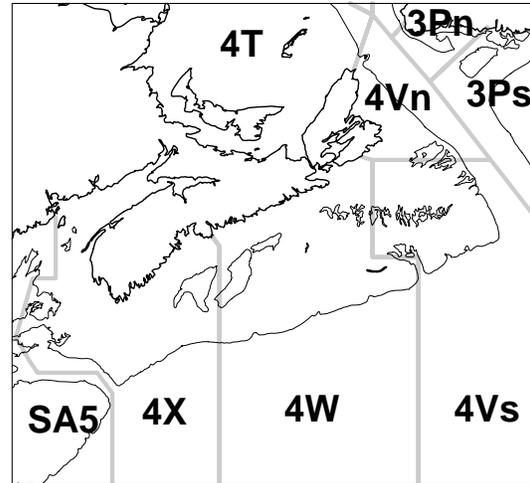
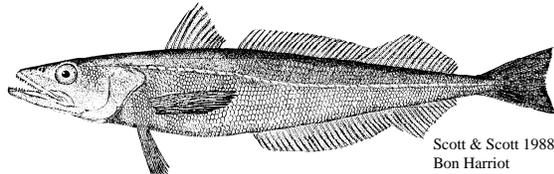




SILVER HAKE ON THE SCOTIAN SHELF (DIV. 4VWX)



Context

Silver hake (*Merluccius bilinearis*) is a bottom dwelling member of the gadoid family, found from Cape Hatteras to the Grand Banks and the Gulf of St. Lawrence. A population of silver hake occurs on the Scotian Shelf.

Scotian Shelf silver hake are generally found between 7 and 10° C, in deeper water on the shelf edge and in the Emerald and LaHave basins. Seasonal movements occur during the summer, as silver hake move into shallow water on Sable and Western banks to spawn. Scotian Shelf silver hake feed primarily on invertebrates, with krill the predominant prey item. Older fish are piscivorous and exhibit a high degree of cannibalism.

Silver hake exhibit relatively rapid growth with females growing faster than males. Maximum age is 12 years. Maturity is relatively early, with a majority maturing at age 2.

Prior to 1977, fishing on the Scotian Shelf was unrestricted in terms of area, mesh size and season. During this period fishing was conducted over the entire shelf, and the use of trawl mesh as small as 40 mm was common. In 1977, fishing for this species was restricted to the seaward side of the Small Mesh Gear Line (SMGL), west of 60° W longitude, with a minimum mesh size of 60 mm (offshore). In 1994, further restrictions were introduced to minimise incidental catches of cod, haddock and pollock in the silver hake fishery. These included a repositioning of the SMGL to prevent fishing in depths less than 190 m and the mandatory use of a separator grate in the lengthening piece of the trawl. Since 1995 a fishery has been conducted by the Canadian tonnage class 3 (<65') mobile gear fleet in and around Emerald and LaHave basins (inshore).

SUMMARY

- While for many years the silver hake fishery was concentrated on the shelf edge, since 1997 the majority of catches have been taken in Emerald and LaHave basins. Since the mid-1990s, the proportion of young fish in the catch has increased.
- The 2003 year-class is below average, but the 2002 and 2004 year-classes are large at about twice average and among the highest since 1970.
- There has been a generally decreasing trend in biomass from the RV survey since the 1980s. Total biomass and abundance increased from 2002 to 2004, but has decreased in 2005 to a level close to the lowest since 1970.
- Relative fishing mortality does not display any strong trends in the past decade and is expected to remain in the range observed, if the current quota is maintained.
- Recent good recruitment has not been translated into a higher biomass. Early indications are that the 2004 yearclass is also strong, however, it cannot be determined if this will result in an increase in biomass.

DESCRIPTION OF THE ISSUE

Rationale for Assessment

Advice was requested by Fisheries Management on the stock status of 4VWX silver hake in order to determine a TAC that would be consistent with the management plan. Specifically:

- If the 2005/06 TAC for silver hake is continued into 2006/07, evaluate whether or not:
 - fishing mortality will be maintained at a moderate level; and
 - biomass will increase.

The Fishery

Landings (000s t)

Year	1970-79	1980-89	1990-99	2000 ²	2001	2002	2003	2004	2005
TAC	90.2 ³	98.5	53.3	20	20	20	15	15	15
Canada ¹	0	0	3.7	12.9	18.0	16.7	12.8	12.9	
Foreign	115.6	64.2	27.8	0	0	0	0	0	
Total	115.6	64.2	31.5	12.9	18.0	16.7	12.8	12.9	

1. Includes developmental allocations.

2. Commencing in 2000, fishing year, landings and TAC refer to the period from April 1 of the current year to March 31 of the following year.

3. Average TAC for 1974-79 period.

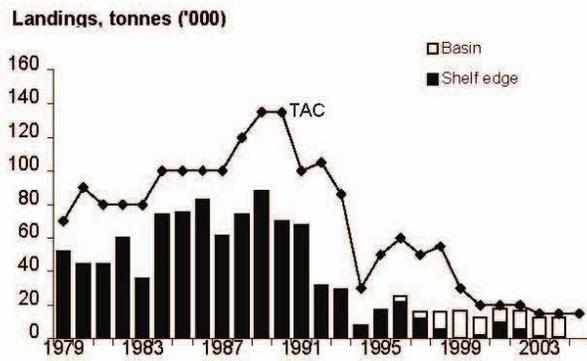


Figure 1. Recent landings and TAC for Scotian Shelf silver hake.

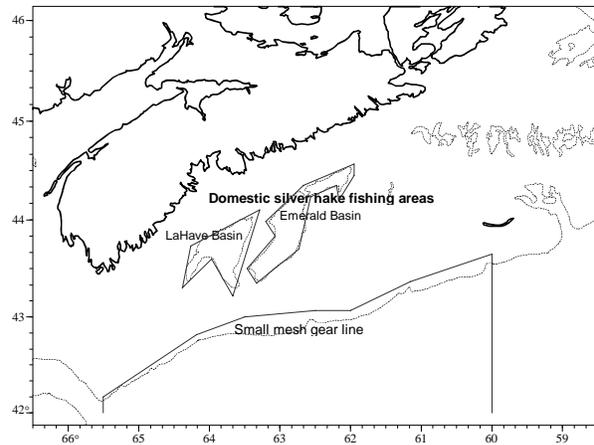


Figure 2. Scotian Shelf silver hake fishing areas.

Landings in the fishery from April 1 through October 27, 2005, are 5275 t. While for many years the silver hake fishery was concentrated on the shelf edge, since 1997 the majority of catches have been taken in Emerald and LaHave basins.

Since the mid-1990s, and the proportion of young fish in the catch has increased (Figure 3).

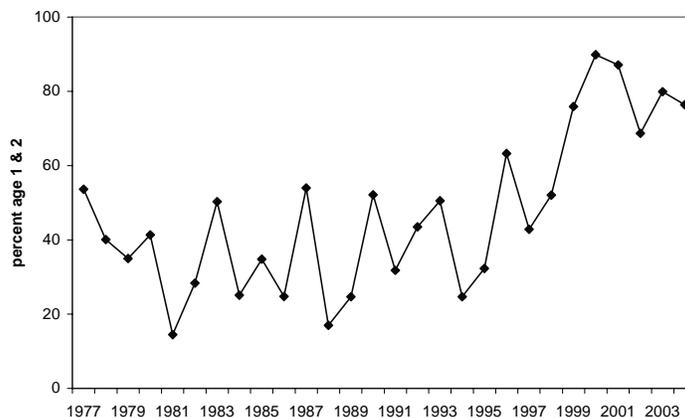


Figure 3. Silver hake catch at ages 1 & 2 as a proportion of the total catch (numbers).

RESOURCE ASSESSMENT

Stock Trends and Current Status

Recruitment to the 2005/2006 fishery is from the 2002-2004 year-classes. The 2003 year-class is below average, but the 2002 and 2004 year-classes are large at about twice average and among the highest since 1970 (Figure 4).

There has been a generally decreasing trend in biomass from the DFO **summer research vessel (RV) survey** since the 1980s. Total biomass and abundance increased from 2002 to 2004, but has decreased in 2005 to a level close to the lowest since 1970 (Figure 5).

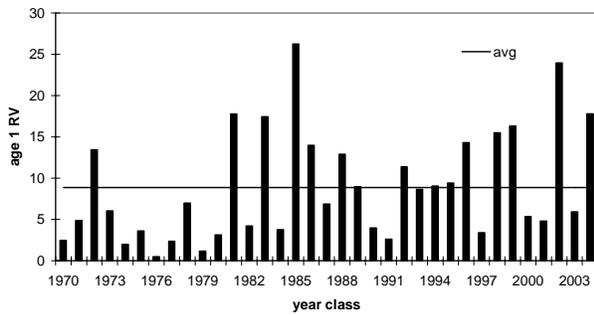


Figure 4. Recruitment estimates for Scotian Shelf silver hake from age 1 July RV survey abundance (2005 point estimated from length data).

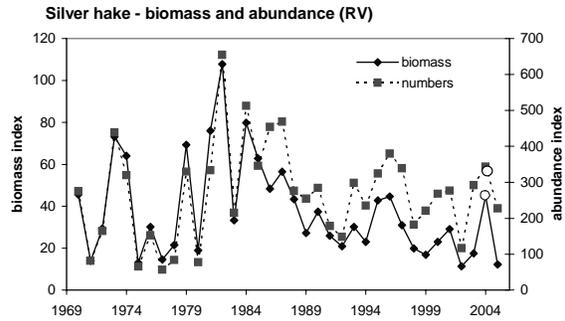


Figure 5. Silver hake abundance and biomass estimates from July RV, 1970-2005 for Scotian Shelf strata 440-483 (excludes Bay of Fundy). Years 1970-81 corrected for survey vessel effect. Clear circles highlight Teleost survey in 2004.

Length-at-age for age 2, 3 and 4 have shown declines, from relatively high levels in the early 1970s to a low in 1995 (Figure 6). Length-at-age for these ages have been relatively stable since 1995, although it still remain below the long-term mean.

Condition shows a general decline from 1975 to 2002 (Figure 7). However, since 2002 condition has improved, although it still remains relatively low.

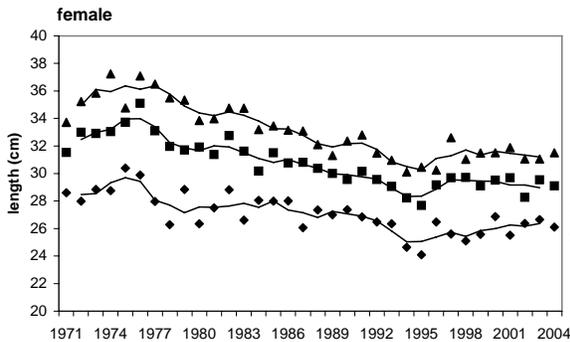


Figure 6. Mean length-at-age for Scotian Shelf silver hake from July RV survey data.

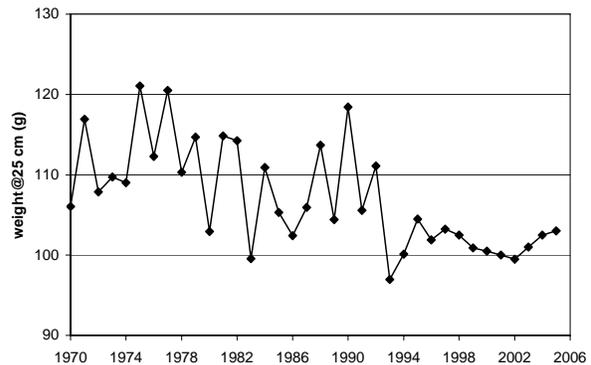


Figure 7. Condition factor (predicted weight at 25 cm) for Scotian Shelf silver hake from July RV survey data.

Total mortality for ages 2-4 fluctuates and recently is relatively low (Figure 8).

There are currently no reliable estimates of fishing mortality (F). However, **relative F** (Figure 9) can be calculated as the ratio of the commercial catch to the biomass from the July RV survey. Current relative F levels suggest exploitation is low relative to the 1970s. However, there are concerns about the comparability over this longer time period. Relative F does not display any strong trends in the past decade.

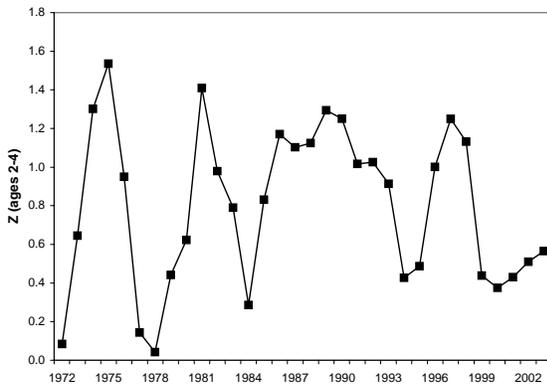


Figure 8. Estimates of total mortality for Scotian Shelf silver hake from July RV numbers, 1972-2003.

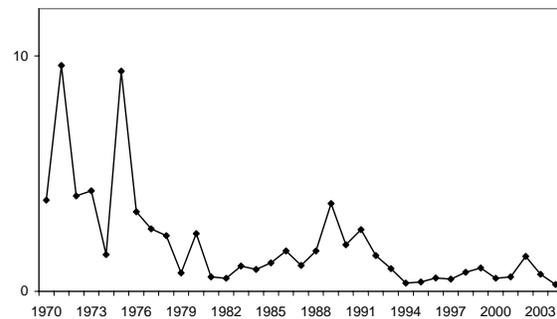


Figure 9. Relative F for Scotian Shelf silver hake from July RV biomass and commercial catch weight.

Sources of Uncertainty

A 2-3 fold increase in the RV survey indices from 2003 to 2004 coincides with a change in survey vessels from the *CCGS Alfred Needler* to the *CCGS Teleost*. Although initial results show the catchability between the two vessels is comparable, more comprehensive analyses are required to determine the magnitude of the change in vessel effect on the analyses of stock status.

Uncertainty in stock structure and survey coverage make inferences concerning status using survey information problematic. Also, the inability to reconcile the indications of recent good recruitment and low relative fishing mortality with the low abundance of older ages suggests that further research is required to improve our understanding of the dynamics of this resource.

ADDITIONAL STAKEHOLDER PERSPECTIVES

Industry was concerned that the RV survey may not adequately reflect the status of the stock. Furthermore, strata in the Bay of Fundy were not included in the survey indices while any catches that may be removed from this area would be attributed to the quota. Industry feels catch rates have been good and that the stock is improving.

CONCLUSIONS AND ADVICE

Outlook

This resource continues to display conflicting indicators of status.

Current relative F levels suggest exploitation is low relative to the 1970s. However, there are concerns about the comparability over this longer time period. Relative F does not display any strong trends in the past decade and is expected to remain in the range observed, if the current quota is maintained.

Growth (condition and length-at-age) is below the long-term average, although it has been relatively stable in recent years. Total mortality for ages 2-4 fluctuates and recently is relatively low. The 2002 yearclass is amongst the highest observed since 1970. However, these promising signs have not been translated into a higher biomass; the most recent survey

estimate is close to the lowest in the time series. Early indications are that the 2004 yearclass is also strong. However due to the complications identified in the 'Sources of Uncertainty' section, it cannot be determined if this will result in an increase in biomass.

OTHER CONSIDERATIONS

Changes have been seen in the catch at age in the commercial fishery, with age 1 fish now an important component of the catch. The implications of harvesting these young fish on production of the stock should be investigated, along with appropriate reference levels.

SOURCES OF INFORMATION

DFO, 2005. Proceedings of the Maritime Provinces Regional Advisory Process on Scotia-Fundy Groundfish Stocks; 31 Oct – 3 Nov 2005. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2005/022.

Showell, M.A., G. Young, R.K. Mohn, and G.M. Fowler. 2005. Assessment of the Scotian Shelf silver hake population through 2005. DFO Can. Sci. Advis. Sec. Res. Doc. 2005/084.

FOR MORE INFORMATION

Contact: Mark Showell
Population Ecology Division
Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, Nova Scotia
B2Y 4A2

Tel: (902) 426-3501

Fax: (902) 426-1506

E-Mail: showellm@mar.dfo-mpo.gc.ca

This report is available from the:

Maritimes Provinces
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

Fax: 902-426-5435

e-mail address: XMARMRAP@mar.dfo-mpo.gc.ca

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

ISSN 1480-4913 (Printed)

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CORRECT CITATION FOR THIS PUBLICATION

DFO, 2005. Silver Hake on the Scotian Shelf (Div. 4VWX). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2005/059.