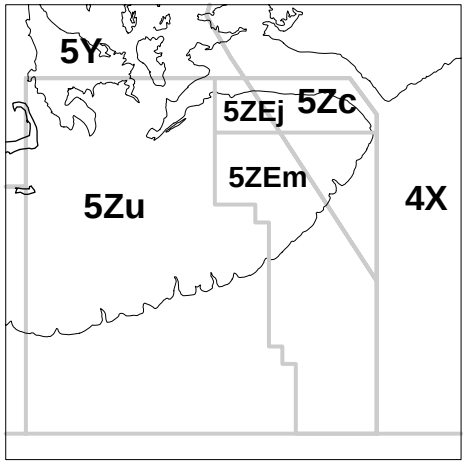
EASTERN GEORGES BANK HADDOCK



Background

The haddock, a bottom dwelling species in the cod family, is found on both sides of the North Atlantic. In the western Atlantic, haddock range from Greenland to Cape Hatteras, with a major concentration on eastern Georges Bank.

Georges Bank haddock feed primarily on small invertebrates and are most commonly caught at depths of 45 to 240 meters (25 to 130 fathoms). Adult haddock appear relatively sedentary but seasonal movements occur. On Georges Bank, young haddock grow rapidly at first, reaching over 50 centimeters (20 inches) by age 3, but grow slowly after, reaching about 75 centimeters (30 inches) by age 10. Many haddock mature by age 2 but it is uncertain if these young fish spawn successfully.

Georges Bank haddock have supported a commercial fishery since prior to 1900. Bottom trawlers have been the principal gear since their introduction in the 1920s. Landings from Georges Bank, which include the eastern Georges Bank component and the Great South Channel component, averaged about 46,000t between 1935 and 1960 and increased to over 100,000t in the 1960s under heavy exploitation. Subsequently, during the early 1970s, spawning season/area closures were introduced as a means of controlling effort and are still in use today. Following the extension of jurisdiction to 200 miles by coastal states in 1977, only Canada and the USA have fished this stock. Both Canada and the USA impose minimum fish size and mesh size regulations. Additionally, Canada establishes quotas with a target exploitation rate of roughly 22% of the harvestable population.

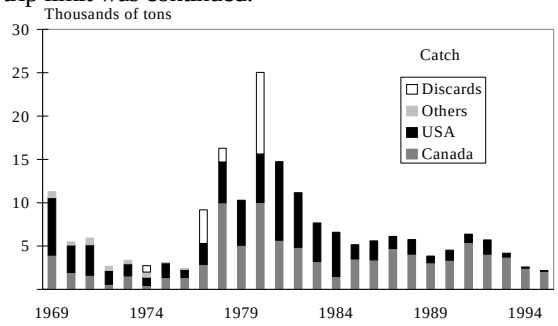
The Fishery

Landings (thousands of tons)

Year	70-79 Avg.	80-89 Avg.	1990	1991	1992	1993	1994	1995
TAC[1]	-	-	n/a	5.0	5.0	5.0	3.0	2.5
Canada	2.7	4.4	3.3	5.4	4.1	3.7	2.4	2.0
USA	2.6	3.8	1.2	0.9	1.6	0.4	0.15	0.1
TOTAL	6.1[2]	9.2[2]	4.5	6.4	5.7	4.1	2.7	2.1

[1] Canadian quota only
[2] Includes foreign catches, discard estimates

Under management restrictions, landings have declined steadily since 1991, reaching a low of 2,164t in 1995 and approaching the historical low levels observed during the mid 1970s. Canadian landings in 1995 declined to 2,064t with most fishery sectors not catching their allocation due to lack of cod quota. The Canadian fishery was closed during January 1 to May 31 in 1995 for all groundfisheries. Fewer vessels participated in the Georges Bank fishery in 1995 compared to 1994 and 1993 and all landings were monitored at dockside. USA landings for 1994 and 1995 were estimated at about 150t and 100t respectively, the lowest on record. The USA expanded closed area was maintained closed to groundfishing for all of 1995 and the 500 pound haddock trip limit was continued.



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The fishery in 1995 was largely supported by the 1991 (average length of 22 in) and 1992 (average length of 20 in) year-classes which comprised about 75% of the landed weight. The 1987 (average length of 26 in) year-class continued to contribute, accounting for about 8% of the landings. Few age 2 haddock were caught compared to the average proportion caught during 1969-94, and this may be due in part to use of square mesh by the otter trawl fleets and changing fishing patterns.

Adjustments have been made for known discards and mis-reporting in the past and it was considered that such practices were not common since 1992, after the introduction of dockside monitoring.

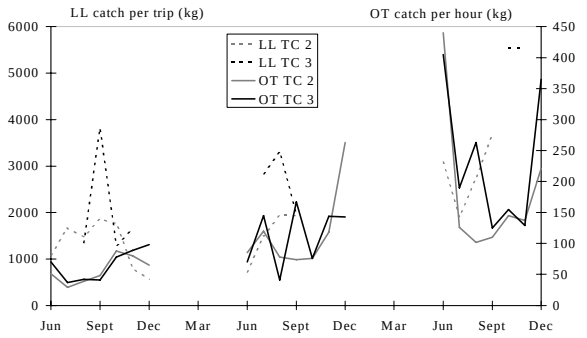
Fishermen noted that haddock appeared more plentiful in 1995 and the fish size was large. They considered that little if any discarding or dumping occurred in recent years and that landings statistics should be accurate.

Fishery weights at age appear larger for year-classes after the 1988 though weights for most of these year-classes decreased in 1995. Weights at age from the Canadian survey were examined to determine if this increase was reflecting an increase in growth. The 1989 and 1990 year-class weights were generally higher than the adjacent weights though not out of range when compared with the whole series.

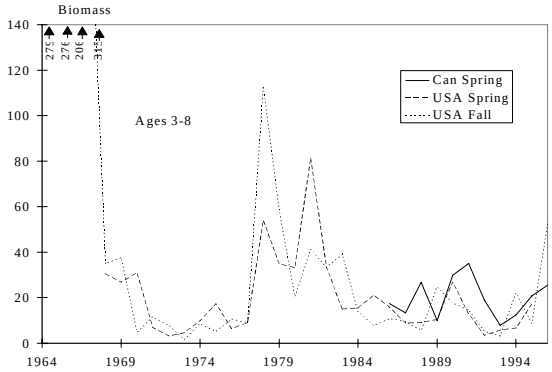
Resource Status

Stock status evaluations were based on an assessment using landings statistics, sampling for size and age composition of the commercial catch and trends in abundance from three bottom trawl research surveys (USA spring and fall and Canadian spring).

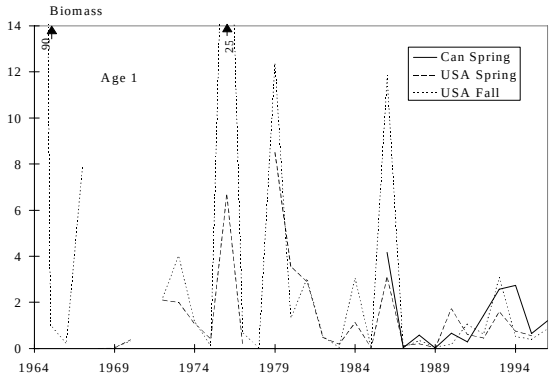
Changes to regulations and gear modifications in recent years make comparison of **catch rates** from year to year difficult to interpret. Generally though, the trends suggest that both otter trawl and longline catch rates increased progressively from 1993 to 1995.

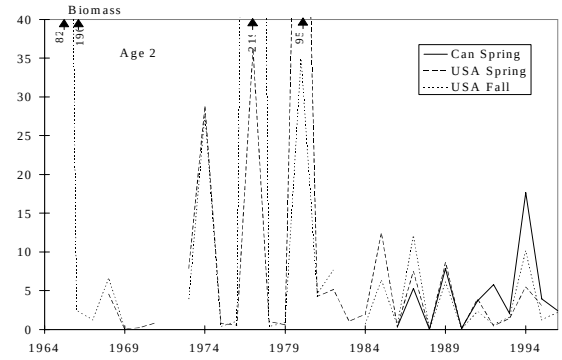


The USA **fall survey** results were compared to the beginning of year indices from the Canadian and USA spring surveys for the respective cohorts. Abundance trends for ages 3-8 increased during the late 1970s after having declined to their lowest in the early 1970s. Following a rapid decline in the early 1980s, abundance remained stable at relatively low levels through the mid to late 1980s before declining again in the early 1990s, approaching the lowest levels observed. There is an increasing trend since 1992-93.

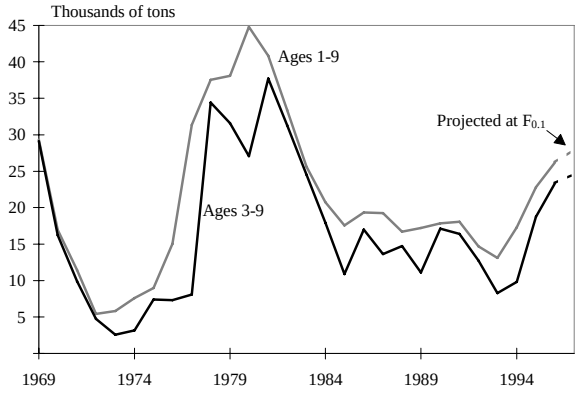


Survey results for ages 1 and 2 identified the strong 1975 and 1978 year-classes and the moderate 1983, 1985 and 1987 year-classes. Recruitment since then has been low but the 1992 year-class appears comparable to those of 1983, 1985 and 1987. The 1991, 1993, 1994 and 1995 year-classes do not appear as abundant ranging from about a third to a half the abundance of the 1992 year-class.

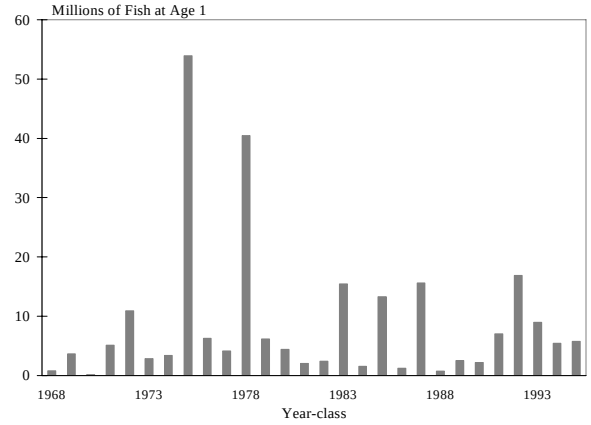




Population abundance estimates indicated that by the mid 1970s, following heavy exploitation by foreign distant water fleets, biomass had decreased to its lowest recorded level, but subsequently increased as the strong 1975 and 1978 year-classes recruited. The stock biomass again declined rapidly in the early 1980s as subsequent recruitment was poor and these two year-classes were fished intensely at a young age.

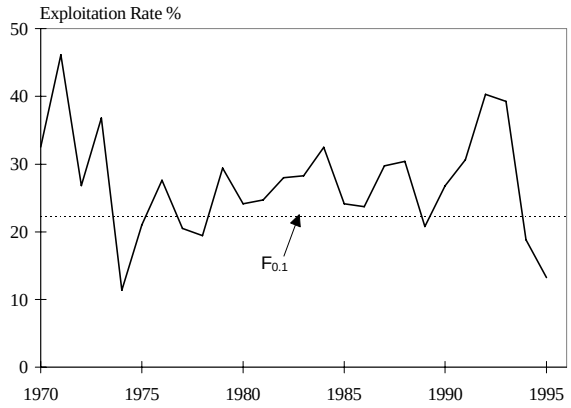


The biomass fluctuated around 18,000t during the late 1980s, supported by the 1983, 1985 and 1987 year-classes which were estimated to be the most abundant since the strong 1975 and 1978 year-classes, before declining to about 13,000t in 1993. The biomass has since steadily increased to about 26,000t in 1996. The recent increase, due principally to the 1992 year-class, but also supported by the 1991 and 1993 year-classes, was enhanced by increased weight at age of haddock from these and adjacent year-classes as well as increased survivorship of young haddock from reduced capture of small fish in the commercial fisheries. The biomass trend for ages 3 and older is similar but at a lower magnitude. The strength of the 1992 year-class was estimated to be about 17 million, comparable to the 1983, 1985 and 1987 year-classes, while those between 1987 and 1991 were weak.



The 1991, 1993 and 1994 year-classes were estimated at about 9 to 5 million. Early indications for the 1995 year-class suggest that it is also weak at about 5 million.

The **exploitation** rate for ages 4 and older has generally exceeded the $F_{0.1}$ target of 22% ($F_{0.1}$ = 0.28) and increased markedly between 1989 and 1992 to about 41%, amongst the highest observed. The previous occasion when the exploitation rate exceeded 35% was during the early 1970s when abundance was at its lowest. The exploitation rate declined moderately in 1993, but then more substantially in 1994 and 1995 to a level below the $F_{0.1}$ target.



Results from assessments for several other stocks have identified a discrepancy between past estimates of stock status and current estimates using additional data (retrospective pattern). Results for this stock indicate that this assessment does not suffer from a retrospective pattern.

An update of the yield per recruit analysis to account for changes in partial recruitment at age and weights at age arising from recent changes in otter trawl mesh and

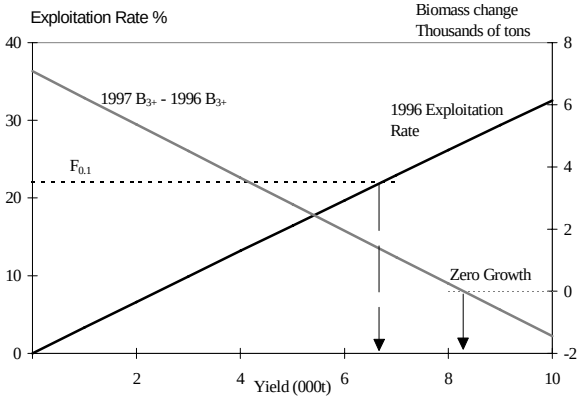
fishing practices resulted in an $F_{0.1}$ = 0.28 (exploitation rate = 22%).

The Georges Bank ecosystem is complex with numerous species interactions. Further, species adapt to fluctuations in abundance of both their prey and predators. These interactions were modeled by a constant natural mortality and there were no indications that this assumption was severely violated. Currently available information does not permit more complex models to be employed.

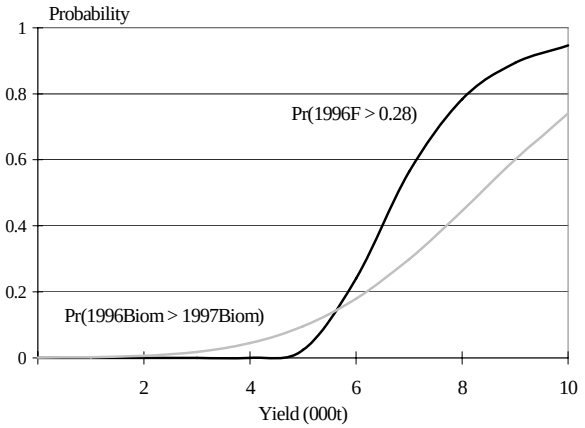
Environmental conditions on Georges Bank have varied but have not displayed extreme deviations in recent years. Though environmental conditions are thought to influence fisheries processes, convincing relationships with quantities such as recruitment, survival rates and fish catchability have not been established for this stock.

Outlook

The **projected** yield at $F_{0.1}$ = 0.28 in 1996 would be about 6,800 t with the 1992 year-class accounting for more than half of the landed weight. The biomass for ages 3 and older is projected to increase marginally from 23,300 to over 24,000 t at the beginning of 1997 with the 1992 year-class accounting for almost half of that biomass.



With the current state of the stock, the 1992 year-class makes a relatively large contribution to the projected yield. As the 1992 year-class gets fished down, the biomass will decline unless there is good recruitment. **Uncertainty** regarding the abundance of any single year-class gets translated to the projected yield which, in this case, had a relative error of roughly 25%. A yield of about 5,000t ensures that $F_{0.1}$ is not exceeded and increases the chances that the biomass for ages 3 and older will increase between 1996 and 1997.



These uncertainty calculations are based on approximations and do not include variations in weight at age, partial recruitment, variations in natural mortality, etc., but should provide useful rough guidelines. Increasing the number of age groups contributing to the yield should lead to greater precision in the advice, reduced fluctuations in biomass caused by recruitment variability and result in more stable yield between years. A larger spawning biomass could enhance recruitment by capitalizing on the opportunities for greater egg and larval survival when environmental conditions are favorable.

The projected increase in haddock abundance is due primarily to recruitment of one year-class, the moderately strong 1992 year-class, but is also bolstered by the adjacent 1991 and 1993 year-classes. Continuing conservation efforts such as low exploitation and fishing practices which permit recruits to realize their growth and reproductive potential are needed to sustain the rebuilding of the population biomass and to expand the age structure.

For More Information

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References

Gavaris, S., and L. Van Eeckhaute. 1996. Assessment of haddock on eastern Georges Bank. DFO Atl. Fish. Res. Doc. 96/21.