WESTERN COMPONENT POLLOCK (*POLLACHIUS VIRENS*) HARVEST CONTROL RULE UPDATE IN 2024

CONTEXT

The Fisheries Management Branch of Fisheries and Oceans Canada (DFO) has requested an update of the harvest control rule for the 2025 fishing year for the Western Component Pollock management area.

This Science Response Report results from the regional peer review of December 10, 2024 on the Update of the Harvest Control Rule for Western Component Pollock.

SCIENCE ADVICE

Status

- The biomass index is between the limit reference point (LRP) and the upper stock reference (USR), placing the stock in the cautious zone.

Trends

- Since the most recent assessment in 2022 when the LRP and USR were determined, the stock has been in the cautious zone.
- The biomass index has increased slightly each year since 2022.
- The fishery catch has increased in each of the last four years, since the series low in 2020.
- Estimated F has increased gradually since the last assessment, reaching 0.19 in 2023.

Ecosystem and Climate Change Considerations

- The mechanism behind how environmental variables or changing ocean conditions impact Western Component Pollock productivity is not well understood (i.e., differences in growth and recruitment cycles). However, simulation testing of the current harvest control rule during the Management Strategy Evaluation (MSE) process accounted for some, but not all of these uncertainties.

Stock Advice

- The biomass index is 18,625 mt, placing the stock in the cautious zone (LRP=14,350 mt, USR=22,960 mt). Based on the available estimate of population biomass, the catch advice for WC Pollock as generated by the HCR for fishing year 2025–2026 is 2,608 mt.
- Although Science has not provided catch advice for the 4Xmn portion of the Western Component management unit, it is recommended that the removal of any Eastern Component TAC be limited to that area to avoid exceeding F in the western portion.

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

2022 (Andrushchenko et al. In Press (b))

Assessment Type

Interim year update

Most Recent Assessment Date

1. Last full assessment: 2022 (DFO 2023)
2. Last interim year update: None since the 2022 management strategy evaluation (MSE) process

Assessment Approach

1. Broad category: Full MSE
2. Specific category: Statistical catch-at-age

Stock, Ecosystem and Fishery Overview Information

The following publications provide the relevant stock, ecosystem and fishery overview information for the advice: DFO 2023, Andrushchenko et al. In Press (a).

Stock Structure Assumption

Pollock in NAFO Divisions 4VWX5 comprise two population components: a slower-growing Eastern Component comprising Divisions 4VW and DFO statistical unit areas 4Xmn, and a faster-growing Western Component (WC) comprising 4Xopqrs and Canadian portions of NAFO Subarea 5, 5Yb and 5Zc (Andrushchenko et al. 2023a). It is unclear whether the difference in growth constitutes a delineation of two genetically diverse stock components, or if this is an environmentally driven difference. The stock structure assumption used by DFO Science (4Xopqrs+5Yb+5Zc) differs from the DFO Resource Management (4X5YbZc) spatial areas for Western Component Pollock.

Reference Points

- Limit reference point (LRP): 14,350 mt (0.2 of B_0)
- Upper stock reference (USR): 22,960 mt (0.32 of B_0)
- Removal reference (RR): 0.187 (when stock is above the USR; $F_{40\%SPR}$)

Harvest Control Rule

The application of the selected management procedure involves a ramp-based harvest control rule (HCR) where the fishing mortality (F) across the cautious zone increases gradually from 0.04 (critical zone) to 0.187 (healthy zone), with an interannual limit on change of 15% when in the cautious zone and 20% when in the healthy zone. In the critical zone, the limit is 50%. The population biomass (“biomass index”) is estimated each year by adjusting a three-year geometric mean of available bottom trawl and acoustic biomass values by the model-generated

index-specific catchability (q). The q-adjusted biomass determines fishing mortality (F) and the accompanying total allowable catch (TAC) using the ramp-based HCR.

Data

Population model:

- Maritimes Summer Ecosystem Research Vessel Survey bottom trawl data in 4Xopqrs5Y and 4Xmn (1983-2021) and 5Z (1989-1990; 2011-2021)
- Maritimes Summer Ecosystem Research Vessel Survey acoustic index (2012; 2016-2020)
- Canadian fishery data (1982-2020)

HCR update:

- Bottom trawl and acoustic indices available to 2024
- Canadian fishery data available to the end of the 2023–2024 fishing year.

ASSESSMENT

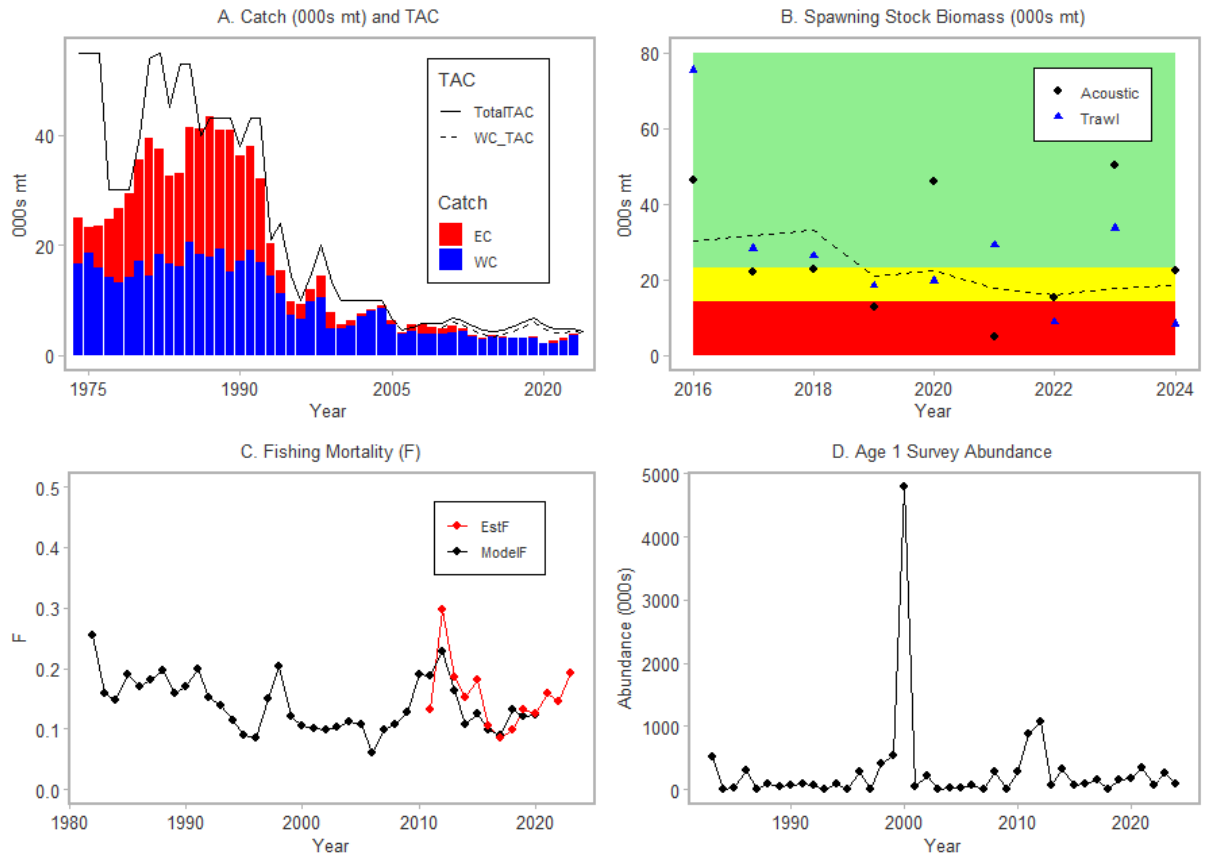

Figure 1: (A) Catch and total allowable catch (TAC) in Eastern Component (EC) and Western Component (WC) management areas, (B) spawning stock biomass (SSB; dashed line) in relation to the limit reference point (LRP) as denoted by the line between the red and yellow blocks (14.35 kt) and upper stock reference (USR) as denoted by the line between the yellow and green blocks (22.96 kt), (C) fishing mortality (F; distinguished as model-estimated F, represented by black line, and estimated F, represented by red line, for 2021–2024), (D) Maritimes Summer Ecosystem Research Vessel Survey bottom trawl Age 1 abundance index.

Stock Status and Trends

Biomass

The most recent model estimate of spawning stock biomass (SSB) in 2020 is 21,711 mt (DFO 2023). The most recent estimated spawning stock biomass in 2024 is 18,625 mt and is based on the SSB between 2022 and 2024.

Removal Rate

Fishing mortality varied historically, with the high levels observed in the early 2010s decreasing to 0.124 at the time of the last MSE (DFO 2023). Between model runs, the fishing mortality is estimated using mean survey biomass estimates, with the current year's fishing mortality estimated at 0.193.

Recruitment

The population model shows alternating periods of high and low recruitment for Western Component Pollock throughout the time series, with the stock undergoing a period of low recruitment with an annual average of 4.7 million recruits from 2016–2020 (DFO 2023). Based on the abundance of small fish in the bottom trawl survey, there is no strong indication that the stock has entered a period of high recruitment since 2020.

Natural Mortality

Natural mortality is understood to change over time, particularly for ages 5–7 and 8+ (Andrushchenko et al. In Press (b)). As a result, a statistical catch-at-age population model was accepted in the 2022 modelling framework where natural mortality was estimated in three temporal blocks for ages 5+ (1994–2000, 2000–2010, and 2011–2020; Andrushchenko et al. In Press (b)). There is no evidence of a substantial change in mortality from 2011–2020 levels.

Current Outlook

The biomass index is between the limit reference point (LRP) and the upper stock reference (USR), placing the stock in the cautious zone. In 2024, the SSB was 130% of the LRP and 81% of the USR.

History of Landings and Total Allowable Catch

Historically, landings of Pollock reached 40,000 mt and were harvested equally between the Eastern and Western components. However, after the mid-1990s, removals of Pollock from the Eastern Component all but disappeared, while those from the Western Component decreased to below 10,000 mt. Since the MSE in 2011, catches of Western Component Pollock have remained below 4,500 mt, with 3,526 mt caught in the 2023 fishing year against a TAC of 3,609 mt (Table 1)

Table 1. Landings and TAC for Western Component (WC) and Eastern Component (WC) Pollock since 2010, based on the management year (April–March). Landings for the 2024 management year not available until end of the management year (March 2025) are denoted by NA. Five-year averages of annual landings are presented for 2010–2014 and 2015–2019.

Years	WC Landings (mt)	EC Landings (mt)	WC TAC (mt)	EC TAC (mt)
2010–2014	3,707	690	4,962	900
2015–2019	3,199	117	4,564	900
2020	2,032	158	4,959	660
2021	2,064	567	4,107	660
2022	2,703	426	4,107	660
2023	3,526	291	4,309	660
2024	NA	NA	3,768	660

Ecosystem and Climate Change Considerations

The impact of environmental variables or changing ocean conditions on Western Component Pollock productivity is not well understood. Although a clear link has not been identified, the cause of slow growth experienced since 2011 is likely ecosystem-based (DFO 2023). It is also unclear whether the difference in growth that delineates the Western and Eastern components is due to an environmentally driven effect (DFO 2023). Finally, there appear to be patterns in the recruitment of Western Component Pollock that are caused by something other than the spawning stock biomass from which it was produced. Simulation testing of the HCR during the MSE process accounted for this recruitment pattern in the projections.

Projections

Projections were last performed in 2022 during the modelling framework and are planned to be completed again after five years in 2027 (Andrushchenko et al. In Press (b); DFO 2023).

Harvest Control Rule Outputs

The biomass index is 18,625 mt, placing the stock in the cautious zone (LRP=14,350 mt, USR=22,960 mt). Based on the available estimate of population biomass, the catch advice for Western Component Pollock for fishing year 2025–2026 is 2,608 mt. This represents a decrease of 15% from the previous fishing year's TAC and is equivalent to F of 0.151.

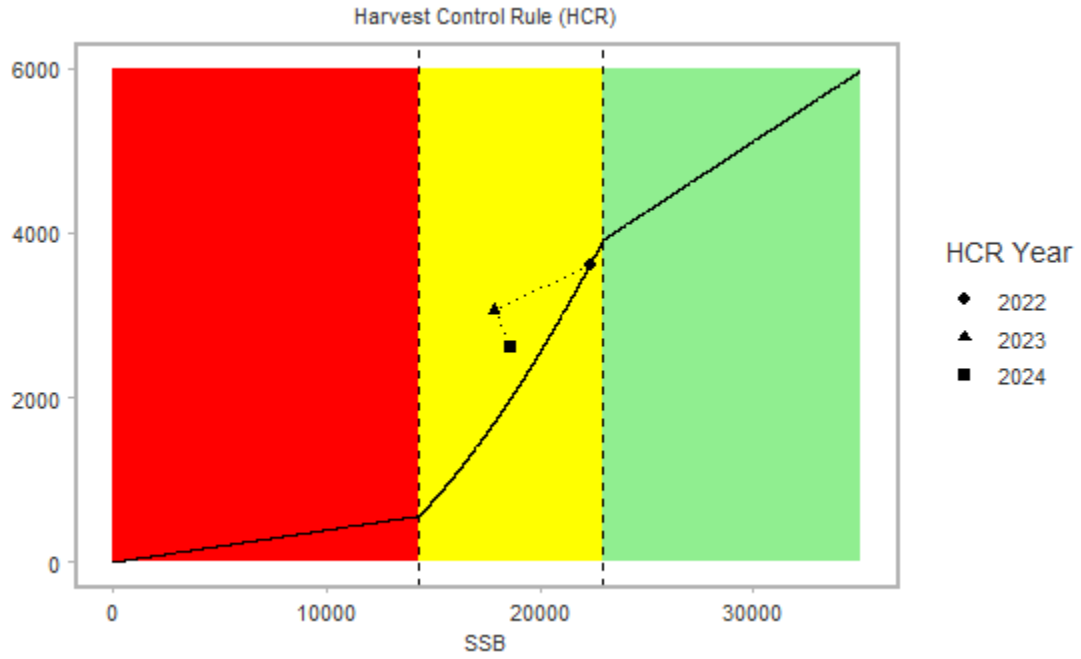

Figure 2: Harvest control rule (HCR) and application since 2022.

Evaluation of Exceptional Circumstances

A review of available data determined that no exceptional circumstances have occurred, so a higher-level review has not been triggered for 2025 (DFO 2023).

PROCEDURE FOR INTERIM YEAR UPDATES

The MSE assessment cycle is described in detail in DFO (2023). It runs with annual Level 1 reviews, which are each an annual provision of advice that is determined by updating the HCR with new survey data and generating new TAC advice and stock status. During a Level 1 review, a check of exceptional circumstances will be conducted to determine if a higher-level review is required in a subsequent year. After five and ten years, higher level reviews, detailed in DFO (2023), will be conducted regardless of whether or not an exceptional circumstance is triggered.

SOURCES OF UNCERTAINTY

The following sources of uncertainty were identified in DFO (2023):

- The cause of the slower growth experienced by Western Component Pollock since the 2011 cohort remains unclear. Given that it appears to be tied to a cohort rather than a year, the cause is likely ecosystem-based, but no clear link could be established through the MSE process.
- The impact of slower growth on productivity of the stock is unknown.
- Recruitment of Western Component Pollock appears to exhibit a multi-year oscillatory tendency, caused by something other than the spawning stock biomass that produced it.

- The cause of temporal changes in natural mortality for Western Component Pollock are unknown.
- The validity of simulation testing is linked directly to the validity of the assumptions made in setting up the simulation. The various components of the Western Pollock MSE were built on assumptions around the biology, fishery, and environmental factors influencing Western Component Pollock, all of which are detailed in Andrushchenko et al. (In Press (a); In Press (b)).

An additional uncertainty identified during the CSAS review for this document is that uncertainty in stock status is not calculated as part of the HCR Update.

Research Recommendations

The cause, likely ecosystem-based, of slower growth experienced by Western Component Pollock since the 2011 cohort could be further explored. Identification of a cause would help monitor the change and may help determine whether the change is permanent or reversible.

To improve the predictive capacity of the models, a mechanistic relationship for spawning stock biomass-independent impacts on recruitment could also be explored.

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SOURCES OF INFORMATION

Andrushchenko, I., R. Martin, P. Doherty, A. Debertin, Q. McCurdy, E. MacEachern, D. S. Clark, and C. M. Clark. In Press (a). Western Component Pollock - Data Inputs. DFO Can. Sci. Advis. Sec. Res. Doc.

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DFO. 2023. Western Component (4Xopqrs5) Pollock Management Strategy Evaluation, Stock Status, and Advice. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2023/037.

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