

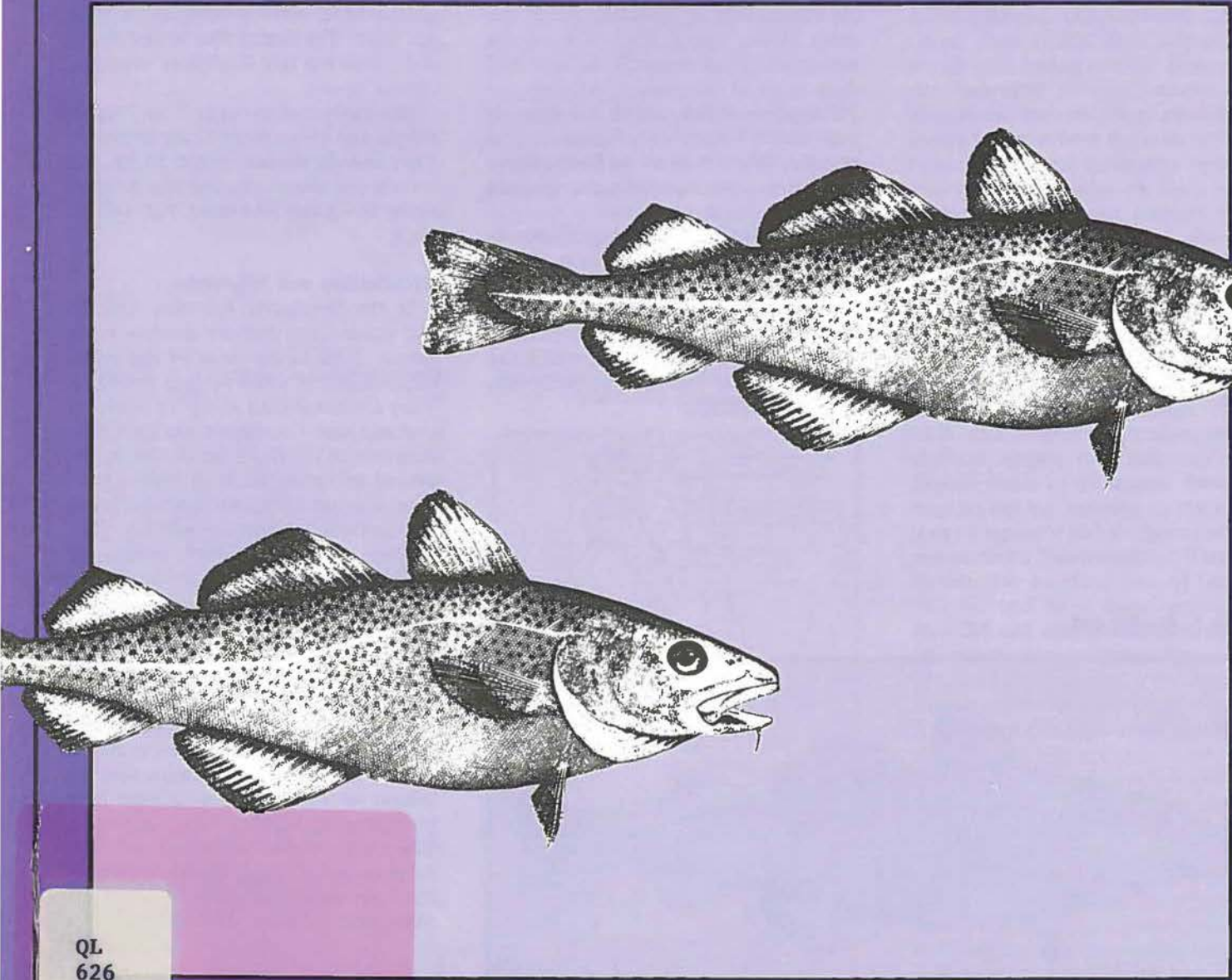
Pêches
et Océans
Fisheries
and Oceans



Underwater World

DFO - Library / MPO - Bibliothèque
14017349

ATLANTIC COD



QL
626
U52
No 38
1984



ATLANTIC COD

Since the discovery of the New World, the Atlantic cod (Fig. 1) has been the dominant commercial species of the Northwest Atlantic. The cod has traditionally and quite justifiably been called "Newfoundland currency" (Fig. 2). So important was the cod to the early economy of New England that a carved wooden codfish was hung in the Massachusetts House of Representatives in Boston as a memorial of the importance of the codfish to the welfare of the commonwealth.

The Atlantic cod figured predominantly in the early colonization of North America. The Portuguese began fishing the Newfoundland waters in 1501 and the French and Spanish Basques by the early 1500s. The English fishery was slower to develop in the New World than those of the French, Spanish and Portuguese. When it did, however, it provided a source of training in seamanship that bolstered the British Navy and later contributed to the English supremacy of the seas.

The shipbuilding industry in North America was boosted as the need for fishing ships and cargo ships increased. Consequently, this led to the design of superb crafts with fine, sleek lines of international racing class of which the "Bluenose" of Lunenburg, N.S., was the finest example.

Description

The Atlantic cod (*Gadus morhua*) is one of 59 species of the family Gadidae. The cod family is the most numerous and best represented of fishes in the Canadian area. A marine fish which occurs mainly in cool waters in northern seas, the cod is soft-rayed, has three dorsal fins on its back and two anal fins behind its whitish-coloured belly, and generally has an elongated hair-like projection called a *barbel* on its chin. It is generally grey or green but may be brown or reddish, depending upon the habitat into which its colour will generally blend. The scales are small and smooth. The mouth is large with a projecting upper jaw and the gill openings are wide. The lateral line of the cod is pale, and the tail is slightly concave, almost square.

Generally cod average 2 to 3 kg in weight and about 60 to 70 cm in length. They usually do not exceed 30 kg, but there is one record of a cod that weighed about 96 kg and was more than 180 cm long.

Distribution and Migration

In the Northwest Atlantic, Atlantic cod occur from inshore shallow water (about 5 m) to the edge of the continental shelf, in water as deep as 600 m. They are distributed along the coasts of east and west Greenland. On the Canadian side of the Davis Strait cod do not extend as far north as in west Greenland. The northern limit is off Frobisher Bay and extends into Ungava Bay. They become more abundant along the Labrador coast and off Newfoundland. They are distributed on the Flemish Cap, Grand Banks, Gulf of St. Lawrence, Nova Scotian Shelf, Gulf of Maine, and as far south as Cape Hatteras (Fig. 3).

Cod in the Canadian area are divided into stocks which are defined as recognizable units displaying characteristics unique to each stock with very little intermingling between adjacent stocks. The stock division serves as a very useful management unit for management of the cod resources. Cod stocks in the Northwest Atlantic area are (Fig. 4):

Figure 1. Atlantic cod.

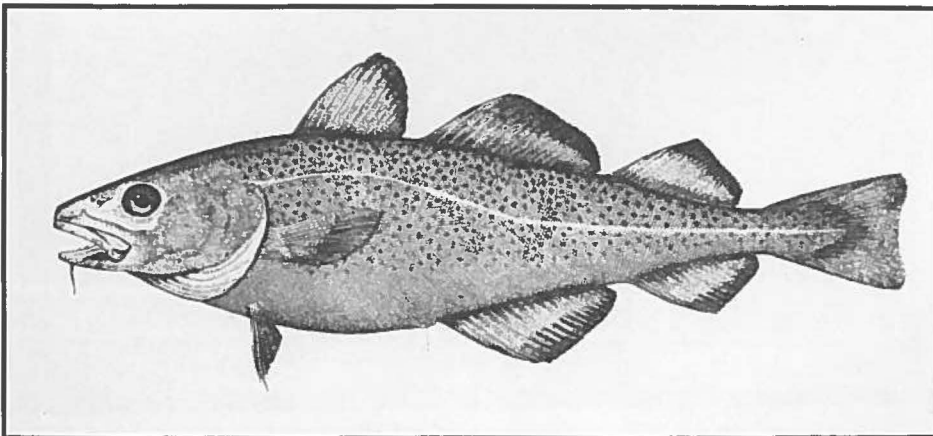
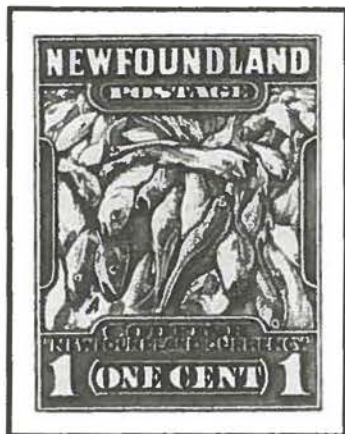


Figure 2. Newfoundland postage stamp depicting Codfish "Newfoundland currency".



- 1) West Greenland (NAFO Div. 1A-1F)
- 2) Northern Labrador (NAFO Div. 2G+2H)
- 3) Southern Labrador-Eastern Newfoundland (actually a stock complex composed of several large interrelated stock components) (NAFO Div. 2J+3K+3L)
- 4) Southern Grand Bank (NAFO Div. 3N+3O)
- 5) Flemish Cap (NAFO Div. 3M)
- 6) St. Pierre Bank (NAFO Div. 3Ps)
- 7) Northern Gulf of St. Lawrence (NAFO Div. 4R+4S+3Pn)
- 8) Southern Gulf of St. Lawrence (NAFO Div. 4T+4Vn)
- 9) Northern Scotian Shelf (NAFO Div. 4Vs+4W)
- 10) Southern Scotian Shelf (NAFO Div. 4X)
- 11) Gulf of Maine (NAFO Div. 5Y)
- 12) Georges Bank (NAFO Div. 5Z)

The cod in some of these stocks undergo extensive migrations. These migrations have been determined from the marking of cod with tags, which are later captured and the tags returned by fishermen. The cod of the southern Labrador-eastern Newfoundland stock

complex (NAFO Div. 2J,3K,3L) for example may migrate up to 800 km from their winter spawning grounds on Hamilton Bank to the inshore feeding area during summer. Generally these northern cod spend the winter in depths of 200 to 600 m and water temperatures of about 2° to 4°C along the outer slopes of the continental shelf. The cod within this stock complex, which overwinter on Hamilton Bank, migrate during summer mainly to the Labrador coast and off northeast Newfoundland. Those of Belle Isle Bank migrate during summer mainly to the southern Labrador Coast, the entrance to the Strait of Belle Isle and the northeast coast of Newfoundland. The cod which overwinter on Funk Island Bank migrate over a wide area during summer from southern Labrador to southeastern Newfoundland, but contribute most significantly to the inshore fisheries in White, Notre Dame, and Bonavista bays. The cod which overwinter on the northern Grand Banks do not migrate during summer northwards along the Newfoundland coast, but disperse southwards over the top of the Grand Banks and westwards around the coasts of southeastern Newfoundland (Fig. 5).

Along northern Labrador (NAFO Div. 2G and 2H) the cod are related to the 2J+3K+3L stock complex. The cod of 2G and 2H overwinter along the continental slopes off Labrador from Saglek Bank to Hamilton Bank and migrate during summer to the coastal area of northern and southern Labrador and northern Newfoundland. Thus their distribution overlaps that of the 2J+3K+3L cod to a large degree. The 2G+2H cod are considered separately for management purposes from the rest of the Labrador-east Newfoundland stock complex because the effect of past fisheries on this part of the stock complex was more severe than in the south.

The southern Grand Banks cod (3N+3O) stock tend to spend the winter on the southwest to southeast Grand Banks and to spread northward and inhabit the shallow (less than 90 m) area of the bank during the late spring and summer. A very small proportion of the stock migrates in the feeding season to the southeastern coast of Newfoundland.

Figure 3. Cod distribution in the Northwest Atlantic.

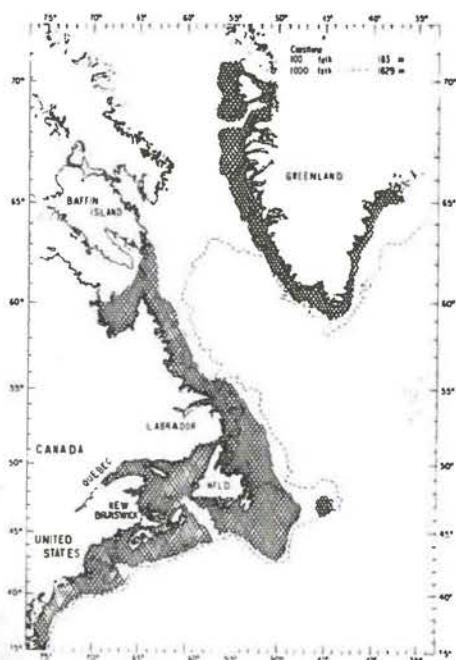
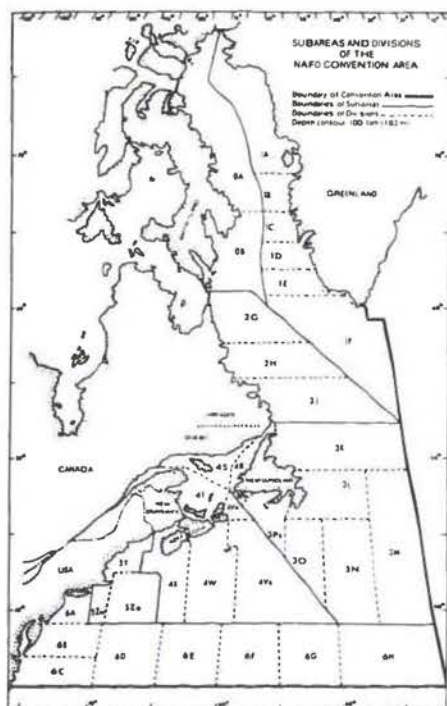


Figure 4. NAFO Subareas and Divisions of the NAFO Convention Area.



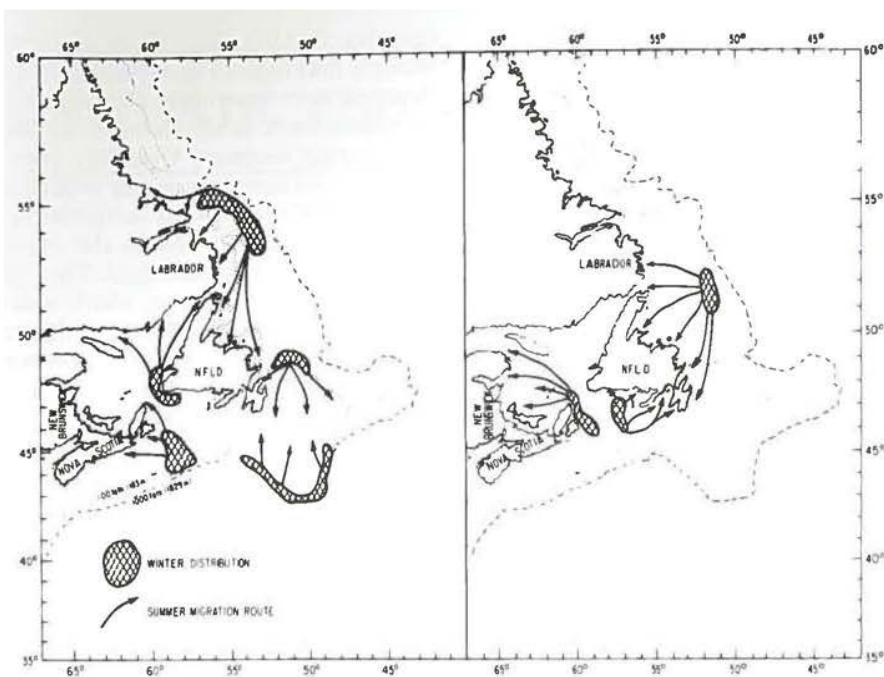


Figure 5. Some major migration patterns of cod in the Canadian area.

On St. Pierre Bank and surrounding areas (3Ps) the cod overwinter on the slopes of St. Pierre Bank, and Grand Banks and the deep channels between these banks. They migrate during summer to the coastal area of the south coast of Newfoundland where they intermingle with cod of the Burgeo Bank stock. They also intermingle during summer-autumn on the coastal banks and shelves with feeding schools of the Labrador-east Newfoundland stock.

Cod of the Flemish Cap (3M) do not migrate off the Cap. They tend to concentrate in deeper water, mainly on the southwestern part of the bank, where they spawn from March to May. They migrate to shallower water on top of the Cap in summer.

Those cod which overwinter along the coast of southwestern Newfoundland (4R + 4S + 3Pn) migrate and disperse into the northern Gulf of St. Lawrence, the Quebec North Shore and the Strait of Belle Isle during summer. In the Strait of Belle Isle north of Point Riche in Newfoundland and Blanc Sablon in Quebec, the Gulf cod intermingle with schools of Labrador-east Newfoundland cod.

Cod of the southern Gulf of St. Lawrence (4T + 4Vn) overwinter off eastern Cape Breton and the continental shelf south of the Laurentian Channel and in summer return to the southern Gulf

around Magdalen Shallows, Chaleur Bay and Gaspé. There is also evidence for an inshore resident, or local, stock in 4Vn which does not migrate into the Gulf.

Some of the cod of the northern Scotian Shelf (4Vs + 4W), mainly Banquereau, Misaine and Sable Island banks migrate during summer to the neighbouring outer coast of Nova Scotia and northern Cape Breton and a few to the southern Gulf. The migration of Sable Island Bank cod into the southern Gulf is much less than that of Banquereau or Misaine Bank cod.

There are local inshore populations of cod along the Nova Scotian coast which migrate only short distances. They remain mainly in the inshore area but move a short distance offshore to deeper water during winter and return inshore during summer.

Southern Scotian Shelf cod (4X) generally spend the winter in deeper water either in inshore areas or offshore around Lahave and Browns banks. In summer the inshore stocks move into shallower water while the offshore stocks of Lahave and Browns banks remain offshore where they migrate to the shallower areas of the offshore banks. There is some migration across the Fundian Channel to neighbouring Georges Banks and vice versa.

Gulf of Main cod (5Y) are mainly coastal with limited migration.

Georges Bank cod (5Z) are mainly limited to eastern Georges Bank but with some intermingling with cod of southwestern Nova Scotia. The South Channel stock spends the summer in South Channel, especially on the western side of this channel, and for most of the year migrates southwards and inshore to the Nantucket Shoals-Chatham region.

Recaptures of cod tagged at inshore localities during the summer feeding migration suggest a strong degree of homing in subsequent years to the tagging area or areas immediately adjacent. Similar evidence for cod homing to their winter spawning ground also has been demonstrated. This homing tendency in cod is by no means as high as for Atlantic salmon, but is nevertheless significant in maintaining uniqueness to the characteristics of stock components.

Reproduction

The female Atlantic cod matures sexually at about six years of age, although the age at first maturity may vary from five to eight, depending on the spawning stock. The size at first maturity generally ranges from about 45 to 60 cm in length. The males generally mature at a slightly younger age and smaller size than the females.

Cod spawning occurs over a wide area of the continental shelf and over a wide range of depth zones. Cod off Labrador and northern Newfoundland spawn from March to May along the outer slopes of the continental shelf in depths from 200 to 600 m and bottom temperatures of about 2.5° to 4°C. On the Grand Banks, spawning begins in April and continues to June. On the south coast of Newfoundland spawning begins in May. On the Nova Scotia banks, cod spawn in March and April. Occasionally in localized areas cod spawn during autumn.

Cod are very prolific. Female cod about 80 cm long produce about two million eggs, while a cod of about 130 cm produced over 11 million eggs. The eggs are buoyant, round and about 1 to 2 mm in diameter. They float in water of about 30‰ salinity (coastal surface water). Thus they rise and remain at or near the surface while they are hatching. The fertilized eggs that rise to the surface and the resulting larvae are at the mercy of the currents and face immense hazards from larger predatory fish. The mortality rate is tremendous. Of the several million eggs each female spawns, only about one egg of each million succeeds in completing the cycle to become a mature cod. The newly-hatched larvae (about 5 mm long) depend for food on the yolk sac attached to the abdomen for about one to two weeks, after which the yolk is absorbed and the larvae must begin to forage for living food. At about a length of 4 cm, the young cod settle to the bottom and feed there or near the bottom. The bays of eastern Newfoundland serve as nursery areas for young cod of the large northern cod stock of southern Labrador and eastern Newfoundland.

Food

Young cod fry feed mainly on copepods, amphipods, and other small crustaceans in the plankton. Juveniles feed mainly on shrimp, amphipods, euphausiids, and fish and shellfish larvae. Adult cod feed mainly on capelin, herring, sand lance, flounders, young Greenland turbot, crabs, shrimp, brittle stars, combjellies, and a host of other species of fish and shellfish. In fact, a cod will eat almost anything including stones so that it can digest the sea anemones, hydroids, and other organisms growing on them.

Age and Growth

A cod's age may be determined by counting the annual rings on the otoliths, two pearly-white earstones that form the balance mechanism in the cod's skull (Fig. 6). Atlantic cod grow at different rates in different areas. There are annual differences in growth rate in the same area depending upon population sizes, temperature, and food. Generally, growth is slower off Labrador and eastern Newfoundland than on the southern Grand Banks and is slower in the Gulf of St. Lawrence than on the Scotian Banks and Georges Bank (Fig. 7). Most of the cod caught by fishermen in Atlantic Canada are from four to eight years old. By age 15 most of the cod have passed out of the fishery, although there is a record of a 27-year-old cod taken from Labrador during the 1960s.

The Fishery

The cod fishery at Newfoundland by European ships began almost immediately after the discovery of the New World. It is reported that prior to 1550 there were 128 fishing vessels sailing to Newfoundland. This fishery continued to expand both at Newfoundland and all along the Atlantic coast wherever cod were plentiful. By the late 1600s the catch of cod at Newfoundland had reached almost 100,000 metric tons (t) per year. By the late 1700s the catch had reached as high as 200,000 t annually. The cod landings during the 1800s ranged between about 150,000 and 400,000 t annually.

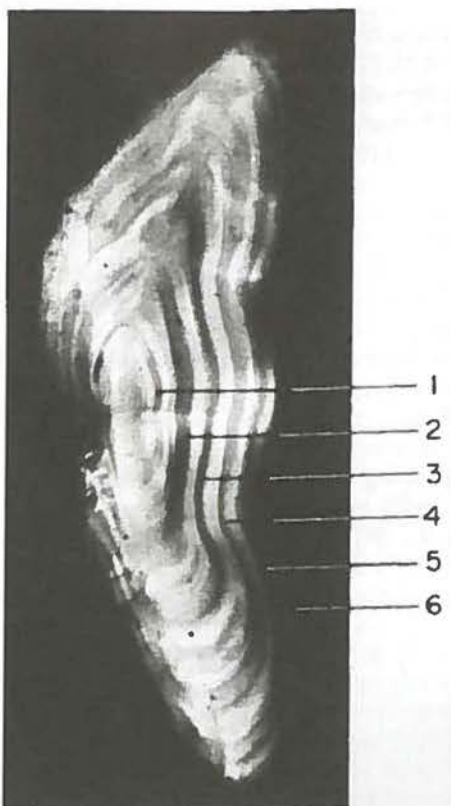


Figure 6. Cross section of the otolith of a 6-year-old cod.

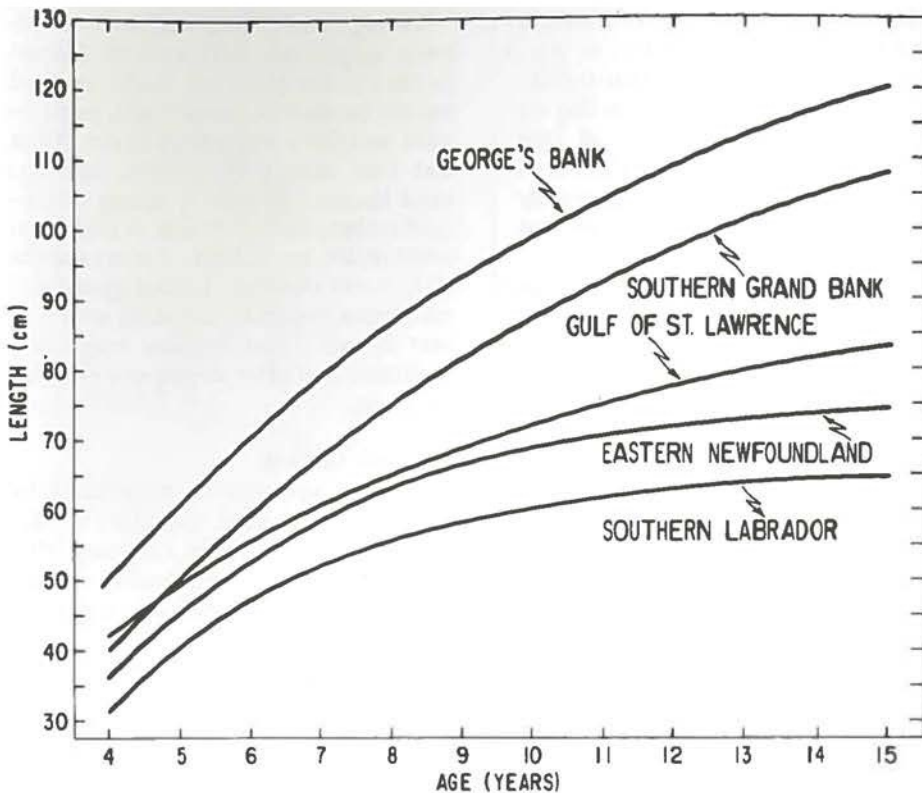


Figure 7. Growth rates of cod from selected areas of the Northwest Atlantic.

Figure 8. A catch of cod in a cod trap.



The inshore fishery traditionally has used a variety of gears such as cod traps, (Fig. 8) line trawl, longline, gillnet, handline, jigger, and in previous years, the cod seine. The offshore banks fishery by schooners traditionally used line-trawls set out and hauled by men in dories on the coastal and offshore banks. Prior to 1900 the entire catch of cod was preserved by salting. In the twentieth century technological change heralded a new era into the fisheries for cod and other species. This was the introduction of the steam trawler and the otter trawl which had been developed in 1905 and which was itself based on the 1894 version of the beam trawl. This new fishing gear increased the catching efficiency of the fishing fleet. In time, other new developments such as the stern trawler, (Fig. 9) more powerful winches, echosounders for fish detection, and automated floating fish factories to process and freeze the catches at sea resulted in ever-increasing catches of cod and other species. Increasingly, the catches were processed as frozen fillets or frozen blocks in contrast to the earlier methods of salting and

drying. Catches of cod from the Northwest Atlantic were stable during the 1950s at about 900,000 t, but increased sharply during the 1960s to a peak of almost 2,000,000 t, and declined dramatically during the 1970s to below 500,000 t in 1977. The catches from the Southern Labrador-Eastern Newfoundland stock contributed significantly to the overall cod catches during the 30-year period (1953-1982) and accounted on average for almost 40 per cent of the total (Fig. 10). The European trawlers during the 1960s carried out a great winter and spring fishery on the prespawning, spawning, and post-spawning concentrations of cod on the Southern Labrador shelf. This offshore fishery affected the inshore fisheries of Labrador and northern Newfoundland by reducing both the quantities and sizes of cod. Eventually the stocks became overfished and there was a collapse of both the inshore and offshore fisheries from their previous levels.

In 1973 the major cod stocks, and in 1974 all of the cod stocks in the Northwest Atlantic and in particular those of the Canadian area, were placed under quota regulation. The Total Allowable Catch (TAC) for each stock was based upon scientific advice presented to the International Commission for Northwest Atlantic Fisheries (ICNAF) which later became Northwest Atlantic Fisheries Organization (NAFO). The TACs at first were not effective in curbing the overexploitation, mainly because enforcement was not effective and catches exceeded them in many cases. With the introduction of the 200-mile limit in 1977, the setting and enforcement of TACs in Canadian waters became a Canadian responsibility. With added policing and more rigid TACs, the stocks, especially the northern cod stock (2J+3K+3L), began to increase and catch rates have risen to a level approaching those of the 1960s. All cod stocks are not increasing, however, especially those of the Flemish Cap and the southern Grand Banks, which are outside or partially outside the 200-mile limit, and TACs are not so rigidly enforced as those inside the zone. The projected TACs for 1987 for the several cod stocks in the Canadian area are as follows:

Underwater World factsheets are brief illustrated accounts of fisheries resources and marine phenomena prepared for public information and education. They describe the life history, geographic distribution, utilization and population status of fish, shellfish and other living marine resources, and/or the nature, origin and impact of marine processes and phenomena.

Others in this series:

American Eel
American Plaice
American Smelt
Arctic Cod
Atlantic Cod
Atlantic Groundfish
Atlantic Halibut
Atlantic Herring
Atlantic Mackerel
Atlantic Pelagic Fish
Atlantic Salmon
Atlantic Shellfish
Atlantic Snow Crab
Capelin
Grey Seal
Haddock
Harbour Seal
Harp Seal
Irish Moss
Lingcod
Lobster
Northern Shrimp
Oyster
Pacific Herring
Pollock
Redfish
Red Hake
Red Tides
Roundnose Grenadier
Sea Scallop
Selected Freshwater Fish
Selected Shrimps of
 British Columbia
Spiny Dogfish
Thorny and Smooth Skates
Turbot (Greenland Halibut)
White Hake
Winter Flounder
Witch Flounder
Yellowtail Flounder

Published By:

Communications Directorate
Department of Fisheries and Oceans
Ottawa, Ontario
K1A 0E6

DFO/1245 UW/38

Minister of Supply and Services
Canada 1984
Catalogue Number Fs 41-33/38-1984E
ISBN 0-662-13368-4

Disponible en français