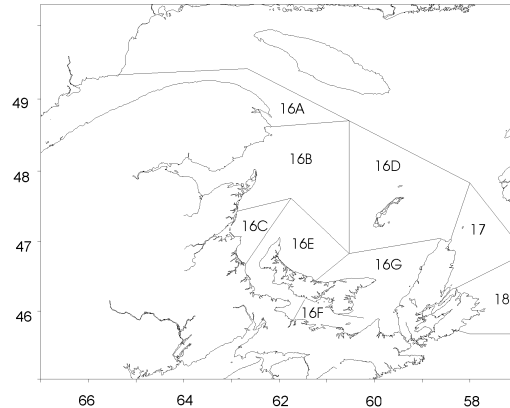


Southern Gulf of St. Lawrence Herring



Background

Herring are a pelagic species which form schools during feeding and spawning periods. Herring in the southern Gulf of St. Lawrence consist of a spring spawner component and a fall spawner component. Spring spawning occurs primarily in May but extends into June at depths <10m. Fall spawning occurs from mid-August to October 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, southeast New Brunswick and Magdalen Islands areas and the largest fall spawning population is in Chaleur Bay.

The stock area for southern Gulf of St. Lawrence herring extends 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 percentage of spring and fall spawner component 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 attained. Spawning group assignment is done using a gonadosomatic index to assign maturity stage and a monthly key that links maturity stage and month to spawning group. Juvenile spawning group assignment is done by otolith shape type.

The inshore fleet harvests almost solely the spring spawner component in the spring and almost solely the fall spawner component in the fall. The purse seine fleet harvests a mixture of spring and fall spawner component 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 a mixture of fall and spring spawner component.

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 spawner component

- Reported 2000 landings of fall spawner component were 59,086t against the fall spawner TAC of 71,000t.
- There were no 4T herring caught in the overwintering fishery in 4Vn. Participants in this fishery indicated that there was little effort put in searching for herring in 4Vn in 2000.
- Inshore catch rates in 2000 were equal to 1999, and these were the highest in the time series which started in 1978. The acoustic index indicated that abundance was similar to 1999. Opinions of abundance expressed during the phone survey of the inshore fleet generally indicated an increase in abundance from 1999 to 2000.

Gulf Fisheries Management Region

- The 1995 and 1996 year-classes are estimated to be the most abundant since 1978.
- The age 4+ biomass for 2001 is estimated to be near the highest since 1978.
- The age 7+ exploitation rate in 2000 is below the target.
- The estimated catch at $F_{0.1}$ for 2001 is 60,500t. At this fishing level, there is a 50% probability of exceeding $F_{0.1}$.
- Risk analysis indicated that to reduce the probability of exceeding $F_{0.1}$ to 25%, the catch would have to be below 51,000t. A catch of approximately 70,000t would result in a probability of exceeding $F_{0.1}$ of 75%.

Spring spawner component

- Reported 2000 landings of spring spawner component were 16,730t against a TAC of 16,500t.
- Inshore catch rates in 2000 were the second lowest since 1990. The 1999 catch rates, though lower, were considered to be an underestimate because the fishery opened after herring had arrived on the spawning beds.
- Year-classes produced after 1991 are average or below average.
- Age 4+ spawning biomass has been declining since 1995. The estimate for 2001 is 49,000t.
- The age 4+ exploitation rate was above target in 2000.
- The estimate of the $F_{0.1}$ catch for 2001 is 12,500t compared to 17,000t and 25,000t from the previous assessment.

Southern Gulf of St. Lawrence Herring

- At a catch of 12,500t in 2001, there is a 50% probability of exceeding $F_{0.1}$.
- Risk analysis indicated that to reduce the probability of exceeding $F_{0.1}$ to 25%, the catch would have to be below 10,000t.

The Fishery

The TAC has been set separately for spring and fall spawner components since 1985. The 2000 allocation of the southern Gulf of St. Lawrence herring TAC was 77% for the inshore fleet and 23% for the seiner (>65') fleet. The TAC for fall spawner component in 2000 was 71,000t, compared to 60,500t in 1999. The allocation for 4Vn is included with the fall spawner component.

2000 FALL FISHERY (Statistics Branch)

Area	Allocation	Landings (t)
INSHORE		
Isle Verte	426	18
Chaleur Bay	25,673	24,427
Escuminac-West PEI	8,519	10,272
Magdalen	1,776	291
Pictou	8,805	5,037
Fisherman's Bank	8,805	10,344
4Vn	710	0
Total Inshore	54,714	50,398
SEINERS (>65')		
Chaleur Bay	12,086	8,697
4Vn	4,200	0
Total Seiners	16,286	8,697
Grand Total	71,000	59,086

The 2000 TAC for spring spawner component was 16,500t compared to 18,500t in 1999.

2000 SPRING FISHERY
(Statistics Branch)

Area	Allocation	Landings (t)
INSHORE		
Chaleur Bay (Jan-June 15)	800	910
Escuminac (Jan-May)	4,100	2,262
Magdalen (Jan-June 15)	1,200	3,855
Southeast NB – West	5,100	7,256
PEI (Jan-May)		
Bait and Roe all 4T (Jan –June 30)	1,508	1,898
Total Inshore	12,708	16,181
SEINERS(>65') (All 4T)	3,792	549
Grand Total	16,500	16,730

Percentage of Spring and Fall Spawning Components by Season and Gear Type for 2000

Season	Gear	Spawning Group %	
		Spring	Fall
Spring	Inshore	96	4
	Seiner	42	58
Fall	Inshore	1	99
	Seiner	15	85

Fall component landings (000s t)

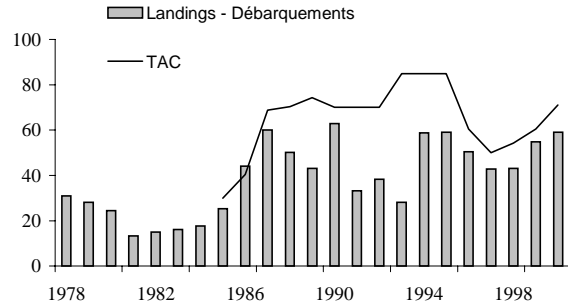
Year	Average				
	1987-96	1997	1998	1999	2000
TAC	73.6	54.2	58.4	60.5	71.0
Landings	52.0	42.7	43.0	53.6	59.1

Spring component landings (000s t)

Year	Average				
	1987-96	1997	1998	1999	2000
TAC	18.1	16.5	16.5	18.5	16.5
Landings	17.2	16.4	15.7	17.0	16.7

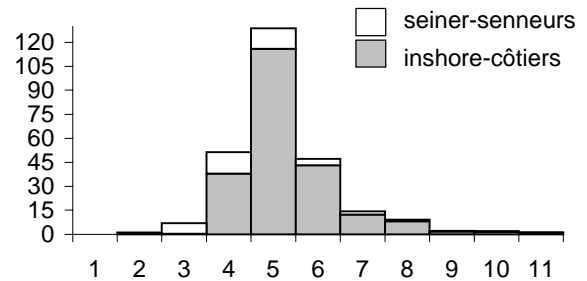
Since 1987, landings of the fall component have been below the TAC. Fall inshore landings are primarily driven by the roe market. The price for roe herring in 2000 was 10 cents/pound; the same as in 1999. The TAC was not reached in certain areas because the market became saturated.

4T Fall Spawner Landings and TAC (000 t)



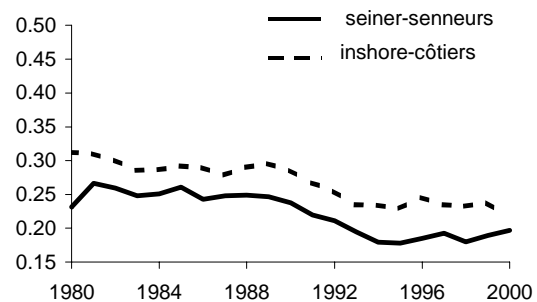
The 1995 year-class (age 5) was dominant in the 2000 catch of the fall spawner component. There were no 4T herring caught in the overwintering fishery in 4Vn. Participants in the fishery reported that little effort was put in searching for herring in 4Vn in 2000.

Fall Spawner 2000 Catch-at-Age (millions of fish)



Since 1990, the average weights-at-age for the fall spawner component has been below those observed during the 1980s, as exemplified by age 5.

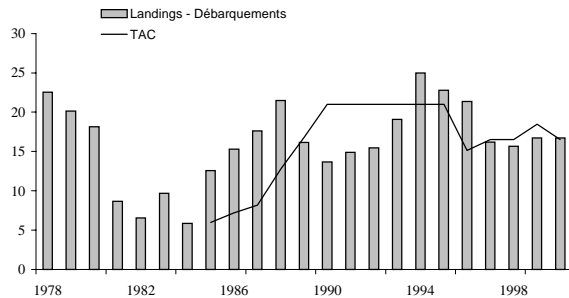
Fall Spawner Component Weight-at-Age 5 (kg)



Landings of spring spawner component were slightly above the TAC in 2000. The market for the spring fishery is different from that of the fall fishery. Spring herring caught by the inshore fleet are sold primarily

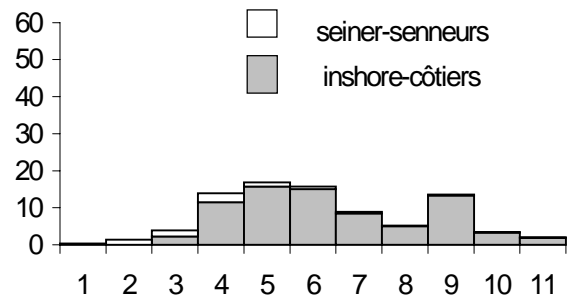
for bait and to the bloater (smoked herring) markets. The price for spring herring in 2000 was 8 cents/pound, a decrease of 5 cents/pound from 1999.

4T Spring Spawner Landings and TAC (000 t)



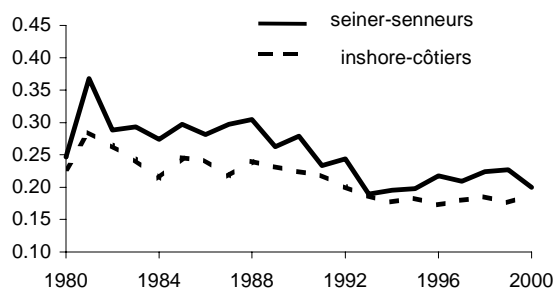
The 2000 spring spawner catch-at-age was composed of many age groups. The strong 1991 year-class (age 9) was still apparent in the landings.

Spring Spawner 2000 Catch-at-Age (millions of fish)



Since 1990, average weights-at-age for the spring spawner component have been below those observed during the 1980s. This decline in mean weights has leveled off for most ages in recent years.

Spring Spawner Component Weight-at-Age 5 (kg)



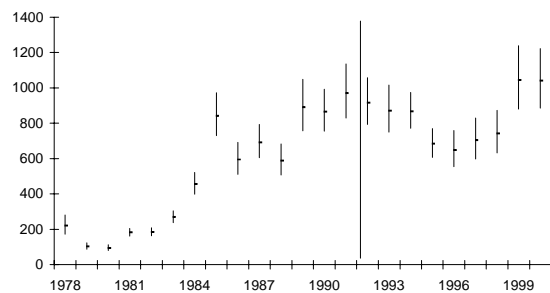
FALL SPAWNER COMPONENT

Resource Status

Resource status of 4T fall spawning herring was determined using a sequential population analysis (SPA) that combined two sources of information: the fishery catch-at-age and an abundance index derived from catch rates in the inshore fishery.

The abundance index used catch rate to estimate stock status based on inshore catches determined from purchase slips and effort information derived from a phone survey of 25% of the active inshore fishers. This index covers the entire inshore fleet and extends from 1978 to 2000. Catch rates in 2000 were equal to 1999, the two highest in the time series.

Fall Spawner Catch Rate (kg/net/trip)



The abundance index was split into two time periods (line in graph) for the population analysis. The time periods were (1978-1991), when a greater percentage of the inshore fleet used 25/8" mesh compared to the more recent time period (1992-2000), when a higher percentage of gillnetters have been using larger mesh.

The 2000 acoustic survey index indicates that abundance was similar to 1999. The estimate is near the average for the time series.

Fall Spawner Component Acoustic Survey Index (age 4+ numbers in millions of fish)

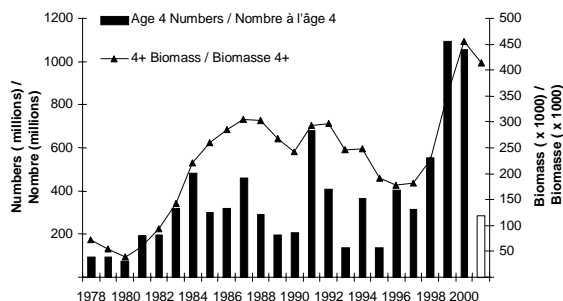


Opinions of abundance expressed by fishers during the annual phone survey of the inshore fleet indicated an increase from 1999 to 2000.

The importance of the 1995 and 1996 year-classes in the commercial fishery and the acoustic surveys suggests that the abundance of these year-classes are well above average.

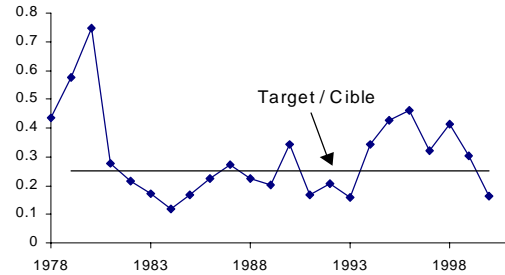
Estimated **population biomass** of age 4+ fall spawner component at the beginning of 2001 was about 415,000t, near the highest since 1978. The increase in biomass from recent years is due to the 1995 and 1996 year-classes, which are estimated to be the most abundant since 1978. The 1997 year-class was not estimated and is set at the average value over the time series.

Fall Spawner Component Stock Size



The target **exploitation rate** for fall spawner component is about 25% for fully recruited age-groups (7+). Exploitation rate has decreased over the last few years and is now below the target.

Fall Spawner Age 7+ Exploitation Rate



Sources of Uncertainty

Even with improvements in the estimates by splitting the catch rate index into two time series to account for the shift in mesh size, there still appears to be a tendency to over-estimate 4 year-olds in the most recent year. Last year’s analysis indicated that the 1995 year-class was the highest in the time series. The current analysis continues to indicate that the 1995 year-class is large, but is now estimated lower than in the 2000 assessment. The 1996 year-class is estimated to be of similar abundance. The tendency to overestimate incoming year-classes at age 4 is a source of uncertainty in this assessment.

An alternative analysis that included the catch rate and acoustic survey indices was attempted. While this model was judged not as suitable as that which incorporated the CPUE alone, it provided a more conservative interpretation of population status.

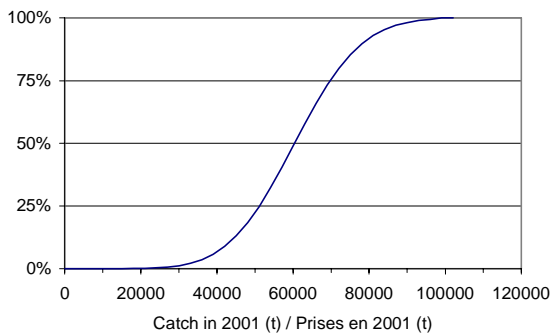
Outlook

The point estimate of the $F_{0.1}$ fall spawner catch for 2001 is 60,500t. The preliminary $F_{0.1}$ level for 2002 is also 60,500t. These levels take into account the tendency to over-estimate age 4 fall spawner component. This was done by discounting population numbers for that age group in 2001 by 15%. Since weights-at-age have been declining in recent years, the weights for 2000 were used in projections, as opposed to the average of recent years. It is estimated that the 1995

year-class would account for 39% of the catch weight in 2001. Changes in the estimate of this year-class in subsequent assessments will have a significant effect on future $F_{0.1}$ fishing levels.

A risk analysis indicated that a fishery at the $F_{0.1}$ catch of 60,500t will result in about a 50% probability of exceeding the target level in 2001. To reduce the probability of exceeding $F_{0.1}$ to 25%, the catch would have to be below 51,000t. A catch of approximately 70,000t would result in a probability of exceeding $F_{0.1}$ of 75%.

Probability of Exceeding $F_{0.1}$ for the Fall Spawning Component



In summary, the abundance of the fall spawning component continues to be high. The incoming 1995 and 1996 year-classes are estimated to be large and should support the fishery over the next few years.

SPRING SPAWNER COMPONENT

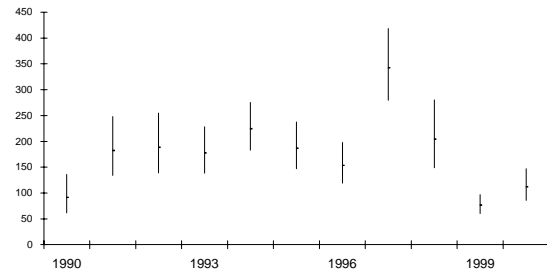
Resource Status

Resource status of the 4T spring spawning herring was determined using a similar approach to that of the fall but included both catch rate and acoustic survey indices.

The spring catch rate analysis included dockside monitoring data from Escuminac, southeast New Brunswick and the Magdalen Islands. The Magdalen Islands data were included as landings from this fishery have increased in recent years. Effort was calculated using the average number of nets

used in each area as determined by the phone survey. Catch rate was defined as kg/net/trip. The 1999 catch rate was considered anomalously low (see below). Excluding that year, catch rates in 2000 were the lowest since 1990.

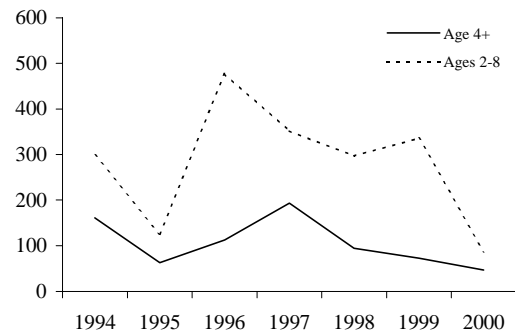
Spring Spawner Catch Rate (kg/net/trip)



Opinions of abundance from fishers (contacted in the **phone survey**) of the three main fishing areas (Escuminac, Southeast New Brunswick and Magdalen Islands) were that herring abundance was lower in 2000 than in 1999. These areas account for at least 70% of the spring inshore landings.

The 2000 acoustic abundance of the spring spawner component was the lowest in the series.

Spring Spawner Component Acoustic Survey Index (millions of fish)

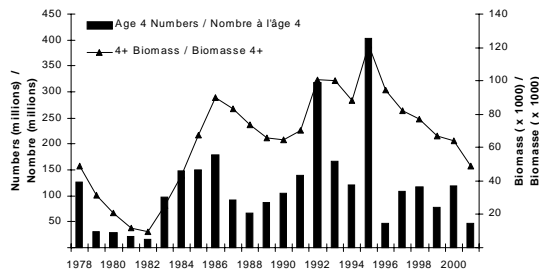


The SPA included the gillnet catch rate index and the acoustic survey index. In 1999, catch rates were the highest for the season at the beginning of the fishery, suggesting that the peak of the spawning run may have been missed. As a result, catch rates for the spring fishery in 1999 were likely biased downwards and were removed from the analysis as was done in the 2000

assessment. The analysis has a retrospective pattern, a tendency to overestimate recent population sizes. There is considerable uncertainty about the population estimates at age.

The analysis indicates that **population biomass** of age 4+ spring spawner component peaked in 1995, when the large 1991 year-class entered the fishery as 4 year-olds. Biomass has been declining since. In the last year, population biomass has decreased below the 1990 level. The 2001 age 4+ biomass is estimated to be about 49,000t.

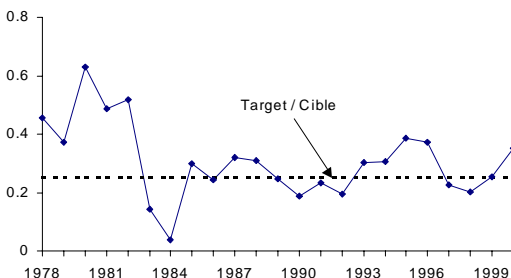
Spring Spawner Component Stock Size



Recruitment estimates from the analysis indicate that year-classes after 1991 are average or below average.

The target **exploitation rate** at $F_{0.1}$ used for spring spawner component is about 25% calculated for ages 7+. The estimated exploitation rate was above the target in 2000.

Exploitation Rates (age 7+)



Sources of Uncertainty

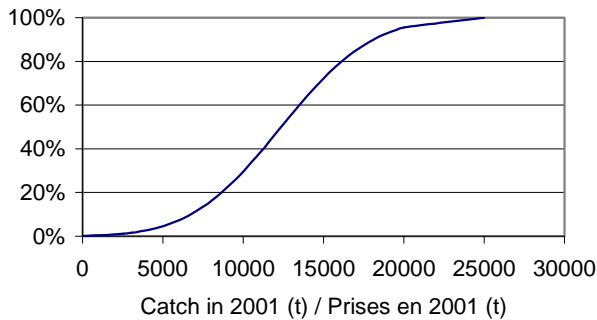
Population estimates for the spring component are less precise (c.v.'s of 40%-60%) than for the fall component. As well, there is a tendency for the SPA formulation to overestimate population size in the current year.

Outlook

The indices of abundance indicate a decline in stock size since the mid-1990s. In addition, the proportion of spring spawner component caught in the fall seiner fishery was the lowest observed. Also, the industry has expressed concerns regarding the abundance of spring spawner component in some of the major areas of the spring gillnet fishery.

The point estimate of the $F_{0.1}$ catch for the spring spawner component in 2001 is 12,500t compared to between 17,000t and 25,000t from the previous assessment. Thus, this assessment represents a more pessimistic view of the resource compared to 2000. The corresponding preliminary estimate for 2002 is 11,600t.

A risk analysis shows that there is about a 50% probability of exceeding the target level in 2001 at a catch of 12,500t. To reduce the probability of exceeding $F_{0.1}$ to 25%, the catch would have to be below 10,000t.

Probability of Exceeding $F_{0.1}$ for the Spring Spawner Component

In summary, views of the resource indicate that the 4T spring spawning herring stock has declined since 1995.

For more information:

Contact: Claude LeBlanc / G. Chouinard
Gulf Fisheries Centre
P.O. Box 5030
Moncton, NB
E1C 9B6

Tel: 506-851-3870 / 6220
Fax: 506-851-2620
E-mail: Leblancch@ dfo-
mpo.gc.ca

References

LeBlanc, C.H., G. A. Chouinard and G. A. Poirier. 2001. Assessment of the 4T southern Gulf of St. Lawrence herring stocks in 2000/ Évaluation des stocks de hareng de la zone 4T de l'OPANO dans le sud du Golfe du St. Laurent en 2000. DFO CSAS Res. Doc 2001/045/ MPO SCES Doc de rech. 2001/045.

This report is available from the:

Maritime 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
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, 2001. Southern Gulf of St. Lawrence Herring. DFO Science Stock Status Report B3-01(2001).