

NORTHERN (2J3KL) COD

Background

Cod are found on both sides of the Atlantic and from Greenland to Cape Hatteras in the Northwest Atlantic. Cod has traditionally been called the "Newfoundland currency," and played a significant role in the settlement of the island. Cod in the Northwest Atlantic are managed as twelve stocks.

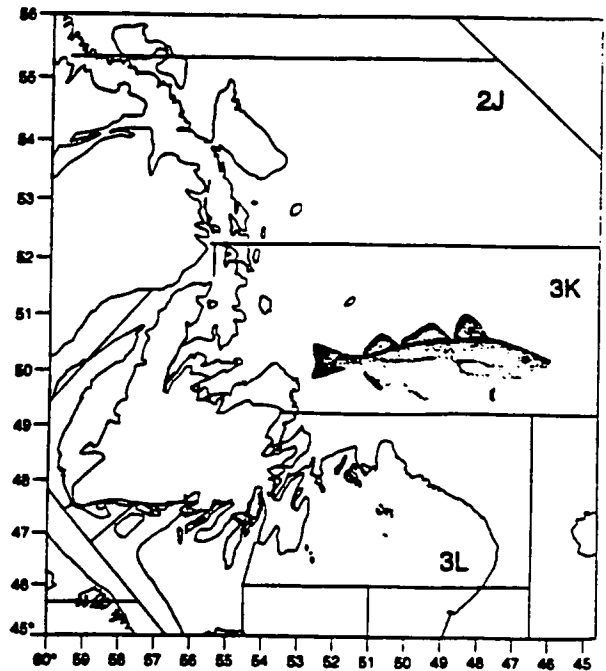
The northern (NAFO divisions 2J3KL) cod stock has been and is potentially one of the largest in the world and of vital importance to the economic and social structure of eastern Newfoundland and Labrador.

The stock covers about 117,000 square miles, and within this area considerable migrations occur, particularly between the inshore and offshore. Some fish overwinter in the inshore. The relationship between inshore and offshore fish is poorly understood.

Cod from this stock grow more slowly than in warmer areas. An age 5 cod would be about 50 cm. (about 20 inches) long. Throughout the area female cod have a variable age at maturity, presently about age 5.

Cod feed on a wide variety of food items but as adults take mainly capelin.

This stock has supported a commercial fishery since the 16th century. For the century prior to 1960 the catches were mainly between 200,000 metric tons and 300,000 metric tons. With high catches in the late 1960s, mainly by foreign fleets, the stock declined until the mid 1970s. Quotas were first put in place in 1973, but during the early years they were not restrictive. After the extension of jurisdiction in 1977, the stock increased until the mid 1980s but has declined more recently. The stock is presently at a very low level, probably less than 3% of that in the mid 1980s. A moratorium on fishing has been in effect since July, 1992.



The Fishery

Catches by non-Canadian fleets increased rapidly in the 1960s and, although inshore landings were declining over this period, the total catch reached a peak of 800,000 metric tons in 1968. As a result of these large catches the stock declined to a low biomass by 1977.

Landings (thousand metric tons)

Year	62-76 Avg.	77-91 Avg.	1992	1993 ¹	1994 ¹	1995 ¹	1996
TAC	N/A	N/A	0 ²	0	0	0	0
Can. Fixed	97	90	12	9	1	+	
Can. Mobile	7	84	14	+	0	0	
Others	386	38	15	2	+	+	
Totals	490	212	41	11	1	+	

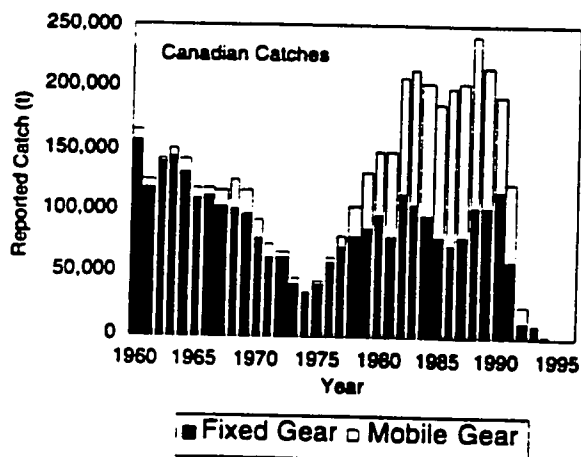
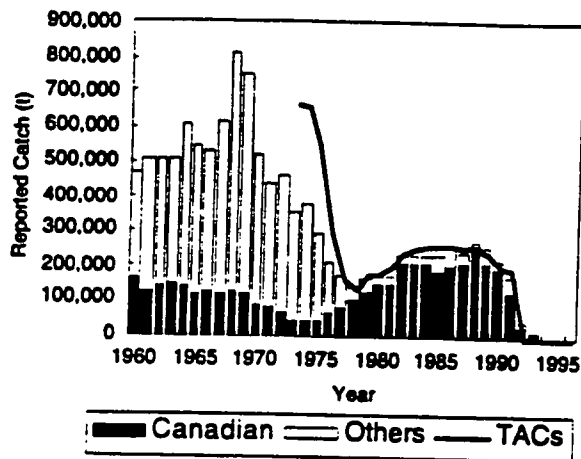
¹ Provisional

² Moratorium imposed July 2, 1992

⁺ Catch less than 500 metric tons

Following extension of jurisdiction the stock began to recover as a consequence of lower catches, strong 1973-75 year classes, and an increasing trend in fish growth rates. However the 1976 and 1977 year classes were weak and fish growth rates decreased in the early 1980s at

a time when fishing mortality was high, arresting the recovery of the spawner biomass after 1982. Catches varied throughout the 1980s. For the inshore the available data show that effort measured by horsepower, boat capacity and nets per person increased through the 1980s (see Regional Overview).



Although the 1978 to 1982 year-classes ranged from moderate to strong, growth rates were low. As a consequence of high catches the stock collapsed to exceptionally low levels by the early 1990s. A moratorium was imposed on directed commercial fishing in July 1992.

According to research survey indices at age 3, the 1984-88 year-classes that should have contributed to the fishery in 1992 were not detectably different from those of the previous 6 years; but these early indications were not borne

out in the reported catches or in surveys after 1991.

Although catches from a recreational fishery were relatively high in the year following the moratorium, catches over the last two years are thought to have been minimal.

In an attempt to account for a greater proportion of the deaths attributable to fishing, discards of cod in the cod- and shrimp-directed fisheries have been estimated from observer records for the period 1980-94. Observer estimates of discards rose from less than 0.5% of the landings in 1980 to about 6.5% in 1986 and subsequently declined to around 2% in the early 1990s. These estimates do not include discarding by the inshore and foreign offshore vessels. Also, prior to 1986 not all Canadian vessels had observers on board.

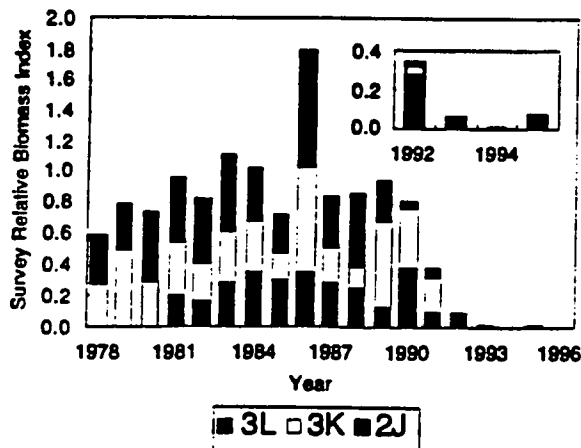
Analysis of tagging data suggest that small fish are relatively more abundant in traps, less abundant in gillnets and least abundant in line trawls. The implications of these results are being worked on.

Resource Status

Current stock status was estimated mainly using trends in abundance and biomass indices from annual bottom trawl surveys, conducted seaward of 12 miles at a time of the year when the stock is expected to be mainly offshore, and information from the Sentinel Survey carried out in 1995.

Autumn research vessel survey indices of relative cod biomass and abundance in divisions 2J3KL have indicated severe declines in recent years.

The 1995 estimate cannot be compared directly with the preceding estimates because of the change in survey gear and vessel, (see Regional Overview for details), however, the mean catch per tow remained exceptionally low throughout the survey area in 1995.



No significant aggregations of fish of any age were found during the 1995 bottom trawl survey. Cod older than age 7 have been virtually absent in these surveys since 1993.

A large concentration of spawning cod was found in Smith Sound, Trinity. Hydroacoustic work in May 1995 suggested a biomass of around 17,000 t. Samples in December 1995 showed that the fish were mainly aged 3 to 8 and in good condition. Samples in April 1996 found them to be spawning again. The April 1996 survey also revealed adult cod in Northwest Arm and Southwest Arm, Trinity Bay. Unusually high parasite incidences suggested that these cod had resided in the inshore throughout the fall and winter months. Acoustic estimates of the biomass of cod in all three arms of Trinity Bay from the April 1996 survey are being prepared.

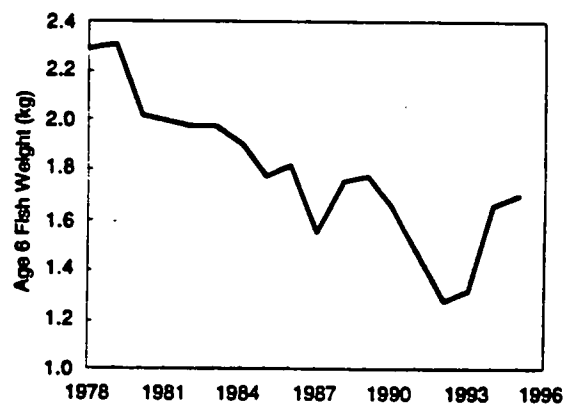
Although cod which remain inshore may have been a small component in the early 1980s when the stock was much larger, the virtual absence of cod in the offshore in recent years suggests that inshore aggregations may be very important for the recovery of the stock.

Of particular concern is the absence of any indication of good recruitment. Estimates of the abundance of pre-recruits (ages 0 to 2) were obtained from a variety of indices. The 1994 year class, which appeared strong at age zero

now appears no stronger than the previous three year classes. The 1993 year class also now appears weaker than previously thought.

The Sentinel Survey in 1995 indicated that catch rates were lower than the last year of the commercial fishery off Labrador and the Northern Peninsula, same as the last year in White Bay, higher than the last year in Notre Dame Bay, and variable in Trinity Bay, Conception Bay and eastern Avalon. Fishers involved in the survey cautioned that high catch rates in some areas may have been a consequence of the lack of competition among gear because of the low levels of effort involved.

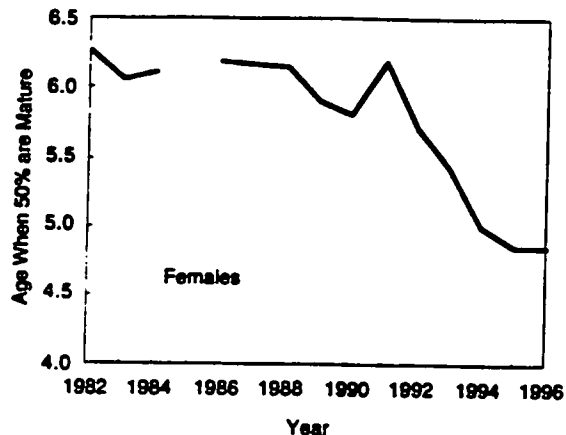
Growth, as measured by weight-at-age in the trawl survey samples decreased over the late 1970s and 1980s resulting in very low values by the early 1990s. Subsequently growth rates have shown signs of increasing. At least some of the variability in growth can be explained by environmental variables such as water temperature.



Condition factors, as measured by body weight relative to length, declined in the trawl survey samples from 1989 to 1992 in Division 2J and to a lesser extent in Division 3K. There was no apparent decline in Division 3L. The declining trend in condition appears to have reversed in 1993 and 1994. The 1995 value is similar to or lower than that for 1994, depending on the age of the fish. Reports from Sentinel fishers and

biological sampling of the catch both indicate that fish in the 1995 Sentinel catch were in good condition.

Since about 1990-91, the age at which 50% of cod have been maturing has been declining. The values for 1995 are the lowest in the time series.



Ecological Factors

Ocean conditions in 1995 were closer to the long-term average than in recent years. The volume of the cold intermediate layer (CIL) is close to the lowest level measured over the last 15 years (see Regional Overview) These changes may be beneficial to the stock in terms of recovery.

The food of cod includes a variety of prey. Capelin, which has historically been their major prey has been assessed to be at high abundance in 1995. However, capelin have been scarce in Division 2J in recent years. Northern shrimp, a moderately important prey on the Northeast Newfoundland Shelf, is at high abundance. Arctic cod, which has historically been a minor prey, appears to be at a high abundance. The status of most other important prey (e.g. hyperiid amphipods, sand lance, small snow crabs, euphausiids, miscellaneous species of shrimp and crabs) is unknown.

Harp seal numbers have increased substantially since the early 1980s and their consumption of cod as well as other fish species has

consequently increased. Information on their feeding, based primarily on inshore sampling, indicates that cod, mostly age 3 and less, make up a relatively small portion of the diet. The harp seal diet analyses are currently being revised and estimates of potential impact should be available by early 1997.

Major Sources of Uncertainty

We do not know the abundance of cod inshore, what portion of it might constitute a genetically distinct sub-stock, and how such a substock, if it exists, might contribute to the recovery and sustainable harvest of the total resource. Similarly, inshore and offshore components might each consist of smaller subcomponents that might not recover easily from local depletions.

Changes in maturity and weight at age affect the ability of the population to replace itself and grow. The extent to which apparent changes can be explained by the environment (both physical and biological), by a response to changes in population size, by fishing and by sampling artifacts is not yet established.

Although the groundfish trawl surveys do not measure the abundance of cod in the inshore, they have been considered a reliable index of cod abundance outside 12 miles in the past. However, the substantial decrease in survey indices since 1992 in the absence of a commercial fishery currently lack explanation.

Although there is observer information on discards in the Canadian cod and shrimp offshore fisheries since about 1980, the extent of discarding in other fisheries is unknown.

Not all juvenile cod are found in trawlable habitats. The amount of cod in these habitats and the extent to which this varies over time has not been determined.

Outlook

None of the above uncertainties affect the basic conclusion: all indices available indicate that this stock is still at an extremely low level. The only significant aggregation of cod that has been studied in the last two years is in Smith Sound, Trinity Bay. The Smith Sound aggregation contained actively spawning fish in 1995 and 1996 and, together with other aggregations that may exist in the inshore, could hold the key to stock recovery, and therefore must be conserved to the fullest extent possible.

An analysis of the spawner stock and recruitment data indicates that population growth rate for Division 2J3KL cod at low population size should average about 18% per year. This analysis is consistent with other cod stocks at this temperature. However, recruitment values estimated for the last 10 years have nearly all fallen below the average stock-recruit relationship on which the 18% is based. This may indicate a change in the ecosystem and consequently much lower population growth rates may now apply.

For More Information

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