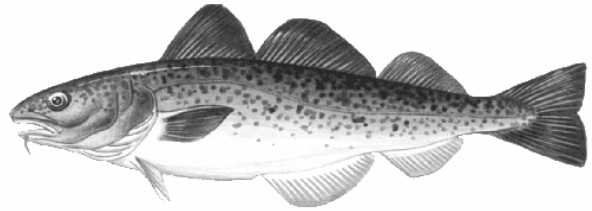
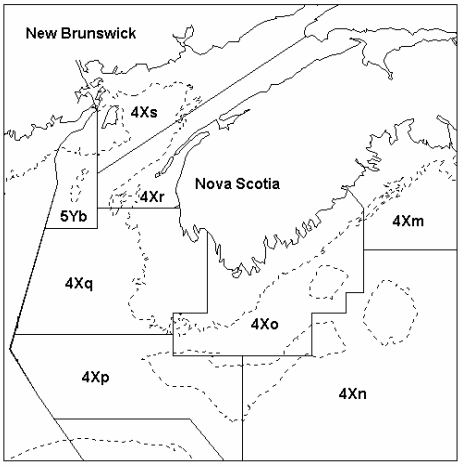


Cod on the Southern Scotian Shelf and in the Bay of Fundy (Div. 4X/5Y)



Background

Atlantic cod (Gadus morhua) is a bottom dwelling fish occurring on both sides of the North Atlantic. In the Canadian Atlantic, cod range from northern Georges Bank to northern Labrador. There are several concentrations of cod within this range, including those on the southern Scotian Shelf and Bay of Fundy (NAFO Division 4X and Canadian portion of 5Y).

Juvenile cod feed on a wide variety of invertebrates and as they grow include fish in their diet. Seasonal movements associated with spawning occur and a number of spawning areas exist in this management area with the largest occurring during winter on Browns Bank. Cod in this area reach on average 53 cm (21 inches) by age 3 years and increase to 72 cm (29 inches) by age 5 and 110 cm (43 inches) by age 10. Growth rates, however, vary among cod in this area with more rapid growth noted in the Bay of Fundy. Age at first reproduction generally occurs at 3 years and individuals tend to spawn several batches of eggs during a single spawning period.

Cod has supported a commercial fishery in this area since the 1700s. Following extension of jurisdiction to 200 miles by coastal states in 1977, only Canada has made substantial landings of cod from this area. Minimum mesh size and hook size regulations have been enacted to reduce the catch of juvenile cod. Closure of Browns Bank is in place from 1 February-15 June.

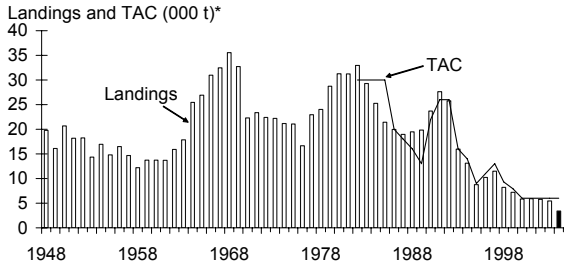
Summary

- The TAC from 2000-2004 has been 6000 t annually and landings dropped to the lowest recorded in 2003 at 5600 t.
- Recruitment indices in both surveys have shown improvement for 1998-2001 year classes over the previous five year classes. The 2002 year class, however, appears weak.
- Biomass has not increased since 1999, when the quota was reduced to 6,000 t.
- Length-at-age and condition are about average.
- Rebuilding was expected to be supported by the incoming 1998 and 1999 year classes but their abundance declined more rapidly than expected and an increase in biomass did not materialize.
- Prospects for rebuilding are now dependent only on the incoming 2001 year class and it is unlikely that any sustained increase in biomass will be achieved at a TAC of 6000 t.

The Fishery

Landings (000s t)*

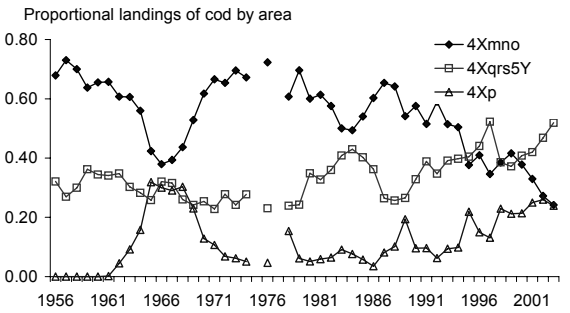
Year	1970-1979 Avg	1980-1989 Avg.	1990-1999 Avg.	2000	2001	2002	2003	2004
TAC	-	23.4	15.4	6	6	6	6	6
Total	22.5	24.9	15.2	5.8	5.9	5.8	5.6	



*Prior to 1999 quota year was Jan. 1-Dec. 31. 1999 quota year was Jan. 1, 1999 - Mar. 31, 2000; subsequent to that it is Apr. 1 -Mar. 31.

In the 1960s, **landings** increased as domestic and foreign otter trawl fleets joined the fishery, then dropped in 1970 as effort declined due to restrictions on haddock fishing. Recent landings reflect the restrictive total allowable catch (TAC). The TAC from 2000-2004 has been 6000 t annually and landings dropped to the lowest recorded in 2003 at 5600 t. As of November 25th, 3801 t of the 2004 quota had been landed.

The distribution of the fishery has shifted in recent years, with the Bay of Fundy (4Xqrs5Y) and Georges and Crowell basins in 4Xp increasing in importance. This is a general pattern in the groundfish fishery, and reflects shifts in fishing patterns and distribution of abundance for a number of species.



In 2003 and 2004, fishing was poor in coastal areas and on the Scotian Shelf. Many longliners delayed their activity in 2003, reportedly due to the prevalence of dogfish early in the summer and low water temperatures, and fixed gear landed only 84% of their cod and 60% of their haddock quotas. In 2004, poor fishing in some areas for haddock and cod, coupled with low groundfish prices and high bait costs, led many hook and line fishers to curtail their fishing activity. Despite increased landings by gillnetters, it appears likely that fixed gear will catch less of their quota in 2004 than in 2003.

In 2003, landings were dominated by the 1998 and 1999 year classes and the age composition was similar to the average for 1980-2002. In the first half of 2004, landings (by number) have been dominated by the 2001 year class, while ages 7+ represented a small part of the fishery.

There were numerous reports of cod being discarded or landed unreported in 2000 and 2001 to avoid exceeding the quota. This is thought to have decreased in 2002. More recently, there have been few reports from industry of discarding.

Discrepancies in species composition between trips carrying an observer and unobserved trips may be used to indicate potential discarding or misreporting of landings. The level of observer coverage in 4X increased in 2004 to 4% for otter trawl and 1% for longline, but remains too low for any meaningful comparisons. Much higher coverage would be required for useful comparisons of observed and unobserved trips. Experience with the 5Z groundfish fishery suggests that 10% observer coverage may not always be sufficient for detecting potential discarding.

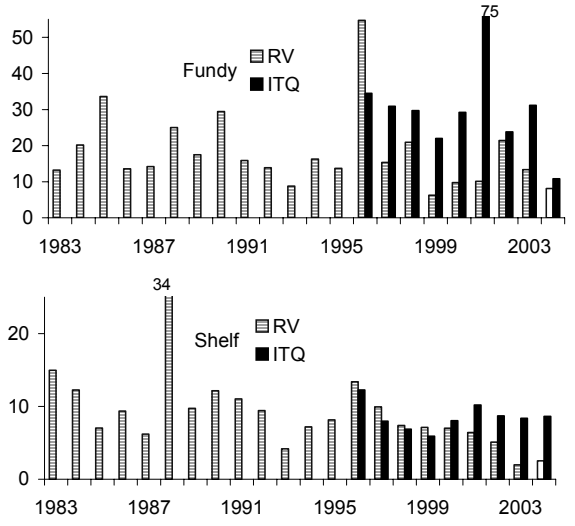
Resource Status

An analytical assessment was not produced for 2004 pending the partitioning of landings to appropriate biological components. In the interim, survey and fishery data were

examined to determine if biomass has increased to an extent which could permit an increase in TAC.

In the **Bay of Fundy**, the research vessel (RV) survey **biomass index** has been variable without any persistent trend since 1983. The index in 2002 and 2003 was above the 1983-2003 median but in 2004 was the second lowest. The 2004 index may not be directly comparable to previous years because the survey was conducted by the *Teleost* and conversion factors between it and the *Needler* are not available. The abundance of ages 8+ has been lower since the early 1990s. The ITQ survey biomass index has shown little variation since 1996, except for the anomalously high value in 2001. It also declined substantially to its lowest level in 2004.

4X cod RV and ITQ biomass indices (2004 index from Teleost shown with open bar)



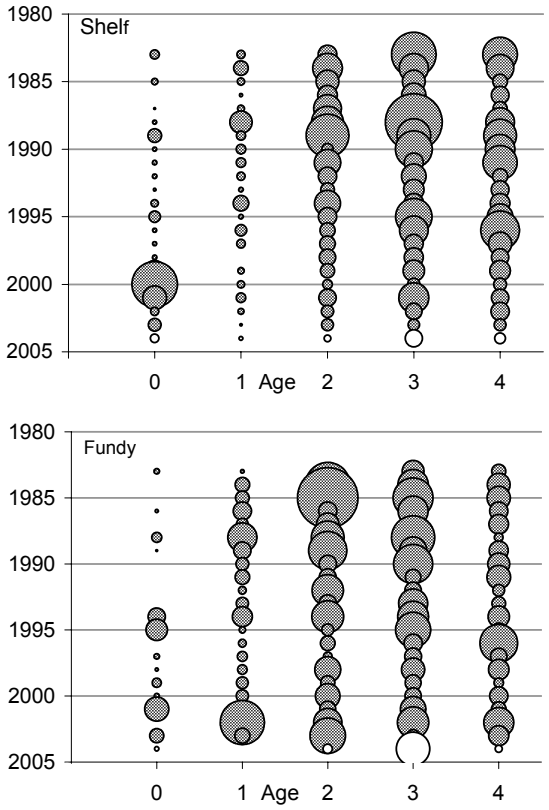
On the **Scotian Shelf**, the RV survey biomass index shows a declining trend since 1996 and remained at the lowest level in 2003 and 2004. The abundance of ages 8+ has been variable since 1983. The ITQ survey biomass index shows little interannual variability since 1996 and the 2004 biomass was above the median.

Recruitment indices in both surveys have shown improvement for 1998-2001 year classes over the previous five year classes.

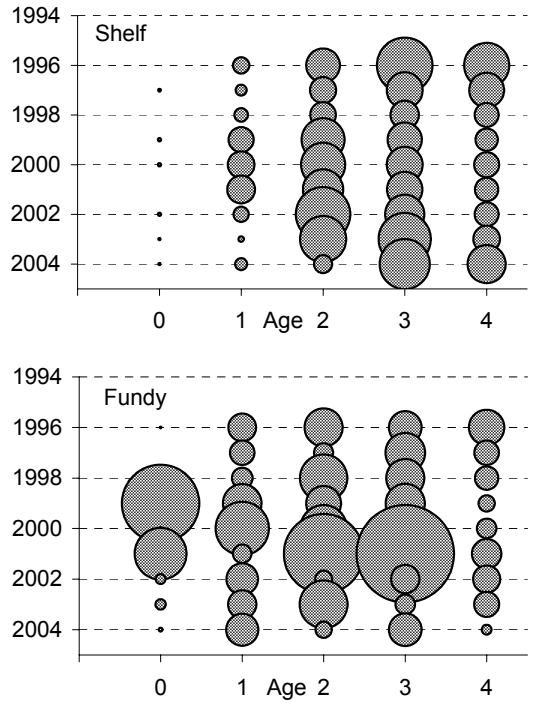
In the **Bay of Fundy**, recruitment showed generally weaker year classes for 1993 to 1997 than previously, but somewhat improved recruitment for the 1998 to 2001 year classes. Early indications for the 2002 year class suggest it is weak.

On the **Scotian Shelf**, recruitment indices show generally weaker year classes since the 1994 year class, with no consistent indication of improvement. However, indices of abundance from the ITQ survey have consistently indicated that the 1999-2001 year classes are stronger than any since 1994. Early indications for the 2002 year class suggest it is weak.

4X cod RV survey indices at age (2004 indices from Teleost shown with open symbols)



4X cod ITQ survey indices by area



The **Length-at-age** and **Condition** (Fulton's K) are currently about average for cod in both the Scotian Shelf and Bay of Fundy.

The proportion of RV survey sets where cod are caught in the Bay of Fundy has varied considerably without trend. The proportion of ITQ survey sets where cod are caught shows little interannual variability. The proportion of RV survey sets where cod are caught on the Scotian Shelf has varied considerably but displays a modest downward trend since 1999. The proportion of ITQ survey sets where cod are caught shows little interannual variability. These patterns for both the Bay of Fundy and the Scotian Shelf broadly resemble the biomass trends.

Total mortality (Z), calculated from the RV survey, has high inter-annual variability but has been high in recent years in the Bay of Fundy. The absence of a decline in total mortality is not consistent with the reductions in nominal landings and fishing effort.

Sources of Uncertainty

The lack of an analytical assessment compromises the ability to assess the status of the stock, and puts heavy reliance on the survey indices. The survey results are highly variable from year-to-year, and their interpretation is subject for concern. The *Teleost* was used for the RV survey in 2004. Also, bottom temperatures were 2-3^{o} C below average at the time of the summer survey. These lower temperatures delayed fishing activity in 2004.

Outlook

Biomass has not increased since 1999 when the quota was reduced to 6000 t to promote rebuilding, and may have declined; therefore, an increase in quota is not supported.

Rebuilding was expected to be supported by the incoming 1998 and 1999 year classes but their abundance declined more rapidly than expected and an increase in biomass did not materialize. Prospects for rebuilding are now dependent only on the incoming 2001 year class. It is unlikely that any sustained increase in biomass will be achieved at a TAC of 6000 t.

Management Considerations

There are separate cod stock components in 4X/5Y that may be following divergent trends. As stock structure is not well understood, special attention is required to avoid over exploitation of local or sub-populations. Potential impacts on cod should also be considered in managing other groundfish species.

For More Information

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Clark, D.S., and J. Hinze. 2004. Assessment of cod in Division 4X in 2004. Can. Sci. Adv. Sec. Res. Doc. 2004/100.

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