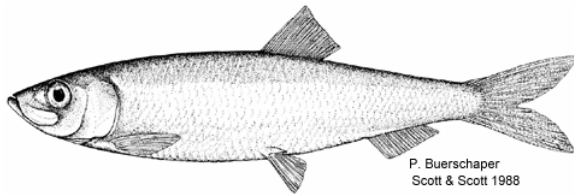


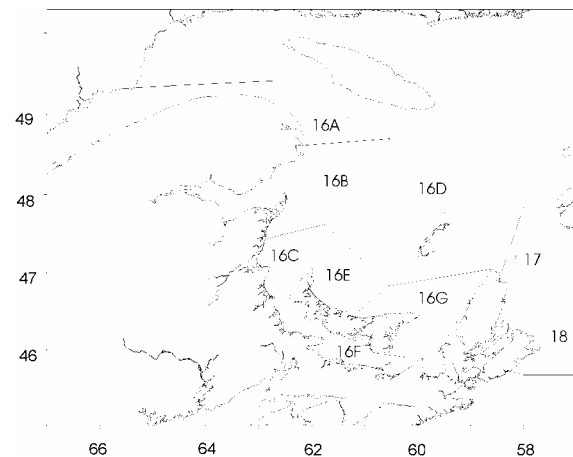


Gulf Region

Stock Status Report 2004/023



Southern Gulf of St. Lawrence (4T) 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 April-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 gonado-somatic 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, north PEI and western Cape Breton, 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 5 active seiners (>65').

Summary

Fall Spawner Component

- Reported 2003 landings of the fall spawner component were 58,821t against the fall spawner TAC of 62,000t. There was no fishery in the 4Vn (Area 17) overwintering area.
- Mean inshore catch rates in 2003 were slightly less than 2002, but remain at a high level in the time series starting in 1978.
- The 2003 telephone survey of fish harvesters indicated that the abundance of fall herring was considered equal to or higher than abundance in the previous year.
- The 1995, 1996 and 1998 year-classes are estimated to be well above average.
- Estimates of population biomass and abundance are currently high, however retrospective patterns indicate a tendency to overestimate the size of the population in the current year.
- The age 7+ exploitation rate in 2003 is estimated to be below the target.

- After adjusting for the tendency to overestimate population numbers, the estimated catch at $F_{0.1}$ for 2004 is 77,500t. A catch of 67,000t corresponds to a 20% chance of exceeding $F_{0.1}$.

Spring Spawner Component

- Reported 2003 landings of the spring spawner component were 8,450t against a TAC of 11,000t.
- Mean inshore catch rates in 2003 were slightly higher than 2002 but remain at a low level compared to the early 1990s.
- Opinions of fishers from the telephone survey varied by fishing area. Fishers from Escuminac, southeast NB and PEI thought that the abundance was similar or lower than in 2002. Fishers from the Magdalen Islands and Nova Scotia considered the abundance to be higher.
- Most year-classes produced after 1991 are estimated to be below average. The 1997 year-class appears to be above average. The 1999 year-class (age 4 in 2003) was estimated for the first time in this assessment and appears above average.
- Age 4+ spawning biomass has declined since 1995 and is estimated to be 65,000t at the beginning of 2004.
- The fully recruited ages 6 to 8 exploitation rate was below the target in 2003.
- The $F_{0.1}$ catch for the spring spawner component in 2004 is 17,000t. A catch of 13,500t corresponds to a 20% chance of exceeding $F_{0.1}$.

The Fishery

The catch allocations for the fall and spring seasons are based on the TACs set for

each spawning component. Landings are compiled by fishing season.

2003 FALL FISHERY

Area	Fall spawner Allocation TAC	Fall season Landings (t)	Fall spawner component Landings in the fall (t)
INSHORE			
Isle Verte	372	3	3
Chaleur Bay	22,418	21,480	21,454
Escuminac-West PEI	7,439	7,475	7,475
Magdalen	1,551	0	0
Pictou	7,689	8,773	8,773
Fisherman's Bank	7,689	8,165	8,161
4Vn (Area 17)	620	-	-
Total Inshore	47,778	45,896	45,866
Seiners (>65')			
4T	14,222	13,173	12,789
Grand Total	62,000	59,069	58,655

2003 SPRING FISHERY

Area	Spring spawner Allocation TAC	Spring season Landings (t)	Spring spawner component Landings in the spring (t)
INSHORE			
Chaleur Bay (Jan-June 15)	533	288	258
Escuminac (Jan-May)	2,233	273	273
Magdalen Islands 16D (Jan-June15) *	800	* 2,806	* 2,806
Southeast NB – West PEI (Jan-May)	3,900	4,340	4,321
Bait and Roe all 4T (Jan –June 30)	1,006	396	336
Total Inshore	8,472	8,103	7,994
Seiners (>65') 4T	2,528	102	44
Grand Total	11,000	8,205	8,038

*16D landings include bait fishery (210t) not counted against the spring TAC

Catches made throughout the year are attributed to the spring or fall spawning components based on visual examination and a gonado-somatic index to assign maturity stage, coupled to a monthly key that links maturity stage and month to spawning group. Juvenile spawning group assignment is made using otolith characteristics.

Gulf Region

2003 Percentage of Spring and Fall Spawning Components

Season	Gear	Spawning Group %	
		Spring	Fall
Spring	Inshore	99	1
	Seiner	44	56
Fall	Inshore	1	99
	Seiner	3	97

The TAC has been set separately for spring and fall spawner components since 1985. As in previous years, for both spring and fall, 77% of the TAC is allocated to the inshore fleet and 23% to the seiner (>65') fleet.

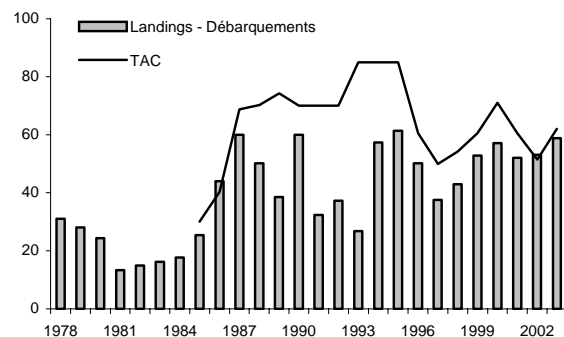
The TAC for the fall spawner component in 2003 was 62,000t, compared to 51,500t in 2002. The allocation for 4Vn (Area 17) is included with the fall spawner component. The combined 2003 **landings of the fall spawner component** in both the spring and fall fisheries were 58,821t. Fall inshore landings are primarily driven by the roe market.

Total Fall Component Landings (000s t)

Year	Average				
	1989-99	2000	2001	2002	2003
TAC	69.5	71.0	60.5	51.5	62.0
Landings	48.0	57.5	52.8	53.1	58.8

In 2003, the TAC was not attained. Landings of the fall spawner component had been significantly below the TAC up to 2001, but surpassed the TAC in 2002.

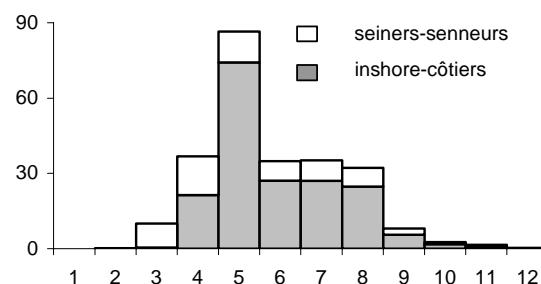
4T Total Fall Spawner Component Landings and TAC (000t)



For the **fall spawner component**, the 1998 year-class (age 5) was dominant in the 2003 **catch-at-age**.

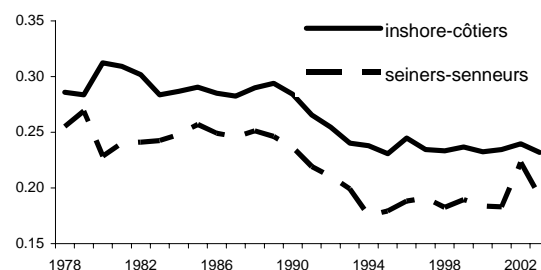
Southern Gulf of St. Lawrence Herring

Fall Spawner 2003 Catch-at-Age (millions of fish)



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

Weight (kg) of 5-Year-Old Fall Spawners



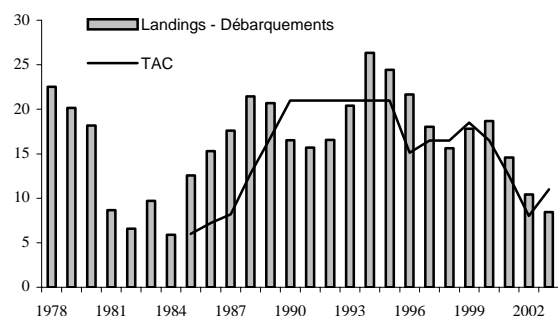
The 2003 TAC for the spring spawner component was 11,000t compared to 8,000t in 2002. The combined 2003 **landings of the spring spawner component** in both the spring and the fall fisheries were 8,450t. The 2003 spring spawner component TAC was not reached mainly because the spring seiner effort was low with a catch amounting to 4% of their allotted spring quota and the fact that the 16C Escuminac gillnet spring fishery caught only 12% of their allotted quota.

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.

Total Spring Component Landings (000s t)

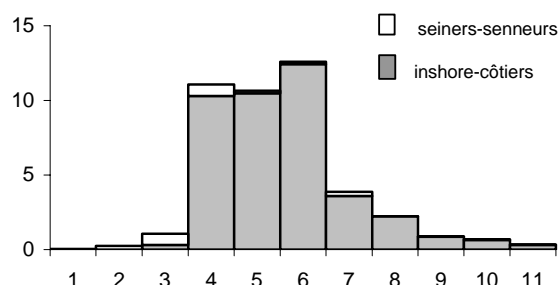
Year	Average				
	1989-99	2000	2001	2002	2003
TAC	19.0	16.5	12.5	8.0	11.0
Landings	19.8	18.2	14.7	10.4	8.4

4T Total Spring Spawner Component Landings and TAC (000t)



The **catch-at-age** of the 2003 **spring spawner component** was composed of many age groups. The 1997 year-class (age 6) was dominant in the 2003 catch.

Spring Spawner 2003 Catch-at-Age (millions of fish)



Since 1990, average **weights-at-age** for the spring spawner component also have been below those observed during the 1980s. This decline in mean weights has levelled off for most ages in recent years. Weights-at-age in the seiner catches were generally lower than in 2002.

Weight (kg) of 5-Year-Old Spring Spawners



FALL SPAWNER COMPONENT

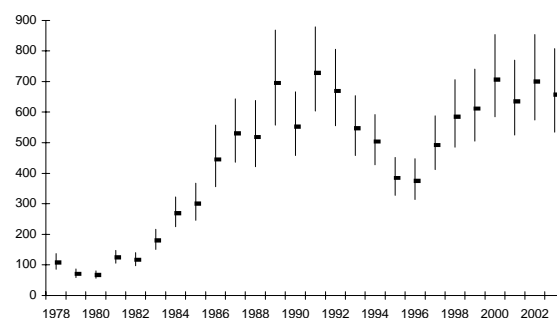
Resource Status

The acoustic survey in 2003 indicates that abundance was higher than in 2002. For the fall spawning component, this survey index is not used to calibrate the population analysis because it does not follow year-class strength consistently.

Gillnet fishers contacted during the annual telephone survey indicated equal or higher abundance from 2002 to 2003 in all major fishing areas.

The **abundance index** used to calibrate the population analysis for the fall spawning component is a catch rate (CPUE) index based on fishery data of inshore catches determined from purchase slips and the dockside monitoring Program (DMP) combined with effort information derived from a telephone survey of approximately 25% of the active inshore fishers. This index covers the entire inshore fleet and extends from 1978 to 2003. The mean CPUE in 2003 was slightly less than 2002, but remains high recently compared to the mid-1990s.

Fall Spawner CPUE index (kg/net/trip)

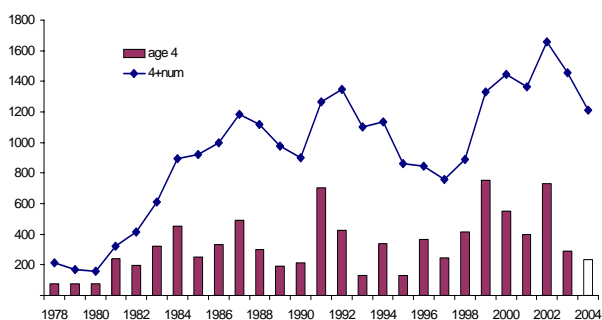


In the 2002 assessment, retrospective patterns (in this case, a tendency to overestimate stock abundance) were present but less severe than in 2001. In this assessment, there is still a retrospective pattern, but less severe than 2002. The retrospective pattern indicated that the current estimates of population abundance

in 2000 were about 19% lower than the initial estimates. To take into account this tendency, population numbers in 2004 were reduced by 19% equally for all ages. All results for the fall spawner component (numbers, biomass and exploitation rates) incorporate this adjustment.

Recruitment estimates (age 4) from the analysis suggest that the abundance of the 1995, 1996 and 1998 year-classes in the commercial fishery is above average and that overall abundance is currently high.

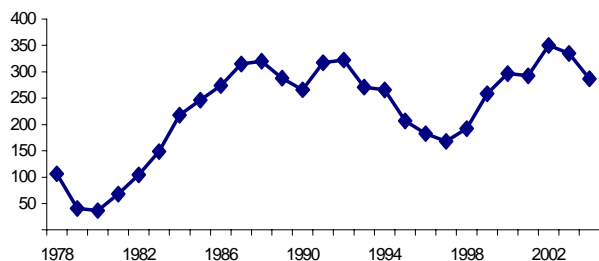
Fall Spawner Component Population Numbers (millions of fish)



Age 4 in 2004 is the geometric mean of 1978-2003

The analysis indicates that **population biomass** of age 4+ fall spawner component peaked in 2002, when the large 1998 year-class entered the fishery as 4 year-olds. Biomass has increased since 1998. The 2004 beginning-of-year age 4+ biomass is estimated to be about 287,000t, the lowest in the last five years, but remains amongst the highest levels since 1978.

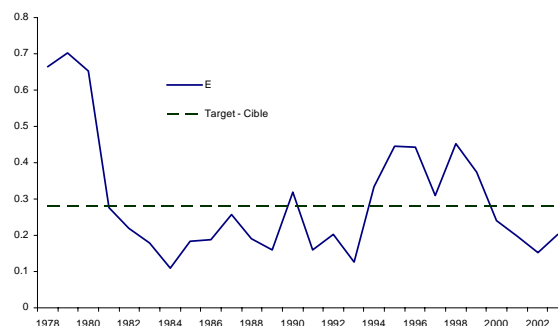
Fall Spawner Component 4+ Biomass (000t)



The target **exploitation rate** ($F_{0.1}$) for fall spawner component is about 28% for fully recruited age-groups (7+). Exploitation rate

has increased from 2002 but remains below the target.

Fall Spawner Age 7+ Exploitation Rate



Sources of Uncertainty

The estimated population numbers in 2004 have been reduced by 19% to account for a potential overestimation of population size in the current year, indicated by the retrospective patterns. Retrospective patterns in the assessment are a source of uncertainty.

Catch rates from the gillnet fishery continue to be among the highest in the series. There is concern that catch rates may not accurately track population biomass because of the nature of the fishery. For example, boat limits and saturation of nets may impact CPUE negatively, while searching behaviour could positively influence CPUE.

There is uncertainty about the recent year-classes (2000-2002) as there are no estimates of recruitment prior to age 4.

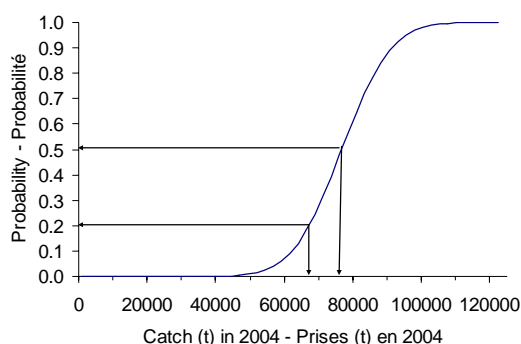
Outlook

Overall, the stock appears to remain at a high level relative to the late 1970's and early 1980's. The $F_{0.1}$ estimation of fall spawner catch for 2004 is 77,500t. This level includes adjustment for potential over-estimation of population numbers in the current year.

It is also possible to estimate the uncertainties regarding stock size and then

use these in a **risk analysis**. The risk analysis considered the probability of exceeding $F_{0.1}$. This analysis can provide some guidelines for decision making. For example, it indicates that a risk of 20% of exceeding $F_{0.1}$ corresponds to a catch of 67,000 t.

Risk Analysis for the Fall Component



This risk analysis includes uncertainties in population estimates but not those associated with the retrospective pattern, natural mortality, weight at age or partial recruitment.

SPRING SPAWNER COMPONENT

Resource Status

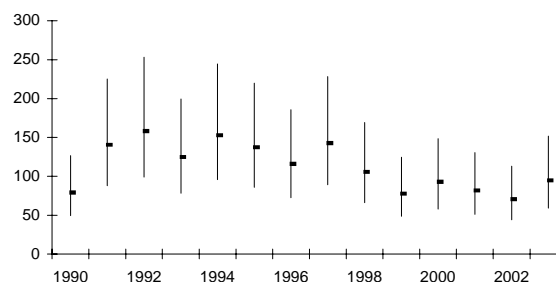
Fishers from three main fishing areas (Escuminac, southeast New Brunswick and western Prince Edward Island) contacted in the **telephone survey** indicated that herring abundance was similar or lower in 2003 than in 2002. The opinions from the Magdalen Islands and Nova Scotia were that it was higher.

Resource status of the 4T spring spawning herring was determined using a population analysis that included both the gillnet catch rate (CPUE) and acoustic survey indices.

The spring CPUE analysis included dockside monitoring data from all areas with recorded landings data. Effort was

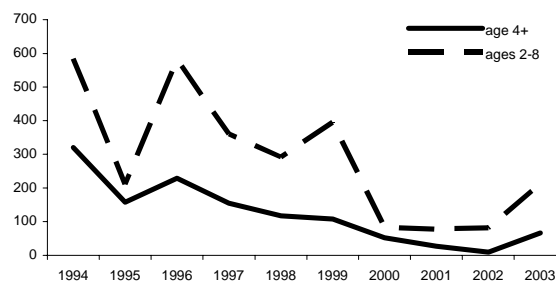
calculated using the average number of nets used in each area, as determined by the telephone survey. CPUE was defined as kg/net/trip. **Mean spring spawner catch rates in 2003** were slightly higher than 2002, but remain at a low level in the series that starts in 1990.

Spring Spawner CPUE index (kg/net/trip)



The 2003 **acoustic survey abundance** of the spring spawner component was higher than in 2002, but has been declining during recent years.

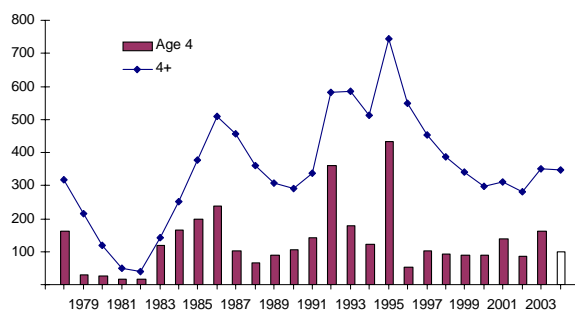
Spring Spawner Component Acoustic Survey Index (millions of fish)



The population analysis showed no retrospective pattern. An internal weighting procedure was used to estimate population abundance. This tends to give more weight to the more coherent index in terms of its ability to track cohorts.

Recruitment estimates (age 4) from the analysis indicate that most year-classes after 1991 were below average. The 1997 year-class appears to be above average. The 1999 year-class (age 4 in 2003) was estimated for the first time in this assessment and appears above average.

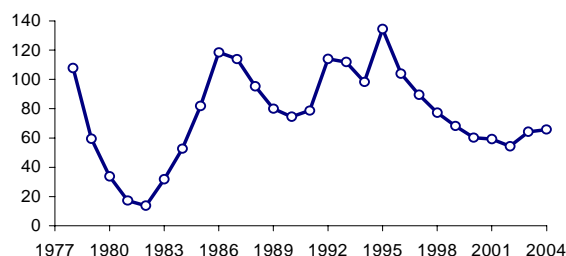
Spring Spawner Component Population Numbers (millions of fish)



Age 4 in 2004 is the geometric mean of 1978-2003

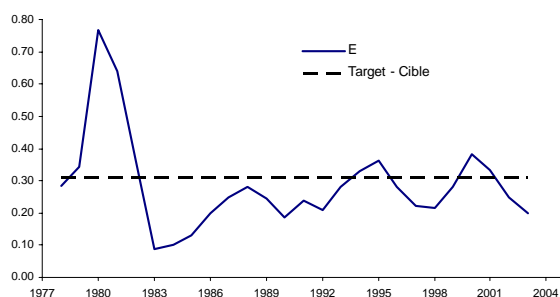
The analysis indicates that both **population abundance and biomass** of ages 4+ spring spawner component peaked in 1995, when the large 1991 year-class entered the fishery as 4 year-olds. Biomass has declined since 1995. Age 4+ biomass is estimated to be about 65,000t at the beginning of 2004.

Spring Spawner Component Age 4+ Biomass (000t)



The target exploitation rate at $F_{0.1}$ for the spring spawner component is about 31% over fully recruited ages 6 to 8. The estimated exploitation rate has been close to the target in recent years. The exploitation rate in 2003 was below the target.

Spring Spawner Exploitation Rates (ages 6 to 8)



Sources of Uncertainty

While recent gillnet catch rates are lower than in the mid-1990's, they appear to have levelled off. There is uncertainty relative to the catch rates particularly as they relate to the amount of effort used (size (depth) of nets).

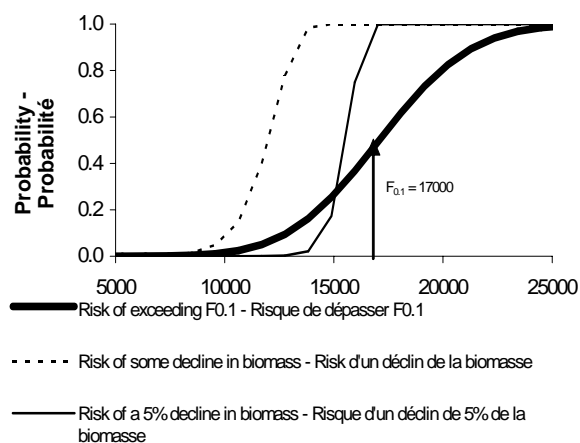
There is uncertainty about the recent year-classes (2000-2002) as there are no recruitment estimates (ages 2 to 4).

Outlook

Similar to the fall assessment, risk analyses were conducted. These analyses were: 1) the risk of exceeding $F_{0.1}$, 2) the risk of some decline in biomass, and 3) the risk of at least a 5% decline in biomass. The point estimate of the $F_{0.1}$ catch for the spring spawner component in 2004 is 17,000t.

The risks associated with different catch levels can be examined. For example, a 20% chance of exceeding $F_{0.1}$ corresponds to a catch of 13,500t. Alternatively, a 50% chance of no decline in spawning stock biomass corresponds to a catch of 11,500t.

Spring Spawner Component Risk Analysis



These risk analyses include uncertainties of the population estimates but not those associated with natural mortality, weight at age and partial recruitment.

This is a more optimistic view of the resource than the one presented last year. This is likely due to the acoustic survey which was thought to have missed some of the population in 2000 -2002. The acoustic survey numbers at age were larger in 2003 than in 2002.

There is concern about the decline in catches in the Escuminac gillnet fishery (herring fishing area 16C).

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LeBlanc, C.H., G.A. Poirier, G. A. Chouinard, C. MacDougall, and C. Bourque. 2004. Assessment of the NAFO Division 4T southern Gulf of St. Lawrence herring stocks in 2003 / Évaluation des stocks de hareng de la zone 4T de l'OPANO dans le sud du Golfe du Saint-Laurent en 2003. DFO CSAS Res. Doc 2004/029 / MPO SCES Doc de rech. 2004/029.

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