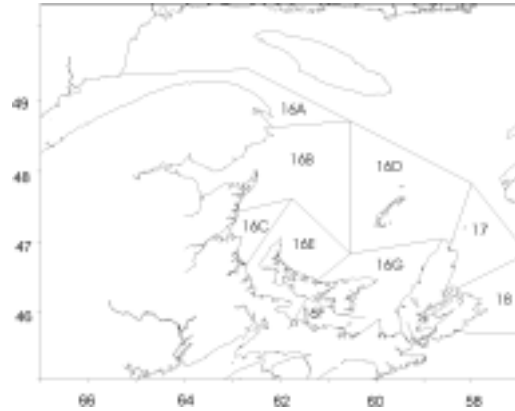


## Southern Gulf of St. Lawrence Herring



### Background

Herring are a pelagic species which form schools during feeding and spawning periods. Herring in the southern Gulf of St. Lawrence consist of two components, spring spawners and fall spawners. Spring spawning occurs primarily in May but extends into June at depths <10m. Fall spawning occurs from mid-August to mid-September at depths 5 to 20m. Eggs are attached to the bottom and large females produce more eggs than small females. First spawning occurs primarily at age four. The largest spring spawning populations are in the Escuminac and southeast New Brunswick areas and the largest fall spawning population is in Chaleur Bay.

The stock area for southern Gulf of St. Lawrence herring is the area extending from the north shore of the Gaspé Peninsula to the northern tip of Cape Breton Island and includes the Magdalen Islands. Adults overwinter off the east coast of Cape Breton in NAFO area 4Vn.

Southern Gulf of St. Lawrence herring are harvested by an inshore gillnet fleet on spawning grounds and a purse seine fleet (vessels >65') in deeper water. The inshore fleet harvests >97% spring spawners in the spring and fall spawners in the fall. The purse seine fleet harvests on average about 70% spring spawners during their spring fishery which occurs in the area between Cape Breton Island and the Magdalen Islands. In the fall, the purse seine fleet concentrates in Chaleur Bay and harvests 60-70% fall spawners.

TAC management was initiated in 1972. Currently there are approximately 3,500 inshore licenses and 6 active seiners (>65'). These seiner catches are restricted by the requirement that no more than 10% of the catch for any day can be below 24.5 cm fork length.

### Summary

#### Fall Spawners

- Reported 1998 landings of fall spawners were 43,023t compared to the fall spawner TAC of 54,248t.
- A major change in the fall fishery in 1998 was the lowest recorded catch (<100t) in the 4T overwintering fishery in 4Vn. Participants in the fishery reported that these low catches were the result of herring being inaccessible to the gear, rather than a problem with abundance.
- Inshore catch rates were similar in 1997 and 1998 and were at the high end of the time series.
- The 1993 year-class, which was estimated last year to be the highest since 1978, was estimated in this assessment to be above average and only the fourth highest in the time series.
- The estimated 4+ biomass for 1998 was the highest in the time series. The most recent year-class (1994) 4 year-olds were 38% and 5 year-olds (1993) were 22% of the 400,000t estimated age 4+ biomass in 1998.
- Other indicators of fall spawner biomass do not support the estimate that 1998 4+ biomass is the highest in the time series. The acoustic and bottom trawl survey indices are at moderate levels and opinions of abundance expressed during the phone survey of the inshore fleet

generally indicated declines in abundance from 1997 to 1998.

- The age 4+ fishing mortalities have been below the target exploitation rate for each year since 1981, except for 1990 and 1995.
- The best estimate of  $F_{0.1}$  fall spawner fishing level for 1999 is 60,500t. This level takes into account the tendency to over-estimate age 4 fall spawners. Without this correction, the 4+ biomass was the highest in the time series and the  $F_{0.1}$  fishing level for 1999 would be 67,500t.

### Spring Spawners

- Reported 1998 landings of spring spawners were 15,653t compared to a TAC of 16,500t.
- Inshore catch rates calculated from the New Brunswick market co-ordinator program in Escuminac and southeast NB and the dockside catch monitoring program indicated a slight decrease in the overall abundance from 1997 to 1998. However, there was an increase in abundance of ages 4, 5, and 7. These catch rates are at the higher levels of the time series.
- Abundance of herring that spawn during the spring in Chaleur Bay has declined during the last five years and continued to be low in 1998.
- The 1991 year-class is dominant in the population at this time; the incoming 1994 year-class was slightly above average, and age 4+ spring spawner biomass was above average at 86,000t in 1998.
- The age 4+ fishing mortality has been very close to the target exploitation rate of 24% in recent years.
- The  $F_{0.1}$  fishing level for 1999 is 18,500t. This estimate is above the 13,000t projected for 1999 from the 1998 assessment.

### The Fishery

The TAC has been set separately for spring and fall spawners since 1985. The 1998 allocation of the southern Gulf of St. Lawrence herring TAC remained at 74% for

the inshore fleet and 26% for the seiner (>65') fleet. The  $F_{0.1}$  fishing level for fall spawners in 1998 was 66,000t, compared to 50,000t in 1997. In 1998, due to uncertainty in the size of the 1993 year-class it was recommended to fish below  $F_{0.1}$  and consequently the final fall TAC was set at 58,448t.

### 1998 FALL FISHERY (Statistics Branch)

Area	Allocation	Landings (t)
<b>INSHORE</b>		
Isle Verte	330	10
Chaleur Bay	18,399	17,805
Escuminac-West PEI	7,260	7,059
Magdalen	1,375	1,213
Pictou	6,820	5,466
Fisherman's Bank	6,820	7,204
Quebec Small Seiners	605	332
4Vn	556	154
<b>Total Inshore</b>	<b>42,165</b>	<b>39,243</b>
<b>SEINERS (&gt;65')</b>		
Within Chaleur Bay	9,464	3,597
Outside Chaleur Bay	1,739	978
4Vn	4,200	52
<b>Total Seiners</b>	<b>15,403</b>	<b>4,627</b>
<b>Grand Total</b>	<b>57,568</b>	<b>43,870</b>

### 1998 SPRING FISHERY (Statistics Branch)

Area	Allocation	Landings (t)
<b>INSHORE</b>		
Isle Verte (Jan-June 15)	130	52
Chaleur Bay (Jan-June 15)	800	152
Escuminac (Jan-May)	4,100	2,982
Magdalen (Jan-June 15)	1,200	1,887
Southeast NB – West PEI (Jan-May)	5,100	7,498
Pictou (Jan –June 15)	300	148
East PEI (Jan-June 15)	200	456
Bait and Roe all 4T (Jan –June 15)	745	732
4Vn	133	66
<b>Total Inshore</b>	<b>12,708</b>	<b>13,973</b>
<b>SEINERS(&gt;65') (All 4T)</b>	<b>3,792</b>	<b>1,004</b>
<b>Grand Total</b>	<b>16,500</b>	<b>14,977</b>

The 1998  $F_{0.1}$  fishing level and TAC for spring spawners was 16,500t, as it was in 1997. As in 1996-97, the seiners were restricted to taking no more than 50% of their fall season 4TVn allocation within Chaleur Bay in 1998. In addition, they could not start fishing within the bay until September 1. The seiner 4Vn allocation was 4,200t.

The percentage of spring and fall spawners in the catch varies according to season and gear type. As a result, **landings** during the fall and spring fisheries must be separated into the appropriate spring and fall spawning groups to determine if the TAC for these groups has been caught.

**Percentage of spring and fall spawners by season and gear type for 1998**

Season	Gear	Spawning Group	
		Spring	Fall
Spring	Inshore	99	1
	Seiner	76	24
Fall	Inshore	1	99
	Seiner	21	79
4Vn	Seiner	6	94

The TAC and landings are separated by spawning group and include catches in the 4Vn overwintering fishery. The allocation for 4Vn has been included with the fall spawners because a minimum of 83% of the landings since 1992 has been fall spawners.

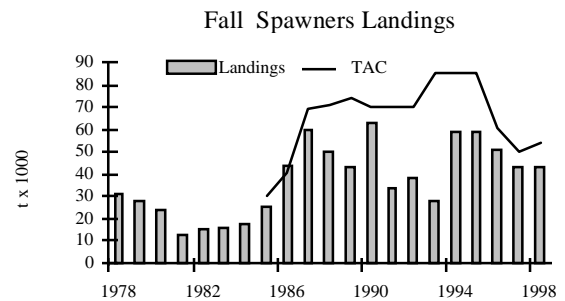
**Fall spawner landings (000s of t)**

Year	1985-94	1995	1996	1997	1998
TAC	66	85	56	50	54
Landings	48	66	54	45	43

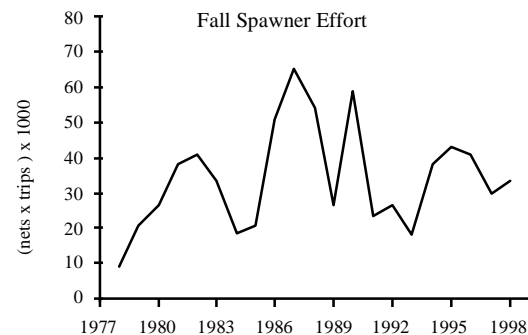
**Spring spawner landings (000s of t)**

Year	1985-94	1995	1996	1997	1998
TAC	16	21	17	17	17
Landings	18	23	21	15	17

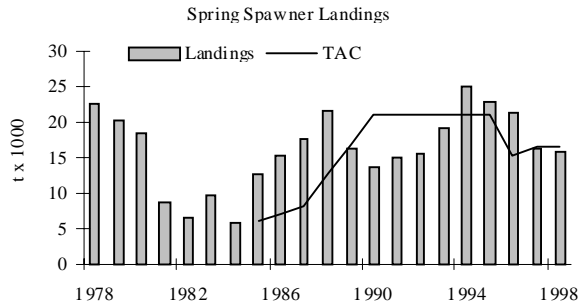
Since 1988, **landings of fall spawners** have been below the TAC. Fall inshore landings are primarily market driven. The primary market for the fall inshore fleet, which has 74% of the allocation, is the roe market. From 1991-1993, the price for roe herring was 3-4 cents/pound. In 1994, markets improved to 6-8 cents/pound and increased up to 14-20 cents/pound in 1996. In 1997 and 1998, the price decreased to 6-8 cents/pound.



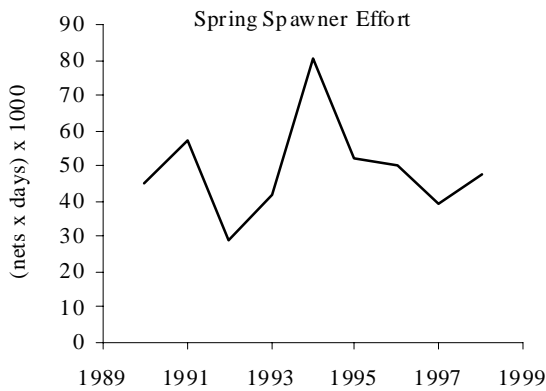
Effort levels in 1998 were similar to those in the early 1980s and below the high levels seen in 1987 and 1990.



**Landings of spring spawners** were above the TAC from 1994 to 1996, and were close to the TAC in 1997 and 1998. The market for the spring fishery is different from that of the fall fishery. Spring herring caught by the inshore fleet are sold primarily for bait and to the bloater (smoked herring) markets. There is a small experimental fishery using trapnets for roe-on-kelp in Escuminac and southeast New Brunswick in May-June.



Effort increased in the 1998 spring fishery from 1997 but was below peak levels seen in 1994.



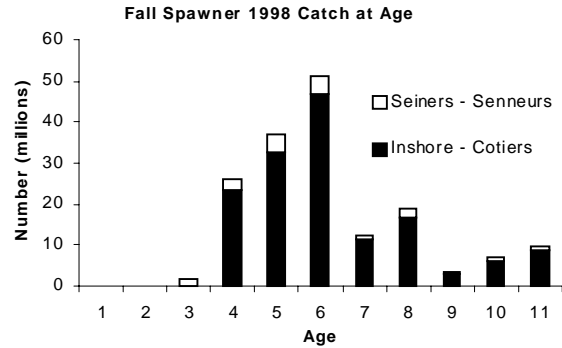
**FALL SPAWNERS**

**Resource Status**

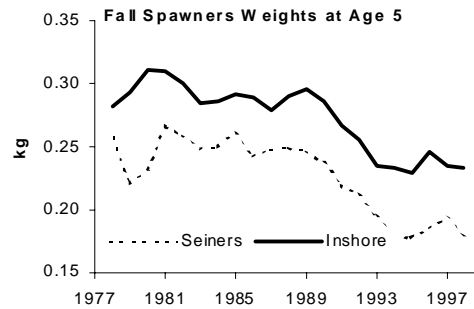
Resource status of 4T fall spawning herring was determined using a population analysis which combines two sources of information: the fishery catch-at-age and an abundance index determined from catch rates in the inshore fishery.

The 1992 year-class (age 6) was dominant in the 1998 catch of fall spawners. A major change in the fishery in 1998 compared to 1997 was the low catch (<100t) of herring caught in the 4T overwintering fishery in 4Vn. Participants in this fishery reported that herring were located close to the bottom and were inaccessible to the gear which was

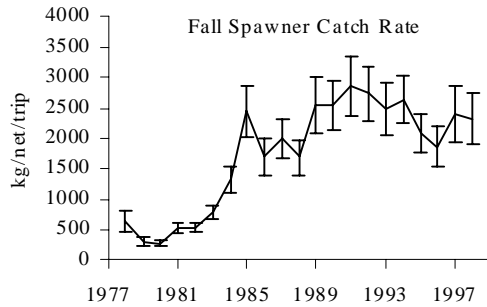
the reason for low catches rather than a decline in abundance.



Average **weights-at-age** of age 5 fall spawners caught by inshore and purse seine fleets since 1990 have, like most other ages, been below those observed during the 1980s. This decline in mean weights has started to increase in most ages.



The **abundance index** used to estimate stock status is based on inshore catch rates determined from purchase slip, dockside monitoring, and a phone survey to determine effort. This index covers the entire inshore fleet and extends from 1978 to 1998. Catch rates in 1998 were above those in 1995 and 1996 but similar to that in 1997.



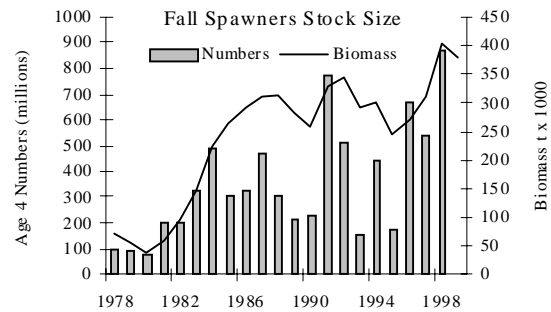
The 1998 analysis indicated a break in the catch rate time series used to calibrate the fall population model. This break was coincident with a trend for some areas of the southern Gulf gillnet fishery to switch from 2 5/8" mesh to larger mesh sizes. The analysis adopted in 1998 incorporated the changes in mesh size by splitting the abundance index into two time periods. The time periods were (1978-1991), when a greater percentage of the fleet used 2 5/8" mesh compared to the more recent time period (1992-1998), when an increasing percentage of gillnetters have been using 2 3/4" mesh. Splitting the time series in this manner provided improved results of the statistics used to test the model.

The feasibility of combining the catch rates into one series was reviewed in the current analysis. It was determined that splitting the catch rate series, as was done in 1998, was appropriate and was the method adopted this year. An additional improvement in the method determining resource status was made by estimating the ratio of fishing mortality between the 11+ age group and the age 10 herring. Statistical tests applied to this method indicated that it was better than the previous method which had assumed that this ratio was equal to one.

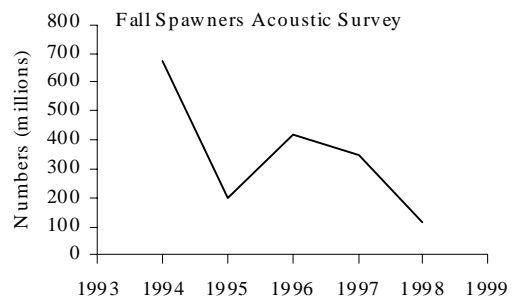
**Percentage of 2 5/8" mesh used in fall gillnet fishery.**

Year	Percentage
1987	92
1988	91
1989	89
1990	81
1991	79
1992	67
1993	61
1994	60
1995	54
1996	58
1997	57
1998	60

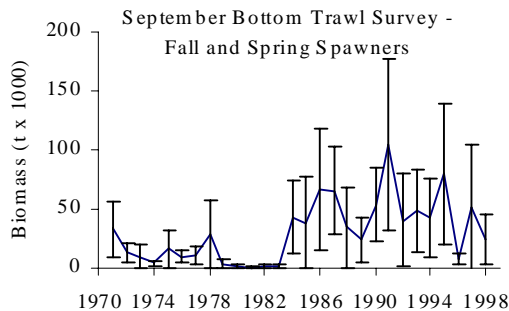
**Population biomass** of age 4+ fall spawners in 1998 was the highest in the time series at about 400,000t. This level was due to the size of the incoming 1994 year-class which was estimated to be the highest in the time series.



Other indicators of fall spawner biomass indicate that 1998 is not the highest biomass observed since 1978. The 1998 acoustic survey index was the lowest since 1994.



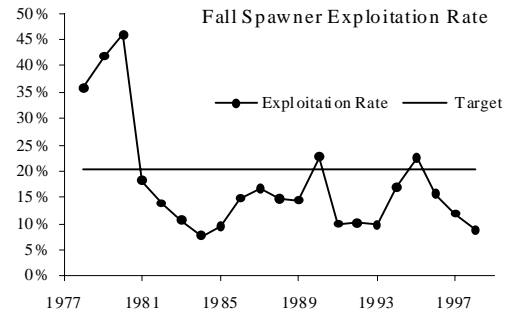
The 1998 **bottom trawl survey** is at moderate levels but is in general agreement with the catch rate indices.



As well, opinions of abundance expressed during the annual phone survey of the inshore fleet indicated declines from 1997 to 1998. In addition, the inshore fleet was slower in catching its quota in 1998 than in recent years, and catches in 4Vn were extremely low.

While these indicators do not support the conclusion that 1998 is the highest biomass estimate in the time series, there are indicators that support the conclusion that the stock is above average in abundance. For example, older fish are still present in the population, ages observed in the acoustic and bottom trawl surveys and the commercial catch indicate that three of the four recent year-classes are above average, and inshore fishing fleet effort is stable.

The target **exploitation rate** for fall spawners is 20% on the age 4+ biomass. The age 4+ fishing mortalities have been below the target exploitation rate for each year since 1981 except for 1990 and 1995.



### Sources of Uncertainty

Even with improvements in the estimates by splitting the catch rate index into two time series there still appears to be a tendency to over-estimate 4 year-olds in the most recent year. In 1998, the model using the split catch rate estimated the 1993 year-class to be the highest in the time series. The analysis completed for this year provided a much lower estimate for this year-class. Therefore, a major source of uncertainty in the assessment the size of the 1994 year-class, which is now being estimated as the highest in the time series.

### Outlook

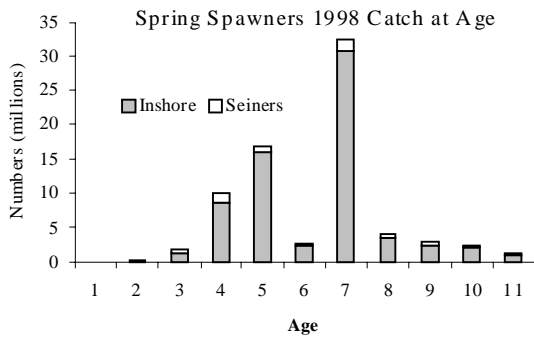
The  $F_{0.1}$  fall spawner fishing level for 1999 is 60,500t. The preliminary  $F_{0.1}$  level for 2000 is 56,000t. These levels take into account the tendency to over-estimate age 4 fall spawners. Without this correction, the 4+ biomass was the highest in the time series and the  $F_{0.1}$  fishing level for 1999 would be 67,500t and for 2000 would be 63,000t. The 1994 year-class accounts for 38% of the age 4+ biomass estimate and changes in relative strength of this year-class in subsequent assessments will have a major effect on future  $F_{0.1}$  fishing levels.

**SPRING SPAWNERS**

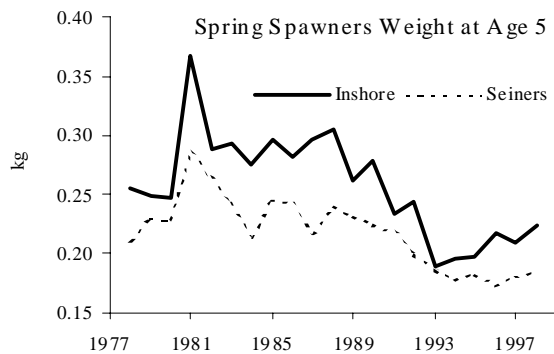
**Resource Status**

Resource status of 4T spring spawning herring was determined using the same approach as for fall spawners. Catch rates for the Escuminac and Southeast New Brunswick inshore fisheries form the abundance index for spring spawner model.

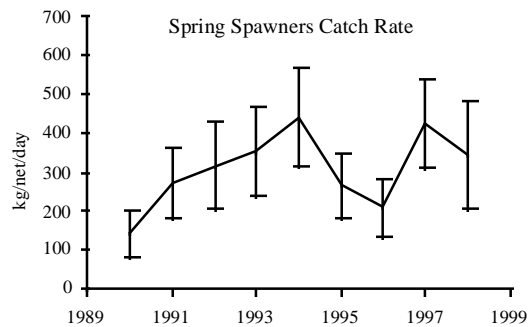
The 1991 year-class (age 7) was dominant in the 1998 **spring spawner catch**. The 1993 year-class (age 5) was the second most abundant age in the catch.



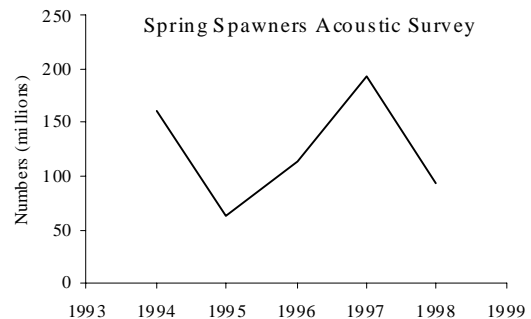
Average **weights-at-age** of age 5 spring spawners caught by inshore and purse seine fleets since 1990 have, like most other ages, been below those observed during the 1980s. This decline in mean weights has stopped and they have started to increase in most ages.



The spring catch rate model consists of catch data from the New Brunswick market co-ordination program from 1990 to 1996 and from dockside catch monitoring programs in 1997 and 1998. Effort is the average number of nets used in each area as determined by a phone survey of 20 to 25% of active inshore fishers. Catch rate was defined as kg/net/day. Catch rates in 1998 were slightly below, but not significantly, than those in 1997. Catch rates increased from 1990 to 1994, then declined for two years. Catch rates in 1997 and 1998 have been above average.



**Other abundance indices** for spring spawners identified declines from 1997 to 1998. Abundance of spring spawner age 4+ biomass in the 1998 acoustic survey for years in which the same areas were surveyed (1994-1998) in Chaleur Bay was less in 1998 than in 1997.

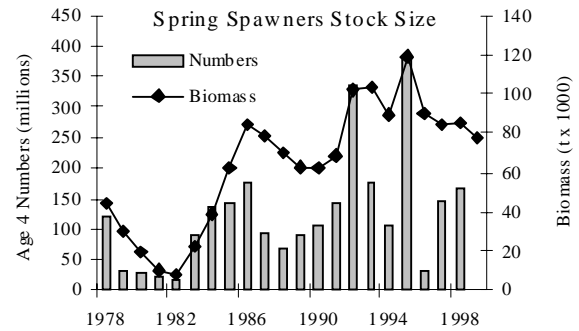


Opinions of abundance, reported during the phone survey, in the two areas (Escuminac

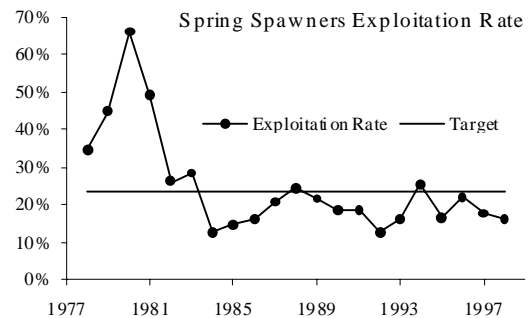
and Southeast New Brunswick) used in the catch rate index were that abundance was less in 1998 than 1997. These areas account for about 70% of the spring inshore landings. Other areas indicating a decline in abundance from the phone survey were the Magdalen Islands and Chaleur Bay. Combined spring and fall biomass estimates from the September bottom trawl survey also declined from 1997 to 1998.

As for fall spawners, the model used to estimate population abundance was changed from one which assumed a one:one ratio in fishing mortality between 11+ and age 10 herring, to one in which this ratio was estimated. This model was felt to be an improvement because it was more stable as subsequent years were removed from the analysis than the previous method and because it used an estimated ratio of fishing mortality between the plus group and the next youngest age rather than an assumed ratio. There was very little difference in population estimates using these two models.

**Population biomass** of age 4+ spring spawners has declined from the peak in 1995, when the largest year-class estimated since 1978 came into the fishery as four year-olds. Current population levels are similar to those observed in the late 1980s. The incoming 1994 (age 4) and 1993 (age 5) year-classes are above average, the 1992 year-class (age 6) is one of the lowest in the time series, and the 1991 year-class (age 7) is the largest since 1978. The increase in age 4+ biomass is consistent with the increase in catch rates for the principal ages in the fishery, 4, 5, and 7 year-olds.



The target **exploitation rate** for age 4+ spring spawners is 24%. The age 4+ fishing mortality has been very close to the target exploitation rate in recent years.



Positive indicators for this stock are that the TAC was caught, that the length of time to catch the TAC was short, and that three of the last four year-classes are above average in abundance. The age structure estimated using the population model based on the fishery index matches that expected from the age structure derived independently from the acoustic survey, experimental gillnets with variable mesh sizes fished, and roe-on-kelp experimental trapnet.

Negative aspects are that catches and abundance in Chaleur Bay are poor and that the seiner fishery in the spring was later than usual. Industry raised concerns regarding the abundance of spring spawners in Chaleur Bay. They have expressed these concerns for several years.



### *Sources of Uncertainty*

The major source of uncertainty in the estimation for spring spawners is the shortness of the abundance index time series. There is also some uncertainty about the combination of the two data sets. The catch rates may be biased because of seasons being shortened by quotas being reached.

### *Outlook*

The  $F_{0.1}$  **fishing level** for spring spawners in 1999 is 18,500t. The preliminary estimate for 2000 is 16,000t. The 18,500t is greater than the 13,000t  $F_{0.1}$  fishing level for 1999 based on the previous assessment. The main reason for this difference is that the abundance of the 1991 year-class, the largest estimated since 1978, is estimated to be higher than previously thought. The abundance of the 1993 year-class is somewhat higher than estimated last year and the 1994 incoming year-class is estimated to be above average. This year-class had been assumed to be average in strength in making the previous projection for 1999.

### *For more information:*

Contact: Ross Claytor  
Marine Fish Division  
P.O. Box 5030  
Moncton, NB  
E1C 9B6  
Tel: 506-851-6249  
Fax: 506-851-2620  
E-mail: ClaytorR@mar.dfo-  
mpo.gc.ca

### *References*

Claytor, R.R. and C. LeBlanc, 1999. Assessment of the NAFO Division 4T Atlantic herring stock, 1997. DFO Canadian Stock Assessment Secretariat Res. Doc.99/54.

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](http://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, 1999. Southern Gulf of St. Lawrence Herring. DFO Science Stock Status Report B3-01 (1999) (Revised).