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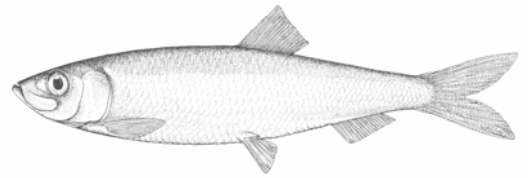
Newfoundland and Labrador Region **Stock Status Report 2004/046**



East and Southeast Newfoundland Atlantic Herring

Background

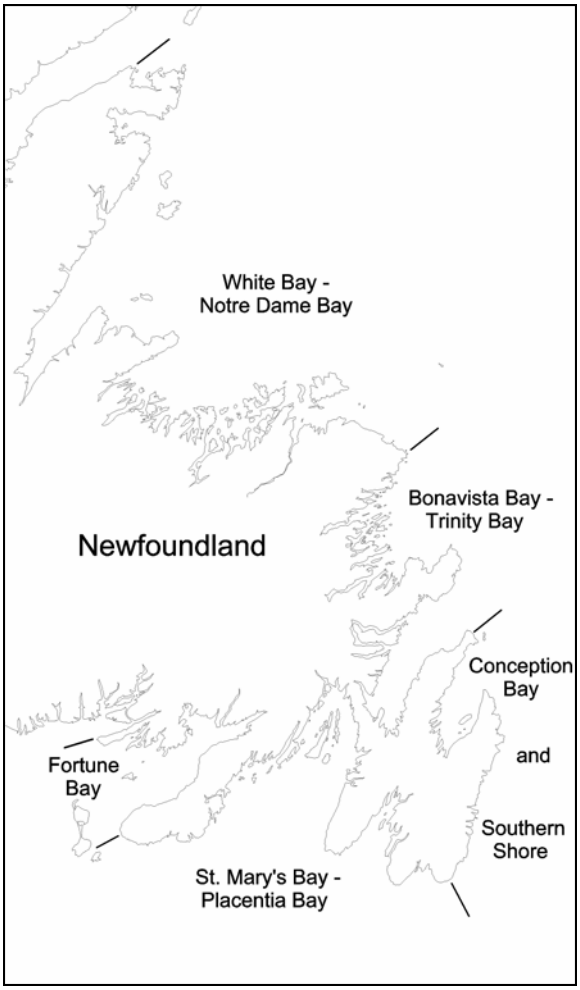
Herring (Clupea harengus*) are distributed in the Northwest Atlantic from Cape Hatteras to southern Labrador.*

There are five herring stocks distributed along the east and southeast coasts of Newfoundland: White Bay - Notre Dame Bay, Bonavista Bay - Trinity Bay, Conception Bay - Southern Shore, St. Mary's Bay - Placentia Bay, and Fortune Bay.

These herring migrate extensively on an annual basis through the coastal waters from near shore spawning grounds to feeding areas throughout the bays and returning to over winter in deep coastal inlets.

Historically, the stocks have supported commercial food and bait fisheries. The fishery along the northeast coast developed in the mid 1970's and peaked during the late 1970's as a result of increased markets due to the collapse of the North Sea herring fishery. The fisheries in all stock areas were closed in the early 1980's due to declining stock sizes but were reopened in the mid 1980's with the recruitment of the 1982 year class. Although controlled by TAC's, the fisheries since then have been largely driven by market availability and in most years quotas have not been taken.

Separate performance reports have been prepared within this document for all areas except Conception Bay - Southern Shore, where this is a limited commercial fishery and lack of scientific data.



Summary

- As in the 2002 assessment, performance reports, including evaluation of abundance indices and biological characteristics, were used to assess the current status and prospects of each stock.
- Retrospective performance reports were also prepared for 1998 and 2000. All performance reports were standardized to allow for inter-annual comparisons.

Canada

- For this assessment, the precautionary approach was implemented by quantifying levels of concern in relation to mean research gill net catch rates.

- Based on performance reports, in the two northern areas, White Bay - Notre Dame Bay and Bonavista Bay - Trinity Bay, abundance has increased since 2002 but is still low. In St. Mary's Bay - Placentia Bay, and Fortune Bay, abundance has decreased since 2002.

- Most year classes produced during the 1990's were generally weak, contributing to the low abundance. The 1999 year class is the most recent year class that can be estimated. It is above average in all areas.

- This assessment includes analyses to the spring of 2004, where data are available.

Species Biology

Historically, these stocks have been characterized by the predominance of spring-spawning herring; however, in recent years, autumn spawning herring have formed a substantial component of the commercial catch in all areas except Fortune Bay.

Growth is most rapid at earlier ages, herring at age 4 being an average of 27 cm in length and at age 10, 35 cm. Growth rates declined through the 1990's in all areas.

In most areas, the age at which herring mature has remained stable. Most herring are mature by age 6 and can live in excess of 11 years. However, in recent years, due to reduced growth rates, herring are smaller at all ages. This affects fecundity (number of eggs produced). For example, a one centimetre reduction in the length at which 50% of herring mature results in a 12 – 16% reduction in fecundity (Hodder 1972).

Herring within the Newfoundland region are at the northern extent of their geographic range. Ideal conditions seldom exist and consequently strong recruitment is very sporadic.

It has been shown (Winters and Wheeler 1987) that when good survival of young herring (i.e. recruitment) occurred through the 1960's to 1980's, it was largely influenced by suitable environmental conditions, principally warm over-wintering water temperatures and high salinities prior to spawning.

Large year classes of herring produced in 1968 and 1969 supported the stocks through the 1970's. The moderately large 1982 year class allowed stocks to rebuild in the 1980's. Since then, the 1987 and 1996 year classes have been of moderate strength, but in some areas only. Ocean temperatures and salinities in the early to mid 1990's were below average and year classes produced during this period were weak. Ocean temperatures have been above average since the late 1990's. Similarly, salinities have also increased since 2001 and are currently above average, potentially providing better environmental conditions for survival of young herring. However, there are no estimates of recruitment beyond the 1999 year class.

Herring are important as a prey for many species including other fish, sea birds and marine mammals.

Quantitative information on consumption of herring is available only for seals. Hammill and Stenson (2000) estimated that, in 1996, seals consumed 36,000 t of herring in NAFO Div. 2J3KL, an area encompassing all of the Newfoundland herring stocks, except those in Fortune Bay and Gulf of St. Lawrence. From 1990 to 1996, it was estimated that the consumption of herring by seals in Atlantic Canada increased by 40%. Most of the herring consumed by seals are <30 cm in length.

Methodology to Describe Stock Status

For each stock area, current stock status and future prospects were summarized in a performance report. Abundance indices, biological characteristics, and ecological considerations, were interpreted and then evaluated using the traffic light method (Caddy, 1998). This method uses a system of red (-), yellow (?), and green (+) lights to categorize indicators as 'cause for concern', 'uncertain', or 'positive'. In this assessment, 'uncertain' was defined as 'uncertainty of an interpretation', rather than precautionary uncertainty. However, a measure of precautionary uncertainty was also included in each performance report.

Four series of abundance indices were evaluated for each of the herring stocks including: research gill net catch rates, commercial gill net catch rates, gill net fisher observations, and purse seine fisher observations. Purse seine fisher observations were not available from Fortune Bay as there is no purse seine fishery in the area.

Biological characteristics, including age compositions, mean weights (ages 4 to 10), and year class sizes were evaluated. Ecological considerations included the potential effects of changes in water temperature and salinity on recruitment. Information on the consumption of herring by seals, to 2002, was also incorporated.

In evaluating current stock status, only abundance indices and age compositions were considered. Age compositions from research gill nets were considered to best represent population age structure. Current stock status was described based upon a standardized evaluation of all abundance indices and age composition data (range of mature age groups).

Future prospects were described by evaluating the strength of the mature year classes and of the 1999 recruiting year class. Recruitment data were available from research gill net catch rates at age.

The Precautionary Approach concept was introduced this year and a limit reference point was proposed to delineate situations which could result in serious harm to the stocks. Precautionary uncertainty was evaluated by measuring the current year research gill net catch rate in relation to the long-term mean (Table 1). Research gill net catch rates were used in this evaluation as they are the longest time series available and provide a proxy for abundance. The precautionary approach concept is evolving and will be assessed and adapted as more information becomes available.

	Level of Concern	Measure of Concern
Area of Concern	Very High Risk	<= 2.5% of mean
	High Risk	2.6% to 5.0% of mean
	Medium Risk	5.1% to 7.5% of mean
	Low Risk	7.6% to 10.0% of mean
	Limit Reference Point	
Area of No Concern	Very Low Risk	10.1% to 30.0% of mean
	No Risk	> 30.0% of mean

Table 1: Application of the Precautionary Approach to performance reports based upon current year research gill net catch rates in relation to mean research gill net catch rates.

White Bay - Notre Dame Bay

The Fishery

Landings decreased from 358 t in 2002 to 332 t in 2003 (Table 2). In addition to annual reported landings, an unknown amount of herring (considered to be less than 500 t) is caught in the gill net bait fishery. Mortality from discards in the 2003 fall purse seine fishery, due to damaged gear and quota restrictions, was estimated by fishers to be approximately 115 t.

	1993	1994	1995	1996	1997	1998
TAC	13.5	13.5	1.2	1.6	4.9	2.5
Landings	1.7	1.4	1.6	0.7	2.5	0.7
Year	1999	2000	2001	2002	2003	2004
TAC	2.5	2.5	1.1	1.1	1.1	1.1
Landings	1.1	1.1	<0.1	0.4	0.3	<0.1

2002 and 2003: provisional landings
2004 provisional to end of August.

Table 2: White Bay – Notre Dame Bay landings and TAC's ('000 t), 1993 – 2004.

The 2003 fall purse seine fishery was concentrated in the Fogo Island area. The 2004 spring gill net fishery was mainly east of the Bay of Exploits.

Documented effort has declined since the 1980's. Purse seine effort in the fall fishery (sets per fisher) decreased by 90% from 1997 to 2003. Gill net effort (net nights fished per fisher) in the spring fishery, decreased by 87% from 1996 to 2004.

Resource Assessment

Abundance Indices

Research gill net catch rates (number of fish per nights fished) increased by 340% from 2002 to 2004 (Figure 1). Current catch rates are still at a low level, 27% of the long-term mean (1988 – 2004).

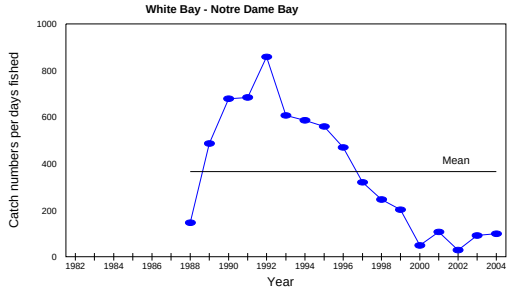


Figure 1: Research gill net catch rates, White Bay – Notre Dame Bay.

Commercial gill net catch rates (kilograms per standard net per nights fished) increased by 1118% from 2002 to 2004 (Figure 2). Current catch rates are 107% of the long-term mean (1996 – 2004).

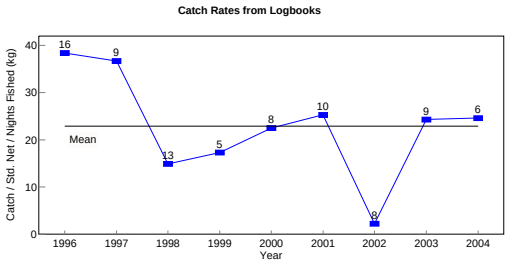


Figure 2: Commercial gill net catch rates, White Bay – Notre Dame Bay (sample sizes above each point).

Gill net fishers indicated (on a ten point scale) that herring abundance was higher in 2004 than in 2002 but still below average (Figure 3).

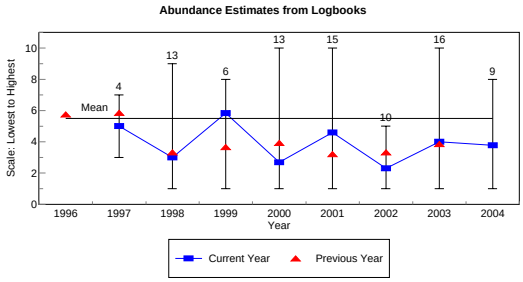


Figure 3: Commercial gill net fisher observations on herring abundance, White Bay – Notre Dame Bay (line and rectangular markers represent mean responses for the current year; triangular markers represent perception in previous year from current year; vertical bars represent range of responses, and numbers above bars represent sample sizes).

Purse seine fishers indicated (on a ten point scale) that herring abundance was higher in 2003 than in 2002 and above average (Figure 4).

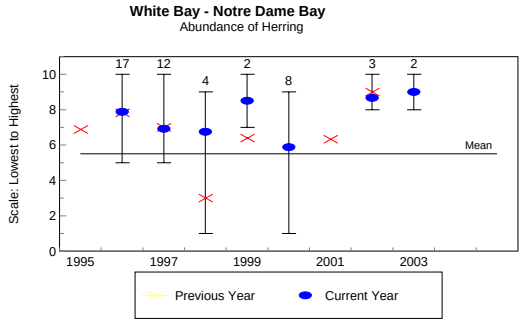


Figure 4: Commercial purse seine fisher observations on herring abundance, White Bay – Notre Dame Bay (circular markers represent mean responses for the current year; x's represent perception in previous year from current year; vertical bars represent range of responses, and numbers above bars represent sample sizes).

Biological Characteristics

Based on research gill net catch rates of year classes since 1982, four of six current mature year classes (1993 to 1998) are below average strength (Figure 5). The 1999 year class is above average in strength. All year classes in this time series are considered to be weak in relation to the strong year classes of the late 1960's.

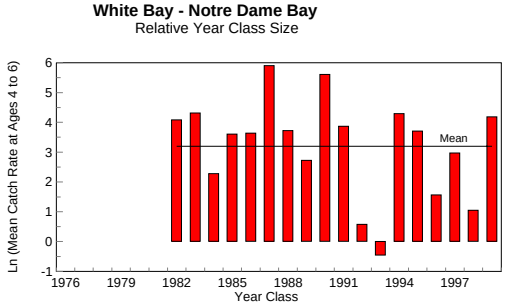


Figure 5: Year class strength relative to the long-term mean, as estimated from research gill net catch rates (at ages 4, 5, and 6).

The age composition from the 2003 research gill net catch was dominated by the 1999 year class which accounted for 61% of the catch (Figure 6). The age distribution was considered stable as five year classes each accounted for greater than 5% of the catch. However, there were very few fish older than age 8 and little evidence of recruiting year classes since 1999.

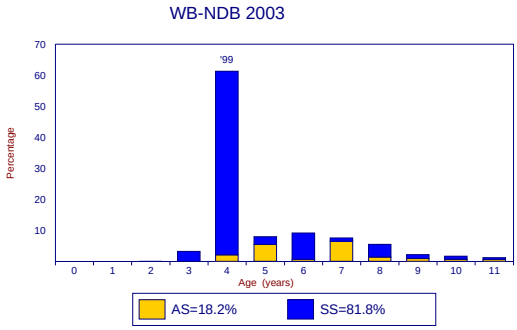


Figure 6: Age distribution from research gill nets fished in 2003, White Bay – Notre Dame Bay.

Mean weight (ages 4 to 10) decreased continuously during the 1980's and 1990's but has exhibited an increasing trend since 1998 (Figure 7). However, the mean weight in 2003 was still below average, 89% of the long-term mean (1983 -2003).

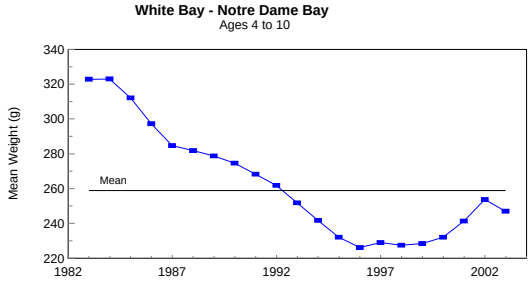


Figure 7: Mean weights at age (three year moving average) of spring spawning herring, ages 4 to 10, from samples collected January to June.

Ecological Considerations

As reported in the 2002 assessment, the proportion of herring in the diet of harp seals, in inshore areas of NAFO Div. 2J3KL, increased between the late 1980's and the mid 1990's, during a time when the harp seal population increased by approximately 44%, from 3.5 million to 5.2 million seals. However, due to the high variance associated with diet estimates, and changes in sampling over this time period, it is not clear if this resulted in an increase in consumption of herring from the area. No update on the consumption of herring by seals or any other predation information was available for this assessment.

The mean annual water temperature (at 20 m), at Station 27, off St. John's has increased gradually since 1992. In 2003, it was 22% above the long-term average (1983 – 2003).

The mean annual salinity (at 20 m), at Station 27, off St. John's has increased since 2001. In 2003, it was 1% above the long-term average (1983 – 2003).

Resource Status

All abundance indices show that this stock has increased since 2002 but is still at a very low level. The spawning stock is dominated by one age group; however, the population age structure is considered to be stable as five year classes each account for greater than 5% of the catch.

The mean weight of fish has decreased since the 1980's and is still below average; this may have resulted in increased fishing mortality per tonne of catch.

During this same period, there has been an increase in the proportion of herring in the diet of harp seals, at a time when the seal population is increasing.

Stock status has improved since the last assessment in 2002 but abundance is still considered to be low.

Outlook

Most mature year classes in the population are below average and considered to be weak. However, the 1999 year class is above average in strength relative to year classes within the past two decades.

Recruitment has been shown to be positively influenced by warm over-wintering temperatures and high salinities during the over wintering period prior to spawning. Recent water temperatures and salinities, which have been above average relative to the last two decades, may enhance recruitment.

Level of Concern (Precautionary Approach)

Current research gill net catch rates are 27% of the long-term mean. This implies very low risk of serious harm. If catch rates were to drop below 10% of the mean, the level of concern would be increased.

Interpretation and evaluation of current status, future prospects, and level of concern, is summarized in the attached performance report (Appendix 1).

Bonavista Bay - Trinity Bay

The Fishery

Landings increased from 566 t in 2002 to 1029 t in 2003 (Table 3). In addition to annual reported landings, an unknown amount of herring (considered to be less than 300 t) is caught in the gill net bait fishery. Mortality from discards in the 2003 fall purse seine fishery, due entirely to quota restrictions, was estimated by fishers to be approximately 20 t.

Year	1993	1994	1995	1996	1997	1998
TAC	10.0	10.0	1.0	1.4	1.6	2.5
Landings	2.3	2.7	1.5	1.1	1.1	1.0

Year	1999	2000	2001	2002	2003	2004
TAC	2.5	2.5	3.5	3.5	3.0	3.0
Landings	1.4	1.1	0.5	0.6	1.0	0.6

2002 and 2003: provisional landings
2004 provisional to end of August

Table 3. Bonavista Bay – Trinity Bay landings and TAC's ('000 t), 1993 – 2004.

The 2003 fall purse seine fishery was concentrated in the northern part of Bonavista Bay. The 2004 spring gill net fishery was not concentrated in one area but distributed throughout Bonavista and Trinity Bays.

Documented effort has decreased since the 1980's. Purse seine effort (sets per fisher) decreased by 46% from 2001 to 2003. Gill

net effort (net nights fished per fisher) in the spring fishery declined, by 85% from 1996 to 2004.

Resource Assessment

Abundance Indices

Research gill net catch rates (number of fish per nights fished) increased by 527% from 2002 to 2004 (Figure 8). Current catch rates are 107% of the long-term mean (1988 – 2004).

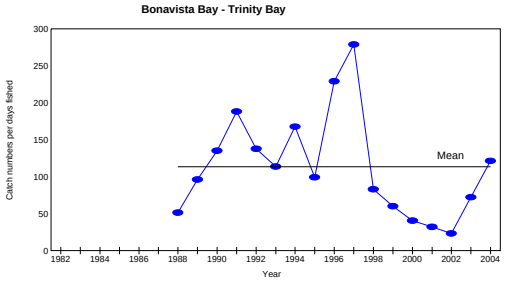


Figure 8: Research gill net catch rates, Bonavista Bay – Trinity Bay.

Commercial gill net catch rates (kilograms per standard net per nights fished) decreased by 9% from 2002 to 2004 (Figure 9). Current catch rates are 36% of the long-term mean (1996 – 2004).

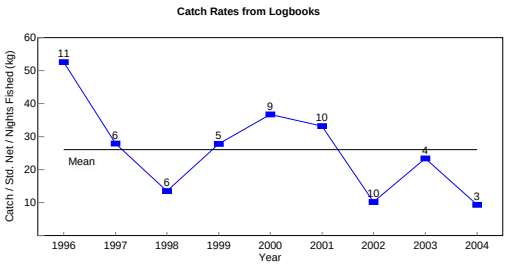


Figure 9. Commercial gill net catch rates, Bonavista Bay – Trinity Bay (sample sizes above each point).

Gill net fishers indicated (on a ten point scale) that herring abundance was higher in 2004 than in 2002 but still below average (Figure 10).

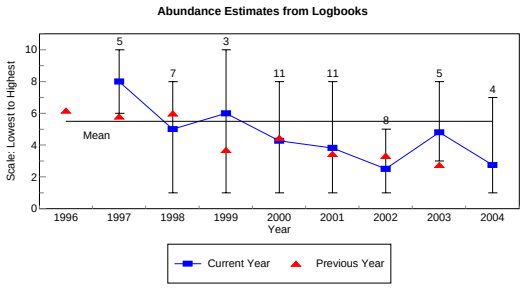


Figure 10: Commercial gill net fisher observations on herring abundance, Bonavista Bay - Notre Dame Bay (line and rectangular markers represent mean responses for the current year; triangular markers represent perception in previous year from current year; vertical bars represent range of responses, and numbers above bars represent sample sizes).

Purse seine fishers indicated (on a ten point scale) that herring abundance was lower in 2003 than in 2002 but still above average (Figure 11).

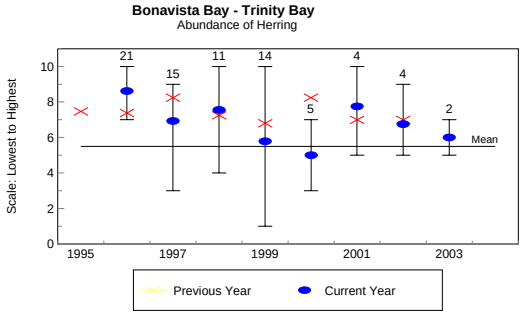


Figure 11: Commercial purse seine fisher observations on herring abundance, Bonavista Bay – Trinity Bay (circular markers represent mean responses for the current year; x's represent perception in previous year from current year; vertical bars represent range of responses, and numbers above bars represent sample sizes).

Biological Characteristics

Based on research gill net catch rates of year classes since 1982, four of six current mature year classes (1993 to 1998) are below average strength (Figure 12). The 1999 year class is well above average in strength. All year classes in this time series are considered to be weak in relation to the strong year classes of the late 1960's.

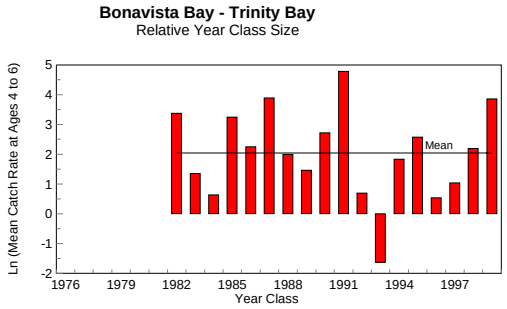


Figure 12: Year class strength relative to the long-term mean, as estimated from research gill net catch rates (at ages 4, 5, and 6).

The age composition from the 2003 research gill net catch was dominated by the 1999 year class which accounted for 67% of the catch (Figure 13). The age distribution of the catch was considered stable as six year classes each accounted for greater than 5% of the catch. Fish aged 11+ also accounted for 10% of the catch. There was little evidence of recruiting year classes since 1999.

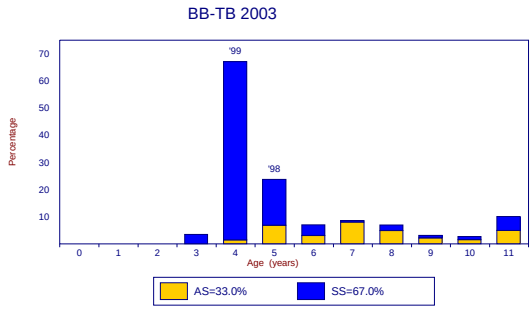


Figure 13: Age distribution from research gill nets fished in 2003, Bonavista Bay – Trinity Bay.

Mean weight (ages 4 to 10) decreased continuously during the 1980's and 1990's but has exhibited an increasing trend since 1996 (Figure 14). However, the mean weight in 2003 was still below average, 96% of the long-term mean (1983 – 2003).

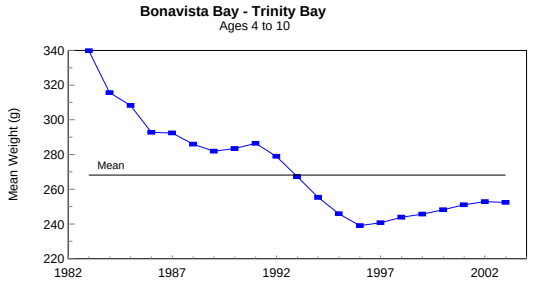


Figure 14: Mean weights at age (three year moving average) of spring spawning herring, ages 4 to 10, from samples collected January to June.

Ecological Considerations

As reported in the 2002 assessment, the proportion of herring in the diet of harp seals, in inshore areas of NAFO Div. 2J3KL, increased between the late 1980's and the mid 1990's, during a time when the harp seal population increased by approximately 44%, from 3.5 million to 5.2 million seals. However, due to the high variance associated with diet estimates, and changes in sampling over this time period, it is not clear if this resulted in an increase in consumption of herring from the area. No update on the consumption of herring by seals or any other predation information was available for this assessment.

The mean annual water temperature (at 20 m), at Station 27, off St. John's has increased gradually since 1992. In 2003, it was 22% above the long-term average (1983 – 2003).

The mean annual salinity (at 20 m), at Station 27, off St. John's has increased since 2001. In 2003, it was 1% above the long-term average (1983 – 2003).

Resource Status

Research gill net catch rates and commercial gill net fisher observations show that this stock has increased since 2002 but is still at a low level. The spawning stock is dominated by one age group; however, the population age structure is considered to be

stable as six year classes each account for greater than 5% of the catch.

The mean weight of fish has decreased since the 1980's and is still below average; this may have resulted in increased fishing mortality per tonne of catch.

During this same period, there has been an increase in the proportion of herring in the diet of harp seals, at a time when the seal population is increasing.

Stock status has improved since the last assessment in 2002 but abundance is still considered to be low.

Outlook

Most mature year classes in the population are below average and are considered to be weak. However, the 1999 year class is well above average in strength relative to year classes within the past two decades.

Recruitment has been shown to be positively influenced by warm over-wintering temperatures and high salinities during the over wintering period prior to spawning. Recent water temperatures and salinities, which have been above average relative to the last two decades, may enhance recruitment.

Level of Concern (Precautionary Approach)

Current research gill net catch rates are 107% of the long-term mean. This implies no risk of serious harm.

Interpretation and evaluation of current status, future prospects, and level of concern, is summarized in the attached performance report (Appendix 2).

St. Mary's Bay - Placentia Bay

The Fishery

Landings decreased from 1568 t in 2002 to 1084 t in 2003 (Table 4). In addition to annual reported landings, an unknown amount of herring (considered to be less than 150 t) is caught in the gill net bait fishery. Fishers reported minimal discard mortality in the 2004 winter/spring purse seine fishery.

Year	1993	1994	1995	1996	1997	1998
TAC	1.5	1.5	1.1	0.7	6.6	2.0
Landings	1.1	1.0	0.8	0.5	4.0	2.3

Year	1999	2000	2001	2002	2003	2004
TAC	2.0	2.0	2.0	2.0	2.5	2.5
Landings	0.3	0.5	0.7	1.6	1.1	1.4

2002 and 2003: provisional landings
2004 provisional to end of August

Table 4: St. Mary's Bay – Placentia Bay landings and TAC's ('000 t), 1993 – 2004.

The purse seine fishery, in March 2004, was concentrated along the eastern sides of Placentia Bay and St. Mary's Bay. The 2004 spring gill net fishery was mostly in Placentia Bay.
Documented effort increased from the 1980's to the 1990's. Purse seine effort (sets per fisher) peaked in 1997 and has since declined by 59% from 1997 to 2004. Gill net effort (net nights fished per fisher) peaked in 1998 and has since declined by 94% from 1998 to 2004.

Resource Assessment

Abundance Indices

Research gill net catch rates (number of fish per nights fished) decreased by 68% from 2002 to 2004 (Figure 15). Current catch rates are 68% of the long-term mean (1982 – 2004).

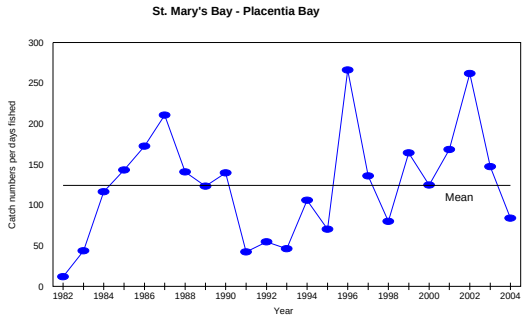


Figure 15: Research gill net catch rates, St. Mary's Bay – Placentia Bay.

Commercial gill net catch rates (kilograms per standard net per nights fished) decreased by 86% from 2002 to 2004 (Figure 16). Current catch rates (based upon two logbooks) are at a low level, 28% of the long-term mean (1996 – 2004).

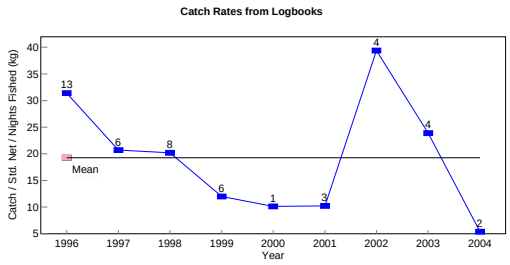


Figure 16: Commercial gill net catch rates, St. Mary's Bay – Placentia Bay (sample sizes above each point).

Gill net fishers indicated (on a ten point scale) that herring abundance was lower in 2004 than in 2002 and below average (Figure 17).

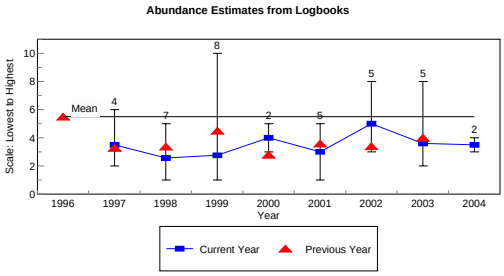


Figure 17: Commercial gill net fisher observations on herring abundance, St. Mary's Bay – Placentia Bay (line and rectangular markers represent mean responses for the current year; triangular markers represent perception in previous year from current year; vertical bars represent range of responses, and numbers above bars represent sample sizes).

Purse seine fishers indicated (on a ten point scale) that herring abundance was lower in 2004 than in 2002 but still above average (Figure 18).

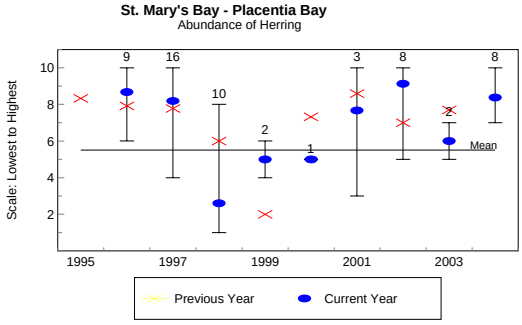


Figure 18: Commercial purse seine fisher observations on herring abundance, St. Mary's Bay – Placentia Bay (circular markers represent mean responses for the current year; x's represent perception in previous year from current year; vertical bars represent range of responses, and numbers above bars represent sample sizes).

Biological Characteristics

Based on research gill net catch rates of year classes since 1976, three of six current mature year classes (1993 to 1998) are below average strength (Figure 19). The 1999 year class is well above average in strength. All year classes in this time series are considered to be weak in relation to the strong year classes of the late 1960's.

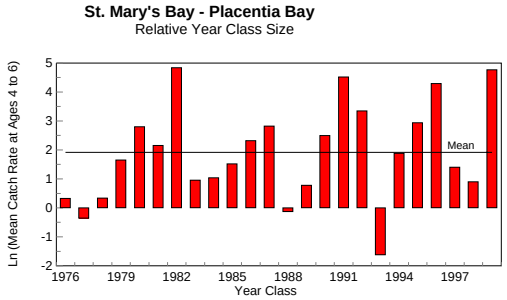


Figure 19: Year class strength relative to the long-term mean, as estimated from research gill net catch rates (at ages 4, 5, and 6).

The age composition from the 2003 research gill net catch was dominated by the 1999 year class which accounted for 62% of the catch (Figure 20). The age distribution of the catch was considered stable as five year classes each accounted for greater than 5% of the catch. Fish aged 11+ also accounted for 7% of the catch. There was little evidence of recruiting year classes since 1999.

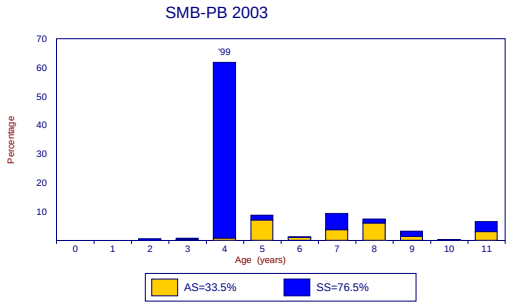


Figure 20: Age distribution from research gill nets fished in 2003, St. Mary's Bay – Placentia Bay.

Mean weight (ages 4 to 10) has exhibited a decreasing trend since 1983 (Figure 21). The mean weight in 2003 was below average, 89% of the long-term mean (1983 – 2003).

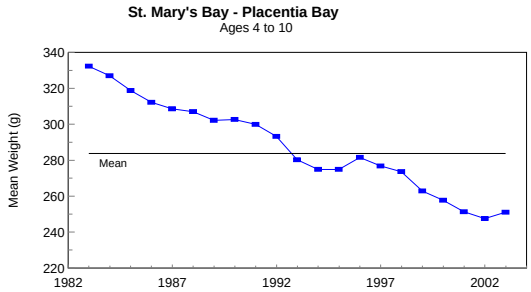


Figure 21: Mean weights at age (three year moving average) of spring spawning herring, ages 4 to 10, from samples collected January to June.

Ecological Considerations

No predation information was available for this stock.

The mean annual water temperature (at 20 m), at Station 27, off St. John's has increased gradually since 1992. In 2003, it was 22% above the long-term average (1983 – 2003).

The mean annual salinity (at 20 m), at Station 27, off St. John's has increased since 2001. In 2003, it was 1% above the long-term average (1983 – 2003).

Resource Status

All abundance indices show that this stock has decreased since 2002. The spawning stock is dominated by one age group; however, the population age structure is considered to be stable as five year classes each account for greater than 5% of the catch.

The mean weight of fish has decreased since the 1980's and is still below average; this may have resulted in increased fishing mortality per tonne of catch.

Stock status has deteriorated since the last assessment in 2002.

Outlook

Most year classes in the population are at or below average and are considered to be weak. However, the 1999 year class is well above average in strength relative to year classes within the past two and a half decades.

Recruitment has been shown to be positively influenced by warm over-wintering temperatures and high salinities during the over wintering period prior to spawning. Recent water temperatures and salinities, which have been above average relative to the last two decades, may enhance recruitment.

Level of Concern (Precautionary Approach)

Current research gill net catch rates are 68% of the long-term mean. This implies no risk of serious harm.

Interpretation and evaluation of current status, future prospects, and level of concern, is summarized in the attached performance report (Appendix 3).

Fortune Bay

The Fishery

Landings increased from 2259 t in 2002 to 3392 t in 2003 (Table 5). In addition to annual reported landings, an unknown amount of herring (considered to be less than 400 t) is caught in the gill net bait fishery in Fortune Bay.

Year	1993	1994	1995	1996	1997	1998
TAC	1.5	1.5	1.5	1.5	5.4	5.4
Landings	0.2	0.3	0.5	0.1	0.1	<0.1

Year	1999	2000	2001	2002	2003	2004
TAC	5.4	5.4	2.7	2.7	3.7	3.7
Landings	0.5	0.8	1.7	2.3	3.4	2.6

2002 and 2003: provisional landings
2004 provisional to end of August

Table 5: Fortune Bay landings and TAC's ('000 t), 1993 - 2004.

In recent years, most landings have been by bar seine. During the spring of 2004, this fishery was concentrated in the Long Harbour area. The 2004 gill net fishery, from late March to mid June, was distributed throughout Fortune Bay. There is no purse seine fishery in Fortune Bay.

Documented effort in the 1980's and 1990's was very low. Gill net effort (net nights fished per fisher) in the spring fishery peaked in 1997 but has since declined by 88% from 1997 to 2004. No effort information is available from the bar seine fishery.

Resource Assessment

Abundance Indices

Research gill net catch rates (number of fish per nights fished) decreased by 44% from 2002 to 2004 (Figure 22). Current catch rates are 42% of the long-term mean (1982 – 2004).

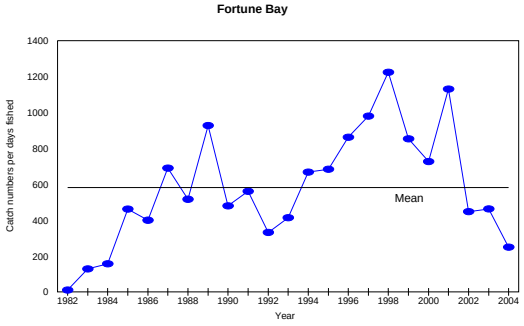


Figure 22: Research gill net catch rates, Fortune Bay.

Commercial gill net catch rates (kilograms per standard net per nights fished) decreased by 51% from 2002 to 2004 (Figure 23). Current catch rates are 55% of the long-term mean (1996 – 2004).

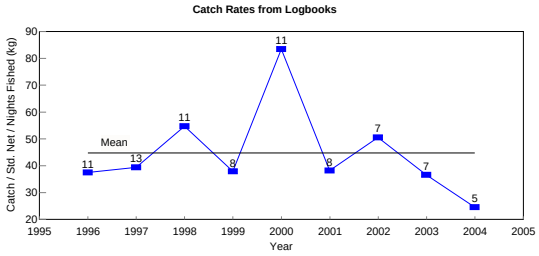


Figure 23: Commercial gill net catch rates, Fortune Bay (sample sizes above each point).

Gill net fishers indicated (on a ten point scale) that herring abundance was lower in 2004 than in 2002 and below average (Figure 24).

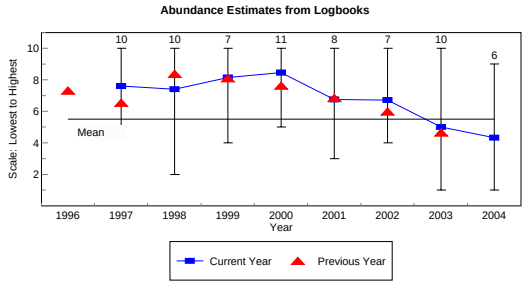


Figure 24: Commercial gill net fisher observations on herring abundance, Fortune Bay (line and rectangular markers represent mean responses for the current year; triangular markers represent perception in previous year from current year; vertical bars represent range of responses, and numbers above bars represent sample sizes).

Biological Characteristics

Based on research gill net catch rates of year classes since 1976, three of six current mature year classes (1993 to 1998) are below average strength (Figure 25). The 1999 year class is above average in strength. All year classes in this time series are considered to be weak in relation to the strong year classes of the late 1960's.

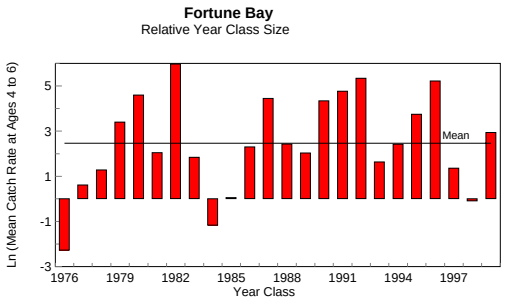


Figure 25: Year class strength relative to the long-term mean, as estimated from research gill net catch rates (at ages 4, 5, and 6).

The age composition from the 2003 research gill net catch was dominated by the 1996 year class (Figure 26). This was the only stock in which the 1999 year class was not dominant. The age distribution was truncated as only three year classes each accounted for greater than 5% of the catch. However, fish aged 11+ accounted for 36% of the catch.

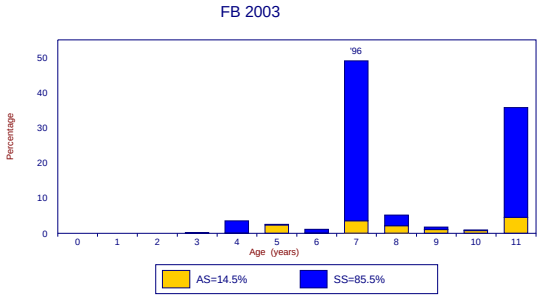


Figure 26: Age distribution from research gill nets fished in 2003, Fortune Bay.

Mean weight (ages 4 to 10) has exhibited a decreasing trend since 1983 (Figure 27). The mean weight in 2003 was below average, 88% of the long-term mean (1983 – 2003).

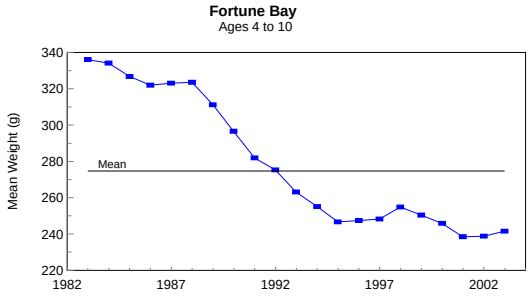


Figure 27: Mean weights at age (three year moving average) of spring spawning herring, ages 4 to 10, from samples collected January to June.

Ecological Considerations

No predation information was available for this stock.

The mean annual water temperature (at 20 m), at Station 27, off St. John's has increased gradually since 1992. In 2003, it was 22% above the long-term average (1983 – 2003).

The mean annual salinity (at 20 m), at Station 27, off St. John's has increased since 2001. In 2003, it was 1% above the long-term average (1983 – 2003).

Resource Status

All abundance indices show that this stock has decreased since 2002. The spawning stock is dominated by one age group. The population age structure is truncated as only three year classes each account for greater than 5% of the catch. However, fish aged 11+ accounted for 36% of the catch.

The mean weight of fish has decreased since the 1980's and is still below average; this may have resulted in increased fishing mortality per tonne of catch.

Stock status has deteriorated since the last assessment in 2002.

Outlook

Most year classes in the population are at or below average and are considered to be weak. However, the 1999 year class is above average in strength relative to year classes within the past two and a half decades.

Recruitment has been shown to be positively influenced by warm over-wintering temperatures and high salinities during the over wintering period prior to spawning. Recent water temperatures and salinities, which have been above average relative to the last two decades, may enhance recruitment.

Level of Concern (Precautionary Approach)

Current research gill net catch rates are 43% of the long-term mean. This implies no risk of serious harm.

Interpretation and evaluation of current status, future prospects, and level of concern, is summarized in the attached performance report (Appendix 4).

Sources of Uncertainty

Accurate landings data are essential in assessing stock status. Information from commercial gill net logbooks and commercial purse seine questionnaires indicates that in some areas and years, official landings statistics are under-estimated.

Estimation of recruiting year class strength is important in evaluating the future prospects of these stocks. Recruitment data are available from one source only, the research gill net data set. Strong year classes are normally seen across stock areas and quickly become dominant in most data sources. However, it is more difficult to predict the future prospects of weak and moderately strong year classes.

The evaluation of trends within abundance indices is dependent, among other things, upon the uncertainties associated with each index. Due to the limited fishery and research data, sample sizes for the indices in these assessments are generally small resulting in higher uncertainties. Particular concern was expressed regarding the low rate of commercial gill net logbook returns. Fishers are strongly urged to complete and return logbooks to help improve the quality of this index.

Standardization of performance reports requires the combination of several indices. In this assessment, indices were weighted subjectively based upon the perceived validity of the index. Weighting methods require further evaluation prior to the next assessment.

The central concept of the precautionary approach is the notion of "serious harm". Limit reference points are an attempt to demarcate the point at which values of the stock attributes are considered to be consistent with serious harm. However, if the current status of a stock is uncertain, greater caution is advised to ensure that serious harm does not occur. In this assessment, research gill net catch rates were used as a proxy for abundance. Research gill net catch rates were chosen because they had the longest time series available and include both recruiting and mature year classes. There is uncertainty as to how well these catch rates reflect the actual abundance. The choice of a limit reference point was also somewhat arbitrary. Consequently, this is a source of uncertainty.

Management Considerations

Performance reports provide a review of stock status and a visual description of stock status; however, they do not provide absolute estimates of abundance.

Management should also consider the impact of recent catch levels when formulating management plans.

Industry Perspective

Fishers in St. Mary's Bay – Placentia Bay and Fortune Bay indicated that stock abundance was more positive than indicated in this assessment.

Purse seine fishers reported that their catches often include mixtures of large commercial sized herring and small non-commercial sized herring. They noted that current regulations allow for catches to have a maximum of 10% (by number) of non-commercial sized herring. Fishers felt that this regulation is not practical and therefore should be examined in detail.

For More Information

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This report is available from the:

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Appendix 1. White Bay – Notre Dame Bay performance table to the spring of 2004 (not to be considered in isolation from the text of the Stock Status Report).

The Fishery	**Observation**		
Reported Landings: 2002 - 2003	Landings decreased from 358 t in 2002 to 332 t in 2003; 30% of the TAC was taken in 2003; average landings of 2800 t during 1990's; peak landings of 15,700 t in 1979.		
Total Removals: 2003	In addition to reported landings in 2003, an unknown amount of herring (considered to be less than 500 t) was caught in the gill net bait fishery; mortality from discards in the purse seine fishery, due to damaged gear and quota restrictions, was reported by fishers to be approximately 115 t.		
Effort: 2003 and 2004	Documented effort has declined since the 1980's; purse seine effort decreased by 90% from 1997 to 2003; gill net effort has also decreased by 87% from 1996 to 2004.		
Geographic Distribution of Fishery	The 2003 purse seine fishery, in November and December, was entirely in the Fogo Island area. The 2004 gill net fishery, from late April to late June, was mostly in eastern Notre Dame Bay.		
Abundance Indices	**Observation**	**Interpretation**	**Evaluation**
Research Gill Net Catch Rates 1988 – 2004 (numbers / nights fished)	Increased by 340% from 2002 to 2004; 2004 = 99, mean = 366, maximum = 859.	Current abundance below average and increasing.	+
Commercial Gill Net Catch Rates 1996 – 2004 (kg / net / nights fished)	Increased by 1118% from 2002 to 2004; 2004 = 25, mean = 23, maximum = 38.	Current abundance average and increasing.	+
Gill Net Fisher Observations 1996 - 2004	Abundance perceived to be higher in 2004 than in 2002 but still below average.	Current abundance below average and increasing.	+
Purse Seine Fisher Observations 1996 - 2003	Abundance perceived to be higher in 2003 than in 2002 and above average.	Abundance in 2003 high and increasing.	+
Biological Characteristics	**Observation**	**Interpretation**	**Evaluation**
2003 Research Gill Net Age Compositions (ages 3+)	Dominated by the 1999 year class; 5 year classes each account for >5% of catch.	Population age structure considered to be stable.	+
Current Year Classes: 1993 to 1998 Time series: 1982 - 1999 year classes	4 of 6 current mature year classes below average.	Most current mature year classes below average and considered to be weak.	-
Recruitment: 1999 year class Time series: 1982 to 1999 year classes	1999 year class above average.	Above average recruitment of the most recent estimatible year class.	+
Mean Weight: (ages 4 to 10) 1983 - 2003	Increasing trend since 1998 but still below average; 2003 = 231, mean = 259, maximum = 323.	Potential increase in fishing mortality per tonne caught.	?
Ecological Considerations	**Observation**	**Interpretation**	**Evaluation**
Predation	As in 2002, proportion of herring in harp seal diet has increased in near shore areas since the 1980's; no other predation data available.	Increased mortality by harp seals; other changes in predation mortality unknown.	?
Water Temperature: 1983 - 2003 (at 20 m, Station 27 off St. John's)	Above average in 2003 (4.44); mean = 3.64, maximum = 4.71.	Recent higher temperatures may enhance recruitment.	?
Water Salinity: 1983 - 2003 (at 20 m, Station 27 off St. John's)	Increasing trend since 2001 and above average in 2003 (32.00); mean = 31.79, maximum = 32.18	Recent higher salinities may enhance recruitment.	?
STOCK STATUS	**Interpretation**	**Evaluation**	
Current	Current abundance has increased since 2002 but is still low; population age structure is considered to be stable.	+	
Prospect	Most current mature year classes are considered to be weak; above average recruitment of the 1999 year class.	?	
Level of Concern (Precautionary Approach)	As an index of abundance, the 2004 research gill net catch rate implies very low risk of serious harm.	low risk	

-	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

All available data indicate that this stock has increased since 2002 but is still at a low level. The current status has improved since the last assessment in 2002. Prospects are uncertain; although the 1999 year class is above average, most mature year classes are below average and are considered to be weak. Prospects are similar to 2002.

Appendix 2. Bonavista Bay – Trinity Bay performance table to the spring of 2004 (not to be considered in isolation from the text of the Stock Status Report)

The Fishery	**Observation**		
Reported Landings: 2002 - 2003	Landings increased from 566 t in 2002 to 1029 t in 2003; 34% of the TAC was taken in 2003; average landings of 2600 t during 1990's; peak landings of 12,000 t in 1977.		
Total Removals: 2003	In addition to reported landings in 2003, an unknown amount of herring (considered to be less than 300 t) was caught in the gill net bait fishery; mortality from discards in the purse seine fishery, due entirely to quota restrictions, was reported by fishers to be approximately 20 t.		
Effort: 2003 and 2004	Documented effort was less in the 1990's than in the 1980's; gill net effort has continued to decline, by 85% from 1996 to 2004; purse seine effort decreased by 46% from 2001 to 2003.		
Geographic Distribution of Fishery	The 2003 purse seine fishery, in October through December, was concentrated in the northern part of Bonavista Bay. The 2004 gill net fishery, from mid April to late June, was distributed throughout Bonavista and Trinity Bays.		
Abundance Indices	**Observation**	**Interpretation**	**Evaluation**
Research Gill Net Catch Rates 1988 - 2004 (numbers / nights fished)	Increased by 527% from 2002 to 2004; 2004 = 121, mean = 113, maximum = 279.	Current abundance average and increasing.	+
Commercial Gill Net Catch Rates 1996 – 2004 (kg / net / nights fished)	Decreased by 9% from 2002 to 2004; 2004 = 9, mean = 26, maximum = 57.	Current abundance below average and decreasing.	-
Gill Net Fisher Observations 1996 - 2004	Abundance perceived to be higher in 2004 than in 2002 but still below average.	Current abundance below average and increasing.	+
Purse Seine Fisher Observations 1996 - 2003	Abundance perceived to be lower in 2003 than in 2002 but still above average.	Abundance in 2003 above average and decreasing.	-
Biological Characteristics	**Observation**	**Interpretation**	**Evaluation**
2003 Research Gill Net Age Compositions (ages 3+)	Dominated by the 1999 year class; 6 year classes each account for >5% of catch.	Population age structure considered to be stable.	+
Current Year Classes: 1993 to 1998 Time series: 1982 to 1999 year classes	4 of 6 current mature year classes below average.	Most current mature year classes below average and considered to be weak.	-
Recruitment: 1999 year class Time series: 1982 to 1999 year classes	1999 year class well above average.	Above average recruitment of the most recent estimatible year class.	+
Mean Weight: (ages 4 to 10) 1983 - 2003	Increasing trend since 1996 but still below average; 2003 = 258, mean = 268, maximum = 340.	Potential increase in fishing mortality per tonne caught.	?
Ecological Considerations	**Observation**	**Interpretation**	**Evaluation**
Predation	As in 2002, proportion of herring in harp seal diet has increased in near shore areas since the 1980's; no other predation data available.	Increased mortality by harp seals; other changes in predation mortality unknown.	?
Water Temperature: 1983 - 2003 (at 20 m, Station 27 off St. John's)	Above average in 2003 (4.44); mean = 3.64, maximum = 4.71.	Recent higher temperatures may enhance recruitment.	?
Water Salinity: 1983 - 2003 (at 20 m, Station 27 off St. John's)	Increasing trend since 2001 and above average in 2003 (32.00); mean = 31.79, maximum = 32.18	Recent higher salinities may enhance recruitment.	?

STOCK STATUS	**Interpretation**	**Evaluation**
Current	Current abundance has increased since 2002 but is still low; population age structure is considered to be stable.	+
Prospect	Most current mature year classes are considered to be weak; above average recruitment of the 1999 year class.	?
Level of Concern (Precautionary Approach)	As an index of abundance the 2004 research gill net catch rate implies no risk of serious harm.	no risk

-	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

Most available data indicate that this stock has increased since 2002 but is still at a low level. The current status has improved since the last assessment in 2002. Prospects are uncertain; although the 1999 year class is well above average, most mature year classes are below average and are considered to be weak. The prospects have improved since the last assessment in 2002.

Appendix 3. St. Mary's Bay – Placentia Bay performance table to the spring of 2004 (not to be considered in isolation from the text of the Stock Status Report).

The Fishery	**Observation**		
Reported Landings: 2002 - 2003	Landings decreased from 1568 t in 2002 to 1084 t in 2003; 43% of the TAC was taken in 2003; average landings of 1200 t during 1990's; peak landings of 4000 t in 1997 (since large mobile purse seine fishery in 1960's).		
Total Removals: 2003	In addition to reported landings in 2003, an unknown amount of herring (considered to be less than 150 t) was caught in the gill net bait fishery; fishers reported minimal discard mortality in the purse seine fishery.		
Effort: 2004	Documented effort increased from the 1980's to the 1990's; purse seine effort peaked in 1997 and has since declined by 59% from 1997 to 2004; gill net effort peaked in 1998 and has since declined by 94% from 1998 to 2004.		
Geographic Distribution of Fishery	The purse seine fishery, in March 2004, was concentrated along the eastern side of Placentia Bay and St. Mary's Bay. The 2004 gill net fishery, from early April to mid June, was mostly in Placentia Bay.		
Abundance Indices	**Observation**	**Interpretation**	**Evaluation**
Research Gill Net Catch Rates 1982 – 2004 (numbers / nights fished)	Decreased by 68% from 2002 to 2004; 2004 = 84, mean = 124, maximum = 266.	Current abundance below average and decreasing.	-
Commercial Gill Net Catch Rates 1996 - 2004 (kg / net / nights fished)	Decreased by 86% from 2002 to 2004 (2004 = 2 logbooks) ; 2004 = 5, mean = 19, maximum = 39.	Current abundance below average and decreasing.	-
Gill Net Fisher Observations 1996 - 2004	Abundance perceived to be lower in 2004 than in 2002 and below average.	Current abundance below average and decreasing.	-
Purse Seine Fisher Observations 1996 - 2004	Abundance perceived to be lower in 2004 than in 2002 but still above average.	Current abundance above average and decreasing.	-
Biological Characteristics	**Observation**	**Interpretation**	**Evaluation**
2003 Research Gill Net Age Compositions (ages 3+)	Dominated by the 1999 year class; 5 year classes each account for >5% of catch.	Population age structure considered to be stable.	+
Current Year Classes: 1993 to 1998 Time series: 1976 to 1999 year classes	3 of 6 current mature year classes below average.	Half of current mature year classes below average and considered to be weak.	-
Recruitment: 1999 year class Time series: 1976 to 1999 year classes	1999 year class well above average.	Above recruitment of the most recent estimatible year class.	+
Mean Weight: (ages 4 to 10) 1983 - 2003	Decreasing trend since 1983; below average in 2003 (254); mean = 284, maximum = 332.	Potential increase in fishing mortality per tonne caught.	?
Ecological Considerations	**Observation**	**Interpretation**	**Evaluation**
Water Temperature: 1983 - 2003 (at 20 m, Station 27 off St. John's)	Above average in 2003 (4.44); mean = 3.64, maximum = 4.71.	Recent higher temperatures may enhance recruitment.	?
Water Salinity: 1983 - 2003 (at 20 m, Station 27 off St. John's)	Increasing trend since 2001 and above average in 2003 (32.00); mean = 31.79, maximum = 32.18	Recent higher salinities may enhance recruitment.	?

STOCK STATUS	**Interpretation**	**Evaluation**
Current	Current abundance has decreased since 2002; population age structure is considered to be stable.	-
Prospect	Most current mature year classes are considered to be weak; above average recruitment of the 1999 year class.	?
Level of Concern (Precautionary Approach)	As an index of abundance, the 2004 research gill net catch rate implies no risk of serious harm..	no risk

-	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

All available data indicate that this stock has decreased since 2002. The current status has deteriorated since the last assessment in 2002. Prospects are uncertain; although the 1999 year class is well above average, most mature year classes are below average and are considered to be weak. Prospects have improved since 2002.

Appendix 4. Fortune Bay performance table to the spring of 2004 (not to be considered in isolation from the text of the Stock Status Report).

The Fishery	**Observation**		
Reported Landings: 2002 - 2003	Landings increased from 2259 t in 2002 to 3392 t in 2003; 92% of the TAC was taken in 2003; average landings of 200 t during 1990's; peak landings in 2003 (since large mobile purse seine fishery in 1960's).		
Total Removals: 2003	In addition to reported landings in 2003, an unknown amount of herring (considered to be less than 400 t) was caught in the gill net bait fishery.		
Effort: 2004	Documented effort in 1980's and 1990's was very low; gill net effort peaked in 1997 and has since declined by 88% from 1997 to 2004; there is no purse seine fishery in Fortune Bay; the current fishery is primarily by bar seine for which no effort information is available.		
Geographic Distribution of Fishery	The 2004 spring bar seine fishery was concentrated in the Long Harbour area; the gill net fishery, from late March to mid June, was distributed throughout Fortune Bay.		
Abundance Indices	**Observation**	**Interpretation**	**Evaluation**
Research Gill Net Catch Rates 1982 - 2004 (numbers / nights fished)	Decreased by 44% from 2002 to 2004; 2004 = 249, mean = 581, maximum = 1224.	Current abundance below average and decreasing.	-
Commercial Gill Net Catch Rates 1996 - 2004 (kg / net / nights fished)	Decreased by 51% from 2002 to 2004; 2004 = 24.6, mean = 45, maximum = 84.	Current abundance below average and decreasing.	-
Gill Net Fisher Observations 1996 - 2004 time series	Abundance perceived to be lower in 2004 than in 2002 and below average.	Current abundance below average and decreasing.	-
Biological Characteristics	**Observation**	**Interpretation**	**Evaluation**
2003 Research Gill Net Age Compositions (ages 3+)	Dominated by the 1996 year class; 3 year classes each account for >5% of the catch; fish aged 11+ well represented.	Population age structure considered to be stable due to substantial contribution of older fish.	+
Current Year Classes: 1993 to 1998 Time series: 1976 to 1999 year classes	3 of 6 current mature year classes below average.	Half of current mature year classes below average and considered to be weak.	-
Recruitment: 1999 year class Time series: 1976 to 1999 year classes	1999 year class above average.	Above average recruitment of the most recent estimatible year class.	+
Mean Weight: (ages 4 to 10) 1983 - 2003	Decreasing trend from 1983 to 2001; below average in 2003 (243); mean = 275, maximum = 336.	Potential increase in fishing mortality per tonne caught.	?
Ecological Considerations	**Observation**	**Interpretation**	**Evaluation**
Water Temperature: 1983 - 2003 (at 20 m, Station 27 off St. John's)	Above average in 2003 (4.44); mean = 3.64, maximum = 4.71.	Recent higher temperatures may enhance recruitment.	?
Water Salinity: 1983 - 2003 (at 20 m, Station 27 off St. John's)	Increasing trend since 2001 and above average in 2003 (32.00); mean = 31.79, maximum = 32.18	Recent higher salinities may enhance recruitment.	?

STOCK STATUS	**Interpretation**	**Evaluation**
Current	Current abundance has decreased since 2002; population age structure is considered to be stable.	-
Prospect	Most current mature year classes are considered to be weak; above average recruitment of the 1999 year class.	?
Level of Concern (Precautionary Approach)	As an index of abundance, the 2004 research gill net catch rate implies no risk of serious harm.	no risk

-	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

All available data indicate that this stock has decreased since 2002. Current status has deteriorated since the last assessment in 2002. Prospects are uncertain; although the 1999 year class is above average, most mature year classes are below average and are considered to be weak. Prospects have improved since 2002.