Fisheries Fact Sheets

Issued by Information Services,
Department of Fisheries, Ottawa

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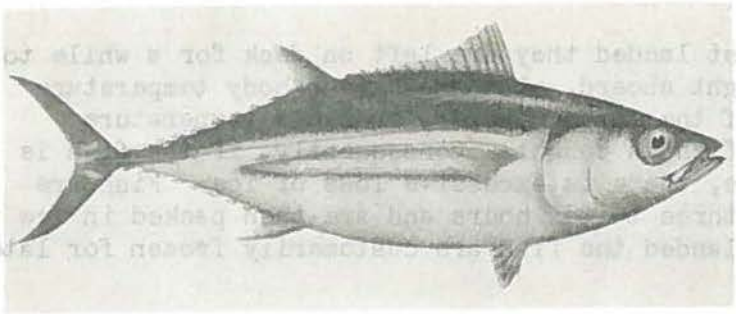
FISHERIES FACT SHEETS

Subject: ALBACORE

The albacore is one of the most highly prized of British Columbia's commercial fishes. Like the other tunas, it is very streamlined, with a round cross section, conical head, and very slender caudal peduncle. The fins are even recessed, that is, they can be retracted into depressions of the body to keep them out of the slipstream when the fish is swimming rapidly. Albacore are readily distinguished from the other tuna-like fish by the long sabre-like pectoral fin, for which they are sometimes called the long-finned tuna. The upper part of the body is a steely blue, and the sides and under surface are silvery with an iridescent sheen.



Albacore
(Thunnus Alalunga)

The albacore taken by the Canadian fishing fleet are, for the most part, between ten and twenty pounds. Small fish (below 5 pounds) are very rarely encountered and the largest are close to 40 pounds. Much larger albacore occur in other parts of the world.

Albacore are found in all warm and temperate seas but are rare in the north-east Atlantic. The extent to which the different populations mix is not known.

The stomach contents of albacore taken by the British Columbia fishery consist principally of saury, rockfish, and squid. In some seasons anchovy, herring, pilchards, and lantern fish are important food items, and frequently the shrimp-like red feed is prominent in the diet.

The Canadian albacore fishery started in 1939 with a landing of 284,000 pounds but it failed to develop during the war years. Since 1944 it has grown rapidly, coming into prominence rather suddenly in 1948 with a catch of 2,174,700 pounds.

The Canadian fishery is carried out by trolling boats working up to a hundred and fifty miles offshore between the Queen Charlotte Islands and California. The fishing is done from salmon trolling vessels or converted vessels of other types. Trolling lures are made of wood, bone, plastic, or feathers, and are trailed within a few feet of the surface. Boats troll at about six knots. Double, barbless hooks are used as the fishing is very fast when fish are striking and the fishermen believe that they lose fewer fish from the barbless hooks than they would as a result of time-loss in removing fish held more securely. Each boat trolls six to nine lines which are tended by two or more fishermen.

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When the fish are first landed they are left on deck for a while to "cool off". When first brought aboard, albacore have a body temperature several degrees above that of the surface water, and this temperature rises for a while after the fish is caught. Consequently, if the fish is iced down in the hold at once, there is excessive loss of ice. Fish are cooled off in the course of three to ten hours and are then packed in ice in the hold of the boat. When landed the fish are customarily frozen for later processing.

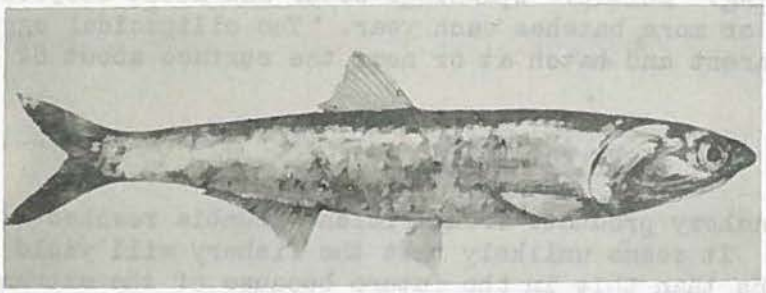
For canning, albacore are removed from cold storage and allowed to thaw before they are dressed and washed. The fish are then graded according to size on trays, and pre-cooked in steam-heated retorts. The cooked fish are then skinned and boned, the dark meat is removed, and the white meat sliced for canning. The cans for the premium grades are filled with solid pieces of white meat, with vegetable oil and salt added. The cans are then exhausted, sealed, cooked, cooled, and labelled in the usual manner. A substantial part of the Canadian catch is exported frozen for processing in the United States.

FISHERIES FACT SHEETS

Subject: ANCHOVY

Distribution and Importance

The Pacific anchovy, Engraulis mordax, occurs from British Columbia to southern Lower California. Along the coast of southern British Columbia it is found in limited numbers in most of the bays and inlets as far north as Ogden Channel. Off the coast of California it occurs in great abundance along the coast and an unknown distance to sea. It is a pelagic fish, typically moving in schools, and feeding largely on plankton.



Northern Anchovy

The anchovy belongs to the same family as the herring and pilchard but differs from its two familiar relatives in having a very large mouth which extends almost to the gill cover, and a characteristic snout which protrudes beyond the lower jaw. A pair of large eyes are situated near the tip of the snout. The body is elongate, slender and somewhat spindle-shaped with a metallic blue colour on the dorsal surface and a silvery colour on the ventral surface.

Anchovy are fished during the spring and summer months throughout most of the coastal waters of British Columbia, using small purse-seine nets. Since the beginning of the fishery in 1939 much of the catch has been reduced to meal and oil. Reduction of anchovy is, however, not considered to be profitable because of the low oil content. In recent years the majority of the catch has been canned to give an attractive product which may be favourably compared with the best canned sardines. The fish which are to be used for canning are carefully packed in 400 pound iced fish boxes for transportation to the canneries. In California, where the same species occurs in great quantities, the fish are used mainly for bait. A small part of the catch is canned, made into pastes, pickled in brine or sold in the fresh fish markets.

Most of the fish caught are two or three years of age, but some may reach an age of seven years. During the first year growth is fast and the young anchovy reach a length of 4½ to five inches. In the second year they grow to about six inches. Very few anchovy are found larger than seven inches or older than four years of age.

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Growth is fast during the spring and summer months but slow during the winter months. The incoming year class does not enter the adult schools until the end of its first year.

Origin

Anchovy spawn in British Columbia during late June, July and August at the heads of bays and inlets and also many miles out to sea. Young anchovy have been found in the stomachs of tuna fish caught up to 200 miles offshore. Maturation of the sexual products begins in February and March. By June, the females have matured three batches of eggs preparatory to spawning. Multiple spawnings occur and about 150,000 eggs are spawned in three or more batches each year. The ellipsoidal eggs are colourless or transparent and hatch at or near the surface about 62 hours after spawning.

Market Value

Marketed anchovy products from British Columbia reached a value of $600,000 in 1946. It seems unlikely that the fishery will yield much greater annual returns than this in the future because of the extreme fluctuations in abundance from year to year. It is possible, however, that extensive populations may occur offshore as they do off the coast of California and Oregon. Populations of the Pacific anchovy throughout the entire range of distribution from Lower California to British Columbia represent an almost virgin stock, although they are abundant enough to be of great potential commercial importance. It is believed that of the few remaining latent fisheries of the Pacific coast, the anchovy is capable of yielding the greatest returns.

Pacific Biological Station,
Fisheries Research Board of Canada,
Nanaimo, B.C.

FISHERIES FACT SHEETS

Subject: ATLANTIC SALMON

Distribution and Importance

The Atlantic salmon with the scientific name Salmo salar is a member of the same family as the Pacific salmons, the trouts and the chars. It has been perhaps the best and most widely known of all game fishes for over 18 centuries. Consequently it has been simply referred to as "the salmon". It inhabits the North Atlantic, ranging from Hudson Bay, Iceland and northern Europe to Cape Cod and the Bay of Biscay. There are many salmon rivers in Quebec, New Brunswick, Nova Scotia and Newfoundland. It is one of the most desirable of game fishes and as such is responsible indirectly for great revenues to the countries where it occurs. There is also a valuable commercial fishery in the sea and river estuaries.

Atlantic Salmon
(Salmo salar)

Description

Like other members of the salmon family, it is characterized by its moderately stout body, small scales, prominent fleshy fin on the back just in front of the tail, and the bright steely blue to green above and silvery colours below. Although similar to the trouts, chars and Pacific salmons in these general respects, it does differ sufficiently to be separated readily from them. It resembles closely the steelhead or rainbow trout of the Pacific Coast but is more distinct from the Pacific salmons which spawn only once and die immediately in the rivers. The Atlantic salmon may spawn several times in the rivers, migrating out to sea each time after depositing its eggs or milt.

Habits and Movements

Normally the Atlantic salmon lives the greater part of its life and makes most of its growth in the sea but spawns in October and early November on the gravel beds in shallow river tributaries. The fish on entering fresh water is silvery with red flesh full of fat and is highly prized by anglers. The fish does not feed in the rivers and the sexual glands develop at the expense of other tissues so that the colour becomes dull. In the sexually mature male the front teeth are enlarged, both jaws are prolonged, and the lower jaw is hooked upwards. In Quebec and the Maritime Provinces salmon have become established and spend their entire life in certain freshwater lakes where they are called "landlocked" or "sebago" salmon.

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Reproduction

The female scoops out a trough in the gravel and deposits her eggs there where they are fertilized by the male. The female then covers the eggs with gravel to a depth of about a foot by strokes of her tail. The eggs are about one-quarter of an inch in diameter and in the nest or "redd" develop so slowly in the low temperature of winter that hatching does not take place until late in the following April or early in May.

Growth

The fry or "alevins" have a large yolk-sac which provides their nourishment for a month or two during which they live in the gravel. The young fish, a little more than an inch long, emerge and feed on small insect life. They develop a series of dark bars along the sides and are known as "parr". When about to migrate to sea, usually during their third spring, the parr become silvery and are termed "smolts". The smolts generally enter the sea during May. In the sea they feed voraciously and grow rapidly and after their first winter when they are termed "grilse", may weigh several pounds and towards the end of their second summer 10 pounds or more. Grilse may return to the river from which they came in order to spawn, but many do not spawn as grilse and may spend several years in the sea before returning to spawn as adult salmon. After spawning, the salmon which is very thin and weak is termed a "kelt" and makes its way towards the sea. Probably few of this species live more than 10 years, or spawn more than three or four times. Large fish weighing 50 pounds or more may be taken but are not necessarily very old. They are fish that have spent several years in the sea without spawning. Grilse and adult salmon are angled for in freshwater rivers and streams, while the commercial fishery is carried out in the sea by means of set nets or drift gill-nets. Anglers often mistake young salmon for "trout" and consequently remove many potential salmon. Trout are recognized by the worm-like markings on the back and the squarish tail while the young salmon in the streams have no worm-like markings and have a well-forked tail.

Food

In fresh water the young salmon feed largely on stream insects. In the sea, little is known about the food habits, but an abundance of food is available to the salmon including crustaceans and small fishes.

Migration Movements

Research involving the tagging of many salmon has indicated that they often do not move far from the mouth of the parent river but some have travelled great distances, as from the Bay of Fundy area to Newfound-

land. The "homing" or returning of salmon to the rivers where they were produced, seems to be a highly developed feature of their movements.

Enemies

During its life cycle the salmon faces numerous unfavourable conditions and enemies. Unfavourable water temperatures, floods and silting may kill the eggs in the "redd". Small eels often invade the nests and feed on the eggs and fry. Parr are taken in great numbers by the fish-eating birds -- the Kingfisher, and Fish Duck or Merganser. Smolts, when they first go to sea, fall prey to any large predaceous fish but after one or two years in the sea salmon are so heavy and strong that only fish as large as tuna, swordfish or the larger sharks can menace them. Seals, of which there are considerable numbers in Canadian Atlantic waters, are said to be one of the worst enemies of the adult salmon. Man, if he fishes out of season or uses illegal methods, can be a serious enemy also.

Processing and Markets

Nearly all of Canada's commercial catch of Atlantic salmon is marketed in the fresh and frozen forms in Canada and the United States. A small quantity is canned, and sometimes a few of the fish are pickled or smoked.

Source: Fisheries Research Board of Canada,
Atlantic Biological Station,
St. Andrews, N.B.

March, 1950.

Subject: BLACKCOD

Distribution and Importance

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.

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Blackcod (cont'd.)

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 long-line vessels. The main landings usually occur after the halibut season has closed. Since otter-trawlers do not fish as deep as the long-liners 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.

Subject: CANADA'S FISHERIES

The waters off Canada's coasts comprise some of the most important fishing grounds of the globe. Those off the Atlantic coast have been continuously exploited by many nations for more than 400 years. Fishing is Canada's oldest industry and is carried on in inland waters as well as on both the Pacific and Atlantic coasts. The industry is of the greatest importance to many of the communities along Canada's many thousands of miles of coastline. It provides 130,000 people with full or seasonal employment either in fishing (105,000) or in fish processing (25,000). The industry ranks among the first ten fishing industries of the world, and Canada with over two-thirds of its catch being sold in foreign markets is one of the world's largest fish exporters. Nearly two billion pounds of fish are caught annually, having a total marketed value of about $180 million.

Canada's fishing grounds fall naturally into three main divisions: Atlantic, Pacific and Inland, each with its own special characteristics.

Atlantic Fisheries

The fisheries of Newfoundland, Nova Scotia, New Brunswick, Prince Edward Island and Quebec together account for more than one-half the marketed value of all Canadian fish.

The most valuable Atlantic catch is that of cod, taken by the fishermen of all the five provinces, with Newfoundland and Nova Scotia predominating. Other "groundfish", so called because they feed at the sea bottom, are often taken with the cod. They include haddock, pollock, hake, cusk, rosefish, and catfish. Other inhabitants of deep waters caught by Atlantic fishermen are the flatfish: halibut, plaice, yellowtail, witch, flounder and skate. Lobsters, which come second in value among Atlantic fishery products, are mainly caught in the three Maritime Provinces but are also found in the waters of Quebec and Newfoundland. Other types of shellfish are

Dories returning to Schooner on Atlantic Coast bank

clams and quahaugs, of which New Brunswick and Nova Scotia both produce considerable quantities, oysters (chiefly from New Brunswick and Prince Edward Island) and scallops from Nova Scotia. Mussels, winkles and crabs are marketed on a smaller scale. Of the fish species occurring in schools ("pelagic" fish) and those entering the river estuaries, the herring are the most important. Immature herring landed in southwestern New Brunswick are the basis of an important sardine canning industry. Other pelagic fish are the mackerel, smelts which are caught in large numbers off New Brunswick and elsewhere, Atlantic salmon and swordfish.

Altogether, more than 30 different kinds of fish, shellfish and marine mammals such as seals and whales, are commercially taken by Canada's Atlantic fishermen. In addition, other marine products such as Irish moss and other sea-grasses are harvested.

There is a fairly clear distinction to be made between two branches of the Atlantic fisheries. The shore fishery, which is the more important, is carried on in waters within 12 or 15 miles of land, while the deep-sea fishery is worked on the 'banks' farther away. Individual fishermen fishing near their homes from small row-boats, sailboats, or motor-boats, produce the bulk of the landings of the shore fisheries. The Labrador Coast fishing is of a special type, being conducted mainly by Newfoundland fishermen who voyage there for the summer. Handlines, and trawl lines with individually baited hooks, are the gear chiefly used in the shore fisheries to catch such fish as cod, haddock and halibut, but in Newfoundland the greater portion of the inshore cod catch is accounted for by cod-traps. Mackerel and herring are captured with seines, trap-nets and gill-nets; lobsters are trapped in "pots"; while smelts are mostly caught in winter in box-nets and bag-nets through holes in the ice. Oysters are gathered from their beds by special rakes or tongs, scallops are landed by drags or dredges.

The traditional deep-sea fishing vessel is the schooner from 70 to 125 tons and beyond in size, nowadays propelled by an engine as well as by sails. It carries 12 to 24 fishermen who, once the fishing grounds are reached, fish in pairs from small boats called "dories" using trawl lines. A comparatively small number of steam trawlers of 250 to 300 tons and many smaller vessels called "draggers" working out of Newfoundland, Nova Scotia and New Brunswick ports catch fish in a large bag-like net or "trawl" dragged along the bottom of the sea.

Canada's Fisheries Cont'd....

A considerable proportion of the production of the Atlantic fisheries - mainly cod and related species - is traditionally salted and dried, in some places by modern methods, largely for export to the West Indies, South America and the Mediterranean countries. However, modern developments in refrigeration and transport have enabled the fisheries to sell an even larger part of the catch of almost all kinds of fish in the fresh or frozen state, mostly to the Canadian and United States markets. Much of this fish is sold as fresh or smoked fillets, ready for cooking. A substantial proportion of some species such as lobster, sardines, mackerel, haddock and other ground fish ('chicken haddie'), and tuna are canned and a smaller quantity of Atlantic fish is pickled. Liver and other vitamin oils are extracted from some species. Fertilizer and other non-food products are also manufactured as by-products. Herring provides the bulk of the bait for hand and trawl lines.

Pacific Fisheries

The fisheries of British Columbia, Canada's Pacific Coast Province, are dominated by salmon which account for over one-half the total value. Herring, together with anchovies and the erratic pilchard, contribute between one-fifth and one-quarter , and halibut with other flat-fish (soles, flounders) about one-tenth of the marketed value of the British Columbia catch. Grayfish, soup-fin and other sharks are rich sources of vitamin oil and as such commercially important. Ling and black cod (not related to the true cod), albacore tuna and clams, crabs and oysters also provide a source of income to fishermen. A variety of other aquatic species, ranging from shrimps to whales, are among the catches of the British Columbia fishermen.

Almost all fishing in British Columbia waters is carried on within sight of land and there are no very large vessels; but even small boats, usually highly powered and equipped with modern mechanical gear, navigational aids and radio travel long distances up and down the coast following the seasonal movements of the fish and taking advantage of open seasons in widely scattered areas.

Among the typical craft and gear used are the purse-seine boats which are important in the salmon fishery and account for the bulk of the herring catch.

Mobility, modern equipment and efficiency characterize the Pacific fisheries which show a high degree of organization both among the fishermen and among the processing companies.

The greater part of the Pacific salmon catch is canned. The product enjoys a world-wide reputation for quality and is exported to many countries.

Canada's Fisheries Cont'd.....

Fresh and frozen salmon, halibut and many other species, including shellfish, are supplied to Canadian and United States markets. Herring is turned largely into fish meal and oil, as are the waste materials produced in the canning and filleting of other types of fish. The extraction of vitamin oils from livers and viscera is another important and growing branch of the industry.

Inland Fisheries

Apart from being a great sport-fishing area, the inland waters of Canada, which comprise over one-half the fresh water of the globe, also support important commercial fisheries, particularly in Ontario, the Prairie Provinces and as far north as Great Slave Lake in the Northwest Territories. Quebec, New Brunswick and Yukon have commercial inland fisheries on a smaller scale.

A great variety of fish is taken in these inland waters; whitefish, which occur in all the provinces, head the list, followed by lake-trout and pickerel or dore. Other species are sometimes of considerable local importance, e.g., saugers in Manitoba and eels in Quebec.

The Great Lakes, and the larger bodies of water in the Prairie Provinces and Great Slave Lake in the Northwest Territories are fished extensively in the summer, the fishermen using boats up to 46 feet in length (e.g., the whitefish boats on Lake Winnipeg) as well as skiffs and canoes. Gill-nets and pound-nets are the chief gear. Production is channelled through permanent shore stations with docking, icing, cooling, grading and warehousing facilities.

Winter fishing on large and small lakes with gill-nets set through holes in the ice is carried on by teams of men, many of whom are only part-time fishermen with their chief occupation in farming, lumbering or the fur industries. Accommodation for the fishermen as well as handling facilities are available at hutted camps or in the form of mobile cabooses. Dog teams, horses, cars and snowmobiles are used to haul fish and equipment.

Most of the catch is marketed fresh or frozen, with a large proportion going south across the border.

Information and Educational Service
Department of Fisheries of Canada

Subject: CANADIAN FISHERY STATISTICS

Landings, Landed and Marketed Values, 1951

	Landings	Landed Value	Marketed Value
Pacific Coast (British Columbia)	600,452,000 lbs	$ 41,181,000	$85,000,000
Atlantic Coast (NS, NB, PEI, Que)	704,804,000 lbs	33,034,000	64,500,000
Newfoundland	612,460,000 lbs	13,500,000	29,000,000
Inland (Freshwater) (Manitoba, Ontario, Alberta, Saskatchewan, Northwest Territories, Quebec, New Brunswick)	94,965,000 lbs	14,460,000	21,125,000
GRAND TOTAL	2,012,681,000 lbs	$102,175,000	$199,625,000

1951 Landings, Landed and Marketed Value by Province

SEA FISHERIES	Landings	Landed Value	Marketed Value
British Columbia	600,452,000 lbs	$ 41,181,000	$ 85,000,000
Nova Scotia	366,855,000 lbs	20,735,000	37,000,000
New Brunswick	219,380,000 lbs	7,279,000	19,500,000
P.E.I.	27,002,000 lbs	2,785,000	5,100,000
Quebec	91,567,000 lbs	2,235,000	2,900,000
Newfoundland	612,460,000 lbs	13,500,000	29,000,000
TOTAL	1,917,716,000 lbs	$ 87,715,000	$178,500,000

FRESHWATER FISHERIES (Estimates)			
Manitoba	35,000,000 lbs	$ 5,300,000	$ 8,000,000
Ontario	33,250,000 lbs	6,800,000	8,000,000
N.W.T.	7,478,000 lbs	535,000	2,300,000
Saskatchewan	8,500,000 lbs	800,000	1,500,000
Alberta	7,000,000 lbs	500,000	800,000
Quebec	3,000,000 lbs	450,000	450,000
New Brunswick	737,000 lbs	75,000	75,000
TOTAL	94,965,000 lbs	$ 14,460,000	$ 21,125,000

GRAND TOTAL	2,012,681,000 lbs	$102,175,000	$199,625,000

CANADIAN FISHERY EXPORTS 1951
BY TYPE

	Quantity	Value
Fresh or Frozen (whole or dressed)	172,224,000 lbs	$ 33,022,500
Fresh or Frozen, fillets	80,725,000 lbs	20,339,800
Smoked	12,664,000 lbs	1,929,900
Salted or dried	156,558,000 lbs	21,606,000
Pickled	40,670,000 lbs	4,052,500
Canned	46,205,000 lbs	13,896,600
Molluscs and Crustaceans	30,367,000 lbs	15,227,700
Fish Oils	3,980,000 lbs	5,509,800
Miscellaneous		9,015,400
VALUE OF TOTAL EXPORTS		$124,600,200

NUMBER OF FISHERMEN IN CANADA - 1950
BY AREAS

Pacific Coast	12,159
Maritime Prov. & Quebec	36,488
Newfoundland	20,550
Inland Fisheries	16,390
TOTAL	85,587

Value of fishing gear and craft in Canada - 1950 (exclusive Nfld.) $ 75,314,000

Value of fishing gear and craft in NEWFOUNDLAND - 1945 $ 10,000,000

Landings, Landed Value and Marketed Value of the Main Species of Canada's Fishes for 1950

	Landings	Landed Value	Marketed Value
PACIFIC COAST			
Salmon	184,700,000 lbs	$24,336,000	$48,702,000
Herring	397,566,000 lbs	5,147,000	9,313,000
Halibut	18,882,000 lbs	3,837,000	5,552,000
Crayfish	551,000 lbs	134,000	170,000
Tuna	2,119,000 lbs	373,000	768,000
Sablefish	954,000 lbs	127,000	264,000
Lingcod	4,638,000 lbs	375,000	573,000
Soles	10,471,000 lbs	534,000	914,000
ATLANTIC COAST (NS, NB, PEI & QUE)			
Cod	250,000,000 lbs	$ 7,140,000	$16,797,000
Lobster	44,685,000 lbs	12,137,000	16,260,000
Herring	162,468,000 lbs	1,354,000	5,036,000
Sardines	68,092,000 lbs	708,000	5,000,000
Salmon	2,219,000 lbs	758,000	4,981,000
Haddock	47,319,000 lbs	2,366,000	4,246,000
Halibut	10,406,000 lbs	2,610,000	2,891,000
Mackerel	27,120,000 lbs	932,000	2,192,000
Smelts	7,022,000 lbs	945,000	1,295,000

(The breakdown of species for Newfoundland is not available, while the 1951 figures for the rest of Canada are not yet in final form).

PER CAPITA FISH CONSUMPTION IN CANADA BY FORMS (1947)

Fresh and Frozen

lbs.

Prince Edward Island	1.42
Nova Scotia	9.25
New Brunswick	1.34
Quebec	3.53
Ontario	3.28
Manitoba	3.23
Saskatchewan	1.77
Alberta	2.10
British Columbia	4.04

Smoked and Cured

Prince Edward Island	0.35
Nova Scotia	2.46
New Brunswick	1.93
Quebec	0.04
Ontario	0.26
Manitoba	0.82
Saskatchewan	0.67
Alberta	0.58
British Columbia	0.56

Shellfish

Prince Edward Island	1.52
Nova Scotia	0.60
New Brunswick	0.58
Quebec	0.30
Ontario	0.06
Manitoba	0.02
Saskatchewan	0.02
Alberta	0.09
British Columbia	0.48

Canned Fish

Prince Edward Island	4.16
Nova Scotia	4.37
New Brunswick	5.71
Quebec	5.60
Ontario	4.06
Manitoba	5.33
Saskatchewan	1.80
Alberta	4.35
British Columbia	8.14

PER CAPITA FISH CONSUMPTION IN CANADA BY PROVINCES

	All forms lbs
Prince Edward Island	7.45
Nova Scotia	16.68
New Brunswick	9.56
Quebec	9.68
Ontario	8.26
Manitoba	9.40
Saskatchewan	4.26
Alberta	7.12
British Columbia	13.22

Note: Per capita consumption figures for Newfoundland are not available.

MONTREAL AND TORONTO

Fresh and Frozen

Montreal	6.79
Toronto	6.30

Smoked and Cured

Montreal	0.56
Toronto	1.46

Shellfish

Montreal	0.75
Toronto	0.17

Canned Fish

Montreal	9.85
Toronto	10.00

All Forms

Montreal	17.95
Toronto	17.93

A sample survey made in Halifax in 1946 indicated the rate of consumption in that city as approximately 35 pounds per capita. Data for other cities are not available at present.

WORLD CONSUMPTION FIGURES

Europe	lbs per capita	year
Norway	46.7	1950-51
Denmark	35.9	1950-51
Iceland	65.3	1950-51
United Kingdom	29.9	1948-49
France	14.8	1950-51
Germany	19.8	1949
Holland	17.9	1950-51
Belgium	21.6	1950-51
Portugal	20.5	1950-51
Italy	12.6	1950-51
China	6.0	1947-48
Japan	83.3	1947-48
United States	11.1	1948
Canada	13.7	1951

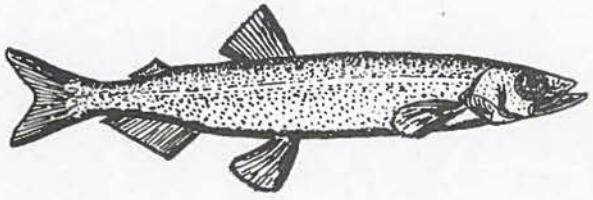
Figures for European countries, United States and Canada represent fillet weights, except for Italy and Holland, where per capita consumption figures include fish at fresh weights. The basis for the calculation of China and Japan figures are unknown.

Where year 1950-51 is shown, the figures are preliminary estimates as published by FAO.

Subject: CAPELIN

Distribution and Importance

The capelin, scientifically known as Mallotus villosus, is a close relative of the smelt and indeed belongs in the same family of fish. It occurs in all Arctic seas and southward along the Atlantic coast of North America, occasionally as far as the Gulf of Maine. Off Labrador and Newfoundland, especially the north and east coasts and the easterly half of the south coast, the capelin is extremely abundant. Around Gaspe it is fairly numerous but is only occasionally seen in the waters off New Brunswick, Prince Edward Island and Nova Scotia.



Capelin
(Mallotus villosus)

In Newfoundland the capelin ranks next to the cod in general importance. Most forms of large fish, sea mammals and sea birds live to a large extent on capelin during a good part of the year. It is the main and almost only food of the east and south coast cod during June and July and the north and northeast Grand Bank cod from early spring to late July. In addition to this 25,000,000 to 50,000,000 pounds are caught in dip nets and beach seines during the spawning season, and used annually by the Newfoundland people as fertilizer (50 per cent), bait (30 per cent), dried dog food (8 per cent), while the remainder (12 per cent) is used for local human consumption, exported in the dried state or made into meal.

The capelin is considered a very fine food fish whether dried, lightly smoked, frozen or fresh.

The smelt, silverside and capelin, small, slender, silvery fishes which occur in Canadian Atlantic waters, are three distinct marine species which look so much alike that some fishermen and many of the general public confuse them. Even in the adult stage, smelt and capelin may often be confused and the silverside, particularly in the young stages, has frequently been mistaken for a young smelt or a capelin.

Description

The capelin has no fang-like teeth such as those which identify the smelt. It has a moderate sized mouth, which opens to the front half of the eyes. The lower jaw protudes. Of four to 12 inches in length, the male of the species averages about seven inches, and the female 6 1/2 inches. A translucent olive-green on the back, the lower parts of the sides are silvery, and the fish has a white belly. The scales are very

small, with two rows of ridges along the sides of the males at spawning time. A large soft fin is located on the middle of the back, and a small fin in front of the tail. A thin line extends along the sides from the head to the tail.

Spawning

The capelin lives in the open northern seas except for one or two months in early summer when it spawns in vast numbers along the shore. (Recent investigations conducted on the Grand Bank point to a very large capelin population which spawns on the banks after the inshore spawning has been completed. Adult capelin have been found in the stomachs of offshore cod and great numbers of undigested capelin eggs in haddock.) The eggs are deposited in great quantities on the sands along the beaches about Newfoundland in June. Capelin are perhaps best known for their characteristic "rolling" during the spawning act when whole schools allow themselves to be tossed by the breakers upon the shingle or gravel beaches. Here the eggs are laid and fertilized. The adult fish are often left stranded and die.

Cast nets, seines and dip nets are used to fish the capelin during the early summer when they spawn along the shore. They are used for local human consumption as well as fertilizer, bait, dog-food and meal.

FISHERIES FACT SHEETS

Subject: CHICKEN HADDIE CANNING
AND
OTHER CANNED PRODUCTS

Chicken Haddie Canning

Cod, hake, haddock and cusk are combined in the canning of "Chicken Haddie", which is done only on the East Coast. When the fish are brought to the cannery, they are cleaned, skinned and washed well before being brined in saturated brine for ten to twenty minutes, depending on the size. The brining gives the product a uniform, slightly salty flavour and makes the raw fish firmer. The brined fish are then steamed, or pre-cooked, to remove excess moisture. The steaming lasts about twenty-five minutes at 212 degrees F. depending on the size of the fish, or for fifteen to twenty minutes at 240 degrees F.

The meat is separated from the bones and drained in a colander or perforated tray. The flakes of meat are then placed tightly into the cans which are parchment-lined and the cans are exhausted for about fifteen minutes before being sealed. After sealing, the cans are processed in steam retorts at 240 degrees F. for at least seventy minutes.

Other Canned Products

More than twenty different kinds of Canadian fish and shellfish are available in canned form. Some are packed in cans in combination with ingredients other than fish to produce products such as clam chowder and codfish cakes. Canning of mackerel, kippered snacks and lobster paste is done at many points in the Atlantic provinces while crabs, shrimps and abalone are canned in British Columbia. Annual outputs in the case of some of these products are relatively small but in general principle the processes employed are similar to those which have been outlined for the major canning operations.

No. 53

Issued by Information Services, Department of Fisheries, Ottawa

FISHERIES FACT SHEETS

Subject: CHUM SALMON

Importance and Distribution

Formerly known as dog salmon, the chum, with the scientific name Oncorhynchus keta, has also been called the qualla, keta and calico salmon. It is caught all along the coast of British Columbia, its range extending from northern California to northwestern Alaska, and ascends practically all streams. The catch is widely marketed in several forms.

Chum Salmon
(Oncorhynchus keta)

Description

Like other Pacific salmon (sockeye, pink, spring and coho), the body of the chum is elongate and the head is conical. The teeth are strongly developed, and in the mature male resemble fangs. The parr marks on the young are slender bars, and the back has a green iridescence. The back of the adult fish is a metallic blue with occasional black specklings. There are black tinges at the tips of the pectoral, anal and caudal fins, especially marked in the male. When the adult chum returns to fresh water to spawn and die, it changes colour, becoming almost black with irregular reddish, dusky streaks across the sides of its body, and the tips of the pelvic and anal fins turn white. The length runs to about three feet, and the average weight is about eight pounds, although the chum frequently goes as high as 18 and in rare instances has been known to reach 30 pounds. The life span is four years, sometimes three or five. During the spawning season it develops the characteristic hook over the upper jaw. The flesh of the chum is white, with a creamy tinge. It lives on small crustaceans, and its own food value is similar to that of others of the species. Of the five, the chum is fourth in protein content and fifth in fat content.

Migration and Reproduction

The spawning schools of chum appear off the B.C. coast during autumn — the latest of the species to return from the sea. As is the case with all salmon, the ocean migration routes are unknown, but tagging operations have shown that large numbers of chum enter the Strait of Georgia through Johnstone Strait as well as through the Strait of Juan de Fuca. The young chum heads for the sea from fresh water during its first year. It usually remains in the ocean for three or four years, but has been known to stay for five years before returning to spawn in a running stream of the river system in which it started life. (A separate fact sheet deals in greater detail with the migration and reproduction of all British Columbia salmon).

Issued by Information Services, Department of Fisheries, Ottawa

Methods of Catching

The chum is taken by means of purse-seines, gill-nets and, to a limited extent, by traps. Those caught in traps are taken in the Strait of Juan de Fuca, the only region where this method of fishing is permitted in British Columbia. Floating traps are not allowed at all.

Processing and Markets

A variety of methods is employed to prepare the chum for market. A large quantity is sold fresh, other portions of the catch are frozen, canned, or dry-salted. Indians produce smoked chum, but for their own use. As is the case with all British Columbia salmon, the markets are world-wide but largest in the United States.

Subject: CLAM CANNING

Since clams are clothed in a hard shell, the canning process is similar to that for lobster canning. These bivalve shellfish with such tender delicious meat bury themselves in the sand and mud of tidal beaches and submerged bottoms and are taken by digging, raking or dredging. Clams are combined with other ingredients in the preparation of appetizing canned clam chowder. They are also sold fresh in the shell for wayside restaurants or shucked for export in the fresh or frozen form.

Clam canning is carried on both on the Atlantic and Pacific coasts. Common practice is to steam the fresh clams thoroughly for 20 minutes to shrink them as well as to remove the sweet cream-coloured meat from the shells. This meat is carefully freed from grit and the black portion of the neck is cut off. After cleansing, the meat is placed in cans and weighed, allowing for shrinkage during the processing. The liquor which drained from the clams during the steaming is filtered and poured boiling hot into the cans immediately before sealing so that no extra exhausting is necessary. This liquor or "clam nectar" may be diluted with clean water, either fresh water or sea water. The cans are exhausted for ten minutes at 212 degrees and hermetically sealed. In the retorts the cans are then cooked at 240 degrees F. They are cooled in cold water as soon as processing is completed.

No. 52

Issued by Information Services, Department of Fisheries, Ottawa

FISHERIES FACT SHEETS

Subject: CLAMS (WEST COAST)

Distribution and Importance

Of the various species of clams found along the coast of British Columbia, only three are used commercially to any great extent. These are the butter clam (Saxidomus giganteus), the little-neck clam (Paphia staminea), and the razor clam (Siliqua patula). The first two are generally found on the same beaches and widely distributed, while the third is much restricted in its distribution. The geoduck (Panope generosa), although not maintaining a commercial fishery, is edible and provides a sport fishery.

Saxidomus giganteus

The butter-clam (Saxidomus giganteus), the most abundant of British Columbia clams, is the species used most extensively for canning. It is widely distributed over the province, and although it may live in many types of soil it occurs most frequently on beaches composed of a mixture of sand and gravel, at a depth of not more than a foot below the surface of the beach. In vertical distribution it occurs in approximately the lower third of the intertidal zone. In one locality it is known to exist in at least 30 feet of water.

The little-neck clam (Paphia staminea) or rock-cockle is widely distributed over the British Columbia coast and is found on nearly every type of beach. The typical habitat of the little-neck, however, is a mixture of pebbles and fine mud.

The razor clam (Siliqua patula) is found in situations quite different from those of Saxidomus and Paphia. A very fine sand, free of gravel and clay, seems to be most desirable. Apparently this clam will not stand as great a variety of physical conditions, because it is not found in the inner waters where the salinity is low and the surface tem-

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Issued by Information Services, Department of Fisheries, Ottawa

Clams (Cont'd.)

perature high at certain times of the year. The only beach in British Columbia that is dug commercially for razor clams is on Graham Island, largest of the Queen Charlotte group.

The geoduck (Panope generosa), though not at all abundant, is a clam that arouses considerable interest. Digging for it is considered a sport because the limited abundance and the great depth at which it lives makes it extremely difficult to secure. The habitat of the geoduck is confined to fairly well protected sandy beaches; localities where it is definitely known to exist are Sidney Island, Tofino, Nanoose and Seal Island, near Comox, although it doubtless occurs elsewhere. All of the meat of this mollusc may be utilized, although the exposed parts, siphon and foot, require to be skinned.

Description

Externally the shell of the butter clam is quite smooth, with numerous fine concentric lines of growth interspersed between a number of more prominent grooves which represent the winter-checks in growth. The muscle-scars on the inside of the shell are quite large and deeply impressed. There are several hinge-teeth and the external hinge-ligament is large and prominent. All of the meat of this species may be eaten, although the black tips of the siphons are usually removed. The butter clam may reach a length of five inches. The average size in the commercial catch is about three inches.

The shells of the little-neck clam are pure white or cream-coloured, with angular brown markings, have numerous fine radiating lines as well as many concentric ones. The muscle-scars are clearly outlined and the hinge-teeth are quite prominent. The average size is about two inches but a length of nearly three inches may be attained.

The long, narrow, thin shells of the razor-clam are covered with a distinctive shiny brown periostracum. They may reach a length of six inches and a height of two and one-half inches. This species must not be confused with the small "jack-knife" clam which it resembles and which is found on sandy beaches in the Gulf of Georgia.

The shell of the geoduck is nearly rectangular in shape and the deeply engraved concentric lines give the outside a rugged appearance. The edges of the white shell are covered with a thin, light brown periostracum. The muscle-scars are quite small in proportion to the size of the mollusc, but the pallial line is very broad with a shallow sinus. There is a single tooth on each valve. The shells always gape, show-

ing the compact brown mantle, which being completely fused, except for one small posterior opening, completely hides the body of the clam. The neck or siphon is so large that, like the horse-clam, it cannot be withdrawn into the shell. In the larger specimens it can be extended to a length of three feet or more, which is the depth at which these clams are found.

Food and Feeding

Both little-neck and butter-clams feed on minute plant and animal organisms that swim and float about in the water, and are collectively known as plankton. The minute organisms are carried by the water current between the shells and are caught by the small flaps or palps that are situated at each side of the mouth. They pass through the mouth into the digestive tract. There is apparently no choice of food particles. If the food is small enough to be swallowed, it is used.

The razor clams live on the same kind of food, obtained in the same way as the butter and little-neck clams. They are much more active in their movements but that has little effect on their ability to obtain food.

The thick, tube-like neck, which is the most highly developed part of the geoduck, contains twin siphons that daily transport hundreds of gallons of water to and from the geoduck's digestive apparatus. In one chamber of the internal pump, the minute plant and animal organisms that the geoduck uses for food are filtered out.

Reproduction

Both the butter clam and the little-neck clam are divided into distinct sexes, but there is no apparent difference between male and female. The size and numbers of males and females are approximately equal. The eggs and sperm are shed into the water, and soon after fertilization, tiny free-swimming larvae develop. In southern part of the Strait of Georgia, the butter clam spawns extensively, but the breeding season is not well known. In the same locality the little-neck clam spawns during the summer.

In the main, spawning of the razor-clam takes place during July, but it is probable that in some summers it may be earlier, depending upon the time when the temperature of the water reaches the minimum for spawning (55.4 degrees Fahrenheit).

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Clams (Cont'd.)

Not much is known of the life cycle of the geoduck, and for descriptive purposes it must be assumed that it follows the general pattern of other bivalves. The sexes are distinct and spawning takes place once a year in late April or early May.

Growth

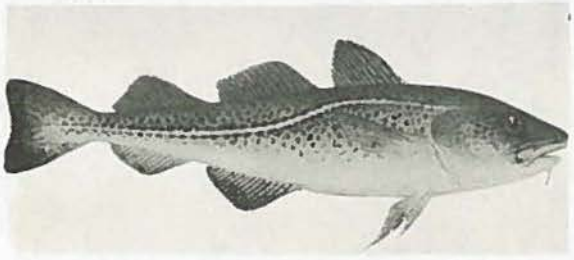
When the larva is still free-swimming, it develops a pair of shells and in time the small animal settles to the sand or gravel to begin its sedentary existence and gradual growth. Large numbers of butter clams begin to spawn when they are three years old, but many of them not until they are four years old. The minimum length of the first spawners of the butter clam is about one and one-half inches. After the first spawning, under normal conditions, annual spawning takes place. Most of the clams taken commercially are less than 12 years old, but occasional specimens as old as 17 years have been found. When the little neck larvae settle they are about one-fifth of an inch long. About half of them spawn in their second year, when the shell is about one inch long, and the remainder for the first time in their third year. Few little neck clams more than eight years old are obtained but at least one has been found as old as 14 years.

The razor clam settles when the shell is about one-tenth of an inch in length. There is not much growth during the remainder of the season. The earliest spawning is at the end of the third year, and nearly all spawn first at that time. The shells are then about 3.6 inches in length. Among the large number collected, rarely is a razor clam found to be over nine years old and six inches in length. However, the shell of a much larger one (7.25 inches) has been found, indicating an age of 15 years.

Subject: COD (Atlantic)

Distribution and Importance

The Common, Atlantic, or Rock Cod, with the scientific name Gadus callarias is well-known on both sides of the North Atlantic. On the American coast it is found as far north as Greenland, Davis Strait and Hudson Strait and south nearly to Cape Hatteras. It is particularly abundant in the waters around and off the Canadian Atlantic Coast. The cod of the Grand Banks of Newfoundland was one of the principal inducements which led England to establish colonies in America. So important was this fish in the early history of this country that its picture was placed on a Nova Scotian banknote with the legend "Success to the Fisheries". From the early days to the present it has retained great economic importance to Canadian East Coast fishermen and it has contributed a large share of the fisheries income of all the Maritime Provinces. Salted codfish is the "backbone" of the fisheries industry of Newfoundland. The flesh is highly palatable, easily digestible and nutritious.



Atlantic Cod
(Gadus callarias)

Description

The most noticeable external characteristics are its three dorsal and two anal fins, its protruding upper jaw, its almost square tail and a pale line running along each side of the body from the head to the tail. There is a fleshy barbel under the lower jaw. In most fish the upper part of the body is thickly speckled with small, round, vague-edged spots, somewhat darker than the body color which may range from a reddish hue to brown, gray or greenish.

Cod sometimes grow to a tremendous size. A monster of 211¼ pounds, more than six feet long, was caught off the Massachusetts coast in 1895. However, a "large" fish is considered one of from 25 to 50 pounds in weight.

Habits and Movements

Although it stays close to the bottom of the sea and therefore is typically a "groundfish", it may be found anywhere from surface to 250 fathoms. Its usual habitat is within a few fathoms of the bottom but it comes to the top of the water in pursuit of

small fish or squid. Cod live chiefly over rocky, pebbly ground, on sand or gravel and seldom on soft mud. Their movements are not well understood. They go in schools, but not in such dense bodies as mackerel and herring. The movements on and offshore and from bank to bank are due chiefly to temperature influence, the presence or absence of food and the search for proper spawning conditions. Sometimes they make long journeys as has been shown from tagging operations carried out by the Fisheries Research Board of Canada. Migrations into the Gulf of St. Lawrence in spring and back to the offshore banks in the fall have been indicated. These fish prefer a rather definite range of temperature which varies with the locality and season. Best catches are made at bottom temperatures ranging from 32°F. to 40°F. while smaller catches are made in waters of up to 50°F.

Food

Cod feed voraciously on almost all types of sea life. During its early floating life, the young feed upon some of the small animals around them. When older and about an inch long they take to the bottom where they feed on small worms and tiny shrimp-like animals. As they grow older they become largely ground or bottom feeders, consuming such things as mussels, crabs, small lobsters, brittle stars and sea urchins in quantity. More important foods are the capelin, herring and sand launce. The cod depends largely upon smell to locate food since its range of vision is limited to a few feet.

Spawning

The majority spawn during the early spring months, each fish producing from 3,000,000 to 9,000,000 eggs depending on its size. The minute transparent eggs rise and drift in the water at the mercy of the wind and tide and the animals which feed on them. The eggs hatch in from 10 to 40 days depending on the temperature of the water, and the young fish about three-sixteenths of an inch long begin to feed for themselves.

Growth

Growth varies from area to area and from season to season depending largely on the food available and the temperature of water in which they live. The cod of the Bay of Fundy grow much faster than those of the Grand Banks of Newfoundland. Cod of 30 to 32 inches in length have an average weight of approximately 10 pounds and in the Bay of Fundy area would be about six years of age. However, fish of the same length and weight would be about nine years of age on the Grand Banks. Cod from fishing banks off Nova Scotia enter the commercial fishery at about four years of age. In 1948 the greater proportion of the commercial catch on Canadian offshore fishing banks was of this fish six to nine years of age.

Fishing Areas and the Fishery

Areas fished extend from Labrador along the whole Canadian coastline. However, the most productive areas are our offshore banks such as the Grand Banks of Newfoundland, the fishing banks off Nova Scotia and the banks of the Gulf of St. Lawrence. Great quantities are also caught within five miles of the shoreline along the entire Canadian Atlantic coast.

They are caught mainly by means of hook and line and by means of otter trawl. Large quantities are also taken by trap-nets and gill-nets. Millions of pounds of herring and mackerel are stored in cold storage units along the Canadian Atlantic coastline to provide year round bait for the cod fishermen.

A large part of the commercial catch is split, salted and dried. The progress in refrigeration and transportation has increased the production of fresh and frozen fillets. Waste after filleting forms the basis for fish meal valued for its high protein content and used as cattle feed. Livers are used for the extraction of cod-liver oil.

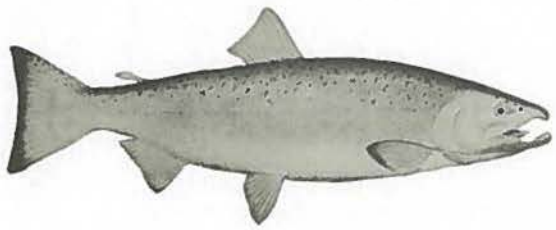
Source: Fisheries Research Board of Canada,
Atlantic Biological Station,
St. Andrews, N.B.

December 1949.

Subject: COHO SALMON

Importance and Distribution

Common throughout the coastal waters of British Columbia the coho, known scientifically as Oncorhynchus kisutch, not only provides the canneries with a large proportion of their product but is eagerly sought by game fishermen. It will rise to a lure and is often taken by trolling. Because of its colouring, the coho is also known in some areas of B.C. as the blueback, and in the United States is often referred to as the silver. It is caught from northern California to northwestern Alaska.



Coho Salmon
(Oncorhynchus kisutch)

Description

The body of the coho is elongate, differing chiefly in size from the other salmon of the same species — sockeye, spring, pink and chum. It has a conical head, and needle-like teeth which are firmly set. The back of the fish is a metallic blue, and the undersurface is silvery. The body is covered with numerous irregular black spots. The parr marks are strongly developed in the young coho. The flesh is pink, in some areas bright red. It averages about three feet in length at maturity, and weighs anywhere between six and 12 pounds, although it has been known to go 26½ pounds. Maturity is usually reached at the end of the third summer, when it leaves the sea and develops the hooked snout of the spawning Pacific salmon. Occasionally it lives four years. The coho's food is varied. It lives on herring, pilchard and sand-lance as well as other small fishes, squid and crustaceans. Its flesh is second among the five varieties in protein content, and third in fat content.

Migration and Reproduction

The great majority of the young coho remain in fresh water for a full year, but a few migrate to the ocean during the first year and some others wait until their third. It may spawn quite close to the sea, although sometimes it proceeds far inland to the upper reaches of the larger rivers. Like all Pacific salmon, it dies after spawning. (The life cycle of the five species of Pacific salmon is similar and is dealt with in a separate fact sheet).

Methods of Catching

Commercial fishermen catch coho in purse-seines and gill-nets, by trolls, and in stationary traps which are allowed in the Strait of Juan

de Fuca. Sport fishermen take it by fly-casting or on the troll.

Processing and Markets

The bulk of the catch is canned and sold as coho or blueback salmon. It is also sold on the fresh fish market and a proportion of the catch is used for frozen fillets. It is considered a choice item in all world markets, but particularly on the North American continent.

FISHERIES FACT SHEETS

Subject: COMMERCIAL SHRIMPS
(Pacific)

In the waters off the British Columbia coast five species of shrimp are found in sufficient quantities to support an enterprising minor fishery. Landings of shrimps and total marketed values for six selected years are as follows:

YEAR	LANDINGS IN CWTS.	MARKETED VALUE
1919	805	$ 17,528
1929	1,293	26,579
1939	831	12,246
1946	1,185	40,431
1948	3,540	84,900
1951	4,986	148,933

Descriptions and Life Histories of Species.

In general the five species are quite similar in appearance and size. However, there are a number of anatomical features which can be used for positive identification. In addition to its distinctive anatomical features, each species possesses a unique colour pattern. The common names used by west coast shrimpers are based mostly on colour characteristics. The accompanying pictures show features used in identification. Characteristic features are indicated in the photograph of each species.

The life histories of the five commercial shrimps are quite similar. The mature shrimps breed in the late autumn or early winter. The developing eggs appear on the abdomen of the female shortly after breeding, and are carried over the winter months. The young shrimps are hatched in the early spring and swim freely for about three months before settling to the bottom to begin adult life. The commercial shrimps mature first as males in the first or second year, depending on the species. After one or two seasons as sexually active males, these shrimps change sex and function as females for the rest of their lives.

A. "Side-stripe" or "Giant-red" (Pandalopsis dispar)

In size this shrimp is second only to the prawn. A large specimen may measure eight inches in overall length. The long antennules and striped abdomen easily distinguish this species from other commercial shrimps.

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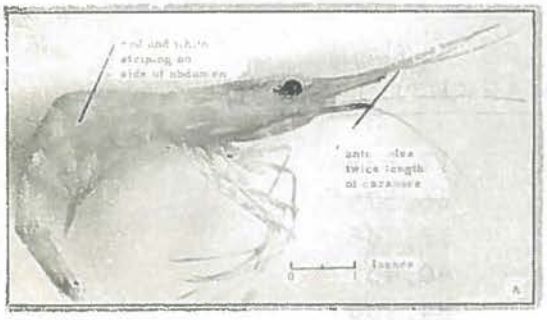
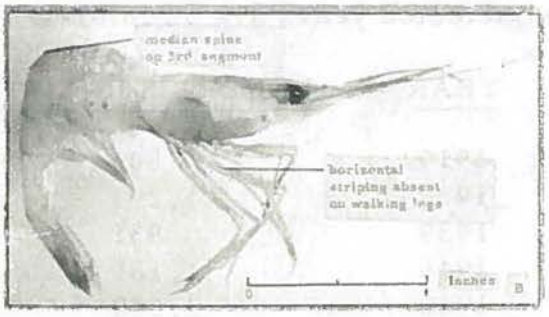
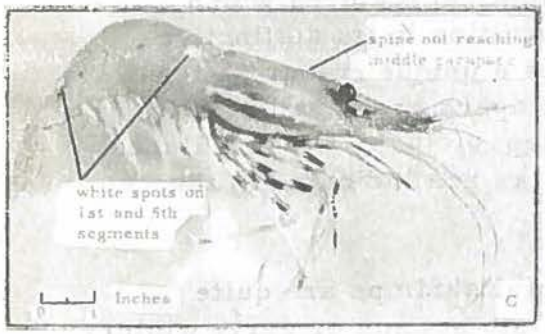
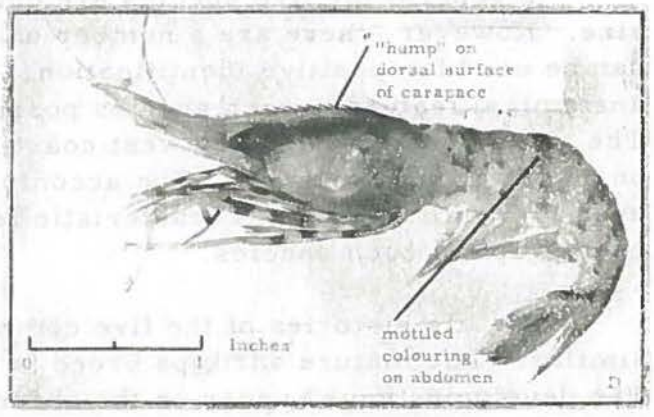
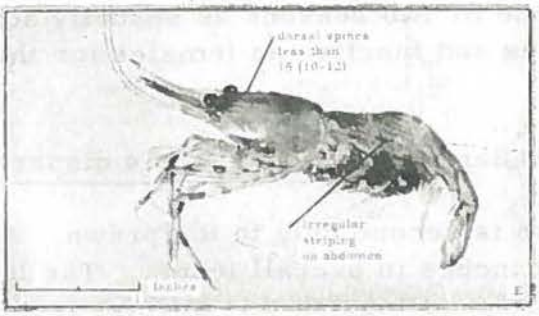
Pacific Commercial Shrimps (cont'd.)











Pacific Commercial Shrimps (cont'd.)

The "Side-stripe" shrimp is found on muddy bottoms. The distribution on the Pacific coast is from the Bering Sea to the Washington coast.

The "Side-stripe" shrimp functions as an active male during its second and third years, and then changes sex during the fourth year.

B. "Pink" shrimp (Pandalus borealis)

Generally, the length of this shrimp is three to four inches but larger individuals may reach six inches. The sharp spine or lobe pointing backward on the third abdominal segment is the most distinctive feature of this species.

The distribution of this shrimp is circumpolar, ranging from the Columbia River on the Pacific coast to Massachusetts Bay on the Atlantic coast of America. It is found on muddy bottoms.

The "Pink" shrimp is an active male in its second year, and becomes a female during the third year. The entire life is at least four years.

C. "Prawn" or "Spot" (Pandalus platyceros)

This species is the largest of the commercial shrimps. Large individuals may reach almost nine inches in length. The colour of the body is usually reddish brown with distinctive white spots on the first and fifth abdominal segments, and with horizontal white bars on the carapace.

The "Prawn" as an adult is generally found on rocky bottoms. The distribution on the Pacific coast is from Unalaska, Alaska, to San Diego, California.

The "Prawn" functions as an active male during its second and third years then changes sex during the fourth year.

D. "Hump-back" or "King" shrimp (Pandalus hypsinotus)

This shrimp may reach a length of six inches. The "Hump-back" shrimp is given its common name because of the arched shape of the carapace. The body is covered with a mottling of reddish brown which is conspicuous on the abdomen.

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Pacific Commercial Shrimps (cont'd.)

The recorded distribution is from the Bering Sea to the Strait of Juan de Fuca. This shrimp usually is found on muddy bottoms.

The "Hump-back" shrimp is an active male in its second year, and becomes a female during the third year.

E. "Coon-stripe" shrimp (Pandalus danae)

A large "coon-stripe" shrimp may attain the length of five inches. This shrimp derives its common name from the irregular striping of brown and red on the abdomen.

The "Coon-stripe" shrimp is found on sand or gravel bottoms, usually where a rapid tidal current exists. The distribution is from Sitka, Alaska, to San Francisco, California.

This species functions as a male during the first and second years, and becomes a female in the third year.

Fishing Methods and Areas

The commercial shrimps are fished at moderate depths, ranging from 15 to 70 fathoms. The four species generally found on muddy or sandy bottoms are caught by towing a bag-shaped net over the bottom. This method of fishing is called trawling. The trawl net is conical in shape, open at one end and tapering to an apex at the other end. As the net is towed along the bottom, shrimps are gathered in the mouth of the net and pass into the apex.

In order to fish effectively the mouth of the net must be kept open. This is accomplished in two ways. In the beam trawl, the upper edge of the mouth of the net is lashed to a wooden beam (20 to 30 feet in length), and the two sides to two D-shaped runners, which support the beam. In the otter trawl the upper edge of the mouth of the net is supported by glass floats, and the sides of the net are attached in a special way to two vane-shaped boards, so that when the gear is towed along the bottom the resistance of the water causes the boards to spread the mouth of the net open.

The larger shrimp boats (about 40 feet in length) generally use the otter trawl, as it is gear to be handled by two men. The beam trawl is used on the smaller one-man boats (about 30 feet in length). The size of the mesh (stretched) used in shrimp nets is 1-1/4 inches.

Pacific Commercial Shrimps (cont'd.)

As this mesh size is smaller than allowed for the fish trawl (4 inches), any fish caught in the shrimp net must be returned to the water.

Trawls used for shrimps are designed so that the upper edge of the mouth goes first. The idea is that when the shrimps are disturbed from the bottom by the ground line, they cannot escape by swimming rapidly above the net. Shrimp trawls are towed relatively slowly. Doing so prevents the capture of too many fish and gives a catch which is reasonably free of mud.

Prawns, which occur on rocky bottoms, are caught by means of traps. Prawn traps are generally rectangular in shape, made of a light iron frame covered with shrimp netting. At each end of the trap is a funnel-shaped opening through which the prawns enter the trap. In the fishing operation, traps are baited and set along the bottom in a line; the position of the traps is shown by means of a floating buoy. The traps are raised to the surface at regular intervals to remove the prawns and renew the bait.

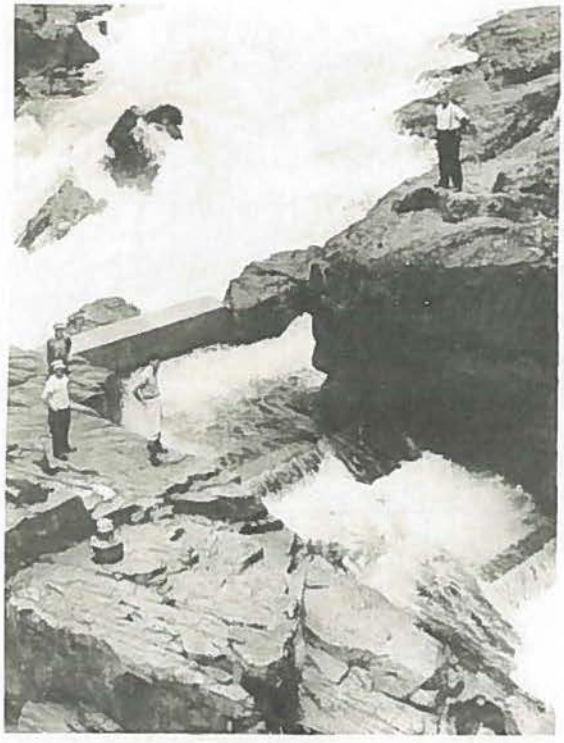
Important shrimp fisheries are located in Burrard Inlet, Howe Sound, Knight Inlet, Queen Charlotte Strait, and Masset Inlet.

Shrimps are cooked fairly soon after capture, and the meat is removed from the shells. The shells are processed for use as fertilizer or animal feed. Until recent years a small amount of shrimp meat was canned. At the present time the entire catch is marketed fresh or frozen.

FISHERIES FACT SHEETS

Subject: CONSERVATION MEASURES

The fisheries should be regarded as annual crops and developed and reaped in much the same way as land crops to give the greatest continuous return to the largest number without jeopardizing future production. Therefore conservation in respect to the fisheries, a renewable natural resource, means the kind of control and management that will permit man to make the maximum exploitation in perpetuity.



Salmon Ladder
(Stamp Falls, B.C.)

Protective measures are embodied in the Fisheries Act and Fishery Regulations and are enforced by a protective service which includes wardens, inspectors and supervisors who carry on patrols on land, on water, and to some extent from the air, to prevent undue exploitation and illegal fishing.

Minimum size limits are enforced to prevent young fish from being caught until they have reached an age or a size where the majority may reproduce their kind at least once. Bag limits enable the fishermen to take a reasonable number of fish per day but require them to leave some for the next fisherman. Seasonal catch limits or quotas restrict the total quantity of fish that may be taken lawfully from a body of water during the year on the assumption that the catch should not exceed the natural increase for the same period.

Closed Seasons, Annual or Extended

Annual closed seasons are the periods during each year, when no individuals of a species designated may be taken legally. They usually cover the period when fish are congregating on their spawning beds, as well as their spawning season. Protection during this period is of the utmost importance, because not only are the fish more readily taken than at other seasons but all the eggs (which are potentially young fish) that they might have laid, would be lost after the fish had passed all the hazards, both natural and artificial. The fishery would thus be so much the poorer.

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Extended close seasons may cover a period of one or more years and are employed to build up a limited or partially depleted fishery or to permit non-native or introduced species to reach a size where most of them will have spawned at least once.

Protection of Escapement by Regulation of Nets, etc.

Boundaries within which fishing is not permitted may be established or extended, or fishing may be prohibited, should such action be necessary to permit fish to reach the spawning grounds in sufficient numbers to maintain the fishery. The regulation of escapement is based on analyses of catches of previous years and the general condition of the fishery. The size of the mesh of nets is regulated to permit small and immature fish to pass through until they reach legal size or the age at which the majority is likely to spawn at least once. Where conditions call for such action, fishing gear is placed so as to leave open a portion of the channel that the fish follow and thus permit a fair proportion to reach their spawning grounds.

The discharge or drainage from any source, - vessels, mines, factories, sawmills, etc., - into water frequented by fish in sufficient quantities to be injurious to fish life is prohibited by the Fishery Regulations. Some of these discharges are directly poisonous to fish, some cover the stream bed and destroy natural fish foods, some decompose and use up the dissolved oxygen in the water that is necessary to support fish life, while others cause mechanical injury to the fishes' gills.

Regulation of Screens, Obstructions, Fishways

The screening of inlets to irrigation ditches is required under the Regulations. Without such screens extremely heavy losses may sometimes be caused by fish following the ditches and being carried on to the irrigated lands. The screening of inlets leading to power plants is also required to prevent fish from being drawn into and destroyed in the turbines.

Many species of fish spend the greater portion of their life and attain their growth in lakes, the deeper portions of rivers or in the sea, while their most suitable spawning grounds or their only spawning grounds and the nurseries for their young are much further upstream, in streams tributary to lakes or in small headwater brooks. Log jams or accumulations of debris, waterfalls or power dams may prevent fish from reaching excellent spawning grounds and nurseries. Such conditions are remedied by removing or opening the jams, modifying or lessening the ascent at the falls to ease the passage, or by means of fishways that enable the fish to surmount falls or dams, thus increasing the productive area of the system to the extent to which suitable spawning grounds or nurseries are made accessible.

The use of explosives for killing fish is also prohibited. Dynamite and other explosives, besides being most "unsportsmanlike", destroy old and young alike and may cause great damage to the fisheries.

Pilchard oil production has always fluctuated sharply from year to year because of the instability of the pilchard catch. During 1946-47-48-49 negligible quantities of pilchard oil have been produced. The great expansion of herring oil production filled the market left vacant by pilchard oil.

Contrasting with the lack of growth in non-medicinal marine oil production is the great expansion in the vegetable oils industry during the war. The quantity of vegetable oils produced in Canada was multiplied eight times during the decade from 1938 to 1949. In addition to this increased domestic production, large quantities of vegetable oils have been imported from the United States. Thus the great expansion in the use of non-medicinal oils for foods and other products was served exclusively by the vegetable oils industry. The trend of vegetable oils production is of importance for the future of the Canadian marine oil industry because these two kinds of oil are substitutes for one another and therefore are in competition.

In the past, the principal users of marine oils in Canada have been the food industries, chiefly the producers of shortening. Whale oil is a very good raw material for shortening, being superior in some respects to the vegetable oils which are chief competitors. Whale oil can be used for all but the highly emulsified type of shortening which is designated for cake and pastry baking. A good margarine also can be made with the use of whale oil although only a negligible amount has as yet been employed for this purpose in Canada. Because of various factors which enter into the manufacture and marketing of food products of this type, it is necessary for marine oils such as whale oil to sell at a somewhat lower price than vegetable oils in order to be attractive to potential users. Food manufacturers would probably purchase marine oils at prices about 85 to 90 per cent of those of vegetable oils.

The only other product for which marine oils are used in substantial amounts is soap. The food industries and soap-making together accounted for 80 to 90 per cent of all marine oils consumed in Canada. In soap-making, marine oils compete principally with animal fats and a price differential is necessary to attract purchasers. The total production of soaps may be substantially reduced in the future, due to the competition of new synthetic detergents. Since marine oils do not contain the components necessary for this synthetic product, the market for marine oils may be substantially reduced by this innovation.

Marine oils are also used in small quantity in a number of other commodities such as chemicals, protective coatings, rubber, tanning, and textiles. Whether a larger potential market for Canadian marine oils exists in one or more of these industries is difficult to say. The marketing situation may warrant some investigation of these minor uses.

March 1950.

building spawning beds of gravel. Shelter for the young may be improved or provided by the introduction of aquatic vegetation or by rock and brush piles, logs or piles of stone. Some waters are not congenial or suitable for adult fish at certain seasons of the year on account of shallow water or lack of pools. Pools may be provided by logs placed across a stream, by deflecting, straight or V-shaped dams, thus providing suitable habitat during the warm weather low water periods of the summer, or during the low water period of the winter months. Natural food conditions in some instances may also be improved by the establishment of aquatic vegetation, which usually carries considerable insect life. Sometimes, food conditions for the newly-hatched fry are excellent, but there is a deficiency of suitable food in the shape of minnows for the larger fish. This deficiency may be remedied to some extent by the introduction of minnows to fill this break in the food chain.

Most bodies of water are capable of producing a certain poundage of fish each year. This crop may be in the form of a small number of large fish or a larger number of small fish. A large number of small fish may be due to an insufficiency of natural food to produce normal growth and might possibly be remedied to some extent by more intensive fishing.

Competitors for the available food supply or predatory fish may tend to keep the annual crop of desirable fish at a low level. In some instances this condition may be improved or remedied by reducing or removing the competitors and predators. Reduction of competitor and predator fish is a difficult matter and should only be undertaken with the advice of a competent fish cultural officer.

In some instances, much damage has been caused to streams and portions of lakes by the methods followed in lumbering operations which tend to cause: a quick run-off and lower water levels below the needs of the fish, severe freshets with destructive soil erosion, flooding, silting of spawning beds and scouring of stream bottoms, which lessens and may even prevent or destroy natural reproduction of the fish as well as the production of natural fish food organisms. Where conservative methods have been followed these damaging conditions have not been severe and in most instances conditions may be improved by reforestation involving the control of soil erosion and eventually the moderation of freshets of a serious nature.

Fish and Game Protective Associations and local organizations can be of the greatest assistance in maintaining the fisheries by good example, by discouraging illegalities and by co-operating closely with the Protective Service. In a few instances such organizations have engaged actively and successfully in fish cultural work, particularly in building, maintaining and operating ponds in which small fish or "fry" are retained and fed for several months before they are distributed in suitable waters.

July 1950.

FISHERIES FACT SHEETS

Subject: DOGFISH (Pacific)

Distribution and Importance

The Pacific dogfish (Squalus suckleyi) is found from southern California to northwestern Alaska. Of all the shark species caught in British Columbia waters the dogfish is by far the most important. It is important not as a food fish but as a source of vitamin A which is obtained from its liver. Once the livers have been removed, the carcasses are usually discarded at sea by the fishermen. Attempts to market the flesh of the dogfish as fresh or canned fish have proved unsuccessful. Some industrial companies have used the carcasses for reduction into oil, meal, and fertilizer but this operation has been practiced only where fishing occurs within a convenient distance from a reduction plant. Difficulties involving handling and processing techniques as well as the problem of maintaining a continuous supply of raw material has limited the success and profit in reducing carcasses.

Increased requirements for vitamin A during World War II brought about a very rapid growth of the dogfish liver industry and fishery. Landings of dogfish livers increased from 178,000 pounds valued at $10,702 in 1937 to a peak of 7,769,564 pounds valued at $2,661,573 in 1944. In 1944 a marketed value of $3,751,567 for the livers, liver oil, meal, and fertilizer placed the fishery third in importance in British Columbia and fifth in importance in all of Canada. It was exceeded only by the salmon, cod, herring and lobster fisheries.

The introduction of synthetic vitamin A and the importation of considerable quantities of vitamin liver products from Japan since 1949 has caused a decline in demand for British Columbia dogfish livers. The future of this branch of the industry is now somewhat uncertain.

Description

The dogfish is a small shark and like other sharks, it is characterized by a cartilaginous skeleton rather than a bony skeleton. Its

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mouth is situated on the under side of the head well behind the snout and its jaws are covered with many sharp teeth in several rows. Five pairs of gill openings (instead of one as in the so-called bony fishes), a spiracle close behind the eye, the absence of an anal fin, and the presence of two dorsal fins, each of which is preceded by a sharp stout spine, readily distinguish the dogfish from other sharks found in this area. In colour the dogfish is slate gray on the dorsal surface and dirty white on the ventral surface. White or yellowish spots are present on the sides of young dogfish.

Reproduction and Maturity of Dogfish

Dogfish give birth to living young. Mating time occurs during the months of November and December, usually after the female has given birth to her young. In the male, parts of the pelvic fins are modified to form claspers which make possible the fertilization of the eggs within the body of the female. The fertilized eggs, with much yolk (larger than the yolk in a chicken's egg), descend to the uterus and are found enclosed in a thin, light amber-coloured gelatinous or membranous capsule called a "candle". After a period of a few months this capsule or "candle" breaks down or is shed, leaving the young unattached within the uterus of the mother. While the embryos are growing, new ovarian eggs are developing to take their place. It is known that the gestation period, or the period of development of the young dogfish inside the mother, has a duration of two years. At birth the young are between 10 and 11 inches long. The number of young in a single litter may range from 2 to 17, but the most usual number is seven or eight.

Maturity in the males is attained at a length of 27 to 30 inches, and 31 to 36 inches in the female.

Age and Growth

The alternate dark and light rings on the second dorsal spine have been used in the age determination of the dogfish. Annulations on the spines of the dogfish are the result of periods of fast growth during the summer months (light rings), and periods of retarded growth during the winter months (dark rings). These annulations indicate that some dogfish may live to reach an age of about 30 years.

Male dogfish attain a length of 39 inches and a weight of about eight pounds. The females may reach a length of five feet but seldom

exceed a length of four feet and a weight of 20 pounds. The rate of growth of both sexes is between one and 1-1/2 inches each year.

Food

Dogfish are voracious in their food habits. They feed predominantly upon small fishes such as the pilchard, herring, anchovy, smelt, and flatfishes. Other items in their diet include small crabs, squid and brill or euphausiids (small shrimp-like crustaceans).

The predacious food habits of the dogfish have caused great concern in other fisheries in the past. At times bounties for its destruction have been recommended because of the damage to fishing gear and netted fish. This interference is especially noticeable in the salmon and herring fisheries.

Schooling Habits and Migration

Schools of immature dogfish usually contain about equal numbers of males and females. However, segregation of the sexes into separate schools seems to become a common occurrence once maturity is reached. Fishermen often find large schools travelling in the offshore waters. Their movements northward in summer and southward in winter in the waters off the coasts of California, Oregon, Washington, and British Columbia have been demonstrated by tagging experiments. The tagged fish are easily detected by fishermen recovering the marked dogfish in their catches at a later date. A distance of over 1200 miles has been recorded for one dogfish, which travelled from the eastern coast of the Queen Charlotte Islands southward to the waters off Santa Cruz, California, during the period from September, 1945 to March, 1946.

Fishing Methods

Three different types of fishing gear are utilized in catching dogfish in British Columbia. Otter trawls are used extensively in all inshore and offshore waters, but are limited to grounds where the type of bottom is suitable for trawling.

Dogfish are caught by long-line or hook and line gear operated by boats rigged specially for fishing dogfish. However, considerable

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Pacific Dogfish (cont'd.)

quantities are caught incidentaly by halibut and blackcod vessels. This type of gear is particularly effective over reefs, in swift tidal waters, in depths of 100 fathoms or more, close to shore, and in areas where other types of fishing gear cannot be employed.

Sunken gill nets have been employed successfully in Hecate Strait and off the west coast of Vancouver Island. The mesh size of the sunken gill nets is such that only the largest dogfish, those with highest vitamin A concentration in their livers, are caught, whereas the smaller individuals of no commercial value pass through the webbing.

FISHERIES FACT SHEETS

Subject: EULACHON

The eulachon fishery depends on a small fish of the smelt family and is one of the oldest fisheries in British Columbia. The fish has a great variety of names and there are fourteen ways of spelling eulachon. Candle fish is one other name. This name is used because the dried fish is so fat that it was used by the Indians as a source of light when threaded with a wick of rush pith or cedar bark.

Like the other smelts, the eulachon is a delicate fish. It has an adipose fin, and lines on the gill cover parallel to its exposed edge. The mouth is rather large. There is no fleshy flap above the pelvic fins, such as is found in the salmon family. While the fish are in salt water they have pointed teeth but these are lost at spawning time. The sexes become quite different during spawning migrations, when the males take on special breeding characteristics such as small rounded swellings on the head and thickening of the muscles in the body wall, making the whole fish quite rigid.

Eulachon
(Thaleichthys pacificus)

The eulachon reaches a length of about nine inches, but usually the fish taken in spawning runs in British Columbia are between seven and eight inches. Most spawning eulachons are completing their second or third year of life. Certainly very many and possibly all die after they have spawned.

Eulachon are found from northern California to the Bering Sea. They spawn in all the larger British Columbia mainland rivers and in some of the smaller streams. The runs in different rivers seem not to mix very much, but the fish must travel considerable distances away from the spawning rivers before returning to spawn, as eulachon are known to occur as much as one hundred miles from the closest spawning stream.

The spawning migration of eulachon is in the spring from March to May. At first and throughout most of the run, males predominate. Each female fish produces from 17,000 to 40,000 eggs, depending on her size. The eggs are deposited on the bottom of the main river and anchored there by a special mechanism. The mature egg, as it leaves the female, has a double skin whose two layers are attached over a small area. The inner layer is strong and becomes the permanent shell when the outer one ruptures and turns inside out. The parts of the broken skin which are exposed are very sticky and become anchored to the sand grains on the river bottom. When the young fish hatch they are about a quarter of an inch long and presumably drift quickly into salt water. Little is known of what happens to them in salt water. They are occasionally captured and are found to be feeding on so-called red feed (euphausiids).

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Issued by Information Services, Department of Fisheries, Ottawa

As the eulachon is regarded as being partly reserved for the use of Indians, the commercial fishery is limited now to the Fraser River where the fish are taken with drifting gill nets. The nets used are between 1 1/8" and 1 1/2" stretched-mesh measure. The catch is used fresh or smoked, and as food for fur-bearing animals. In recent years the catch has been about 30 tons. There is considerable natural fluctuation in the size of the run.

The most important use of eulachon is by the Indians, who have always placed a very high value on them and on the oil which can be obtained by reducing them by interesting variations of current reduction practices. Use was not restricted to coast Indians; the interior tribes used the so-called "grease trails" to travel to the coast in the spring to obtain a supply. Indians and others believe eulachon oil to have remarkable medicinal properties but these do not seem to be due to any of the recognized vitamins. Unlike most fish oils, eulachon grease is solid at ordinary temperatures.

During the spawning run and possibly at other times, eulachon are important food for birds, mammals, and other fish which congregate in great numbers in the rivers and around the river mouths. At other times they are eaten by spring salmon and fur seals, and possibly also by other species of commercial fish and mammals.

FISHERIES FACT SHEETS

Subject: FISH HATCHERIES

Fish hatcheries are establishments where fish eggs are hatched and where the young fish or "fry" are retained and fed for varying periods, sometimes for several seasons until they have been stripped of their eggs and milt for fish cultural purposes, or, until it is no longer economical to continue to do so because of lessened production.

Federal trout rearing ponds
Cardigan, P.E.I.

The term "Fish Hatchery" describes the buildings, ponds and equipment used in hatching fish eggs and rearing fish.

Fish culture in Canada is carried on in the interest of the more important freshwater and anadromous fishes such as Atlantic salmon and speckled trout in the East; whitefish, lake herring, salmon trout or lake trout, speckled trout, pickerel, bass and maskinonge in the Interior; and rainbow, Kamloops and cutthroat trout in the West.

Object of Fish Culture

Fish Culture interpreted in the broad sense in its relation to water crops is analogous to agriculture in its relation to land crops. The object of fish culture is to help conserve and maintain the fisheries against depletion, and, at the same time, enable them to be utilized to the fullest possible extent. It includes the stocking of suitable barren waters with desirable species of fish to make them productive, the replenishing of depleted streams and lakes and the encouraging and maintaining of fish life generally. It also includes stream management, building and maintaining fishways, removal of obstructions, fry salvage, control of depredations by birds, control of pollution, and fish predators, fertilization of waters, removal of undesirable fish through poisoning and testing and applying results of fishery research.

The adults or parent fish from which the eggs are obtained are captured in various ways depending upon the species, the topography of the country and the nature of the streams and lakes in which the fish are caught.

Issued by Information Services, Department of Fisheries, Ottawa

Obtaining the Eggs

Whitefish, pickerel and salmon trout are usually taken in pound-nets. A considerable portion of the parent Atlantic salmon are purchased from commercial fishermen who have caught them in pound-nets or trap-nets. Salmon which are secured in this way during the spring and early summer are held in ponds until they "ripen" and are stripped in October or November following. In some instances advantage is taken of existing barriers or dams and in other cases rivers are fenced and the fish are trapped by intercepting them on their way to the spawning grounds. Salmon caught in this way are usually near the spawning period and consequently they are not held in pens or ponds, until they "ripen", nearly as long as are salmon caught in the spring of the year. All Atlantic salmon that reproduce, whether they are caught during the spring or during the late summer or autumn months, spawn about the same time during the autumn. Kamloops, rainbow and cutthroat trout spawn in the spring of the year. Speckled trout spawn in the autumn and are sometimes caught in traps set in lakes or in streams, but most speckled trout eggs hatched by the federal Department of Fisheries, are obtained from adult fish that have been reared in ponds and maintained at the various hatcheries.

The eggs of all fish propagated by the Department are hatched in running water. Salmon and trout eggs are hatched in trays or baskets in troughs. The water is almost invariably obtained by gravity from running streams. It is piped into head troughs in the hatcheries. From there it flows by gravity into the individual hatching troughs. The quantity in all instances is controlled by valves and may be lessened or increased as may be required.

The eggs of whitefish, lake herring and pickerel are semi-buoyant as compared with salmon and trout eggs. Semi-buoyant, or lighter eggs, are hatched in jars. The water used is usually pumped from a lake into a large overhead tank in the hatchery. From the tank it is distributed by gravity and is carried in a regulated flow through a tube to the bottom of each jar. The water, in its upward flow from the bottom of the jar keeps up a gently boiling motion amongst the eggs. This motion carries the dead and infertile eggs, which are lighter than the good ones, to the tops of the jars from which they are readily removed.

Bass have not as yet been stripped successfully as have many other species. It is therefore the practice to place the proper number of pairs of adult bass in prepared ponds that are under control at all times and in which the proper number of prepared spawning beds or nests have been provided. The bass spawn on these prepared beds or nests. The adult bass keep the eggs clean and free from sediment and guard both the eggs and the fry from their enemies until the fry rise from the spawning beds and begin to disperse. The adult bass are then removed from the ponds and the young bass survive on natural or artificial food.

The stripping of fish and the fertilizing and handling of their eggs are comparatively simple operations but require the greatest care at all

stages. Stripping, or taking the eggs artificially, is done by exerting a gentle pressure of the hand on the abdomen of the female fish, which, if the fish is "ripe", causes the eggs to flow into a stripping pan that has been rinsed in clean unadulterated cold water. The male fish is stripped in the same way. The eggs from the female and the milt from the male fish are gently but thoroughly mixed as they are extruded. When the stripping pan contains a sufficient quantity of eggs and milt, thoroughly mixed, a little water is added, the contents of the pan gently but thoroughly stirred and allowed to stand a few minutes. More water is then added, the eggs gently stirred and the water poured off. This is repeated until all surplus milt is removed and the water comes away clear. The eggs in pans or in trays are then placed in running water in hardening tanks or in hatching troughs if they have been obtained near a hatchery. If running water is not available the eggs are kept in the pans or in the pails or tubs in a cool shaded place and the eggs which are covered with water are stirred gently at half hour intervals until they are packed in trays in cases for shipment or are transferred to a hatchery.

When fish eggs are first extruded or stripped they are soft to the touch. Fertilization takes place as soon as the milt comes in contact with them. On addition of water, absorption takes place until the eggs become quite firm to touch and are "water hardened".

Development of the Eggs

Fish eggs that are stripped or spawned during the autumn hatch during the following spring. From seven to twelve weeks after the eggs are stripped, depending upon the temperature of the water, the eyes of the fish appear as two black spots, followed by the outline of the back-bone. When the eyes are visible the eggs are in what is called the "eyed" stage. Fish eggs in the eyed stage are much less susceptible to injury from handling than they are during an earlier stage, and it is while they are eyed that long distance shipments of fish eggs are made between hatcheries.

For a short time after the egg hatches the young fish or "fry" obtains nourishment from the contents of the food sac that is attached to its abdomen. As the contents of this sac are absorbed the young fish begins to swim and takes other natural food present in the water or artificial food that is provided.

It is the practice of the Department to begin to feed fry when the food sac is slightly more than half absorbed. Up to the present, fresh beef liver ground or pulped to suit the size of the fish has been found to give the best general results with regard to growth, health and mortality. Experimental feeding of other foods and combinations of foods is carried on with a view to finding a ration that is more efficient and less expensive than liver. Some of these rations have given encouraging results but a certain amount of liver is essential.

Egg Distribution

A small portion of the annual output from the hatcheries operated by the Department is distributed as fry. A large portion is retained and fed

to the advanced fry, fingerling, yearling and older stages before being distributed.

When the fish are ready to plant out they are carefully transferred from the hatching troughs, tanks or ponds to distributing cans, barrels or tanks and conveyed to the lake or stream which is to be stocked, or in which the fish are to be distributed. When the point of distribution is reached the water in the container is gradually brought to the same temperature as the water of the lake or stream by adding water from the latter to the former, pouring off, and repeating the process until the water in the container is of the proper temperature. The fish are then distributed, a few only at each place and as widely as may be feasible, over all suitable areas of the lake or stream that is being stocked.

Fish Marking

For the purpose of gaining information regarding their growth, migrations and results that are being obtained some of the fish produced in hatcheries, or handled in connection with hatcheries, may be marked before being liberated. Fingerlings and small fish are marked by clipping or removing one or more of their fins. Such fish are bathed in a salt solution and retained at the hatchery for at least ten days before they are distributed.

Thirteen hatcheries, six rearing stations and six salmon retaining ponds are operated by the Department in New Brunswick, Nova Scotia and Prince Edward Island. Their locations and the species propagated in each are indicated in the annual reports of the federal Department of Fisheries. Hatcheries are operated also by the provinces of Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia and by the National Parks Bureau of the Federal Department of Resources and Development.

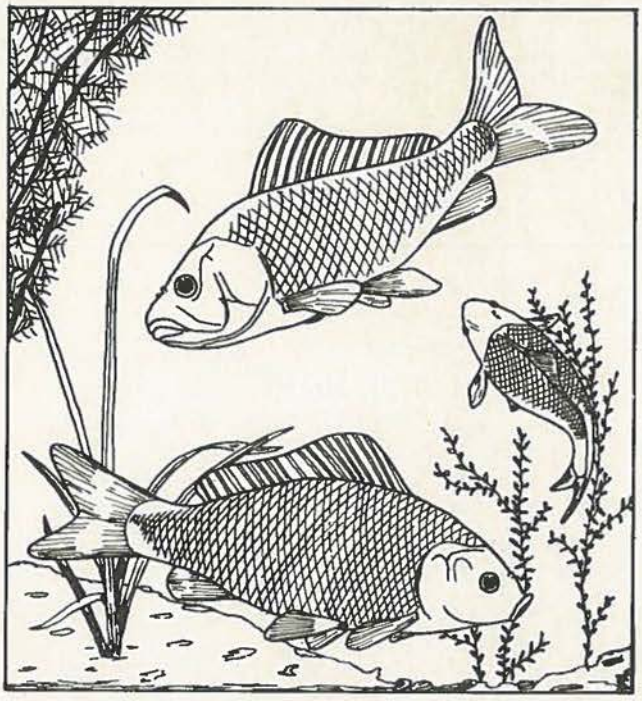
April, 1950.

Subject: GOLDFISH

The federal Department of Fisheries does not propagate goldfish, but as many requests are received for information in regard to the species, the following may be of interest to the beginner. Most of the data have been compiled from the following sources:

"Goldfish Varieties and Tropical Aquarium Fishes" by W.T. Innes; "Goldfish, Their Care in Small Aquaria and Ponds" by E.C. Fearnow.

Goldfish are members of the carp family. There are two root-stocks, the European goldfish, Carassius carassius, and the Asiatic, Carassius auratus. The Orientals, principally those of Korea, China and Japan must be given credit for first establishing by selective breeding, the goldfish as an ornamental pet, and for fixing fancy breeds.



Cleanliness, good light, plants well distributed over the bottom, proper food in moderate quantity, scavengers, prompt removal of sick fish, and avoidance of overstocking, are essential factors for the maintenance of a successful aquarium.

The common goldfish is a very hardy pet, and should live when properly taken care of from 10 to 20 years. In ponds their span of life is even longer, and if not subjected to severe winter conditions, should survive for 30 years or more. Fancy goldfish, however, seldom exceed twelve years of age.

Fancy Types

By careful selective breeding many fancy types have been developed. Some of these are known as - the Comet, the Shubunkin, the Fantail, the Japanese Fringetail, the Japanese Barnacled Goldfish, the Japanese Nymph, the Chinese Telescope, the Scaleless Veiltail Telescope, the Chinese Moor Telescope, the Chinese Celestial Telescope, the Lionhead or Buffalohead, the Oranda, the Chinese Eggfish and others. These fancy types are more delicate than the common goldfish, and require more care

and attention, but their added beauty fully recompenses for any extra effort required to raise them.

Their Care in Small Aquaria

The common goldfish is quite hardy and will live under conditions that would kill most other fishes. The main causes of failure in order of their importance are, - overcrowding, overfeeding, sudden temperature changes, lack of proper plant life and insufficient lighting.

Some fish fanciers give the rule - one inch of fish to one fallon of water. That is, in a 10-gallon aquarium of the usual oblong shape, well planted and in good light, it is permissible to retain ten one-inch fish or five two-inch fish or two five-inch fish.

Unless raising young stock, never feed more than will be consumed at once. If any food is left after five minutes, they have been overfed, and the surplus food should be removed with a dip-tube. When the water is at 60 degrees, or higher, it is permissible to feed daily. When it is 55 to 60 degrees, every other day is sufficient, and when it is 40 to 55 degrees, feeding separated by about three to six days will keep the fish in good condition.

Water from the city mains if chlorinated or otherwise treated should be used sparingly if at all. It is better to use river, pond or cistern water as these waters conform more nearly to natural conditions. Excessively hard water from whatever source is undesirable.

If it becomes necessary to change the water, do not subject the fish to any sudden change of temperature either higher or lower. This is one of the most frequent causes of sickness and eventual death. New water should be "ripened" before using by letting it stand at least an hour or two, but do not use galvanized iron or new wood receptacles for this purpose.

For the prevention of acid condition in the aquarium which is usually brought about by the decomposition of plants, a small piece of Plaster-of-Paris is recommended. Pieces of gypsum will perform the same function but more slowly. When snails are kept in the aquarium the Plaster-of-Paris or gypsum is necessary for their shell formation.

Water Temperature

The larger the water surface the higher the temperature the fish can stand. A general standard for summer would be 65 to 75 degrees and for winter 50 to 65. Temperatures slightly in excess of 85 degrees should not prove harmful if the water is well aerated. Newly hatched goldfish-fry under six weeks in age do well in temperatures of 75 to 85 degrees.

Because of its narrow neck the so-called fish globe is not well adapted to keeping goldfish in a comfortable and healthy state. Its small

amount of water surface does not permit sufficient oxygen to be absorbed. It is also objectionable because it reflects and refracts the light rays and tends to make the fish nervous and uneasy. An aquarium with straight sides is the most suitable for goldfish. It should be of rectangular shape and of equal width at top and bottom. The bottom should be covered with clean sand and gravel to a depth of about one ane one-half inches. If a globe 'must' be used, select one of the larger sizes; do not fill it over two thirds full of water, and do not overcrowd or overfeed. Be sure to establish growing plants.

When relations of plant life and animal life in an aquarium are properly proportioned the aquarium is said to be self-sustaining or 'balanced' and the water need seldom be changed - filling it to make up for what has evaporated is all that is necessary. Fish live by absorbing oxygen and they give off carbon dioxide as a waste product. Plants under the influence of daylight do the exact opposite so that what is poison to one is life to the other. It is therefore desirable to have suitable plants in your aquarium. The plants are benefited by the presence of the fish and the fish are helped by the presence of the plants.

Oxygen-Producing Plants

Different plants have varying powers of producing oxygen, and purely ornamental plants are desirable only after a sufficient quantity of oxygen-producers have been provided. In order of their oxygenating powers the following are named - Anacharis, Vallisneria, Sagittaria, Nitella, Herpestis, Fontinalis, Potamogeton and Ludwigia. Cabomba or Fanwort is a leading aquatic plant but does not live so well in the aquarium. It is brittle, and fish if active soon pick it to shreds. Myriophyllum at first looks well in an aquarium, but it deteriorates. Its finely divided leaves however are ideal for receiving the spawn of goldfish. Ceratophyllum or Hornwort is a poor aquarium plant as it is very brittle and liable to decompose.

Plants require daylight to do their work. Select for the aquarium a place close to a window with a good strong light, preferably one where it will get about two hours of direct sun a day. In hot weather be careful not to overheat a small aquarium in the sun. Too much light will overstimulate the growth of algae causing the water to turn green.

Food

Aquarium fish naturally desire a variety of foods and the nearer nature is approximated in this regard the better will be the results. Always keep in mind the necessary balance of vegetable, animal, and mineral content required. Most of the better foods are granular in form, usually of a dark color, and composed of dried insects, meat, fish roe, flour, codfish and other ingredients. Puppy biscuit when broken up and ground in a coffee mill to small sizes is said to be a good fish food.

A food used with considerable success is oatmeal prepared exactly as it comes to the breakfast table. For fish under 10 weeks old the oatmeal should be squeezed through cheesecloth to take out the kernels. Let the young fish have as much as they can eat all day, but let none remain over night. This does not apply to fish in their second year or over, although oatmeal in much smaller quantity is good for them also. Practically all fishes enjoy scrambled egg. Finely chopped lettuce leaves and boiled spinach chopped fine, may be used. In feeding dried granular food, use small sizes as water may cause the grains to swell considerably. Dried mussel flesh in powdered form is said to be good. Chopped earthworms, meal worms or daphnia may be fed; also infusoria, mosquito larvae, cyclops, cypris, blood worms, tubifex worms, gammarus, enchytrae and flies. Fish as a rule do better on living foods than on an artificially prepared diet.

Breeding and Spawning

The chief indications of a male fish in the breeding season (January to August) are the small tubercles appearing on the gill plates and sometimes on the first ray of the pectoral fins. The female is usually shorter and fuller of body, particularly when carrying spawn. Early in the year the male may be distinguished from the female by the fact that he chases her around the aquarium. This, however, is not an infallible sign of sex as males sometimes chase each other.

Goldfish begin breeding in their second year, and while they may continue to reproduce for six or seven years, they yield the maximum number of eggs in their third and fourth years. As spawning time approaches, fish should be well fed on nourishing food, such as finely chopped earthworms or live daphnia. Scrambled egg alternating every other day with regular fish food, is a fair substitute for live food at this time. When the breeders have been selected they should be placed together by themselves. Two or three males to one female will insure a higher percentage of fertilized eggs than if only one male is used. Papier mache or seasoned wood tubs may be used for the spawners. Goldfish deposit their eggs preferably on floating aquatic plants, and these should be provided (first making sure they contain no snails or other enemies of fish eggs). The best plants for spawners are water hyacinths and bunches of myriophyllum. The eggs are of a mucilaginous character and adhere where they touch. They are about 1-16th of an inch in diameter and are at first of a pale amber hue, becoming still paler and more difficult to see on the second and third days. The infertile eggs turn white on the second day, and soon become the centre of a ball of fungus. A complete spawning of a medium sized female runs from 500 to 1,000 eggs. As the plants become covered with eggs they should be removed from time to time, allowing a few minutes for the last deposit to become fertilized. These plants may be transferred to large enamel receptacles containing clean water of the same temperature as the breeding tank or tub. If more convenient the fish may be removed after spawning to allow the eggs to hatch as they have fallen. Some females eat their own spawn, so eggs and fish must be separated. Snails should not be present as they will

eat the eggs. However, after the eggs have hatched, snails should be used to eat the infertile ones. Eggs will hatch in from four to 14 days depending on the temperature of the water. The yolk sac will be absorbed in about three days, and the little fish will need some food. The first natural food is a large variety of microscopic animals known under the gneral head of infusoria. These are present in all exposed water which has stood a few days. Dried and powdered lettuce, duckweed leaves or pea flour sprinkled thickly on water will produce them in a few days if kept in a warm place and a subdued light; also a quantity of hay over which boiling water is poured will soon produce the creatures. After the culture is apparent and the fish swimming freely, occasional dips of culture water should be put in with the young fry. This sort of food should be used for about 10 days or two weeks. After the fry have noticeably increased in size they should be fed young daphnia which have been screened through a fine wire tea strainer. As size increases, feed full sized daphnia. If it is not possible to secure living food, the young fry may be started on rice flour, yellow of eggs forced through bolting cloth or fish food reduced to a powder, and sifted through cheesecloth. As they increase in size an excellent food is the paste from boiled oatmeal after straining through muslin or cheesecloth. Scrambled eggs with a little cream of wheat or cream of barley cooked in it makes one of the best substitutes for live food after the fry are six weeks old. Young fish should be fed liberally. It is better to feed several times daily than to put in a whole day's supply at one time. As the fish grow they should be sorted into sizes and kept separate. Do not overcrowd your fish - a growing fish requires plenty of water. - Small fry should be dipped out with a spoon and never poured as rough handling will kill them.

Treatment of Diseases

Fish are subject to diseases. If a fish is out of condition it is usually shown by listless movements, loss of appetite, dropping dorsal fin (when the fish is in the habit of holding it erect) congested or frayed fins, white slime on body, and bubbles in the excrement. Affected fish should be immediately removed from the rest, as the disease may be contagious. The most common treatment of diseased fish is the salt bath. The best medicine is real sea water properly diluted. The next best is Turk's Island salt. When the fish show a tendency to constipation one-quarter of the salt content may be Epsom salts. If neither sea water nor Turk's Island salt are available, then ordinary table salt may be used in the proportion of two heaping teaspoonfuls to each gallon of water. In placing the patient in the medicated water see that there is no considerable change in temperature. Aquarium fishes can live indefinitely in the solution described but it is well to give them a new solution daily. If the sick fish does not show signs of improvement in four days, gradually increase the strength of salt solution for two or three days until four heaping teaspoonfuls are used to each gallon of water. After remaining in this for two days the salt proportion is slowly weakened down again to the first formula. This salt treatment is the

simplest and is the one usually used for goldfish diseases. Some of the common ailments of goldfish are fin congestion, white fungus, black fungus, itch, gill congestion, constipation, consumption, dropsy, swimming bladder trouble and eye inflammation. Parasites may also infect them. The most common are leeches, lice, flukes and ichthyophthirius.

Enemies

The following are enemies of aquarium fishes and should be guarded against - water tiger, which is the larva of the predaceous diving beetle; the spearmouth, which is the larva of the large water scavenger beetle; dragon fly larvae; giant water bug; water scorpion; whirligig beetle and larva; water strider; mites; hydra.

Scavengers are desirable in an aquarium as they remove harmful offal and decomposition. The following snails are excellent - the large Japanese snail (Viviparus malleatus), the so-called African paper-shelled snail (Lymnaea auricularia), the Ramshorn snail (Planorbis) and the Pond snail (Physa). These are all active in eating vegetable growth from the glass or particles of food which the fish have not taken. Another scavenger is the freshwater mussel. It helps to keep down the vegetable growth which causes aquarium water to turn green.

Two fishes that are scavengers are the weatherfish and the Saccobranchus fossilis. Both of these are harmless to other fish, but should not be used when over five inches long as they stir up the water too much.

Cleaning the Aquarium

The glass in an aquarium may be quickly cleaned by scraping with a safety razor blade. Water absorbs most gases and fumes readily. This applies to coal gas and heavy tobacco smoke, neither of which is good for the fish. If fish persist in coming to the top and gasping air it is usually a sign that they are overcrowded or that the water has become bad from some kind of decomposition. The trouble should be quickly found and remedied. A partial change of water or the removal of some of the fish will usually improve matters. Sometimes the condition is produced by a dead snail or mussel or from the decomposition of uneaten food.

Goldfish must be handled gently and as little as possible to avoid injury to their scales, fins and tails. In lifting fish a dip net should be used. If it can be avoided fish should not be grasped with the hands, but if the hands 'must' be used they should be wet before touching the fish.

If the family cat develops the habit of "fishing" for your goldfish or if the fish jump out of the aquarium, a fine mesh screen may be fitted over the top of the receptacle to discourage these habits - a tight air proof cover however should not be used, as a free circulation of air is quite necessary for the fish.

March, 1950.

FISHERIES FACT SHEETS

Subject: GRAY COD

Distribution and Importance

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. In 1951 the total catch exceeded five million pounds and dominated other groundfish species for the first time in the history of the trawl fishery. The total catch by Canadian and Washington vessels off the British Columbia coast exceeded ten million pounds in 1951.

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, like those of flatfish species 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 thirty to fifty fathoms.

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Gray cod (cont'd.)

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

Age and Growth

The gray cod grows very rapidly, reaching a length of 22 inches by the end of its third year. The average age in the commercial catches is four or five years but some fish may reach an age of ten years and a length of close to three feet. Maturity is reached in three or four 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.

Handling

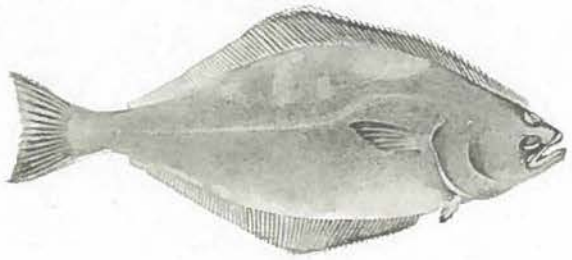
In the years following World War II there has been an increasing demand for gray cod. Most of the catch is landed dressed. It is then filletted and packaged for freezing. The remainder is sold on the fresh fish market or smoked for sale under the erroneous title of "finnan haddie" (there are no haddock in Pacific coast waters).

FISHERIES FACT SHEETS

Subject: HALIBUT (Atlantic)

Distribution and Importance

The halibut is found on both the Atlantic and Pacific coasts of Canada. It is also common in the northern seas of Europe and around Iceland and Greenland. The Atlantic halibut (Hippoglossus hippoglossus) is caught off the coasts of Nova Scotia, and in the Gulf of St. Lawrence as well as on the offshore banks. Nova Scotia contributes the major portion of the Atlantic halibut landings. Quebec fishermen take a considerable number from the Gulf of St. Lawrence. The total eastern catch, however, only makes up about 11.4 per cent of Canada's annual landings and is principally a by-product of the more important cod and haddock fisheries.



Halibut (Atlantic)
(Hippoglossus hippoglossus)

Description

This most important of all Canadian flatfishes is very readily recognized from all the others by its large mouth which gapes back as far as the eyes, a forked tail and a lateral line along the side which is quite arched. Not only is this flatfish the most valuable one, but it is also the largest, reaching a weight sometimes of 600 to 700 lbs. It is exceeded in size only by some of the sharks, tuna and swordfish. The Greenland halibut occurs commonly in the more northern waters and may be distinguished from the common halibut by its straight lateral line along the side.

While many of the large fish, and almost all of the small ones are usually white on the blind or lower side, quite a number of the large halibut are more or less blotched with gray. These are called "grays" by the trade and are not as valuable a fish. In many cases, too, the blind side is suffused with red and then the fish are called "cherries" or "cherry bellies".

Habits and Movements

Like the Pacific halibut, the mature East Coast halibut are bottom dwellers which migrate extensively to and from the spawning grounds. When immature, the halibut moves in a very restricted area. The eggs are heavier than the surface sea water and lighter than the deep water, so they float about at intermediate levels, though at a greater depth than the eggs. As the young halibut develop, they rise toward the surface and drift inshore. When six or seven months old, they settle on the bottom where they spend most of their lives.

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Atlantic halibut (Cont'd.)

Food

Although groundfish, the halibut occasionally rise to the surface in quest of food. They are exceedingly voracious and active, and prey on other fish. Their food consists of fishes, crabs, clams, squid, worms, etc.

Spawning

Like the Pacific halibut, the Atlantic spawn at about 10 years of age. At that time a female halibut weighing 200 pounds will produce over 2,000,000 eggs. On the Atlantic coast the main spawning season is in the winter and spring, although on both coasts spawners may sometimes be found during a longer period. Spawning usually takes place in well defined areas not exceeding a depth of 225 fathoms.

Growth

Since the eggs are heavier than the surface sea water and lighter than the deep water, they float at about intermediate levels of the ocean. The newly hatched larvae also live at intermediate depths, though at rather lower levels than the eggs. As development proceeds they drift into shallower water near shore. Like many flatfish, the young halibut is born in an upright position, with eyes on each side of its head, and is of uniform colour on both sides. It then 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 of the head. Also the right or upper side of the body becomes a marbled slate brown. The lower side remains grayish-white. By early spring transformation is complete, and the young fish settle to the bottom on sandy bays and inshore banks. The female halibut grows to large size, sometimes weighing several hundred pounds, and, in exceptional cases, 600 or 700 pounds. Males rarely exceed 30 pounds in weight, or more than 25 years of age. The female, on the other hand, may attain an age of 35 years or more.

Fishing Areas and The Fishery

With the growth of the "fresh" and frozen fish trade during the war years, species other than cod, which formerly was the chief catch, have been more in demand from Newfoundland. The halibut fishery there is conducted chiefly from Port-aux-Basques, and the fish are also caught both off the south and west Newfoundland coasts. The fishery is generally a mixed one, but some special trips for halibut may also be made.

In some years, very few halibut are caught out of Halifax and Lunenburg. In other years a few or many fishermen make good catches on such well recognized grounds as the Grand Bank, Green Bank and Banquereau. Various grounds in the Gulf of St. Lawrence (off St. Paul's island, off Bay of Islands and even off Anticosti in the northern part of the Gulf), yield good catches of halibut in certain seasons. On occasion, too, some Lunenburg vessels have fished halibut off Labrador and Greenland. However, trips to these more remote grounds for halibut are infrequent.

The halibut landed from inshore waters on the East Coast are almost all obtained, the Cape Sable autumn fishery excepted, during the

Atlantic halibut (Cont'd.)

prosecution of the "ground fishery" (cod, haddock and hake), by trawl line in the vicinity of ports handling "fresh fish". Those landed from offshore are taken in both line trawling and drag trawling. The "halibut hooks" used are quite large and heavy and may have either an "eyed" or flat-tipped shank.

As with cod and haddock, commerce has graded halibut into different weights and prices, since some are of a more desirable size than others for certain types of trade. While the names used to designate the various sizes are fairly uniform from district to district ("snapper" always is a smaller fish than "large gray"), the weight range for any one grade may vary considerably from place to place ("Chicken" in one place may be a fish weighing from six to 10 lbs, while in another it may be from five to 50 lbs). Among the large fish companies there is more uniformity, and the series which follows gives a general picture of the "cull" used by the trade in handling halibut.

Snapper	up to 6 or 8 lbs	Medium	40 - 70-80 lbs
Chicken	6 to 10 or 15 lbs	Large Med.	70 -- 125 or 140 lbs
Small Medium	12 to 40 or 45 lbs	Whale	over 125 lbs

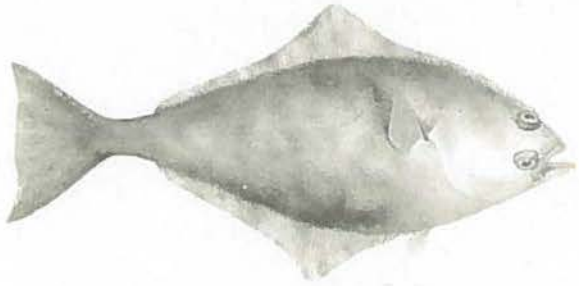
The yearly average marketed value of the Canadian Atlantic halibut fishery is about $500,000.

FISHERIES FACT SHEETS

Subject: HALIBUT (Pacific)

Distribution and Importance

The halibut ranks as Canada's seventh most important food fish and is found on both coasts of the Dominion. The Pacific halibut is distinguished from the Atlantic 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 Aleutian Islands. The principal fishery, however, is centered in the waters off northern British Columbia and in the Gulf of Alaska. Of the 7,000 to 10,000 tons annually caught 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 nearly $5,000,000 annually.



Halibut (Pacific)
(Hippoglossus stenolepis)

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.

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Pacific halibut (Cont'd.)

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.

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 enter 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 a few inches 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, be over eight feet in length and 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 west 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 Pacific halibut fishery is regulated by a commission made up 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

Pacific halibut (Cont'd.)

fathoms. Frozen herring is usually used for 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 "culls" are used to ensure uniformity in the commercial handling of halibut:

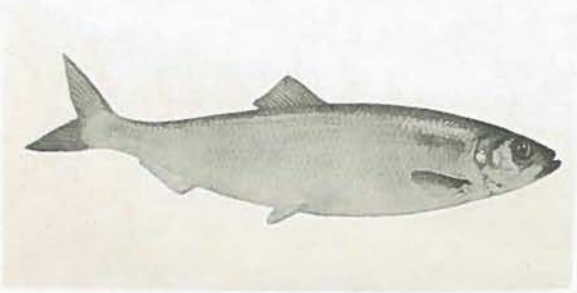
Chicken	5 - 10 lbs	Large Medium	40 - 60 lbs
Small Medium	10 - 40 lbs	Large	60 - 125 lbs
	Whales 125 and over.		

About 88.6 per cent of Canadian halibut is marketed fresh or frozen. The yearly marketed average value for British Columbia is $1,187,469 for fresh halibut, and $2,698,830 for frozen. The West Coast is responsible for all Canadian halibut marketed as fresh and frozen fillets, steaks, viscera oil, offal oil and offal meal. British Columbia is also credited with the production of 69.4 per cent of Canadian fresh halibut and 99.1 per cent of the frozen product.

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, 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.



Atlantic or Sea Herring
(Clupea harengus)

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

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 Gaspe 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 10½ 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.

Source: Fisheries Research Board,
Atlantic Biological Station,
St. Andrews, N.B.
January 1950.

Subject: 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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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.

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.

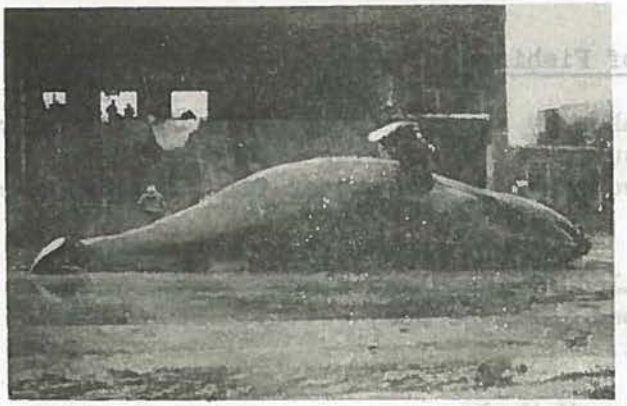
The dressed herring are then packed carefully by hand into cans which are then placed bottom up on wire mesh screens. Still unsealed, they are passed into steam retorts to be partially cooked. In this cooking process the excess moisture and oil is drained from the inverted cans of fish through the wire 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.

Subject:
HUMPBACK WHALE

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 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 last from five to 20 minutes although the humpback has been known to stay under for periods lasting as long as 40 minutes.



Humpback Whale

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 alongside 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 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.

FISHERIES FACT SHEETS

Subject: 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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Issued by Information Services, Department of Fisheries, Ottawa

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 and sent to market in the form of frozen fillets. Drying and smoking are the methods used when the fresh fish are being preserved for future use locally.

Subject: INTERNATIONAL AGREEMENTS

Many of the grounds fished by Canadians are also frequented by fishermen from other nations particularly from the United States. This problem and others such as the migration of fish between Canadian waters and those outside the jurisdiction of the Government of Canada, are the subjects of international agreements.

Since 1933, under the modus vivendi which grew out of an unratified treaty of 1888, licences have been issued to United States fishing vessels permitting entry to Canadian Atlantic ports for purchases of bait and other supplies. Reciprocal privileges have also been extended on the Pacific Coast to United States vessels fishing for halibut. Canadian fishing vessels have been granted permission in United States and Alaskan ports. In 1950 these privileges were placed on a continuing basis by the Pacific Coast Port Privileges Treaty, which did away with the need for special annual legislation. Previous to 1950 Canadian halibut vessels received reciprocal privileges only in Alaskan ports. The privileges granted by Canada include permission to tranship catches, buy bait, ship crews, etc.

Halibut and Salmon Agreements

Two international Commissions, the membership and cost of which are shared equally between Canada and the United States, have been set up on the Pacific Coast to deal with the halibut and the Fraser River sockeye salmon fisheries, respectively. Investigations carried out under the Commissions' auspices, subsequent regulation and limitation of catches and, in the case of salmon, the construction of fishways, appear to have been successful in arresting and reversing an earlier trend towards depletion of these fisheries. Another case of restoring a depleted marine resource by international agreement and action is that of the Pacific fur seals. The provisions of a quadripartite Agreement of 1911 between Canada, the United States, Russia and Japan continue to apply by virtue of a provisional Canadian-United States Agreement although the original treaty lapsed after being abrogated by Japan in 1941.

A step towards international action in the investigation and conservation of the fisheries in the Northwest Atlantic was taken by the Governments of Canada, the United States, and eight interested European countries that signed an

International Convention for this area in February, 1949. The Convention came into force in 1950 when Canada was the fourth signatory power to ratify the Treaty.

An International Commission and panels for specified sub-areas have been established which, on the basis of scientific investigations, may make proposals to the interested governments for joint regulations of the fisheries in the interest of optimum conservation of the stocks of fish.

A convention, signed in April, 1946, by Canada and the United States, not yet ratified, provides for the establishment of a Joint Commission to develop a comprehensive plan for the effective management and maintenance of the fisheries resources in the Great Lakes, connected waters, and part of the St. Lawrence River.

Member of Whaling Convention

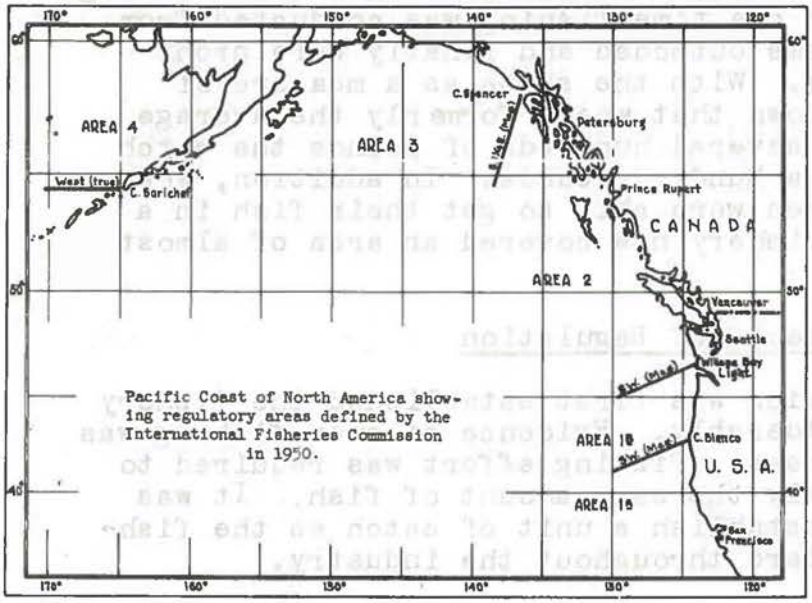
Canada is one of the 15 countries which are parties to the 1946 International Convention for the Regulation of Whaling which governs in some detail the conduct of whaling by fishermen of all the participating countries.

The Permanent International Council for the Exploration of the Sea, established in 1902, to which Canada sends an observer, co-ordinates oceanographic and fishery biological investigations conducted by its members in the Eastern North Atlantic, the North Sea and the Baltic Sea.

The most comprehensive of the international organizations having to do with fisheries is the Food and Agriculture Organization of the United Nations (FAO). In the field of fisheries, at present the FAO concerns itself primarily with the collection, analysis, interpretation, discussion and dissemination of information. This involves statistics (including statistical standards), information on fish resources, cultural and fishing methods, and technological information. The FAO Fisheries Division also organizes studies of economic conditions relating to certain fish commodities that have been suffering from chronic difficulties, assists in the organization of regional research projects, and is doing preparatory work on international commodity standards.

Subject: INTERNATIONAL (HALIBUT) FISHERIES COMMISSION

The International Fisheries Commission regulating the halibut fishery of the North American side of the Pacific Ocean was established in 1923 by treaty between Canada and the United States. It consists of four commissioners--- two from each country. The commissioners serve without salary while the expenses of administration and investigation are divided between the two countries.



Pacific Coast of North America showing regulatory areas defined by the International Fisheries Commission in 1950.

Its original purpose was to eliminate fishing during the halibut spawning season from November to February and to undertake an intensive investigation into the life history of the halibut. As a result of the recommendations of the Commission, a new treaty was concluded in 1930 which set up regulatory power to rebuild the fishery. Included in the Commission's responsibilities was the power to set a catch limit for halibut in any area along the coast.

Historical Background

The year 1888 marked the beginning of the commercial halibut fishery on the West Coast. The completion that year of transcontinental railroads opened eastern markets, especially Boston, to Pacific halibut. From a catch of 1,500,000 pounds in that year the take increased steadily until 1908. Approximately 50,000,000 pounds annually were taken from then on.

To achieve this production the industry had to use more efficient equipment with bigger and stronger ships. Diesel engines reduced costs considerably so that it was possible to make distant fishing a profitable operation. Even with the increased fishing effort there were fluctuations of millions of pounds from year to year.

Owing to the character of halibut which live along the ocean bed and because of the uneven bottom of the fishing

Halibut Commission (Cont'd)

grounds, ground lines are most effective for halibut fishing. The unit of gear, which is the amount of gear that can be easily operated by one fisherman, is known as a "skate". It consists of six fairly heavy ground lines each about 50 fathoms long and to each of which, at 13-foot intervals, five-foot lines are attached which carry a single hook at the end. At one time fishing was conducted from dories but they became outmoded and finally were prohibited in the fishery. With the skate as a measure of efficiency it was shown that where formerly the average catch per skate was several hundreds of pounds the catch had fallen to under a hundred pounds. In addition, where formerly the fishermen were able to get their fish in a 600 mile area, the fishery now covered an area of almost 1,800 miles.

Effects of Regulation

When the Commission was first established the fishery had fallen off considerably. Evidence of over-fishing was apparent. A much greater fishing effort was required to bring in approximately the same amount of fish. It was relatively easy to establish a unit of catch as the fishing method was standard throughout the industry.

Since its inception the Commission has regulated the areas to be fished, changing the quota for each area as seemed advisable at the time. It established nursery areas where fishing was completely prohibited. It set a quota for the entire fishery which at present averages about 54,000,000 pounds. It does not interfere with the rate of fishing.

Summary

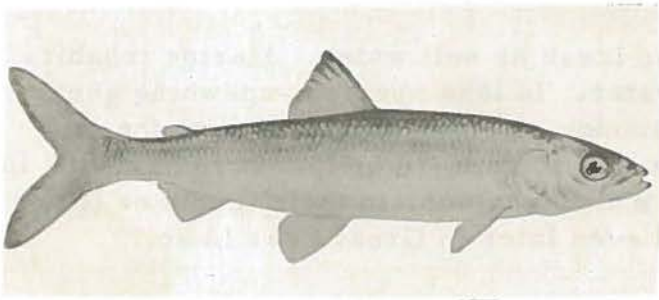
The International Fisheries Commission seems to be successfully achieving its purpose -- the gradual rebuilding of the halibut supply to a higher level of productivity. The Commission's achievements have shown what can be accomplished when two countries co-operate fully to reach a common goal.

The question of port privileges has been a consideration since the Commission was first established. Formerly the two Governments had to pass enabling legislation each year to renew the agreement. However, in March 1950 an international convention was signed allowing reciprocal port privileges for halibut fishing vessels on the West Coast. Instruments of ratification were exchanged later in 1950 and brought the Convention into force. As a result Canadian and U.S. halibut fishermen are assured of yearly reciprocal privileges in the landing of catches for trans-shipment, and obtaining supplies, repairs and equipment.

Subject: 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, 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.



Lake Herring, Cisco or Tullibee
(Leucichthys Spp.)

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. johnannae, 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.

FISHERIES FACT SHEETS

Subject: 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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Issued by Information Services, Department of Fisheries, Ottawa

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.

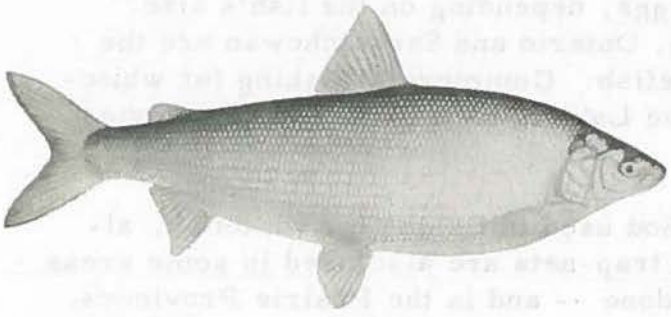
In Great Slave lake the lake trout mature when about eight years old, when they weigh about $2\frac{1}{2}$ pounds and are about 18 inches long. There is a tremendous difference in growth rate, some fish are four times as heavy as others at the same age.

FISHERIES FACT SHEETS

Subject: LAKE WHITEFISH
(Coregonus clupeaformis)

Distribution and Importance

Half a dozen or so varieties of whitefish have been recorded from Canadian inland waters but the common whitefish or Lake whitefish is the only one of commercial importance in Canada's fisheries. It is found in Manitoba, Ontario and Saskatchewan. Large landings are also made from Alberta waters and from Great Slave Lake, N.W.T. Some catches are taken by the fishermen of Quebec, New Brunswick and the Yukon Territory. The whitefish belongs to the family Coregonidae sub-order Salmonoidea and thus is related to Atlantic and Pacific salmon, speckled and rainbow trout, tullibee, criscoes or Lake herring, and several other fish.



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 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 averages 18 inches in length and weighs three or four pounds, though specimens quite a bit larger than that are not uncommon.

Feeding and Breeding Habits

The whitefish lives upon minute mollusks and crustaceans and other small aquatic creatures. Its summer habitat is in the deeper, colder

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Lake Whitefish (Cont'd.)

parts of the lakes, from which they move into more shallow water at spawning time. The spawning time varies somewhat in different years depending on the conditions of the weather and also with respect to the locality. Spawning begins in the latter part of October and continues into the first week of December. In Great Slave Lake it may continue until spring.

Whitefish reach maturity in the third and fourth year. They mature in the eighth year in more northerly lakes. A fullgrown individual deposits from 10,000 to 75,000 eggs, depending on the fish's size. Northwest Territories, Manitoba, Ontario and Saskatchewan are the main Canadian producers of whitefish. Commercial fishing for whitefish was undertaken at Great Slave Lake in the Northwest Territories for the first time in 1945.

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.

Subject: 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 to 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 ap-

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Lingcod (cont'd.)

parently 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" of rock or gravel.

Lingcod reach large size. The largest specimen recorded is 70 pounds but the rather frequent occurrence of 50- and 60- pounders in commercial catches makes it seem probable that the 70-pound weight is occasionally exceeded. Maximum 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, hand lines, trolls, trawls, long lines, and sunken gill nets authorized for taking dogfish. These gill nets are very effective in taking lingcod on some grounds but their use is now prohibited in the Strait of Georgia area.

The characteristic method of fishing for lingcod is hand lining or jigging with live bait. It 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 slaughter and 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

Lingcod (cont'd.)

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 themain 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 fishermen. 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.

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 the 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 80 per cent of the second most important fishery, which is off the west coast of

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Lingcod (cont'd.)

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.

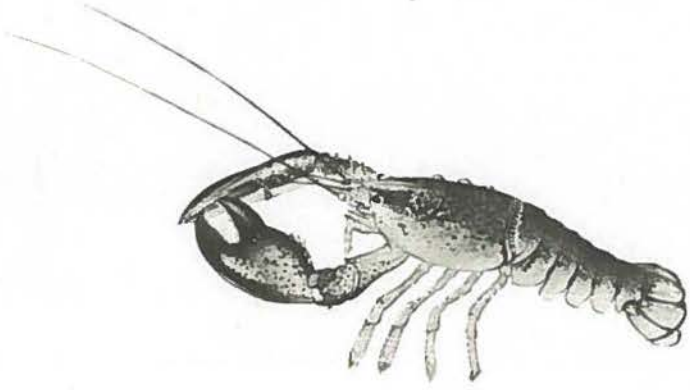
Lingcod is marketed either fresh or frozen, and may be whole or filleted. In 1946 the marketed product was divided as follows: fresh, whole 56 per cent, fillets 3 per cent; frozen, whole 27 per cent, fillets 14 per cent. In addition to the flesh, the liver is a valuable product of the fishery because of the extremely high content of vitamin A in its oil. The other viscera also have vitamin A value and are retained for sale.

The value of the lingcod fishery has fluctuated rather widely because of changes in volume and price. In two years, 1944 and 1945, the total value of lingcod products has exceeded one million dollars. In 1947 the value dropped below half a million. During the eight years following 1941, between one-quarter and one-third of the annual value of the lingcod fishery was represented by the livers and viscera.

Subject : LOBSTER

Distribution and Importance

The American lobster with the scientific name Homarus americanus is found only on the eastern coast of North America. Here it is recorded from about 15 miles north of the Strait of Belle Isle in the north to the coast of North Carolina in the south. It is most abundant in Maine, in the Maritime provinces and on the south and west coasts of Newfoundland. The great bulk of the lobster population lives at depths of from one to 20 fathoms or less. Although lobsters are taken in commercial quantities all along the Canadian Atlantic coastline the areas of major production are located in Northumberland Strait, in the Gulf of St. Lawrence and off the coast of Yarmouth and Shelburne counties in Nova Scotia. In 1945, exclusive of Newfoundland, more than 37 million pounds of lobsters were caught in Canada with a marketed value of $14 million. In Newfoundland waters the annual production varies from two million to five million pounds. The demand for this delicious seafood has been consistently high and has, as a result, provided a reliable income to thousands of Maritime fishermen.



American Lobster
Homarus americanus

Description

Aside from minor details, the lobster is very much like its freshwater relative, the crayfish. The upper part of the body is covered by a hard shell, or carapace, which has a free edge on each side projecting down to cover the gills. Nineteen pairs of appendages project from the under surface of the body. These are: the small feelers which are continually whipping the water and in which the sense of smell resides; the long feelers concerned with touch; the hard jaws on each side of the mouth which grind up the food; the five pairs of mouth parts serving to hold the food; the pair of large claws for capturing food; the four pairs of walking legs; the five pairs of swimmerets, one pair projecting from each segment of the tail, and the last segment of the tail which has the tail fan with a central portion called the telson.

The colour of the adult varies from greenish-blue to reddish-brown. Generally the upper surface of the body is speckled with greenish-black spots. Contrary to popular opinion its shell is red only after boiling.

The large claws of these crustaceans are usually different, a heavy crusher claw and a lighter biting claw or "quick" claw, the latter so-called because the lobster is much quicker in reaching out and snapping with this claw. In both the males and females about 50 per cent have crusher claws on either the right or the left side. Sometimes both claws are biting claws and occasionally, though more rarely, both are crusher claws.

Habits and Movements

The adult lives and feeds on the bottom of the sea. By means of its tail fan, its swimmerets and its walking legs, it can move rapidly from place to place. However, numerous tagging experiments have shown that populations are essentially local, migration being limited to random movements along shore. The lobster shuns the light and in shallow water spends the daylight hours hidden in holes among the rocks or in other shady spots.

Food and Feeding

The lobster is a great scavenger and lives chiefly on fish, dead or alive, and on the invertebrates which inhabit the bottom. In very cold water, just above freezing point, very little if any feeding occurs. As the water warms up during the spring and summer months, feeding increases. All the fixed or slow-moving animals on the bottom such as shellfish like the mussels or clams, the sea urchins and starfish, worms and crabs, serve as food. Small fish may also be captured and eaten. Seaweed is often found in the stomach. In seeking food the lobster uses its sense of smell and touch more than its sense of sight. Adult as well as small ones are cannibalistic and when crowded together in captivity would quickly destroy each other if the claws were not plugged or banded.

Reproduction

Due to the different water temperatures along the Atlantic coast, lobsters reach sexual maturity at different sizes. In the warm waters of the southern Gulf of St. Lawrence and the south and west coast of Newfoundland females as small as seven to eight inches in length, three or four years old and weighing seven ounces, may occasionally be found carrying eggs. Near the mouth of the Bay of Fundy at Grand Manan where the waters are cold, lobsters take much longer to mature and the smallest carrying eggs are about 14 inches long, weigh about 44 ounces and are about eight or nine years old.

Lobsters mate usually within a few hours after the female has cast her shell. This is when the female is in the new soft-shelled

and helpless condition. The male has, at this time, a hard shell. Sperm is deposited and may be retained by the female in sperm receptacles until the eggs are laid from a month to a year after mating. The mature females as a rule only lay eggs once every two years. As the eggs are laid, they pass over the sperm receptacle and are fertilized and frawn into a pocket formed by the curve of the tail. The eggs are covered by a sticky cement which hardens and holds the eggs firmly attached to the female. The number of eggs laid varies according to the size of the female. An eight inch female carries about 5,000 eggs while one 16 inches carries about 60,000 eggs.

The eggs are carried and protected by the female for 11 or 12 months, and by the latter part of June or in July or August and, in the case of a few lobsters in the colder areas, September, of the following year, the eggs are ready to hatch. The eggs are small and very dark green in colour when first laid, but become lighter in colour as the young develop.

Hatching of the eggs is accomplished by the female who, over a period of one to two weeks, shakes the young out of the egg shells.

The young, which are about one-third of an inch long, then rise to the surface and drift on the water at the mercy of the wind and water currents.

Growth

To grow, the lobster casts off its shell. This process is called "moulting" or "shedding". Moulting begins on the second day after hatching and lasts throughout life or at least as long as there is growth.

On hatching, the larvae continue to swim near the surface for from three to five weeks or until after the fourth moult, when they sink to the bottom and pass the remainder of their life essentially like adults. These small lobsters live under stones and submerged rocks and have been found along the rocky shores of bays and small inlets where they are out of reach of most of their enemies. At a later period, when from three and one-half to four and one-half or five inches long they grow bolder and go out further into the deeper waters but never lose their timid habits.

Growth is faster in warmer waters. In general, it reaches the six-inch size in about three years and the nine-inch size in about four and one-half years after moulting about 22 times. After it becomes mature, at an average length of about nine inches in warmer waters, the female grows more slowly than the male since many females moult one year, lay eggs the next and cannot moult again until the eggs are hatched 11 to 12 months later. Thus a 15-inch male is about 10 years old, while a 15-inch female is over 16 years old. As lobsters grow older the number of moults per year decreases.

Although one rarely sees a lobster weighing 10 pounds, much larger ones are occasionally captured. The largest recorded was caught off Virginia Capes in 1935 and weighed 45 pounds.

Fishing Areas and the Fishery

Since the demand for these crustaceans is very high, the fishery is an intensive one. In order to prevent depletion of the populations, closed seasons have been established in the different Canadian Maritime provinces. At present the length and time of these closed seasons vary in various sections of the coast. There also exists a minimum length at which lobsters may be legally taken. This length varies in the different districts. The taking of lobsters to which eggs are adhering, so-called berried lobsters, has been forbidden in Canada since 1873.

Lobsters are captured in traps called pots which may vary in shape but which operate on the same principle. In general they are oblong lath boxes with one or more funnel-shaped openings through which the lobsters pass in their efforts to get at the bait. Pots are weighted down with stones or bricks to keep them on the bottom. Almost any kind of fresh, salted or stale fish is used as bait depending on the custom and the kind of bait available.

Lobsters are sold alive or canned. With the development of air transportation and more efficient refrigeration, new and more distant markets are becoming available for the live product or the chilled meat.

Source: Fisheries Research Board of Canada,
Atlantic Biological Station,
St. Andrews, N.B.

January 1950.

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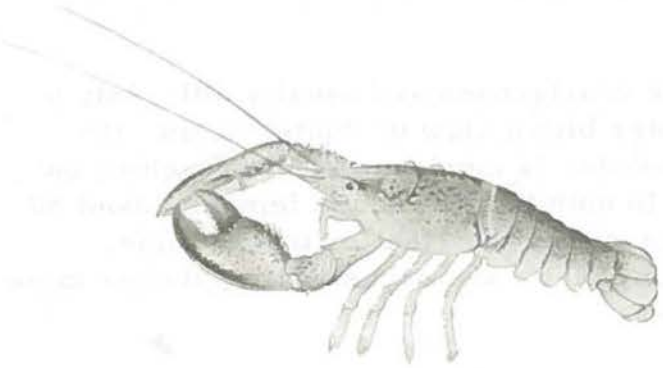

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Lobsters are sold alive or canned. With the development of air transportation and more efficient refrigeration, new and more distant markets are becoming available for the live product or the chilled meat.

Subject: LOBSTER CANNING

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"

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"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

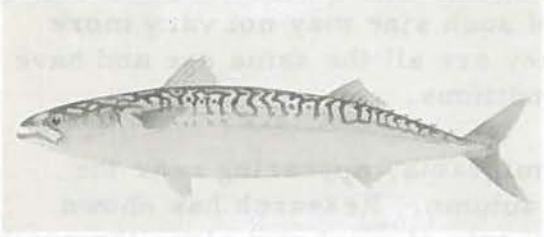
FISHERIES FACT SHEETS

Subject: MACKEREL

Distribution and Importance

The Atlantic mackerel, Scomber Scombrus occurs from southern Labrador to North Carolina in the western Atlantic Ocean. In the eastern Atlantic a different race extends from Norway to Spain. The Atlantic mackerel is often called Northern or Boston mackerel to distinguish it from its close relative the Spanish mackerel which occurs farther south.

Since early colonial days, the Atlantic mackerel has been recognized as a highly desirable item of food, particularly when salted.



Fluctuations in abundance have been extremely wide from year to year perhaps more so than of any other important food fish. Between 1876 and 1950 catches of mackerel in Eastern Canadian waters (excluding Newfoundland) varied from a high of over 70,000,000 pounds in 1880 to a low of 7,000,000 pounds in 1910. Canadian landings in 1949 were about 34,000,000 pounds with a marketed value of over $2,500,000. Of this amount about 22,000,000 pounds came from the fishery off the Atlantic coast of Nova Scotia and about 10,500,000 from the fishery of the Gulf of St. Lawrence. By comparison in 1948 of a total Canadian catch of almost 26,000,000 pounds the Nova Scotia fishery amounted to about 11,000,000 pounds as against about 15,000,000 from the Gulf fishery.

Description

The Atlantic mackerel is a member of the family Scombridae which includes also the tunas, bonito, kingfishes, Spanish mackerel and the wahoos, all of which are capable of great speeds because of their muscular, streamlined bodies and deeply forked or crescent-shaped tail fins. There are two widely placed back fins, the first one being spiny and the second one being soft. Between the second back fin and the tail, on both the top and the bottom of the body, there are four to six, generally five, small finlets. There are two small distinctive keels on each side of the stub of the tail.

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Issued by Information Services, Department of Fisheries, Ottawa

Mackerel (Cont'd.)

The back of the body is dark steely to greenish blue, often almost blueblack on the head, and is barred with 23 to 33 dark transverse wavy bands to the mid-level of the body. The lower sides are white with silvery, coppery or brassy iridescence. The belly is silvery white. The scales of the Atlantic mackerel are so small that its skin is velvety to touch. Atlantic mackerel have been recorded up to 22 inches in length and weighing as much as $3\frac{1}{2}$ pounds.

Habits and Movements

Perhaps most marked of the Atlantic mackerel's habits is that of congregating at or near the surface in dense schools. Schools have been seen which were as much as 20 miles long and half a mile wide. Striking too is the fact that the fish in a school of such size may not vary more than an inch in length, indicating that they are all the same age and have developed and grown under the same conditions.

Atlantic mackerel are seasonal migrants, appearing near the coast in the spring and vanishing in the autumn. Research has shown that there are two main bodies or contingents of mackerel along the north Atlantic coast. Canadian waters are visited by the most northerly body only. This body of mackerel migrates towards the southern New England coast in May and thence goes north-eastward along the Nova Scotia coast to occupy the Gulf of St. Lawrence in summer.

When the mackerel disappear in the fall they go southward and offshore where it is thought they live in the mid waters during the winter months.

Food

The food of the Atlantic mackerel throughout life consists of free-swimming organisms, including small lobster-like animals, shellfish larvae, marine worms, squids, fish eggs and small fish. Atlantic mackerel are fattest in August. Evidence indicates that the fish virtually cease feeding during the winter months.

Enemies

Because of the habit of schooling, Atlantic mackerel fall easy prey to all larger predaceous sea animals. Whales, porpoises, sharks

and tuna take heavy toll. Young mackerel are pursued and eaten by cod, squid and even surface feeding sea birds.

Spawning

Spawning takes place from late June to August in Canadian Atlantic waters. The Gulf of St. Lawrence around Magdalen Islands is probably the most productive nursery for the Atlantic mackerel, except for the middle Atlantic states region of the United States.

Atlantic mackerel spawn over a wide range of temperature and salinity but best spawning and growth takes place between a temperature of 46 and 61 degrees and between salinities of 32 to 33 parts per thousand and never in brackish water. Spawning takes place at or near the surface while the schools are continually moving. The small buoyant eggs and larvae are completely at the mercy of the wind and water currents.

Atlantic mackerel spawn chiefly at night and are moderately prolific, a medium-size female producing 360,000 to 450,000 eggs a year.

Eggs hatch after a period of from four to six days under best conditions of temperature and salinity. The resulting larvae grow to a length of about two inches in two months. At this time, they look like the adult, begin to congregate in schools and, having used all the food in their yolk sac, are feeding for themselves.

Growth

By the end of the first year, Atlantic mackerel range from $3\frac{1}{2}$ inches up to seven inches in length depending on the time of the spawning and the conditions for growth and development. "Yearling" mackerel range from seven inches to nine inches and are called "tinkers" by the fishermen. At this age and size they begin to follow the seasonal migration pattern. The adult mackerel are grown fish of 12 inches and upwards and include all which are two full years of age and over. The majority of the Atlantic mackerel caught commercially in Canadian Atlantic waters are from three to six years of age and are 14 to 18 inches in length.

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Mackerel (Cont'd.)

Fishing Areas and The Fishery

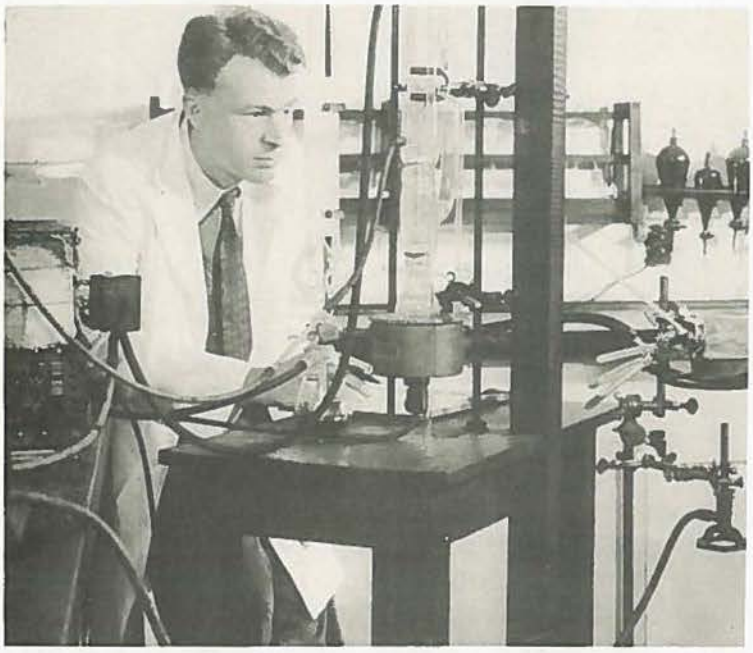
Atlantic mackerel are fished commercially in Canadian waters from the Bay of Fundy to Labrador. However, best catches are landed in southwestern Nova Scotia and in the Gulf of St. Lawrence area around Magdalen Islands, Prince Edward Island and Cape Breton Island. The Gulf fishery is for the spawning stocks and is carried out throughout most of the summer by means of trap nets, gill nets and hand lines or "jigs." Along the coast of Nova Scotia pound nets, traps and gill nets are used during the early summer and early fall fisheries for migrating schools.

Because of the migratory nature of the fish and the wide fluctuation in abundance due to good and bad years for production of the young, the Canadian Atlantic mackerel fishery has varied widely in quantity and from place to place in different years.

The tasty quality and nutritional value of the Atlantic mackerel have resulted in a continued demand for this fish as a food. Salted, smoked and fresh mackerel are consumed in large quantities while salt or pickled mackerel are widely exported. Smaller quantities are canned and used for bait.

Subject: MARINE OILS

Fish and marine animals caught off the Atlantic and Pacific coasts of Canada annually yield large quantities of liver, viscera and body oils used for either medicinal or industrial purposes. These oils are derived from cod, hake, halibut, herring, pilchards, anchovies, tuna, swordfish, whales, salmon, grayfish, black cod, ling cod, red and rock cod, shark, ratfish, belugas, and seals. The production of these oils is, in the main, a by-product of other branches of the fishing industry. While there are some species such as whales and Pacific grayfish which are caught especially for the oil they yield, most of those mentioned above are pursued primarily for their direct use as food.



High vacuum distillation apparatus being used to investigate relationship between Kitol and Vitamin A in whale liver oils.

In terms of dollar values, the oil production of the fishing industry has not been very large. During the period immediately preceding World War II, the average annual value of Canadian marine oil production was less than $900,000. The wartime expansion of production and the great rise in the prices of marine oils increased the value of this industry until, in 1948, the marketed value of marine oils produced in Canada during the year was almost $7.5 million. But even with this great expansion, the production of marine oils in Canada has never accounted for much more than five per cent of the total marketed value of all fishery products. The importance of marine oil production has been somewhat greater for the Newfoundland fishery. In 1948 the marketed value of Newfoundland's marine oil production was almost $4 million, accounting for more than 13 per cent of the total marketed value of the new province's fishery production.

Vitamin Oils

Vitamins A and D are of the fat-soluble variety and are widely found in fish and fish liver oils. Vitamin A is essential for growth and proper development as well as protection against disease in both humans and animals. Vitamin D is necessary to enable the body to assimilate mineral elements in foods and is especially required during childhood when bones

and teeth are developing. Vitamin oils are consumed directly and are also employed extensively in the fortification of certain foods and in the preparation of animal and poultry feeds. A concentrated, high potency vitamin oil is preferred for all these purposes because the smaller volumes required permit their use with greater ease and the addition of the oil does not interfere with the flavour or other characteristics of the commodities to which they are added. Oils of low potency do not find as good a market either for direct human use or for fortification purposes. Consequently, they are usually sold to manufacturers of feeds at lower prices.

In terms of marketed values, vitamin oils account for approximately half of Canada's marine oil production. Before the recent war, there was virtually no well-established vitamin oil industry in Canada. Vitamin oils had been produced on both the east and west coasts but not in great enough volume or with sufficient regularity to establish the Canadian fishery as an important source of vitamin oils. During the years immediately preceding the outbreak of war, the production of Pacific grayfish liver oil was declining steadily. The production of cod liver oil on the Atlantic Coast was highly irregular, varying greatly from one season to the next.

The acute shortage of vitamin oils during the war and the phenomenal rise in price which took place encouraged greater attention by fishermen and processors to the vitamin oil possibilities of their industry.

This wartime development put the Canadian fishing industry in a position to establish itself as a regular supplier of vitamin oils to world markets. The production of vitamin oils will probably never account for more than a minor portion of the yield of Canada's fishing industry, but that part can be one from which both fishermen and processors may receive incomes of substantial size and considerable stability.

The normal market for vitamin oils is a fairly competitive one but is characterized by the superior appeal of high quality products. Recent innovations in the refining and concentrating of vitamin oils have made it necessary for practically all processors to modernize their equipment. One of the difficulties which is posed by these scientific advances is that the cost of a fully modern vitamin oil plant is quite high and requires operations on a large scale. In short, it appears that the further development of primary production and processing facilities would aid each other in their efforts to establish the industry on a sound long-term basis. Modern processing facilities would help to ensure the sale of oil-producing fish by offering a high quality product. In turn, an expansion of primary production would help to ensure the success of such processing plants by enabling them to undertake large-scale operations.

Non-medicinal Oils

During the World War II there was no significant increase in the total quantities of non-medicinal marine oils produced in Canada. There was a rise in the value of production but this was entirely due to higher prices. Whale oil production ceased entirely for the later war years and whaling operations on the Pacific Coast were not resumed until 1948.

Pilchard oil production has always fluctuated sharply from year to year because of the instability of the pilchard catch. During 1946-47-48-49 negligible quantities of pilchard oil have been produced. The great expansion of herring oil production filled the market left vacant by pilchard oil.

Contrasting with the lack of growth in non-medicinal marine oil production is the great expansion in the vegetable oils industry during the war. The quantity of vegetable oils produced in Canada was multiplied eight times during the decade from 1938 to 1949. In addition to this increased domestic production, large quantities of vegetable oils have been imported from the United States. Thus the great expansion in the use of non-medicinal oils for foods and other products was served exclusively by the vegetable oils industry. The trend of vegetable oils production is of importance for the future of the Canadian marine oil industry because these two kinds of oil are substitutes for one another and therefore are in competition.

In the past, the principal users of marine oils in Canada have been the food industries, chiefly the producers of shortening. Whale oil is a very good raw material for shortening, being superior in some respects to the vegetable oils which are chief competitors. Whale oil can be used for all but the highly emulsified type of shortening which is designated for cake and pastry baking. A good margarine also can be made with the use of whale oil although only a negligible amount has as yet been employed for this purpose in Canada. Because of various factors which enter into the manufacture and marketing of food products of this type, it is necessary for marine oils such as whale oil to sell at a somewhat lower price than vegetable oils in order to be attractive to potential users. Food manufacturers would probably purchase marine oils at prices about 85 to 90 per cent of those of vegetable oils.

The only other product for which marine oils are used in substantial amounts is soap. The food industries and soap-making together accounted for 80 to 90 per cent of all marine oils consumed in Canada. In soap-making, marine oils compete principally with animal fats and a price differential is necessary to attract purchasers. The total production of soaps may be substantially reduced in the future, due to the competition of new synthetic detergents. Since marine oils do not contain the components necessary for this synthetic product, the market for marine oils may be substantially reduced by this innovation.

Marine oils are also used in small quantity in a number of other commodities such as chemicals, protective coatings, rubber, tanning, and textiles. Whether a larger potential market for Canadian marine oils exists in one or more of these industries is difficult to say. The marketing situation may warrant some investigation of these minor uses.

March 1950.

Subject: MIGRATION AND REPRODUCTION OF PACIFIC SALMON

Species

The five species of Pacific salmon, although differing in length of life and weight at maturity, all follow the same pattern in their migration and spawning habits. There are slight variations in fat and protein content, although the food value of all is high. The periods of time they spend in fresh water and in the ocean also differ. (Separate fact sheets deal with individual characteristics of each one).

Sockeye Salmon Fighting Swift Water

The five species are sockeye (Oncorhynchus nerka), spring (Oncorhynchus tschawytscha), coho (Oncorhynchus kisutch), pink (Oncorhynchus gorbuscha) and chum (Oncorhynchus keta). Fish called blueback and steelhead also are caught in British Columbia waters, but the blueback is really a coho or on occasion a sockeye and the steelhead belongs to the genus Salmo, being known scientifically as Salmo gairdnerii. The Atlantic salmon, Salmo salar, differs from that found in the Pacific and belongs therefore to a different genus. It may spawn several times during its life, while all west coast salmon spawn just once, then die. It is actually more closely related to the Steelhead, Salmo gairdnerii.

Migration and Spawning Habits

All Pacific salmon are born in the fresh water of tributary streams inland, make their way to the sea (except for some races of sockeye which become lake-locked) and, when the spawning impulse comes, leave the ocean to make directly for the river systems in which they themselves were spawned. All salmon may not go back to the exact small stream in which they were born but they certainly return predominantly to the same systems of waters. The length of time spent in fresh and salt water varies with each species. Some leave inland rivers and lakes as fry, others wait one or two years.

Very little is known of the salmons' life in the ocean. There is even doubt as to whether they range far out to sea in search of food or stay comparatively close to shore.