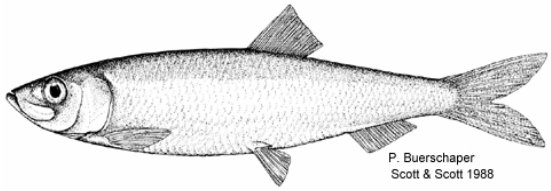
2010 ASSESSMENT OF 4VWX HERRING



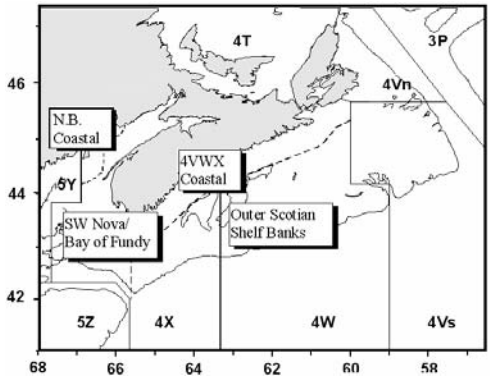


Figure 1. 4VWX herring management area and stock component locations.

Context:

In support of scientific advice for the 2009/10 fishery, the 2010 assessment of the 4VWX herring stock complex was reviewed through a Science Advisory Process. The meeting was held April 14-15, 2010, in Dartmouth, N.S. to review and evaluate biological and fishery information on 4VWX herring status as a basis for establishing quota for the 2009/2010 fisheries, as required in the Integrated Fisheries Management Plan. The terms of reference included an evaluation of the Southwest (SW) Nova Scotia/Bay of Fundy spawning component, compilation and review of information regarding the offshore Scotian Shelf and the coastal Nova Scotia spawning components, an update on southwest New Brunswick migrant juvenile fishery component, an update of progress on target strength and tagging studies, and recommendations to management on stock status. Participants included scientists, fishery managers, representatives of the industry, provincial governments, and other stakeholders. The last assessment of this resource was in 2009.

The 2003-2009 Scotia-Fundy Herring Integrated Fisheries Management Plan (IFMP, rolling evergreen) set out principles, conditions, and management measures for the 4VWX herring fisheries (DFO 2003). The main principle stated in the plan is "the conservation of the herring resource and the preservation of all of its spawning components". Three conservation objectives appear in the plan:

1) *To maintain the reproductive capacity of herring in each management unit through:*
   - *persistence of all spawning components in the management unit;*
   - *maintenance of biomass of each spawning component above a minimum threshold;*
   - *maintenance of a broad age composition for each spawning component; and*
   - *maintenance of a long spawning period for each spawning component.*
2) *To prevent growth overfishing:*
   - *continue to strive for fishing mortality at or below $F_{0.1}$*
3) *To maintain ecosystem integrity/ ecological relationships ("ecosystem balance"):*
   - *maintain spatial and temporal diversity of spawning*
   - *maintain herring biomass at moderate to high levels*

Progress against these objectives was evaluated at this meeting. Since 1995, the herring stock assessment and related research has been increasingly dependant on a number of projects undertaken with the assistance of the fishing industry. These include industry sampling of biological characteristics of the catch, as well as acoustic surveys using industry vessels and tagging. A major review of the assessment framework, including aspects of stock structure, sampling and tagging results, acoustic surveys and design, was conducted in the fall and winter of 2006/07 (DFO 2007). A final framework meeting is planned to evaluate and review assessment formulations and alternative models/approaches.

SUMMARY

SW Nova Scotia / Bay of Fundy

- Landings in 2008/09 were 54,113t against a Total Allowable Catch (TAC) of 55,000t for the Southwest (SW) Nova Scotia/Bay of Fundy component. Landings have tracked the TAC in recent years, with most of the quota being taken each year since 2002.
- In 2009, the fishery catch at age composition was comprised of 45% fish at 2 years of age, 20% at age 3, 24% age 4, and 11% at older ages. The proportion of the catch older than age 5 decreased from 17% in 2008 to 7% in 2009. This decrease of older/larger fish in the catch was due to the high proportion of 2 year olds (potentially indicating a strong 2007 year class).
- Acoustic biomass estimates increased for each of the major survey areas (from 221,001t in 2008 to 377,000t in 2009). Taking into consideration confidence intervals, overall spawning stock biomass (SSB) for the past 5 years has been steady, at a lower level than in the 1999-2004 period. SSB for Trinity is extremely low.
- Fishing mortality could not be determined. Relative exploitation rates based on acoustic SSB estimates with catch decreased in 2009.
- This assessment indicates improvements from the low level of the resource noted in the previous assessment, e.g., SSB estimated from the acoustic surveys is approaching the series average (1999-2008).
- A harvest strategy that exercises continued caution to facilitate further rebuilding is recommended. Catch levels that remain near the current status quo would help to reduce risks related to uncertainties in estimating SSB, recruitment, and the exploitation rate for this stock.

Offshore Scotian Shelf Banks

- Since 1996, a fishery has taken place on feeding aggregations on the offshore banks of the Scotian Shelf, primarily in May and June, with catches ranging from 1,000t to 20,000t. Total landings were above average at 9,088t in 2009, up from 920t in 2008,
- There is little new information to add and no reason to change the previous recommendation that the initial catch allocation for 2010 should not exceed the 12,000t as described in the DFO management plan.
- The industry has been encouraged to explore and undertake structured surveys of the offshore area.

Coastal (South Shore, Eastern Shore and Cape Breton) Nova Scotia

- The landings in the roe gillnet fisheries along the coast of Nova Scotia increased from 3,500t in 2008 to 9,800t in 2009.
- In 2009 there was a large increase in the surveyed biomass in the Little Hope/Port Mouton area from 14,500t to 36,600t and is now well above the recent 5 year average of 24,500t. The surveyed biomass in the Halifax/Eastern shore area saw a slight increase in 2008 and a large increase in 2009 from 30,300t to 54,200t, which is above the recent 5 year average SSB of 43,700t observed for this area.
- Collaborative research with industry has improved knowledge of three areas (Little Hope/Port Mouton, Halifax/Eastern Shore and Glace Bay), but there has been no increase in knowledge of other areas. It is again recommended that no coastal spawning groups

experience a large effort increase in new areas until enough information is available to evaluate the state of that spawning group.
- Harvest levels from these areas use a five year average of recent catches and/or surveyed acoustic biomass with the Calibration Integration Factor (CIF) to set initial targets. It is recommended that the "survey, assess, then fish" protocol should continue to be applied.

SW New Brunswick Migrant Juvenile

- SW New Brunswick migrant juveniles have been considered to be a mixture of juveniles, dominated by those originating from Northwest Atlantic Fisheries Organization (NAFO) Subarea 5 spawning components, and have, therefore, been excluded from the SW Nova Scotia/Bay of Fundy quota.
- Landings in the 2009 New Brunswick weir and shut-off fishery were 4,000t, the lowest catch since 1963 and well below the long term average. Two years previous, this fishery landed 30,900t, which was higher than the long term average of 23,560t.
- The age distribution of fish caught in the 2009 New Brunswick weir and shutoff fishery indicated mostly juveniles, with 86% at age 2.
- The number of weirs with catches decreased in the 2009 season, but effort remained similar.
- The success of this passive fishery is historically unpredictable, and catches are inherently susceptible to many natural variables in addition to abundance.

BACKGROUND

Species Biology

Atlantic herring (*Clupea harengus*) is a pelagic species found on both sides of the North Atlantic. Herring spawn in discrete locations, to which they have a strong affinity. Herring mature and first spawn at three or four years of age (23 to 28cm or 9 to 11in), then begin an annual pattern of spawning, over-wintering, and summer feeding, which often involves considerable migration and mixing with members of other spawning groups. Fishing takes place on dense summer feeding, over-wintering, and spawning aggregations. The majority of herring in the 4VWX stock are fall spawners.

The 4VWX management unit contains a number of spawning areas, separated to various degrees in space and time. Spawning areas in close proximity with similar spawning times, and which share a larval distribution area, are considered part of the same component. These undoubtedly have much closer affinity than spawning areas that are widely separated in space or time, and do not share a common larval distribution. Some spawning areas are large and offshore, whereas others are small and more localized, sometimes very near shore or in small embayments. The situation is complicated further as herring migrate long distances and mix outside of the spawning period both with members considered part of the same component and with members of other components. For the purposes of evaluation and management, the 4VWX herring fisheries are divided into four components:

1. SW Nova Scotia / Bay of Fundy spawning component
2. Offshore Scotian Shelf banks spawning component
3. Coastal (South Shore, Eastern Shore and Cape Breton) Nova Scotia spawning component
4. SW New Brunswick migrant juveniles

Each component except SW New Brunswick migrant juveniles has several spawning areas, and there is mixing of fish among spawning components outside of the spawning period.

Fishery

Fisheries in the 4VWX area in recent years have been dominated by purse seine (90%), followed by weir, gillnet, shutoff and trap.

Landings in 2008/09 were 54,113t against a Total Allowable Catch (TAC) of 55,000t for the SW Nova Scotia/Bay of Fundy component (Table 1). Landings have tracked the TAC in recent years, with most of the quota being taken each year since 2002 (Figure 2). There were additional landings of 22,902t in the non-stock components for an area total of 77,015t, with a decreased proportion of landings from the New Brunswick weirs and shutoffs in 2009, and an increase in landings from the Coastal Nova Scotia and Scotian Shelf Banks components. Catches by fishing grounds were similar to recent years with the largest proportions from the German Bank (48%), Gannet/Dry Ledge (21%) and Grand Manan (31%) areas. There was an increase in catches from New Brunswick coastal area and below average catches from Scots Bay and the Long Island shore area.

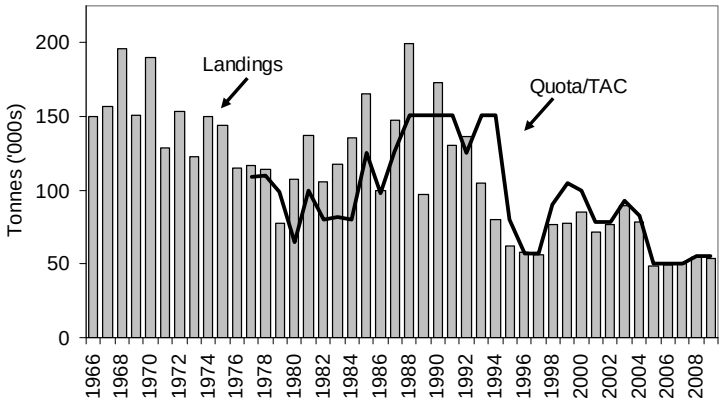


Figure 2. Landings (thousands of tonnes) and TAC for the SW Nova Scotia/Bay of Fundy spawning component.

Industry and management have explored means of managing the complexity within each component (such as distributing fishing effort among spawning areas according to their relative size) and taking appropriate account of the interaction among components (such as fishing restrictions on some areas of mixing). Prior to 2005, there was targeting of young fish and the high proportion of juveniles in the catch resulted in lost potential yield. Since 2005/2006, industry made a concerted effort to avoid small fish (less than 23cm or 2 years old). The result was a decrease in the proportion of fish less than 3 years old in the catch from 2005-2008. This, combined with the reduced TAC, has allowed year classes to survive to older ages (e.g., the 2001 year class has tracked through to age 8). The total removals of fish by number were reduced by close to 50% from 2005 to 2008 relative to 2004 but increased in 2009 with the catch of a large proportion of 2 year olds (45%) by number. This increase in the catch of 2 year olds is attributed to a potentially large year class.

Table 1. Reported landings (thousands of tonnes) and TAC for the 4WX herring management unit by component from 2000 to 2009 with averages for prior decades.

Year	Average 1970-79	Average 1980-89	Average 1990-99	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
4WX SW Nova Scotia TAC[1]	106	106	112	100	78	78	93	83	50	50	50	55	55
4WX SW Nova Scotia[1]	131	131	96	85	72	77	89	78	49	50	50	55	54
4VWX Coastal NS[2]	<1	<1	4	4	6	10	9	7	7	7	5	4	10
Scotian Shelf Banks[2]	38	<0.1	13	2	12	7	1	4	5	10	5	1	9
SW New Brunswick[2]	26	24	24	17	20	12	9	21	13	13	31	6	4
Total Landings	172	155	137	108	110	106	108	110	74	79	92	66	77

1 - Quota year from Oct. 15 of the preceeding year to Oct 14 of the current year

2 - Calendar year from Jan. 1 to Dec. 31

ASSESSMENT FOR THE SOUTHWEST NOVA SCOTIA/BAY OF FUNDY SPAWNING COMPONENT

In 2009, the fishery catch at age composition was comprised of 45% fish at 2 years of age, 20% at age 3, 24% age 4, and 11% at older ages (Figure 3, 4). The proportion of the catch older than age 5 decreased in 2009 to 7% from 17% in 2008. This decrease of older/larger fish in the catch was due to the high proportion of 2 year olds (potentially indicating a strong 2007 year class).

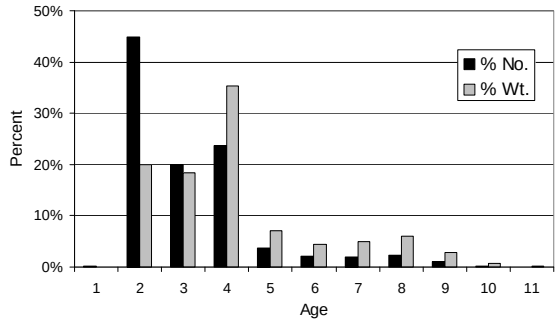


Figure 3. Fishery catch at age (% numbers and % weight) from the SW Nova Scotia/Bay of Fundy spawning component.

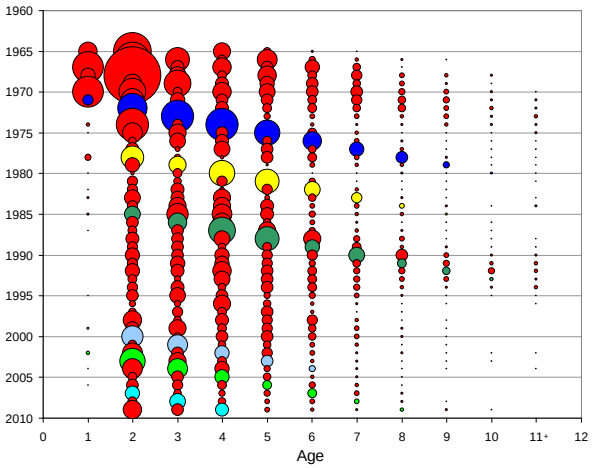


Figure 4. Historical catch at age for SW Nova/Bay of Fundy spawning component from 1965-2009.

The total number of fish removed by the fishery was calculated to be 588 million, an increase of 130 million or 28% from 2008 with the same overall TAC and similar landings.

The acoustic surveys that document primarily spawning fish have an age composition different from the fishery, with the highest proportion at age 4 and higher numbers in proportion, up to age 11, than was seen in the catch (Figure 5).

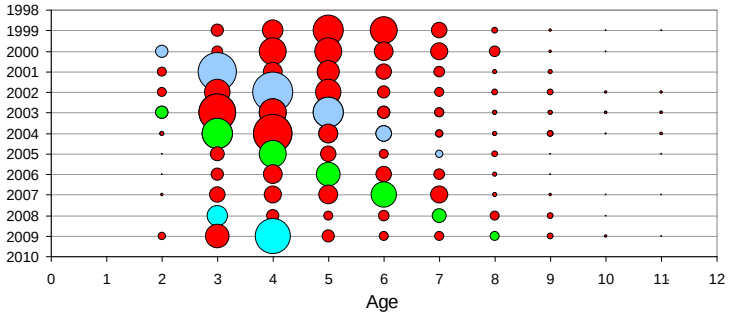


Figure 5. Acoustic survey age composition for the SW Nova/Bay of Fundy spawning component alone.

Acoustic Surveys

Industry led surveys with automated acoustic recording systems deployed on commercial fishing vessels were used to document the distribution and abundance of herring. Scheduled surveys were conducted approximately every 2 weeks on the main spawning components and an index of spawning stock biomass (SSB) for each component was estimated by summing these results (Table 2).

Table 2. Acoustic survey biomass index for SW Nova Scotia / Bay of Fundy spawning component for 1999 to 2009 ('000's t). Blanks indicate that no survey was undertaken. Estimates are calculated without the use of the CIF.

Location/Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average 1999-2008
Scots Bay	41	106	164	141	134	108	17	29	46	19	68	80
Trinity Ledge	3.9	0.6	14.8	8.1	14.5	6.5	5.1	8.5	1.4	0.3	0.7	6
German Bank	461	356	191	393	344	368	211	246	337	202	309	311
Spectacle Buoy (spring)			1.1		1.4		0.3		0.1	-		0.4
Spectacle Buoy (fall)			88									88
Subtotal	506	463	458	542	493	482	233	283	384	221	377	407
Scots Bay (outside box)											5	
German Bank (outside box)								4	3	2	1	3
Seal Island			3	1	12			8				6
Browns Bank			46					6				26
Total	506	463	507	543	505	482	233	301	387	223	384	415
Overall SE % *	19	14	10	9	17	15	28	16	25	27	27	18

* Overall SE% is the percentage of the standard error of the estimate to the mean.

Five surveys were conducted in Scots Bay in 2009. While there was no sampling of the first (relatively early) survey, it was assumed that fish detected were herring in spawning condition, and the survey was included in the SSB estimate. Seven surveys were conducted on German Bank, 5 of which were used in the estimate of SSB. Individual survey area coverage was good and consistent with established protocols. Inclusion of the Calibration Integration Factor (CIF) is deemed to provide a more accurate estimate of biomass and re-analysis for earlier years was begun in 2009. Until the revision including the CIF for 1999 to 2002 is completed, only results without this factor are shown when comparing years.

The amount of spawning fish documented on Trinity Ledge in 2009 was again extremely low and survey coverage was again very limited. There were no surveys and no reports of spawning herring around Seal Island and Browns Bank grounds. No spring fishery or survey were conducted on Spectacle Buoy in 2009.

In 2008, biomass estimates in the traditional survey areas for Scots Bay, Trinity Ledge and German Bank were decreased by approximately 160,000t from 2007.

In 2009, biomass estimates in the traditional survey areas for Scots Bay, Trinity Ledge and German Bank were 377,000t, which is an increase of approximately 156,000t from 2008. While the overall acoustic biomass is higher than in 2008, due to variability around the survey estimates, it is not statistically different from the previous 4 years, which are at a lower level than from 1999-2004 (Figure 6, 7). The overall biomass estimate in 2009 is slightly below but approaching the time series average.

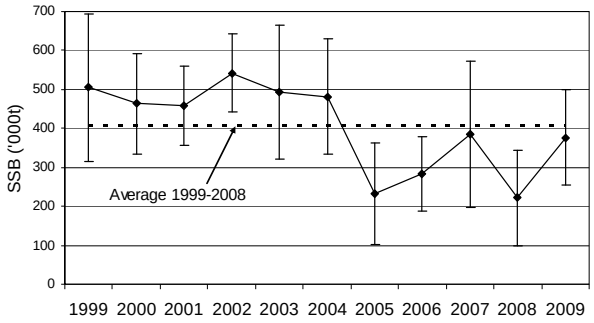


Figure 6. SSB index from acoustic surveys for the overall SW Nova Scotia/Bay of Fundy spawning component.

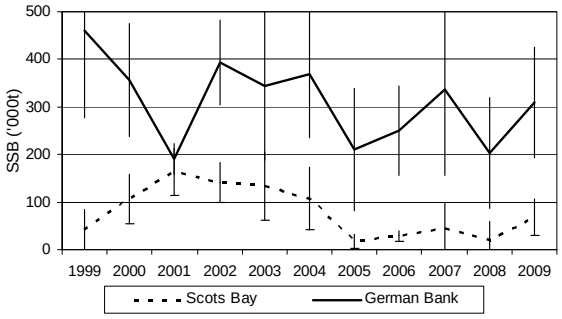


Figure 7. SSB index from acoustic surveys for Scots Bay and German Bank.

Stock Trends and Current Status

The last time a Virtual Population Analysis (VPA) was used to provide management advice in this fishery was in 2006. Due to discrepancies between the acoustic survey estimate of SSB and the VPA results, as well as identified problems with aging of 4VWX herring, the use of the VPA was suspended until these issues were resolved. Aging issues have now been resolved, quality control measures have been implemented, otoliths from 1999 to 2005 were re-read, otoliths from 2006-2009 were read, and a revised catch at age was developed along with a revised age disaggregated acoustic survey index. However, there are outstanding concerns with the VPA updated with the revised catch at age that will be investigated further, along with other model options, at a subsequent framework meeting. Stock status and scientific advice in 2010 are based on the acoustic survey index and evaluation of the IFMP objectives.

The 2007 framework review concluded that while the current acoustic survey can only provide a relative index of abundance, efforts should continue towards developing an absolute estimator. These efforts have continued, including work on target strength, residence time, and impacts of pulse length.

Fishing mortality could not be determined. Relative exploitation rate decreased in 2009 based on the acoustic SSB estimate and catch (Figure 8).

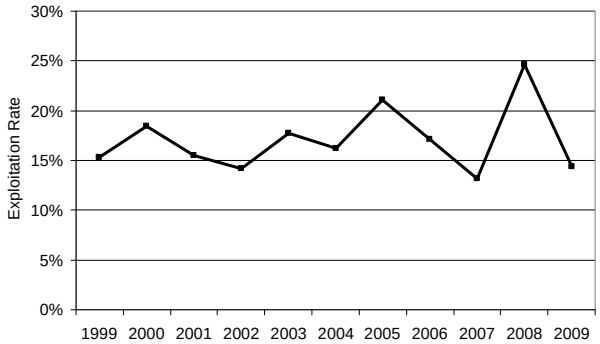


Figure 8. Relative exploitation rate using overall catch as a proportion of the overall acoustic SSB.

Sources of Uncertainty

There is no independent index of recruitment.

The size of an apparently strong 2007 recruiting year class is unknown but made up 45% (by number) of the catch in 2009.

A source of uncertainty continues to be the assumption that the surveys are simply additive. If herring do not move on to and off of the spawning grounds in waves, the estimate of total SSB will be biased; upward due to double counting or downward due to the missing of waves. As well, herring have been observed close to bottom or near the surface (dead/blind zone), which can lead to an under-estimation of biomass from acoustic surveys. Other significant issues relate to the completeness of coverage of the survey area on Trinity Ledge, inter-annual turn-over processes on each area, and factors that influence the target strength and acoustic backscatter (DFO 2007).

CONCLUSIONS AND ADVICE

The objectives for this stock from the management plan and the current observations are summarized below.

Objective	**2009: Observations**
Persistence of all spawning components	Spawning observed in Scots Bay and German Bank. Spawning activity could not be determined on Seal Island or Browns due to a lack of fishing or survey effort. Trinity Ledge had minimal spawning.
Maintain biomass of each component	Acoustic biomass estimates increased for each of the major survey areas. Taking into consideration confidence intervals, overall SSB for the past 5 years has been steady, at a lower level than in the 1999-2004 period. SSB for Trinity is extremely low.
Maintain broad age composition	Appears to be a broad range of ages in the commercial catch (1-9), as well as in the acoustic survey catch at age (3-11).
Maintain long spawning period	Start of spawning in 2009 for German Bank was earlier based on survey results. Spawning in Scots Bay appeared to start earlier and end earlier than in previous years. Virtually no

Objective	2009: Observations
	spawning occurred on Trinity Ledge.
Fishing mortality at or below $F_{0.1}$	Fishing mortality could not be determined. Relative exploitation rates based on acoustic SSB estimates and catch decreased in 2009.
Maintain spatial and temporal diversity of spawning	Broader spatial distribution of spawning on German Bank. Duration of spawning in Scots was improved in 2009. Trinity spawning is very restricted in space and time. There is a lack of documented spawning in other areas.
Maintain biomass at moderate to high levels	There was an increase in acoustic SSB for Scots Bay and German Bank; however, SSB appears to be slightly below but approaching the 1999-2008 average. The presence of two apparently strong recruiting year classes is likely to increase biomass levels in the next few years.

This assessment indicates improvements from the low level of the resource noted in the previous assessment (DFO 2009), e.g., SSB estimated from the acoustic surveys is approaching the series average (1999-2008). A harvest strategy that exercises continued caution to facilitate further rebuilding is recommended. Catch levels that remain near the current status quo would help to reduce risks related to uncertainties in estimating SSB, recruitment, and the exploitation rate for this stock.

OTHER CONSIDERATIONS

Pooling or sharing of catches amongst vessels to minimize sets and discards has reduced fishing effort and minimized occurrence of discards in recent years.

Increases in grey seal abundance and changes in distribution have raised concerns about changes in herring behaviour (e.g., distribution in water column and spawning timing).

Observer reports of by-catch in purse seine sets have reported very small amounts of mackerel, squid, and dogfish.

Reports by fishermen indicate that spawning may be starting earlier in the season; surveys with validation sampling (e.g., biological sampling in addition to acoustic survey) would help to confirm spawning timing and annual variability.

ASSESSMENT, CONCLUSIONS AND ADVICE FOR OTHER COMPONENTS

Offshore Scotian Shelf

Since 1996, a fishery has taken place on feeding aggregations on the offshore banks of the Scotian Shelf, primarily in May and June, with catches ranging from 1,000 to 20,000t (Figure 9). Total landings were above average at 9,088t in 2009, up from 920t in 2008. Most landings were caught by purse seiners in May and June, in the vicinity of the Patch, Emerald and the Western Hole.

In 2009, the age composition of the catch was mostly adult herring with a substantial proportion age 4 and older (Figure 10).

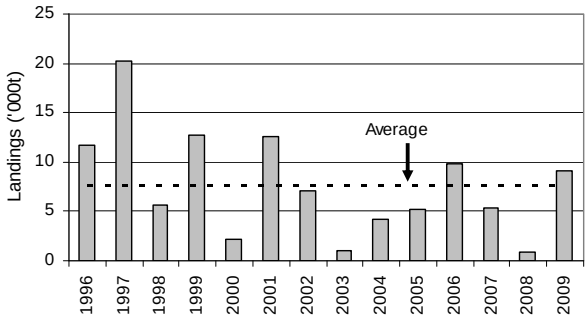


Figure 9. Offshore Scotian Shelf herring landings since 1996 with overall average for the period.

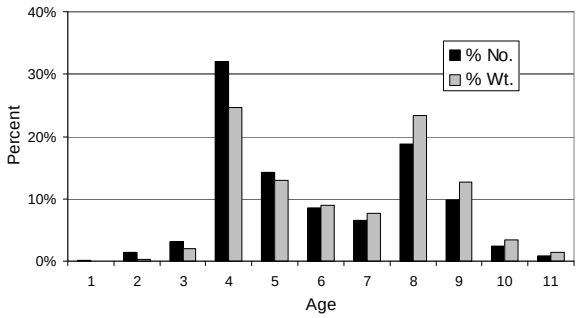


Figure 10. Fishery catch at age (% numbers and % weight) for the 2009 Offshore Scotian Shelf herring component.

An industry survey of the offshore Scotian Shelf area was conducted in June 2009, but, due to timing, few herring were observed and results were not considered to be useful. The DFO summer ecosystem trawl survey index, which previously demonstrated considerable abundance of herring widely spread over the Scotian Shelf, declined substantially from a high in 2004 (355 mean number per tow) to a below average level in 2009 (39 mean number per tow). The bottom trawl data are not considered indicative of overall herring abundance.

There is little new information to add and no reason to change the previous recommendation that the initial catch allocation for 2010 should not exceed 12,000t as described in the DFO management plan. The industry has been encouraged to explore and undertake structured surveys of the offshore area.

Coastal (South Shore, Eastern Shore and Cape Breton) Nova Scotia

There is no quota for the coastal Nova Scotia spawning component. Apart from the four areas indicated in Table 3, the size and historical performance of various spawning groups are poorly documented. In addition to the traditional bait and personal-use fisheries, directed roe fisheries have occurred on several spawning grounds since 1996.

Table 3. Recorded landings (thousands of tonnes) of herring from major gillnet fisheries on the Coastal Nova Scotia spawning component for 1996 to 2009.

Landings	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Little Hope/Port Mouton		0.5	1.2	2.9	2.0	2.9	4.0	4.5	1.3	2.2	3.1	1.5	1.1	3.7
Halifax/Eastern Shore	1.3	1.5	1.1	1.6	1.4	1.9	3.3	2.7	4.2	3.5	3.4	3.7	2.4	6.0
Glace Bay		0.2	1.7	1.0	0.8	1.2	3.1	1.9	1.5	0.6	0.1	0.0	0.0	0.0
Bras d'Or Lakes	0.2	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1.5	2.3	4.1	5.6	4.3	6.0	10.4	9.1	7.0	6.3	6.6	5.3	3.5	9.8

The landings in the roe gillnet fisheries along the coast of Nova Scotia increased from 3,500t in 2008 to 9,800t in 2009. From 2008 to 2009, landings increased from 1,100t to 3,700t in the Little Hope/Port Mouton area and from 2,400t to 6,000t in the Eastern Shore area. Increases were managed based on observed acoustic biomass during the season (using the survey, assess and fish protocol). Landings were minimal for Glace Bay. The Bras d'Or Lakes area remained closed. There was an additional 6t landed from trap nets located in Cape Breton and

St. Margaret's Bay. In 2009, the age composition of the catch for the overall component was primarily adult herring from this size selective gillnet fishery with a substantial proportion (99%) at age 4 and older (Figure 11).

As the inshore roe gillnet fisheries off Glace Bay, East of Halifax and Little Hope developed (since 1996), participants have contributed to sampling and surveying. In 2008 there was an increase in surveyed acoustic biomass in the Little Hope/Port Mouton area from the low of the previous year, but biomass was below average (Table 4, Figure 12). In 2009, there was a large increase in the surveyed biomass in the Little Hope/Port Mouton area from 14,500t to 36,600t and is now well above the recent 5 year average of 24,500t. The surveyed biomass in the Halifax/Eastern shore area saw a slight increase in 2008 and a large increase in 2009 from 30,300t to 54,200t, which is above the recent 5 year average SSB of 43,700t observed for this area (Figure 13). Surveys were also completed near Glace Bay, but there were very little spawning herring documented or catch reported (Figure 14). No herring surveys have been conducted in the Bras d'Or Lakes since 2000.

Table 4. Estimated herring acoustic SSB (thousands of tonnes) and recent 5 year average for the Coastal Nova Scotia spawning component areas as calculated with the CIF.

Acoustic Survey SSB (000's t)

Acoustic Survey SSB	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average 2005-2009
Little Hope/Port Mouton	14.1	15.8	5.2	21.3	56.0	53.1	22.5	44.7	24.1	2.8	14.5	36.6	24.5
Halifax/Eastern Shore	8.3	20.2	10.9	16.7	41.5	92.6	28.4	37.0	68.9	28.3	30.3	54.2	43.7
Glace Bay	0.0	2.0	0.0	21.2	7.7	31.5	0.0	3.2	n/s	0.2	0.5	0.1	1.0
Bras d'Or Lakes	0.0	0.5	0.1	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	no surveys

n/s - no survey

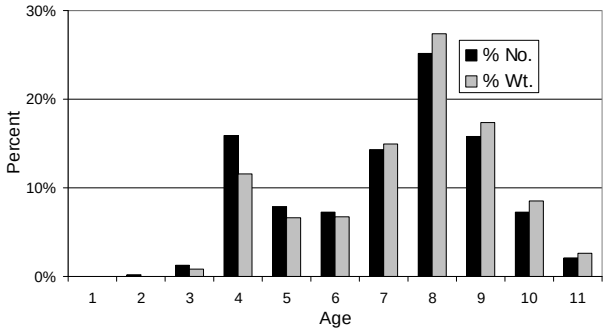


Figure 11. Fishery catch at age (% numbers and % weight) for the 2009 Coastal Nova Scotia herring component.

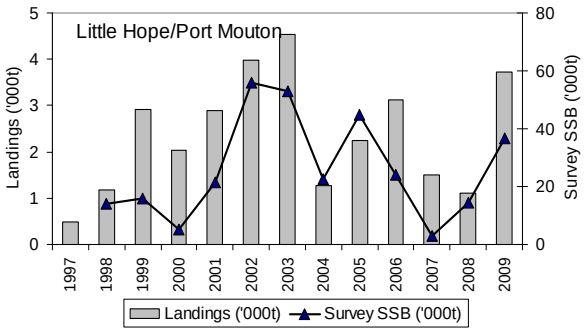


Figure 12. Landings and acoustic survey SSB ('000t) for the Little Hope/Port Mouton gillnet fishery for 1997-2009.

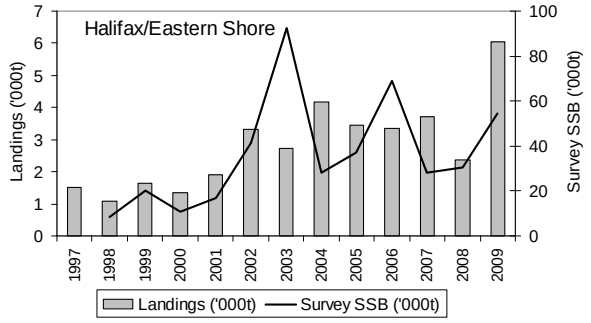


Figure 13. Landings and acoustic survey SSB ('000t) for the Halifax/Eastern Shore gillnet fishery for 1997-2009.

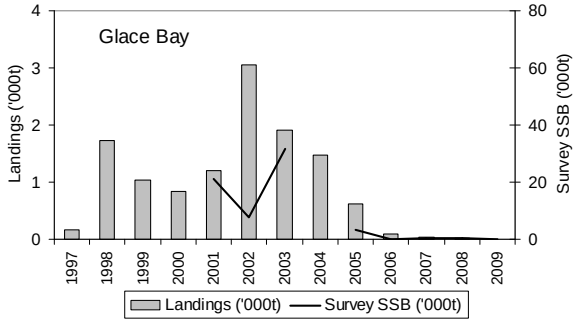


Figure 14. Landings and acoustic survey SSB ('000t) for the Glace Bay gillnet fishery for 1997-2009.

As indicated for the SW Nova Scotia/Bay of Fundy component, summing of multiple surveys may result in overestimates of SSB due to double counting. However, the majority of surveys of the Coastal Nova Scotia spawning component were undertaken on spatially separated aggregations of fish.

Collaborative research with industry has improved knowledge of three areas (Little Hope/Port Mouton, Halifax/Eastern Shore and Glace Bay), but there has been no increase in knowledge of other areas. Individual spawning groups within this component are considered vulnerable to fishing because of their relatively small size and proximity to shore. It is again recommended that no coastal spawning groups experience a large effort increase in new areas until enough information is available to evaluate the state of that spawning group.

It has been noted since 1997 that the status of herring in the Bras d'Or Lakes is cause for concern, but there has been no research or surveys in recent years. It is; therefore, appropriate to reiterate that no fishing should take place on this spawning component.

Harvest levels from these areas use a five year average of recent catches and/or surveyed acoustic biomass with the CIF to set initial targets. It is recommended that the "survey, assess, then fish" protocol should continue to be applied.

SW New Brunswick Migrant Juveniles

The southwest New Brunswick weir and shutoff fisheries have relied, for over a century, on the aggregation of large numbers of juvenile herring (ages 1-3) near shore at the mouth of the Bay of Fundy. These fish have been considered to be a mixture of juveniles, dominated by those originating from Northwest Atlantic Fisheries Organization (NAFO) Subarea 5 spawning components, and have, therefore, been excluded from the SW Nova Scotia/Bay of Fundy quota.

Landings in the 2009 New Brunswick weir and shut-off fishery were 4,000t, the lowest catch since 1963 and well below the long term average. Two years previous, this fishery landed 30,900t, which was higher than the long term average of 23,560t (Figure 15).

The age distribution of fish caught in the 2009 New Brunswick weir and shutoff fishery indicated mostly juveniles, which are well suited to the sardine market, with 86% at age 2 (Figure 16). The number of weirs with catches decreased in the 2009 season, but effort remained similar.

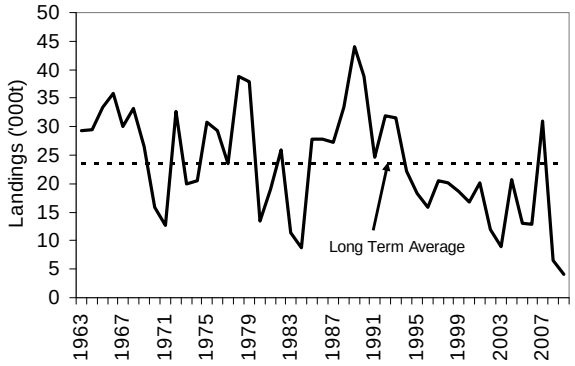


Figure 15. Herring landings from New Brunswick weir and shutoff fishery for 1963-2009 with long term average catch.

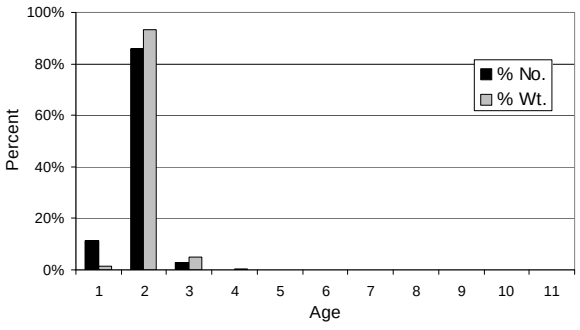


Figure 16. Fishery catch at age (% numbers and % weight) for the 2009 SW New Brunswick migrant juvenile herring component.

The success of this passive fishery is historically unpredictable, and catches are inherently susceptible to many natural variables in addition to abundance. In 2009, weir fishermen in most areas reported good abundance close to their weirs, but weir catches remained low throughout the season. After mid-October 2009, when an area restriction was removed, purse seiners caught 1,600t of herring within this area and an additional 1,100t were also taken in January 2010.

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