



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

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 Area 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 and Oceans Canada (DFO) 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). The MSE is an approach 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 a 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.

In January 2017, Resource Management and Industry asked that the 2015 DFO Summer RV Survey index value be considered a missing value to reflect concerns that the point was not representative of the state of the stock (DFO 2018). Further, as the HCR uses the previous year's quota as a starting point for the following year, the actual 2016/2017 quota of 3,081 t was used in the HCR to generate advice for 2017/2018. This approach was supported by members of the Scotia Fundy Groundfish Advisory Committee (SFGAC) as it stayed as close as possible to the HCR for this stock, while reflecting the increasing trends seen in the DFO Summer RV Survey index, the fishery, and U.S. surveys. Following this approach, the HCR quota for Fishing Year (FY) 2017/2018 was set at 3,697 t.

This report provides an update to the 2017 analysis (DFO 2018) of the Western Component Pollock Harvest Control Rule and provides advice on the FY 2019/2020 catch limit generated by the Pollock MP and HCR using updated information from the 2018 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 2018, generated a catch limit of 5,324 t for FY 2019/2020, up 20% from 4,437 t for FY 2018/2019. The DFO Summer RV Survey biomass index decreased from 13.16 kg/tow in 2017 to 12.97 kg/tow in 2018 and did not trigger the exceptional circumstance provision of the DFO Summer RV Survey biomass index being < 6 kg/tow for two consecutive years and the Survey Index Ratio being < 0.2.

This Science Response Report results from the Science Response Process of December 6, 2018, on the Status Update of the Western Component Pollock Management Strategy Evaluation.

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 1984-2018, a period when the same survey design and bottom trawl (Western IIA) have been used annually (Figure 1). The biomass index exhibits strong year-effects, which reflect the semi-pelagic schooling behaviour of Pollock and changes in availability arising from differing distributions in the water column at the times of the survey. In general, there has been a declining trend in the index since the late 1980s, an increasing trend from 2003-2007, followed by another decline to 2012. Since 2012, the survey biomass index has remained low, with a slight increase evident in recent years (Figure 1). Although the index is highly variable, the long-term trends are informative. The RV Survey series, using a 3-year geometric mean (GM; 3-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).

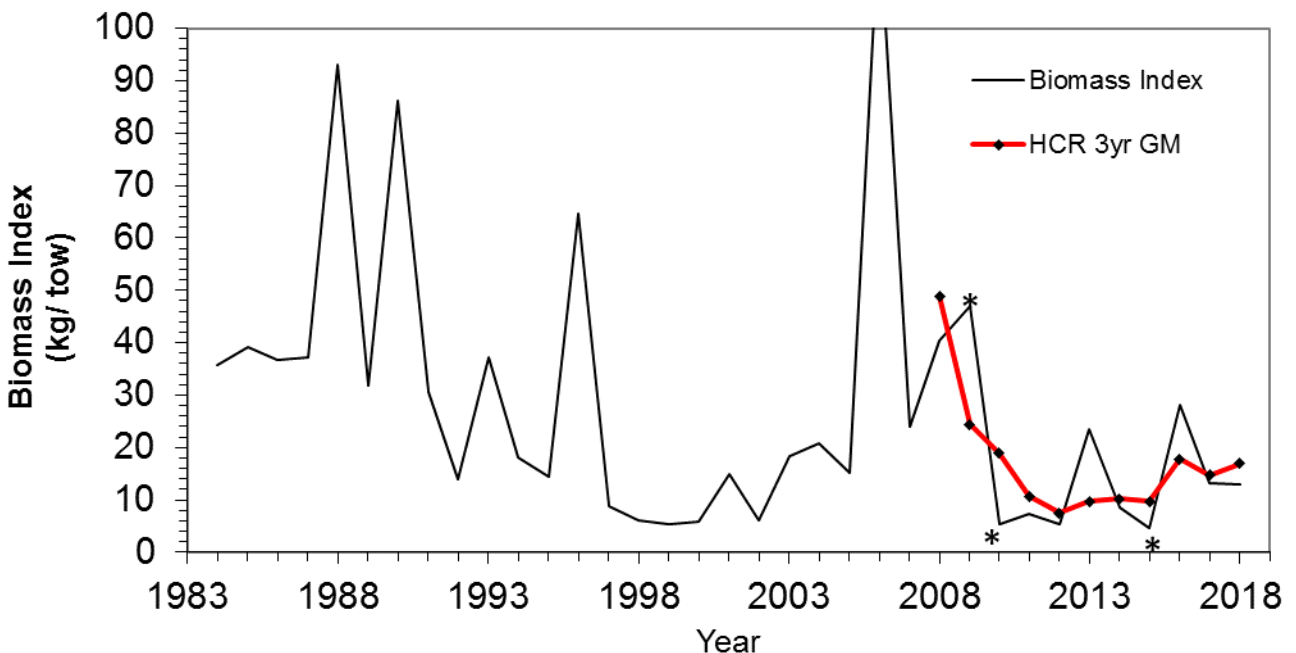


Figure 1. The DFO Summer Research Vessel Survey biomass index (black line) and 3-year geometric mean (GM) index used in the HCR (red line) based on survey strata representing unit areas 4Xopqrs+5Yb, 1984-2018. Survey biomass indices marked by asterisks were modified (2009 and 2010, Rademeyer and Butterworth (2011)) or excluded (2015) for the calculation of the 3-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 greatest) 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 2011 for the Pollock MP Model and decreased every year from FY 2012/2013 to FY 2016/2017. The catch limit has since increased every year by the maximum permitted limit (20%). The 2018 survey biomass index decreased from 13.16 kg/tow in 2017 to 12.97 kg/tow. The 3-year GM index for 2018 is 16.87 kg/tow and uses biomass indices from the three most recent years (2016-2018) for the first time since the 2015 data point was omitted in 2016. The resultant survey index ratio increased from 0.41 in 2017 to 0.47 in 2018. Based on this value, the HCR calculates a catch limit of 5,324 t for FY 2019/2020, which is the maximum permitted increase of 20%.

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

Exceptional Circumstances Protocol

There are provisions to cover situations outside the range for which the Pollock MP model was simulation tested or beyond situations that the management procedure 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 RV 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 2016-2018 as a proportion of the index for 1984-1994) is 0.47, 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 13.16 kg/tow in 2017 and 12.97 kg/tow in 2018, which does not trigger an exceptional circumstance.

3. Additional situations.

The 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 2). Despite recent improvements in the numbers of fish in the population older than Age 7, the number of older fish remains low.

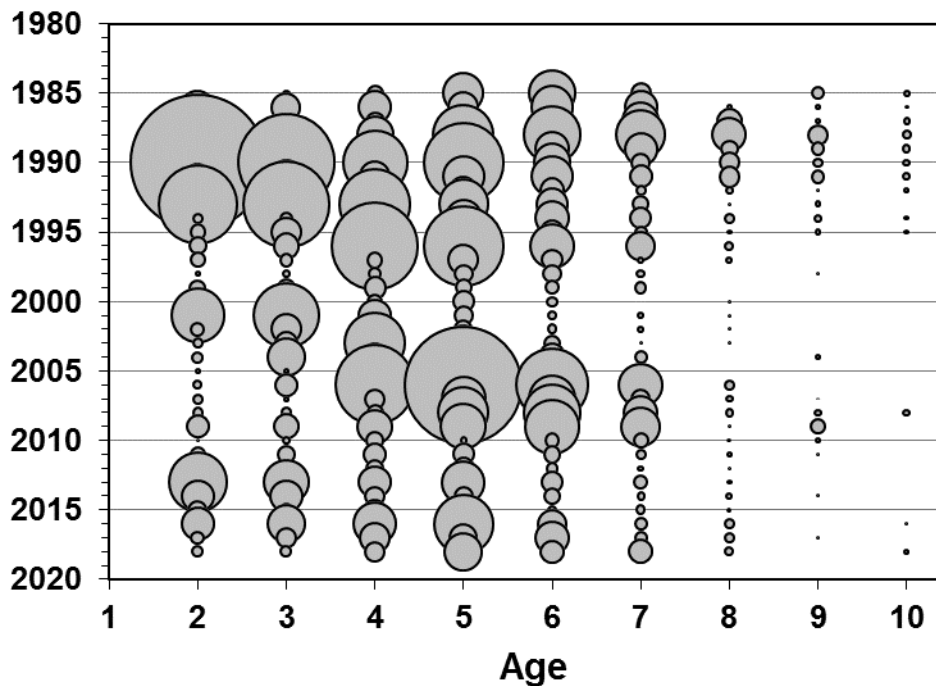


Figure 2. Stratified mean number per tow at age for Pollock from the DFO Summer Research Vessel Survey based on strata representing unit areas 4Xopqrs+5Yb for ages 2-10, 1985-2018. Bubble size is proportional to the stratified mean number per tow at age.

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, and recent DFO Summer RV Survey coverage of eastern Georges Bank. This report provides updated survey biomass indices for NMFS Spring (2018) and Fall (2017) Surveys, as well as DFO Summer RV Survey coverage of eastern Georges Bank up to 2018.

The DFO Summer RV Survey biomass index is based on survey strata representing unit areas 4Xopqrs+5Yb and does not include 5Zc (eastern Georges Bank). Recently, 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. The NMFS carries out bottom trawl groundfish surveys that cover part of the Western Component 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 3). NMFS survey biomass indices were scaled to the DFO Summer RV Survey. Scaling was achieved by taking an average of the indices for 1984-1994 (the same reference period used for the DFO survey index in the HCR) and each NMFS survey index from 1984-2018 was divided by its reference period average then multiplied by the DFO RV Survey average index. It should be noted that the 2018 NMFS Fall Survey was not completed at the time of the update report and is therefore not included in the calculations.

Maritimes Region

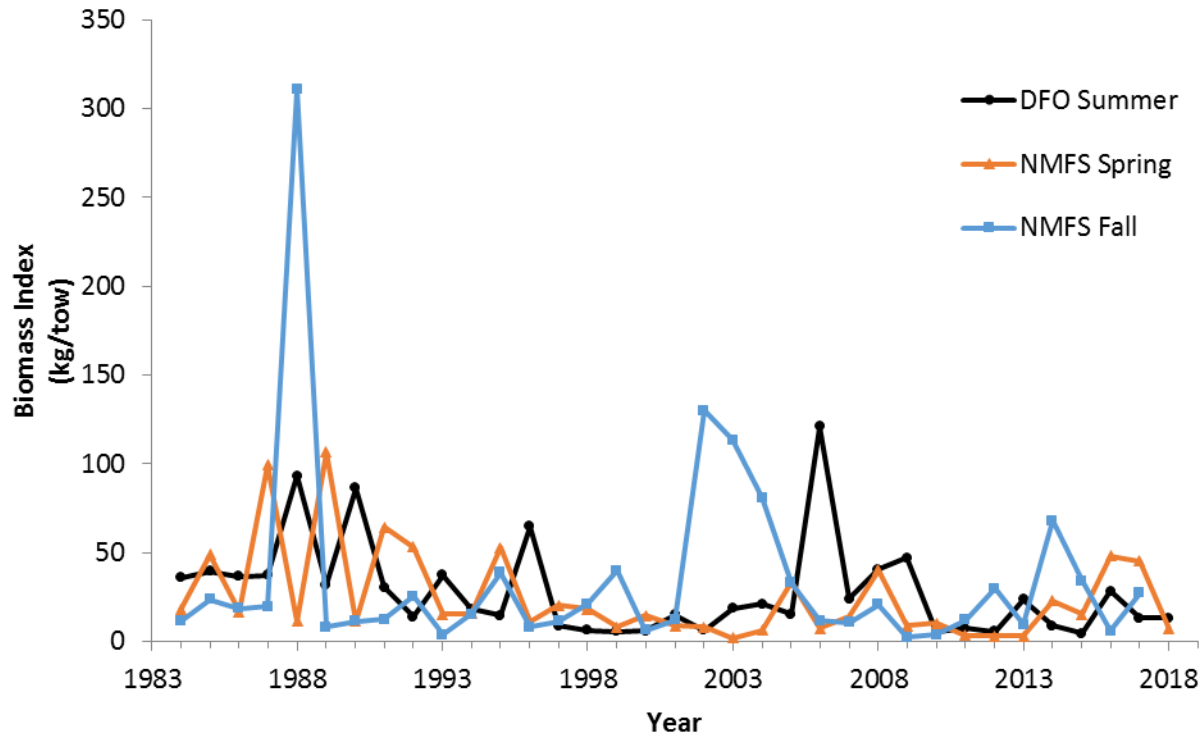


Figure 3. Western Component Pollock biomass indices, for the DFO Summer (black line), NMFS Spring (red line), and NMFS Fall (blue line) surveys from 1984-2018 scaled to the DFO Summer Research Vessel Survey mean (1984-1994).

In recent years, the DFO Summer RV Survey has included some coverage of eastern Georges Bank including strata 5Z9 (2011-2018), 5Z1 (2011-2013, 2016-2017) and 5Z2 (2016-2017). Representative coverage of 5Z1 and 5Z2 was not completed in 2018 due to vessel constraints; zero tows were completed in either stratum. The biomass index for Georges Bank (Figure 4) is only represented by 5Z9, which received 2 tows (minimum coverage) (DFO 2019). With the exception of 2016 and 2017, the survey coverage on Georges Bank has been minimal and the indices from these data are likely a poor representation of Pollock biomass in unit area 5Zc. In most years, including survey coverage from eastern Georges Bank generates a very similar biomass index to the current survey coverage in 4Xopqrs+5Yb with the exception of 2011 and 2016 where the index is higher when Georges Bank data are incorporated (Figure 4).

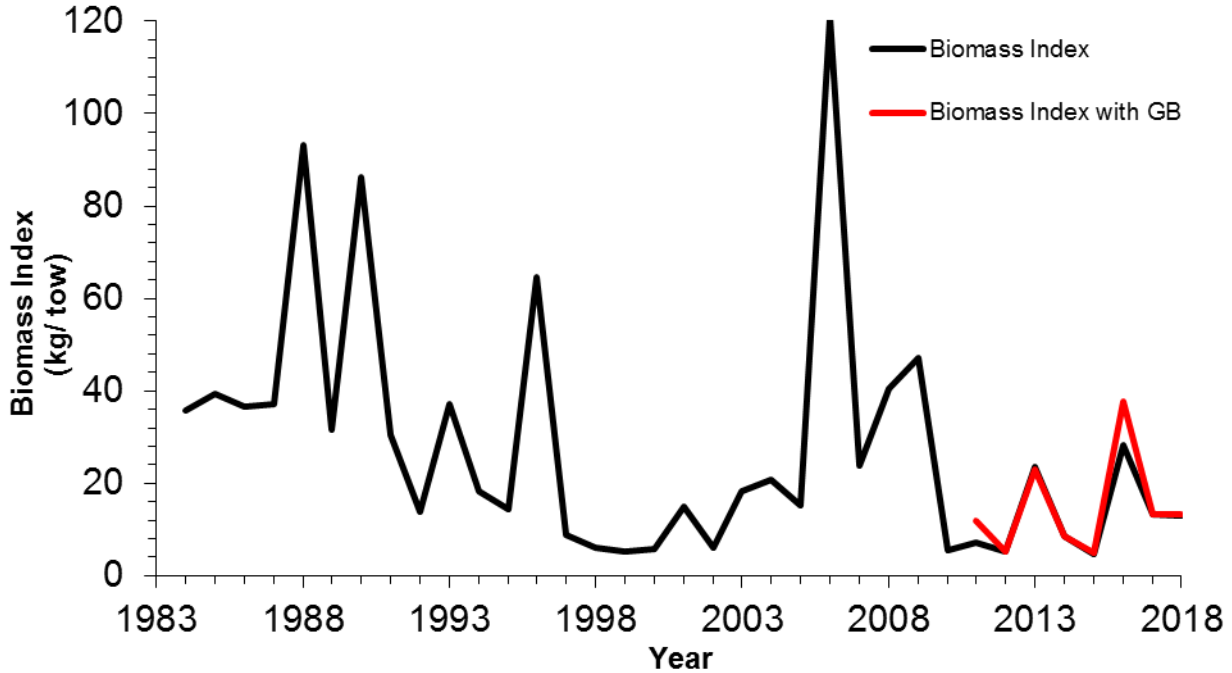


Figure 4. DFO Summer Research Vessel Survey biomass index based on strata representing Subdivisions 4Xopqrs+5Yb (black line), 1984-2018, and the DFO Summer RV Survey biomass index for strata representing 4Xopqrs+5Yb+5Zc (red line), 2011-2018.

Conclusions

Using updated monitoring data from the 2018 DFO Summer RV Survey, the HCR calculates a catch limit of 5,324 t for WC Pollock for FY 2019/2020 up by the maximum annual permitted change of 20%.

The Pollock MP and its HCR have responded to declining trends in the RV Survey biomass index for WC Pollock by decreasing the catch limits. Increases in the DFO Summer RV Survey biomass index in recent years have resulted in an increase in the catch limit reported in the current update. Since the inception of the HCR in 2011, no exceptional circumstance has been triggered.

This report provides an updated review of additional biomass indices of WC Pollock from the NMFS Spring and Fall surveys and recent DFO Summer RV Survey coverage of Georges Bank. Incorporating a new data input time series within the current HCR framework would require a detailed analysis involving comparisons with the original operating models used in 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 exploration of improved indices of abundance, such as the partnership industry bottom trawl acoustic survey currently being investigated, and the importance of a HCR designed to reduce erratic changes in catch limits.

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