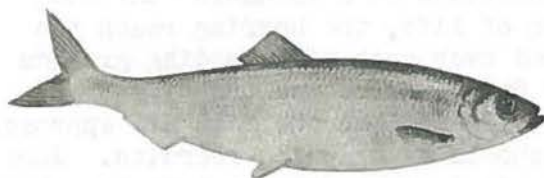


FISHERIES FACT SHEET

Subject: HERRING (Atlantic)
(Sea)

Distribution and Importance

The Atlantic or Sea Herring with the scientific name Clupea harengus is one of the most important of the foodfishes in the Atlantic, if not the world. Distributed throughout the entire North Atlantic, it is probably the most numerous fish in these waters. It has been estimated that some of the many schools seen in these waters,



Atlantic or Sea Herring
(Clupea harengus)

would go a long way towards supplying the whole of man's consumption of herring. This fish is found in the temperate and colder parts of the North Atlantic. Off Europe, it ranges north to Norway, the White Sea, Iceland and Greenland and south to Gibraltar. On the North American coast, it is known as far north as northern Labrador and south to Block Island. In the north Pacific it is replaced by a

very close relative, the Pacific Herring, with the scientific name Clupea pallasii. From 1945 to 1948, well over 100,000 tons of herring have been taken annually from Eastern Canadian waters (excluding Newfoundland). Of this quantity, mature herring normally constitute two-thirds of the catch and "sardines" (immature herring) about one-third. The marketed value has averaged over \$6,500,000 a year. Canadian Pacific herring landings have averaged about 125,000 tons with a marketed value of about \$7,500,000 a year.

Description

The herring has an elongate body which is deep steel-blue or greenish-blue on the back with green reflections. The sides and belly are silvery. The body is much deeper than thick. The mouth is large with the lower jaw projecting beyond the upper. The tail is deeply forked and the single dorsal fin stands over the small ventral fin. The scales are large and loosely attached. These fish grow to a length of 17 inches and live for as many as 20 years.

Habits and Movements

The life history of the herring has never been completely worked out. The known facts indicate that it lives in deep waters off the coast, moving inshore at spawning time. Scientific investigations have produced evidence that there are many distinct populations of herring which may differ in size, spawning time and

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Department of Fisheries of Canada

various other qualities and traits, each population having its own particular time and ground for spawning. In the Gulf of St. Lawrence, more or less distinct populations are located (1) in the estuary of the St. Lawrence (2) along the Gaspé coast (3) in the southern Gulf of St. Lawrence (4) along the west coast of Newfoundland (5) along the south coast of Newfoundland.

The life of the herring may be divided roughly into three stages which are suggested by differences in distribution and movements. These are, first, the young or "sardine"; second, the immature or "fat", and third, the mature or "spawn" stage. The young are found in scattered schools in our coastal waters. However, the Passamaquoddy area of the Bay of Fundy provides ideal conditions for concentrating dense schools which contribute to a valuable "sardine" canning industry. After two years of life, the herring reach the "fat" stage and are found scattered over such rich feeding grounds as the open waters of the Gulf of St. Lawrence and the offshore banks. At between three and four years of age the fish are approaching maturity and join the adult schools as spawning recruits. Just before spawning time, the adults move in vast schools into the shoal coastal waters and on to the spawning grounds. After spawning, the "spent" herring disappear and presumably return to the deep offshore waters to recover and feed.

One of the most interesting habits of this fish is the so-called "swim" which takes place twice daily. During the hours of darkness schools of herring will be found at the surface of the water spread over a large area. As the light increases at dawn, they sink to the bottom of the water where they remain during daylight hours in close-knit schools. As darkness approaches they rise rapidly to the surface.

Food

The herring is a plankton feeder which means its diet consists mainly of small suspended marine animals. Soon after hatching, the young fish begins to take food and its early diet consists mainly of the eggs and young of small marine crustaceans and diatoms. Later it confines itself almost mainly to the adult form of small marine crustaceans such as copepods and shrimp-like animals.

Spawning

Spawning in Eastern Canadian waters takes place mainly in the spring, summer and fall depending on the locality and the herring population occupying it. In the Gulf of St. Lawrence there are spring and fall spawning populations while along the outer coast of Nova Scotia the major spawning takes place in late August or early September. Each fish deposits from 20,000 to 40,000 eggs depending on its size. Spawning takes place in water from two to 30 fathoms in depth. The eggs sink to the bottom, where by means of their coating of mucus, they stick in layers or clumps to the sand or clay, seaweeds, stones and other objects. The eggs hatch in from 10 to 40 days depending on the temperature of the water. The young fish are about one-fifth of an inch at hatching.

Growth

The growth varies from locality to locality depending on the food available and the temperature of the water. Herring of the comparatively colder waters of the estuary of the Gulf of St. Lawrence grow much slower than the herring populations of the main Gulf. They grow rapidly until they mature at about a length of $10\frac{1}{2}$ inches or more at which time they are three to four years of age. In 1948 the average age of the herring in the commercial catch in the southern Gulf of St. Lawrence was about six years while those caught along the south and west coast of Newfoundland averaged more than 10 years of age.

Fishing Areas and the Fishery

Herring are fished all along the Canadian Atlantic coastline. However the most productive areas are:

- (1) The Passamaquoddy area of the Bay of Fundy where an intensive fishery for "sardine" herring is carried out throughout most of year. Weirs and seines are the principal fishing methods used.
- (2) Chaleur Bay, Northumberland Strait and Magdalen Islands. This fishery for spring spawning herring is located close inshore. Gill nets are responsible for most of the catch. However, traps are operated on the Magdalen Islands for the capture of herring and mackerel.
- (3) Southern portion of Nova Scotia from Halifax to Yarmouth. This fishery for late summer spawning herring is carried out by means of gill nets and traps set along the shore.
- (4) South and west coast of Newfoundland. Extensive winter and spring fisheries are carried on here for spring spawning herring.

The Atlantic coast mature herring catch forms the basis for a variety of valuable processing activities, great quantities being salted, smoked, or used for bait. The processing forms in 1939 were: fresh and frozen (18 per cent); salted, including vinegar cured (8 per cent); bloatered (i.e. cured and smoked round), smoked boneless or bloater fillets, and "kippered" (12 per cent), and canned (3 per cent). Bait and fertilizer comprised about 60 per cent of the quantities used. "Sardine" or immature herring are utilized in an important canning industry and a small oil and meal production. The Pacific herring catch, at the outbreak of World War II, was mainly used in the manufacture of oil and meal. During the war years huge quantities were canned but today the chief products again are meal and oil.

HERRING AND SARDINE CANNING

The canning of sardines, herring, pilchards and anchovies may be grouped together because they are tender-meated oily fish of small size. They demand very careful handling and call for more hand-labour in the canning process than in salmon canning, for instance.

In weight and numbers, landings of sea herring exceed those of any other variety of fish taken by Canadian fishermen. These fish are found in abundance on the Atlantic and Pacific coasts, and besides being canned on both coasts they are marketed in a variety of smoked, pickled and salted forms.

Canadian sardines are the young of herring and the sardine canning industry in Canada is confined to the Bay of Fundy and Passamaquoddy Bay districts in New Brunswick, where the largest sardine canning plant in the British Commonwealth is located. The canning of pilchards and anchovies is confined to British Columbia and packs are small.

While the general principle of cooking and sealing in a tin container applies to all these species of fish, there are variations in methods and equipment in the processing.

Sardine Canning

Sardines are usually caught in weirs which are fence-like structures erected close to shore. The weir diverts the fish into an enclosure, then fishermen run a seine net around the inside of the enclosure and gather the catch within it. Each cannery has its own fleet of collecting boats, "buyers" as they are called by the fishermen. These boats arrange with the weir owner for the purchase of his supply of sardines while the tasty little fish are still alive and swimming in the weir.

The collecting boats are fitted with water-tight holds kept scrupulously clean. Into these, the sardines are dumped alive with a considerable amount of water and a quantity of salt. The fish are practically afloat in brine by the time the boat is loaded. This prevents any chance of deterioration setting in before the canning process is begun. They must remain in this strong pickle for at least three hours and if the carrying boat reaches

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Herring & Sardine Canning (Cont'd.)

the cannery before that time, unloading does not begin until the three hours have elapsed.

At the cannery wharf the young herring are dumped into a bin and washed down a chute to washing tanks on the lower floor of the cannery. In the washing tanks the scales are rubbed off by stirring and rotation in streams of water against wire screens. Many of the scales have already rubbed off in the holds of the collecting boats. The scales are collected both from the boats and from the washing tanks and sold to pearl essence factories.

The fish are then conveyed automatically to a machine which spreads them out on wire mesh trays called flakes. The machine which does this operation is called a flaking machine. One man constantly feeds the wire mesh trays on to a conveyer leading to the machine and another man takes the filled trays and places them in "racks".

The rack is simply an upright framework which holds tiers of flakes for the cooking process. As fast as a rack is filled, it is wheeled into the steam cooker, or steam box as it is commonly called, and subjected to a preliminary cooking from seven to eleven minutes.

The cooker is simply a compartment built in the cannery with iron walls and ceiling and a cement floor. A drainage pipe carries off the escaping moisture. Cooking is by direct application of steam. From the cooker the racks are wheeled to the dryer which extracts much of the excess moisture from the fish.

All the packing is done by women. At the packing tables, women grade the fish as to size, snip off the heads and tails with scissors and pack them precisely and carefully into flat cans. These cans may be brought to the room on an endless belt from the can-making machine and dropped into bins near the packing tables.

Filled cans are placed on trays which are conveyed to an automatic oil-filling machine. A regulated quantity of oil -- just enough to fill each can brim-full -- is added. Olive oil or other salad oils, rich tomato sauce or fragrant mustard sauce may be used to cater to varying tastes.

The sealing of the covers on the cans is done mechanically. The cover, fitted with a rubber gasket, is rolled on to ensure absolute tightness. Some modern can-closing machines seal as many as thirty-four cans a minute.

Herring & Sardine Canning (Cont'd.)

From the closing machines, the cans drop on to a conveyer which carries them to retorts for sterilization. Each retort holds about fifty cases and is filled about half full of water so the cans will not be damaged when they drop from the conveyer. From the retorts, the racks of canned sardines are withdrawn, washed and cooled, labelled, wrapped and packed in cases containing 100 cans each, ready for shipment to any part of the globe. Some are fitted with key-openers.

Herring Canning

As soon as the herring are landed at the cannery wharf, they are "dry-salted" in bins, using coarse ground salt. The purpose of this salting is to allow some salt to penetrate into the fish, making them more tasty, firming the flesh slightly and toughening the skin so that it will not be so easily broken in the packing and steaming procedures. They are left in the bins until the salt has produced the desired results -- usually from six to ten hours.

Then they are washed and scaled in revolving metal mesh cylinders using large volumes of clear pure water. In some plants "scaling" is done before "salting". Regardless of this, all the herring are again washed before being dressed and cut for the cans.

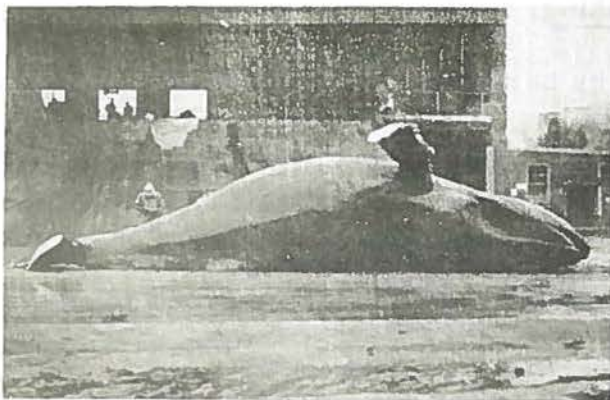
The scaled and washed fish then go to automatic machines that cut off the heads and pull out the entrails, leaving the cleaned fish ready for the can. In some plants, the heads, entrails and tails are removed by hand.

The dressed herring are then packed carefully by hand into cans which are then placed bottom up on wire mesh screens. Still unsealed, they are passed into steam retorts to be partially cooked. In this cooking process the excess moisture and oil is drained from the inverted cans of fish through the wire screens. Upon being taken out from the retorts and while still steaming hot, the cans are turned right side up and passed under a machine which injects boiling tomato sauce and a sprinkle of salt into them. Sealing is the next operation and then the canned herring is given the final cooking. After coming from the retorts, the cans are washed, cooled and boxed for storage and ultimate shipment.

Herring are usually packed in flat oval cans, although some canneries pack them in "talls". Canned herring are an inexpensive canned product furnishing high quality protein, fat and other essential food factors. They are suitable for eating cold or hot or for use in salads or cooked dishes.

Distribution and Importance

The humpback whale, Megaptera nodosa is found along the coastlines and in the bays of the world's ocean areas including the Pacific Ocean off the British Columbia coast and the Atlantic off Newfoundland and Labrador. It reaches a length



Humpback Whale

of from 45 to 50 feet when fully grown. It is clumsy in appearance with a thick-set body, but nevertheless is a very graceful swimmer. It has a pair of flippers just back of the head, which in adults are up to 14 feet in length. The throat has a number of longitudinal folds like those of the related finbacks. The blow or spout is vertical, being broad and relatively short. Its flukes are large with a serrated hind margin and are often white or mottled white on the under surface. On the last blow before submerging the back is humped and the animal dives almost vertically, throwing its flukes in the air. The dive usually lasts from five to 20 minutes although the humpback

has been known to stay under for periods lasting as long as 40 minutes.

The humpback is one of the few good-sized whales which can jump clear out of the water. It is very playful and at times will swim along-side a ship for miles, until it tires of the fun and swims away. Like most whalebone whales it feeds on small shrimps but eats a few fish as well. Because of its tremendous size and its almost constant food requirements it can be found only where a plentiful supply of food is available. (In winter, in the low latitudes, the stomachs of whales are usually empty). In feeding it fills its mouth with food and water as it swims through thick masses of small shrimp-like crustacea. It pushes out the water with its huge tongue, using the whalebone, or baleen, as a sieve to retain the food. This baleen consists of long, flat plates hanging from the sides of the upper jaws. They are of a fibrous, hornlike substance, very strong and flexible, and their function is to strain from the water the small organisms called "krill" upon which the humpback and other members of the whalebone family feed. At one time the whales of this family were hunted entirely for whalebone and oil, and the remainder of the whale was discarded.

Reproduction and Growth

Humpback whales, like other whales and most of the big mammals, bear only one offspring at a time, although occasionally they have twins. The gestation period for a humpback is slightly less than a year, and there is usually a two-year interval between calves, as the young whales are called. Sometimes a humpback will calve twice in three years. The young are fed on the mother's milk, which

Humpback (Cont'd.)

has a very high fat content. On an average, whales weigh one ton for every foot of length. The calf's rate of growth is tremendous in its first year of life and it may gain up to a ton in weight in the first 16 days. The humpback matures sexually when only 22 months old.

Method of Fishing

In Canada the humpback is taken by harpooning off both the Atlantic and Pacific coasts. When a whale suitable for killing is located, the lookout on the masthead gives the word and the harpooner fires his missile from the bow of the vessel.

After the whale has been killed it is pulled alongside the vessel and inflated with air which is pumped into the body cavity. Then it is towed to the shore processing plant.

Processing Methods

When the whale has been made ready the flensers take over. They are so called because of the sharp flensing knives they use to remove the blubber. The blubber is a three to six inch layer of fat immediately below the skin. Incisions are made along the entire body and a piece of blubber is undercut to release it from the body. Then a rope or cable is tied around the blubber and a power winch peels off the entire strip. This is continued until all of the blubber has been removed. These strips are cut up in small squares and are ready to place in the boiling vats to extract the oil. After all the oil has been taken from them the bones are manufactured into fertilizer. The meat is high in food value but it is not at present being handled commercially on the Canadian market.

The oil yield is from 50 to 80 per cent of the blubber's weight. However, there is a considerable oil yield from the meat and bones. The oil is a very good raw material for shortening, being superior in some respects to the vegetable oils which are the chief competitors. A good margarine also can be made using whale oil although only a negligible amount has yet been used for this purpose in Canada. A competitive price to vegetable oils is the main requirement.

Research is also being carried out by federal scientists in order to investigate the possibilities of obtaining commercial quantities of insulin from whales.

INCONNU
(*Stenodus leucichthys*
mackenzii)

Distribution and Importance

The inconnu is an edible fish, found in some parts of the Northwest and Yukon Territories where it is of some local importance both as a food for humans and for sled dogs. It was given its vernacular name by the early French-speaking voyageurs. As they travelled the north they caught some of the fish, the first of the kind they had ever seen. "Poissons inconnus", unknown fish, they said, and as time went by "inconnu" passed into usage as the name of the species. Very often, fishermen shorten the name to "connie" or "coney". In Alaska it is called the "Sheefish".

Scientific records generally list the fish as *Stenodus mackenzii*. The "mackenzii" derives from the fact that in North America the inconnu is found mainly in the Mackenzie River basin, though it is present also in the Yukon Territory and in Alaska. A similar species occurs in Siberia and is known as *Stenodus leucichthys*. Some scientists regard the Canadian inconnu as the same species as the Siberian one, hence the commonly accepted name is *Stenodus leucichthys mackenzii*. Although the inconnus of the Mackenzie basin all belong to the same species, there appear to be two groups among them or two "forms" to use the scientific term. One of the two is a "landlocked" or freshwater form found in Great Slave Lake and the second is a migratory form found in the lower Mackenzie River. Fish in the first group are believed to spawn in the Big Buffalo River and other tributaries of Great Slave Lake, the other in the Mackenzie and some of its tributaries.

Description

Inconnus of quite large size are sometimes taken in the Mackenzie area and individuals weighing 25 or 30 pounds are not uncommon, though they are well above the average. There is record, however, of at least one inconnu caught in the Mackenzie area which weighed 63 pounds and was a little over 59 inches in length. Others have been reported weighing from 45 pounds to something over 56 pounds. Inconnus found in the Yukon are said to be of smaller size, on the average, than those taken in the

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Inconnu (Cont'd.)

Mackenzie district. Inconnus are light in exterior colouring with the dorsal fins dusky at the tip, the caudal fin shading to dark at the edge. The lower jaw is longer than the upper and usually somewhat hooked. There are bristle-like teeth on the upper jaw and weaker ones below. The flesh is white but rather soft and oily.

Methods of Fishing

Although Inconnus will take the hook, under certain conditions at least, white fishermen make their catches by means of gill-nets. Eskimos in the Mackenzie delta, on the other hand, sometimes catch them with barbless hooks, fishing through the ice, sometimes by means of a fishing spoon or bait, or perhaps by a hook baited with a thin piece of bone. On the Yukon River, the fish are said to offer good sport when fished with troll or minnow, in contrast to the Mackenzie inconnus, which seem to show little spirit.

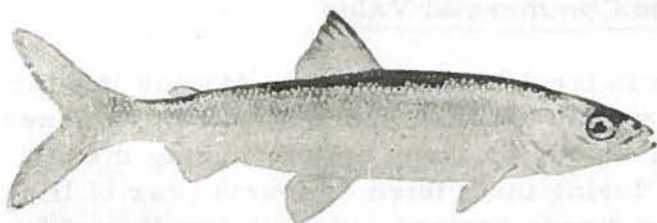
Handling the Catch

Until 1945 there was no fishing for inconnus on a commercial scale. Catches were made only to meet local needs. Since 1945, however, some of the fish have been handled commercially by fishermen operating on Great Slave Lake. These inconnus are taken in nets set primarily for whitefish and lake trout. Drying and smoking are the methods used when the fresh fish are being preserved for future use locally.

LAKE HERRING, CISCO OR TULLIBEE

Fifteen Species in Group

The common names "lake herring", "cisco", or "tullibee" do not refer to one single species of fish but to a very complex group belonging to the genus Leucichthys comprising, in North America,



Lake Herring, Cisco or Tullibee
(Leucichthys Spp.)

some fifteen species. Certain species do possess a particular common name such as Leucichthys alpenae, long-jaw cisco, L. nigripinnis, black-fin cisco and L. artedi, the lake herring. More often several associating together in a lake are grouped under one name. In this sense "chubs" and "bloaters" are used on the Great Lakes. The term "tullibee", first used by fur traders for lake herring of northern distribution, has persisted in the Prairie Provinces. It may be used either as a synonym for lake herring or as the large and deep-bodied form of one species, Leucichthys artedi. This confusion between common names is the result of extreme similarity between species. Specific identification is a task better left to the specialist.

Distribution and Description

Lake herring, like other members of the family Coregonidae, are of northern distribution, occurring in Siberia, Alaska, Northwestern Canada and Northern Europe. In America their most southern limit is in the Great Lakes region. Individual species are more restricted. Two Siberian species, L. autumnalis and L. sardinella reach their eastern limit in Alaska and the Mackenzie delta. Confined to the Great Lakes region are L. alpenae, L. johnnae, and L. kiyi. L. zenithicus, L. nigripinnis and L. artedi have been recorded from the Northwest Territories, Manitoba and the Great Lakes region.

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Lake Herring, Cisco or Tullibee (Cont'd.)

Lake herring possess cucloid scales, an adipose fin and lack sharp spines in the fins. Shiny scales give a silvery appearance, while the underlying surface is green on the back shading to white on the sides and belly. Fins may be clear or dusky. Form of body and size attained vary according to the species. The larger species attain fourteen inches in standard length and one and one-half pounds in weight. However, ciscoes in the Prairie Provinces weighing seven pounds are not uncommon.

Life History and Commercial Value

Lake herring may live in fresh or salt water. Marine inhabitants, however, spawn in fresh water. In lake species, spawning generally occurs in shallow water on muddy or stony bottom during the fall months. Lake herring mature during their third or fourth year of life in the Great Lakes and Lake of the Woods regions, in their fourth or fifth year in the Hudson Bay area and even later in Great Bear Lake.

These fish are mainly plankton feeders. In turn, they serve as food for lake trout, Cristivomer namaycush; pike, Esox lucius; inconnu, Stenodus leucichthys, and ling, Lota lota.

When caught commercially, they are taken in gill-nets either floated up or set on the bottom. Pound nets have been used in the Lake of the Woods.

LAKE TROUT
(Cristivomer namaycush)

Description and Importance

Lake trout go by more than half a dozen names. Lake trout and salmon trout are the two most generally used but in New Brunswick people call the fish the "togue"; in parts of Quebec the "touladi", and in some other Quebec areas and sometimes in Ontario the "grey trout". Occasionally the fish is called the "namaycush" or "Great Lake trout". In northern British Columbia some of the Indians have a name for it which, in rough conversion into the white man's tongue, seems to be "so-pi."



Scientifically, the fish belongs to the Salmonidae family. That means that it has a good many relatives, in one degree of relationship or another, among Canadian fish. Most trout, of course, are game fish but lake trout enter mainly into the commercial fishery. They will take the hook, both in fly fishing and when some baits are used. They run, in general, to bigger sizes than any of the other species of trout. Those living in large lakes usually grow to a larger size than those in smaller bodies of water. Occasional specimens weighing as much as 75 pounds or more have been taken, and 20- to 30-pounders are not uncommon though, on the average, the weight of the fish entering into commercial catches is probably about 10 pounds and the length two feet or so.

Description

In exterior colouring lake trout vary from almost black to grayish or very light green. Similarly, there are variations in the colour of the flesh. Sometimes the tissues are deep pink or blood red, sometimes pale ivory, sometimes any one of the several shades between the two. These differences are probably determined in part by heredity

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Lake trout (Cont'd.)

and in part by environment. Some of the fish are probably by nature lighter in flesh colour than others. On the other hand, it is probable that the kind and amount of food eaten also influences flesh colour. The main food is fish although smaller aquatic organisms are also eaten.

Fishing Areas and the Fishery

Lake trout are North American fish, with wide distribution over the continent. They occur in Labrador, in one or two sections of the Maritime Provinces, on through Quebec and Ontario, and thence westward and northward. In the western provinces their distribution is in northerly waters rather than those in the southern areas. They are present, too, in the Northwest Territories and the Yukon. In the United States the fish are found in Maine and in some of the western states and in Alaska. Incidentally, the statement that lake trout occur in Maritime Provinces should be qualified by the explanation that they are found in western Nova Scotia and in the Chamcook Lakes region of southwestern New Brunswick.

Chief producers of lake trout are the Great Lakes, the northern lakes of Saskatchewan, and Great Slave Lake in the Northwest Territories. In fact, Great Slave Lake yields more trout than any other single lake in Canada. In Nova Scotia and New Brunswick, fishing for trout is restricted entirely to angling.

Commercial fishing for lake trout in Canada is done mainly by means of gill-nets and pound-nets, although trolls and set hooks are used in some places. The greater part of the catch is taken in the summer months but in the Prairie Provinces, as a whole, most of the fish are caught in winter when the nets are set through the ice. The fish are marketed in the fresh and frozen forms. Much of each year's catch is exported to the United States.

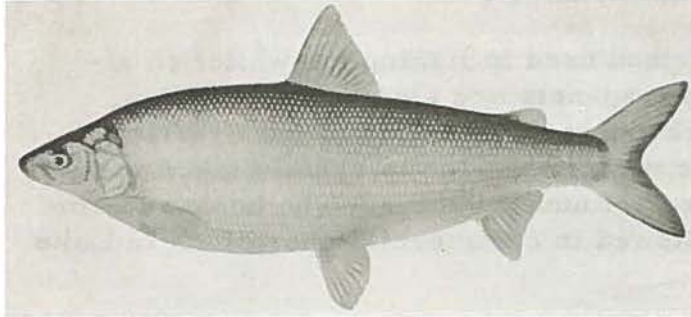
In Great Slave lake the lake trout mature when about eight years old, when they weigh about $2\frac{1}{2}$ pounds and are about 18 inches long. There is a tremendous difference in growth rate, some fish are four times as heavy as others at the same age.

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LAKE WHITEFISH
(Coregonus clupeaformis)

Distribution and Importance

Of the varieties of whitefish recorded in Canadian inland waters the common whitefish or lake whitefish is of greatest importance in Canada's commercial fisheries. The whitefish, along with Ciscoes,



lake herring and bloaters, belongs to the family Coregonidae. The common whitefish occurs in all larger lakes from the Maritimes to the Yukon Territory. Lakes in the Northwest Territories, Manitoba, Ontario and Saskatchewan are the main pro-

ducers of whitefish. Commercial fishing for whitefish at Great Slave Lake in the Northwest Territories was undertaken for the first time in 1945.

Description

In colouring the whitefish is olivaceous on the upper part of the body, with whitish sides and under portions. The lower fins may be dusky. The tail fin is deeply forked. Head and mouth are comparatively small, the scales large. The mouth is sub-terminal, distinguishing it from certain other members of the family. Some adult whitefish have a fleshy bump at the shoulders. So far as weight and body measurements are concerned, it is not possible to give exact averages for any species of fish but the mature whitefish average 18 inches in length and weigh about 2½ pounds. This size makes up 75 per cent or more of the catch.

Feeding and Breeding Habits

The whitefish lives upon minute molluscs, crustaceans and other small aquatic creatures. Its summer habitat is in the deeper, colder parts of the lakes, from which it moves into more shallow water at spawning time. The spawning time varies somewhat in different years depending on weather conditions and locality. Spawning begins in the latter part of October and continues into the first week of December. In Great Slave Lake it may continue into January in some areas.

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Lake Whitefish (Cont'd.)

Whitefish generally reach maturity in the third and fourth year, but may not mature until the eighth year in lakes where the average water temperature is low. A full grown individual deposits from 10,000 to 75,000 eggs, depending on the fish's size.

Gill-netting is the chief method used in fishing for whitefish although stationary pound-nets and trap-nets are also used in some areas. In areas where winter fishing is done -- and in the Prairie Provinces, the bigger part of the whitefish catch is usually taken in the winter season -- the gill-nets are set under the ice. The hook-and-line method of fishing for them is followed in commercial operations in Lake Simcoe.

Virtually all of the whitefish marketed by Canadian fishermen is sold in the fresh and frozen forms, though small quantities are smoked. The catch finds sale in Canada and the United States, most of it in the latter country.

No. 21

Life History, Migration and Reproduction of Pacific Salmon

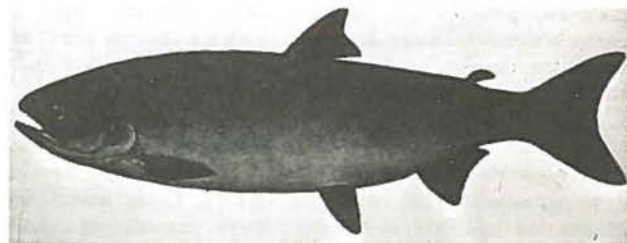
THERE are five kinds, or species, of Pacific salmon in British Columbia. Their common and scientific names are:

- Sockeye (*Oncorhynchus nerka*)
- Pink (*Oncorhynchus gorbuscha*)
- Chum (*Oncorhynchus keta*)
- Coho (*Oncorhynchus kisutch*)
- Chinook or
 spring (*Oncorhynchus tshawytscha*)

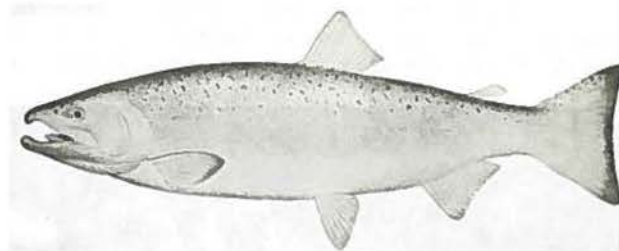
Except for some races of sockeye which remain throughout their life in lakes (known by many names but most commonly as "Kokanees") all salmon are anadromous. That is, they begin their life in fresh water, grow and mature in the ocean and return to fresh water to spawn. More detailed accounts of the life-history of individual species are given in other Fact Sheets forming part of this series.

SPAWNING AND DEVELOPMENT

Adult salmon enter rivers and streams from late summer to early winter, the exact time differing between stocks and species. The female, upon choosing a suitable spawning site, digs a nest or



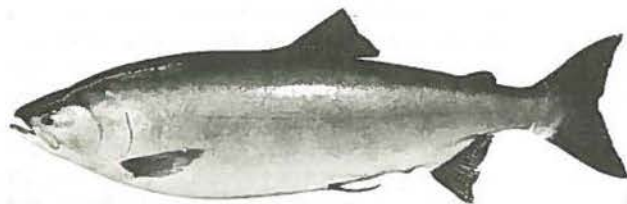
CHUM SALMON



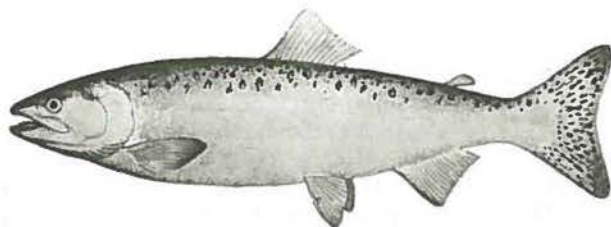
COHO SALMON



CHINOOK or SPRING SALMON



SOCKEYE SALMON



PINK SALMON

"redd" in the streambed. The male, meanwhile, remains in close attendance, courting the female and fending off competing males. When the redd is completed, the female drops into it and releases some of her thousands of eggs, the numbers varying between species and size of individual. At this moment the male moves alongside his mate and releases milt, thus fertilizing the eggs. The female, then with snout, fin and tail covers the eggs while the male returns to his post to resume vigilance. This sequence of redd-building, courting and spawning is repeated until the sex products of both male and female are exhausted, and having spawned once each depart and shortly die.

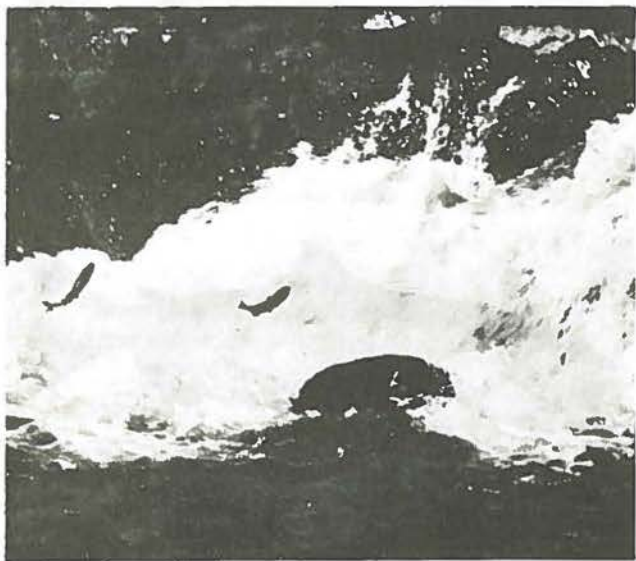
Of the eggs spawned, some hatch while others

are lost as a result of poor stream conditions or predation by trout and other stream fishes. The time required for hatching is influenced by the temperature of the stream. The newborn salmon, or alevin, remains hidden until spring in the gravels forming the streambed. Receiving nourishment from a yolk-sac attached to the under side of its body, the alevin gradually transforms into a miniature salmon, and in the spring emerges from the gravel as a fry. Depending on the species, the fry migrates either immediately to sea, or remains in the stream or river for a few months, or takes up lake-residence for a year, usually, or two, before going to sea. Those living in lakes for a year or more are known as smolts when they leave for the sea.

In the ocean, as in fresh water, the different species as well as stocks of the same species spend varying amounts of time, ranging from about 14 months for pinks to 4 or 5 years for chums and chinooks.

DISTRIBUTION AND MIGRATION

Along the Pacific coast of North America salmon occur from central California northward into the Arctic Ocean as far east as the Mackenzie



Salmon fighting their way upstream to the spawning grounds.

River, but are most abundant between southern British Columbia and western Alaska. Within this length of coastline the geographic range of each species overlaps considerably so that some species at the same time occupy not only the same geographic territory but frequently the same stream.

During their ocean life, salmon range widely throughout the northern North Pacific Ocean and the



Fish ladders such as this one at Stamp Falls, B.C., help salmon move upstream.

Bering Sea, occurring farther south in the winter than in summer. In the spring and summer maturing fish depart the high seas for coastal spawning grounds, travelling at rates which increase as the fish matures. Salmon originating in British Columbia inhabit the eastern North Pacific Ocean where they become intermixed with salmon from Alaska, and to a much lesser extent, with some from Asia.

SIZE AND GROWTH

The size of salmon varies between species, as well as between individuals of the same and different stocks. On the average, chinooks are the largest of the salmons, followed in order of size by chums, coho, sockeye and pinks. While smallest in ultimate size, pinks grow more rapidly than the other species, reaching an average length of 24 inches and an average weight of 4 pounds from the time they leave the streams as fry and return as adults, a period of about 14 months. Chinooks frequently reach a weight of 50 pounds and on occasion 100 pounds.

Maturing salmon, silver and corpulent and belonging to many runs, enter coastal waters during the summer and fall where they are caught by purse-seine, gill net and trolling gear. The average annual catch of salmon in British Columbia amounts to about 180,000,000 pounds and has a landed value of about \$25,000,000. (Prepared by the Fisheries Research Board of Canada Biological Station, Nanaimo, B.C.)

The Lingcod

THE lingcod is one of the larger commercial fish of British Columbia. It is notable for its large mouth, large pectoral fins, smooth body, and long continuous dorsal fin divided by a notch into spiny and soft parts. Young individuals are slender throughout, but larger specimens are moderately robust forward with large heads and fearsome jaws. The colour is very variable, usually darkly mottled, on backgrounds ranging from dark gray to fawn. Fish taken from the same reef are frequently coloured alike with the result that some experienced fishermen claim the ability to tell the origin of fish by their appearance. The sexes can be distinguished externally by the presence in the males of an anal papilla.

Lingcod are found in the coastwise waters of North America from California to Alaska. In British Columbia they occur at a considerable range of depths- from very shallow to more than 70 fathoms. The lingcod has no very close relatives among other fish species. The closest are the so-called greenlings and sculpins, which are familiar but have no commercial value.

Lingcod spawn in the winter from December to February. The eggs are deposited in porous pearly masses stuck to the rocks, usually, in crevices or beneath overhanging boulders. Egg masses may be two feet in length, weigh as much as thirty pounds, and contain more than half a million eggs. A considerable number of egg masses are found in the intertidal zone. Some evidently occur below low tide mark but what proportion, or how deep, is not known. The egg masses are tended by the males, who drive away potential predators.

The eggs hatch in one or two months to produce larvae about half-an-inch long. At this stage they have small yolk sacs on the abdomen with a ten-day supply of food and noticeably blue eyes. The young apparently move around near the surface until they are three or four months old, when they are found near the bottom in shallow water. Many of them gradually work down to take up more or less permanent positions in deep water. In general, the larger lingcod are found on "hard bottom" or rock or gravel.

Lingcod reach large size. The largest specimen recorded is 105-pounds and 50-60 pounders are frequently caught by commercial gear. Maximum



LINGCOD (*Ophiodon elongatus*)

length is between 4 and 4-1/2 feet. Males are much smaller than females and it is doubtful that they exceed three feet in length or a weight of 25 pounds. As might be expected from their larger size, female lingcod grow about 1-1/2 times as fast as males. On the average, female lingcod grow about 2-3/4 pounds per year, and males 1-3/4 pounds. The rate of growth is not constant throughout life, so that at eight years of age a male lingcod will weigh about 9-3/4 pounds and a female 14-3/4 pounds. The age of the 60-pound monsters can be only a guess but it seems likely that they are not only old but have grown faster than average too.

The data obtained by tagging nearly 2,000 lingcod in the Strait of Georgia with strap tags on the gills, or celluloid spirals rolled on the upper jaws, have shown that many of them are very sedentary, as they are recaptured years later in the same place as tagged. Others show considerable movement and the evidence of the fishery on the west coast of Vancouver Island is that lingcod appear on fishing grounds as though they were taking part in a mass migration.

Lingcod are caught commercially on several types of gear. These are, in order of importance, trawls, hand lines, trolls, and long lines.

Hand lining or jigging with live bait is carried out from small or medium-sized vessels fitted with live wells in which the water is continually changing. The live wells hold living herring for bait and also keep the catches so that they can be brought into harbour alive and retained in floating, slat boxes for sale as the market requires. Lingcod handled in this

way are regarded as a superior product and usually command better prices than when handled in other ways. The gear is designed to bring the hooks baited with live herring close to the lingcod on the bottom without disturbing the lingcod or damaging the precious bait. On the ends of the main lines are heavy weights (2 to 5 pounds) and spreader bars of heavy wire or light rod. The live herring on hooks are attached to short lines on the ends of the spreader bars which keep them from damage or fouling when the weights touch the bottom in the fishermen's constant efforts to follow the contour. Usually the bait is fished a few feet (3 to 6) off the bottom. There are different methods of rigging the gear. By some fishermen the main line and weight is attached to one end of the spreader bar and by others to the centre. Lingcod occur in quantity only in very limited areas which are known and thoroughly studied by the fisherman. In some of these areas dead bait is found to be reasonably effective so live wells are dispensed with and the fishing methods are modified accordingly.

OTHER FISHING METHODS

Additional lingcod landings are made by gears used chiefly for other species although fishing methods with them are occasionally modified to concentrate on lingcod. For example, modern trolling gear, in which the lures are streamed on short leads from an almost vertical wire held down by a 20- to 35-pound cast iron or lead "cannon ball", is sometimes used as an effective method of fishing near known lingcod reefs by working large lures or dead herring bait close to the bottom. The main wires pass over sheaves supported by large springs so that fisherman has warning of when his gear hits bottom by the action of the springs. Trolling and hand-lining methods grade into one another and are frequently carried on by the same boats so they are not always distinguishable.

Otter trawls, in which open cones of net are dragged along the bottom, take travelling lingcod in some areas and seasons. When fished with special precautions to avoid catching the net on rocks, more sedentary lingcod are occasionally taken on the reefs in great quantities.

Where lingcod are abundant so that competition for food is keen, they are often taken on long-line gear set for halibut or dogfish. Long lines are made by attaching hooks on short (5 feet) side lines from heavier main lines held in place on the fishing banks by anchors at either end.

Fishing methods differ with season and locality. Trollers and hand liners provide practically all of the highly productive fishery during the spring and early summer in the sheltered waters between Victoria and Discovery Passage. Trawlers contribute about 90 per cent of the most important fishery, which is off the west coast of Vancouver Island during the summer, and trawlers also take the greater part of the catch in the northern part of British Columbia.

The primitive method of fishing by Indians was ingenious. A wooden shuttlecock-like lure or hee-hee made of wood and fibres was pushed down toward the reef with a long 3-tined spear. When the spear was sharply withdrawn, the hee-hee spun slowly toward the surface followed by the curious or hungry lingcod. When the fish came close to the surface it was deftly speared and landed.

Lingcod is marketed either fresh or frozen, and may be whole or filleted. In 1965, 60% of the total catch was taken by trawlers. The earlier markets for oil and Vitamin A derived from lingcod livers and viscera has now almost completely vanished. In 1966, landings of about five million pounds were worth \$602,000. ✓

FISHERIES FACT SHEET

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Canada's catch of lobsters, which are taken only in Atlantic coast waters, usually amounts to thirty million pounds or more a year. They are a real sea delicacy bringing high prices to the fishermen. At one time the greater part of it was marketed in canned form but in recent years, more and more of the catch has been marketed in "live" form. Now less than fifty per cent of the catch is canned. The world's pack of canned lobster comes from the Maritime provinces.

Lobsters are clothed in a hard shell which must be removed before any canning can be done. Since rapidity of operation is essential to the production of a first class pack, the first step is to take them to the cannery as soon as they are landed and boil them in large vats of clean sea water or salted fresh water for from eight to fifteen minutes. Steam cooking is preferred by many canners. This loosens the meat from the shell.

After this boiling, the lobsters are placed on large tables known as "coolers" for draining and cooling. Women packers extract the meat from the claws and tails which are broken from the bodies. The claws are split by a small cleaver and the meat is "shaken" from the claws, "pulled" from the tails with a fork and "picked" from the arms with a small knife.

Cool running water washes the meat thoroughly and particular attention is paid to the removal of all blood and the gut in the tail. Following this, the meat is carefully packed in parchment-lined cans.

Into each can is poured a small quantity of weak pickle mainly for flavouring but also to ensure rapid heat penetration during processing. The tails are placed around the inside of the cans at the bottom, arm meat in the centre and claws on top to make an attractive and uniform pack. Each can is weighed to ensure it has the required legal quantity of meat and then the covers are hermetically sealed.

In the steam retorts the cans are cooked for from thirty-five to forty-five minutes, according to the size of the cans being processed. After this the cans are cooled, tested for defects such as "leaks"

(over)

Lobster Canning (Cont'd.)

"swells" and "flippers" and packed in wooden cases or cartons for shipment.

Labelling may be done before the boxing or this may be left to the wholesale distributor who wishes to market the product under his own brand. In some instances, glass containers are used instead of cans but the quantity of lobster packed in this wall is small. The process is the same as that followed for packing in cans.

No. 51

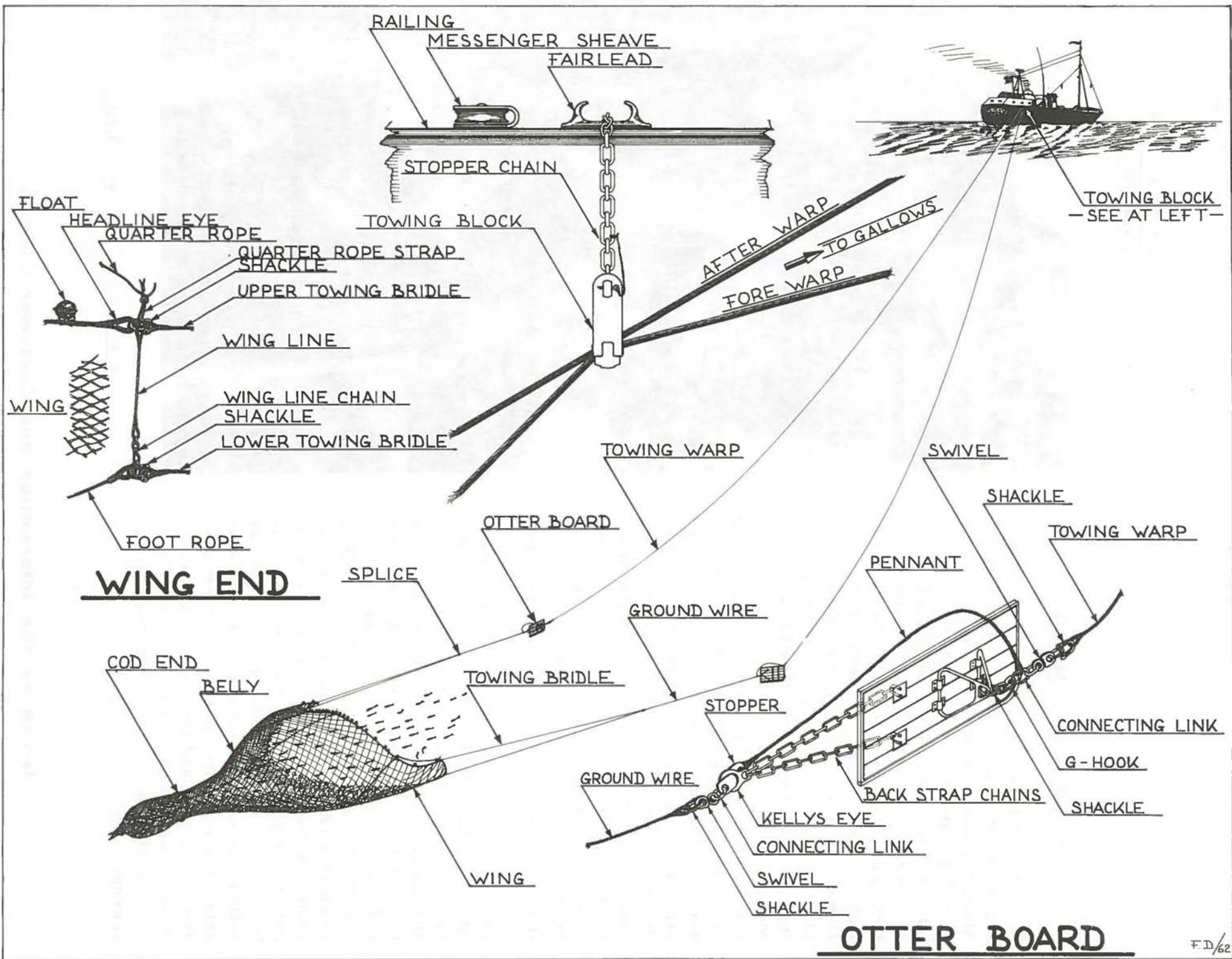
OTTER-TRAWLING (Dragging)

Evolution of the Method

Otter-trawling is a method of fishing by which a bag-shaped net is dragged along the ocean floor by a powered vessel called a trawler. The origin of the method is vague, but in England at least there is a record as early as 1376 which mentions an instrument having the description of a beam trawl. Beam trawls were commonly used by sailing vessels and later by steam trawlers up to the beginning of the 20th century. The first commercial otter trawls were used near the end of the last century. These were originally beam trawls with the beams removed and otter-boards or door-shaped structures substituted where the ends of the beams were formerly located. This method was first adapted to Canadian fishing in 1899 when an east coast vessel was fitted with an otter trawl made in the Maritimes from specifications sent out from England. Although the first experiment was unsuccessful, the potential advantage of the otter trawl was recognized. In 1908 an English steam trawler was the first vessel to pursue this type of fishery in Canadian waters on a full-time basis. The early vessels had many difficulties to overcome, but as captains became more familiar with the fishing grounds and as numerous improvements were made to the gear and the vessels, particularly the introduction of the bridge between the door and the trawl wing in the 1920's, the change to diesel power in vessels, and the introduction of echo-sounders and Loran and Decca navigation, trawling has evolved into the very efficient method for catching fish that it is at present.



Trawler on the Grand Banks.



Description and Method of Operation

The net is cone-shaped and that part towards the apex forms a trap called the "codend". The large opening of the forward part of the trawl is kept open horizontally by iron-shod wooden doors or "otter-boards" attached at each side by a bridle to the wings. Wire ropes or "warps" from the trawler to the otter-boards are used to tow the trawl astern of the ship. The otter-boards stand on edge and have a kite-like action. As the net is pulled forward by the vessel the otter-boards deflect outwards keeping the mouth of the net spread wide horizontally. Floats are attached to the "headrope" along the upper edge of the forward opening to keep the trawl open vertically. Heavy rollers are placed along the bottom edge or "foot-rope" to keep the footrope on the bottom and to aid the net in passing over obstructions as it is dragged along the bottom. On the bottom side of the codend cow-hides are usually attached to prevent chafing and tearing of the net as a result of contact with the ocean floor.

As the trawl is pulled forward, many of the fish in its path enter the net and eventually become massed in the codend. If the meshes of the codend are large enough, most of the fish that are too small for the market will be able to pass out unhurt through the meshes and escape capture. Fish too big to pass through the meshes will be captured. Usually the trawler tows the trawl at a speed of 3 to 4 knots with the duration of the tow depending on the skipper's knowledge of the fishing ground and the degree of concentration of fish on or near the bottom. When the skipper thinks that the net contains a good catch, the warps are hauled in by winches until the otter-boards or doors are brought to the two "gallows" frames, one forward and one aft of the working space on the main deck. The doors are then hooked to the gallows

and the trawl is pulled alongside the ship between them. The forward parts of the trawl are pulled on board until only the codend containing the catch is in the water. This is then hoisted onboard and the draw-rope or codline, which keeps the codend closed during the fishing operation, is released. The catch is thus spilled into pens on the deck to be sorted and cleaned for icing in the hold. Before this commences, however, the net is put out again to start another tow.

Vessels and Equipment

The method described above is that of a conventional side trawler used by Canadian fishermen on the offshore fishing grounds. Canadian trawlers may range from 50 feet or less in length, for use on fishing grounds in coastal waters or on fishing grounds not too distant from the coast, to about 150 feet long for use on the distant offshore banks. They carry crews ranging from 5 men or less for the small vessels to about 20 for the larger ones. In terms of gross tonnage they range up to about 500 tons and are classed as small and medium size trawlers. All are equipped with radio-telephones and depth sounders, while the larger ones carry the latest in navigational and fish-finding equipment, such as radar, direction-finders, Loran, Decca navigators and echo-sounders for detecting fish concentrations.

Other countries with fishing fleets in the Northwest Atlantic also use conventional side trawlers, but these are generally much larger than those used in Canada and their size may range up to 2000 gross tons. For a number of years Spain has operated a fleet of pair trawlers. This method involves the operation of two vessels as a fishing unit using a trawl several times as big as that used by Canadian trawlers. Instead of using otter-boards to keep the mouth of the net spread



Model of Canadian otter trawler used in the Northwest Atlantic.

apart, the trawl is towed by two vessels. They alternate in taking the catch on board.

A number of European countries with fleets in the Northwest Atlantic now use stern trawlers, which are usually large factory ships, generally over 2000 gross tons. The large trawl when being pulled back is taken completely on board over the sloping ramp at the stern of the ship. When the cod end is opened the catch is dumped through a hatch onto the deck below, where it is sorted, cleaned, filleted, packaged and stored in the refrigerated compartments, and is all ready for the market when the ship returns to its home port.

A trawler crew member tugs at the cod end rope of a trawl to spill a load of flounder into the overflowing checkers.



Distribution and Importance

Although three species of oysters are grown in British Columbia, by far the most important is the one first imported from Japan about 30 years ago and now known as the "Pacific" oyster (*Ostrea gigas*). It may be grown throughout the length of the coastline but the industry is located mainly in the Georgia Strait region, on both the Vancouver island and mainland shores and among the Gulf Islands. Nearly all suitable oyster ground in this area is now taken and further expansion must take place to the north. At present the normal annual production is about 50,000 gallons valued at approximately \$200,000.

Description

The Pacific or Japanese oyster is one of the larger cultured oysters and, if permitted, may grow to a length of one foot or more. The colour is variable but in the young the outer new shell may be red or purple and the older shell a mouse gray. The light mauve muscle scar on the inside of the shell is not as clearly outlined as in the eastern (Atlantic) oyster. There are deep radial grooves and the concentric rings are prominent with extensive fluting. The shape is very variable, depending on the type of ground on which it is grown and on the degree of crowding. The oyster itself may be distinguished from other North American edible oysters chiefly by means of the colour of the mantle edge, which is the curly fringe. This is most often black, although in some localities it may be a dark brown -- but never as light as in the eastern oyster.

Habitat

The Pacific oyster is a hardy animal and can withstand great extremes of temperature and of salinity. Its natural habitat is at the half-tide mark, although it is grown commercially between this point and the level of the lowest tides. Most Atlantic oysters, on the other hand, are grown on ground in shallow water below the level of the lowest tides. Oyster beds in British Columbia are found in sheltered locations where wide expanses of flats of firm mud, sand or gravel composition are exposed when the tide falls below the half-tide mark or lower. If the ground is not sheltered, wave action either moves or buries the oysters and if the ground is too soft they become partly buried, grow long and thin and are difficult to work. Oyster beds are frequently found at river mouths, partly because the right type of ground is found in estuaries. However, Pacific oysters may be successfully cultured far from the influence of rivers.

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Oysters (Pacific)(cont'd.)

Food

The Pacific variety, like all other oysters, is a "filter" feeder, which means that it obtains its food by sieving large quantities of water through its mesh-like gills on which are caught the microscopic particles of food which float in the sea. The particles (collectively called plankton) are microscopic plants and animals with their reproductive bodies and these, enmeshed in mucous, are transported along the gills to the mouth. The adult oyster is a stationary animal so its food must be brought to it by means of currents which thus play an important part in the growth of oysters.

Breeding

Since the Pacific oyster is a native of Japan, where water temperatures are somewhat higher than those in British Columbia, it does not breed regularly in its new home. This is one of the industry's most serious problems. Limited successful breeding does occur on occasion in one or two localities but it is not dependable; therefore, in order to maintain the supply, young oysters, called seed, must be imported annually from Japan. During the last war this source of seed was, of course, cut off and the industry is only now recovering from the curtailment of supplies during that period. Seed is transported from Japan by ship in wooden cases as deck cargo, each case containing about 10,000 seed oysters $\frac{1}{4}$ " in diameter, which are attached to oyster shells. The seed cases are washed daily with salt water and this, along with the hardening process they were subjected to previously, permits them to survive the 10 to 14-day voyage across the Pacific in good condition. The average annual import of Japanese seed oysters into British Columbia is 5,000 cases (50,000,000 seed).

Growth

Under favourable conditions the Pacific oyster grows rapidly and they have been known to reach a marketable size in less than two years. However, the normal age at which they reach this size (of 4 to 6 inches in length) is about three years in most grounds in the Georgia Strait area of British Columbia. Nearly all the annual growth is added from April to October. Pacific oysters are known to live to an age of at least 20 years.

Enemies

So far the only enemies of the oyster in British Columbia are the sea stars and oyster drills. The sea stars do not present a serious problem

Oysters Pacific (cont'd.)

for it is merely a matter of picking them up from the beds at low tide or destroying them with a sprinkle of lime or carbide. The oyster drills are more difficult to combat. The two species which do all the damage have both been accidentally imported with seed oysters, one from the Atlantic coast and one from Japan, the latter being the most destructive. Fortunately, they are restricted to only a few beds and now every shipment of imported seed is carefully inspected. Most damage is done to young oysters for the drills can quickly bore a small hole in the thin shell through which they are able to attack the oyster. So far the only solution is to remove the drill from the beds and this is a difficult matter when hundreds of acres are involved.

Culture

Oyster ground in British Columbia, as part of foreshore lands, is held by the Crown in the right of the Province and is administered by the Provincial Department of Lands and Forests in conjunction with the Provincial Department of Fisheries and the Provincial Department of Health and Welfare. All oyster ground is leased for periods of 10 or 20 years and the leases have an average size of about 40 acres, although they range from less than one acre to several hundred.

The seed oysters arrive from Japan each year early in April. They are immediately spread on beds where they are allowed to grow for a year. At this time the clusters of oysters, now two inches or more in length, are broken apart. This is necessary since there may be a dozen or more young oysters attached to one "mother" shell and as they grow larger they become crowded and misshapen and separating at an early age prevents this. They may remain on the same bed or be moved to another one on which faster growth occurs. Later they are usually moved to a bed known to be a good fattening area. When they have reached a marketable size and are considered fat and in prime condition by the grower, they are harvested during the low-tide periods, either by hand or by rake and fork, and carried in baskets to nearby floats. At high tide the floats are poled or towed to the oyster house where the oysters are washed and shucked. (Shucking is the process in which oysters are removed from the shells.) Nearly all Pacific oysters are shucked before being marketed and very few go to the half-shell trade. After shucking they are packed in gallon cans for the restaurant trade, or in glass or cardboard containers for the retail trade. Sanitary regulations governing shucking and shucking houses are strictly enforced. The containers are sealed at the time of shucking and no further packing or repacking is permitted. Therefore, the consumer is assured of a perfectly sanitary product. The shucking house registration number is stamped on the container so it is of advantage to the grower to pack oysters only of the finest quality. Only oysters from registered beds and registered shucking houses are permitted to be marketed.

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Oysters Pacific (Cont'd.)

While oysters may be eaten at all times of the year, during the warm summer season when they are in the spawning, or post-spawning condition, the characteristic delectable oyster taste is missing and that is why the oyster season occurs during the colder months of the year, usually from October to April. So it may be seen that the old myth regarding the eating of oysters only in those months in which an "R" occurs in the spelling, was not far from the mark. However, good quality oysters, properly fresh-frozen during the winter and stored until summer, are able to fill in for the lack of fresh oysters during the offseason.

The Pacific Blackcod

(Prepared by the Nanaimo Biological Station of the Fisheries Research Board of Canada.)

THE blackcod (*Anoplopoma fimbria*) like several other species of Pacific coast fish is misnamed in that it is not a true cod. Active fisheries for this species occur from California to Alaska. The total annual production for the Pacific coast has been maintained at a level of 14 to 18 million pounds in recent years, with Alaska taking between 40 and 50 percent. The Canadian catch, which has averaged over two million pounds per year, has had an average landed value of over a quarter of a million dollars. Over 60 percent of this catch comes from the waters off the Queen Charlotte Islands and off the coast of Alaska during the summer months.

DESCRIPTION

The blackcod or sablefish is a member of the skilfish family. It is distinguished by its green to bluish black colour, two widely separated dorsal fins, a slender caudal peduncle and a smooth, streamlined body.

HABITS

The adults of this species inhabit much greater depths than most other groundfish species, being commonly taken in waters of 70 to 250 fathoms. Spawning takes place in the late winter months and is believed to occur in deep water off the west coast of Vancouver Island and off the Queen Charlotte Islands. The eggs are pelagic. Very young stages have been captured near the surface several hundred miles off the continental shelf. Large schools of immature fish between one and two feet in length are frequently seen in the surface waters close to land in the straits and inlets. On the fishing banks the smaller fish are encountered at shallower depths than the larger fish.

The food of the blackcod consists mainly of herring, sand lance and crustaceans.



BLACKCOD (*Anoplopoma fimbria*)

AGE AND GROWTH

From a study of the rings on the scales of the blackcod it has been found that commercial size is reached at an age of approximately five years and maturity is reached at about six to eight years. At that age the fish are about 28 inches in length. Very old fish may reach a length of three and a half feet and a weight of forty pounds.

FISHING METHODS

Almost all of the Canadian catch of blackcod is landed by longline vessels. The main landings usually occur after the halibut season has closed. Since otter-trawlers usually do not fish as deep as the longliners they seldom encounter fish which are much over the legal size.

HANDLING

The major part of the catch is put through the smoking process, the finished product often appearing on the market as "smoked Alaska cod". Small quantities are dry-salted. Because of the high oil content in the flesh, blackcod is seldom marketed fresh.

The liver oil, like that of the lingcod, halibut and dogfish, is high in vitamins A and D. The heavy demand for this product during the war years contributed greatly to the expansion of the fishery.

February 1967

FISHERIES FACT SHEET**Pacific Edible Crab**

THE PACIFIC edible crab, or Dungeness crab (*Cancer magister*) is one of the larger crustaceans found on the Pacific coast of North America, exceeded in size only by the king crabs of the Gulf of Alaska and the Bering Sea. The distribution of the edible crab on the Pacific coast is from Unalaska to Monterey, California. It lives from the low tide mark to as deep as 100 fathoms, but is not often fished in British Columbia waters deeper than 20 fathoms. The crab fishery is one of the minor fisheries of British Columbia, with an annual total landed value of about \$627,000 in 1966.

The mature crabs usually mate during the summer months in the inshore waters. The male pairs with a soft-shelled, i.e. recently moulted female. In late fall or early winter, eggs are spawned by the female and retained on the lower surface of the abdomen.

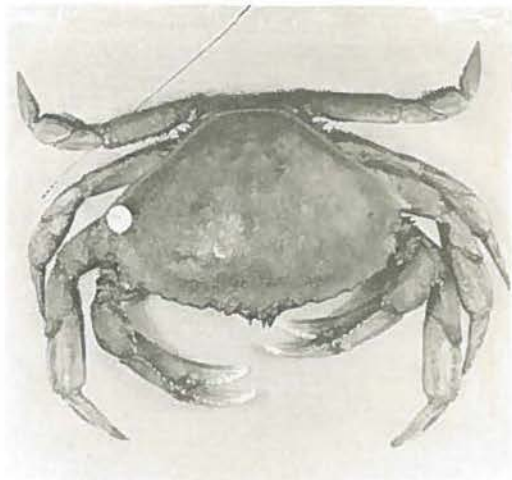
The eggs, as many as a million, are carried by the female until hatching in the spring, after which the young crabs (larvae) swim freely for three months or longer before settling to the bottom.

Growth is accomplished by frequent moulting of the juvenile crab. After the attainment of maturity (believed to be three years in British Columbia), moulting takes place annually or sometimes less frequently. The legal minimum size of 6 1/2 inches, measured across the back and including the longest spines, is reached at about 4 years. The maximum size for the edible crab is about 10 inches. Females rarely reach the minimum size, so in actual practice do not appear in commercial catches.

The crab is generally found on a firm sandy bottom. Specimens taken from a muddy habitat are small in size and often quite discoloured. Its diet consists of clams, marine worms, and even small fish.

FISHING AREAS AND METHODS

Up to three quarters of the total British Columbia catch is taken off the northern part of the Queen Charlotte Islands. Other areas are in Boundary Bay, at the mouth of the Fraser River, Chatham Sound, Burrard Inlet, Sooke Harbour, and near Tofino on the west coast of Vancouver Island.

Pacific Edible Crab (*Cancer magister*)

Traps are largely used in the capture of the edible crab. In all areas today, the main trap is a heavy circular, stainless steel-meshed type, having a diameter of about 40 inches and depth of 14 inches, with two tunnel mouths. Each trap has a separate line and floating buoy. Formerly light, rectangular traps, attached at intervals along a long groundline, were the regular crab gear in sheltered bays and inlets. Clams, squid or frozen herring are used for bait. A limited quantity of crabs is caught by bottom trawling.

Crab canneries are situated at Masset in Queen Charlotte Islands, at Prince Rupert and at nearby Port Edward. Other products include: whole cooked crabs, fresh and frozen; frozen unshelled but gutted crabs; and fresh crab meat.

(Prepared by the Nanaimo Biological Station
of the Fisheries Research Board of Canada.)

The Pacific Gray Cod

THE gray cod (*Gadus macrocephalus*) is the true cod of the Pacific Ocean and is closely related to the famous cod of the north Atlantic. It is an inhabitant of the colder waters of the coast and seldom ventures south of Oregon. The species is abundant off the west coast of Vancouver Island and in Hecate Strait. Extensive fisheries have occurred as far north as Alaska and the Bering Sea. Over the past few years the gray cod has been increasing in importance to the Canadian fishermen. The total catch by Canadian and American vessels of the British Columbia coast exceeded 30 million pounds in 1965.

DESCRIPTION

The presence of three soft-rayed dorsal fins and two anal fins are characteristics which distinguish the members of the cod family. The gray cod is readily distinguishable from its relatives, the tomcod and whiting, by the long barbel on the lower jaw (the tomcod has a very short barbel and the whiting has none).

HABITS

Little is known of the life history of the gray cod. Spawning is known to take place during the winter months, but the actual location of the spawning grounds is known only for a few small inshore populations. The eggs of the cod, unlike those of some flatfish species, do not float after they have been liberated.

Small gray cod are encountered in shallow water during the summer months and the adults occur at depths of 30 to 60 fathoms.

Food consists mainly of herring, sand lance and flatfish. Other items in the diet include crabs, shrimps and euphausiids.



GRAY COD (*Gadus macrocephalus*)

The gray cod grows very rapidly, reaching a length of 24 inches by the end of its third year. The average age in the commercial catches is three or four years but some fish may reach an age of eight years and a length of close to three feet. Maturity is reached in two or three years.

FISHING METHODS

Otter-trawlers, particularly those equipped with high opening nets of light web, account for the major part of the gray cod landings. Small quantities are caught incidentally in the line fisheries. Several decades ago there existed an active line fishery for gray cod off the Alaska coast and in the Bering Sea, but this petered out, probably because of marketing problems.

In the years following World War II there has been an increasing demand for gray cod. Some of the catch is landed dressed. It is then filleted and packaged for freezing. A fair percentage of the catch is used as halibut bait by longliners.

(Prepared by the Nanaimo Biological Station of the Fisheries Research Board of Canada).

Dec. 1966

The Pacific Halibut

THE HALIBUT ranks as Canada's eighth most important food fish (in terms of value of products) and is found on both coasts of the Dominion. The Pacific halibut is distinguished from the Atlantic species by certain scale characteristics which have given it the specific name, *Hippoglossus stenolepis*. Halibut are found both in shallow waters and in depths of at least 600 fathoms, but for the most part range from 30 to 225 fathoms. British Columbia fishermen take halibut from within the whole area of the continental shelf extending from the Strait of Juan de Fuca to the eastern Bering Sea. The principal fishery, however, is centered in the waters off northern British Columbia and in the Gulf of Alaska. Of the 35 to 40 million pounds caught annually by Canadians in Atlantic and Pacific waters, the British Columbia catch makes up 85 to 90 per cent of Canada's total. The marketed value of West Coast halibut amounts to more than \$10 million annually.

DESCRIPTION

The halibut, a member of the flatfish family, is dark brown on the upper side, with lighter irregular blotches. The lower side is white, and rarely blotched. It has a mouth extending to a point below the eye. The eyes are large, with the upper eye slightly behind the lower. The scales are very small and smooth and the lateral line is arched.

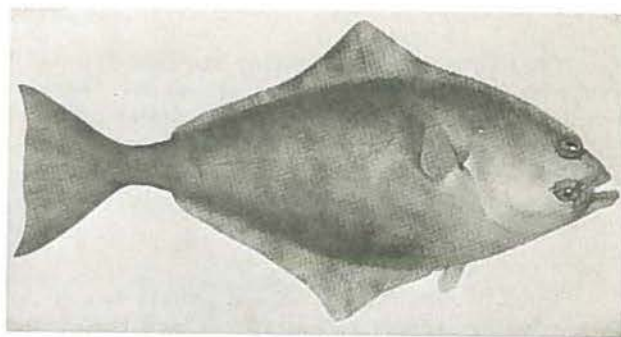
HABITS AND MOVEMENTS

The eggs and larvae are heavier than surface sea water and lighter than the deep water. For this reason, they drift passively with the currents at depths down to 375 fathoms. They gradually rise to the surface as development proceeds, and drift into shallow water with the inshore surface currents.

When six or seven months old, the young fish settle to the bottom in the shallow waters of sandy bays and inshore banks. With advancing size and age they move into deeper waters. Tagging operations have shown that the immature halibut move within very restricted areas. Mature fish, however, migrate extensively to and from the spawning grounds. A few West Coast halibut have travelled as much as 2,000 miles.

FOOD

The halibut are ground feeders, but occasionally will swim near the surface in quest of food, which consists of fishes, crabs, clams, squid, worms, etc.



THE PACIFIC HALIBUT (*HIPPOGLOSSUS STENOLEPIS*)

SPAWNING

Spawning takes place from November to January in well defined areas of depths from 150 to 225 fathoms. Halibut do not spawn until they are 10 to 12 years old. At that time, a large female of 140 pounds may have as many as 2,700,000 eggs.

GROWTH

The larvae like those of other members of the flatfish family, begin life in an upright position with eyes on each side of the head, and both sides of the body the same colour. However, after the young halibut is about an inch long, an extraordinary transformation takes place. It proceeds to the bottom, from the near-surface depths of the ocean in which it has lived since birth, and acquires the habit of resting and swimming on its left side. Gradually, as the young halibut grows, the left eye migrates or twists over towards the right side of the head. Simultaneously the left or underside of the fish changes colour and becomes white or grayish, while the right or upper side is a varying slate brown, often mottled and sometimes almost black. By early spring the transformation is complete and the young fish settles to the bottom in the shallow waters near shore. The female halibut is faster growing than the male. However, she does not reach maturity until she is from eight to 16 years old, averaging around 12 years, while males mature considerably earlier. Males have been known to attain an age of 25 years and a weight of 40 pounds. They have been known to reach 4 feet, 7 inches in length. Female halibut may weigh as much as 470 pounds, and reach a length of over eight feet. They are known to live for 35 years or more.

FISHING AREAS AND THE FISHERY

British Columbia is close to the world's greatest halibut fishing grounds. Some of the principal ones are off the north coast of Vancouver Island, off the Queen Charlotte Islands, in Hecate Strait and in Dixon Entrance. Others, farther away, but commercially accessible to British Columbia vessels, lie off Alaska. All told, these areas yield more than 60 per cent of the world's annual halibut catch.

The fishery is regulated by the International Pacific Halibut Commission, consisting of representatives of Canada and the United States, which operates under a treaty between the two countries. The work of the Commission is one of the world's outstanding examples of successful international action in fisheries conservation.

The Canadian Pacific halibut fishery is a primary industry, and as such a specialized fleet is engaged in its prosecution. The halibut is caught on set-lines, the unit of line being the "skate". These

are run out on relatively shallow bank areas, ranging in depth from 10 to 150 fathoms. Frozen herring, cod or octopus is usually used for bait, and the bait, and the baited long lines are paid out directly from the power-boats. In early days of the fishery, however, the gear was set from dories.

Among the West Coast companies, the following categories are used to ensure uniformity in the commercial handling of halibut.

Chicken	5 - 10 lbs.
Small Medium	10 - 40 lbs.
Large Medium	40 - 60 lbs.
Large	60 - 125 lbs.
Whales	125 and over.

Practically all the five million pounds landed on the Atlantic Coast are marketed as fresh, of which about half is exported to the United States. On the Pacific Coast, about 25 per cent of the catch is landed directly by fishermen at U.S. ports and most of what is landed in Canada is sold as frozen dressed. About two-thirds of B.C. production of frozen dressed halibut is sold to foreign markets, mainly to the United States and United Kingdom.

(Prepared by the Fisheries Research Board of Canada Biological Station, Nanaimo, B.C.)

September 1966

The Pacific Herring

HERRING were one of the first coastal fishes to be utilized by man. In northern Europe, particularly, they have been a source of food since before written history. In British Columbia herring and herring roe have been an article of food or barter of the coastal Indian tribes for many centuries. They were not fished, however, on a commercial basis until 1877 when 75 tons were caught.

From 1959-1963 the annual catch has averaged about 210,000 tons.

While this fishery is first in landed weight and second to salmon in landed value, it is only worth about one-quarter as much as British Columbia's salmon catch.

Fluctuations in the world price of fish meal and oil cause the market value of about eight million dollars to vary from year to year.

THE FISHERY

The British Columbia herring fishery is a highly organized operation utilizing modern shore plants and efficient fishing vessels. The seventy-to eighty-foot long seine boats are equipped with the very latest electronic fish-detecting equipment, enabling the fishermen to "see" the shoals before setting the net. In some areas the eighty vessel fishing fleet may use powerful blue-tinted lights to attract fish schools.

Purse seining has been the dominant method of harvesting the herring crop since 1910. The 275-fathom long net encircles a school of herring and a purse line closes off the bottom like a draw string to prevent herring from escaping.

Sets average about 70 tons but catches up to 300 tons or about three million herring are not uncommon. The largest catches by a single net ever recorded were 1260 tons from Ogden Channel near Prince Rupert in 1950 and 1150 tons off Comox in 1949. The former was made by the seiner "Maple Leaf C", the latter by the seiner "Western Ranger". The captured herring are scooped two tons at a time with a giant dipnet or brailer into the hold of the fishing vessel and conveyed rapidly to the shore plants. Some herring are also caught by mid-water trawls and a few, to supply the fresh fish market, by gill nets.

In southern British Columbia the most pro-



The Pacific Herring (*Clupea palasii*)

lific fishing grounds are along the Vancouver Island shoreline. On the east coast the best localities are off Campbell River, off Comox and amongst the "Gulf Islands" between Nanaimo and Victoria and on the west coast in Barkley Sound, in Nootka Sound and in Esperanza Inlet. In central British Columbia herring are caught in the channels near Bella Bella and in northern British Columbia around the islands south of Prince Rupert. Considerable catches are sometimes made along the lower east coast of the Queen Charlotte Islands.

Fish caught in southern British Columbia are generally processed at Steveston near Vancouver while those captured in central and northern British Columbia are delivered to shore plants in Prince Rupert and Namu, south of Bella Bella.

At the shore plants herring are unloaded by a giant suction hose into storage bins to await processing into fish meal and oil. The herring harvest of British Columbia is not utilized directly for human consumption but rather forms a protein and mineral rich supplement in the diet of poultry, pigs and mink. The edible fish oil is shipped by rail and truck to markets in Canada and the United States for use in the manufacture of soaps, paints and cooking compounds. Only five per cent of the total herring catch is used for human sustenance either canned, salted, pickled or fresh.

DESCRIPTION

Pacific coast herring are bony fish about nine inches long with blue-green backs shading away to silvery white on the sides. The mouth is large with a slightly projecting lower jaw; the tail is deeply forked. They are graceful but somewhat nervous swimmers, characteristically travelling in large shoals. They are grouped scientifically in the family Clupeidae, to which also belong such other closely related Pacific coast species as the pilchard (Pacific sardine) and the shad.

Iridescent, loosely attached scales, about

one-quarter of an inch broad, are imprinted with annual rings that can be used to tell the age of a herring. In British Columbia the herring catches are composed mainly of fish that are three and four years of age. If there were no fishery some herring would grow to be quite old. The oldest herring on record, caught several years ago near Prince Rupert, was more than fifteen years old.

REPRODUCTION AND GROWTH

To fulfill the instinct to reproduce their species the herring legions undertake long spawning pilgrimages each year. In the fall, they leave the rich offshore feeding grounds above the continental shelf and migrate to inshore waters. Here, they form in dense schools awaiting the ripening of their reproductive organs. It is during this winter resting phase that the fishermen intervene to make their catches. Spawning takes place along the shore in early spring.

Each spring herring leave the ocean depths and crowd onto the beaches in vast numbers to perpetuate their race. Although male and female are present in equal numbers on the spawning ground there is no "pairing off" during the spawning act. Females discharge sticky eggs on green eel grass and brown rockweed, japweed and kelp. The males shed milt into the surrounding water turning it milky and opaque for miles. During the 1964 spawning season, over 220 miles of spawn were deposited along the 17,000 miles of British Columbia shoreline. After spawning, the spent fish return offshore to feed in scattered schools.

An average-sized herring deposits about 20,000 eggs each year. The transparent eggs are less than one-sixteenth of an inch in diameter and one square inch of seaweed may be covered with as many as one thousand eggs. After a sixteen-day incubation period the embryonic fish finally break out of the confining egg membranes and drift away.

During the brief period that they are fastened to moist seaweed many thousands of eggs are destroyed. Storms frequently annihilate whole spawnings. Seagulls and diving ducks are attracted in large flocks to the spawning beaches, first to feed on the spawners and then on the spawn left exposed at low tide. Mortality during the egg stage may amount to as much as 70-80 per cent.

By late April the sea lanes are populated with tremendous numbers of newly hatched, almost invisible herring larvae. These fragile, thread-like one-quarter-inch long infant herring bear little resemblance to the adult fish. They lack scales, the head and black eyes are greatly enlarged and they can barely swim. Two months later when about one and one-half inches long they will have undergone a gradual metamorphosis that changed their outward appearance into that of a miniature adult herring.

After schooling up, the infant herring now

known as juveniles can be found frequenting kelp beds for protection during the summer months. These sardine-sized fish are raked by sports fishermen for use as live bait when trolling for salmon. Occasionally, a small fishery for these juveniles takes place but the schools of young herring have never been exploited to the extent of those along the Atlantic seaboard and in the Gulf of Maine.

In October, when about 4 inches long, juvenile herring normally forsake their shallow-water haunts and move seawards into deeper waters. Their survivors will return in the fishable stocks mostly as mature, three-year-old herring. They will continue to return each year in the spawning runs for the remainder of their life span. Little information exists with respect to the distribution and abundance of immature herring between the time they leave shallow water and the time they return as adult fish.

Herring research has shown that two types of herring stocks exist in the coastal waters of British Columbia; major migratory stocks and minor resident stocks, the latter present in local waters all year round. A twenty-year herring tagging program carried out by the Nanaimo Biological Station of the Fisheries Research Board of Canada has indicated that there are at least nine relatively separate migratory herring populations along the coast.

MANAGEMENT PROGRAM

Present day efforts are designed to provide a scientific basis for a management program that will allow the greatest possible catch from all populations. In the continuing program emphasis is placed on compilation of catch statistics, sampling for age, length and maturity, estimating spawn abundance and echo-sounding surveys. The analysis of these data provides information on the level of abundance of each population and on the relationship between the size of the spawning stock (measured by the amount of spawn deposited) and the resulting number of recruits to the fishable schools (year-class strength).

The British Columbia herring fishery is regulated through the Federal Department of Fisheries by a combination of closed areas, closed seasons and catch quotas. The closed season extending from February 5 to May 1 in southern British Columbia is designed to protect the fish at spawning time when they are massed close to shore. By mutual agreement, a 48-hour closure period occurs each weekend as well as a 3-week shut-down over Christmas. However, control of the fishery is provided principally by a system of catch quotas applied to most of the major herring populations. Thus, 40,000 tons of herring may be taken each year from the herring population off the lower east coast of Vancouver Island. If surveys by patrol vessels of the Department of Fisheries and biological evidence indicate



A power winch operates the brailer or huge scoop used to take the thousands of herring from the net. Gulls hover and swoop down on the catch.

fish are unusually abundant, extensions to quotas are usually granted.

Pacific herring are almost entirely lacking in either defensive or offensive abilities, consequently, they are more preyed upon than any other species of coastal fish. Their perpetuation is dependent upon their abundance. At all stages of their life span herring form a basic food supply in the economy of the coastal waters of the north-eastern Pacific Ocean. Only one herring from 10,000 eggs is destined to return to spawn. Many fishermen think adequate stocks of herring are necessary to sustain important food fishes such as coho and spring salmon. However, available biological evidence suggests that perhaps these fish could subsist on alternative foods should herring abundance ever reach very low levels.

Herring are eaten by many creatures. Eggs are consumed by many kinds of sea birds, larvae by numerous invertebrates and older herring by

sea lions, lingcod, dogfish and salmon. It is truly astonishing that any individuals live long enough to reproduce their kind.

In turn, herring feed on flea-sized organisms, such as copepods, amphipods and the young, free-swimming stages of barnacles and crabs. This diet is supplemented in the summer months with euphausiid shrimps, known locally as red feed. Herring food forms part of the category of ocean life known as zooplankton or animal plankton. The zoo-plankton organisms rise nightly towards the sea surface and descend again at dawn to avoid the intense daylight. Because herring are zooplankton feeders they also exhibit a similar up and down movement. The fishing fleets utilize this characteristic upward, nocturnal swim to bring the herring shoals within reach of their nets

(Prepared by the Fisheries Research Board of Canada Biological Station, Nanaimo, B.C.)

July, 1966

The Pacific Oyster

ALTHOUGH three species of oysters are grown in British Columbia, by far the most important is the one first imported from Japan about 35 years ago and now known as the "Pacific" oyster (*Crassostrea gigas*). It may be grown throughout the length of the coastline but the industry is located mainly in the Georgia Strait region, on both the Vancouver island and mainland shores and among the Gulf Islands. Nearly all suitable oyster ground in this area is now taken and further expansion must take place to the north. At present the normal annual production is about 150,000 gallons valued at approximately \$650,000.

DESCRIPTION

The Pacific or Japanese oyster is one of the larger cultured oysters and, if permitted, may grow to a length of one foot or more. The colour is variable but in the young the outer new shell may be red or purple and the older shell a mouse gray. The light mauve muscle scar on the inside of the shell is not as clearly outlined as in the eastern (Atlantic) oyster. There are deep radial grooves and the concentric rings are prominent with extensive fluting. The shape is very variable, depending on the type of ground on which it is grown and on the degree of crowding. The oyster itself may be distinguished from other North American edible oysters chiefly by means of the colour of the mantle edge, which is the curly fringe. This is most often black, although in some localities it may be a dark brown -- but never as light as in the eastern oyster.

HABITAT

The Pacific oyster is a hardy animal and can withstand great extremes of temperature and of salinity. Its natural habitat is at the half-tide mark, although it is grown commercially between this point and the level of the lowest tides. Most Atlantic oysters, on the other hand, are grown on ground in shallow water below the level of the lowest tides. Oyster beds in British Columbia are found in sheltered locations where wide expanses of flats of firm mud, sand or gravel composition are exposed when the tide falls below the half-tide mark or lower. If the ground is not sheltered, wave action either moves or buries the oysters and if the ground is too soft they become partly buried, grow long and thin and are difficult to work. Oyster beds are frequently found at river mouths, partly because the right type of ground is found in estuaries. However, Pacific



Pendrell Sound, British Columbia, breeding ground of the Pacific oyster.

oysters may be successfully cultured far from the influence of rivers.

FOOD

The Pacific variety, like all other oysters, is a "filter" feeder, which means that it obtains its food by sieving large quantities of water through its mesh-like gills on which are caught the microscopic particles of food which float in the sea. The particles (collectively called plankton) are microscopic plants and animals with their reproductive bodies and these, enmeshed in mucous, are transported along the gills to the mouth. The adult oyster is a stationary animal so its food must be brought to it by means of currents which thus play an important part in the growth of oysters.

GROWTH

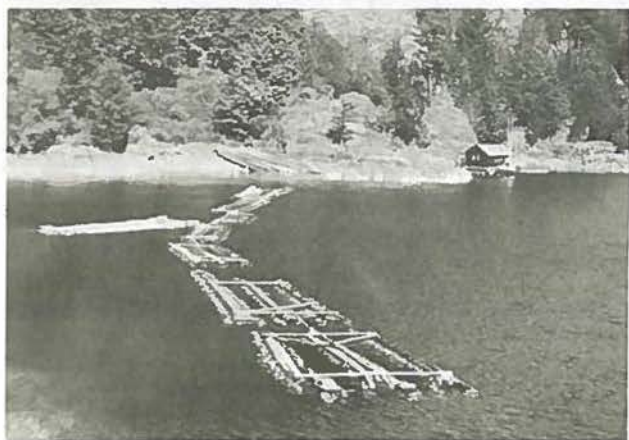
Under favourable conditions the Pacific oyster grows rapidly and they have been known to reach a marketable size in less than two years. However, the normal age at which they reach this size (of 4 to 6 inches in length) is about three years in most grounds in the Georgia Strait area of British Columbia. Nearly all the annual growth is added from April to October. Pacific oysters are known to live to an age of at least 20 years.

ENEMIES

So far the only enemies of the oyster in British Columbia are the sea stars and oyster drills. The

sea stars do not present a serious problem for it is merely a matter of picking them up from the beds at low tide or destroying them with a sprinkle of lime or carbide. The oyster drills are more difficult to combat. The two species which do all the damage have both been accidentally imported with seed oysters, one from the Atlantic coast and one from Japan, the latter being the more destructive. Fortunately, they are restricted to only a few beds.

Most damage is done to young oysters for the drills can quickly bore a small hole in the thin shell through which they are able to attack the oyster. So far the only solution is to remove the drill from the beds and this is a difficult matter when hundreds of acres are involved.



Bags of oyster shell (known as 'cultch') suspended from logs are used to collect oyster seed.

CULTURE

Oyster ground in British Columbia, as part of foreshore lands, is held by the Crown in the right of the Province and is administered by the Provincial Department of Lands and Forests in conjunction with the Provincial Department of Fisheries and the Provincial Department of Health and Welfare. All oyster ground is leased for periods of 10 to 20 years and the leases have an average size of about 40 acres, although they range from less than one acre to several hundred.

For many years it was necessary to import seed oysters into British Columbia from Japan to maintain the industry. The annual average import amounted to about 50,000,000 seed. This is no

longer necessary as in recent years sufficient locally-bred oyster seed has been available from Pendrell Sound, B.C.

When the seed oysters arrive in October, they are immediately spread on beds where they are allowed to grow for a year. At this time the clusters of oysters, now two inches or more in length, are broken apart. This is necessary since there may be a dozen or more young oysters attached to one "mother" shell and as they grow larger they become crowded and misshapen and separating at an early age prevents this. They may remain on the same bed or be moved to another one on which faster growth occurs. Later they are usually moved to a bed known to be a good fattening area.

When they have reached a marketable size and are considered fat and in prime condition by the grower, they are harvested during the low-tide periods, either by hand or by rake and fork, and carried in baskets to nearby floats. At high tide the floats are poled or towed to the oyster house where the oysters are washed and shucked. (Shucking is the process in which oysters are removed from the shells.)

Nearly all Pacific oysters are shucked before being marketed and very few go to the half-shell trade. After shucking they are packed in gallon cans for the restaurant trade, or in glass or cardboard containers for the retail trade.

Sanitary regulations governing shucking and shucking houses are strictly enforced. The containers are sealed at the time of shucking and no further packing or repacking is permitted. Therefore, the consumer is assured of a perfectly sanitary product. The shucking house registration number is stamped on the container so it is of advantage to the grower to pack oysters only of the finest quality. Only oysters from registered beds and registered shucking houses are permitted to be marketed.

While oysters may be eaten at all times of the year, during the warm summer season when they are in the spawning, or post-spawning condition, the characteristic delectable oyster taste is missing and that is why the oyster season occurs during the colder months of the year, usually from October to April. So it may be seen that the old myth regarding the eating of oysters only in those months in which an "R" occurs in the spelling, was not far from the mark. However, good quality oysters, properly fresh-frozen during the winter and stored until summer, are able to fill in for the lack of fresh oysters during the off-season.

(The preceding was prepared by the Nanaimo Biological Station of the Fisheries Research Board of Canada.)

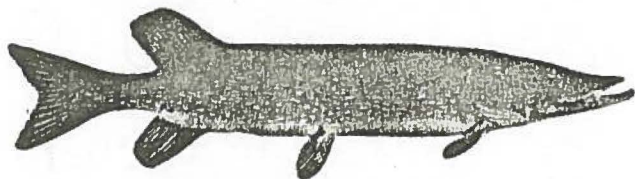
How Taken

PIKE

Description and Distribution

The pike (Esox lucius) is also called jackfish, and in the United States great northern pike or pickerel.

Pike are soft-rayed fish with no adipose fin, and with one dorsal fin posterior to the typical position. Pike are quite long in proportion to depth and width, and are dark green, mottled with lighter spots. Their mouths bristle with sharp, pointed teeth. They are closely related to the maskinonge (Esox masquinongy), and the uninitiated often confuse the two.



Pike
(Esox lucius)

Ireland. In some parts of Canada they are eagerly sought by anglers, but in others they are considered less highly as a game fish.

Pike are found in lakes, ponds and quiet weedy streams throughout the northern United States and most of Canada, and their range extends across Alaska, Siberia and Europe as far west as

Life History

The adult fish spawn in the spring, generally after ascending streams tributary to their usual habitat. The eggs hatch in less than two weeks, and subsequent growth is rapid compared to most Canadian freshwater fish.

Pike are generally found in shallow water, and they tolerate higher temperatures, lower concentrations of oxygen and higher concentrations of carbon dioxide than many species of freshwater fish. They generally lie motionless and well camouflaged among the shallow water vegetation, waiting to pounce on anything which swims too close. Although they mostly eat fish, they also take any other animals which are small enough and which happen to swim within striking distance, such as frogs, mice, muskrats, ducks, etc. They are notorious for their ability to swallow fish almost as big as themselves.

(over)

Pike (Cont'd.)

PIKE

How Taken

Approximately six million pounds of pike are taken annually by commercial fishermen. Most of these are taken incidentally to other fishing operations, in gill nets, pound nets, fyke nets, and seines. Some are taken in fisheries conducted primarily for them, mainly through intercepting spawning runs with fyke nets, weirs or gill nets.

Millions of pounds of pike are taken annually for domestic use by nets, weirs, spears, angling, etc.

No. 48

FISHERIES FACT SHEET

PIKE-PERCH OR PICKEREL

Importance and Distribution

The fish known scientifically as Stizostedion vitreum is commonly included among the pickerels. It is actually a member of the perch family, or Percidae, and not a member of Esocidae, the family to which the pikes belong. Fisheries biologists say, the fish



Pike-Perch or Pickerel
(Stizostedion vitreum)

should be known as the pike-perch, not as the pickerel. They use the hyphenated name partly because this one of the perches is somewhat pike-like and partly to distinguish the fish from the common yellow perch.

There are several species of Canadian freshwater fish, in addition to S. vitreum, which in one locality or another are called pickerel — some of them properly so — and, adding something more to the possibilities of confusion, S. vitreum itself is quite often known popularly by such names as wall-eyed pike and yellow pickerel. Among French-speaking Canadians, the name doré is ordinarily used.

Other fish often marketed as pickerel include two species of pike which, by nature, never grow very large, and the term 'pickerel' is correctly applied to them since the fish are actually little pike. Sometimes small specimens of the common pike, are also referred to as pickerel. The name sand pickerel is occasionally, though incorrectly, applied to the sauger, a member of the perch group.

Among the Canadian provinces, Manitoba is much the largest producer of pike-perch, and usually has more than half of the country's annual catch to its credit. Ontario is a big producer, and landings of substantial size are made also in Saskatchewan and Alberta. Smaller quantities are taken in several other areas. Ontario fishermen also land large quantities of a fish generally known as the blue pickerel and known to the biologists as the blue pike-perch.

The pike-perch occurs also in the Northwest Territories, the Hudson Bay region, and Labrador. In the United States it ranges from Vermont westward to the upper Mississippi Valley and southward to Alabama and Georgia. In the United States, incidentally, the fish is known by a wide variety of popular names, not only as the wall-eyed pike, for instance, but also as the jack salmon, the blowfish,

okow, and green pike.

Description

As for the pike-perch, its exterior colouration may be described as, in general, dark olive, with fine brassy mottlings forming indistinct oblique bars on the body. In maximum weight to about 20 pounds, though most specimens in the Canadian catch weigh from three to seven pounds. The pike-perch has white, firm, flaky flesh and is one of Canada's more important food fishes. Usually it frequents waters of moderate depth, and spawns in early spring, on hard or gravel bottom in shoal waters. From the very beginning of life it shows a voracious appetite, and even the youngsters are not above gobbling up their own little kin. Minnows and other kinds of small fish are staples in the pike-perch diet.

Fishing Areas and the Fishery

Pike-perch will take the hook, both the baited hook and the fly, showing considerable fight and in various areas is of considerable importance as a sport fish. Canada's commercial catch, however, is landed mainly by gill-nets set from boats or, in some localities, by stationary pound-nets. In Manitoba and Saskatchewan most of the landings are made in winter when the nets are set under the ice.

Canada's pike-perch landings are marketed in the fresh and frozen forms, with some of the fish filleted. A large part of the annual catch is exported to the United States and the remainder sold on the domestic market.

FISHERIES FACT SHEET

PILCHARD

The Pacific pilchard is a moderate-sized fish of the herring family. It can be told from the herring by its rounded body form (it is nearly round in cross-section whereas a herring is considerably flattened), by



Pilchard
(Sardinops caeruleus)

the dark spots on the back and sides, by the fine radiating ridges on the gill cover, and by the small flaps on the tail. Pilchards are dark steely blue above and silvery below, with a yellowish sheen around the head in fresh specimens. In general, the pilchards taken by the Canadian fishery are larger than herrings.

Nearly all pilchards taken in Canada are more than 9 inches long and individuals over 11 inches are not uncommon.

Closely related populations of pilchards supply great fisheries in other parts of the world such as Japan, Chile, Australia, South Africa and France.

Pilchards feed principally on the abundant small plants called diatoms which float freely in the sea and on small crustaceans called copepods. They strain these plants and animals from the water with their long and numerous gill rakers.

Pilchard eggs float freely, usually within 150 feet of the surface of the water. Spawning takes place over a considerable area but the principal spawning grounds are within 200 miles of shore between San Diego and Point Conception, California. There are, in addition, important inshore spawning grounds in the vicinity of Cedris Island off Lower California. Each female pilchard spawns one to several times during the spring months, producing around 50,000 eggs at each spawning. After hatching, the young fish swim or are carried by the currents toward the shores of southern and lower California, where they congregate.

Pilchards are highly migratory. Young pilchards make short migrations north each summer and south again in the autumn. Older ones make longer trips and the oldest and largest pilchards travel north to British Columbia in the summer and back to southern California in the autumn. The youngest pilchards to reach British Columbia waters in quantity are usually four or five years old. In some years, such as 1936 and 1940-42, when small fish have been abundant in Canadian waters, there have been significant deviations from the simple pattern of migration as outlined.

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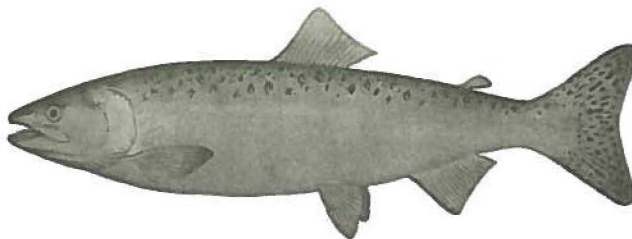
Purse seines are used for taking pilchards in Canada. The nets used for pilchards are more than 1200 feet long and more than 120 feet deep. One edge is supported by corks and other kinds of floats, and the other edge is weighted with a heavy headline. Customarily, 60- to 85-foot vessels fish in pairs - the seiner and the tender. The seiner carries a seven-man crew and the tender a crew of five. When a school is sighted as a discoloured area on the sea surface with occasional flipping individuals, the seine boat catches the fish by running the net around the school and closing its bottom with a cable running through rings placed at intervals along the headline. When the pilchards are closely confined in one end of the net they are dipped into the hold of the tender which carries them to the shore plants. Because the Canadian fishing is usually carried out in exposed offshore waters, and because pilchards are more active than herring, individual catches are usually smaller than for herring and do not frequently exceed 100 tons. The fishing is carried out in summer with its peak in August.

In California the fishing is done quite differently. Boats fish their purse seines singly at night, detecting the presence of schools of fish by the phosphorescent glow in the water. As the light produced is too weak to be seen in moonlight, the fishing comes to a stop when the moon is full. The California fishery is extensive, producing more than ten times as much as the Canadian one.

Most of the Canadian pilchard catch is reduced to oil and meal by a process of cooking and pressing the fish to separate the solid from the liquid parts. The solid part is dried to make fish meal while the liquid part is centrifuged or allowed to settle in order to separate the oil. About five per cent of the catch is canned. Formerly half flat or pound tall cans with salt only added were used exclusively, but in recent years oval cans with tomato sauce added have become more popular.

The size of the pilchard fishery has varied excessively. Between 1927 and 1947 it three times exceeded 80,000 tons and three times it was less than 5,000 tons. Since 1947 landings have dwindled to nothing. This variability has had two sources. The first is the changes in the migration pattern of the fish, which in such years as 1933 and 1939 kept the fish beyond the effective range of the Canadian fleet. This type of change is not at present predictable. The other source of variability in catch is the changing success of pilchards in reproduction. In some years many young survive to catchable size; in others, few. Five years after a succession of poor years the Canadian fishery suffers. The recent decline in Canadian landings resulted from a failure of the pilchards to have really successful spawning since 1939. Few or none of the relatively small numbers of fish which were produced in later years survived to be old enough to make the migration to Canadian fishery grounds. It now appears that the Canadian pilchard fleet will not have satisfactory fishing until there has been one spawning or a sequence of spawnings successful enough to survive the intense California fishery in substantial numbers.

Pink Salmon



Pink Salmon (*Oncorhynchus gorbuscha*)

THE PINK SALMON, under the scientific name *Oncorhynchus gorbuscha*, makes up an important part of the annual British Columbia salmon pack. It occurs naturally around the North Pacific rim from northern California to Korea, hence it is common along the entire B. C. coast.

DESCRIPTION

The smallest of the Pacific salmon (other species are sockeye, chum, coho and spring), the pink is similar to all in shape, with an elongate body, and a conical head. The teeth are small and weak, and the scales also are small. It has a metallic blue back and silvery sides, and is covered with black blotches.

At spawning the colors of both sexes become a dark olive brown shading into white on the under surfaces. In the males, a change in shape occurs, with a pronounced hump or ridge forming on the back, and the jaw becoming elongated, with the upper jaw hooked downward at its tip. Because of this it used to be known as the "humpback salmon", although a similar change also occurs in the male sockeye. The young seldom have parr marks. The length of the pink is usually about two feet, and the weight runs from three to five pounds, occasionally going as high as 10. The flesh is pink, hence the common name, and is highly nutritious, being first in protein content and fourth in fat content of the five B. C. salmon species.

MIGRATION AND REPRODUCTION

Its life cycle is similar to that of all Pacific salmon. The young pink goes to sea from fresh wa-

ter as fry and matures in two years, returning to the spawning ground from September to early November. In most cases there is a large spawning run of a particular population in one year and a small one in the next. Occasionally, however, the runs of successive years are of about the same size, and in a few localities there are no runs in the second year. Massett Inlet and Naden Harbour, both in British Columbia, are examples of areas having even and odd year runs of equal size in the same region.

In the southern part of B. C. the large runs are generally in the odd years while in the north they are in the even years. As is the case with all species of salmon, the ocean movements of the pink salmon are extensive and encompass thousands of square miles of area. Pink salmon usually remain near tidal water to spawn but occasionally travel long distances, for instance to the upper reaches of the Skeena River.

METHODS OF CATCHING

The pink salmon is largely taken in purse seines and gill nets. However, substantial catches are landed by fishermen using trolling gear. The latter catches are usually sold on the fresh-fish market.

Almost the entire net catch is canned and is eagerly sought in many countries. Its biggest sale is in the United States.

(Prepared by the Nanaimo Biological Station of the Fisheries Research Board of Canada).

FISHERIES FACT SHEET

Provincial Fisheries BRITISH COLUMBIA

VALUE OF THE FISHERY

The fisheries of British Columbia are of great cultural and economic importance. The history of the industry is interwoven with that of the province and the exploitation of the rich salmon and other marine resources has opened new fields for human skill and enterprise.

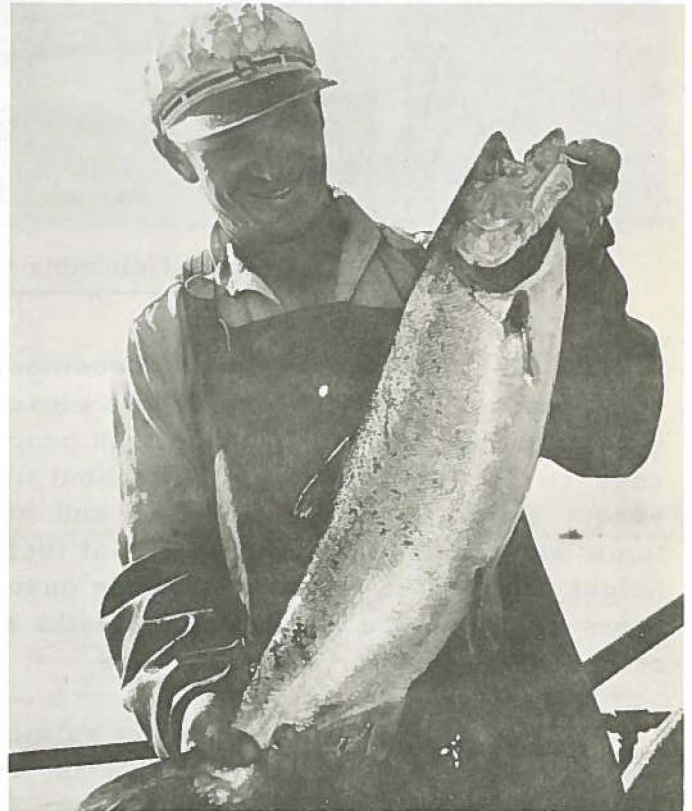
British Columbia lands about 600 million pounds of fish annually. While the volume of landings has remained relatively consistent, the value of production rose fairly steadily after 1950 and reached a peak of 98 million dollars in 1958. The average annual value of production during the period 1956-1960 was 70 million dollars. When it is considered that the total annual Canadian commercial catch is about two billion pounds, with a marketed value of about 200 million dollars, it can be seen that the commercial fisheries of British Columbia contribute significantly to the economic status of the Canadian fishing industry. British Columbia leads the other provinces in the production value of fish and fish products.

SALMON FIRST IN IMPORTANCE

Salmon stand first in importance among the species caught off the British Columbia coast and are the chief factor in placing the province in top position. Five principal species of salmon are caught: sockeye, spring, coho, pink and chum. The marketed value of the catch has been increasing steadily and averages about 50 million dollars. Most of the catch, which

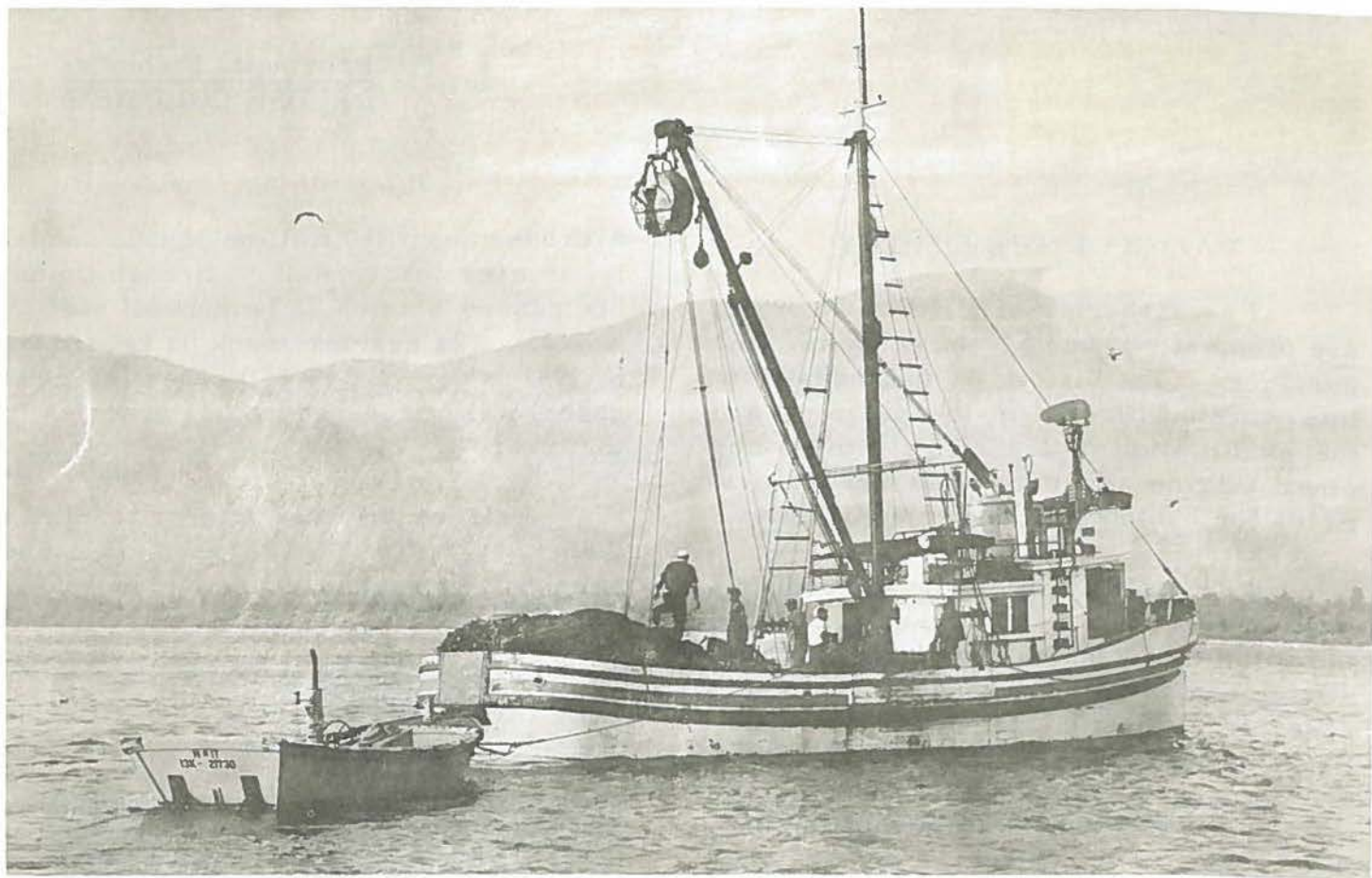
averages about 150 million pounds annually, is used for canning. British Columbia canned salmon is famous all over the world. The heaviest pack on record was in 1941 when 2,248,870 cases (48-pound cases) were produced by the canneries for that year.

This record was almost reached in 1958 when 1,900,000 cases of canned salmon were produced. An increasing quantity of salmon each year finds its



A fine example of B. C. salmon.

way to the fresh and frozen markets in the United States and Canada, while smaller quantities are used for mild curing, smoking and pickling.



British Columbia purse-seiner in operation

Except for the period of December and January, which is generally a closed season, some salmon fishing is in progress in British Columbia throughout the year. But it is in the summer and autumn months that operations are at their height and the fish are taken in huge quantities as they swarm into the mouths of rivers to begin their spawning runs.

One of the most important salmon nurseries in British Columbia is the Fraser River system. The Fraser is particularly noted for its great runs of sockeye salmon which are protected by special conservation measures of the International Pacific Salmon Fisheries Commission. Since the sockeye runs pass through both Canadian and United States coastal waters in the Strait of Juan de Fuca as they approach the river mouth, these fish are shared by the fishermen of

both countries and an international treaty provides for the operation of the Commission to prevent overfishing.

OTHER SPECIES

Great quantities of herring are taken annually in the waters of British Columbia. In fact, herring accounts for about sixty per cent of all British Columbia fish landings. The bulk of the catch is processed into meal and oil and the annual value of production between 1956 and 1960 was about $7\frac{1}{2}$ million dollars. Thus herring leads other fish in total weight of landings and is about equal to halibut in monetary value of production.

British Columbia is close to one of the greatest halibut fishing grounds in the world. Some of the principal grounds

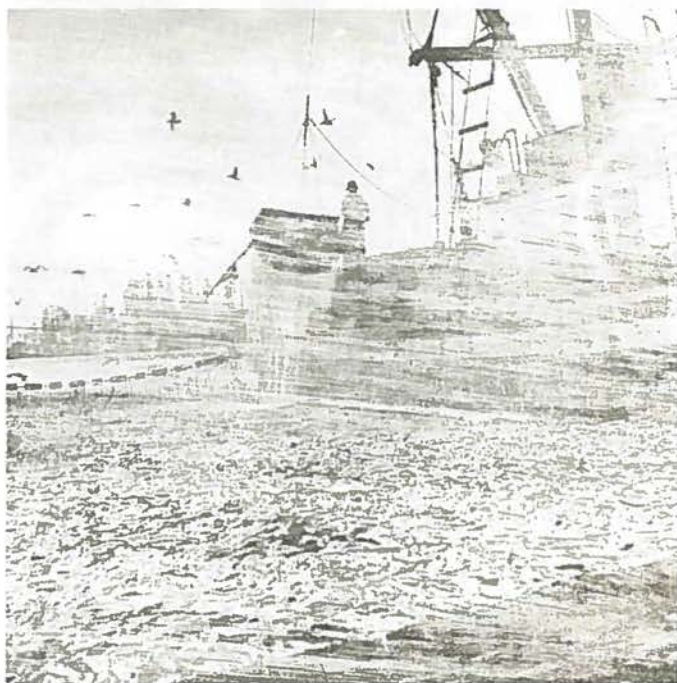
are off the west coast of Vancouver Island, some off the Queen Charlotte Islands, some in Hecate Strait, in Dixon Entrance. Others, farther away but commercially accessible to British Columbia vessels, lie off Alaska. All told these various areas yield more than 60 per cent of the world's annual halibut catch. British Columbia fishermen share this rich fishery with United States vessels and an international commission regulates operations so that the grounds are not overfished. Before the establishment of this commission under a treaty between Canada and the United States, the halibut stocks were becoming depleted as a result of uncontrolled exploitation.



Halibut fishing in Hecate Strait

Regulations of the commission have helped restore the stocks of halibut on the grounds to the point where large catches are again being made. Landings of halibut by British Columbia vessels increased sharply between 1956 and 1960, reaching a peak of nearly 35 million pounds in the latter year, with a marketed value of about 7.7 million dollars. However, about one-quarter of this total was landed direct at U. S. ports by Canadian fishermen, under the international agreement.

The trawl fishery for sole and grey and ling cod has been maintained at a fairly constant level over the past number of years and a small but efficient fleet of trawlers and draggers brings in steady supplies of soles and many other varieties of small flat fish. These species form the basis of a growing output of frozen fillets of fish.



Brailing herring

The tuna fishery, which at one time during the late part of the 1940's was a major fishery in the province, has practically disappeared as far as the troll operation off Canada's west coast is concerned, although there are indications that an off-shore seine fishery might develop. However, large quantities of imported tuna are canned in the off-season by canneries in British Columbia.

SHELLFISH

In recent years, shellfish have become of increasing importance to B.C. fishermen. Production figures show that during the period 1956-1960, the marketed value of crab and shrimp averaged 1.3



Shrimp fisherman

million dollars. Shrimp and crab are sold as shucked meat, either in the fresh or frozen state, or are canned. Most of the shrimp is taken by trawlers in the southern areas of British Columbia, while crabs are caught for the most part by traps.

Oyster production contributed between \$200,000 and \$400,000 annually to the B.C. fishing income, while clams have shown wide fluctuation in marketings, ranging in value from \$200,000 to \$600,000 each year.



Unloading salmon at Vancouver dock.

MEAL AND OIL PRODUCTION

The meal and industrial oil production in British Columbia has shown considerable variation from year to year as market prices have fluctuated and production has been affected by these returns. Until 1959 one company conducted a whaling operation off the west coast of Vancouver Island but with the declining prices of meal and oil this operation was discontinued in 1960 and 1961; it has been resumed in 1962.

FISHERIES FACT SHEET

Subject : Provincial Fisheries
MANITOBA

Importance of Fisheries

With the annual marketed value of its products ranging between five and seven million dollars, the commercial fishing industry of Manitoba does not rank high in the economy of the province. However, it gives employment to some 6,500 fishermen and probably as many more in subsidiary industries such as transportation, fish processing, fish marketing and fish box manufacture. Some 17 freighting vessels transport the catch to market and about 2,500 fishing boats and skiffs are used in the fishery. These craft represent an investment of some \$750,000. Some 100,000 gill-nets are used, valued at about \$2.0 million. All told the investment in equipment is about \$3.0 million.

Of the 100 million pounds of fish landed annually in the commercial freshwater fisheries of Canada, about two thirds of the total comes from Manitoba and Ontario. At one time about half Canada's freshwater catch came from Ontario with one-quarter from Manitoba. In recent years Manitoba has forged ahead and on a few occasions caught more than Ontario. In 1951, Manitoba's total catch was about 35.5 million pounds, while Ontario landed about 31 million pounds. In 1952, however, Manitoba's catch declined to 31 million pounds while Ontario fishermen landed about 38 million pounds. In 1954 there was a further decline in Manitoba to 28 million pounds and Ontario fishermen landed 48 million pounds.

Species

In the past 10 years the commercial fisheries of Manitoba have yielded an annual catch of about 30 million pounds. Lake Winnipeg, the seventh largest freshwater lake in North America, has provided almost half of Manitoba's annual catch. From Lake Winnipeg comes the famous Selkirk whitefish which are in great demand in the United States where they are smoked for the delicatessen trade. The Winnipeg goldeye, which made its first appearance from Lake Winnipeg catches, is Manitoba's most famous fish but landings have declined over the years and its contribution to the total is small. The greater part of the goldeye catch now comes from Lake Winnipegosis and the Saskatchewan River.

In poundage, the greater part of the catch is pickerel, followed by whitefish, saugers, pike and tullibee. Other species, in addition to gold-

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**Issued by the Information and Consumer Service,
Department of Fisheries of Canada**

Manitoba (Cont'd.)

eye, are bass (sheepshead), bullheads, carp, catfish, perch, suckers and lake trout.

The areas producing the catch include sixty or more lakes, some of which are quite small. The principal production is from Lake Winnipeg, Lake Manitoba, Lake Winnipegosis, South Indian Lake, Gods Lake, several small lakes in the district of The Pas, and the Manitoba portion of Reindeer Lake.

Processing of fish for market has expanded and the demand for Manitoba fillets increased. New plants have been constructed and existing ones remodelled and improved.

Winnipeg is the centre of the freshwater fishing industry in Western Canada and distributes, in addition to the Manitoba production, large quantities of fish produced in the neighbouring provinces.

Methods of Fishing

The summer fishing operation produces somewhat less than half the total catch. The gear in general use is the gillnet and the fishermen operate motor-driven boats, usually about 32 feet long, and skiffs usually about 20 feet long. The boats go out daily and return before nightfall. In the winter the gillnets are set through holes cut in the ice and the fishermen establish camps on the ice right at the fishing grounds and usually stay out a week at a time under semi-Eskimo conditions. Part of the catch is frozen and packed at the camp site and part is hauled in heated cabooses to the packing station to be packed as fresh fish. Tractors and snowmobiles haul it to railheads.

Fishery Regulations

Under federal legislation the Manitoba Department of Mines and Natural Resources administers the fishing regulations. The regulations provide for conservation measures in the fishing areas and the number and sizes of boats permitted. All fish dealers are required to be licensed under the Fish Dealers Act of Manitoba. Special attention is being paid to quality products by officers of the Department of Fisheries of Canada. The federal Department introduced a system of inspection of all export shipments of whitefish from Canada, which came into full operation on May 16, 1951. Federal officers are stationed at points in the province as well as in other provinces and examine shipments of whitefish destined for U.S.

Manitoba (Cont'd.)

markets. The Whitefish Export Inspection Regulations have been welcomed by the industry and now Departmental officers are being asked to inspect shipments of other fish such as pike, pickerel, lake trout and tullibee. The Manitoba department, like Saskatchewan and Alberta, makes whitefish surveys on commercially fished lakes to determine the quality of the fish for market purposes. The data is gathered by provincial conservation officers in the field and an analysis service is provided by the federal Department of Fisheries in Winnipeg.

The concern over the quality of whitefish originating in Manitoba and other inland provinces led to the establishment of a scientific research station in Winnipeg in 1944. This station is operated by the Fisheries Research Board of Canada, the scientific arm of the federal Department of Fisheries, and while the whitefish investigation is still one of its chief responsibilities, it has become concerned with all research problems of the area. One of the more important of these is a programme of studies to determine general principles regarding the best methods to manage lakes so that they will produce the maximum fish crop perpetually. Studies have been conducted on Lake Winnipeg, as well as on Great Slave Lake in the Northwest Territories, to collect data on catch per unit of effort and the size of fish caught. Efficiency of fishing gear is also tested.

FISHERIES FACT SHEET

Provincial Fisheries
NEW BRUNSWICK

Value of Fishery

Commercial fishing operations in New Brunswick are concentrated chiefly along the eastern coast-line and the shores of the southwest corner of the province. The catch of all fish including shellfish fluctuates from year to year but may be said to average about 225 million pounds annually. The marketed value usually amounts to between \$17 million and \$21 million yearly.

Sardines and lobsters are the most important species, from the point of view of monetary returns. Sardines contribute anywhere from \$4 to \$7 million to the annual production total while lobsters account from \$4.5 to \$6.5 million. Herring are third in importance, contributing about \$2.5 million; the cod fisheries account for more than \$1.5 million and the smelt fisheries for about \$300,000.

Virtually all the sardines taken on the Atlantic coast are caught in south-western New Brunswick. Here the largest sardine canning factory in the British Commonwealth is among those operated. The fish, young herring, arrive in great numbers off the New Brunswick shores along the Bay of Fundy every spring and some 65 million pounds are landed, taken by weirs and seines. About half of the catch is canned --- some 700,000 cases annually --- while some 30 to 35 million pounds are sold fresh.

The main sources of lobsters in New Brunswick are the waters along the north-eastern shores, including those of the Northumberland Strait. Lobsters are also taken around Grand Manan and other areas of the Bay of Fundy. About 10 million pounds of these crustaceans are taken annually, the bulk of which is marketed in the shell and as fresh chilled lobster meat. At one time the greater portion of the catch was canned but this situation is now reversed because of the high demand for the "live" product. About 14,000 cases of canned lobster are produced annually.

The Herring Fishery

The herring fishery which is conducted along the same lines as the sardine fishery utilizes the more mature herring which swarm into the coastal areas in the spring to spawn. Herring are marketed in many

forms, including fresh, frozen, kippered, vinegar-cured, pickled, smoked, salted and canned in the round and as kippered snacks, as well as being sold as bait and fertilizer. The scales also have a value, being used in the manufacture of pearl essence. On the average 65 million pounds of herring are caught annually.

Although smelts are caught by fishermen of all Atlantic provinces, by far the greater catch is in New Brunswick where the smelt fishery is at its height in the winter months when the fish come into the rivers from the sea and are caught in the tidal rivers, mainly in bag nets through ice-fishing. The smelt catch usually totals about 4 million pounds, and is marketed fresh or frozen.

New Brunswick also has the most important clam fishery of the Maritime Provinces, soft shelled clams being taken in great quantities and sold in the shell, shucked and canned to the tune of more than \$600,000 annually.

Groundfish such as cod, haddock, hake, cusk and pollock; flatfish such as halibut, flounders and Canadian plaice are taken both on the off-shore and inshore grounds. The off-shore fleet has been developed in the post war years as a result of subsidies made available by the federal government to encourage construction of small trawlers. As a result, the catching efficiency of the groundfish fishery has been considerably improved through the addition of a number of these draggers of approved design. The dragger fleet operates chiefly from the ports on the Caraquet Coast of New Brunswick.

Alewives

The catch of alewives in this province in 1952 was more than 30 million pounds with a market value of close to a million dollars. This fishery has greatly expanded in the last ten years due to a strong demand for pickled fish during the second world war and also because of a steadily increasing demand in the late years for the vinegar-cured product. In the past, St. John's Harbour was the outstanding production centre within the province. A greater demand for pickled and vinegar-cured products has greatly stimulated the alewife fishery in Kent and Northumberland rivers.

Salmon is a great resource of the province of New Brunswick waters. Salmon angling is extensively practiced especially in the Miramichi River where the angling catch exceeds 200,000 lbs. a year. The commercial catch is about 1 million pounds with a market value fluctuating from \$350,000 to \$450,000.

The oyster crop is abundant in the north-eastern area and averages about 6 million pounds yearly with a market value of nearly \$400,000.

Mackerel, shad, sturgeon, tom cod, bass and eels, bar clams, crabs, quahaugs, scallops and winkles, also are taken in the inshore sea fisheries. The inland freshwater fishery, which represents about one per cent of the total production value, produces a few million pounds of fish, the bulk of it being alewives. Other species like shad, salmon, pickerel, eels, are also caught in a small quantity.

Number Employed

Capital equipment in the primary fisheries is valued at about \$7,500,000. The total number employed is 15,000. Of this figure, the primary operations engage about 11,000 and the processing plants, 4,000.

Early in the 30's, co-operative associations were organized in New Brunswick and at that time an educational movement got under way among the farmers, fishermen and miners under auspices of the Extension Department of St. Francis Xavier University, Antigonish, N.S. Study groups were organized, followed by the establishment of local associations of fishermen to form credit unions, buying clubs and stores. The most important organization is the United Maritime Fishermen's Limited, a co-operative association of primary producer groups with 41 locals in New Brunswick.

N.B. Figures used are generally based on a five-year average (1948-1952)

FISHERIES FACT SHEET

Provincial Fisheries
NEWFOUNDLAND

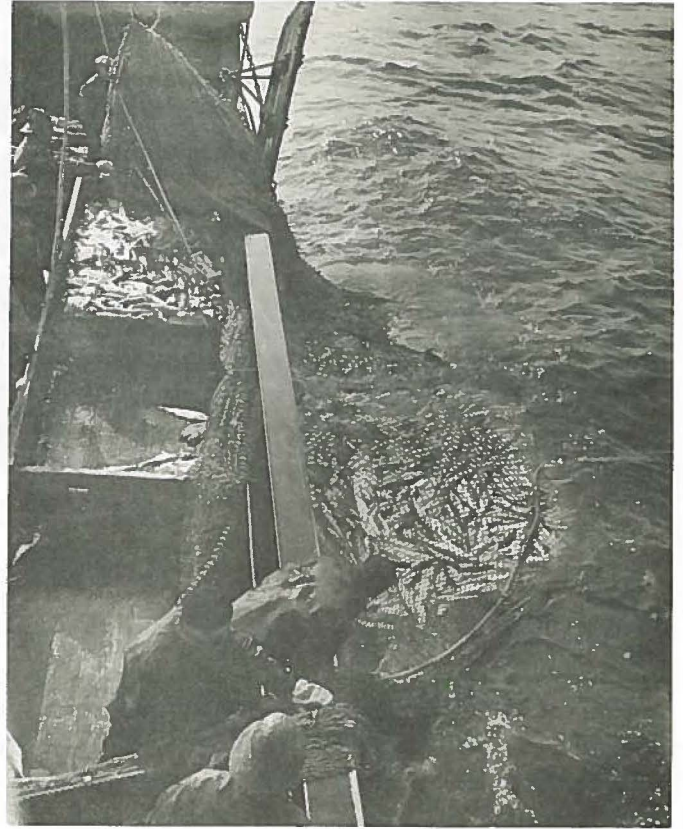
The extent to which the economy and the way of life in Newfoundland are influenced by the fisheries is clearly indicated by a quick look at a map of the island. Very noticeable is the fact that the interior of the province has relatively little habitation, and that only along the railway line. On the other hand, the coastal fringes are pinpointed with upwards of 1200 settlements, large and small, practically all of which came into existence because of their proximity to good fishing grounds and most of which, to this day, are dependent on the fisheries for their existence.

The fisheries, in turn, are dominated by one great species, the cod, as they have been since the earliest days of settlement. Of historical interest in this regard is the report of the elder Cabot on his return to England from his voyage of discovery to Newfoundland in 1497. He told of a sea so teeming with fish (the cod) that they could be dipped out of the sea with baskets. In later years Sir Francis Bacon described the fisheries resources of Newfoundland as being of greater value than the tin mines of Peru.

In describing the fisheries of Newfoundland, it might be useful to consider them by three geographical areas -- the east coast, the south coast and the west coast.

CODFISHERY IMPORTANT

Along the east coast, the codfishery overrides all others in volume as in value. So dominant is this fishery, in fact, that when a Newfoundland fisherman uses the



Trawler fishing on the Grand Bank of
Newfoundland.

word "fish" in the course of conversation he invariably means the cod, while, when referring to other species, he calls them by their specific names. Landings reach their peak during July and August when the cod are swarming into the bays and inlets to feed on the vast schools of small caplin which come into the beaches to spawn. The bulk of the catch is taken, as it has been for centuries past, in the close inshore waters, where the fishermen set out large traps into which the fish wander as they school along the coast. In



Hauling a codtrap in Newfoundland. Fishermen use dipnets to brail the trap into the boat.

other months, when conditions permit, fairly large catches are also made with handlines and line trawls. In bygone years a large fleet of schooners, exceeding 400 in some years, went north from Newfoundland to fish the cod along the Labrador coast but because of a decline in the demand for the salted fish produced from this operation, this fishery has fallen off considerably. Similarly there has been a great decline in the number of Newfoundland fishermen who fish from shore stations in the summertime along "the Labrador".

As against this decline a new form of fishing -- longlining -- has been introduced to the east coast largely through the efforts of the federal and provincial Fisheries Departments and the Fisheries Research Board of Canada. This method requires larger boats, to enable the fisherman to operate farther offshore than formerly; but it means that they can fish throughout a longer period and are not so dependent as were their forefathers on the summer migration of the cod.

Other species taken along the east coast include lobsters, Atlantic salmon,

mackerel, herring, seals and pothead whales as they are called by the local fishermen. The seals consisting of two species, the harps and the hoods, are taken during March and April after they have whelped on the arctic ice pushing down from the north. Part of this catch is made by sturdy motor vessels which penetrate the icefloes and search among the icebergs and growlers for the whelping patches. Quite a few are also taken by landsmen who show great daring and stamina in hunting among the icefloes when the ice is to the land.

HERDING WHALES

Pothead whaling is another colourful and exciting operation. The whales, properly known as blackfish or caa'aaing whales, travel in large herds and enter the bays to feed on squid commencing in July and lasting in some years until as late as November. The fishermen in their small motor boats surround a herd of whales and drive them towards a suitable beach where the potheads become befuddled and stranded in the shallows. It is almost an exact replica of a western cattle drive, with the possible exception that at the end of a pothead round-up the



Caplin, swarming ashore, are scooped up in dipnet.

animals are slaughtered as quickly as possible. The meat is used in making feed for fur-bearing animals while the fat is rendered into oil.

Along the south coast the cod is, once again, a very important species but here greater variety is added to the catch by the many other groundfish species which teem on the offshore fishing grounds. This is the area of the fabulously rich Grand Banks and others of lesser size and renown, but justly esteemed, such as the St. Pierre Bank and Green Bank. It isn't so long ago--up to the Second World War, in fact -- since cod was the only groundfish taken in this area as well as on the east coast. That was before quick-freezing came into prominence; however, as the frozen fish industry expanded, it not only became possible to utilize other species but it also became desirable in order to achieve diversification of production. Coincidental with this expansion, the salt fishing industry declined in importance and the banking schooner fleet went out of existence to be replaced by modern diesel-driven otter trawlers. These ships today



Purse-seining for herring in Bonne Bay, Newfoundland.

take tremendous catches of fish that were at one time discarded, such as haddock, redfish and various flatfishes, in addition to cod.

This deep-sea fishery on the south coast is supplemented by a large inshore fishery which is carried on, in one or more areas, throughout the entire year. Other species of lesser importance but very valuable as supplementary avenues of income are lobsters, herring and salmon. An interesting point here is that the south coast of Newfoundland -- an area in Fortune Bay -- was the scene of the first Danish seine fishery in Canada. This fishery came about as the result of exploratory work by the federal and provincial Fisheries Departments and the Fisheries Research Board, and although it has attained only modest proportions yet, it has been of value to a small fishing group.

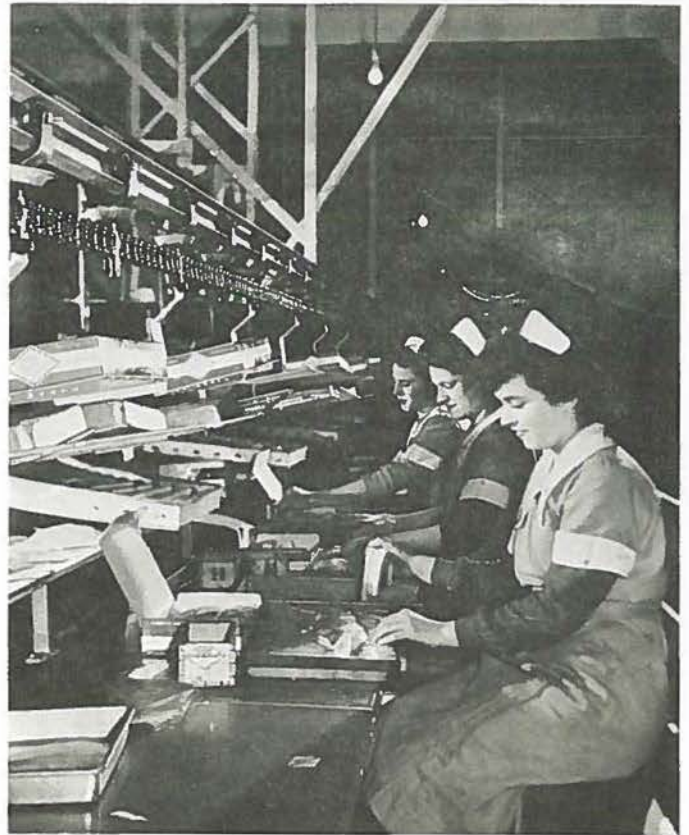
Along the west coast, the codfishery loses much of its importance and, in fact, the fishermen here are more likely to think in terms of lobsters. This is Newfoundland's best lobster fishing area, by



Squid jiggers busy on the fishing grounds, using time-honoured methods.

far, and even though the season is relatively short, lasting about $2\frac{1}{2}$ months, many fishermen make reasonably high earnings. Salmon and herring are also caught on the west coast as well as some cod and halibut, and the only scallop fishery in Newfoundland waters is also located in this area.

This has been a quick look at the more important species of fish caught by Newfoundlanders, and perhaps a word about the processing side of the industry would be in order. Here once again the cod is the most important species, but the traditional method of processing, by salting and drying the catch, has diminished considerably down through the years. This



Weighing and packaging fillets in a freezing plant.

has been occasioned by a shrinkage in the markets for this particular product brought about by world currency and trade problems and, to a not inconsiderable degree, by the growth of national fishing fleets from Europe. Offsetting this decline has been a very significant expansion of the quick freezing industry.

The years since Newfoundland became part of Canada (1949) have been a period of transition in the fisheries, of the evolution of more modern, mechanized fishing vessels and of similar advances in processing techniques. Much of the old still remains, especially in the more isolated areas, but modernization is steadily taking place.

FISHERIES FACT SHEET

Provincial Fisheries
NOVA SCOTIA

Value of Fishery

Nova Scotia has long held an important position in the history and development of Canada's fishing industry, having ready access to the rich fishing banks which stretch from Cape Cod to the Grand Bank of Newfoundland.

Landing more than 400 million pounds of fish annually, Nova Scotia leads the other mainland Maritime provinces in the volume of production and marketed value of fish products. The value of the production of the fisheries for Nova Scotia has increased steadily since 1939 and now stands at some \$45 million.

About 40% of the Nova Scotia catch is comprised of the famous codfish, great quantities of which are taken in the deep-sea fishery. This fish is marketed in as many as 20 different forms including products for industrial and medicinal use and contributes some \$13 million to the total fisheries production figure. Although traditionally cod has been marketed in the cured and salted form and has been very important in the development of Canada's foreign trade, recent years have seen an expansion in the production of fresh and frozen fillets. Haddock, another important groundfish taken in substantial quantities both by offshore and inshore fishermen, also plays a significant part in the fresh and frozen trade.

Lobsters rank second to cod in production value in the Nova Scotia industry and contribute some \$70 million yearly to the provincial income. More lobsters are taken by Nova Scotia fishermen than by any other Maritime province. Of the catch which annually totals more than 20 million pounds, a large portion is marketed alive in response to the great demand for this sea delicacy. At one time the greatest proportion of the catch was canned.

Other Species

In addition to cod and haddock, the deep-sea fisheries off Nova Scotia produce related groundfish species such as hake, cusk and pollock which are chiefly marketed as canned chicken haddie and as salted; the flatfish types such as halibut, winter flounder, Canadian plaice, yellowtail, witch, skates and others; ocean perch or rosefish.

(over)

Nova Scotia (cont'd.)

The inshore fishery of Nova Scotia is widely dispersed along the coast. With the exception of ocean perch, all species taken by the offshore fishermen are also taken on the inshore grounds. In addition, herring, mackerel, tuna, salmon, swordfish, oysters, clams and scallops are taken. The inland rivers and lakes yield salmon, alewives, shad, smelts, trout, bass, perch, and quahaugs.

Fishing activities are limited by weather conditions and regulations for closed seasons. The length of the deep-sea fishing is governed by climatic conditions, the nature of the runs and the customary lay-up of two weeks at Christmas and six or seven weeks in the summer when the vessels are overhauled. The coastal fisheries are carried on from April to November, or to January in sheltered districts. Some of the large vessels work all winter.

Capital equipment in the province's fishing industry is valued at approximately \$25,000,000, the vessels and boats accounting for 60 per cent and nets, traps and other gear, including premises, for 40 per cent. About 20,000 persons are employed in the fisheries. The primary operations engage some 15,000 men and the processing establishments 5,000. About one third of the men in the primary operations take seasonal or shore employment during the customary lay-off period but regard themselves as full-time fishermen. The larger proportion are engaged in fishing operations for not more than six months of the year and are part-time farmers.

Co-operative Associations

Early in the 30's, co-operative associations were organized in Nova Scotia and at that time an educational movement got under way among the farmers, fishermen and miners under auspices of the Extension Department of St. Francis Xavier University, Antigonish, N.S. Study groups were organized, followed by the establishment of local associations of fishermen to form credit unions, buying clubs and stores. The most important organization is the United Maritime Fishermen's Limited, a co-operative association of primary producer groups with 80 locals in Nova Scotia.

Much progress has been made in methods of catching, processing and the distribution of fish, compared to early days. At the turn of the century a fast-sailing schooner was developed in Nova Scotia for bank fishing. An outstanding vessel of this type was the famed "Blue-nose" of the Lunenburg fleet. Today this type of schooner is in most cases equipped with diesel or gasoline engines, and sails are only auxiliary. Many of the larger fishing vessels now have radio direction finders, ship-to-shore telephones, and echo depth sounders for locating fish.

Importance of Fisheries

The fisheries of Prince Edward Island occupy a secondary place in the economy of the island. Except in a limited number of communities the fishermen generally carry on their fishing operations on a part-time basis, farming being their major occupation. For example some fishermen migrate to Ship Wreck Point in Kings County to fish for lobsters in May and June. The houses in the village are for the most part temporary shacks. One farmer is reported to have migrated to Ship Wreck Point for the lobstering each season for the last 50 years.

The marketed value of all fishery products in Prince Edward Island is from \$3 million to \$4 million annually with the lobster fishery accounting for about \$2,000,000 of this figure. Cod are second in importance with hake, and smelts third and fourth. The catch of all fish including shellfish totals some 30 million pounds with a value to the fishermen of some \$2 million. Capital invested in the primary operations in catching and landing the fish amounts to about \$2 million while some 4,000 persons are employed in the fisheries, of which about 1,000 are engaged in the processing plants.

Landings of lobster total some 6,500,000 pounds, of which 2 million are marketed in the shell and 150,000 pounds are marketed as meat. The remainder is canned, producing some 21,000 cases. Prince County generally accounts for a large share of the landings, owing to the occurrence of both a summer and fall fishery within its boundaries.

In the other counties the May 1 to June 30 season only is allowed. As the open season for lobster lasts only two or three months in each zone, many turn to other fisheries in the off-season. The longest period of operations and the most diverse fishery probably is found in the eastern end of the island.

Cod and Hake

The joint fishery of cod and hake usually yields a catch of 12 million pounds with a landed value of nearly \$300,000. More than 50 per cent of the catch is usually taken in Kings County with fishermen operating in small boats, some of which are motor-driven. A large portion of this catch is canned as "chicken haddie" while a considerable amount is produced as wet salted fish. Very little dried fish is produced on the island and the marketing of cod in chilled, frozen or smoked forms is

(over)

Prince Edward Island (cont'd.)

negligible. Marketed value of the products from this fishery amounts to more than \$500,000.

Smelt fishing is a characteristic of the fall and winter fishing on the island. The catch, which usually amounts to more than a million pounds is marketed fresh and frozen. Value to the fishermen is about \$150,000.

Herring are fished, mainly for sale as bait. The catch annually totals some 6 million pounds. Some of the catch is marketed pickled, Scotch cured or otherwise and a few thousand cases of canned herring are produced.

Oyster Industry

Another important fishery in Prince Edward Island is the oyster industry. The bulk of the oyster production originates in Malpeque Bay and the total yield for the province amounts to some 15,000 barrels annually. Oysters are sold in the shell, canned and shucked and contribute some \$175,000 to the overall production figure. Oyster farming is encouraged by the federal Department of Fisheries and culture techniques have been developed at Ellerslie, P.E.I., where the Fisheries Research Board of Canada operates a sub-station for this particular research.

The mackerel fishery is also of importance, some 2 million pounds being landed annually by the inshore fishermen. Mackerel are marketed in the pickled and the canned forms while a sizable amount is also used for bait. Prince Edward Island is the main producer of Irish Moss in the Atlantic Provinces. Some 3 million pounds of this sea-weed are harvested annually, bringing about \$35,000 to the fishermen and adding \$75,000 to the provincial income. Haddock, halibut, flounders, alewives, tomcod, salmon, crabs, clams, quahaugs and scallops are also taken by the island's fishermen.

FISHERIES FACT SHEET

Provincial Fisheries
QUEBEC

Location of Operations

Quebec's commercial sea fishing operations are conducted in the Gaspé Peninsula, the Magdalen Islands and along the north shore of the Gulf of St. Lawrence. The Gaspé Peninsula is well known for its dried fish of the "Gaspé Cure" type. The last few years, however, have witnessed a considerable development in the preparation of fresh and frozen fish products in this district. Although the people of the Gaspé Coast depend to a large extent on forestry and farming for their living, the fisheries are also a basic industry there.

On the Magdalen Islands and the north shore of the St. Lawrence, the fisheries provide the main source of livelihood for the population. Smoked herring (bloaters) salted and pickled products are among the most important products of the Magdalen Islands while the north shore produces both pickled and salted fish.

In addition to the sea fishery, there is a small inland commercial fishery. The main fishing, that for eel, is done in the St. Lawrence, in the vicinity of Ile d'Orleans and also at St. Paul de l'Ile aux Noix, in the Richelieu. Lake St. Pierre supplies fairly considerable quantities of sturgeon.

Value of Fishery

Quebec lands about 100 million pounds of fish annually of which the sea fisheries account for 96 per cent. The catch brings about \$3 million to the fishermen and is marketed for about \$5 million. Cod has always accounted for more than 50 per cent of the landings, while mackerel, lobsters, herring, salmon and smelts are respectively important, each having a production value of more than \$200,000.

The number engaged in the industry totals between 9,000 and 10,000 persons, including about 1,500 in the fish processing plants. Capital equipment employed in landing the fish, including the vessels, boats, gear and premises, is valued at more than \$3 million.

The sea fishing operations are carried out both offshore and inshore. Offshore fishing is engaged in about 20 miles off the coast near Miscou Island in New Brunswick. The largest motor boats are of not more than 20 tons and generally carry four or five men. The boats return to their home port every twenty-four hours or at most every two days,

and operate mainly from ports from Cape Gaspe to Port Daniel. The inshore fishing is carried out in small motor boats of about 20 to 30 feet, carrying two or three men as a rule. The length of the fishing season depends on temperature and the condition of the water

It is cut short by autumn storms and limited by ice fringing on the Quebec sea coast. Fishing generally begins about April 15 and ends about October 1. Inshore fishermen operate during the summer only and may fish from May to October. Between seasons, fishermen are employed primarily in logging operations, many finding employment with forestry co-operatives which exist in some fishing districts. They also repair boats and gear, build new boats and lobster traps.

Landings of cod average between 50 and 75 million pounds annually and the distribution of the catch among finished products has been closely adjusted to market demand. During the war, production of frozen fillets reached unprecedented heights. From 1942 to 1946 it ranged from five to 12 million pounds annually. In recent years this product has fallen off sharply and the salted or dried products have regained first place.

Catch of Herring

The catch of herring ranges between 25 to 30 million pounds, with a marketed value of more than \$400,000. Large quantities, about 5 million pounds annually, are used for bait. The more important marketed products are bloaters and pickled herring. The catch of mackerel totals from five to nine million pounds with a marketed value of more than \$500,000. Pickled mackerel is the principal marketed product, while a few thousand cases of canned mackerel are packed.

Some two million pounds of lobsters are caught annually, having a marketed value of some \$700,000. Fifty per cent of the marketed value is accounted for by the live lobster and chilled lobster meat sales while the other 50 per cent is attributable to canned lobster and tomalley.

Landings of Atlantic salmon total about one million pounds annually with a marketed value of about \$300,000. The bulk of the catch is disposed of as fresh or frozen dressed. The smelt fishery yields about one million pounds with a marketed value of about \$200,000. Hair-seal skins and oil are produced by the seal fishery and contribute some \$200,000 to the total production figure. Fish liver oils and fish meal are important by-products.

Administration

In contrast with the other sea-coast provinces, the Quebec government administers its sea fisheries. The

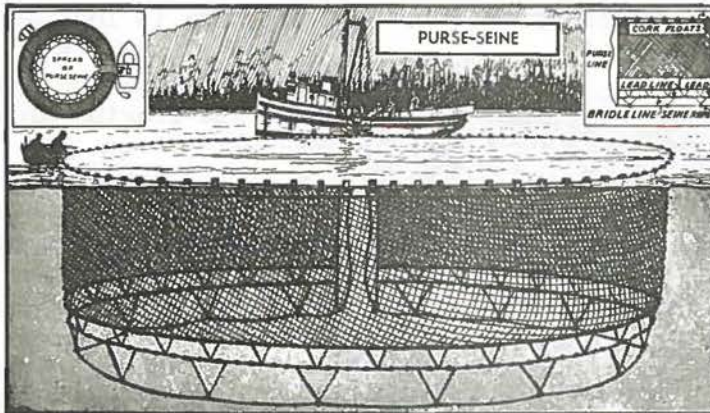
provincial authorities have fostered development through establishment of cold storages, artificial dryers, snow-houses and grading sheds. The snow-houses are built to keep snow for the preservation of fresh fish during the summer especially where communication and transportation are inadequate. Space in the grading sheds is available to fishermen for storage of their dried fish and both grading and packing are carried out in these premises.

The Quebec Department of Fisheries maintains and operates a technical school for fishermen in Grand River, Gaspe, which offers short instructional and training courses in the proper methods of fishing, processing and preserving fish. The Quebec authorities also grant financial aid to the Superior School of Fisheries, Sainte-Anne-de-la-Pocatiere, which operates in conjunction with the Quebec School of Agriculture and is affiliated with Laval University.

Occupational organizations exist among the processors and dealers. Examples are the Quebec and Northern New Brunswick Fish Producers and Exporters Association and the Montreal Fish Merchants Association. There are also the co-operatives such as the Quebec United Fishermen. The co-operative societies deal with the processing and sale of fish caught by their members. They handle about half the total catch taken in the province and also undertake the purchasing of motors for fishing boats and all fishing tackle for their members at favourable prices. There are 40 co-operative syndicates in the province.

PURSE-SEINING

Purse-seining, as the name implies, involves the use of a net which can be "pursed up" to trap a school of fish. It is particularly suitable for capturing migratory species such as salmon and herring, and is used extensively in British Columbia coastal waters.



Sketch of a purse-seine in position in the water (netting and ropes enlarged for clarity). The purse-line at the bottom is hauled in by the boat's engine until the net is closed from below — thus preventing the escape of the fish.

the bottom of the net. When the rope is tightened, the bottom is drawn together, forming a huge purse or bag.

Method of Operation

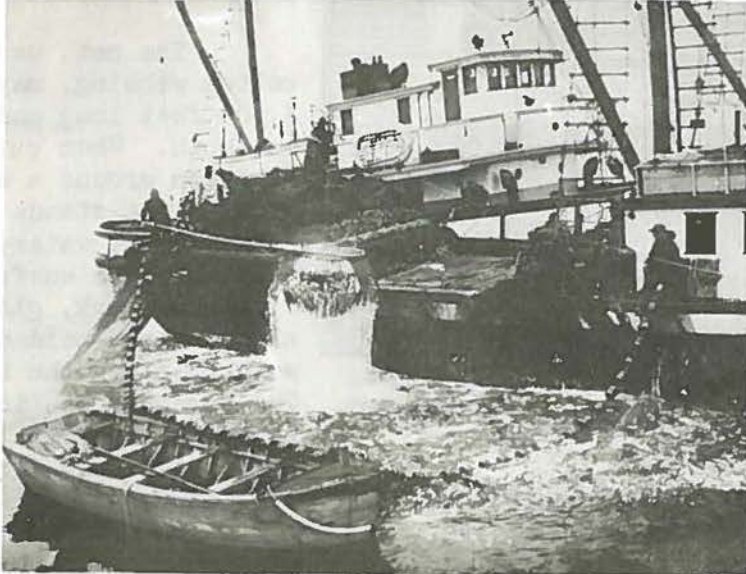
When the boat sets out in search of fish, the net is stowed on a turntable at the stern of the boat. A small skiff is also piled on top of the net or towed astern. The seine is carefully arranged so that the floats are on one side and the weighted end is on the other. This prevents the net from becoming twisted as it is put out from the boat. The platform is power-operated and is controlled by a clutch. After a school is located the row-boat is launched with one end of the seine attached to it. The man in the boat rows a short distance from the seiner until a few fathoms of net have entered the water.

The seiner then moves in a circular direction to surround the school and the net is paid out from the table by the crew. The men are assisted by a mechanically-operated roller on the end of the turntable which helps to get the net over the end with a minimum of time and effort.

When all of the net is in the water and has taken up its vertical position both ends are brought together. The purse line around the bottom is drawn in gradually by the boat's engines until the bottom of the net is closed. The fish inside are now unable to escape. The seine is then hauled aboard until the fish are massed in a small area in the water. A dip-net or "brailer" scoops the fish from the big net and, by means of a power winch, transfers them to the hold of the vessel.

Purse-seining (Cont'd.)

The bottom of the brailer opens by means of a drawstring to drop the fish into the hold. However, fish are sometimes loaded directly into a "packer" boat for transportation to a cannery. When the fish are taken aboard the seine-boat, valuable fishing time is lost during the run to the cannery and the return to the fishing grounds.



Brailing fish from seine to packer
boat alongside purse-seiner

A salmon purse-seine can capture thousands of fish at one "set". As many as 1,200 tons of herring have been taken in one operation. Purse-seiners are among the largest vessels engaged in British Columbia's fisheries. They are stoutly-built diesel-engined craft from 60 to 80 feet in length. They carry crews of from six to eight men. The larger type of seiner will

carry about 130 tons of fish in its hold and has an engine of 240 h.p. These vessels are well-equipped with the latest mechanical devices for fishing and navigating, such as ship to shore telephones, radio, echo-depth sounders and automatic pilots, and have comfortable accommodation for the crews. Quite often through the use of the depth-sounding equipment a school of fish is trapped without a fish being sighted until the net is brought in.

This efficient catching equipment means quick profits for the crew members who work on a share basis. Most of the boats and gear are owned by the packers and are leased to the fishermen, but some are owned by the fishermen themselves. The equipment represents a considerable investment. A fully-equipped boat costs approximately \$90,000. A salmon net comes to between \$5,000 and \$7,000 while a herring net may cost up to \$15,000.

Fish predators, such as harbour seals and sharks, are often trapped in the nets along with the fish and cause extensive damage. Even one tear can mean the loss of hundreds of dollars worth of fish in addition to the cost of repairs. Much time, therefore, is spent between seasons strengthening and repairing the seines. Preservatives such as tar or tan bark are used to coat the webbing as a protection against corrosion and the attacks of marine organisms.

REDFISH

By E.J. Sandeman Fisheries Research Board of Canada

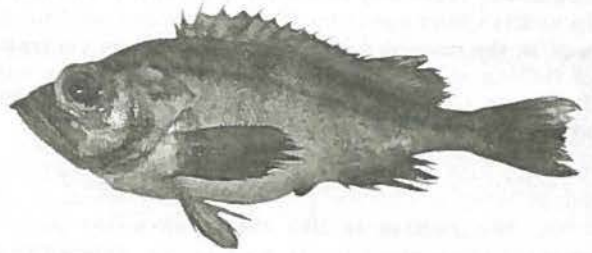
THE redfish, (Sebastes marinus), is also called the Ocean Perch or Rosefish.

Redfish are usually found in deep water and, although they are occasionally taken in shallow water, most of the catch comes from waters 80-250 fathoms in depth. At suitable depths and temperatures redfish are common in the Barents Sea to Spitzbergen, along the Norwegian coast, the Faroes, Iceland, Southern Greenland, and along the eastern seaboard of the North American continent from Labrador to the Gulf of Maine. Individual captures have been reported from the northeast off West Spitzbergen at Lat. $80^{\circ}06'N$ and Long. $11^{\circ}17'W$ and off West Greenland in Lat. $71^{\circ}N$. On the eastern seaboard of North America individual captures are recorded off Cape Dyer in Baffin Island to the North and at Lat. $37^{\circ}38'N$ and Long. $74^{\circ}15'W$ to the south.

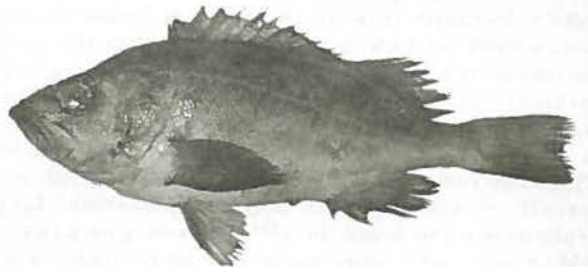
In Europe two forms of redfish (apart from a relatively insignificant inshore coastal species) are generally recognized. The one form (Sebastes marinus marinus) which, until recently, made up the bulk of European landings, lives in the shallower parts of the deep water, grows to a greater size and may be distinguished from its relative (Sebastes marinus mentella) by its usual more orange or yellowish red colour, and its relatively smaller eye and the shape of the bony protrusion on the lower jaw which is usually blunt and weakly developed. The other form (Sebastes marinus mentella), which prefers deeper water, is usually bright red in colour, has a relatively larger eye, and, particularly in large specimens, has a long and pointed bony protrusion on the lower jaw.

In the Western North Atlantic the common redfish resembles the Sebastes marinus mentella of Europe, and these mentella-type fish make up practically the whole of the landings in North American ports. These fish are found in commercial quantities from Southern Labrador to the Gulf of Maine including Flemish Cap and the Gulf of St. Lawrence.

Redfish had little commercial value in Canada and the United States before 1935. Taken incidentally by trawlers while fishing for cod and haddock they were usually returned to the sea except when, through scarcity of other fish, small amounts could be sold. However, the fish were not well known to the consumer. In 1935 technological advances in



Mentella-type redfish.



Marinus-type redfish.

handling fish, particularly filleting, quick freezing and the perfection of an automatic scaling machine; stimulating filleting trials in the United States. The fillets, packaged in cellophane and quick frozen, were shipped to mid-western United States where the attractive new product, offered as "Ocean Perch", was quickly accepted. Its mild flavour, similar to freshwater species, and its relatively low price made it increasingly popular. At the same time, conversion from line trawl with baited hooks to the more efficient fishing method, otter trawling, where an open-mouthed bag is towed over the ocean floor, and the subsequent increased use of the latter, made the catching of great quantities of such small-mouth fish as redfish a possibility. At first the growing trawler fleet concentrated on haddock but was soon forced to become interested in other kinds of fish. With redfish available in abundance and a growing demand for the frozen fillets, landings of redfish increased rapidly.

The total landings of redfish from the whole N.W. Atlantic area for the years 1934-1963 are shown in the table below. This table illustrates how

between the years 1935 and about 1948 a fairly gradual rise in landings occurred. This can be attributed largely to the expansion of the redfish fishery by the U.S. and Canadian fleets and the consequent exploitation of new grounds mainly along the Nova Scotian seaboard. The increase in landings shown between about 1948 and 1956 can be attributed largely to the general expansion of the area of exploitation to include the Grand Banks and Gulf of St. Lawrence. The almost explosive rise in landings which occurred about 1956, and which for the year 1959 resulted in redfish landings from the area second only to cod, was in the main due to the tremendous concentration of fishing effort exerted on the species by some European countries notably U.S.S.R., which in 1959 accounted for about 48% of the total landings.

DESCRIPTION

The redfish is like the fresh-water perch in general appearance but is actually related to the salt-water sculpins by the fact that the cheek has a characteristic bony appearance. Furthermore, the cheeks are spiny. The top of the head is concave while the mouth is large and opens to below the large black eyes which contrast vividly with the orange to flame-red colour of the body. The lower jaw projects and has a bony knob at its tip fitting into a corresponding notch on the upper. The back fin has a spiny and soft portion combined into a single long fin. The common redfish of the N.W. Atlantic occur usually to about 17½" in length. Occasional larger specimens are found to 20" or even greater but these very large specimens are more likely specimens of the much rarer (in the N.W. Atlantic) marinus-type of redfish. Fish less than about 8 inches are usually considered too small for commercial use. Fish from the coastal areas in addition to being generally smaller than those from offshore and deeper waters, are very often much darker in colour and, when taken in shallow water adjacent to the coast, may even appear to be chocolate-coloured or black.

HABITS AND MOVEMENTS

Relatively cold water is preferred by redfish although they cannot be regarded as arctic fish. Over most of the N.W. Atlantic area the temperatures at the depths where redfish are likely to occur in commercial quantities are usually between 37°F and 43°F over most of the year. When redfish are found in arctic areas they are usually in the deeper waters where the temperatures are more often than not 35°F or higher.

Very little is known of the movements of the common redfish on the western side of the Atlantic. Indirect evidence, including differences in size composition in different areas, and data on the numbers of vertebrae possessed by the fish as well as data on the numbers of fish having parasites, supports the belief that the redfish remain rather localized in particular areas and do not undertake

extensive migrations as do many other fish. Their abundance or lack of abundance at certain seasons of the year suggests that some seasonal offshore and inshore movement may be undertaken. Restricted vertical diurnal movements appear to be usual and this has resulted in the normal commercial practice of fishing for redfish only during the daylight hours when the fish are concentrated at the bottom.

In spite of the fact that redfish are usually at or very near the bottom during a great part of the day, examination of the food in redfish stomachs has shown that they are pelagic feeders and do not normally feed on bottom-living organisms.

REPRODUCTION AND GROWTH

The redfish, unlike our other common commercial fishes, bears live young, the eggs being fertilized, developed and hatched within the female. The young are retained within the female until most of the yolk of the egg is used up and they have reached one-quarter inch in length. The female redfish produces between 25,000 and 40,000 young each year. This is a very small brood compared to many of the marine egg-laying fishes (the cod lays 3,000,000 to 9,000,000 eggs). However, the protection offered by being inside the mother's body during early life gives the young a greater chance for survival.

Scientists have found that redfish grow very slowly. An increase of about one inch a year is normal during the early years, the rate decreasing with age. They found that the fish first breed and bear young at about 10 years of age. It has been estimated that many of the fish included in the catch are more than 20 years of age.

Because such slow growth and late maturity cannot keep pace with the removal of the adult stocks by the fishery, the catch in the Gulf of Maine is falling off rapidly.

The general pattern of the redfish fishery through the years has been largely based on an expansion of the area fished and the continued exploitation of new grounds where, because of the accumulated stock of old fish, the catches are very large. As these areas of virgin stocks become fewer and the accumulations of old fish are reduced the catches per unit of effort will decline. This has happened in several of the redfish areas in the Western North Atlantic notably in the Gulf of Maine and Gulf of St. Lawrence. The fishery in these areas must now depend on the balance between the supply of new fish by recruitment and growth and the rate of removal of adult fish by the fishery.

The time of year at which the female fish extrudes its larvae varies according to the area and depth at which they are living but in general in the

Newfoundland area spawning takes place in the spring and early summer (March to July). In the Gulf of Maine the time of extrusion of the larvae may be later and larval redfish may be born from about April to September. The larvae live near the surface for a time and gradually descend in the water as they grow.

Female redfish carrying young may be caught over all the fishing areas and no evidence exists of any special spawning grounds.

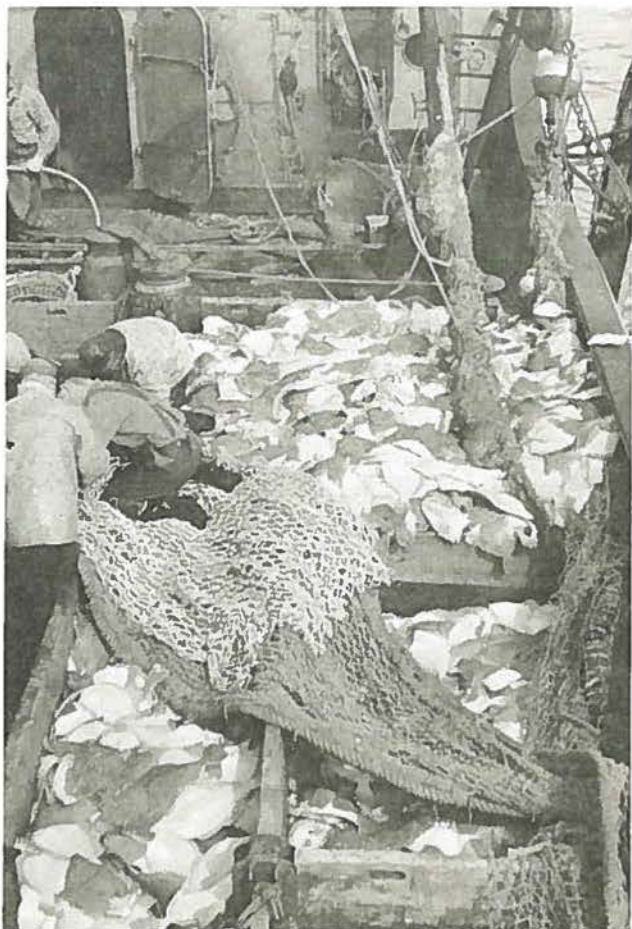
FISHING AND MARKETING

Otter trawls are responsible for the greater part of the catch. Although redfish can be caught on line trawl, only a few thousand pounds are taken each year in shallower waters near shore.

Landings (in millions of lbs.) of redfish from the North West Atlantic Area 1934-1963.

<u>Year</u>	<u>Landings</u>	<u>Year</u>	<u>Landings</u>
1934	2	1949	256
1935	17	1950	236
1936	67	1951	298
1937	58	1952	226
1938	66	1953	231
1939	78	1954	265
1940	85	1955	272
1941	155	1956	240
1942	128	1957	351
1943	115	1958	717
1944	120	1959	719
1945	132	1960	604
1946	179	1961	498
1947	151	1962	412
1948	250	1963	419

Practically all of the catch is used in the production of fillets. In 1946 only 1½ per cent of these fillets were marketed fresh, the balance being frozen. Waste from filleting is used in the production of meal and oil which has a high vitamin content.



Most of the commercial catch of redfish is taken by otter trawls. Picture shows a damaged trawl being repaired.

References:-

Templeman, W. (1959), Redfish distribution in the North Atlantic. Fisheries Research Board of Canada, Bulletin No. 120, pp. 1-173. Price \$1.75.

Rockfish of British Columbia

THERE are approximately twenty-nine species of fish in British Columbia waters belonging to the genus *Sebastes* which collectively are called "rockfish". The fishermen give them a variety of common names, some of which are rock-cod, snappers, canaries, black bass, rock salmon, and Pacific Ocean perch. Their nearest relative in the Atlantic is the redbfish. The rockfish species of the Pacific coast appear to be very abundant off the British Columbia coast.

DESCRIPTION

The rockfish as a group are distinguished by their stout, heavily constructed bodies. Large broad heads, usually bearing spines and strong ridges, and heavily-spined fins are notable features. The colour patterns vary greatly among species and range from black and drab green through to brilliant orange and crimson. The colour of some species is made even more bizarre by the presence of wide red or black stripes.

HABITS

As a rule the rockfishes are found in the vicinity of reefs and rough bottom. A few species, such as the copper rockfish and the orange-spotted rockfish occur among the kelp patches in shallow water from the intertidal zone to depths of twenty fathoms. These two species are usually termed "rock-cod" by the fishermen. Other more brightly coloured species, usually termed "red-cod", such as the red snapper, orange rockfish, and "Spanish flag" occur at depths from thirty to over one hundred fathoms. The majority of the species are inhabitants of deep water off the open coast.

All of the species bear their young alive in prodigious numbers. These young fish are not much more than a quarter of an inch in length when born. During the summer months large schools of fingerling rockfish are encountered in the inlets and bays bordering the open coast. These small fish must also be very abundant in offshore waters for they are frequently found in the stomachs of the albacore tuna.



Pacific Rockfish

The food of the rockfishes consists of herring, sand lance and other small fish, crabs, shrimps and euphausiids.

AGE AND GROWTH

The study of the annulations on scales has revealed that the rockfishes as a group are much slower growing than other groundfish species. It would appear that most of the species do not reach commercial size until they are eight to ten years of age. Some specimens as old as twenty five years have been recorded.

FISHING METHODS

High-opening trawls of light web have proved to be the most effective means of capturing rockfish, since these fish do not congregate so close to the bottom as other groundfish species. Small quantities are caught incidentally in the hand-line fishery for lingcod and the long-line fishery for halibut and blackcod.

HANDLING

Rockfish caught by trawlers are landed in the round while those caught by line vessels are landed dressed with heads off. Most of the catch is filleted and packaged for freezing. A limited amount goes to the fresh fish market and to the "Fish and Chips" trade.

August, 1966

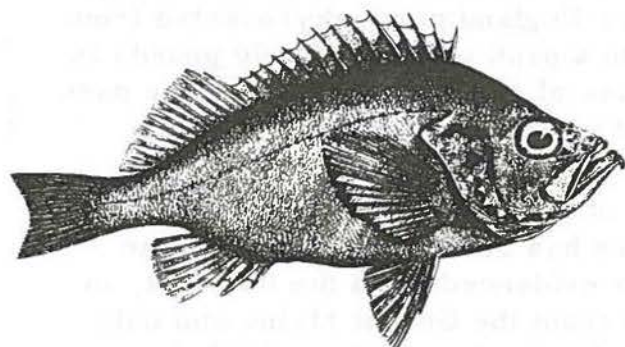
FISHERIES FACT SHEET

ROSEFISH

Distribution and Importance

The Rosefish, Sebastes marinus, more often referred to along the Eastern Canadian coast by another common name, Redfish, is also called the Ocean Perch, Red Perch, Red Bream or Norway Haddock.

The rosefish is usually found in deep water and, although it is occasionally taken in shallow water, most of the catch comes from waters 80 to 110 fathoms in depth. Off the North American coast the rosefish occurs as far south as New Jersey, but is most abundant



Rosefish

in the Gulf of Maine and off Nova Scotia. Exploratory fishing carried out by the Fisheries Research Board of Canada from the Grand Banks of Newfoundland to the northern extremity of Labrador indicates further and yet untapped stocks of rosefish in depths increasing to the northward. The rosefish is found in deep waters around Greenland, Iceland and Spitzbergen. It is found also in European waters where, as the commercial Red Fish

or Norway Haddock, it is a much larger variety than the Western Atlantic rosefish, growing to a length of three feet. A Danish scientist has found that in the North Atlantic, young rosefish of the European variety can be found in 100 to 270 fathoms distributed over immense stretches of the ocean and in quantities which would indicate that the rosefish is present in the ocean in far greater quantities than hitherto known.

The rosefish had little commercial value in Canada and the United States before 1935. Taken incidentally by trawlers while fishing for cod and haddock they were usually returned to the sea except when, through scarcity of other fish, small amounts could be sold. However, the fish were not well known to the consumer. In 1935 technological advances in handling fish, particularly filleting,

quick freezing and the perfection of an automatic scaling machine, stimulated filleting trials in the United States. The fillets, packaged in cellophane and quick frozen, were shipped to mid-western United States where the attractive new product offered as "Ocean Perch" was quickly accepted. Its mild flavour, similar to freshwater species, and its relatively low price made it increasingly popular. At the same time, conversion from line trawl with baited hooks to the more efficient fishing method, otter trawling, where an open-mouthed bag is towed over the ocean floor, and the subsequent increased use of the latter, made the catching of great quantities of such small-mouth fish as rosefish a possibility. At first the growing trawler fleet concentrated on haddock but was soon forced to become interested in other kinds of fish. With rosefish available in abundance, and a growing demand for the frozen fillets, landings by American trawlers based at New England ports skyrocketed from around 7,000,000 pounds in 1935 to a peak of 238,000,000 pounds in 1948. Landings have exceeded those of cod and haddock for the past several years surpassing cod first in 1940 and haddock in 1942.

The increased exploitation of the rosefish stocks on Nova Scotian banks by American trawlers has been responsible for the increased New England landings as evidenced from the fact that, in 1941, 85 per cent of the catch was from the Gulf of Maine and only 15 per cent was from the Nova Scotian Banks, while in 1948 the situation was reversed with 25 per cent coming from the Gulf of Maine and 75 per cent from the Nova Scotian Banks.

In spite of the proximity of the best-known fishing grounds for rosefish, landings by Canadian (other than Newfoundland) trawlers have been very small, but have increased from 25,000 pounds in 1945 to 1,300,000 pounds in 1948. Failure to increase more rapidly is due in part to the lack of Canadian facilities for converting the high percentage of wastage from the filleting operation into high-vitamin-content oil and meal. Landings by Newfoundland draggers and trawlers have been high with as much as 7,000,000 pounds being taken out of Hermitage Bay on the south coast by a fleet of small draggers between August, 1947, and the end of 1948.

Description

The rosefish is like the fresh-water perch in general appearance but is actually related to the salt-water sculpins by the

fact that the cheek has a characteristic bony appearance. Furthermore, the cheeks are spiny. The top of the head is concave while the mouth is large and opens to below the large black eyes which contrast vividly with the orange to flame-red colour of the body. The lower jaw projects and has a bony knob at its tip fitting into a corresponding notch on the upper. The back fin has a spiny and soft portion combined into a single long fin. The rosefish of Canadian and New England waters are up to $17\frac{1}{2}$ inches in length, the average being about 13 inches. Those less than eight inches are considered too small for commercial use. Fish from the coastal areas are generally much smaller than those from the offshore and deeper waters. One of the largest rosefish recorded in recent years was 22 inches long and weighed 5 pounds, 11 ounces.

Habits and Movements

Relatively cold water is preferred by the rosefish although it is not truly an Arctic fish. In North American waters the temperature preference of the rosefish appears to range from 35 to 50° Fahrenheit in winter and summer. Even when it is found in Arctic areas it is in deeper waters that are 35° Fahrenheit or warmer. Not much is known of the movements of rosefish other than seasonal offshore and onshore migrations within the range of their temperature preference.

Otter trawling has shown that the fish are on bottom in the daytime and rise from it at night. Fishing is therefore carried on only during daylight hours. The development of practical trawling in mid-water might be expected to increase the catch.

Differences in size composition of rosefish from different areas and variations in the numbers of fish with parasites argue against rapid and extensive migrations and mixing of rosefish populations.

Reproduction and Growth

The rosefish, unlike our other common commercial fishes, bears live young, the eggs being fertilized, developed and hatched within the female. The young are retained within the female until most of the yolk of the egg is used up and they have reached one-quarter inch in length. The female rosefish produces between 25,000 and 40,000 young each year. This is a very small brood compared to many of the marine egg-laying fishes (the cod lays 3,000,000 to 9,000,000 eggs). However, the protection offered by

being inside the mother's body during early life gives the young a greater chance for survival.

American scientists have found that rosefish grow very slowly. An increase of about one inch a year is normal during the early years, the rate decreasing with age. They found that the fish first breed and bear young at about 10 years of age. It has been estimated that many of the fish included in the catch are more than 20 years of age. Because such slow growth and late maturity cannot keep pace with the removal of the adult stocks by the fishery, the catch in the Gulf of Maine is falling off rapidly.

The rosefish spawns during late spring and most of the summer after the water reaches 39 to 40° Fahrenheit. The time at which the eggs are fertilized is unknown, but well-developed eggs are found in the females in mid-May in the Gulf of Maine. The fully developed young leave the body of the female during July and August and live near the surface, drifting with the current until they are nearly an inch in length. Then they go to the bottom in deep water to remain there for the greater portion of their lives.

Female rosefish carrying young are caught over all fishing areas and young rosefish are taken in quantity almost everywhere in the Gulf of Maine. There is apparently no special spawning ground for the rosefish.

Fishing and Marketing

Otter trawls are responsible for the greater part of the catch. Although rosefish can be caught on line trawl, only a few thousand pounds are taken each year in shallower waters near shore.

Practically all of the catch is used in the production of fillets. In 1946 only 1½ per cent of these fillets were marketed fresh, the balance being frozen. Waste from filleting is used in the production of meal and oil which has a high vitamin content.

The rapid rise in importance of the rosefish is a tribute to two modern developments in catching and processing fish, the otter trawl and quick freezing. With the bulk of the known Western Atlantic rosefish stocks off her shores and new stocks still being discovered, Canada is in a particularly advantageous position geographically to exploit yet another of her vast fish resources.