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

Canadian Science Advisory Secretariat
Newfoundland and Labrador Region | Science Response 2025/023

UPDATE OF NAFO DIVISION 3KLPS ATLANTIC HERRING (*CLUPEA HARENGUS*) TO 2024

CONTEXT

The Resource Management sector of Fisheries and Oceans Canada (DFO) has requested Science advice on the status of Northwest Atlantic Fisheries Organization (NAFO) Division 3KLPs Atlantic Herring stock. The last scientific assessment for this stock was completed in October 2022 (DFO 2024). This stock is divided into five stock complexes: White Bay-Notre Dame Bay (WBNDB), Bonavista Bay-Trinity Bay (BBTB), Conception Bay-Southern Shore (CBSS), St. Mary's Bay-Placentia Bay (SMBPB), and Fortune Bay (FB). This Science Response Report results from the regional peer review of the January 22, 2025 Update of NAFO Division 3KLPs Atlantic Herring and provides interim advice for this stock; a Framework Assessment meeting has been proposed for 2026 where assessment methodology will be reviewed.

SCIENCE ADVICE

Status

- The stock status index in BBTB and FB remained relatively stable in 2023, however the short term outlook appears poor for all stock complexes in 3KLPs. The catch is currently dominated by a single year class (>80%) and recruitment of subsequent year classes has been well below average.

Trends

- The strong 2017 spring spawner year class has dominated the catch in all five stock complexes since 2021. As a result, spring spawners now compose over 80% of the catch in 3KLPs.
- Recent recruitment was largely below average with timeseries lows in several stock complexes.

Ecosystem and Climate Change Considerations

- The Newfoundland and Labrador (NL) Bioregion experienced a broad ecosystem collapse in the early 1990s linked to changes in ocean climate and fishing. Total biomass remains well below pre-collapse levels, and the ecosystem continues to experience low overall productivity conditions. Ecosystem indicators in recent years show improvements from the lows in the late 2010s, but total biomass has not returned to the post collapse highs of the early 2010s.
- Herring stock dynamics are driven largely by environmental conditions. During the 2000s a shift to warmer conditions led to a decline in spring spawner recruitment and a prevalence of fall spawning herring in 3KLPs. If current warming trends continue, strong spring spawner recruitment as observed in the past is less likely to occur.

Stock Advice

- Catches in all stock complexes are currently dominated by a single year class and recruitment has been weak in recent years; the short term outlook for the stock appears poor.

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

2013 (Bourne et al. 2015)

Assessment Type

Interim-Year Update.

Most Recent Assessment Date

1. Last Full Assessment: October 2022 (DFO 2024)
2. Last Interim-Year Update: January 2021 (DFO 2022)

Stock Assessment Approach

1. Broad category: Index based
2. Specific category: Index-based (fishery-dependent and fishery-independent indices)

For stock complexes where a research gillnet program exists, a stock status index (based on catch rates and year class strength) and a recruitment index (age 4 catch rates) are calculated. When possible, indices are calculated for both spring and fall spawning components (Bourne et al. 2015). Acoustic surveys were reinstated in 2019 and provide biomass indices that are comparable with an historical time series. Commercial catch and size-at-age are also provided where available.

Methods for Ecosystem and Climate Change Considerations

Ocean climate information is summarized through a series of physical oceanography indicators synthesized in the Newfoundland and Labrador Climate Index. Information on timing and intensity of phytoplankton dynamics is derived from remote sensing data. Summaries on the status and trends of the marine community are based on indicators derived from DFO Newfoundland research vessel (RV) survey data, and targeted research for some predator species.

Stock Structure Assumption

Division 3KLPs Atlantic Herring are managed based on five biological units/stock complexes (WBNDB, BBTB, SMBPB, CBSS, FB) which were delineated through tagging studies. Herring also occur along the coast of Labrador and the Pass Island to Cinq Cerf area on the south coast of Newfoundland, where there are relatively small commercial fisheries/ total allowable catch (TACs); however, the origin of these herring is unknown and they are therefore not assessed as stock complexes or as part of adjacent complexes. All stock complexes are comprised of a mixture of spring spawners and fall spawners. Because these spawning components never completely separate, the commercial fishery targets mixed aggregations and there are not separate TACs for each spawning component.

Reference Points

- Limit Reference Point (LRP): N/A; not defined
- Upper Stock Reference (USR): N/A; not defined
- Removal Reference (RR): N/A; not defined
- Target Reference Point (TRP): N/A; not defined

There are currently no reference points for these stock complexes.

Data

- DFO Spring Research Gillnet Program
  - BBTB (1986–2024*)
  - SMBPB (1982–2012); PB (2018–2024*)
  - FB (1982–2024*)
    *biological data to 2023, catch rates to 2024
- DFO NL Acoustic Herring Survey (1983–2000, 2019–23)
- Commercial Landings (1966–2023 – most recent three years of data considered preliminary)
- Ecosystem Indicators from DFO NL RV survey (1980–2024)
- MODIS/Aqua Ocean Color Data (2003–24)
- NL Atlantic Zone Monitoring Program (2008–24)
- DFO NL Ecosystem Research Program (1981–2024)

Data changes: Catch rates for PB in 2024 are based on only three fishers (versus four) as there were issues with one fisher's logbook data.

ASSESSMENT

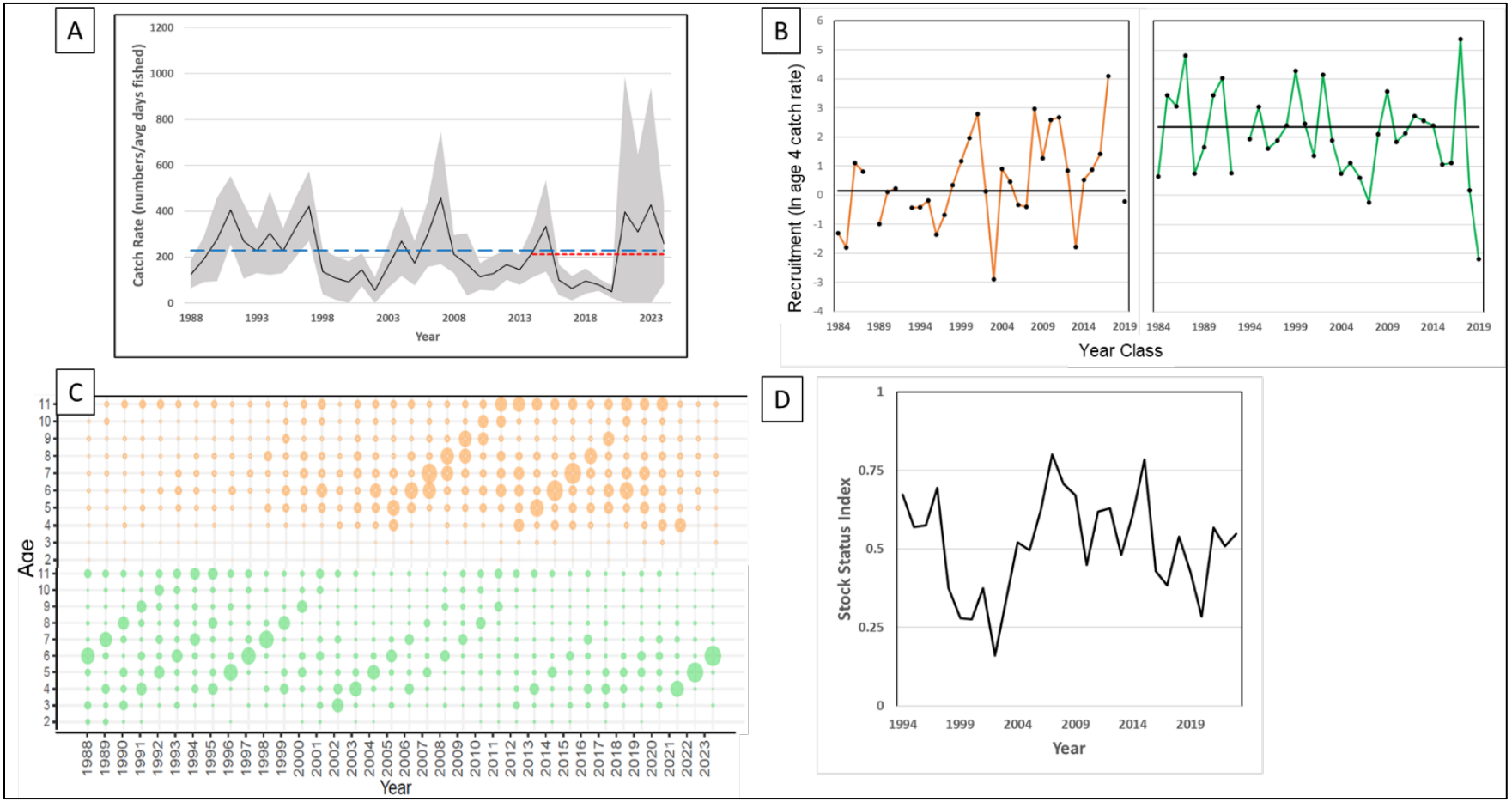

Figure 1. BBTB (A) Research Gillnet Catch Rates (blue/long dashed line = ref period mean [1990–2005], red/short dashed line = decadal mean [2014–24]), (B) Recruitment Index of age 4 herring (left panel=fall spawners, right panel = spring spawners) with reference period mean (black/straight lines) (C) Catch at Age with bubble size representing proportion of catch (orange/top panel = fall spawners, green/bottom panel = spring spawners), (D) Stock Status Index (spring and fall spawners combined).

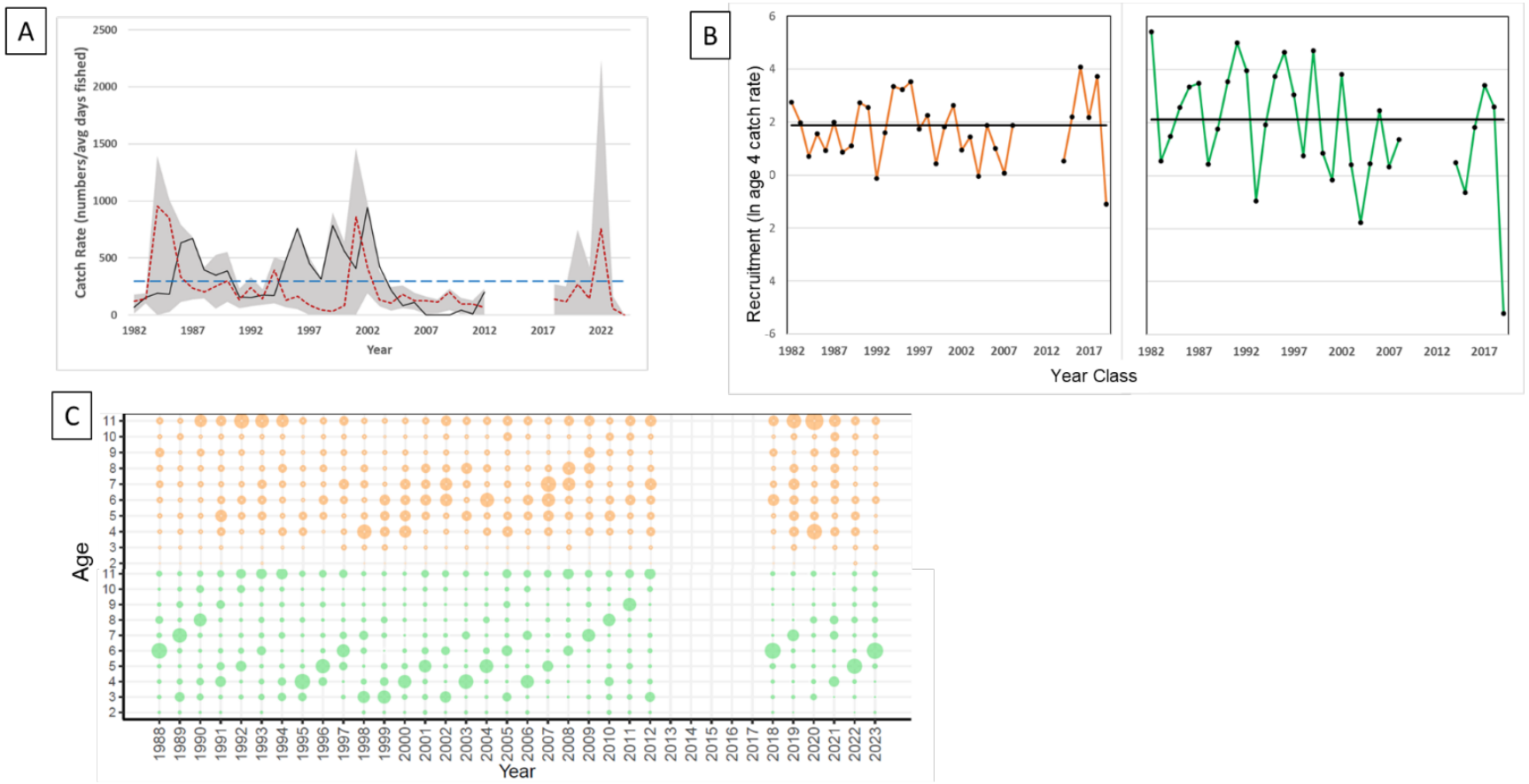

Figure 2. SMBPB (A) Research Gillnet Catch Rates (blue/long dashed line = ref period mean [1990–2005], black/solid line=SMBPB combined catch rate, red/short dashed line = PB catch rate only), (B) Recruitment Index of age 4 herring (left panel=fall spawners, right panel = spring spawners) with reference period mean (black/straight lines) (C) Catch at Age with bubble size representing proportion of catch (orange/top panel = fall spawners, green/bottom panel = spring spawners).

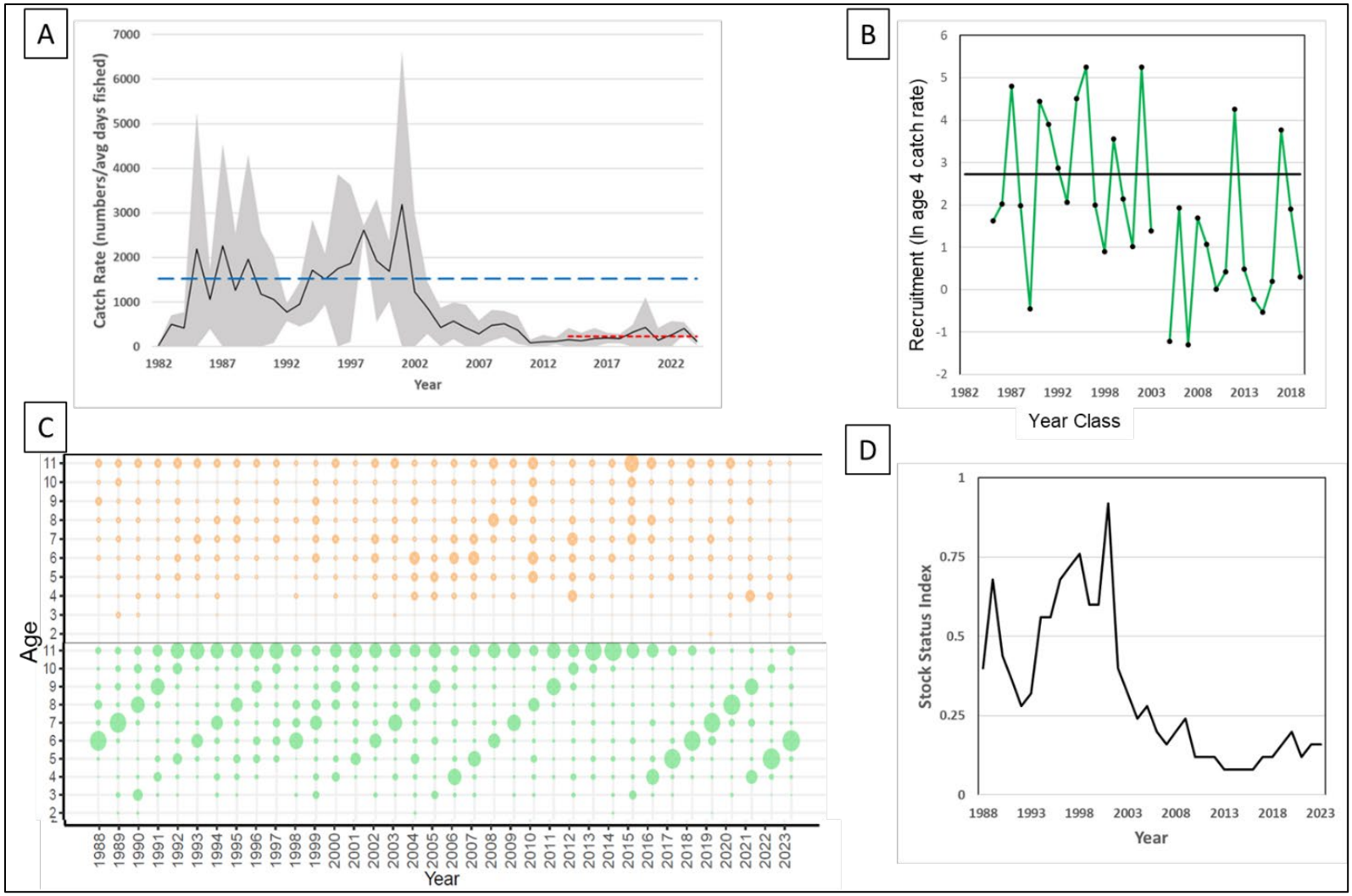

Figure 3. FB (A) Research Gillnet Catch Rates (blue/long dashed line = ref period mean [1990–2005], red/short dashed line = decadal mean [2014–24]), (B) Recruitment Index of age 4 spring spawning herring with reference period mean (black/straight line) (C) Catch at Age with bubble size representing proportion of catch (orange/top panel = fall spawners, green/bottom panel = spring spawners), (D) Stock Status Index (spring spawners only).

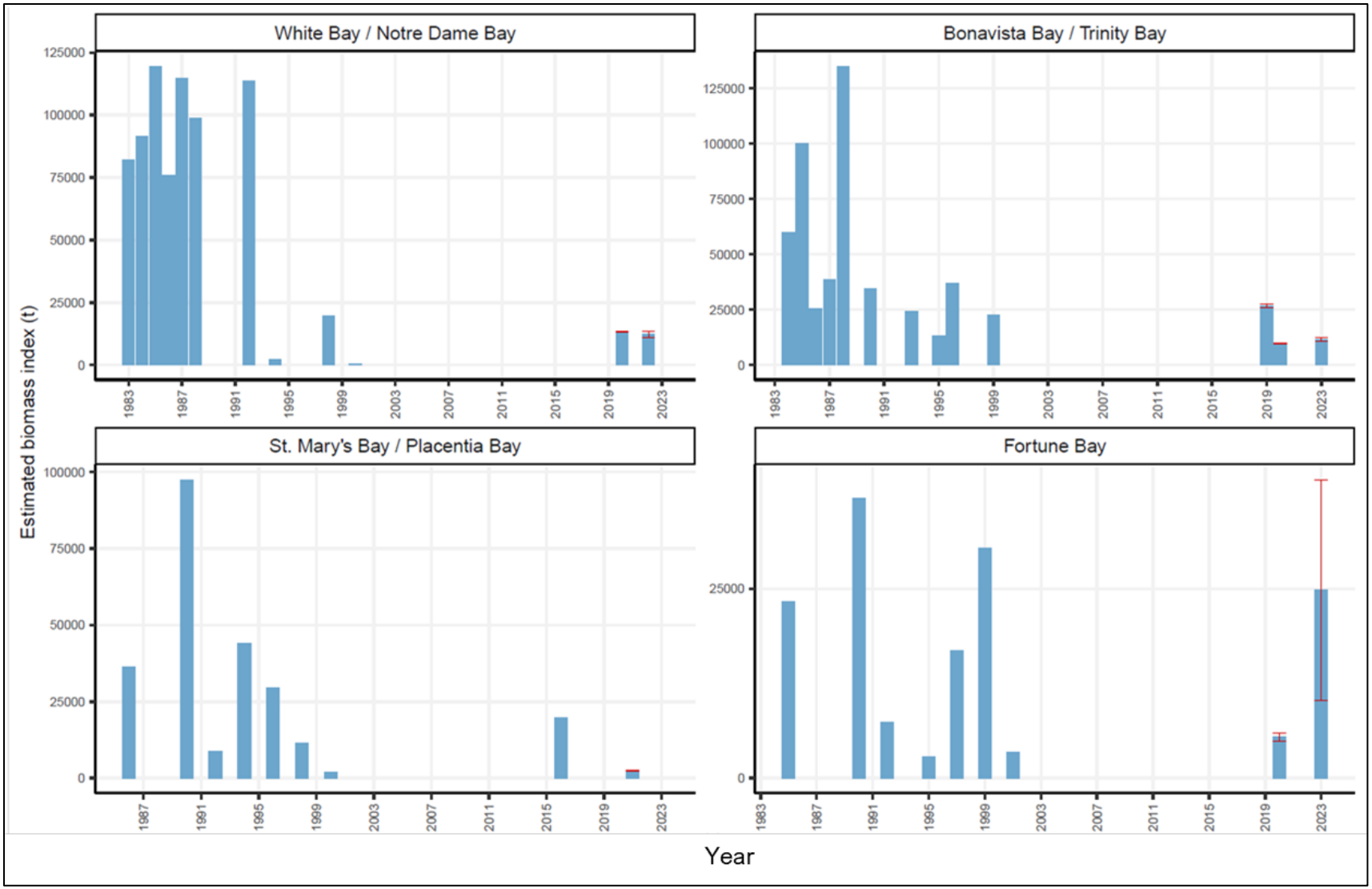

Figure 4. Estimated biomass index (t) from inshore acoustic surveys by stock complex.

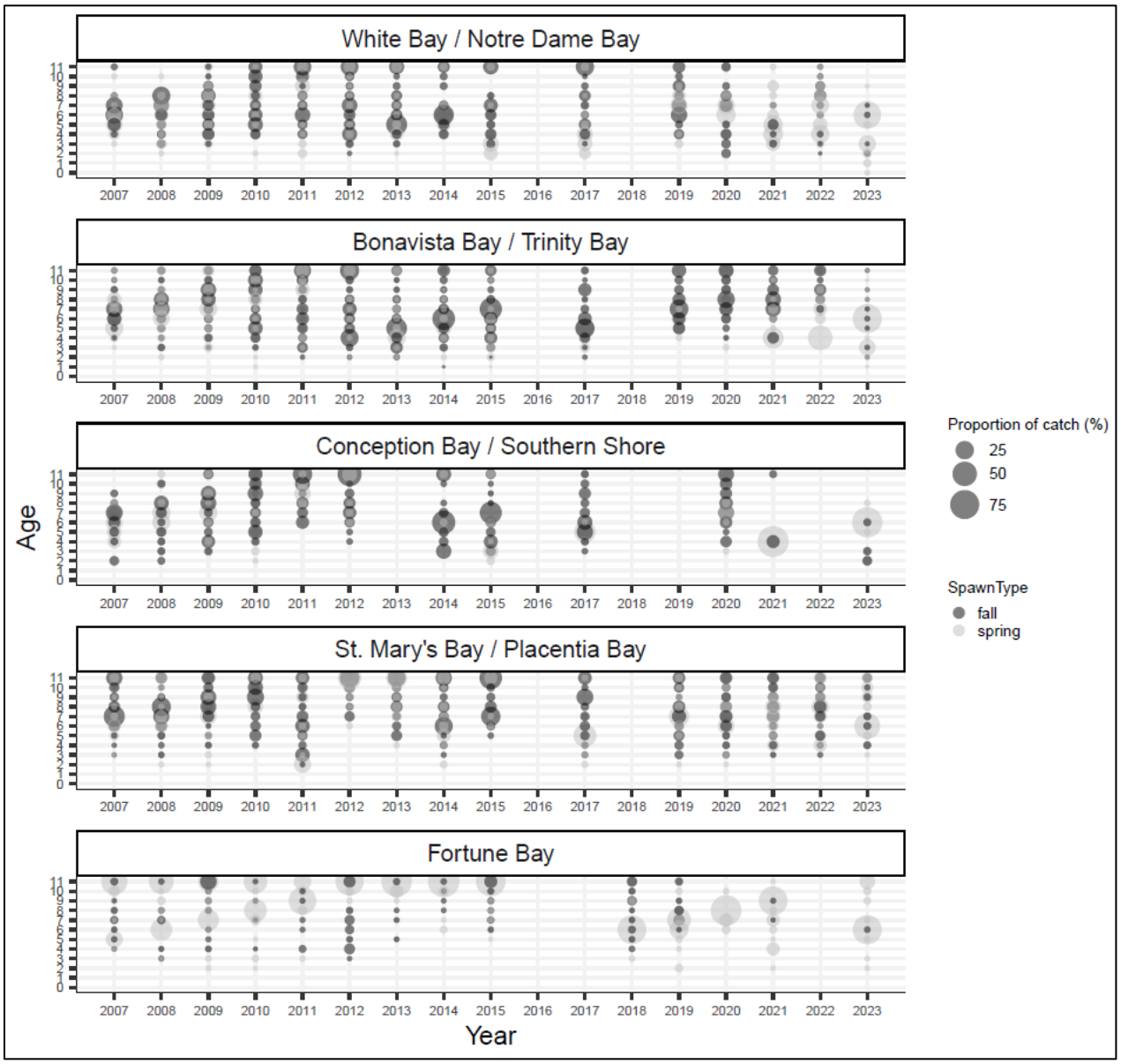

Figure 5. Age and spawning type composition of commercial fishery samples by stock complex.

Historical and Recent Stock Status and Trends

BBTB Research Gillnet Indices

The combined research gillnet catch rate (both spring and fall spawners) declined in 2024 but overall has remained above both the decadal and reference period mean since 2021 (Figure 1A). Despite increases in fall spawner recruitment during the 2000s, mean recruitment remains higher for spring spawners (Figure 1B). After the time series high recruitment of the 2017 year class for both spawning components, recruitment for the 2018 and 2019 year classes was well below average (Figure 1B). The proportion of fall spawners increased through the early 2000s, peaking at ~75% in 2015; however, this proportion has declined since 2018, with spring spawners comprising 94% of the catch in 2023. Several mature fall year classes are of above average strength and the spring 2017 year class is the strongest in the time series since 1994,

accounting for 80–90% of the catch since 2021 (Figure 1C). The stock status index increased in 2021 and has remained relatively stable since (Figure 1D).

PB Research Gillnet Indices

The research gillnet program for this stock complex has included only the PB portion of SMBPB since 2018. The combined research gillnet catch rate (both spring and fall spawners) has remained below the reference period mean during this time with the exception of a peak in 2022 (Figure 2A). Recruitment declined after the time series high of the 2017 year class for both spawning components, reaching time series lows in 2019 (Figure 2B). The proportion of spring spawners was 85% in 2023. Fall spawner year class strength for both 2016 and 2017 was above average. The 2017 spring spawner year class was the strongest observed since 1996 (Figure 2C). A stock status index cannot be calculated as a longer time series is required to calculate the strength of all mature year classes.

FB Research Gillnet Indices

Unlike other stock areas where fall spawner recruitment increased with declines in spring spawners during the 2000s, fall spawners continue to constitute less than 10% of the FB stock complex and are not evaluated in research gillnet indices. The research gillnet catch rate has been well below the reference period mean since 2004, with slight variation in recent years around the decadal mean (Figure 3A). Recruitment in FB has mostly remained below the reference period mean since the early 2000s (Figure 3B). There have only been two year classes of above average strength since 2000, with the 2012 year class dominating the catch from 2016 to 2020, and the 2017 year class since 2021 (composing ~80% in 2023) (Figure 3C). The stock status index has increased from a time series low over the past five years but continues to remain at a relatively low level (Figure 3D).

Acoustic Survey Biomass Indices

The acoustic biomass index for the fall 2022 WBNDB survey was 12,242 t, a slight decrease from 2020. The acoustic survey biomass index for the fall 2023 BBTB survey was 11,375 t, higher than 2020 but well below 2019. In both of these stock complexes the biomass indices remain at historical lows (Figure 4). The acoustic survey biomass index for the winter 2023 FB survey was 24,811 t, nearly five times higher than 2020. However there is significant uncertainty associated with that value (Figure 4), largely because over 80% of the herring observed on this survey were found in a single aggregation/stratum.

Commercial Catch-at-Age

Over 75% of the 2023 catch was comprised of age 6 spring spawners (the 2017 year class). This is consistent with the catch at age data from the research gillnet program and the strength of that year class. This indicates that the 2023 commercial catch at age is consistent with our current understanding of stock structure (Figure 5).

Current Outlook

Spring spawning herring were historically dominant in this stock, and generally have higher mean recruitment and produce stronger year classes than fall spawners. Spring spawner recruitment declined with warming conditions in the 2000s leading to a shift in stock composition to fall spawner dominance through the 2010s in most areas (DFO 2024). However, recruitment of the extremely strong 2017 spring spawner year class shifted the stock back toward spring spawner dominance, as this year class currently comprises the majority of the catch in all areas. However, recruitment of the 2018 year class was weaker and the 2019 was well below average (time series low in BBTB and PB). With a continued warming trend since 2020, strong spring spawner recruitment is less likely to occur. Given that the fishery is being sustained almost

entirely on a single year class, recruitment of subsequent year classes is below average, and catch rates in all three areas with a research gillnet declined in 2024, future prospects are currently poor.

History of Landings/Harvest/Effort

The TAC includes both a commercial quota and bait allocation (Figure 6A). There have been no estimates of bait removals since 2021. Approximately 71% of the total combined 12,842 t commercial quota for 2J3KLPs (excluding bait allocations) was taken in 2022, and 94% in 2023 (Figure 6A).

BBTB has accounted for the highest proportion of landings for the last two years. Fishing activity in CBSS increased during the 2010s; however, there were no landings from 2019–22, largely due to issues with undersized herring. In FB the quota and landings have decreased over the past decade, increasing slightly in the last year (Figure 6B).

The minimum legal size in the fishery (excluding gillnets) was decreased in 2023 (DFO 2024) based on the size at maturity of the 2017 year class, which led to an increase in landings.

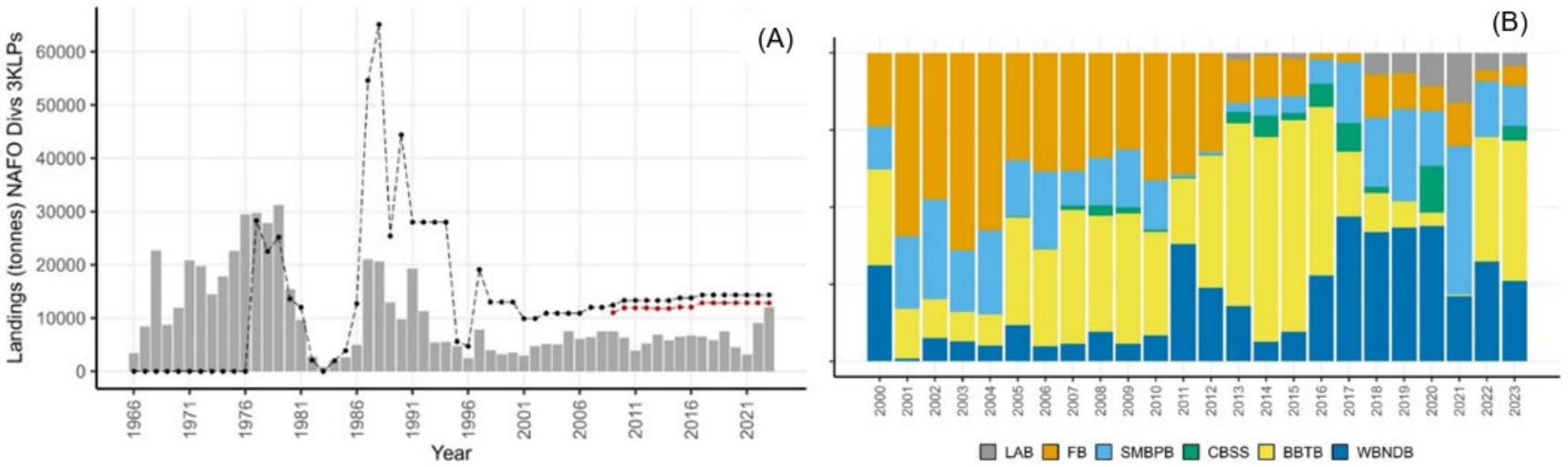

Figure 6. (A) Commercial landings (t), TAC- quota and bait allocation (black line), and commercial quota (red line) for all stock areas combined, (B) Proportion of total landings since 2000 by stock complex.

Ecosystem and Climate Change Considerations

The Ocean Climate in the NL Bioregion has shown decadal scale changes associated with warm and cold conditions. The late 1980s to early 1990s corresponded to the coldest period, while the 1960s and the 2000s were the warmest. A warming phase that began in 2020, which included some record highs, persisted in 2024. Atlantic Herring stock dynamics in the Northwest Atlantic are largely driven by environmental conditions. Fall spawners tend to dominate during warm conditions and spring spawners during cold. Historically, 3KLPs herring were comprised of ~90% spring spawners given that they are at the northern extent of their range. During the warming phase in the 2000s, fall spawners became dominant in most stock complexes, however the recruitment and year class strength of this spawning component is generally weaker than that of spring spawners (DFO 2024). With the strong recruitment of the 2017 spring spawning year class, dominance has again shifted to spring spawning herring, which generally produce larger, stronger year classes in this region (Figures 1C, 2C, and 3C). However, if the current warm phase in ocean climate persists, this increase in spring spawning recruitment may stall.

While Atlantic Herring is a key forage species in many areas, its coastal distribution in the NL Bioregion makes it more difficult to study in an ecosystem context and may limit its availability to offshore predators. The ecosystem changes observed in the 1990s in the NL Bioregion involved the collapse of the entire groundfish community, but trends in recent years appear positive and seem to be associated with the most recent warm phase. There are indications that food availability could be improving, and total biomass is increasing towards the post-collapse relative highs of the early 2010's. However, the production of the Ecosystem Production Units in the NL Bioregion has not yet recovered to pre-collapse levels Stock Advice.

The 2017 year class is one of the strongest in the timeseries and continues to dominate both the commercial fishery (Figure 5) and research gillnet catches (Figures 1C, 2C and 3C). However, catch rates declined in 2024 in the research gillnet program in all stock complexes where the program takes place (Figures 1A, 2A,and 3A) and this raises concerns about the depletion of this year class. In addition, the recruitment of the subsequent year classes has been weaker or extremely poor. Acoustic survey biomass indices are well below historical levels, with the exception of FB where there is high uncertainty in the index. Given the current age structure and lack of positive recruitment signals, the short term outlook for 3KLPs herring appears poor and caution is advised.

SOURCES OF UNCERTAINTY

Decreases in size-at-age, particularly of younger fish in the 2020s (DFO 2024) have likely impacted the catchability of smaller herring in the research gillnet program and in turn, the index of recruitment. In addition, the strength of the 2017 year class and resulting high catch rates in smaller mesh gillnets has potentially led to lower catch rates of other age classes in recent years, which could be skewing the catch at age and recruitment index.

Above average catch rates in the BBTB research gillnet program from 2021–23 were driven by anomalously high catches of one fisher (of eight in the stock area); while these data are valid and can be attributed to the large 2017 year class, it should be noted that large concentrations of herring are occurring in one geographic location and thus driving the trend for the entire stock area. A similar situation occurred in PB in 2022.

Since 2018 the research gillnet program in the SMBPB stock complex has only taken place in PB, therefore results may not be fully representative of the whole stock area.

Research Recommendations

Investigate changes in size at age, condition and catchability, and potential linkages to ecosystem indices.

Revisit potential drivers of herring recruitment – including the high recruitment of the 2017 year class, such as physical and biological oceanography.

LIST OF MEETING PARTICIPANTS

NAME	AFFILIATION
Christina Bourne	DFO-NL – Science
Hilary Rockwood	DFO-NL – Centre for Science Advice
Rachelle Dove	DFO-NL – Centre for Science Advice
Luiz Mello	DFO-NL – Science
Jacob Burbank	DFO-NL – Science
Karen Dwyer	DFO-NL – Science
Aaron Adamack	DFO-NL – Science
Hannah Murphy	DFO-NL – Science
Divya Varkey	DFO-NL – Science
Aaron Adamack	DFO-NL – Science
Hannah Munro	DFO-NL – Science
Mariano Koen-Alonso	DFO-NL – Science
Brandi O'Keefe	DFO-NL – Science
Marc Legresley	DFO-NL – Science
Heather Andres	DFO-NL – Science
Brandon Tilley	DFO-NL – Science
Nick Gullage	DFO-NL – Science
Ron Lewis	DFO-NL – Science
Jacob Burbank	DFO-Gulf – Science
Karen Cogliati	DFO-NCR – Science
Kailey Noonan	DFO-NL – Resource Management

SOURCES OF INFORMATION

Bourne, C., Mowbray, F., Squires, B., Croft, J. 2015. An Assessment Framework and Review of Newfoundland east and south coast Atlantic Herring (*Clupea harengus*) stocks to the spring of 2013. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/029. vi + 106 p.

DFO. 2022. 2021 Stock Status Update for Atlantic Herring In NAFO Div. 3KLPs. DFO Can. Sci. Advis. Sec. Sci. Resp. 2022/035.

DFO. 2024. Assessment of Atlantic Herring in NAFO Division 3KLPs to 2021. DFO Can. Sci. Advis. Sec. Advis. Rep. 2024/064.

THIS REPORT IS AVAILABLE FROM THE:

Center for Science Advice (CSA)
Newfoundland and Labrador Region
Fisheries and Oceans Canada
P.O. Box 5667
St. John's, NL A1C 5X1

E-Mail: DFONLCentreforScienceAdvice@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

ISSN 1919-3769
ISBN 978-0-660-78145-7 Cat. No. Fs70-7/2025-023E-PDF
© His Majesty the King in Right of Canada, as represented by the Minister of the Department of Fisheries and Oceans, 2025

This report is published under the Open Government Licence - Canada

Correct Citation for this Publication:

DFO. 2025. Update of NAFO Division 3KLPs Atlantic Herring *(Clupea harengus)* to 2024. DFO Can. Sci. Advis. Sec. Sci. Resp. 2025/023.

Aussi disponible en français :

*MPO. 2025. Mise à jour de l'état des stocks de Hareng de l'Atlantique des divisions 3KLPs de l'OPANO (*Clupea harengus*) jusqu'en 2024. Secr. can. des avis sci. du MPO. Avis sci. 2025/023.*