Fisheries and Oceans Canada / Pêches et Océans Canada
Ecosystems and Oceans Science / Sciences des écosystèmes et des océans

Maritimes Region

Canadian Science Advisory Secretariat
Science Response 2026/007

4X5Y HADDOCK (*MELANOGRAMMUS AEGLEFINUS*) UPDATE IN 2025

CONTEXT

The Fisheries Management Branch of Fisheries and Oceans Canada (DFO) requested catch advice using the management procedure (MP) for the 2026 fishing year for Haddock (*Melanogrammus aeglefinus*) in the 4X5Y management area.

This Science Response Report results from the regional peer review of December 2–3, 2025, on the Update of the Harvest Control Rule for Haddock in NAFO Divisions 4X5Y.

SCIENCE ADVICE

Status

- The smoothed 2025 DFO Maritimes Summer Ecosystem Research Vessel Survey (DFO Summer RV Survey) index, the secondary indicator of stock status, suggests the stock is in the cautious zone.
- An exceptional circumstance was triggered, which requires a re-run of the assessment models using data up to 2025 to provide an updated stock status.

Trends

- The DFO Summer RV Survey index has generally declined since 2016, and the 2024 and 2025 index estimates are among the lowest observed values in the time series.
- The 2023 and 2024 recruitment estimates from the survey were below the time series median.
- The relative harvest rates for Bay of Fundy and Scotian Shelf have remained below the proxy for F_{ref} since 1993.
- Weight-at-age (WAA) and length-at-age (LAA) have declined since the early 1990s.

Ecosystem and Climate Change Considerations

- Bottom water temperatures have been elevated in 4X5Y since 2010, potentially affecting Haddock behaviour and food availability.
- Haddock adjust their depth distribution with seasonal water temperature changes, typically occupying shallow inshore areas in the summer and moving to deeper waters in winter.

Stock Advice

- Using updated data from the 2025 DFO Summer RV Survey, the MP generates catch advice of 3,069 mt for 4X5Y Haddock for the 2026–2027 fishing year. This is a 57% decline in catch advice from the 2025–2026 fishing year.

BASIS FOR ASSESSMENT

Assessment Details

The assessment of stock status for 4X5Y Haddock is based on model-estimated spawning stock biomass (SSB). In interim years when the model is not run, the DFO Summer RV Survey Index is used as a secondary indicator of stock status.

Year Assessment Approach was Approved

2024 (Barrett et al. 2025)

Assessment Type

Interim Year Update

Most Recent Assessment Date

1. Last Full Assessment: 2025 (DFO 2025)
2. Last Interim-Year Update: 2023 (DFO 2023)

Stock Assessment Approach

1. Broad category: Full MSE
2. Specific category: Statistical Catch-at-age; State-space

Stock Structure Assumption

Haddock in 4X5Y are comprised of a faster growing stock component in the Bay of Fundy (DFO Summer RV Survey strata 482–495) and a slower growing stock component on the western Scotian Shelf (DFO Summer RV Survey strata 470–481). Haddock are known to shift their distribution and home range both seasonally and throughout their life history. Tagging studies have suggested seasonal mixing of Haddock between the Bay of Fundy, Gulf of Maine, Great South Channel, and Georges Bank, with movement varying yearly. When abundance is high, Haddock may move from high density areas to less suitable habitats with lower intraspecific competition (Brodziak et al. 2008, Stone and Hansen 2015). Although some mixing likely exists with adjacent stock units, 4X5Y Haddock are currently assessed as a single unit with the assumption that fish do not move in or out of the area.

Reference Points

- Limit Reference Point (LRP): 23.4 kt, based on three model-weighted estimates of B_{loss}
- Upper Stock Reference (USR): 38.3 kt, based on three model-weighted estimates of B_{PA}
- Fishing Mortality Reference (F_{ref}): 0.25, based on three model-weighted estimates of F_{ref}

Management Procedure

The lower and upper index control points (LCP and UCP) of the MP (Fig 1A) are based on the DFO Summer RV Survey index, corresponding with the q-adjusted and model-weighted LRP and USR, respectively. When the three-year moving geometric mean index falls below the LCP, a constant harvest rate (consistent with 0.4 F_{ref}) is applied. Between the LCP and UCP, the catch advice follows a non-linear path (leaf pattern, NAFO 2024), dependent on whether the three-year moving geometric mean index has decreased or increased since the previous year. Above the UCP, a constant harvest rate (consistent with F_{ref}) is applied with a 15% limit on annual changes in total allowable catch (TAC).

Data

- DFO Summer RV Survey index and age-composition data (1970–2025)
- Canadian commercial fishery catch and age-composition data (1970–2025)

Data changes: The DFO Summer RV Survey was completed in 2021, 2024, and 2025 with a new vessel and new gear. Length-based conversion factors were applied to make the new vessel comparable to the previous vessels (Yin et al. 2025).

ASSESSMENT

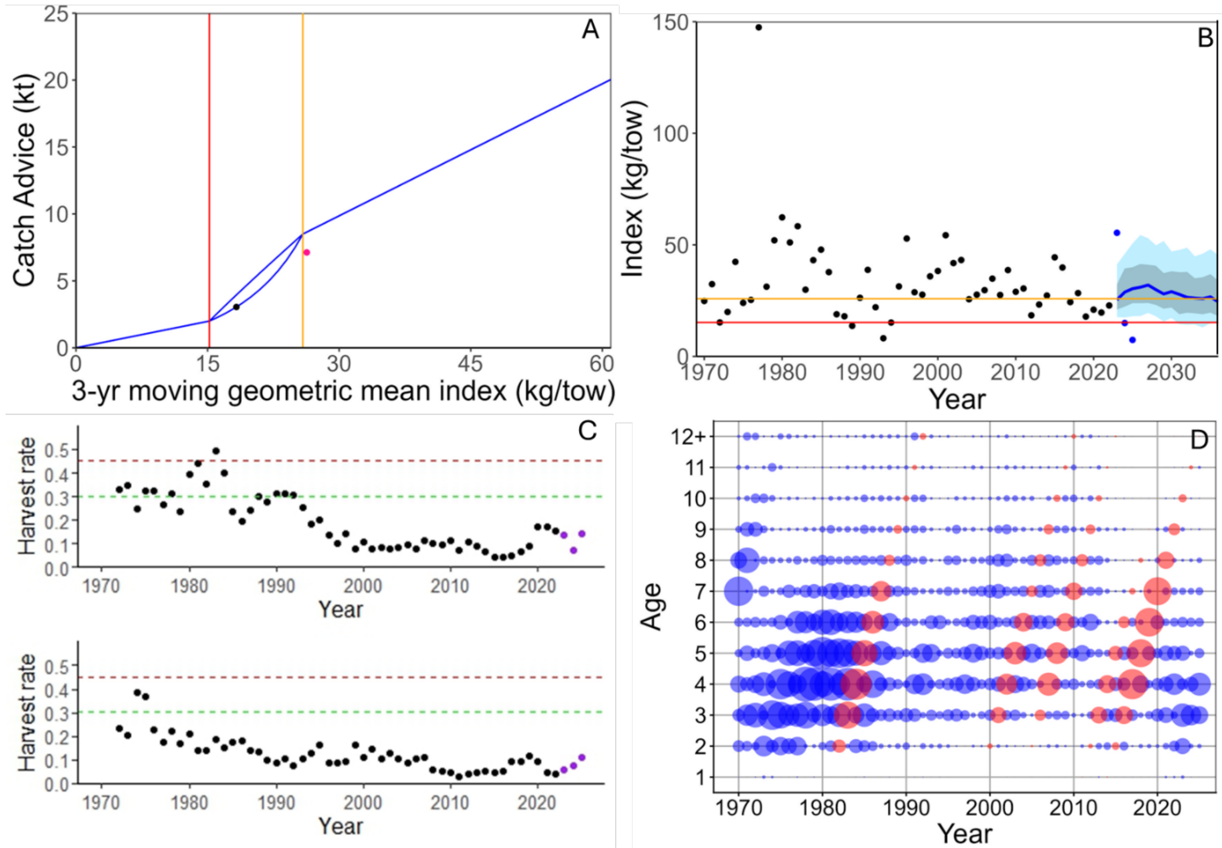

Figure 1. A) Management procedure for 4X5Y Haddock with the 3-yr moving geometric mean index indicated by a pink (2024) and black circle (2025). The vertical lines represent the survey q-adjusted reference points (limit reference point (LRP; red) and upper stock reference point (USR; orange)). B) Observed DFO Summer RV Survey index (black circles for 1970–2022, blue circles for 2023–2025) compared to projected simulations (blue line=median; q-adjusted LRP in red and USR in orange) with 50% and 80% prediction intervals provided in blue. C) Relative harvest rate (catch relative to the smoothed survey index) for the Scotian Shelf (top) and Bay of Fundy (bottom), 2023–2025 are shown in purple and dotted lines are proxies for F_{lim} (red) and F_{ref} (green). D) Fishery catch-at-age with large year-classes highlighted in red.

Stock Status and Trends

DFO Summer RV Survey Index

The DFO Summer RV Survey index has fluctuated annually throughout the time series. The general trend in the index is a decline since 2016, and the 2024 and 2025 index estimates are among the lowest observed values in the time series (Figure 1B). The 2023 index estimate was the highest in the last 20 years, but largely driven by two large tows near Brown's Bank.

Recruitment

To estimate recruitment in update years, the DFO Summer RV Survey numbers-at-age 1 (NAA-1) were compared to model-estimated recruitment. Based on a linear regression, the survey NAA-1 was a good predictor of model-estimated recruitment (lagged by one year; R^2=0.824), suggesting the survey NAA-1 could be used as an indicator of recruitment. Recent estimates for age-1 recruitment based on the DFO Summer RV Survey were above median recruitment for the time series for 2021 and 2022; however, both the 2023 and 2024 age-1 recruitment estimates were below median recruitment.

Fishing Mortality

In update years, a relative harvest rate is estimated using the ratio of the catch to the survey index, with the 2025 relative harvest rate estimated as 0.11 for the Bay of Fundy and 0.14 for the Scotian Shelf (Figure 1C). The relative harvest rates for Bay of Fundy and Scotian Shelf have remained below the proxy for F_{ref} since 1993.

Current Outlook

The smoothed 2025 DFO Summer RV Survey index suggests the stock is in the cautious zone; however, given the index in the last two years has been below the LCP, an exceptional circumstance has been triggered. This trigger requires a re-run of the three assessment models using data up to 2025 to get an updated stock status.

History of Landings, TAC, and Catch Advice

Landings have stabilized since 2017, ranging from 4,600 mt to 5,200 mt. Landings from the 2024–25 fishing season were 4,468 mt with approximately 72% of the quota caught (Table 1), preliminary 2025-26 landings are 2,900 mt (data extracted on November 5, 2025). The fishery catch-at-age for Q1 (Jan–March) in 2025 was composed mainly of the 2021 and the 2022 cohorts (46% and 27% by number; Figure 1D) and length frequencies peaked at 42.5 cm for fixed gear and 40.5 cm for mobile gear (data extracted on November 4, 2025). The 2025 survey catch-at-age was composed mainly of the 2024 and the 2021 cohorts (24% and 21% by number) and length frequencies peaked at 40.5 cm. Both weight-at-age and length-at-age have declined since the early 1990s with slight increases in recent years.

Table 1. Landings and total allowable catch (TAC) in metric tons for the 4X5Y Haddock fishery by fishing year (April 1–March 31).

Fishing Year	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26*
TAC (mt)	5,100	7,650	7,650	9,000	6,877	6,198	6,198	6,198	6,198	7,128
Catch (mt)	3,590	5,182	5,258	5,188	4,979	4,605	4,557	4,627	4,468	2,900*

**Catch data for 2025/26 is preliminary, as data were extracted before the end of the fishing season on November 4, 2025.*

Ecosystem and Climate Change Considerations

Potential ecosystem covariates impacting recruitment and growth were evaluated in the development of the assessment framework, but were not directly included in the models, as they did not improve model diagnostics. Higher levels of natural mortality rates were incorporated into the models, which may reflect indirect changes in the environment that impact movement (i.e., temperature; Lapolla and Buckley 2005, Begg 1998, Rogers et al. 2016) or density dependent pressures.

Growth of 4X5Y Haddock differs between the Bay of Fundy and Scotian Shelf, with larger fish associated with the Bay of Fundy (Barrett and Barrett 2025, Hurley et al.1998) and is likely driven by differences in the ecosystem.

Current ecosystem conditions as described in Hebert et al. (2024) include observations of elevated bottom water temperatures since 2010 in 4X5Y. This could potentially affect Haddock behaviour and food availability. Haddock adjust their depth distribution with seasonal water temperature changes, typically occupying shallow inshore areas in the summer and moving to deeper waters in winter.

Stock Advice

Harvest Decision Rule

The 3-year (2023-2025) moving geometric mean of the survey biomass index for 2025 is 18.3 kg/tow, a decrease from 26.6 kg/tow in 2024. Based on the current index value being below the UCP and above the LCP on the MP, and the decrease in the 3-year moving geometric mean, the catch advice for 4X5Y Haddock for the 2026–2027 fishing year comes from the lower portion of the leaf (Fig 1A) and is 3,069 mt. This represents a decrease of 57% from the previous fishing year's catch advice of 7,128 mt.

Evaluation of Exceptional Circumstances/Assessment Triggers

Exceptional circumstances and secondary indicators were identified in the most recent framework (see Tables 11 and 12 in Barrett et al. 2025). A review of available data determined that the observed DFO Summer RV Survey index is below the LCP of 15.2 kg/tow for the second consecutive year, so a higher-level review has been triggered for 2026. It is recommended in this case, that the models be re-run with data up to 2025 to confirm stock status, and the MP continues to be used for catch advice.

SOURCES OF UNCERTAINTY

Sources of uncertainty were identified in the framework (Barrett and Barrett 2025; Barrett et al. 2025). Additional uncertainties in this interim year update are a) the length-based conversion factors for the DFO Summer RV Survey index applied in recent years are not accounted for in the estimation of observation error and survey selectivity in the framework; and b) the true stock status, given that the stock status indicator is model-estimated SSB and the models are not fit annually.

LIST OF MEETING PARTICIPANTS

Name	Affiliation
Irene Andrushchenko	DFO Science, Maritimes Region
Melanie Barrett (Lead)	DFO Science, Maritimes Region
Tim Barrett	DFO Science, Maritimes Region
Lindsay Beazley	DFO Science, Maritimes Region
Lottie Bennett	DFO Science, Maritimes Region
Eric Brundson	DFO Science, Maritimes Region
Kathryn Cooper-MacDonald	DFO Resource Management, Maritimes Region
Dwayne D'entremont	DFO Science, Maritimes Region

Name	Affiliation
Jamie Emberley	DFO Science, Maritimes Region
Darrell Frotten	DFO Science, Maritimes Region
Kyle Gillespie	DFO Science, Maritimes Region
Michelle Greenlaw	DFO Science, Maritimes Region
Danni Harper	DFO Science, Maritimes Region
Nathan Hebert	DFO Science, Maritimes Region
Brad Hubley	DFO Science, Maritimes Region
Kelly Kraska	DFO Science, Maritimes Region
Chantelle Layton	DFO Science, Maritimes Region
Ryan Martin	DFO Science, Maritimes Region
Selvan Mohan	DFO Science, National Capital Region
Shannan Murphy	DFO Science, Maritimes Region
Claire Mussells	DFO Science, Maritimes Region
Corinne Pomerleau	DFO Science, Maritimes Region
Catriona Regnier-McKellar	DFO Science, Maritimes Region
Daniel Ricard	DFO Science, Gulf Region
Jennifer Saunders	DFO Resource Management, Maritimes Region
Tiffany Small	DFO Science, Maritimes Region
Priyanka Varkey	DFO Science, Maritimes Region
Yanjun Wang	DFO Science, Maritimes Region
Emily Way-Nee	DFO Science, Maritimes Region
Yihao Yin	DFO Science, Maritimes Region

SOURCES OF INFORMATION

Barrett, T.J., and Barrett, M.A. 2025. Framework review for 4X5Y Haddock: Part 1- Review of the Data Inputs. DFO Can. Sci. Advis. Sec. Res. Doc. 2025/020. iv + 85 p.

Barrett, T.J., Barrett M.A., and Hebert, N.E. 2025. Framework Review for 4X5Y Haddock: Operating Model Specification, Projections, Simulation Approach, and Reference Points. DFO Can. Sci. Advis. Sec. Res. Doc. 2025/064. v + 63 p.

Begg, G.A. 1998. A review of stock identification of Haddock, *Melanogrammus aeglefinus*, in the northwest Atlantic Ocean. Marine Fisheries Review. 60(4): 1–15.

Brodziak, J.K.T., Col, L., Palmer, M., and Brooks, L. 2008. Northeast Consortium Cooperative Haddock tagging project: summary of reported Haddock tag recaptures through November, 2008.

DFO. 2023. Stock Status Update of Haddock (*Melanogrammus aeglefinus*) in NAFO Divisions 4X5Y for 2022. DFO Can. Sci. Advis. Sec. Sci. Resp. 2023/018.

DFO. 2025. Stock Assessment for 4X5Y Haddock in 2024. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2025/047.

Hebert, D., Layton, C., Brickman, D., and Galbraith, P.S. 2024. Physical oceanographic conditions on the Scotian Shelf and in the Gulf of Maine during 2023. Can. Tech. Rep. Hydrogr. Ocean Sci. 380: vi + 71 p.

Hurley, P.C.F., Black, G.A.P., Comeau, P.A., Mohn, R.K., and Zwanenburg, K. 1998. Assessment of 4X Haddock in 1997 and the first half of 1998. Can. Stock Asses. Sec. Res. Doc. 98/136. 96 p.

Lapolla, A., and Buckley, L.J. 2005. Hatch date distributions of young-of-year Haddock *Melanogrammus aeglefinus* in the Gulf of Maine/Georges Bank region: implications for recruitment. Marine Ecology Progress Series. 290: 239–249.

Northwest Atlantic Fisheries Organization (NAFO) 2024. Report on the NAFO joint commission-scientific council working group on risk-based management strategies (WG-RBMS) meeting. Bergen, Norway. NAFO/COM-SC Doc. 24-03, serial no. N7571.

Rogers, R., Rowe, S., and Morgan, J. 2016. Depth and temperature associations of Haddock *Melanogrammus aeglefinus* off southern Newfoundland. J. Fish Bio. 89(5): 2306–2325.

Stone, H.H., and S.C. Hansen. 2015. 4X5Y Haddock 2014 Framework Assessment: Data Inputs and Exploratory Modelling. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/022. iv + 90 p.

Yin, Y., Benoît, H., and Martin, R. 2025. Calibration of Bottom Trawl Survey Vessels: Results of Comparative Fishing Between the CCGS *Teleost* and CCGS *John Cabot*/ CCGS *Captain Jacques Cartier* on the Scotian Shelf and Bay of Fundy in 2022 and 2023. DFO Can. Sci. Advis. Sec. Res. Doc. 2025/025. iv + 236 p.

THIS REPORT IS AVAILABLE FROM THE:

Center for Science Advice (CSA)
Maritimes Region
Fisheries and Oceans Canada
Bedford Institute of Oceanography
1 Challenge Dr. PO Box 1006
Dartmouth, Nova Scotia B2Y 4A2

E-Mail: DFO.MaritimesCSA-CASMaritimes.MPO@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

ISSN 1919-3769
ISBN 978-0-660-98214-4 Cat. No. Fs70-7/2026-007E-PDF

Correct Citation for this Publication:

DFO. 2026. 4X5Y Haddock (*Melanogrammus aeglefinus*) Update in 2025. DFO Can. Sci. Advis. Sec. Sci. Resp. 2026/007.

Aussi disponible en français :

*MPO. 2026. Mise à jour de l’état du stock d’aiglefin (*Melanogrammus aeglefinus*) des divisions 4X et 5Y en 2025. Secr. can. des avis sci. du MPO. Rép. des Sci. 2026/007.*