



## 4VWX HERRING (*CLUPEA HARENGUS*) STOCK STATUS UPDATE TO 2024

### CONTEXT

The Resource Management Branch of Fisheries and Oceans Canada (DFO) has requested interim advice for [4VWX Atlantic Herring \(\*Clupea harengus\*\)](#) the 2025 fishing year for subcomponents, Southwest Nova Scotia/Bay of Fundy (SWNS/BoF), Coastal Nova Scotia, Offshore Scotian Shelf banks spawning components, and southwest New Brunswick (NB) migrant juveniles. The meeting objectives were:

- Review of information on the Offshore Scotian Shelf and Coastal Nova Scotia spawning component and Southwest New Brunswick migrant juvenile fishery component.
- Evaluate indicators and the status of the SWNS/BoF component with respect to the limit reference point.
- Determine if exceptional circumstances have occurred for the SWNS/BoF component.

This Science Response Report is from the regional peer review of June 25, 2025 and July 4, 2025, on the Stock Status Update of Herring in Northwest Atlantic Fisheries Organization (NAFO) Fishing Areas 4VWX.

### SCIENCE ADVICE

#### Status

- The 3-year moving average (2022–2024) of the spawning stock biomass (SSB) index for SWNS/BoF Herring is below the limit reference point (LRP). Therefore, the stock remains in the critical zone.

#### Trends

- The 3-year moving average indicator has been at or below the LRP (317,846 t) for the past eight years.
- The 2024 German Bank SSB was 68% below the long-term average (1999–2024; 210,714 t), while Scots Bay SSB is 90% above the long-term average (1999–2024; 123,484 t). Overall, since 2005, German Bank has shown a decreasing trend, whereas Scots Bay has shown an increasing trend.
- The acoustic-based SSB estimates for Trinity Ledge and Spectacle Buoy spawning grounds fluctuate without trends. The biomass for these spawning grounds is minor (23,667 t; 6% of total acoustic-based biomass estimates within SWNS/BoF) compared with Scots Bay and

German Bank (301,290 t; 80% of total acoustic-based biomass estimates within SWNS/BoF).

- The acoustic-based SSB estimate for Seal Island spawning ground increased in 2023 (64,933 t) and, in 2024 (50,013 t) was 75% higher than the average across survey years (2018–2024; 28,602 t).

### **Ecosystem and Climate Change Considerations**

- Ecosystem and climate change considerations were taken into account in the most recent stock assessment and were not further considered during this interim-year update. The previous considerations remain valid.

### **Stock Advice**

- This update provides no catch advice for this stock. A review of the current assessment framework will begin in 2026.

### **Other Management Questions**

- Allocations for the Coastal Nova Scotia spawning component are based on the recent 5-year (2020–2024) average of observed acoustic index of the SSB, for Little Hope/Port Mouton area this value was 58,436 t and for Halifax/Eastern Shore this value was 21,669 t.
- The allocation for Offshore Scotian Shelf banks spawning component was 4,000 t and landings were 10 t in 2024. Systematic acoustic surveys have not been conducted since 1998. There is no new information for evaluating this component.
- Landings from the southwest NB weir and shut-off fishery were 2,328 t in 2024. Landings for this fishery are excluded from SWNS/BoF component quota because they are considered to originate in NAFO subarea 5. Landings within this fishery are highly variable and are not indicative of abundance.

## **BASIS FOR ASSESSMENT**

### **Assessment Details**

#### **Year Assessment Approach was Approved**

2022 (DFO 2022)

#### **Assessment Type**

Interim-Year Update

#### **Most Recent Assessment Date**

1. Last Full Assessment: March 2022 (DFO 2022)
2. Last Interim-Year Update: March 2024 (DFO 2024)

#### **Stock Assessment Approach**

1. Management Strategy Evaluation (MSE; Barrett 2023, Carruthers et al. 2023)

## 2. Statistical catch-at-age

This interim-year update provides an updated biomass index for spawning subcomponents and evaluates whether exceptional circumstances occurred. The previous full assessment (DFO 2022) and previous interim-year updates (DFO 2023, DFO 2024) also evaluated candidate management procedures to assess whether there was a 75% probability of rebuilding the stock by 2030. Catch advice was not requested for this interim-year update, as a harvest decision was made in 2024 to set the TAC at 16,000 t annually for years 2024–2028.

### **Ecosystem and Climate Change Assessment Approach**

Ecosystem and climate change considerations were taken into account in the most recent stock assessment framework and were not further considered during this interim-year update. The previous considerations remain valid.

### **Stock Structure Assumption**

Atlantic Herring within the SWNS/BoF component contains several spawning subcomponents that have strong spawning fidelity. Herring mature in SWNS/BoF subcomponents at age-three, four or five years, then begin an annual pattern of spawning, over-wintering, and summer feeding. This cycle involves migration and mixing with members of other spawning subcomponents. Fishing occurs on dense summer feeding and spawning aggregations.

Herring landed from southwest NB weir and shut-off fisheries have traditionally been considered part of NAFO Subarea 5 spawning component and, historically, considered distinct from the SWNS/BoF component. As a result, DFO Resource Management has excluded these landings from the SWNS/BoF quota. However, NB Weir and shut-off landings are reported here as there is a portion of southwest NB weir and shut-off landings that likely originate from the SWNS/BoF component (Barrett 2023).

### **Reference Points**

- Limit Reference Point (LRP): 317,846 t (acoustic-based SSB of German Bank and Scots Bay spawning grounds)
- Upper Stock Reference (USR): Not available
- Removal Reference (RR): Not available
- Target Reference Point (TRP): Not available

### **Data**

- Landings (by fleet) (1968–2024)
- Fishery Length Frequency (by fleet) (1968–2020)
- Fishery Age Composition (by fleet) (1970–2020)
- Fishery Independent Larval Survey Index (1972–1998, 2009)
- Acoustic survey based estimate of SSB for German Bank and Scots Bay (1999–2024)

Data changes: An adjustment in the Scots Bay 2021–2024 acoustic survey based estimate of SSB were made compared to DFO 2024 because the turnover equation for surveys was not calculated correctly for surveys that exceeded 100 days within a fishing season.

### ASSESSMENT

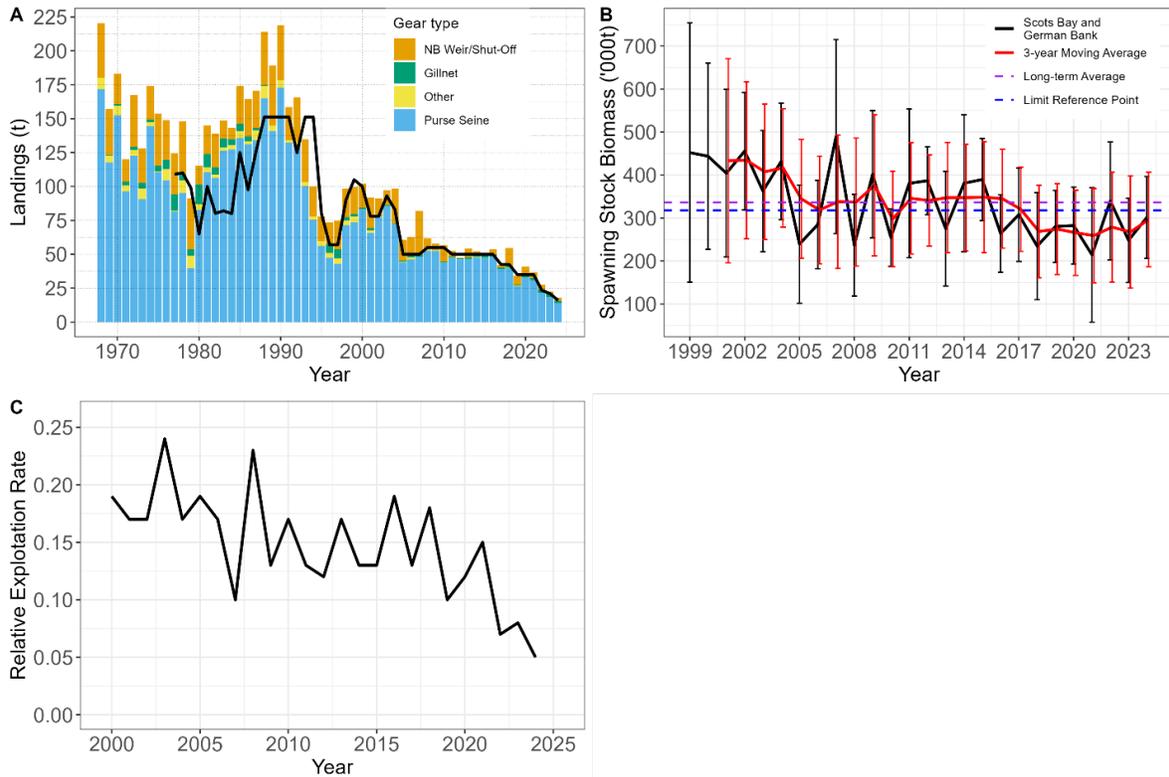


Figure 1. (A) Catch by fishing gears (kt) (bar chart) caught from southwest Nova Scotia/Bay of Fundy (SWNS/BoF) (including the New Brunswick (NB) weir and shut-off fishery) and total allowable catch (TAC) (black line) for the SWNS/BoF fishery. Catch from the NB weir/shut-off fishery is not restricted by a TAC. Other fishing gears include mid-water trawl, and weir/trap, shut-off gear in Nova Scotia, (B) Acoustic index of SSB (in thousands of metric tons) (with 95% confidence intervals; black line), the 3-year moving average (red line), the overall average since 1999 (dashed brown line), and the limit reference point for the SWNS/BoF spawning component (revised 2005–2010 German Bank and Scots Bay average; dashed blue line). (C) Relative exploitation rate which is calculated as the estimated the total catch in SWNS/BoF quota divided by the summed annual acoustic SSB from German Bank and Scots Bank.

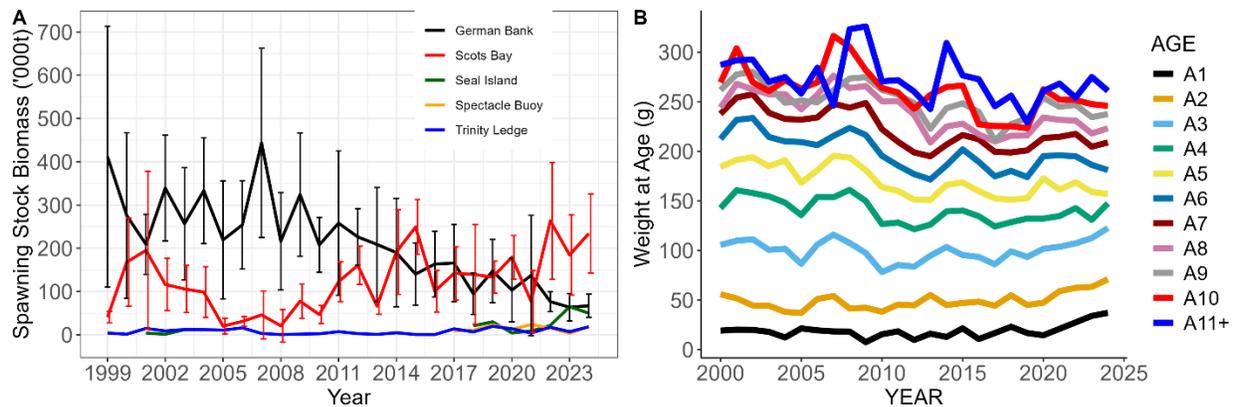


Figure 2. (A) Time series of acoustic-based spawning stock biomass for Scots Bay, German Bank, Trinity Ledge, Spectacle Buoy, and Seal Island spawning grounds. Confidence intervals reported for Scots Bay and German Bank only. (B) Fishery mean weight-at-age for the Southwest Nova Scotia/Bay of Fundy component from 1970 to 2024.

## Stock Status and Trends

### Landings

SWNS/BoF landings have declined from over 100,000 t in the 1970–90s to under 50,000 t since the 2010s (Figure 1A, Table 1). Landings were mostly above the total allowable catch (TAC) prior to the 1990s and after 1992, did not exceed the TAC. In 2024, the total landings were 15,742 t, remaining below the TAC of 16,000 t.

### Acoustic-based Spawning Stock Biomass

The stock status of the SWNS/BoF component is evaluated using a three-year moving average of the mean acoustic index of spawning stock biomass for German Bank and Scots Bay, compared to the LRP of 317,849 t (Clark et al. 2012). The mean annual acoustic index of spawning stock biomass was above the LRP during 1999 to 2004, and then varied above or below the LRP from 2005 to 2017 (Figure 1B). Since 2018, and with the exception of 2022, the mean annual acoustic index of spawning stock biomass has been below the LRP. The stock has been considered in the critical zone since 2018 based on the three-year average acoustic index indicator.

### Relative Exploitation Rate

The relative exploitation rates—calculated as the estimated total catch in SWNS/BoF quota divided by the summed annual acoustic SSB from German Bank and Scots Bay—have been declining since 2000 (Figure 1C). In 2024, the relative exploitation rate was 5%, the lowest in the time series, compared to the long-term (1999–2024) average of 15%.

### Current Status

The stock status of the SWNS/BoF component is evaluated using a three-year moving average of the acoustic index of spawning stock biomass for German Bank and Scots Bay, compared to the LRP of 317,849 tonnes (Clark et al. 2012). The three-year moving average increased from 2023 (267,455 t) to 2024 (296,430 t). The annual index (301,290 t) remains below the LRP, and

based on the three-year moving average indicator, the SWNS/BoF component remains in the critical zone (Figure 1B).

### History of Landings and TAC

The fishery has been consistently dominated by the purse seine fleet, which accounted for 81–99% of landings between 1981–2024 (Figure 1A). Smaller contributions to the landings include those from the gillnet, mid-water trawl, and weir/trap gear in Nova Scotia. Herring is also caught as a by-catch in other directed fisheries using bottom trawl gear.

*Table 1. Landings and total allowable catch (TAC) in kilotonnes (kt) of Herring from purse seine, gillnet and mid-water trawl, and Nova Scotia based weir/brush weir, shut-off fisheries on the Southwest Nova Scotia/Bay of Fundy (SWNS/BoF) spawning component average for 1970–1979, 1980–1989, 1990–1999, 2000–2009, 2010–2019, and biomass for 2020–2024. Landings reported are from the MARFIS database and include Herring landed outside of the allocation season. Landings from New Brunswick (NB) weir/shut-off are traditionally considered to originate from NAFO Subarea 5 spawning component and DFO resource management does not include these landings towards the SWNS/BoF TAC.*

Landings and TAC (kt)		Avg. 70–79	Avg. 80–89	Avg. 90–99	Avg. 00–09	Avg. 10–19	2020	2021	2022	2023	2024
Southwest Nova Scotia/Bay of Fundy	Catch	114	136	95.6	64.2	44.6	34.4	32.6	23.9	20.7	15.7
	TAC	106	106	112	69.2	47.5	35	35	23.4	21	16
NB Weir/Shut-off	Catch	30.1	24.8	24.6	16.3	5.17	6.52	4.18	3.94	1.78	2.34

### Ecosystem and Climate Change Considerations

Direct hypothetical mechanisms of ecosystem and climate changes that may affect the population dynamics of the SWNS/BoF Herring subcomponent were considered in the 2019 to 2022 framework. Large changes in recruitment deviations were examined and potential drivers that were considered include prey fields, phenology, temperature, ecosystem changes, egg predation, and larval condition. Changes in somatic growth (e.g., weight-at-age) have been observed over the period of fishery exploitation which indicates decreased weight-at-age for Age 4+ and increased weight-at-age for Age 2 and Age 3 (Figure 2B). Similar trends in weight-at-age have been observed for Atlantic Herring in NAFO Area 4TVn (Rolland et al. 2022), 4S (DFO 2021) and 4R (Émond et al. 2024). These changes could be due to changes in ocean temperatures, diet, density dependence, or productivity changes in the environment.

### Evaluation of Exceptional Circumstances

The exceptional circumstance protocols defined within the 2022 MSE framework (DFO 2022, Barrett 2023) set science considerations for each exceptional circumstance. Exceptional circumstances are evaluated annually or when new data become available. An exceptional circumstance refers to a situation not previously considered in the MSE to provide catch advice.

Within this update, the exceptional circumstances were evaluated for the 2025 fishing season, and include fishery catch data for 2021 to 2024, and the acoustic index of SSB for SWNS/BoF

for 2021 to 2024. Exceptional circumstances did not occur. Under the management strategy evaluation concept, catch advice from the previous assessment framework could be utilized.

### **Stock Advice**

This update provides no catch advice for this stock. A harvest decision was made in 2024 to set the TAC at 16,000 t annually for years 2024–2028. For this interim year update, Fisheries Management requested an update of indicators with the most recent data and an evaluation of exceptional circumstances. Exceptional circumstances did not occur. Catch advice from the previous framework could be utilized.

Several minor spawning grounds are monitored annually, including Trinity Ledge and Seal Island. Seal Island, once a major spawning area, declined prior to the 1990s but has shown increases in the relative biomass index in 2023 and 2024. It is unclear whether this is due to a shift in distribution or recovery of a spawning ground, and it is not currently included in the formal stock assessment. The increase in the relative biomass index for Seal Island and potential contribution to the SSB is seen as a positive signal, which will be reviewed during an assessment framework that is scheduled to begin this year, concluding in 2026.

## **OTHER MANAGEMENT QUESTIONS**

### **Offshore Scotian Shelf Component**

In 2024 offshore landings were 10 t. Since 1996, catches ranged from 20,261 t in 1997 to 10 t in 2024. Acoustic surveys were conducted in 1996 (estimated value not given, documented as moderate amount of Herring) and 1998 (estimated 17,445 t) (Harris and Stephenson 1999). Systematic acoustic surveys have not been conducted since 1998. There is no new information for evaluating this component.

### **Coastal Nova Scotian (South Shore, Eastern Shore and Cape Breton) Spawning Component**

Allocations for the Coastal Nova Scotia spawning component are based on the recent 5-year average of observed acoustic index of the SSB, where available. Landings in the Little Hope/Port Mouton area were 5,498 t against the 2024 allocation of 6,400 t (Table 2). In the Eastern Shore area, landings were 2,884 t in 2024 against the allocation of 4,682 t. In Glace Bay, landings have been between 0 t to 9 t since 2015, annually. The Bras d'Or Lakes area remained closed to Herring fishing.

The acoustic index of the SSB for the Little Hope/Port Mouton area decreased to 64,189 t in 2024 from 68,573 t in 2023 and remains above the 5-year average of 58,436 t (Table 3).

The acoustic index of the SSB for the Halifax/Eastern Shore area decreased to 15,430 t in 2024 from 28,057 t in 2023 and is below the 5-year average of 21,669 t (Table 3). As in previous years, caution is warranted in applying the acoustic index of the SSB as an absolute tonnage of Herring in the water.

Since 2013, acoustic surveys have not been completed in Glace Bay.

*Table 2. Recorded landings and allocations (tonnes) of Herring from major gillnet fisheries on the Coastal Nova Scotia spawning component average for 1998 to 2014 and biomass for 2015–2024. Landings reported are from the MARFIS database and include Herring landed outside of the allocation season.*

Landings and Allocations (t)		Avg. 98–14	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Little Hope/Port Mouton	Catch	2,616	5,943	5,557	7,353	8,707	10,747	6,355	6,900	8,631	6,900	5,498
	Allocation	2,553	6,151	6,803	7,884	9,757	10,676	8,622	8,595	8,392	8,595	6,400
Halifax/Eastern Shore	Catch	2,441	1,837	2,259	2,553	4,544	6,871	5,635	5,495	3,487	5,495	2,884
	Allocation	3,203	1,884	2,856	3,960	4,671	7,303	6,649	5,699	4,969	5,699	4,682
Glace Bay	Catch	1	0	4	0	9	1	2	0	0	0	0
Bras d'Or Lakes	Catch	0	0	0	0	0	0	0	0	0	0	0

*Table 3. Estimated acoustic index of the Herring spawning stock biomass (tonnes) average for 1998–2014, biomass for 2015 to 2024 and recent 5-year average for the Coastal Nova Scotia spawning component areas.*

Acoustic index of SSB (t)	Avg. 98–14	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Avg. last 5 years
Little Hope (SSB)	29,369	145,395	61,408	66,815	168,164	92,019	35,739	82,297	41,383	68,573	64,189	58,436
Allocation		3,772	6,151	6,803	7,884	9,757	10,676	8,622	8,595	8,392	6,400	
Halifax (SSB)	27,433	68,562	54,312	58,681	42,416	141,198	26,205	18,341	20,313	28,057	15,430	21,669
Allocation		1,066	1,884	2,856	3,960	4,671	7,303	6,649	5,699	4,969	4,682	
Glace Bay		50	-	-	-	-	-	-	-	-	-	-
Bras d'Or Lakes		-	-	-	-	-	-	-	-	-	-	-

"-" = no survey

### Southwest New Brunswick Migrant Juveniles Component

The southwest NB weir and shut-off fisheries have relied, for over a century, on the aggregation of primarily juvenile Herring (ages 1–3) near shore at the mouth of the Bay of Fundy. Herring landed from southwest NB weir and shut-off fisheries have traditionally been considered part of NAFO Subarea 5 spawning component and, historically, considered distinct from the SWNS/BoF component. As a result, DFO Resource Management has excluded these landings from the SWNS/BoF quota.

Landings from the southwest NB weir and shut-off fishery were 2,328 t in 2024, which is higher than the 1,775 t in 2023.

For the time series presented, current southwest NB weir and shut-off landings are at, or near, the lowest observed values. Landings for this fishery are highly variable and are not considered indicative of abundance.

## SOURCES OF UNCERTAINTY

Sources of uncertainty were documented in the last assessment (DFO 2022).

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