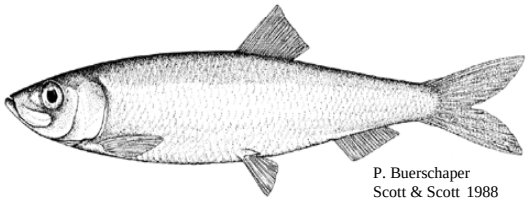
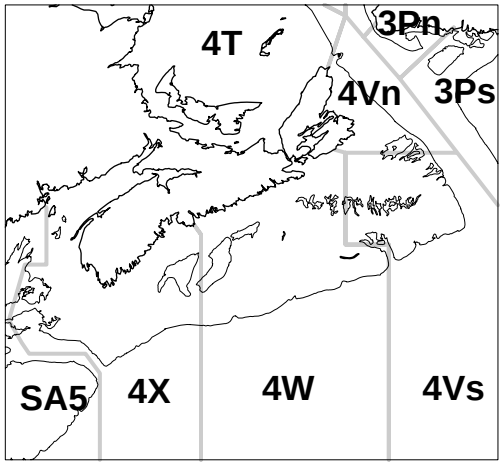


P. Buerschaper
Scott & Scott 1988

4WX HERRING



Background

Atlantic herring is a pelagic species found on both sides of the North Atlantic. In the western Atlantic it ranges from Labrador to Cape Hatteras. Herring aggregate to spawn in discrete locations to which they are presumed to home. Eggs stick to the bottom and hatch in about 10 days into planktonic larvae which have been shown to remain in "larval retention areas" for several months. After metamorphosis into juveniles, herring move more widely, often near shore. Herring first mature and spawn at three or four years of age (23 to 28 cm or 9 to 11 in), then begin a predictable annual pattern of spawning, over wintering, and summer feeding which often involves considerable migration and mixing with members of other spawning groups.

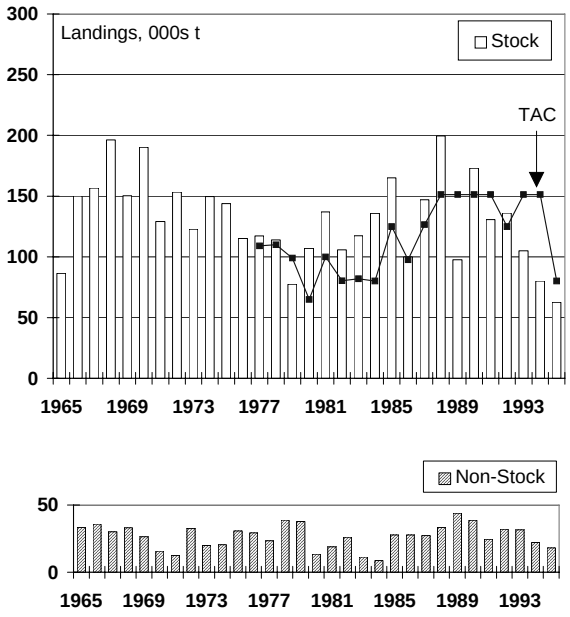
In spite of this mixing and migration, it appears that individual spawning groups are reasonably discrete, and that most current management units are stock complexes. Recognizing this, industry and management have explored means of distributing fishing effort among spawning components. The Division 4WX herring fisheries are based primarily on fish from the major spawning areas off southwest Nova Scotia, and these are considered to be the 4WX stock complex ("stock fish"). However, the area also contains migrants from the Gulf of Maine and small spawning groups along the coast of Nova Scotia which are designated as "non-stock".

Fisheries in the 4WX areas in recent years have been dominated by purse seine and weir, with relatively minor landings by midwater trawl, shutoff, trap, and gillnet.

The Fishery

Landings (thousands of tonnes)

Year	70-79 Avg.	80-89 Avg.	1990	1991	1992	1993	1994	1995
Stock TAC	-	-	151.2	151.2	125.0	151.2	151.2	80.0
Stock	131.3	131.2	172.9	130.8	136.0	105.1	80.1	62.5
Non-Stock	26.2	23.9	38.8	24.6	31.9	31.6	22.2	18.2
Area Total	157.5	155.1	211.7	155.4	167.9	136.8	102.3	80.7



Available from: Maritimes Regional Advisory Process, Department of Fisheries and Oceans, P.O. Box 1006, Stn. B105, Dartmouth, N.S., Canada. B2Y 4A2. Telephone: 902-426-8487. EMAIL: d_geddes@bionet.bio.dfo.ca.

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Non-Stock Fisheries

A total of 18,248t was recorded from weir and shutoff fisheries on the New Brunswick side of the Bay of Fundy, approximately 4000t lower than in 1994, and the lowest for this portion of the fishery since 1984. As in previous years, catches from these fisheries were excluded from the 4WX total allowable catch (TAC), on the grounds that they target primarily juveniles presumed to have originated in the Gulf of Maine. As in previous years, age 2 fish dominated these fisheries in number (69%), and in weight (58%).

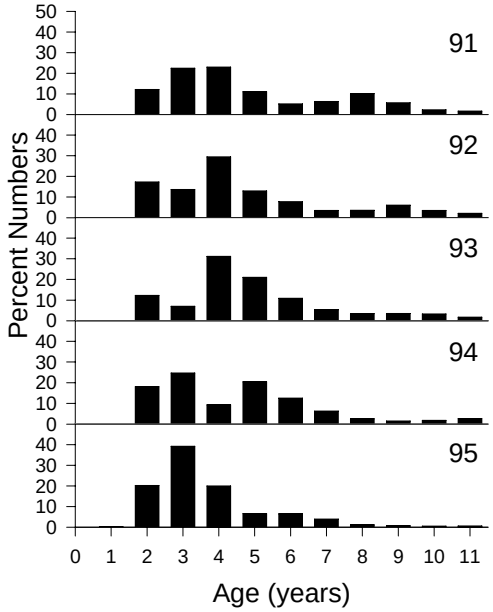
4WX Stock Fisheries

The TAC for 1994/95 was reduced to 80,000, due to a number of indications of reduced stock status in the 1994 fishery, and reduced larval herring abundance in the 1994 survey, and there was provision for a further downward adjustment if required.

Management of this fishery moved further toward a spawning stock unit approach, with separate consideration of individual spawning components (Scots Bay, Trinity Ledge, Gannet/Dry Ledge, Seal Island, German Bank) and discrete fisheries (Long Island shore, Grand Manan). Additional elements of the plan included a mandatory dockside monitoring program for mobile gear (using bulk density conversion of 860 kg/m^3 for wet and 990 kg/m^3 for dry vessel holds), and the establishment of a DFO/Industry Monitoring Working Group (MWG) to develop in-season management measures for 4WX spawning stock areas.

Landings in the stock portions of the fishery declined further in 1995 to 62,500t. The highest landings (48,481t) occurred in the summer purse seine fishery on the pre-spawning and spawning aggregations off southwest Nova Scotia (subareas 4Xq and 4Xr) from June to mid-October. Other major fishing activity occurred in the purse seine fisheries on over-wintering aggregations of herring in eastern Nova Scotia including the Chedabucto Bay area (November 1994 through February 1995; 3,191t), and off Grand Manan in the 4Xs fall and winter fishery.

The move to in-season management improved the record of information from the fishery. Information included records of all searching activity and catch locations, very thorough coverage of all portions of the fishery for biological characteristics, and a series of surveys of major spawning areas using commercial vessels in which sonars and sounders were used to document number, location and approximate size of herring schools.



A very large portion of the stock catch was made up of fish of ages 2 - 4 (79% in number, 59% in weight). Age 3 fish (1992 yearclass; approximately 25 cm length) dominated landings from the stock portion of the fishery in both number (39%) and weight (27%). There was a second length mode in most areas at about 30 cm (age 6). Although this high proportion of small fish has been observed before (primarily during the meal fishery in the 1960s), the reduced representation of older fish in the catch is cause for concern. There was considerable discussion during the summer fishery about the abundance of small fish. It was generally concluded that while there were good signs of small fish, particularly in the Long Island area, large fish were scarce. Catch at age shows that while the weight of fish landed from the stock portion was less in the 1995 fishery than in 1994, the same number of fish were caught (i.e. more fish of smaller weight).

Resource Status

Biological observations from each major segment of the 1995 fishery were compared with historical patterns during in-season management discussions. While generally improved over 1994, observations confirm the conclusion of the last assessment that the stock status has declined substantially in recent years. Such indications include:

- With the lack of large fish, this fishery has moved further toward relying on single years of recruitment

as soon as they occur. This seems to be evident in the focus on age 3 in the 1995 catch.

- As was noted last year, there still seems to be a lack of fish in some traditional summer feeding and pre-spawning areas.

- Although spawning was documented at the appropriate times in most key spawning areas, the apparent lack of spawning in the Seal Island area is of great concern. This area has received a high proportion of the fishing effort in some recent years and was expected to be one of the major spawning areas in 1995, but this did not occur.

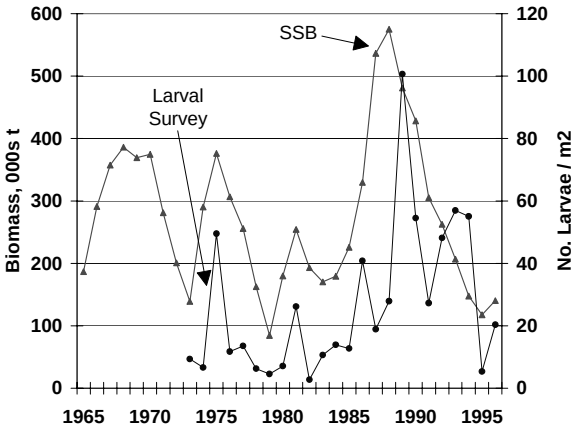
The warm temperature anomaly noted in 1994 was not evident in 1995. Most months were slightly cooler than the 1961-1990 mean, and all were well within the extremes noted in the past. The problem of low fat content in herring observed in 1994 appeared not to be a problem in 1995. There was a persistent abundance of juveniles in the Long Island area.

Stock status evaluation was based on sampling and analysis of the commercial fishery combined with the results of a larval abundance survey.

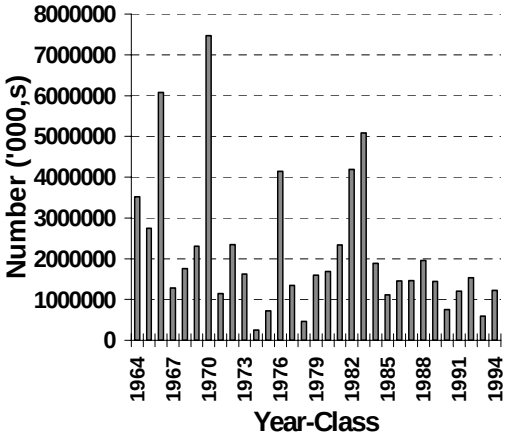
An annual (late October and early November) survey of recently hatched herring larvae in the Bay of Fundy and eastern Gulf of Maine has been conducted since 1972 using consistent methodology. From this, an index of larval herring abundance has been calculated as the mean of larval density (no. per m^2 to bottom) for a standard set of 78 stations. Larval herring abundance has been shown to reflect the general state of herring stocks elsewhere (including the collapse and recovery of the North Sea and Georges Bank stocks). This index, although characterized by great fluctuation, is considered to be a reflection of post-fishery spawning stock biomass.

An analytical assessment, similar in structure to that used in 1995 was attempted. Larval abundance was related to spawning stock biomass (population x weight at age x maturity) at the beginning of the year immediately following the November survey. However, there is difficulty in fitting the trends in overall stock abundance to the larval survey index.

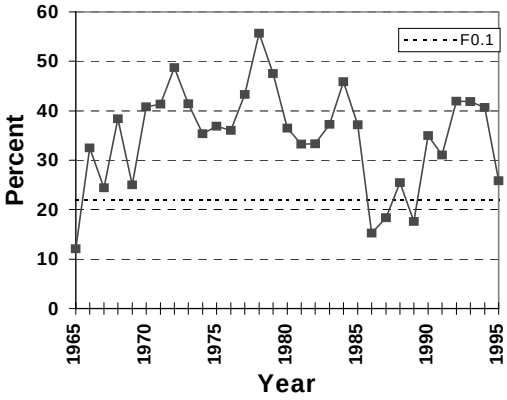
Analyses with a range of fishing mortalities in 1995 generate temporal patterns in exploitation rate that are roughly consistent with effort trends. The results indicate an SSB in 1996 between 100,000 and 200,000t. An intermediate scenario indicates a SSB of only 140,000t at the beginning of 1996. In this scenario, F was well above $F_{0.1}$ in the 1990s but lower in 1995 consistent with a reduction in effort resulting from management restriction. There have been no strong yearclasses since 1983.



Recruitment at Age 1



Exploitation Rate



Outlook

There continues to be concern for the state of this stock. The SSB has decreased considerably in recent years, and while it is estimated to have increased slightly in the last year, it is still considered to be between 100,000 and 200,000t. Projections from an intermediate level within this range (terminal F=0.3) would indicate a $F_{0.1}$ yield in 1996 of about 50,000t.

It is noted that a large portion of the projected biomass and yield are recruiting yearclasses. This projection was done assuming full recruitment at age 3. The catch in 1996 is predicted to contain 42% by number, and 18% by weight, fish $\leq$ 3 years of age. This may not be advisable when the stock is at a low state.

Management Considerations

1. The system of in-season management, implemented in 1995, led to improved information and protection of components of the fishery. In light of concern and uncertainties about the state of this stock, it is recommended that a similar system be continued in 1996.

2. The initiative of increased consideration of spawning groups in management is encouraged. Further research should be undertaken to document the size of spawning groups.

3. The small spawning stocks along the south shore of Nova Scotia should continue to be considered separate from the southwest Nova Scotia spawning complex, and should be documented more completely.

4. Further investigation of herring on offshore Scotian Shelf Banks is encouraged. Catches from this area in 1996, particularly during spawning season, could again be excluded from 4WX quota.

For More Information

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