



HARVEST CONTROL RULE UPDATE FOR WESTERN COMPONENT POLLOCK (*POLLACHIUS VIRENS*) IN NAFO DIVISIONS 4XOPQRS5 FOR 2020

Context

Pollock (*Pollachius virens*) in Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX5 comprise two population components: a slower-growing Eastern Component including Divisions 4V and 4W, as well as Subdivisions 4Xm and 4Xn, and a faster-growing Western Component (WC) including 4Xopqrs and Canadian portions of Division 5. The WC has been the main focus of past analytical assessments, but scientific advice on stock status and catch limits using Virtual Population Analysis (VPA) modeling became highly variable in the mid-2000s (Stone 2011). Consequently, the Canadian fishing industry recommended exploration of alternative approaches, which would provide more stability in future catch limits to allow for better business planning and a more stable fishery.

In 2011, fisheries managers and the fishing industry decided to manage WC Pollock using a risk-management approach and embarked on a Management Strategy Evaluation (MSE) process, with the help of government scientists and outside experts (DFO 2011). MSE is a technique to explicitly consider the uncertainty in stock assessment assumptions and models, and to compare the likely consequences to Management Objectives when a predetermined Management Procedure (MP) incorporating a Harvest Control Rule (HCR) is applied. The Pollock MP was selected on the basis of satisfying three medium-term objectives agreed upon for management of the resource, which relate to sustainability, catch levels, and the extent of annual catch changes. The MP model was built around an HCR that either increased or decreased future catch limits based on results from ongoing monitoring from the annual DFO Summer Research Vessel (RV) Survey. An Exceptional Circumstances Protocol was put in place to cover situations that fall outside the range for which the MP was simulation tested and, if necessary, to allow for some form of intervention.

This report provides an update to the 2019 analysis (DFO 2020) of the WC Pollock Harvest Control Rule and provides advice on the 2021–2022 Fishing Year (FY) catch limit generated by the Pollock MP and HCR using updated information from the 2020 DFO Summer RV Survey. It also describes current status with respect to the provisions in the Exceptional Circumstances Protocol. The HCR with updated monitoring data for 2020 generated a catch limit of 3,407 t for FY 2021–2022, down 20% from 4,259 t for FY 2020–2021. No exceptional circumstances were triggered in 2020.

This Science Response Report results from the Regional Science Response Process of December 1-2, 2020, on the Stock Status Updates of Groundfish Stocks in the Maritimes Region.

Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

Analysis and Response

DFO Summer Research Vessel Survey Index

The DFO Summer RV Survey time series for the WC Pollock biomass index (kg/tow) extends from 1984 to 2020, a period when the same survey design and bottom trawl (Western IIA) have been used annually. The biomass index exhibits strong year-effects, which reflect the semi-pelagic schooling behavior of Pollock and changes in availability arising from differing distributions in the water column at the times of the survey. In general, there was a declining trend in the index in the 1990s, an increasing trend throughout 2000s, and, after a decline around 2010, the stock has remained at relatively low levels since then. Although the index is highly variable, the long-term trends are informative. The RV series using a three-year geometric mean (GM; three-year moving average) provides a clearer indication of long-term trends by smoothing year effects and provides the monitoring data used in the HCR for calculating future catch limits (Figure 1).

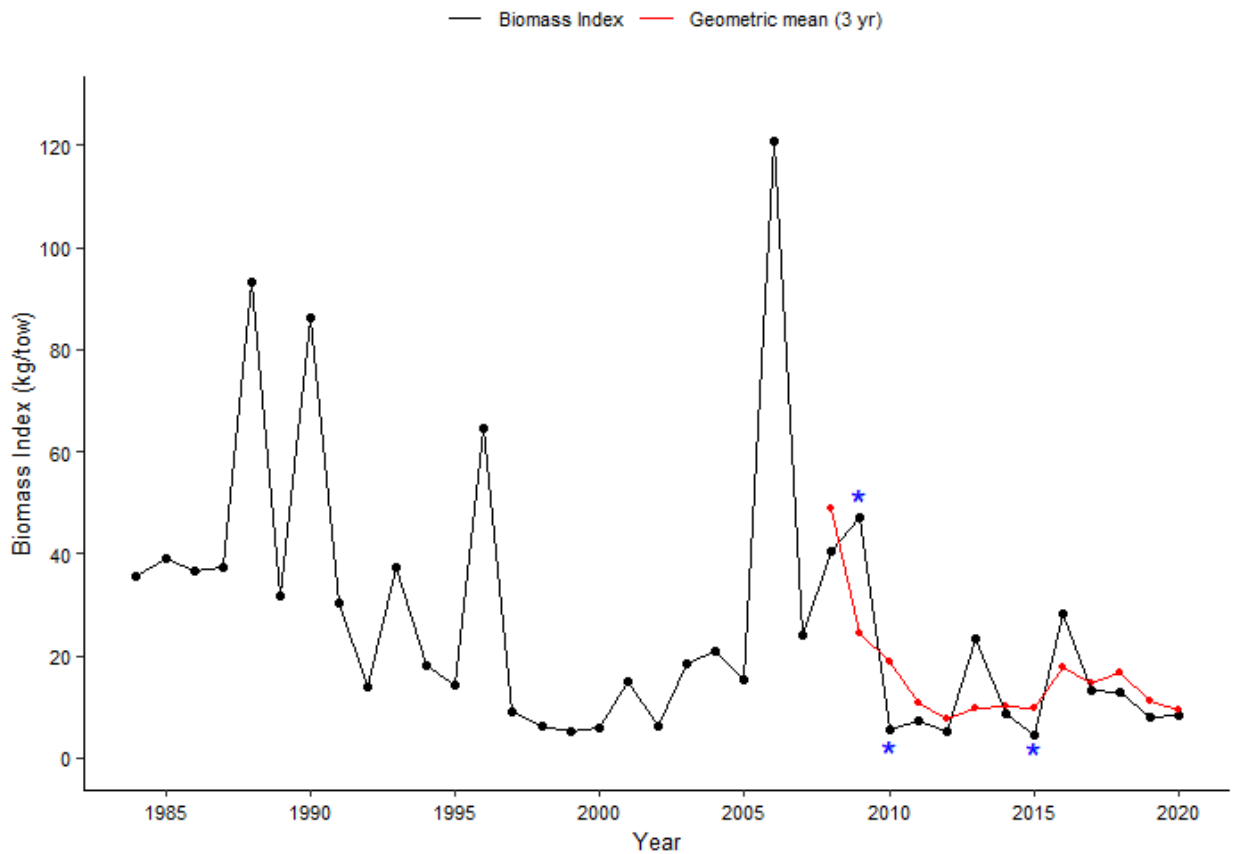


Figure 1. DFO Summer RV Survey biomass index (black line) and three-year Geometric Mean (GM) index used in the HCR (red line) based on survey strata representing unit areas 4Xopqrs+5Yb, 1984–2020. Survey biomass indices marked by asterisks were modified (2009 and 2010) or excluded (2015) for the calculation of the three-year geometric mean.

Harvest Control Rule

The Pollock MP is linked to the HCR to calculate catch limits based on results from ongoing monitoring (DFO Summer RV Survey). The catch limit either increases or decreases by up to 20% annually (with increases capped at 20% or 500 t, whichever is the greater), depending on the value of the GM biomass index for the most recent 3 years as a proportion of the GM of the index for 1984–1994, a period of high productivity (also referred to as the Survey Index Ratio). The catch limit was initially set at 6,000 t in FY 2011–2012 for the Pollock MP Model and decreased every year until FY 2016–2017. The catch limit then increased every year by the maximum permitted limit (20%) until it decreased by 20% in FY 2020–2021. Since the inception of the HCR in 2011, the catch limits have either increased or decreased by the maximum permitted limit (20%) every year except for FY 2015–2016 and 2016–2017, which reflects the highly variable nature of the Pollock survey index. The 2020 survey biomass index increased from 7.86 kg/tow in 2019 to 8.14 kg/tow. The 3-year GM index for 2020 is 9.40 kg/tow and uses biomass indices from the three most recent years (2018–2020). The resultant survey index ratio decreased from 0.30 in 2019 to 0.26 in 2020. Based on this value, the HCR generates a catch limit of 3,407 t for FY 2021–2022, which is the maximum permitted 20% decrease (Figure 2).

Technical details of the Pollock MP and HCR are described in Rademeyer and Butterworth (2011).

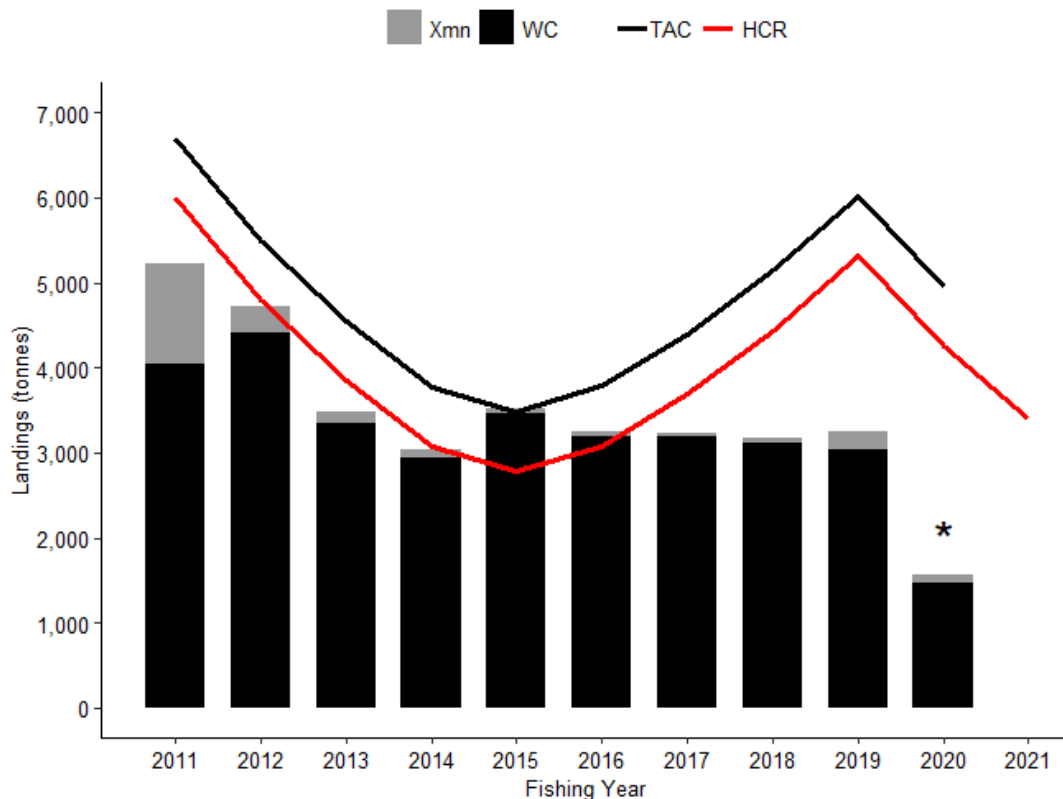


Figure 2. Fishing year (April 1–March 31) landings of Pollock from the Western Component [4Xopqrs5] (black bars) and from 4Xmn (gray bars) with respect to the HCR generated catch advice (red line) and Total Allowable Catch (TAC; black line). The TAC for Western Component Pollock includes an additional 700 t from 4Xmn that can be fished within the Western Component management area, or in 4Xmn. The 2020 fishing year, marked with an asterisk, was still ongoing and landings were incomplete, as of October 30, 2020.

Maritimes Region

Since the implementation of the HCR in 2011, the Total Allowable Catch (TAC) has included the HCR generated catch limit and an additional 700 t of quota transferred from the Eastern Component, which can be fished throughout the WC management area and in NAFO Subdivisions 4Xmn. The total WC Pollock landings exceeded the HCR catch advice in 2015 and 2016 but remained below the TAC. In these years, the majority of landings that exceeded the HCR catch limit came from the WC management area, as opposed to 4Xmn (Figure 2). It should be noted that the 2020 fishing year is still ongoing, and landing values for 2020 are currently incomplete as of October 30, 2020.

There are provisions to cover situations outside the range for which the Pollock MP model was simulation tested or beyond situations that the MP was designed to handle. These provisions can be applied by decision-makers to amend the catch limits set by the Pollock MP or to revise the MP itself, but application should not be a frequent occurrence.

Results that would trigger an exceptional circumstance based on the protocol established in DFO 2011 include:

1. When the Survey Index Ratio falls below 0.2 or is beyond the 90% probability level from model predictions

The current Survey Index Ratio (based on the 3-year GM survey index for 2018–2020 as a proportion of the index for 1984–1994) is 0.26, which is above the exceptional circumstance value of 0.2.

2. When the RV survey biomass index is < 6.0 kg/tow for two consecutive years

The DFO Summer RV Survey index was 7.86 kg/tow in 2019 and 8.14 kg/tow in 2020, which does not trigger an exceptional circumstance.

3. Additional situations

Research Vessel survey age-specific indices are monitored for changes in age structure, which could also trigger an exceptional circumstance (i.e., when extremely compressed/expanded). There has been a period of diminished numbers-at-age for older ages from 1995–2005, with some modest improvement since then (Figure 3).

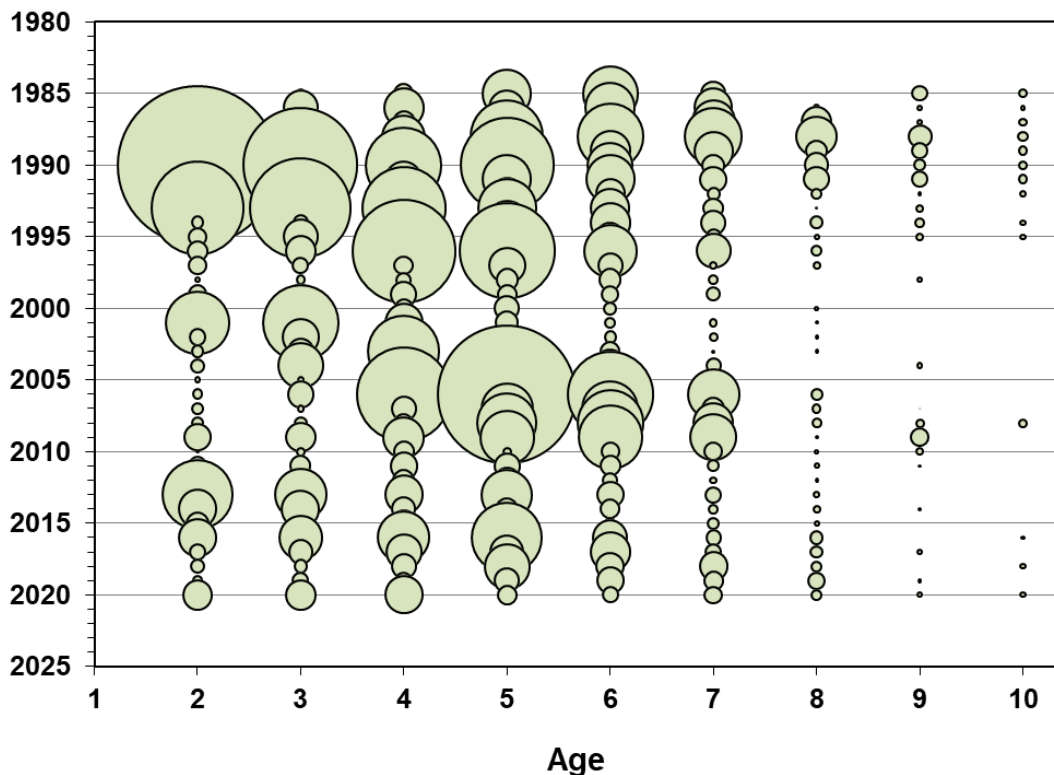


Figure 3. Stratified mean number-per-tow at age for Pollock from the DFO Summer RV Survey based on strata representing unit areas 4Xopqrs+5Yb for ages 2–10, 1985–2020. Bubble size is proportional to the stratified mean number-per-tow at age.

Review of Additional Biomass Indices

In 2016, Resource Management requested a review of additional biomass indices for WC Pollock from the National Marine Fisheries Service (NMFS) Spring and Fall Surveys, as well as recent DFO Summer RV Survey coverage of Eastern Georges Bank. This report provides updated survey biomass indices for NMFS Spring and Fall Surveys up to 2019, as well as DFO Summer RV Survey coverage of Eastern Georges Bank up to 2020.

The DFO Summer RV Survey biomass index for WC Pollock is based on survey strata representing unit areas 4Xopqrs+5Yb (DFO Maritimes Survey Strata 474, 476, 480–495) and does not include 5Zc (Eastern Georges Bank; strata 5Z1, 5Z2, 5Z9). Since 2016, members of the fishing industry have raised concerns regarding the lack of survey coverage on Georges Bank, an area with an increasing proportion of WC Pollock landings in recent years. NMFS carries out bottom trawl groundfish surveys that cover part of the WC management unit and includes Eastern Georges Bank, but, unlike the DFO Summer RV Survey, the NMFS Surveys occur in the Spring and Fall. All three surveys are subject to high inter-annual variability in Pollock abundance (Figure 4). The surveys were scaled by dividing each point by the 1984–1994 average for each survey (the same reference period used for the DFO survey index in the HCR), then multiplied by the DFO survey average index for the same time period. It should be noted that both the 2020 NMFS Fall and Spring Surveys were not conducted due to the COVID-19 pandemic.

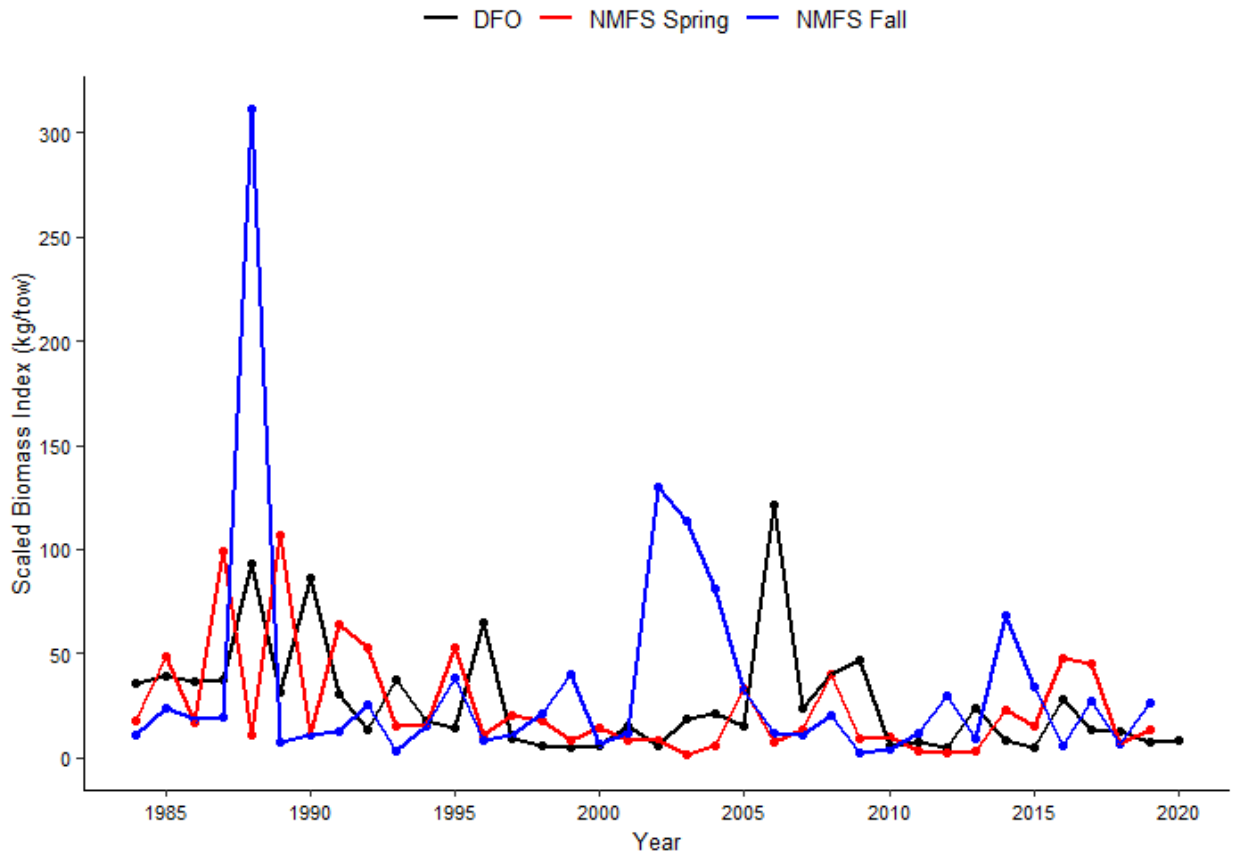


Figure 4. Western Component Pollock biomass indices, scaled to the DFO Summer RV Survey mean (1984–1994) for the DFO Summer (black line), NMFS Spring (red line), and NMFS Fall (blue line) surveys from 1984–2019 (NMFS Spring and Fall) and 1984–2020 (DFO Summer).

In recent years, the DFO Summer RV Survey has included some coverage of Eastern Georges Bank including strata 5Z9 (2011–2020), 5Z1 (2011–2013, 2016–2017, 2019–2020), and 5Z2 (2016–2017, 2019–2020). With the exception of 2018, the DFO Summer RV Survey has completed full coverage of Eastern Georges Bank since 2016 and provides an outlook of the WC Pollock biomass that is currently unaccounted for in the HCR.

Including survey catch data from Eastern Georges Bank generates a very similar mean catch-per-tow to the current survey coverage in 4Xopqrs+5Yb, with the exception of 2011, 2016, 2019, and 2020, where the index is higher when Georges Bank data are incorporated (Figure 5). In years with full survey coverage of Eastern Georges Bank (2016–2017, 2019–2020), the proportion of total survey biomass for WC Pollock caught on Georges Bank ranges from 17–38% and represents on average 33% of the total biomass (Figure 6). When all years are included where there was at least some survey coverage on Georges Bank (2011–2020), an average of 25% of the total biomass came from Georges Bank (Figure 6). The difference in perceived magnitude of biomass on Eastern Georges Bank between the mean catch-per-tow and the total biomass indices emphasizes that careful consideration needs to be given to the data inputs of any future harvest control rules.

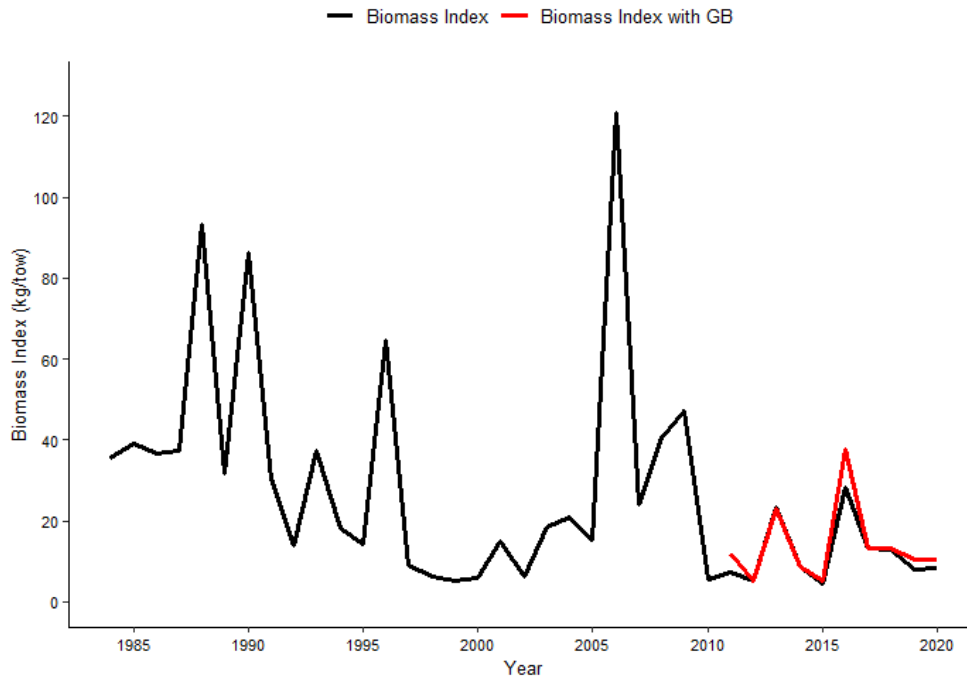


Figure 5. DFO Summer RV Survey biomass index (mean kg/tow) based on strata representing subdivisions 4Xopqrs+5Yb (black line), 1984–2020, and the DFO Summer Survey biomass index for strata representing 4Xopqrs+5Yb+5Zc (red line), 2011–2020.

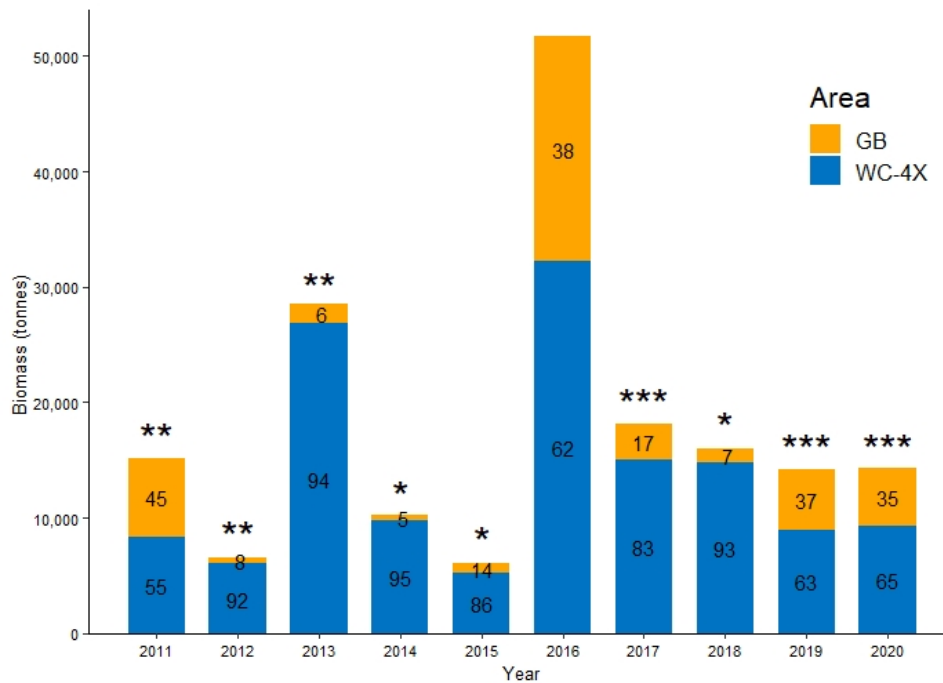


Figure 6. DFO Summer RV Survey total biomass (tonnes) for Western Component Pollock (4Xopqrs+5Yb+5Zc), 2011–2020. Values represent the proportion of total biomass from Georges Bank (orange) and strata representing 4Xopqrs+5Yb used in the HCR (blue). Asterisks represent the Georges Bank strata covered in a given year (* = 5Z9; ** = 5Z1, 5Z9; *** = 5Z1, 5Z2, 5Z9).

Conclusions

Using updated monitoring data from the 2020 DFO Summer RV Survey, the HCR calculates a catch limit of 3,407 t for WC Pollock for FY 2021–2022, which is a decrease of 20% from 2020–2021. Since the inception of the HCR in 2011, no exceptional circumstance has been triggered.

This update report provides an updated review of additional biomass indices of WC Pollock from the NMFS Spring and Fall surveys, as well as recent DFO Summer RV Survey coverage of Georges Bank. With shifts in fishery catch distribution and increased survey coverage of Georges Bank in recent years, it is becoming evident that restricting the HCR biomass index to 4Xopqrs5Yb may reduce the ability to detect changes in total Pollock biomass within the assessment unit. However, incorporating a new or revised data input within the current HCR framework would require a review of the Pollock MSE, which is beyond the scope of this update. Regardless of the data source, indices of Pollock biomass continue to be highly variable, further emphasizing the need for improved indices of Pollock abundance and a HCR designed to meet the Management Objectives for WC Pollock.

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