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DEPARTMENT OF LANDS AND FORESTS

HON. A. KELSO ROBERTS, Q.C., MINISTER

F. A. MACDOUGALL, DEPUTY MINISTER

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The Cover

The work of a Conservation Officer sometimes requires that he spend extended periods of time in the woods, camping wherever night overtakes him, regardless of season of the year. In this photograph by K. M. Andresen, Conservation Officer Percy Swanson prepares his evening meal while on patrol in the Chapleau Crown Game Preserve. On the back cover is Ted Jenkins' aerial photograph of fish huts on Lake Simcoe.

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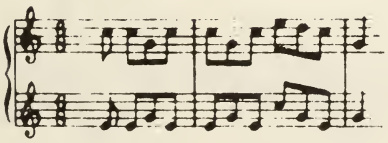
THE SORBIATI

Hunting is not an episode. It is lived, and should be lived well. Said the author of *Tristram Shandy*, "They order this matter better in France". This statement would hardly be so well remembered if there were not some truth in it. Certainly, there is a grace and dignity to French hunting that gives it a supreme justification, and never for a moment is the place of the hunted degraded.

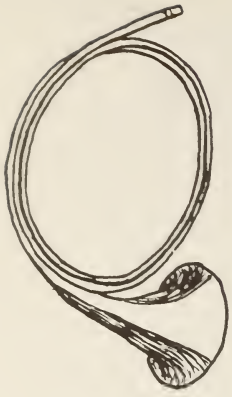
In a good stag hunt, for example, the forest and the herd should both be sound, in good heart, and managed for the best that is in them. The pack should be strong, fast and musical, and yet steady. Huntsmen, handlers and assistants should all know their jobs and, above all, the deer should be given a fair chase and, when his time comes, a clean kill.

It is all done to the sound of the great round French hunting horn, which delights the ears of men even as it rallies the hounds. It is, of course, in the fanfares that tradition has produced significance and beauty. "Leave your kennel, valiant hounds!" has the simplicity and the ringing promise of bird song in early spring. When the stag is "at bay" the most distant forester knows from the notes where he is and what is happening. "Death" is sombre. After it, there is a triumphant "quarry" in which the deer is broken up on his own hide (or cuir-hence the name),

La Sortie du Chenil



Sortez du Cheni!
Mes vaillants limiers;
Il faut aujourd'hui
Battre les halliers.



and then the noble and joyous "Honours" in which trophies are awarded and respects paid. The last music of all, not always remembered, is different. It expresses feeling for the deer, and is both melancholy and resigned. It is the "Sorbiati" otherwise "The Weeping of the Stag". In spite of this title and the conformity of the music, it is actually a "cap" for the huntsman and the words that go with it are, "Open your purses."

Of course, deer do not weep, and for these seeming inconsistencies, there has to be an explanation. "Le Cerf et sa Chasse" (Verlinden and de Janti, Paris, 1960) simply quotes the 11th century Seljuk king, El Jallal, who said, "I fear the Most High God; because I have brought living creatures to their death, when I did not need them for my subsistance, I shall give alms of one dinar for each". He likewise kept all the trophies respectfully.

But, one can see, the huntsman needs no alms. What has happened is that the tip and the fanfare have become symbols of the necessity that the forest should be properly managed, and the surplus deer cleanly and respectfully taken, as by one who fears the Most High God, and honours his Creation. We could do with a Sorbiati, somewhere.

Les Pleurs du Cerf — Sorbiaty

Music: Courtesy of Le Saint-Hubert Club de France

FARM PONDS FOR FISH IN ONTARIO

by R.A. Ryder
Biologist

Ontario possesses one of the foremost freshwater fisheries on the continent, and with the vast water areas in the Province that provide suitable habitat for many game and commercial species, one would wonder if the construction of artificial ponds for fish propagation is necessary. An examination of a topographical map of Ontario, however, would soon cause the observer to change his attitude about the need for farm ponds in certain regions. Most of the natural lakes of any consequence occur in the central and northern portions of the Province in the Precambrian Shield region. Southern Ontario has the Great Lakes and a few major fishing waters such as Lake Simcoe but, for the most part, southern Ontario, west of the Kawartha Lakes and south of Orillia, is almost devoid of waters capable of supporting large populations of sport fish. The nature of the terrain does not lend itself to the natural formation of lakes, and most water bodies take the form of ponds, marshes or streams. The consequent demand for an angling fishery here has been partially satisfied by the construction of thousands of farm ponds. The interest shown in farm ponds in Ontario has accelerated greatly since 1950.

Farm ponds are constructed for purposes other than the support of fish, and fisheries propagation is often only a secondary use. Such facilities as swimming, irrigation, fire protection and stock watering are all corollary uses of a farm pond. Originally, they were constructed to satisfy one or more of these needs but, in the last decade, with the gradual increase in leisure time available for recreation, ponds are being constructed in many cases with the intention that fish propagation will be the major use. It is these latter ponds that are most likely to be successful as they are designed primarily to provide suitable habitat for the fish.

Farm fish ponds in Ontario are of two varieties, namely coldwater or trout ponds, and warmwater ponds. Trout ponds are generally preferred, probably because they are easier to manage, but many ponds do not provide suitable habitat for propagation of trout, and warmwater species such as the largemouth bass must be introduced. Whether a pond is intended for use as a coldwater or warmwater pond, two important conditions are requisite. A suitable site must be available and a satisfactory water supply must be present.

The pond basin must be sufficiently deep to allow fish to survive extreme conditions in both summer and winter, and the underlying layers of the basin must be sufficiently impermeable to prevent seepage of water. In addition, wise conservation practices must be adhered to on the surrounding watershed to prevent a gradual destruction of the pond through soil erosion and resulting sedimentation. Strip farming and contour plowing practices are usually recommended on cultivated land surrounding the pond. Livestock should be fenced out of the immediate pond site to prevent overgrazing and the disturbance of the bottom mud which results in siltation.

A suitable water supply must maintain certain standards of both quantity and quality. Ponds dependent on rain runoff must have a watershed of suf-

ficient size to assure adequate pond levels at all times of the year. Similarly, spring-fed and stream-fed ponds require a continuous flow of water, sufficient to maintain pond levels.

Water quality depends principally on its physical and chemical properties. The degree of quality required depends on whether a warmwater or coldwater pond is considered. Minimal water requirements for a coldwater pond are usually more difficult to achieve and may be impossible to attain in some areas. Generally, subsurface waters must not rise above a temperature of 70°F for any length of time, and dissolved oxygen concentrations should exceed five parts per million. At the same time, excess amounts of toxic gases, such as carbon dioxide, hydrogen sulfide, nitrogen or methane should be eliminated. In unsuitable water supplies, oxygen may usually be added and noxious gases largely eliminated by running the water over a series of baffles before it enters the pond. Some water sources have an excess of dissolved salts although this is not usually a problem in Ontario.

Ponds may be constructed by blocking a valley with a dam and diverting a water supply into it from a stream or spring. Before any stream is dammed or diverted, permission must be obtained from the Department of Lands and Forests. If runoff is sufficiently great and the watershed area large enough, diversion of flowing waters may not be necessary. These latter ponds are usually suitable only for warmwater species because of high summer temperatures, although rainbow trout occasionally thrive in these ponds also.

Sites lacking suitable natural contours will have to be excavated by means of bulldozer or drag-line. The materials obtained from excavation, if impermeable, may be used in the construction of the earthen dam. Many arrangements have been devised for the control of both normal and peak overflows from the pond. During periods of normal flow, the volume of water flowing through the pond should be kept to a minimum, preferably less than two cubic feet per second for each acre of pond surface.

SPECIAL PROBLEMS

Management of farm ponds can be extremely complicated and may frequently encounter problems which require technical assistance. The solution of these problems may require the services of a biologist who is qualified to perform physical, chemical and biological examinations of the pond and its inhabitants. The problems most often encountered include: an overabundance of aquatic vegetation, fish diseases or parasites, fish population imbalances or impurities, turbidities, winter-kill or summer-kill, oxygen deficiency or a corresponding carbon dioxide increase, and many others. Some of these are easily remedied once the causes are understood. It remains for the specialist, however, to deal with the more complicated situations.

Control of aquatic weeds is one of the more common problems. Mechanical methods are usually entirely satisfactory in ponds less than one acre in area. Emergent weeds may be pulled up by the roots by hand. Submergent weeds are often removed by dragging a scythe, rake, or chain behind a boat. Larger ponds may require chemical treatment of weeds as a more practical measure. Both emergent and submergent weeds may be killed by use of one of the various herbicides presently available. As most herbicides are toxic to fish, extreme care must be exercised in the application of these materials to the pond. In Ontario, before the use of any potential fish toxicant on the waters,

A well landscaped farm pond. Photo by T. Jenkins.

a permit must be obtained from the Ontario Water Resources Commission. Filamentous algae may usually be controlled by the application of copper sulfate to the pond. This toxicant will also kill desirable, minute algae forms which are basic to the food chain and it should be used sparingly.

Farm pond productivity, to the pond owner, will be the capability of the physical, chemical and biological properties of the pond to produce fish flesh. The pond owner will usually gauge this measure in terms of pounds of fish per acre of pond surface.

Many of the characteristics of the watershed, the pond basin and the water supply will contribute to pond productivity. The basic productivity of the water, itself, depends on the quantity and proportion of phosphorous, nitrogen and potassium compounds available to the phytoplankton organisms in the water. These organisms are minute plants suspended in the water, and their rate of growth and reproduction depends to a large extent on the chemical constituents in the water. Most of the agricultural areas of Ontario have very rich waters because of natural geological conditions and the additions of fertilizer to the soil in farming. On the other hand, waters on the Canadian Shield are relatively low in nutrients, and the production of ponds in this area could be expected to be lower than in southern Ontario.

Optimum water temperatures will increase the metabolism and growth of various fish species. Ponds maintaining a 65°F temperature during most of the spring and summer months will pro-

Above: this pond was poorly constructed and lacks suitable features. Below: a pond dam, showing spillway structures. Photos by T. Jenkins.

vide satisfactory growing rates for trout. Ponds with temperatures less than 55°F will result in slow-growing trout that may never reach satisfactory angling size. Again, temperatures over 70°F for any length of time may prove lethal to trout. Warmwater species will grow best at temperatures exceeding 70°F, but temperatures in excess of 80°F for any length of time should be avoided.

Water that is overly turbid because of inorganic suspensions will never become productive. Turbidity caused by clay suspensions reduces the depth of sunlight penetration of the water and this reduces the production of plant life including algae. Clay turbidity may be reduced by practising proper conservation measures on the watershed or by introducing a material such as limestone which will cause colloidal particles to settle.

The size and shape of the pond basin will also affect the potential productivity. The basin should be deep enough to provide suitable environmental conditions, and the shoreline slope adequately steep to prevent the encroachment of aquatic vegetation on the pond. Most Ontario ponds range from one-quarter to one acre in area and from six to fifteen feet in depth. Ponds larger than five acres are often difficult to manage because of weed problems or the presence of undesirable fish species. Runoff ponds less than fifteen feet in depth are usually unsuitable for trout or provide only marginal habitat. Hence, while these ponds may be satisfactory during spring and fall, stress periods in midsummer or late winter may result in fish mortalities.

The productivity of most trout ponds in agricultural Ontario may exceed fifty pounds of trout per surface acre of pond. Warmwater fish ponds usually have a larger production per surface acre of pond. Farm ponds in northern Ontario will be proportionally less productive of fish, particularly in the region of the Precambrian Shield, because of less fertile soils and a shorter growing season.

FERTILIZATION AND FEEDING

An adequately stocked pond, properly constructed, will require neither fertilization nor artificial feeding to provide suitable fishing in Ontario. Both these techniques increase the management problems on a pond and should not be attempted where suitable growth and production are attained.

Fertilization will add nutrients to the pond, thereby increasing the primary productivity which will result in the production of more fish food organisms. It may also contribute to oxygen deficiencies in the water with a corresponding uptake of carbon dioxide which may result in fish mortality. If it is decided that fertilization is desirable in your pond, advice on the rate of application should first be obtained from a private, consulting biologist.

Essentially, artificial feeding increases the productivity of the pond, but it also may have some disastrous results unless properly applied. In general, both artificial feeding and fertilization should be avoided if possible on Ontario ponds until more information is available on the usefulness of these techniques in northern latitudes. Both fertilization and feeding are expensive practices and are not normally required.

Fish for pond stocking may be purchased from many private fish hatcheries in Ontario. A list of these, showing the species propagated at each, may be obtained from the Department of Lands and Forests.

Brook (speckled) trout and rainbow trout are the two coldwater species

best suited for pond culture. Both largemouth and smallmouth bass are used extensively for planting in warmwater ponds. Bluegills and golden shiners are occasionally used as a forage species in combination with one of the basses, but their usefulness in this respect has not yet been demonstrated in Ontario. Stocking of trout for best results should take place in the springtime before water temperatures have exceeded 65°F. Brook and rainbow trout are stocked alone or in combination, although a single species seems to thrive better. Stocking rates are variable and depend to a large extent on the potential productivity of the pond. Fertile ponds will support more fish than infertile ponds and a higher rate may be preferable. Stocking rates depend on many factors such as the physical characteristics of the pond and water quality. Overstocking should be avoided and may result in such a slow growth rate that the fish will never reach a size satisfactory for angling.

Ponds may provide suitable spawning facilities for sport fish species. Others will require periodic stocking to maintain an adequate fish population. Natural reproduction in farm ponds is not necessary or in some cases even desirable to provide good fishing. In warmwater ponds, natural reproduction may contribute to more complex management problems.

HARVESTING THE FISH

Harvesting the fish in your farm pond should commence as soon as the fish have reached a satisfactory size for angling or eating. The removal of fish at this stage will allow the remainder to grow to a larger and more desirable size. A farm pond should be fished intensively so that overcrowding and subsequent stunting of fish populations will not result. This pertains particularly to warmwater ponds. Angling with live bait or artificial lures are suitable methods for harvesting fish in most ponds.

In this Province, all fish caught in farm ponds are subject to the laws provided in the current Ontario Fishery Regulations. Consequently, the pond

Easy accessibility to a pond is desirable. Photo by T. Jenkins.

The introduction of yearling brook trout into a pond provides immediate angling. Photo by R. Muckleston.

owner is obligated to conform to seasons, creel limits and other regulations that may be stipulated. Provisions have recently been made which will allow a pond owner to sell trout raised in his pond under licence from the Department of Lands and Forests. He may also charge a fee for angling in his pond under this licence. A landowner may, without need of a licence, charge a tresspass fee, thereby allowing anglers access to his pond. Most pond owners, however, will be providing fish for recreation or food for their families and friends, and will require no licence or permit.

Farm ponds are an important supplement to our natural fishing waters in Ontario and in the future will provide an ever-increasing proportion of our total game fish harvest. Careful consideration should be taken and well formulated plans made to ensure that satisfactory results will be obtained in terms of fish produced and recreation provided.

COUNTING COTTONTAILS

by R.E. Mason
Biologist, Lake Huron District

One of the many problems associated with wildlife management involves keeping an account of the numbers of animals with which we are dealing. Knowing the answer to the question of "how many" is usually required before any management program can be properly evaluated, including the regulation of harvests undertaken by setting bag limits and seasons and by other pertinent legislation.

The use that is made of the census information frequently determines the techniques which can be used in conducting the census. In an Administrative District, most of the requirements for the management of a population can be supplied by census information which simply measures the relative abundance of animals from year to year. That is, we require to know whether a population is increasing or decreasing, and by how much, relative to some previous situation, usually the preceding year. Reliable indices to relative abundance can be obtained without knowing, in absolute terms, the numbers of animals per acre or per square mile, and are obtainable usually with less effort than is required for a complete census (Yates, 1960).

The expenditure of effort is an important consideration in an Administrative District, since man-power resources are limited. As well as making efficient use of man power, the technique must be applicable to large areas (8,860 square miles in Lake Huron District), and capable of covering the area in a short time so that population changes during the census period will not influence the results. Simplicity in the techniques, including whatever equipment may be required, is also of value. Acceptable standards of precision and accuracy must, of course, be achieved.

Based mainly on an evaluation made by Wight (1959) on information collected in Missouri, a system of roadside counts of cottontails was initiated in Lake Huron District in 1959. The actual technique employed has been changed somewhat each year since then, as experience with the technique has increased. These changes have limited the value of the information for between–year comparisons; however, the form used in the 1962 counts is believed to be sufficiently reliable and practical so that future counts can be conducted with consistency.

The 1962 technique involves counts of cottontails along 100 miles of secondary gravel-surfaced roads in each of the 15 conservation officer patrol areas in the District. The counts are started at about 5:15 a.m. on four mornings sometime during the period from July 13 to 21. A total of 25 miles is driven each morning, usually involving one to one and a half hours each. The numbers of cottontails observed are recorded for each five-mile segment of the 25-mile daily trip. Cottontails are designated as adult or juvenile on the basis of their size.

For clarity, the five-mile segments are called transects; the daily 25-mile segments, lines; and the 100-mile segments, patrols. The locations of the four lines within each patrol remain the same each year.

In addition to the number of cottontails observed, certain information on weather factors, such as temperature, wind velocity, and precipitation, is

A white forehead blaze marks most juvenile cottontails. Photo by W. Masters.

recorded. The technique was expanded to include snowshoe and European hare, and mourning doves, although the value of the technique for these species has not yet been determined.

The advantages of using roadside counts to provide an index to relative abundance are that they combine simplicity with relatively low, man power requirements, and can cover large areas in relatively short periods of time. The difficulty with roadside counts is that factors other than cottontail abundance can influence the numbers of individuals which will be seen. As a result, the information secured can be inaccurate, in that it is measuring one of these other factors; or the variation encountered can be so great that the precision of the count is adversely affected.

Factors which may influence counts include such items as: changes in the activity pattern of cottontails with the time of day and season of the year; influences of weather factors on cottontail activity; rural traffic; cutting and spraying of roadside vegetation; salting of roads; speeds driven (may be too fast to permit accurate observation of size classes, or so slow that cottontails flush from the roadway too far in advance of the vehicle); and observers may have different abilities to distinguish rabbits. Changes in habitat quality along the roads and among patrols can be expected to increase the variability of the data.

In spite of these and, possibly, other factors, roadside counts can produce a reliable index to cottontail abundance if properly conducted. Wight (1959) found only two years out of a total of 11 years' information in which road counts of cottontails were not re-

Young cottontails grow quickly. In about a week, their eyes are open; at two weeks, they are strong enough to leave the nest. Photo by R. Muckleston.

lated to the following winters' hunting success. In one of these cases, the disagreement could be attributed to unusually poor hunting conditions, rather than failure of the census technique.

Based mainly on studies by Lord (1959), Lord (1961), Newman (1959) and Wight (1959), attempts are made in the design of the technique and the analysis of data to control or measure the effects of these factors.

The selection of the starting time of 5:15 a.m. is a compromise between the activity pattern of cottontails during the midsummer period, the necessity of minimizing rural traffic, and having enough light available to facilitate observation. The requirement that lines remain the same each year somewhat limits the avoidance of roads where roadside vegetation has been cut or sprayed, or the roads salted, beyond an initial selection of roads which are seldom subjected to these activities. Usually, such roads are also less heavily trafficked. The midsummer period (July 13-21) is chosen since this time permits the greatest number of cottontails to be aged on the basis of size. By conducting the census over four days, the contribution made by the peculiarities of the weather on any particular day is reduced. Limitation to four days is desirable. Speeds driven must be partly determined by road conditions, but speeds between 15 and 25 m.p.h. have been found satisfactory.

The only weather factors selected against at this time are severe rain and severe fog. Over enough time, the observations made on weather factors will permit an analysis of the manner in which these affect the results, and corrections can be made on the data from future censuses.

The use of five-mile transects provides some averaging of habitat differences, particularly broad differences

such as wooded versus grassland situations, thus producing some reduction in variability. Increasing the transect length beyond five miles might further reduce the variability, but it also reduces the number of experimental units. Variability associated with different lines and different patrols is measured in the analysis of the data. The variability associated with observers is included in that for patrols.

As previously stated, the changes made in the technique each year since the beginning of the study have limited the value of comparisons of information collected in different years. In 1960 and 1961, the technique employed in four patrols was sufficiently similar to allow a comparison between those years; in 1961 and 1962, a comparison can be made on the basis of information from five patrols. Only three patrols are common to 1960, 1961, and 1962, and this number is not considered sufficient to allow a comparison of the three years together.

The information from each of these three years must be subjected to detailed statistical analysis to determine whether the observed differences could have been produced by pure chance, considering the degree variation within the data. Biologists and workers in other technical fields, who use statistical techniques to evaluate their results, are generally agreed that phenomena which have less than one chance in twenty of having occurred by chance alone can be considered to demonstrate real differences. On this basis, we find that the number of cottontails in Lake Huron District showed a definite increase from 1960 to 1961 which had less than one chance in twenty of occurring by chance. This can, therefore, be accepted as a definite increase in population level of about 30 per cent. In comparing the data for 1961 with those for 1962, we find that although a slight decline in abundance is suggested, the statistical analysis shows that this indication has about one chance in ten of having occurred by pure chance. While our observations do not, therefore, provide definite proof of a decrease in the abundance of cottontails, we do have an indication at ten to one odds that there has been a slight (13%) decline from the 1961 level.

It is hoped that, with standardized procedure, future comparisons of annual cottontail abundance can be made on a District basis, and that hunting season prospects can be made available to local hunters well in advance of opening day. 1961 provided a bumper crop of cottontails. Based on the results of this study, hunters can expect to encounter slightly fewer cottontails during the 1962-63 season but it should still rate as a very good cottontail year.

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THE RABBIT REGAINS ITS STATUS AS A GAME ANIMAL

by Wm. W. Bittle

This reinstatement is rightfully so, for in many parts of North America the rabbit is considered Number One in importance to game hunters. More people find pleasure in the hunt for these animals, and enjoyment in the many ways they can be served as a table delicacy, than any other game, be it feather, fur or hair.

Perhaps it took the "New Canadian" to show us just how important the rabbit is. Many of these people now residing in and around Metropolitan Toronto took to the field in search of their favourite game and, when they found it (rabbits) in abundance, took advantage of so ready a harvest. More of their friends joined them and news of good hunting brought hunters into wooded areas in the Tweed District and onto our agricultural lands.

Actually, this was a good thing, for the rabbit, at times, becomes a source of concern to foresters and farmers. Young pine and spruce plantations as well as orchards are particularly vulnerable to rabbit damage.

One plantation owner in the Tweed District sent out special invitations to rabbit hunters as an aid in controlling the animals. A record of the harvest was kept on eight acres of pine with the following results. Three parties, comprised of six men in each party took 82, 86 and 104 rabbits in separate hunts at various times. Two men on four separate hunts took a total of 110 rabbits. This adds up to 382 rabbits on eight acres.

All the animals were utilized (cleaned and stored for ready use) by people who realize how acceptable rabbits are as a food source.

The Department of Lands and Forests have received many requests from sportsmen (individually and in groups) who are interested in rabbit hunting, where they can be found and where and when they can be hunted. Here, in Tweed, we have been pleased to direct hunters into our wooded areas where the snowshoe rabbit can be found. Also, we advise hunters out after "Jacks" and cottontails to seek the permission of landowners who are usually willing to allow hunting provided they know who is doing the hunting.

All three types of rabbits are now classified as game, and common sense will tell the sportsman to wait until the fall when the animals are tender and fat before going gunning. The season opens on September 1st and closes at the end of March, at which time the struggle to survive the rigors of winter makes the animals tough, lean and a little on the "barky" side. Of course, landowners may destroy the animals at any time if they are doing damage, but let's take them at a time when there is no waste. Weekly News Report, Tweed District, August 11, 1962.

There were two ardent fishermen who got a good strike at exactly the same instant. Both fishermen started to reel very cautiously, giving line when the pull seemed to threaten the strength of the tackle. So the battle went on, reeling and breaking. After considerable time, when both anglers thought they had played the fish out, and both gave the final surge to land the fish they found that each had a man, with rod and reel on their hook. What did they do? They untangled their hooks, wiped sweat from their brows and continued fishing. Cochrane Weekly News Report, May 11, 1962.

THE BAIT—FISH INDUSTRY IN ONTARIO

by M.J. Brubacher
Biologist

In a report to the Legislative Assembly of Ontario in 1930, a Special Committee on the Game Fish Situation stated with respect to minnows: "Local capture and sale, which represents both a source of revenue to children and others, and a convenience to sportsmen, is probably harmless if the minnows are not taken by destructive apparatus". During the thirty-two years which have passed since this report was made, the business of "capture and sale" of minnows has changed considerably in Ontario. From the time when it was classed as a means of providing supplementary income for "children and others", it has reached the position of providing retail sales in excess of one and one-half million dollars. Minnows may now be found for sale at all times of the year in nearly every part of the Province.

The growth of the bait-fish industry certainly reflects the increased interest and participation in angling which has characterized the last three decades, particularly the period since the end of World War II. Tables I and II show the increase in the number of commercial bait-fish licences issued in Ontario since 1925 (Earlier records are not available but licences were probably issued for some years before this date).

The use of live, small fish as bait for angling has long been recognized as one of the better ways to ensure a well filled creel. The practice may be frowned upon by those sportsmen who use the fly rod and flies exclusively for bait; the spinning enthusiast who depends entirely upon the brightly coloured bits of metal, wood, plastic or feathers for bait; or by the casting rod specialist who depends upon his plugs and spoons to attract game fish to his hooks. Each of these types of gear, however, is frequently used effectively with various kinds of small live fish as bait.

In spite of the popularity of live bait fish and the hundreds of artificial baits, the lowly earthworm has also maintained a high degree of popularity. A recent estimate of one of the bait dealers in the Province places the number of night crawlers, dewworms or earthworms exported annually from southern Ontario at between one hundred and two hundred million. Nor does this take into account the sales within the Province or the numbers caught or dug by the more independent or youthful angler.

Many kinds of small fishes are used for bait. The majority may truly be named "minnows" since they belong to the large class of principally small fishes known as *Cyprinidae*, but fry and fingerlings of other families of fishes, such as suckers, are important as bait. It was because of the specific meaning of the word "minnow" that the more general words "bait fish" were substituted in the Ontario Fishery Regulations about six years ago.

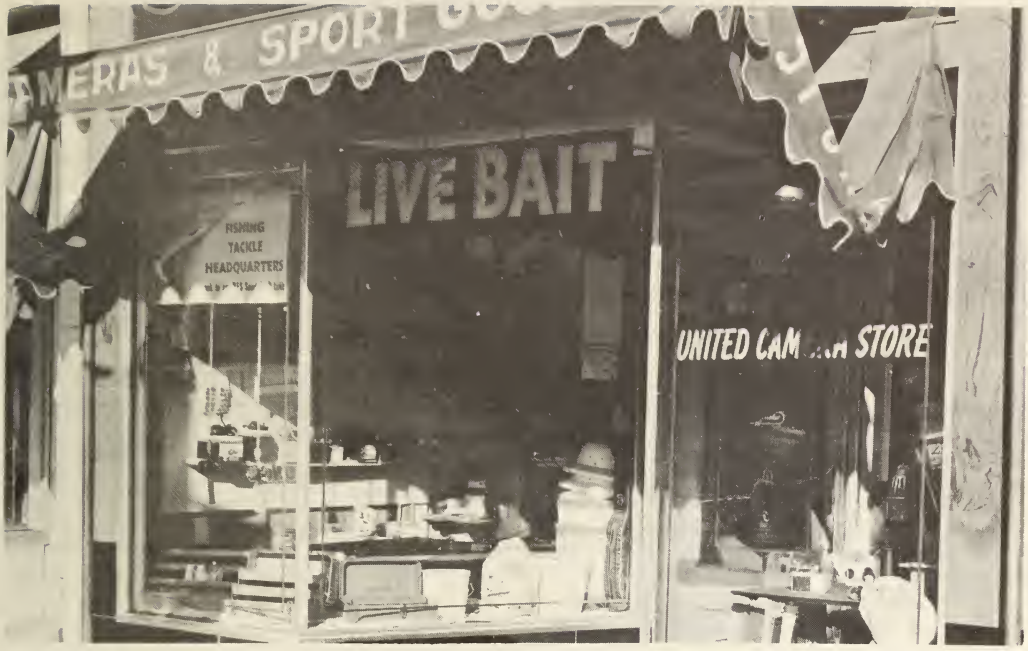
The Ontario angler has a large variety of bait fish to choose from, but there are a few which are not permitted to be used. These include the young of all game fish and walleye or yellow pickerel, pike, lake trout and whitefish. All species of lamprey are prohibited as bait because of the very real danger of spreading the most harmful form, the sea lamprey, into waters in which it fortunately has not gained access. For a similar reason, a number of other species of fish may not be used alive as bait in Ontario. The careless empty-

A bait fish pond just outside Toronto. Retaining boxes and sporting equipment are used when minnows are prepared for shipment. Photo by T. Jenkins.

ing of minnow buckets at the conclusion of a day's fishing is not only contrary to the Regulations but is one of the ways in which undesirable species can be introduced. Live alewife, carp, dogfish, gar pike, goldfish, white perch, yellow perch, rock bass, sunfish and smelt are all prohibited because of this danger. An exception is made for the waters of the Great Lakes where perch and alewife are already present, and these two species may be used as live bait in the Great Lakes and connecting waters only.

It becomes a great deal more difficult to list all of the commonly used bait fish species. In fact, it is somewhat difficult to identify these small fishes unless one notes carefully the various characteristics of each. Except for the carp, goldfish and fallfish, the true minnows found in Ontario are all small with toothless jaws and soft-rayed fins. They possess "throat teeth" or pharyngeal teeth which press against a hard pad at the base of the skull in grinding food. Their food is mainly composed of microscopic plant or animal life called plankton. One of the most important roles of these little fishes in our waters is that of providing food for the larger fishes which we prize. It is this fact which undoubtedly makes them such good bait since they are the usual food of many game fish. For the same reason, many artificial baits are constructed to imitate the colour, shape, size or movement of minnows. The commonly used bait species of this family include the chubs, dace, shiners, fathead minnow and bluntnose minnow of which some twelve or more are generally popular. Suckers, of fingerling size or larger, are the fish other than minnows most highly regarded

The angler in Ontario may obtain his bait fish in two ways. He may either buy his supply from one of the two thousand or more commercially licensed dealers or fishermen, or he



A typical retail outlet for bait fish. Minnows are a necessary commodity in a store that specializes in sporting goods. Photo by T. Jenkins.

may catch his own supply. The Ontario Fishery Regulations allow an angler without a special bait-fish licence to use a trap or a small dip net in taking his personal bait fish supplies. During the summer angling period, up to November 1st, a maximum possession limit of fifty fish is permitted each angler. This amount provides bait, usually sufficient for a few days' fishing and is about the largest number which can be held in most minnow containers without undue loss. Under the authority of an Angler's Bait-fish Licence, obtained from the Department of Lands and Forests at a nominal cost of one dollar, a larger dip net up to six feet by six feet in size may be used throughout Ontario, and a small seine up to six feet by thirty feet may be used in the Great Lakes and their connecting waters and in Lakes Simcoe and Nipissing.

The commercial bait-fish fisherman in Ontario has a remarkable number of lakes, rivers, and ponds in which to fish for his supplies. He may use, under licence, a seine up to sixty feet by six feet or one hundred feet by eight feet, for an annual licence fee of ten or fifteen dollars, respectively; a dip net up to ten feet by ten feet at a fee of five dollars; or traps at a fee of two dollars each. Many minnow fishermen have two or all three types of licences. In the areas of soft bottomed, weedy "pot hole" lakes or ponds, traps are the only practical gear, and a few operators have as many as forty or fifty traps under licence.

The bait-fish fisherman can dispose of his catches directly to the angler or he may supply the larger dealers whose business might be classed as wholesale.

Bait-fish dealers operate under a different licence known as a Bait-fish Dealer's Licence for which an annual fee of ten dollars is paid. The dealer is restricted to the purchase and resale of the fish. He does not fish for his stocks in public waters but must pur-

TABLE I

SUMMARY OF COMMERCIAL BAIT-FISH LICENCES IN ONTARIO
(By selected years from 1925-1961)

Water or Area	Type	1925	1930	1934	1945	1950	1961
Lake Ontario	Dip net			2	1	7	8
	Seine	9	9	10	13	33	28
	Traps						2
	TOTAL	9	9	12	14	40	38
Lake Erie	Dip net		3	5	5	9	31
	Seine	26	15	22	20	41	70
	Traps						
	TOTAL	26	18	27	25	50	101
Lake St. Clair (incl Detroit R.)	Dip net		10	17	16	18	31
	Seine	3	8	1	20	25	35
	Traps						
	TOTAL	3	18	18	36	43	66
Lake Huron	Dip net			2	4	8	11
	Seine	1				6	36
	Traps						1
	TOTAL	1	0	2	4	14	48
Georgian Bay	Dip net		1		2	2	15
	Seine			1	8	16	14
	Traps					1	2
	TOTAL	0	1	1	10	19	31
North Channel (incl R. St. Mary)	Dip net				3	4	4
	Seine					1	4
	Traps						2
	TOTAL	0	0	0	3	5	10
Lake Superior	Dip net					2	1
	Seine						
	Traps						2
	TOTAL	0	0	0	0	2	3
Northern Inland Waters	Dip net			8	30	61	73
	Seine			3	38	212	338
	Traps				2	23	575
	TOTAL	0	0	11	70	296	986
Southern Inland Waters (incl St.Lawrence River)	Dip net	1	1	6	51	165	235
	Seine	59	53	73	79	198	347
	Traps				4	35	327
	TOTAL	60	54	79	134	398	909
PROVINCIAL TOTALS		99	100	150	296	867	2,192

chase his supplies. This licence also covers any operation of private bait-fish hatcheries, rearing ponds or holding ponds.

A number of licences are issued each year at a five-dollar fee to permit preserving of bait fish by freezing, salting or by some pickling formula. Although live fish are usually preferred as bait, there is also a demand for the preserved fish. Surplus supplies or fish, which cannot safely be held for long, often are used for this processing. Lake shiners, which are frequently taken in large numbers from unbelievably large concentrations of these little fish along the bays and inlets of the lakes, constitute most of the preserved supplies. The maximum poundage which any processor may produce yearly is limited by Regulations.

Management of the bait-fish industry in Ontario is patterned largely upon the principles which are applied in the regular food supplying commercial fishery. The aims are simply stated: to allow full utilization of the stocks of these fish while assuring, in so far as possible, a constant high supply, both now and in the future, and at the same time permitting and encouraging wide public use and assuring easy availability of good dependable supplies to the angler.

The practice of limiting, where necessary, the number of commercial bait-fish fishermen not only helps to conserve the supply in any specific area but also assures a higher economic yield to the Province from the resource. Bait-fish licences, which are now issued by the District Forester in each of the twenty-two districts of the Department, restrict fishing to the waters or areas specified in the licence. The area may be large, covering a township or more, or it may be limited to a rather small section of a shore, depending upon the most satisfactory management for the area. It is frequently found that several fishermen share the same fishing grounds if their areas are quite broad, but the number is always related to the supplies normally available in the area. For these management reasons, any applications for licences are always directed through the field officers who are familiar with the conditions in their own patrols.

In spite of the many lakes and rivers with which our Province is enriched and their large populations of bait fishes, there are occasionally times when bait fish are in short supply. Minnows are most difficult to find and capture during the hot summer months and during the periods when the water is covered by ice. There are periods of heavy demand beginning with the perch runs in spring and the opening days of the walleye season, again on bass opening and the holidays of July 1st and July 4th, as well as the tourist vacation season of July and August. In early fall, the pike and muskie enthusiasts require large-size sucker or chub bait and the season may be said to end or perhaps begin again with the ice fishing demands of Lakes Simcoe, Erie, St. Clair and the others too numerous to name. The white bass runs in the lower lakes also require generous bait supplies when schools of these popular sporting fish are biting.

To meet these peak demands, a few permits have been issued to allow the importation of specific species under conditions carefully designed to ensure freedom from disease and suitability of species. It is apparent that importation, even in quantity in large aerated or oxygenated tanks on large trucks is not economically practical except during periods when native wild stocks of minnows are unavailable. The industry itself is gradually making the necessarily rather high capital investment in hold-

TABLE II

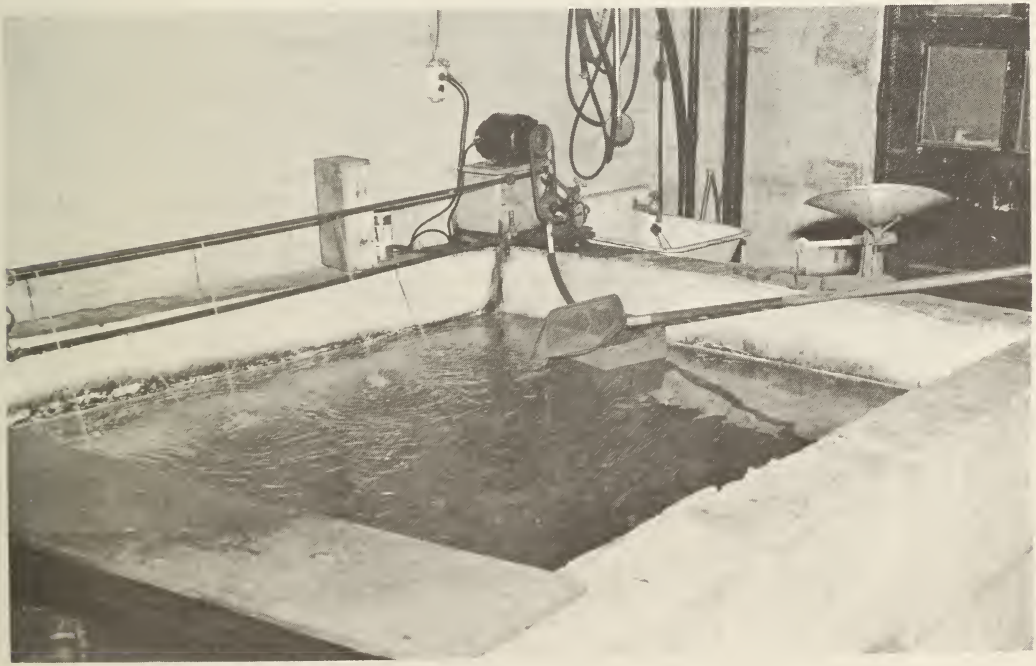
SUMMARY OF COMMERCIAL BAIT-FISH LICENCES IN ONTARIO, 1955-1961

Year	Fishing Licences (Dip, Seine & Trap)	Dealer's Licences	Preserving Licences	Total
1955	1,374	32	12	1,418
1956	1,457	188	26	1,671
1957	1,612	256	43	1,911
1958	1,756	324	50	2,130
1959	1,841	387	59	2,287
1960	1,853	419	76	2,348
1961	2,192	510	88	2,790

ing and rearing ponds so that stocks can be held safely from periods of plentiful supply until the times when supply does not meet demands.

The practicability of regular bait-fish hatcheries in our climate with its short growing season has not yet been fully demonstrated. It may be that through multiple use of farm ponds, flooded gravel pits, small pot hole lakes and other ready-made ponds, that bait-fish culture will be found to be more profitable. The Department of Lands and Forests has, for several years, had numerous requests for assistance in the development of bait-fish farms or hatcheries. In spite of the assistance rendered by field biologists and Head Office staff, few of these projects have been as successful as most enthusiasts originally anticipated. It seems probable that the competition from wild minnow supplies, the rather high capital requirements, and the short growing season have combined to discourage most of those who have made attempts. Rather notable exceptions have occurred, however, and some bait-fish operators are now looking forward to the near future when the raising and sale of these fishes will provide a large share of their annual income.

The future of the live-bait industry in Ontario is bright. Most of the larger dealers handle worms as well as bait fish; crayfish and other less common baits are also available but usually less popular. Improved techniques of holding and shipping large concentrations of live fish in a minimum of water have improved the economic aspects of the industry. Good bait can now be moved within twelve hours to distances in excess of five hundred miles to supply areas which are in short supply. The introduction of the Bait-fish Dealer's Licence in 1955 allowed the development of a more stable, more highly capitalized segment of the bait-fish industry.

Although some Provinces of Canada prohibit the use of live fish for bait, either to safeguard their waters from introductions or to give some highly prized fish more sporting chances against the angler, and although in Ontario a quite lengthy list of lakes, supporting especially desirable brook trout populations, may not be fished with live bait fish, nevertheless it seems probable that in our warm water lakes, especially, and in the Great Lakes, the use of live fishes for bait will continue.

Bait fish in a dealer's indoor holding tank. The larger fish (four to six inches) are suckers, in demand for pike and muskie fishing in the fall. In typical tank, below, the water is filtered, aerated and re-circulated. Photos by T. Jenkins.