups represented, sex and degree of sexual maturity, were determined. From these samples about 5000 individual fish have been specially measured and sexed. And from these data the spawning habits, the class of fish taken, and the variation in the catch have been studied. The degree of mixing of age or size groups, or the degree of uniformity of size in different schools is also being investigated.

The measurements of the large series of fish above mentioned, in addition to indicating the character of the run, have been tabulated to show the frequency with which fish of each length occur. This tabulation of length-frequency is the oldest reliable method of determining the age of fishes (see *California Fish and Game*, Vol. 5, No. 2, p. 53), and the curves or graphs prepared from our figures give undoubted indications of the ages of the various sizes of commercial importance.

The study of the maturity and spawning habits of the sardine at San Pedro was begun two years ago when Mr. Thompson and assistants made series of examinations of the condition of the roe during the spring of 1918 and 1919. The results of these observations were published in this magazine in July 1919.* The same observations were repeated during the past spring season by the writer and in addition to the records of spent and relatively mature fish, the roe of about 140 fish was preserved at weekly intervals and deposited in the laboratory collections for future microscopical study. The records of the maturity obtained while measuring the large series of fish mentioned above have also been tabulated and curves drawn to show both the relative numbers of immature, relatively mature, and spent fish present in each size group, and also the per cent of mature fish at each length.

The same series of measurements has been studied to determine the relative numbers and sizes of the two sexes, in regard to possible selective migrations, relative mortality, and differences in rate of growth. E. H.

*California Fish and Game, Vol. 5, No. 3, p. 159, July, 1919.

THE SARDINE PROBLEM IN THE MONTEREY BAY DISTRICT.

That the Monterey sardine fishery has increased in volume to eight times that of three years ago is evidence enough that the possibility of depletion can not be much longer ignored. The value of the present annual pack, about five and half million dollars, warrants the concentration of attention on this problem. Consequently, in the summer of 1919 the work was commenced.

The investigation was begun November 12, 1919, and was carried on energetically to the end of the season in March, 1920. The work was necessarily of the nature of a preliminary survey and involved the taking of extensive daily records of the various aspects of the daily commercial catch. Samples from about six boat loads were taken daily as the fish were unloaded at the canneries. An average weight of sardines in the respective catches was ascertained by the weight and count of the fish in these representative samples, the locality of the catch was obtained in most cases by a personal interview with each fisherman, and a number of fish were reserved from each sample for further examination. This remaining work was done at Hopkins Marine Station, where the Fish and Game Commission was courteously granted the use of quarters and facilities. This made possible the taking of accurate measurements of the sardines and a dissection for the purposes of determining sex and the development of spawn in the fish. During the season 345 samples were taken, 7534 fish were measured and sexed, and about 200 ovaries were preserved for study of the egg development.

A partial analysis of this data shows

that we have definite clues to the answers of the vital questions, and it but remains for a more extended study to corroborate and substantiate facts which we have concerning the age, rate of growth, migration and spawning. A complete report of findings will be published by the fisheries research laboratory at an early date.

Of course large questions of yearly fluctuations in abundance and sizes, with their important bearing on depletion, can not be comprehended in the results of one season's data, but the data taken this last season are invaluable as the first of a series of consistently comparable scientific observations of each season's catch, without which nothing concerning depletion can be detected before the harm is already done. It now remains for continuance of this study to solve all of the problems concerned, and insure the perpetuity of our great resource, through the adoption of intelligent conservational measures. O. E. S.

LARGE TUNA.

A large proportion of the blue-fin tuna caught during the month of August this year was of unusually large size. A six-ton load of excessively large ones was brought in to San Pedro by the boat "Little Perina" on August 16. The fish averaged 113 pounds, the largest tuna weighing 182 pounds and measuring five and a half feet in length, and the smallest measuring over four and a half feet in length. The average weight of tuna, and the size most convenient to handle, varies around 30 or 40 pounds. The fishermen complain of much damage to their nets by the large tuna, the meshes not being strong enough to withstand the assaults of these monsters. O. E. S.

LIFE HISTORY NOTES.

BAND-TAILED PIGEON NESTS IN SEQUOIA NATIONAL FOREST.

On September 1, 1920, Guard Arnold and myself, while working on the head waters of Deer Creek, Section 35, T. 23 S., R. 31 E., M. D. M., at an elevation of approximately 6500 feet, discovered the nest of a band-tailed pigeon, *Columba fasciata fasciata*.

The nest consisted of a few small dry fir limbs and twigs about 10 feet from the ground in a dogwood tree. The nest was so rudimentary that it did not seem possible that it could be a nest at all. On it was one small squab about one-fourth the size of the parent bird. It was naked except for a few sparse reddish-brown hairs on the head and back. We saw eight adult birds near where we found the nest and they acted as if they had nests near by. W. F. DERBY.

LARGE MACKINAW CAUGHT IN DONNER LAKE.

On July 10, 1920, Mr. J. C. Purdy of Sacramento, California, caught a fifteen-and-a-half-pound mackinaw trout in Donner Lake. This large fish was caught with a trolling tackle. The mackinaw trout was first planted in Lake Tahoe in 1895 and a year later in Donner and other nearby lakes after the successful hatching of a shipment of eggs. Although fish of this species are occasionally caught in lakes of the Truckee Basin, the mackinaw, or Great Lakes trout as it is sometimes called, has never thrived to the extent expected when introduced into this part of the country.

FIG. 47. Mackinaw trout caught by J. C. Purdy, in Donner Lake, Truckee, California.

SPARROWS DESTROY GARDENS.

The damage to fruit by the house finch and the damage to fall and winter gardens of the city and suburbs and some country districts by the intermediate sparrow are responsible for most of the bad feeling which some people hereabouts have for "birds." Owing to the flocking and cover-loving habits of this sparrow the damage to gardens is confined to those near which the birds find ready cover. For example, a garden in the open or even a hundred feet from a hedge or brushy canyon is perfectly safe. Plots that suffer are little home gardens in the thinly settled parts of city and country.

The vegetables eaten are lettuce, peas, string beans, turnips, radishes, beets, the things planted here from October to April when this sparrow is one of our most abundant birds. Onions are untouched, and I believe carrots also, and potatoes very seldom if other stuff is present; besides the potato grows too fast to be greatly damaged. But where the birds have congregated they will practically clean up small gardens of growing tender vegetables. Trapping is of no avail, owing to their numbers. Screens of wire or cloth are effective but people dislike the trouble and expense. Often they give up in despair until April. Frightening birds away with clods only drives them to a friendlier place. The only solution of the problem I know is to plant after October 1 what the birds will not eat and cover up other tender things until April. CARROLL DEWILTON SCOTT.

REPORTS.

STATEMENT OF EXPENDITURES.

For the Period from July 1, 1919, to June 30, 1920.

Administration:		
Commissioners	$1,672 70	
Executive offices	26,217 67	
Printing	3,824 84	
Research and publicity	5,030 44	
Accident and death benefits	2,765 19	
		$39,510 84
Commercial fish culture and conservation:		
Superintendence	$13,639 99	
Inspection and patrol	29,693 55	
Research	18,122 68	
Statistics	9,662 74	
Market fishing license commissions	765 00	
Propagation and distribution of salmon	22,703 34	
		94,587 30
Sporting fish culture and conservation:		
Superintendence	$14,510 34	
Printing	1,909 94	
Prosecutions and allowances	655 05	
Angling license commissions	15,324 20	
Special field investigation	252 35	
Fish exhibits	7,208 91	
General patrol (pro rata share)—		
San Francisco District (40 per cent)	34,545 05	
Los Angeles District (40 per cent)	14,148 00	
Sacramento District (40 per cent)	27,303 76	
Propagation and distribution of trout	121,102 29	
		236,960 89
Game conservation:		
Printing	$3,879 17	
Prosecutions and allowances	1,225 38	
Hunting license commissions	21,131 20	
Mountain lion hunting and bounties	6,950 23	
General patrol (pro rata share)—		
San Francisco District (60 per cent)	51,580 75	
Los Angeles District (60 per cent)	21,222 05	
Sacramento district (60 per cent)	40,956 68	
		146,945 46
Tahoe camping ground		3,152 98
Total expenditures		$521,157 47

CALIFORNIA FRESH FISHERY PRODUCTS, APRIL, MAY AND JUNE, 1920.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Glenn	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexican
Albacore												391,103		513,018		904,121	
Anchovies			3,092					119,160	150	12,350				16,060		150,813	
Barracuda								97			912	2,258,943	27,783	601,753		2,889,488	21,604
Bocaccio		15						24,677	43,615	200,745						269,052	
Bonito												7,718	10	1,538		9,266	
Carp				7,121	22,621		7,615	2,524								39,881	
Catfish		5,019		11,963	24,110		15,905									56,997	
Chilipepper								24,784	70,875	525						96,184	
Cultus cod	699	12,383						50,757	17,055	12,777		13				93,684	
Flounders				6,401			552	263,997	13,675	530	2,141	989	4			288,289	
Grayfish							555	7,250		70		19,565		272,635		299,915	
Hake								37,025	500							37,525	
Halibut	6,951	11,799	700					12,363	579	3,539	97,272	398,093	43,006	407,290		981,592	122,689
Hardhead					1,380											1,380	
Herring			810													810	
Kingfish								6,538	40,360	77,125	259	35,936	216	447		160,881	
Mackerel									842	38,227	519	852,693	7,442	79,373		979,096	515
Mullet														55		55	
Perch	3,432		12,710				9	10,840	3,381	7,222	1,520	5,876	170	625		45,735	
Pike				630	779		292									1,701	
Pompano								1,214	1,218	679		5,681		27		8,819	
Rock bass											340	37,404	3,562	19,342		60,588	210
Rockfish	2,742	3,555						146,870	84,439	97,312	22,818	145,470	4,515	151,661		658,782	170
Sablefish								135,960	5,446	12,212						153,618	
Salmon	27,602	626,951	4,098	447,699	117,996	77,880	400,696	21,765	167,794	1,098,533						2,989,814	
Sanddabs								240,654	38,969	4,750		2,403				286,776	
Sardines			113					5,550	625	1,597,662		3,566,582		3,611,229		8,781,761	
Sculpin												12,208	63	665		12,936	
Sea bass (black)											495	5,117	200	21,975		27,787	550
Sea bass (white)								213	521	177	20,353	777,062	1,964	124,641		924,931	9,845
Sea trout								187				8,901	250	615		9,953	
Shad			100	748	72		6,968	28,795	142	104						36,929	
Shad (buck)				174,571	24,028		206,666	1,075								406,340	
Shad (roe)				287,555	39,253		539,680	1,398								867,886	
Sheepshead												63		1,088		1,151	
Skates								15,647	1,250			600	22			17,519	

Skipjack																	10,844
Smelt	17,710		7,961				3,551	29,888	18,757	10,792	17,208	21,167	6,203	509		133,746	
Sole	25							680,160	156,150	9,663	6,129	6,257	83	550		859,017	
Splittail					544											544	
Striped bass			780	97,214	27,059		104,092	67,253	40							296,438	
Stingaree			120,300	170										170,817		291,287	
Suckers					593											593	
Surf fish												10				10	
Swordfish												163				163	273
Tomcod								8,782								8,782	
Trout (steelhead)	10															10	
Tuna												17,062		4,109		21,171	10,844
Tuna (bluefin)												4,340				4,340	
Tuna (yellowfin)												310				310	487,119
Turbot			13													13	
Whitebait			10					58						60		128	
Whitefish												6				6	
Yellowtail												548,766	37	73,512		622,315	20,890
Miscellaneous				205			55	13,713	3,385	1,271	385	10,910	1,661	1,260		32,845	
Total fish	58,571	659,722	150,688	1,023,677	258,435	77,880	1,286,476	1,959,194	669,718	3,186,265	170,351	9,141,411	97,131	6,074,254		24,823,773	685,553
Crustaceans—																	
Crabs (doz.)	1,032		166					11,682	259	9						13,148	
Shrimps								250,910				99				251,009	
Spiny lobsters																	320,743
Mollusks—																	
Abalones	180							35		165,324	59,729					225,268	1,509
Clams (cockle)	499	80	2,214								100		2,870			5,754	
Clams (mixed)	2,706		13,645					204					465			17,014	7,057
Clams (Pismo)											79,370					79,370	
Clams (soft-shell)	44	3,899	2,050				40,475	1,857								48,325	
Cuttlefish								12,146	4,343	3,297		375				20,161	
Limpets													10,500			10,500	
Mussels		510					1,871				28		13,575			15,984	
Oysters:																	
Eastern (No.)			161,225					913,400								1,074,735	
Native			26,380													26,380	
Squid									145	93,281		280				93,706	
Miscellaneous—																	
Terrapins (doz.)				6												6	
Turtles																	38,399
Scallops													230			230	

All amounts shown in pounds unless otherwise specified.

VIOLATIONS OF FISH AND GAME LAWS

April 1 to June 30, 1920.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without license	7	$125 00
Trapping without license	3	35 00
Deer—close season—killing or possession	20	805 00
Female deer—spike bucks—fawns—killing or possession	3	100 00
Illegal deer hides—possession	3	700 00
Brush and cottontail rabbits—closed season—killing or possession	5	125 00
Quail—in captivity without permit	2	100 00
Doves—closed season—killing or possession	7	175 00
Ducks—closed season—killing or possession	3	75 00
Nongame birds—killing or possession	5	35 00
Protected shore birds—killing or possession	1	25 00
Pheasant—killing or possession	1	----------
Possession condor wings	1	10 00
Total game violations	61	$2,310 00
Fish.		
Angling without license	27	$600 00
Fishing for profit without license	13	120 00
Striped bass—underweight—excess limit and offering for sale—closed season	6	190 00
Black bass—closed season—taking or possession	7	260 00
Sunfish—closed season—taking or possession	3	60 00
Perch—excess limit—taking or possession	1	20 00
Trout—excess limit—closed season—taking other than by hook and line	7	100 00
Clams—undersized—excess limit	7	175 00
Crabs—undersized—excess limit	13	70 00
Abalones—under or oversized—closed season	45	1,400 00
Shrimps—dried—possession	5	100 00
Fishing in restricted waters	4	50 00
Illegal fishing apparatus	10	750 00
Pollution of state waters	1	----------
Total fish violations	149	$3,895 00
Grand total fish and game violations	210	$6,205 00

SEIZURES—FISH AND GAME AND ILLEGALLY USED FISHING APPARATUS.

April 1 to June 30, 1920.

Game.

Deer meat	243½ pounds
Doves	8
Rabbits	1
Miscellaneous game	1
Deer hides	3
Deer heads	1

Fish.

Sturgeon	210½ pounds
Trout	27 pounds
Black bass	25½ pounds
Striped bass	189¾ pounds
Barracuda	2,100 pounds
Halibut	1,300 pounds
Salmon	14 pounds
Dried shrimps	1,000 pounds
Crabs	617
Abalones	780
Clams (Pismo)	369
Clams (cockle)	606 pounds
Illegal nets (including 26 fyke nets)	34
Crawfish traps	10

Searches.

Illegal fish and game	7

INDEX VOLUME 6.

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PATROL SERVICE.

SAN FRANCISCO DIVISION.

E. L. Bosqui, Commissioner in Charge. Chas. A. Vogelsang, Executive Officer.

J. S. Hunter, Assistant Executive Officer. E. C. Boucher, Special Agent.

Head Office, Postal Telegraph Building, San Francisco.

Phone Sutter 6100.

W. H. Armstrong---Vallejo	L. L. Koppel---San Jose
Earl P. Barnes---Eureka	Henry Lencioni---Santa Rosa
Theo. M. Benson---Fortuna	Albert Mack---San Francisco
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F. A. Bullard---Dunlap	E. V. Moody---Santa Cruz
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D. H. Hoen---San Rafael	Chas. Bouton--Launch "Quinnat," Vallejo

SACRAMENTO DIVISION.

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Geo. Neale, Assistant.

Forum Building, Sacramento.

Phone Main 4300.

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LOS ANGELES DIVISION.

M. J. Connell, Commissioner in Charge.

Edwin L. Hedderly, Assistant.

Union League Building, Los Angeles.

Phones: Broadway 1155; Home, F 5705.

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J. J. Barnett---Ventura	H. I. Pritchard---Los Angeles
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1919 ABSTRACT CALIFORNIA FISH AN

WHITE SQUARES INDICATE OP

NUMBERS IN SQUARES ARE OPEN DATES

	DISTRICTS	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG LIMITS, ETC.
DEER	1-1½-4½ 23-24-25-26								15		14			No Does, Fawns or Spike Bucks. No sale of venison. Two Bucks per season. See Notes 1-2-8-9-10-14
	2-3									14				
	4								15	15				
RABBITS, Cottontail and Brush	ALL											15		15 per day. 30 per week. No limit in District 4
TREE SQUIRRELS	ALL													12 per season
ELK, ANTELOPE, MOUNTAIN SHEEP	ALL													Killing of Elk or possession of Elk meat a felony
SEA OTTER, BEAVER	ALL													$1,000 fine for Sea Otter
BEAR, FUR ANIMALS	ALL										15			See Notes 11-12
DUCKS, GEESE, JACK SNIPE, REED HENS	ALL										15			See Notes 4-14-15-17
RAIL, WOOD DUCK, WILD PIGEON, SHORE BIRDS (Except Jack Snipe)	ALL													
QUAIL, Valley and Desert	1-1½											15		15 per day. 30 per week.
	2-3													
	4-4½										15			
MOUNTAIN QUAIL	1-1½													10 per day. 20 per week.
	2-3											15		
	4-4½										14			
SAGE HEN	ALL Except 4								15					4 per day. 8 per week.
	4													
DOVE	ALL													15 per day. 30 per week.
GROUSE	ALL									15	14			4 per day. 8 per week.
TROUT (Except Golden), WHITE FISH	1-12a-12b													
	1½													See Note 44 50 fish or ten pounds and one
	2													See Note 43 fish or one fish weighing ten
	3													See Note 45 pounds or over.
	4-4½													See Notes 36-37-39
	Lake Almanor													See Note 26
	23-24-25					30								
GOLDEN TROUT	ALL						30				1			25 per day. None under 5 inches.
BLACK BASS	ALL													25 per day. None under 7 inches.
	Clear Lake in Lake Co.													No sale. Hook and line only.
SACRAMENTO PERCH, SUNFISH and CRAPPIE	ALL													25 per day. Hook and line only.
STRIPED BASS, SHAD	ALL													See Note 23
SALMON	ALL Except 15													See Notes 27-46
	15				15									
CATFISH	ALL					14			15					Closed season only for commercial fishing
CRABS	ALL							30				16		See Note 28
ABALONES, Red	ALL													See Note 33
Green, Pink, Black	ALL													
PISMO CLAMS	17													See Note 32

HUNTING LICENSES

License Year from July 1 to June 30

Residents, $1.00. Non-residents, $10.00. Certain Aliens, $10.00. Other Aliens, $25.00.

ANGLING LICENSES

License Year from January 1 to December 31

Residents, $1.00. Non-Residents, $3.00. Aliens, $3.00.

TRAPPING LICENSES

License Year from July 1 to June 30

Citizens, $1.00. Aliens, $2.00.