



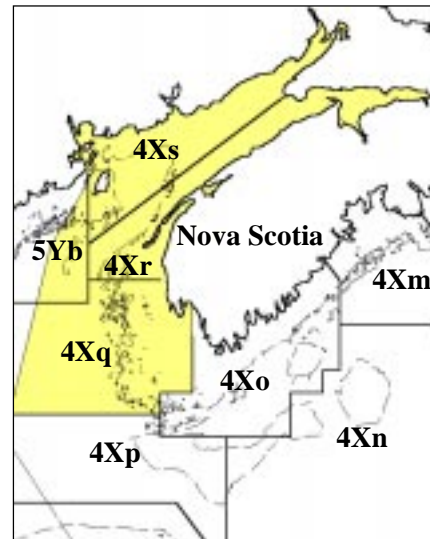
Southern Scotian Shelf and Bay of Fundy Haddock

Background

Haddock are found on both sides of the North Atlantic. In the west Atlantic, they occur from southwest Greenland to Cape Hatteras. A major stock exists in the southern Scotian Shelf and Bay of Fundy area. This bottom-dwelling species is a member of the cod family and feeds mainly on small invertebrates. It is most common at depths ranging from 25-75 fathoms (46-137 m) and in bottom temperatures above 2°C. Although seasonal migrations are evident within the stock area, there is relatively little exchange between adjacent haddock stocks.

Young haddock in this stock are relatively fast growing, reaching 17 inches (43 cm) and 1.7 pounds (0.8 kg) by age 3 on average. Growth slows thereafter and haddock reach only about 26 inches (66 cm) in length by age 10. Haddock in the Bay of Fundy grow more rapidly than those on the southern Scotian Shelf. Approximately 50% of female haddock are mature by age 3; however the number of eggs produced by a female of this age is low and increases with age. Browns Bank is the major spawning area for the stock and peak spawning occurs from April to June.

Reported annual landings have been as high as 36,000t and the long-term average is about 20,000t. Landings have been below 11,000t since 1988. This fishery has been dominated by mobile gear historically. During 1990-93 the proportion of landings taken by fixed gear was greater; however mobile gear landings has been greater than 50 percent since 1994. Quotas for this stock were introduced in 1970 and a spawning season/area closure has been in place since that time. Scientific advice is presented on the basis of a target capture rate of approximately 20% of the population and maintaining a large spawning stock biomass to enhance the probability of good recruitment.



Summary

- Reported landings of 4X haddock increased from a low of 4,406t in 1994 to 6,527t in 1997. The stock unit was redefined in this assessment to include Canadian landings in unit area 4Xs and Division 5Y. Landings in the first half of 1998 were 3,597t.
- Both the 1993 and 1994 year-classes had been estimated to be high, but the retrospective pattern evident in the last three years infers the size of these year-classes to be lower.
- Exploitation rate for ages 5-7 decreased from approximately 50% in the early 1980s and dropped below the target in 1994 and 1995. Exploitation in 1998 will be about the target if the TAC is not exceeded.
- The projected yield at $F_{0.1}$ in 1999 would be about 9,000t.
- If fished at $F_{0.1}$, the spawning stock biomass is projected to increase to 36,000t in 1999, and decrease subsequently.

The Fishery

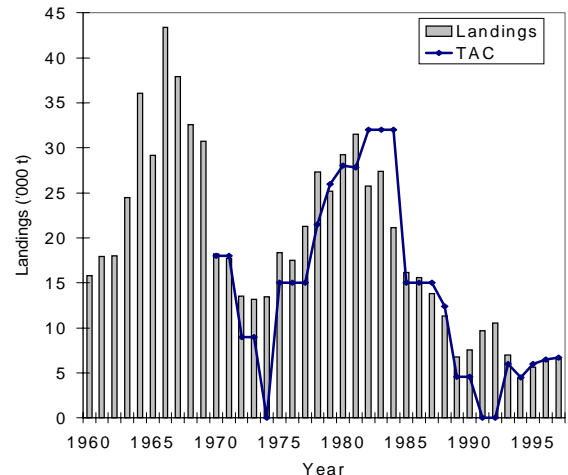
Landings (thousands of tonnes)

Year	1992	1993	1994	1995	1996	1997	1998
TAC	-	6.0	4.5	6.0	6.5	6.7	8.1
TOTAL	10.5	7.0	4.4	5.7	6.2	6.5	

Reported **landings** of 4X haddock in 1997 were 6,527t relative to a quota of 6,700t. Mobile gear landings were 4,303t while fixed gear landings were 2,215t. The 1998 TAC is 8,100t. Landings in the first half of 1998 were 3,597t.

Haddock landings from 4Xs have not been included in previous assessments of this stock, as it was felt these fish were from the 5Y stock. As a result of a re-evaluation of the stock unit, it is now felt that the majority of haddock caught in 4Xs and in the Canadian portion of 5Y in the recent period were of 4X origin. This assessment includes Canadian landings of haddock from 4Xs and 5Y and includes research vessel survey indices for all survey strata in 4X for 1970-98, the period covered by the assessment. This change in stock definition had little effect on the historical view of stock status.

Typically landings from 4Xs and 5Y have been less than 100t each. Last year, it was noted that mobile gear landings in 4Xs and 5Y increased in 1996 to 505t. In 1997, mobile gear landings in these areas increased further to 652t. This was consistent with a trend of an increasing proportion of mobile gear landings coming from 4Xqr since 1988.



In 1998, there was a shift in mobile gear effort directed for haddock in the spring. A concentration of haddock was located in 4Xn in an area and depth where haddock have not traditionally been found. As a result of increased haddock quota and favourable markets, a substantial amount of haddock was landed. This concentration of market-size haddock also contained small haddock and a small fish closure was implemented for some of this area in March. The mobile gear sector landed 3,018t in the first half of 1998, almost 60% more than in the first half of 1997. Mobile gear landings in the Bay of Fundy in the first half of 1998 are much lower than in the previous years.

Fixed gear landings in the first half of 1998 were 579t, up from 426t in 1997, but well down from previous years at this time. This delay in the fixed gear fishery is due in part to the introduction of community management in 1997, and to low availability of cod in the first half of 1998.

Reports from industry indicate that haddock abundance is good throughout most of the stock area but not in the eastern portion of 4X. Catches of small fish are prevalent, particularly in eastern 4X. Roseway Bank was closed again for 2 weeks in August 1997. It was felt that discarding of small

haddock in the longline fleet was reduced in 1997 and had improved further in 1998. It was thought that misreporting, associated with the introduction of community quotas in 1995 and 1996, was also reduced.

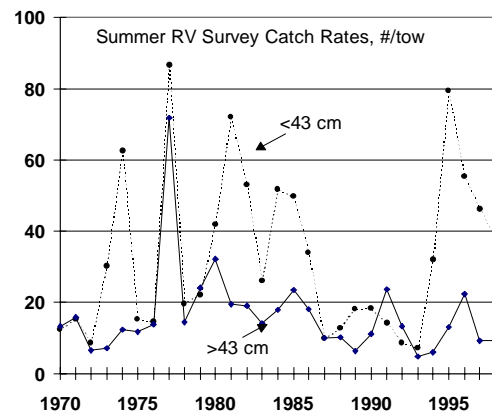
A comparison of the **size composition of commercial landings** of 4X haddock showed that the mean length of mobile gear landings increased after the introduction of square mesh and ITQs in the early 1990s; however mean length in mobile gear landings decreased from 54.7cm in 1995 to 51.6cm in 1996 and remained about the same in 1997. Mean length in mobile gear landings in the first half of 1998 decreased to 49.6cm, due largely to small fish encountered in 4Xn in March. Mean length in fixed gear landings decreased from 54.1cm in 1990 to 49.1cm in 1996, but increased to 49.9cm in 1997 and to 50.4cm in the first half of 1998. These increases may be due to avoidance of small fish and a change to fishing later in the year as a result of the introduction of community management into the fixed gear sector.

Resource Status

The stock status of this resource was based on an assessment using landings statistics, sampling of the age and size composition of the commercial catches, trends in the abundance from the summer research vessel surveys, and the results of a joint resource survey conducted in 1995-98 by the ITQ fleet in co-operation with DFO Science.

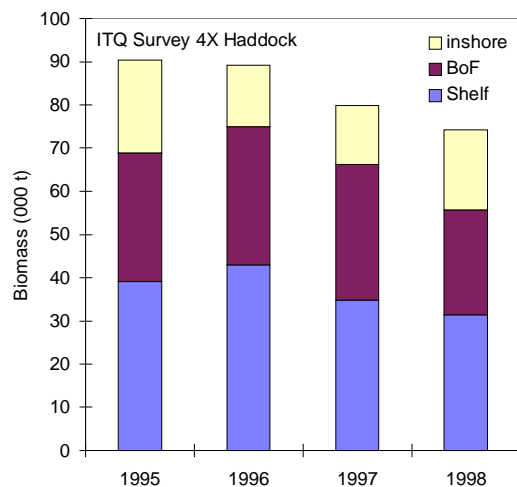
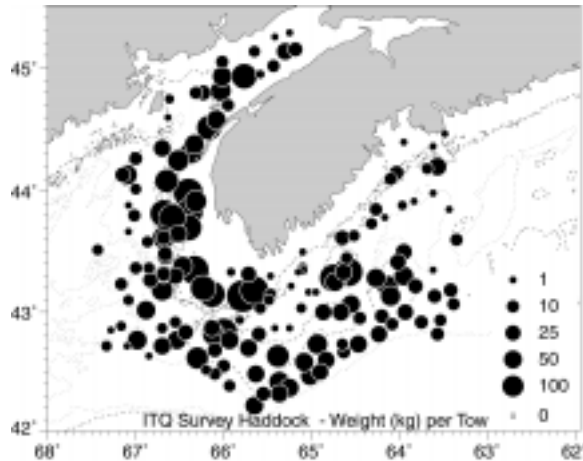
Abundance in **the summer research vessel survey** has decreased from a high level in 1995 to about the long-term mean in 1998. Mean number per tow of small haddock (less than 43cm) decreased but is still above the long-term mean; however the catch rate of market-size haddock remained below the long-term mean. Abundance was high on

Browns Bank and above average on Roseway and Lahave banks but low elsewhere in the Shelf strata. The abundance of market-size haddock was below average on the Scotian Shelf but above average in the Bay of Fundy. The research vessel survey indicates that the 1993 and 1994 year-classes are above average. The 1995 and 1996 year-classes appear relatively weak but the 1997 year-class may be average.

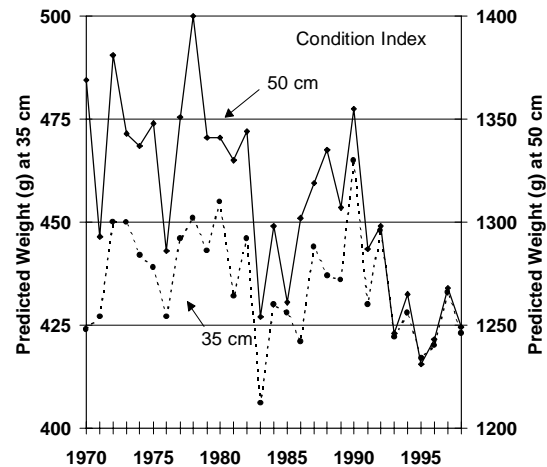


A **joint industry/DFO Science resource survey** of 4X was conducted in summer 1995-98 by the ITQ fleet. Survey coverage has increased to 187 standardized fishing sets and now covers most of the 4X area. In addition to providing extensive coverage of the traditional research vessel survey strata, this survey provides coverage inshore of the traditional strata in an area where a substantial portion of the mobile gear fishery occurs. Biomass trends in the inshore area were different from those in the traditional survey strata and the size and age composition of haddock caught in the inshore area also differed. These differences in the inshore area indicate that these surveys can provide additional information to the assessment. An index of abundance which included the inshore area was generated from these surveys and was incorporated into the assessment. Their inclusion improved the fit

of the model. These surveys indicate a small decrease overall since 1996 but an increase in the inshore area over the same period.



Condition is the relative weight of the fish for their length (i.e. their plumpness). An index of condition, developed from the summer research vessel surveys, was variable but indicated that condition has decreased since the late 1980s to low levels in the 1990s. The cause of low condition in this stock is uncertain.

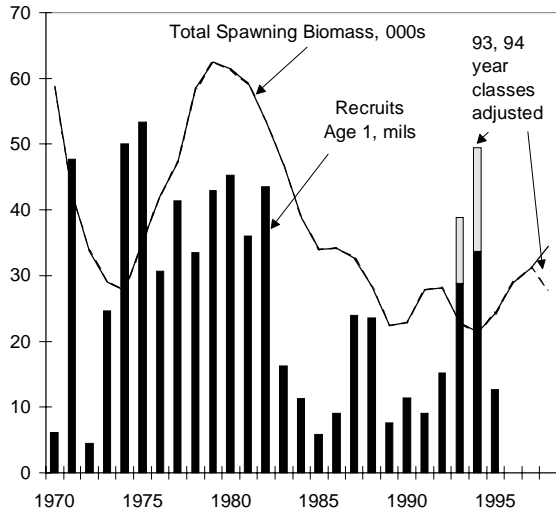


Mean length-at-age of haddock on Browns Bank and the Shelf has decreased since the late 1970s, particularly at older ages. A similar long-term trend was not observed in haddock in the Bay of Fundy; however mean length-at-age has decreased there in the last 3 to 4 years. **Mean weight-at-age** shows similar trends.

Oceanographic conditions in 1998 showed a substantial change. Near-bottom temperature in almost all research vessel survey strata were below their long-term means and many established new low levels. Temperatures in the 2-4°C range were widespread in the eastern portion of 4X. These conditions are associated with an increased transport of Labrador Slope water. The impact on haddock in 4X is not yet understood.

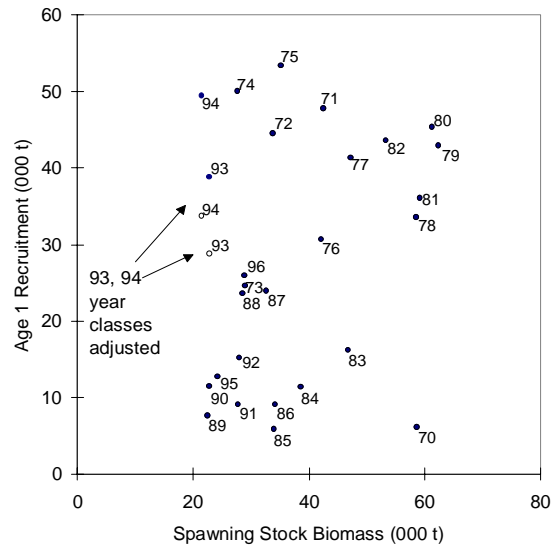
Past **assessments** of this resource have under-estimated exploitation and over-estimated population abundance in the current year, particularly when large year-classes occur, and this is the case in this assessment. Population estimates in recent years are considerably lower than indicated in the assessment last year.

Spawning stock biomass has been decreasing since 1980 and reached a low of 21,000t in 1994. It is estimated that spawning stock biomass has increased to about 30,000t in 1998 as the 1993 and 1994 year-classes mature.

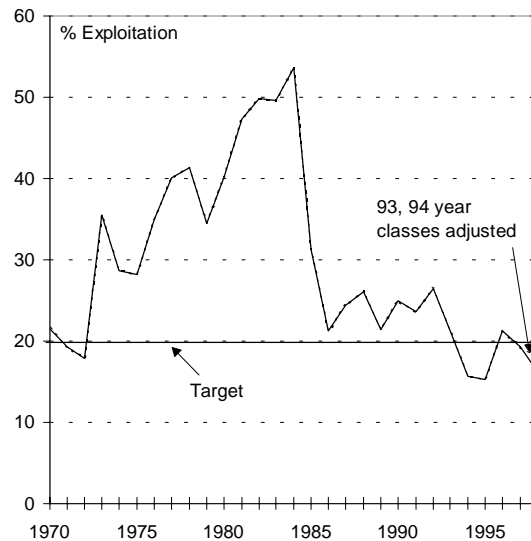


Except for the 1987 and 1988 year-classes, **recruitment** of the 1983-92 year-classes was below average. Both the 1993 and 1994 year-classes are estimated by the research vessel survey to be high. The retrospective pattern evident in the last three years has reduced the apparent size of these year-classes. This analysis indicates there is still a tendency to over-estimate the abundance of large year-classes. The estimates of the 1993 and 1994 year-classes were adjusted downward to 29 and 34 million at age 1 respectively.

There appears to be no relationship between spawning stock biomass and recruitment over the biomass range observed.



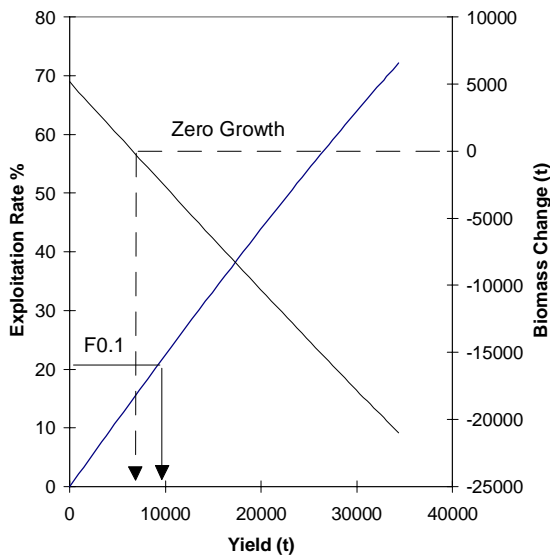
The **exploitation rate** on ages 5-7 has been higher than the target since the early 1970s. Exploitation decreased from approximately 50% in the early 1980s to close to the target level.



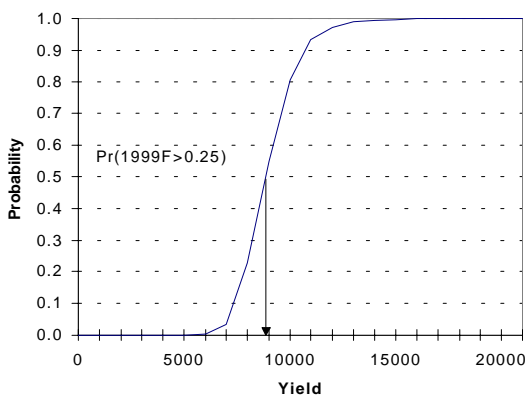
Outlook

An age 1 recruitment of 34 million for the 1994 year-class and 29 million for the 1993 year-class (reduced from the VPA estimate due to the tendency to over-estimate the size of large year-classes) and a mean from the recent past of 12 million for 1996 and

subsequent year-classes were used in the projection. The **projected yield** at the target exploitation rate (20%, $F_{0.1}=0.25$) in 1999 would be 9,000t. Of this projected yield, 67% will come from the 1993 and 1994 year-classes. Spawning stock biomass would peak at 36,000t in 1999 and decrease to 34,000t at the beginning of 2000.



Risk analysis indicates that at a yield of 9,000t, which corresponds to a 50% risk of exceeding $F_{0.1}$, the spawning stock biomass has a 98% probability of decreasing for 2000. This probability of spawning stock biomass decreasing for 2000 decreases to 50% at a yield of 6,100t.



With the reduction in the estimated strength of the 1993 and 1994 year-classes in this assessment, the outlook is not as optimistic

as last year. Spawning stock biomass will not increase to the level predicted last year.

The projected yield was calculated using commercial weights-at-age. These do not show the decreasing trend in recent years that are evident in the research vessel survey weights-at-age. If the commercial weights-at-age used are overestimated, then yield will be overestimated. If there is a shift in the proportion of landings from the Bay of Fundy to the Scotian Shelf where growth is slower, this would also result in yield being overestimated.

For more Information

Contact: Peter Hurley
Marine Fish Division
Bedford Institute of Oceanography
P.O. Box 1006, Dartmouth
Nova Scotia, B2Y 4A2

Tel: 902-426-3520

Fax: 902-426-1506

E-Mail:

HurleyP@mar.dfo-mpo.gc.ca

Reference

Hurley, P.C.F., G.A.P. Black, P.A. Comeau and R.K. Mohn. 1998. Assessment of 4X haddock in 1997 and the first half of 1998. DFO Canadian Stock Assessment Secretariat Res. Doc. 98/136.

This report is available from the:

Maritimes Regional Advisory Process
Department of Fisheries and Oceans
P.O. Box 1006, Stn. B203
Dartmouth, Nova Scotia
Canada B2Y 4A2
Phone number: 902-426-7070
e-mail address: myrav@mar.dfo-mpo.gc.ca

Internet address: www.dfo-mpo.gc.ca/csas
ISSN: 1480-4913

*La version française est disponible à
l'adresse ci-dessus.*



Correct citation for this publication:

DFO, 1998. Southern Scotian Shelf and Bay
of Fundy Haddock. DFO Sci. Stock
Status Report. A3-07(1998).