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

Newfoundland and Labrador Region

Canadian Science Advisory Secretariat
Science Advisory Report 2026/037

2J3KL WITCH FLOUNDER (*GLYPTOCEPHALUS CYNOGLOSSUS)* STOCK ASSESSMENT IN 2026

CONTEXT

The Resource Management sector of Fisheries and Oceans Canada (DFO) has requested detailed science advice on the status of Witch Flounder in NAFO (Northwest Atlantic Fisheries Organization) Div. 2J3KL to inform fisheries management decisions for this stock. A Rebuilding Plan has been in place for this stock since 2022. This Fisheries Science Advisory Report is from the regional peer review meeting of May 19–22, 2026 on the 2J + 3KL Witch Flounder Stock Assessment. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SCIENCE ADVICE

Status

- The 2026 total biomass is estimated at 1.39 (95% Confidence Interval [CI] = 0.74–2.6) times the Limit Reference Point (LRP). The stock is in the Cautious Zone with a high (79%) probability of being above the LRP.
- The current assessment adopted a new approach to assess this stock which extends the time series used to evaluate stock status and allows for projections.

Trends

- Biomass steadily increased since the early 2000s and is currently at the highest level observed since the late 1980s. In 2025, biomass exceeded the LRP for the first time since 1989. Biomass at the start of 2026 is estimated at 31,216 t (CI: 16,638–58,565 t).
- Fishing Mortality (F) has been < 0.01 since 2010 as the stock has increased while bycatch remained low, and in 2025 was estimated at 0.003 (CI = 0.001–0.007).
- Recruitment has been good since the mid 2010s, with multiple cohorts well above the long-term mean.

Ecosystem and Climate Change Considerations

- Ocean climate is a major driver of ecosystem-level productivity in the Newfoundland and Labrador (NL) bioregion. The ongoing warm phase that started around 2020, along with recent improvements in zooplankton biomass levels, is favourable for groundfish productivity. The long-term impacts of increasing warming due to climate change remain unknown.

- Ecosystem biomass as measured by the research vessel (RV) survey is at the highest level since the ecosystem collapse in the late 1980s and early 1990s, but remains below pre-collapse levels. The recent increases are driven by groundfish.

Stock Advice

- The stock is currently in the Cautious Zone at 1.39 times the LRP. At this level, the Rebuilding Plan permits a harvest rate of 0.04 based on the stratified survey index of exploitable biomass. This corresponds to fishery removals of 1,088 t.
- Projections were provided to 2028 under F = 0, and with catch of 1,088 t in 2027. Under these scenarios continued stock growth is expected with a high (66–68%) probability, with the stock expected to remain in the Cautious Zone.
- The change in assessment methodology is a criterion for a review of the Rebuilding Plan which includes this harvest strategy.

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

2026

Assessment Type

Full Assessment

Most Recent Assessment Date

1. Last Full Assessment: 2022 (DFO 2023)
2. Last Interim-Year Update: n/a

Stock Assessment Approach

1. Broad category: Single stock assessment model
2. Specific category: Surplus Production

A stochastic surplus production model in continuous time (SPiCT, Pederson and Berg 2017) which estimates stock size and time-varying fishing mortality back to 1960 by incorporating commercial catch data since 1960 and a model-based index of survey biomass since 1978.

Ecosystem and Climate Change Assessment Approach

The physical environment was characterized by examining trends in ocean climate using oceanographic indicators, and the Newfoundland and Labrador Climate Index (NLCI). Food web components examined included: lower trophic levels characterized using primary production and zooplankton indicators, status and trends of the fish community, and seabird and marine mammal information. The characterization of ecological and environmental interactions included fish diets and estimations of food consumption. Habitat elements included a summary on Significant Benthic Areas and existing fisheries closures. Aggregated fisheries metrics included the fishing footprint and a metric of ecosystem overfishing. The link between ocean climate and ecosystem productivity was discussed as it related to climate change impacts.

Stock Structure Assumption

Witch flounder in NAFO Div. 2J3KL are managed collectively with one LRP. This stock is near the northern extent of this species' range in the northwest Atlantic. Genetic studies indicate multiple sub-populations within the defined stock area (Fairbairn 1981). Mixing with adjacent areas is assumed to be negligible within the assessment. Available telemetry results are consistent with this assumption (Novaczek and Wheeland, in prep.[1]).

Reference Points

- Limit Reference Point (LRP): 40% Biomass at maximum sustainable yield (B_{MSY})
- Upper Stock Reference (USR): 80% B_{MSY}
- Removal Reference (RR): Not defined
- Target Reference Point (TRP): Not defined

The values of the reference points were updated in the current assessment from survey-based proxies of B_{MSY} (DFO 2019) to model-based estimates.

Management Objectives

This stock is subject to a Rebuilding Plan, the primary objective of which is to promote stock growth out of the Critical Zone (i.e., grow the stock above the LRP), by ensuring removals from all fishing sources are kept to the lowest possible level until the stock has cleared this zone.

Data

- DFO Research Vessel (RV) Survey (1978–2021, 2023–25)
- Commercial fishery landings (1960–2025)
- DFO-NL Ecosystem Research Program Indicators (1960–2025)
- Atlantic Zone Monitoring Program Indicators (1950–2025)
- Ocean Colour - ESA Climate Change Initiative (1998–2025)
- Witch flounder acoustic telemetry (2021–23)

Data changes: The time series of RV survey biomass has been re-estimated following the application of conversion factors (DFO 2024) and adoption of a spatiotemporal model for index estimation.

[1] Novaczek, E., and Wheeland, L. In preparation. Movements of Witch Flounder *Glyptocephalus cynoglossus* in NAFO Div. 2J3KL Based on an Acoustic Telemetry 2021 to 2023. DFO Can. Sci. Advis. Sec. Res. Doc.

ASSESSMENT

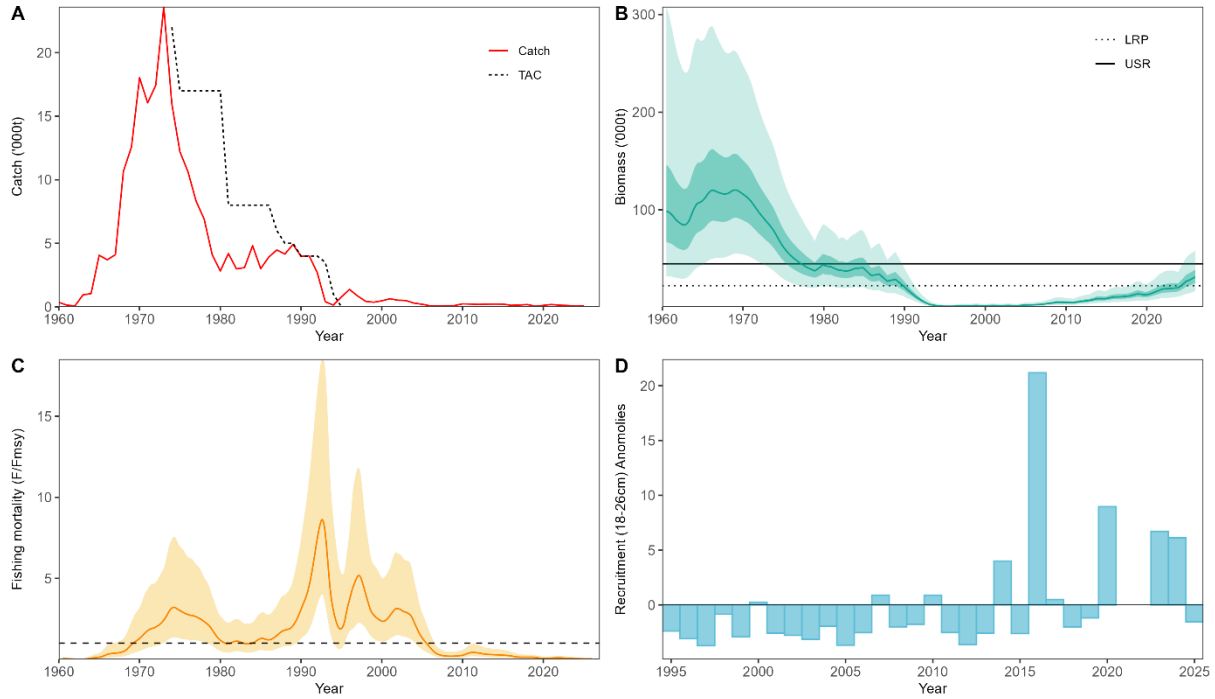


Figure 1. (A) Catch (solid line) and Total Allowable Catch(TAC) (dashed line); (B) Estimated biomass with 95% and 50% confidence intervals in relation to the LRP (dotted line) and USR (solid line); (C) Fishing Mortality (F) relative to F at maximum sustainable yield (msy) with 95% confidence internal, dashed line at Fmsy (D) Recruitment index anomalies (abundance relative to series mean, 1995–2025).

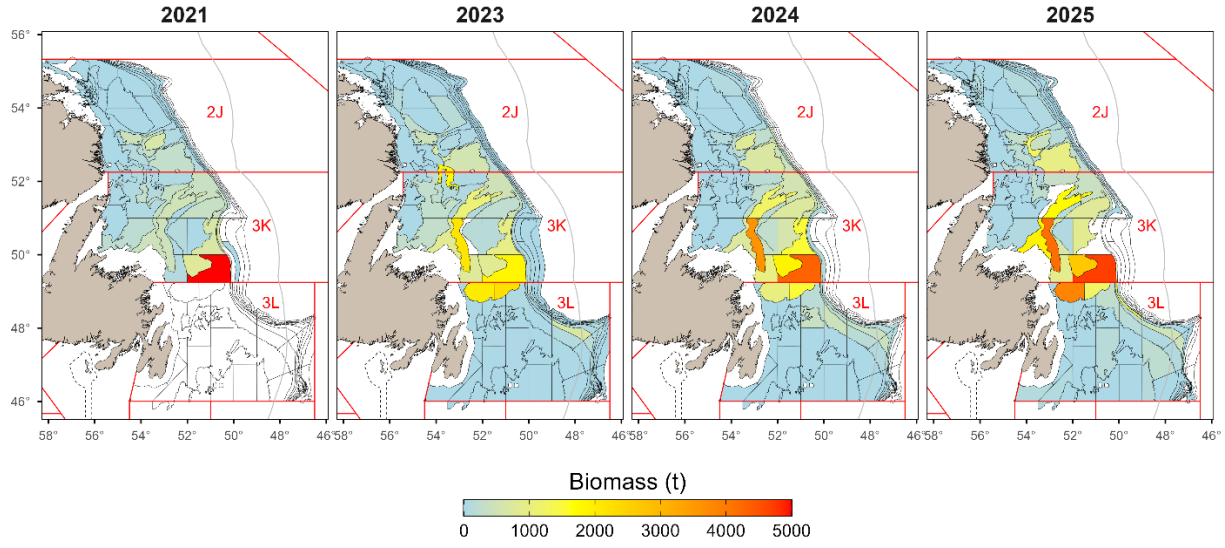


Figure 2. Distribution of Witch Flounder biomass in the fall RV surveys since 2021. White strata were incomplete. There was no survey in the fall of 2022.

Stock Status and Trends

Biomass

Total biomass (Figure 1B) was highest in the 1960s, declined through the 1970s, and was stable at a moderately high level through the 1980s. A further, rapid decline was observed from the late 1980s through the early 1990s. The stock remained at a low level for nearly two decades, but has steadily increased from the early 2000s to present and is currently at the highest level observed since the late-1980s. Biomass at the start of 2026 is estimated to be 31,216 t (95% CI: 16,638–58,565 t).

Fishing Mortality

Fishing mortality (F) increased through the 1960s with the development of the fishery, stabilizing near Fmsy in the 1980s after catches declined from the peaks of the early 1970s (Figure 1C). Fishing mortality increased substantially in the early 1990s when stock size declined rapidly. Despite a moratorium on directed fishing and low removals from bycatch, F remained above Fmsy to the mid-2000s due to very low stock size. F has been < 0.01 since 2010 as the stock has increased while bycatch remained low, and in 2025 was estimated at 0.003 (95% CI: 0.001, 0.007).

Recruitment

In the absence of aging for this stock, length-based survey indices are used as proxies for incoming cohorts. A recruitment index (Figure 1D) is defined as the abundance of fish 18–26 cm in the fall survey since 1995 (i.e., after the switch from the Engel trawl). Recruitment has been good since the mid-2010s, with multiple cohorts well above the long-term mean.

Distribution

Historically, this stock was distributed along the shelf edge, into deep channels, and to a lesser degree onto the banks of the Northeast Newfoundland shelf and the northern Grand Bank. The stock was largely restricted to the shelf edge following stock declines through the late-1980s and early-1990s. Recently, Witch Flounder have been expanding back into deeper channels and onto areas of the banks (Figure 2), coinciding with increasing stock size. This stock is centered in Div. 3K.

Biological Metrics

Observations of weight-at-length in RV surveys from 2023 through 2025 have generally been above the mean length: weight relationship previously estimated for this stock, suggesting a recent improvement in body condition.

Estimates of length at 50% mature (L50) for females has been generally increasing since the mid-2000s. Males in this stock typically reach maturity roughly 10 cm smaller than females, with recent L50 near 30 cm for males and 42 cm for females. Given the current small fish protocol defined in the Rebuilding Plan at 30 cm, these increases in size-at-maturity would be expected to result in a greater proportion of immature fish in this stock being vulnerable to fishing.

Given the absence of aging data we cannot examine growth rates, size-at-age, and age-at-maturity in this stock. Spawning timing and locations are not currently known for this stock.

Current Status

The stock is estimated to have been above the LRP in 2025 for the first time since 1989. Total biomass at the start of 2026 is estimated at 31,216 t, (95% CI: 16,638–58,565 t) which

corresponds to 1.39 times (95% CI: 0.74–2.6) the LRP. The stock is in the Cautious Zone with a high (79%) probability.

History of Landings

Table 1. Commercial TAC and landings (t) since 2022. ndf = no directed fishing permitted.

Year	2022	2023	2024	2025
TAC	ndf	ndf	ndf	ndf
Canada	111	86	48	72
Other	13	22	16	15
Total	124	108	64	87

The fishery for Witch Flounder in NAFO Div. 2J3KL began in the early 1960s and landings increased steadily from about 1,000 t in 1963 to a peak near 24,000 t in 1973 (Figure 1). The regulated fishery began in 1974 with a Total Allowable Catch (TAC) of 22,000 t. Catches declined rapidly, reaching 2,800 t by 1980 and 137 t by 1994. A moratorium on directed fishing of this stock was put in place within the Canadian Exclusive Economic Zone (EEZ) in 1995, and in the NAFO Regulatory Area in 1998. There has been no directed fishing since this time. Since 1998, landings from bycatch ranged from 56 to 633 t. Average landings were 96 t annually across the last four years (2022–25), and were primarily from bycatch in Canadian Greenland halibut fishery and in fisheries undertaken by Spanish vessels outside the Canadian EEZ.

Ecosystem and Climate Change Considerations

The ocean climate in the NL bioregion shows multi-year to decadal scale cold and warm phases, and is a major driver of ecosystem-level productivity. The warm phase that started around 2020 continued in 2025. Recent phytoplankton blooms have been early, which favours recruitment of the copepod *Calanus finmarchicus*, a key food item for many fish. Total zooplankton biomass has been improving since the lows in the early-mid 2010s. These conditions are generally favourable for groundfish production, but long-term impacts of increasing warming due to climate change remain unknown.

NL marine ecosystems collapsed in the late 1980s and early 1990s associated with extreme cold ocean conditions and ecosystem overfishing. Declines in the biomass of groundfish and capelin were not offset by increases in shellfish at the time. While these ecosystems continue to experience overall lower productivity compared to the pre-collapse period, likely related to bottom-up processes (e.g., food limitation), improvements have been observed since the collapse. Ecosystem biomass measured by the RV survey increased between the mid-2000s and early 2010s, when declines occurred. Positive trends have been observed since the lows in the mid-late 2010s, reaching post-collapse highs in 2024–25. These recent increases have been driven by groundfish.

Witch flounder biomass began to increase in the early 2000s, earlier than other groundfish in this area that rely heavily on shrimp *Pandalus spp.* and capelin *Mallotus villosus*. This divergence could be related to Witch Flounder diet, which is dominated by benthic invertebrates like polychaetes and amphipods. However, indices do not currently exist to track availability or trends in the forage resources that support this stock.

Harvest Decision Rule

A Harvest Strategy is outlined in the Rebuilding plan as follows:

- When the stock is in the Critical zone, no directed fishing is permitted and removals from all sources must be kept to the lowest possible level.
- When the stock is between the LRP and 125% of the LRP, the permitted harvest rate is 0.025 (2.5%).
- When the stock is between 125% to 150% of the LRP, the permitted harvest rate is 0.04 (4.0%).

This harvest rate is calculated based on a 3-year, uncertainty-weighted smoother of exploitable biomass ($\overline{B}_{exploit}$; biomass of fish 30 cm or greater) derived from survey stratified estimates (see Annex 1 of the Rebuilding Plan for a detailed description of the calculation and weighting).

Applying a harvest rate of 0.04 to the terminal estimate $\overline{B}_{exploit}$ yields fishery removals of 1,088 t. This estimate is expected to be biased downward because of gaps in survey coverage in the last two years (2024–25).

While the fishery removals output from the harvest strategy were calculated based on stratified survey estimates as defined in the rebuilding plan, the status of the stock relative to its reference points was based on the adopted surplus production model.

The Rebuilding Plan for this stock was established in 2022 with an implementation period of five years. However, the current assessment adopted an analytical assessment model which produces new information and analytical capabilities. The change in assessment methodology is a criterion for a review of the Rebuilding Plan which includes this harvest strategy.

Projections

Projections were provided to 2028 under F = 0, and with catch of 1,088 t in 2027 (Table 2). Under both scenarios, continued stock growth is expected with a moderately high (66–68%) probability, with the stock expected to remain in the Cautious Zone.

Table 2. Probability (prob.) of biomass declining from 2026 levels, and of being in the Critical, Cautious, and Healthy Zones over a 2-year projection period under a no-fishing (F = 0) scenario.

Scenario	Year	F/Fmsy	Biomass (CI) (t)	Biomass/LRP (CI)	Prob. Decline	Prob. Critical	Prob. Cautious	Prob. Healthy
F = 0	2027	0	35,167 (17,392 – 70,984)	1.57 (0.78 – 3.16)	39%	18%	58%	24%
F = 0	2028	0	39,286 (18,234 – 84,641)	1.75 (0.81 – 3.77)	32%	16%	47%	37%
Harvest strategy	2028	0.35	38, 283 (17,554 – 83,491)	1.71 (0.78 – 3.72)	34%	17%	48%	35%

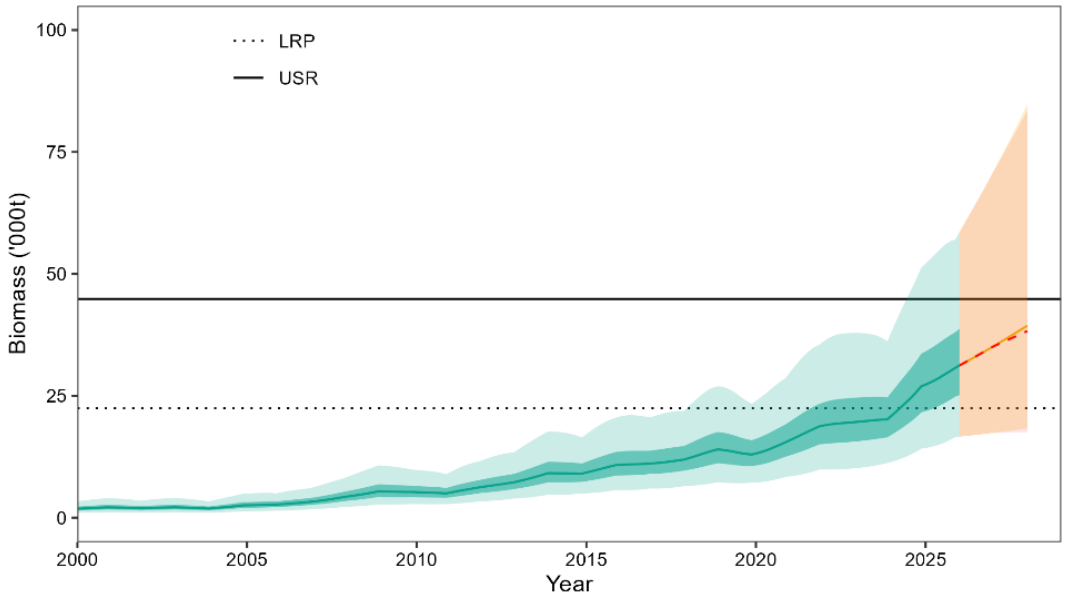


Figure 3. Projected biomass to start of year 2028 assuming no fishing (F = 0; orange, solid), and with catches of 1,088 t in 2027 (red dashed) with shaded 95% confidence intervals, relative to the LRP (dotted line) and USR (solid line).

SOURCES OF UNCERTAINTY

RV surveys of Div. 2J3KL have been incomplete in recent years. Since 2019, the fall survey has been allocated at 70% or 80% of the full survey design, and there have been persistent gaps in deep areas (Figure 2). In 2025, coverage of Div. 3K was particularly poor. Reoccurring gaps in the survey limit our ability to detect and quantify changes in this stock and in the NL shelves ecosystems. While the spatiotemporal model used in the current assessment improves our quantification of stock trends despite coverage gaps, this method does not replace the need for complete survey coverage.

Recent model-based estimates of survey biomass are higher than stratified estimates of survey biomass. This is partially attributed to changes in survey coverage, while other factors such as e.g., finer scale habitat differences or model specification are likely contributing.

Inshore strata have not been sampled since 2010. These have been shown to contain a high number of small fish in some years, particularly in Trinity Bay around the time this stock began rebuilding. When inshore strata are not sampled, the survey is likely to be missing a portion of the recruitment abundance. However, the magnitude of this is unknown and likely to be time-varying, impacted by shifts in stock distribution.

LIST OF MEETING PARTICIPANTS

NAME	AFFILIATION
Karen Dwyer	DFO-NL – Science
Hannah Munro	DFO-NL – Science
Robyn Lee	DFO-NL – Resource Management
Laura Wheeland	DFO-NL – Science
Rajeev Kumar	DFO-NL – Science

NAME	AFFILIATION
Victoria Neville	DFO-NL – Centre for Science Advice
Katherine Skanes	DFO-NL – Science
Emilie Novaczek	DFO-NL – Science
Samantha Trueman	DFO-NL – Science
Paul Regular	DFO-NL – Science
Divya Varkey	DFO-NL – Science
Jenna Makrides	DFO-NL – Science
Fatemeh Hatefi	DFO-NL – Science
Chelsea Melayny	DFO-NL – Science
Kathleen Ryan	DFO-NL – Science
Mariano Koen Alonzo	DFO-NL – Science
David Belanger	DFO-NL – Science
Krista Baker	DFO-NL – Science
Ian Bradbury	DFO-NL – Science
Danielle Davenport	DFO- Maritimes – Science
Danny Ings	DFO- National – Fish Population Science
Samantha Fulton	DFO- Arctic – Science
Wojciech Walkusz	DFO- Arctic – Science
Dayanna Raffoul	DFO- Arctic – Science
Vanessa Bourgeois	Atlantic Groundfish Council
Melvin Starkes	Harvester
John Efford	Harvester
Erin Carruthers	Fish, Food and Allied Workers Union
Miranda Butler	Fish, Food and Allied Workers Union
Samantha Coombs	Department of Fisheries and Aquaculture
Tanya Prystay	Torngat Secretariat
Rob Coombs	NunatuKavut Community Council
Todd Broomfield	Nunatsiavut Government

SOURCES OF INFORMATION

DFO. 2019. Stock Assessment of Witch Flounder (*Glyptocephalus cynoglossus*) in NAFO Divisions 2J3KL. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2018/053.

DFO. 2023. Stock Assessment of Witch Flounder (*Glyptocephalus cynoglossus*) in NAFO Divisions 2J3KL. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2023/012.

DFO. 2024. Newfoundland & Labrador Comparative Fishing Analysis – Part 1. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2024/002.

Fairbairn, D.J. 1981. Which Witch is Which? A Study of the Stock Structure of Witch Flounder (*Glyptocephalus cynoglossus*) in the Newfoundland Region. Can. J. Fish. Aquat. Sci. 38(7): 782–794.

Pedersen, M.W., and Berg, C.W. 2017. A stochastic surplus production model in continuous time. Fish Fish. 18(2): 226–243.

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: DFO.NLCSA-TNLCAS.MPO@DFO-MPO.GC.CA
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

ISSN 1919-5087
ISBN 978-0-662-43756-7 Cat. No. Fs70-6/2026-037E-PDF
© His Majesty the King in Right of Canada, as represented by the Minister of the Department of Fisheries and Oceans, 2026

This report is published under the Open Government Licence - Canada

Correct Citation for this Publication:

DFO. 2026. 2J3KL Witch Flounder (*Glyptocephalus cynoglossus*) Stock Assessment in 2026. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2026/037.

Aussi disponible en français :

*MPO. 2026. Évaluation du stock de plie grise (*Glyptocephalus cynoglossus*) dans les divisions 2J3KL de l'OPANO en 2026. Secr. can. des avis sci. du MPO. Avis sci. 2026/037.*