UPDATE OF INDICATORS TO 2017 OF ADULT ATLANTIC SALMON FOR THE MIRAMICHI RIVER (NB), SALMON FISHING AREA 16, DFO GULF REGION

Context

The last assessment of stock status of Atlantic Salmon (*Salmo salar*) for Fisheries and Oceans Canada (DFO) Gulf Region was completed after the 2013 return year (DFO 2014) and updates on stock status for each of the four Salmon Fishing Areas (SFA 15-18) were prepared in 2014, 2015, and 2016 (DFO 2015a; DFO 2015b; DFO 2016; DFO 2017). DFO Fisheries and Aquaculture Management requested an update of the status of the Atlantic Salmon stock in the Miramichi River for 2017. Indicators for adult Atlantic Salmon for the Miramichi River are provided in this report. This Science Response Report results from the Science Response peer review meeting held in Moncton (N.B.) on December 19, 2017. No other publications will be produced from this science response process.

Background

All rivers flowing into the southern Gulf of St. Lawrence are included in DFO Gulf Region. Atlantic Salmon (*Salmo salar*) management areas in DFO Gulf Region are defined by four salmon fishing areas (SFA 15 to 18) encompassing portions of New Brunswick, Nova Scotia, and all of Prince Edward Island (Fig.1). The Miramichi River is the largest river in SFA 16 and DFO Gulf Region.

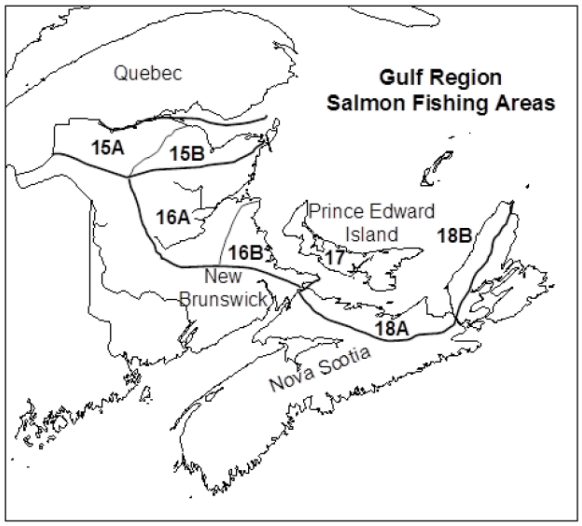

Figure 1. Salmon Fishing Areas in the DFO Gulf Region.

For management purposes, Atlantic Salmon are categorized as small salmon (grilse; fish with a fork length less than 63 cm) and large salmon (fish with a fork length equal to or greater than 63 cm).

Beginning in 2015, mandatory catch and release measures were introduced in all Salmon Fishing Areas of DFO Gulf Region. This was a change from 2014 when retention of small salmon had been allowed in SFA 15, SFA 16A, and SFA 18. Since 1998, rivers in south east New Brunswick (SFA 16B) have been closed to all directed salmon fishing.

Analysis and Response

Abundance indices of adult salmon

SFA 16 - Miramichi River

Catches and counts of adult Atlantic Salmon, by size group, are available from trapnets operated in the estuary and from headwater barrier fences. The annual catches at these monitoring locations presented below are not adjusted for periods when the counting facilities were not operating due to maintenance or high water conditions.

Season catches of small and large salmon have been available from DFO index trapnets located in the Southwest Miramichi at Millerton since 1994 and in the Northwest Miramichi at Cassilis since 1998. In 2017, the trapnet at Millerton operated between 4 June and 27 October while the trapnet at Cassilis operated between 23 May and 27 October. Catches of both small and large salmon at the Millerton trapnet in 2017 were lower relative to levels observed in 2016 and to the long term averages for both size groups at that facility (Fig. 2). Catches of both small and large salmon at the Cassilis trapnet in 2017 were improved over levels observed in 2016. The 2017 catch of large salmon at Cassilis was above the long term average for this group at this facility while the catch of small salmon was below the long term average (Fig. 2).

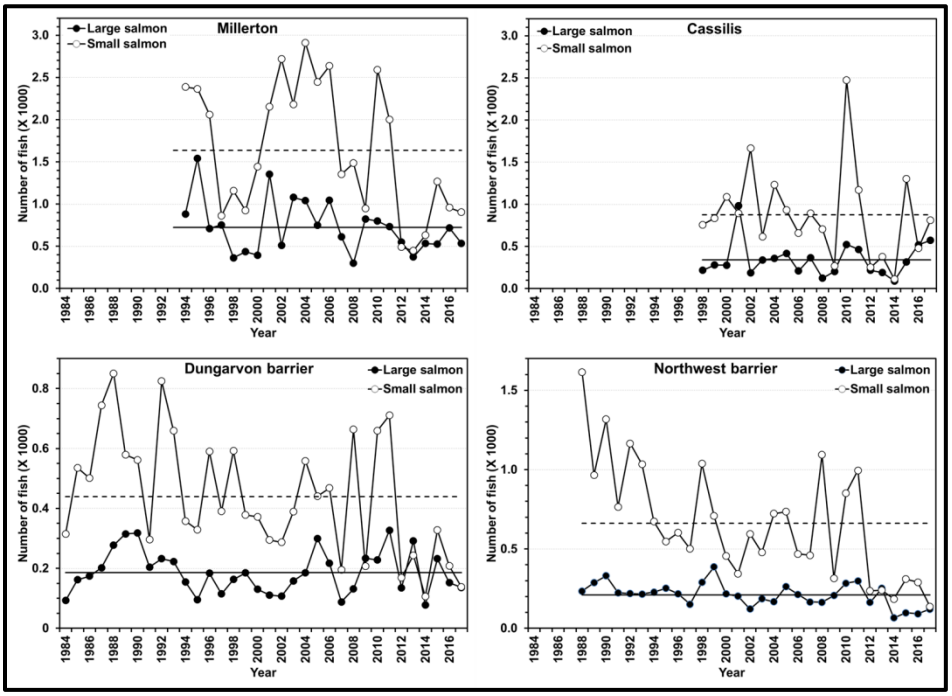

Figure 2. Catches of small salmon and large salmon at DFO index trapnets (top row) at Millerton on the Southwest Miramichi River (top left panel) and at Cassilis on the Northwest Miramichi River (top right panel) and at provincial headwater barriers (bottom row) in the Dungarvon River, tributary of the Southwest Miramichi River (bottom left panel) and the Northwest Miramichi River (bottom right panel) between 1984 and 2017.The horizontal solid and dashed lines represent the average catch or count of large and small salmon, respectively, for the time series of the facility depicted.

Annual counts of small and large salmon have been available from two headwater protection barriers operated by the NB Department of Energy and Resource Development: Dungarvon River, tributary of the Renous and Southwest Miramichi rivers since 1984 and the Northwest Miramichi River since 1988. In 2017, the barrier on the Dungarvon River operated continuously between 30 May and 19 October.

Counts of both large and small salmon at the Dungarvon Barrier in 2017 decreased from levels observed in 2016 and were below the long term average counts for both size groups at this facility (Fig. 2). The Northwest Miramichi Barrier operated continuously between 2 June and 19 October, 2017. Counts of large salmon at the Northwest Miramichi Barrier in 2017 increased relative to 2016 levels while counts of small salmon decreased; counts of both size groups were below their long term averages at that facility (Fig. 2).

Returns of small salmon and large salmon to the Miramichi River and to each of the Northwest Miramichi and Southwest Miramichi branches are estimated using mark and recapture experiments based on catches at various monitoring facilities throughout the watershed (Douglas et al. 2015). The estimated returns of large salmon to the Miramichi River in 2017 were 14,600 fish (median; 5th to 95th percentile range 11,000 to 19,900) while small salmon returns were estimated at 13,300 fish (median; percentile range 10,500 to 16,600). Returns of both large salmon and small salmon to the Miramichi River in 2017 were below 2016 levels and below the average returns estimated for each size group over the time series 1971 to 2017 (Fig. 3).

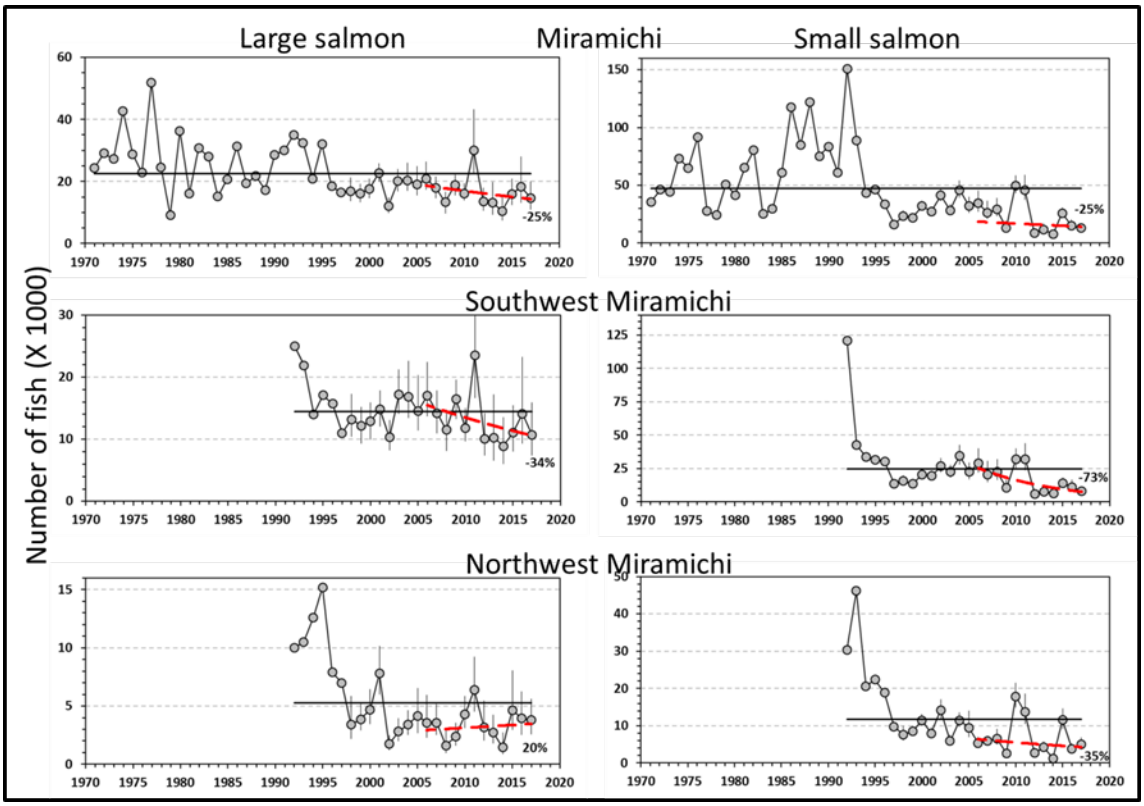

Figure 3. Estimated (median and 5th to 95th percentile range) returns of large salmon (left column) and small salmon (right column) for the Miramichi River for 1971 to 2017 (upper row), the Southwest Miramichi River 1992 to 2017 (middle row), and the Northwest Miramichi River 1992 to 2017 (bottom row).The black horizontal line is the average of the median return estimates of large salmon or small salmon for the available time series. The red dashed line is the trend line (exponential regression) and the corresponding percent change over the twelve year time period (2006 to 2017) are also shown.

Estimated returns for the two main branches of the Miramichi River are available since 1992 (Fig. 3). The returns of large salmon to the Southwest Miramichi River in 2017 were estimated at 10,700 fish (median; percentile range 7,400 to 15,900), whereas small salmon returns were estimated at 8,100 fish (median; percentile range 5,700 to 11,300) (Fig. 3). Returns of both large salmon and small salmon to

the Southwest Miramichi River in 2017 were below 2016 levels and below the average of the median return estimates for each size group over the period 1992 to 2016 (Fig. 3).

The returns of large salmon to the Northwest Miramichi River in 2017 were estimated at 3,800 fish (median; percentile range 2,600 to 5,600), whereas small salmon returns were estimated at 5,000 fish (median; percentile range 3,600 to 6,900) (Fig. 3). Relative to 2016 levels, the return estimates in 2017 represented a decrease for large salmon but an increase for small salmon. Both large salmon and small salmon return estimates in 2017 were below the average of the median return estimates for each size group over the period 1992 to 2016 (Fig. 3).

High catches of small salmon and large salmon at the Cassilis trapnet in the Northwest Miramichi in 2017 did not translate directly into higher returns because the proportion of the total annual returns intercepted at the Cassilis trapnet was the highest of the time series for both size groups (Fig. 4). Similarly, the proportion of the small salmon returns intercepted at the Southwest Miramichi Millertont trapenet in 2017 was the highest of the time series for that facilty (Fig. 4). The proportions of the total returns intercepted at the trapnets are determined in part by discharge conditions which were low in 2017.

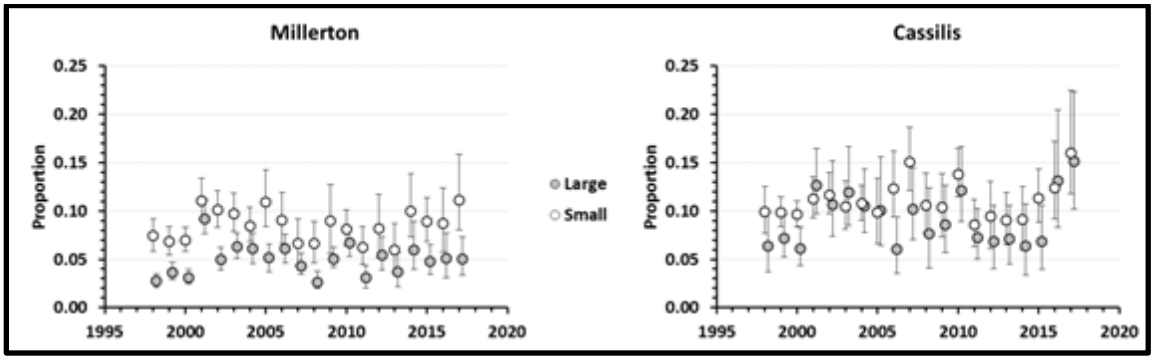

Figure 4. Estimated (median; 5th and 95th percentile error bars) proportions of the annual returns of small salmon and large salmon intercepted at the DFO index trapnet in the Southwest Miramichi at Millerton (left panel) and in the Northwest Miramichi at Cassilis (right panel) during 1998 to 2017.

Over the recent 12 year period, approximately two generations, the estimated returns of large salmon in the Miramichi overall and the Southwest Miramichi have declined by 25% and 34% respectively, while estimated returns of large salmon to the Northwest Miramichi have increased by 20% (Fig. 3). The estimated returns of small salmon have declined in the Miramichi River overall and in each of the main branches, particularly in the Southwest Miramichi (73% decline) (Fig. 3).

Biological characteristics of adult Atlantic Salmon, including mean fork length, proportion female, and eggs per fish for small salmon and large salmon to 2017, are summarized in Figure 5. Considering these biological characteristics, the estimated total eggs in the returns of large and small salmon combined in 2017 were equivalent to 78% of the conservation requirement for the Miramichi River overall, 85% of the conservation requirement for the Southwest Miramichi River, and 63% of the conservation requirement for the Northwest Miramichi River.

With the introduction of the mandatory release of small salmon in the recreational fishery in 2015, losses due to catch and release mortality were assumed to be 0.9% of total returns (3% mortality on catches equivalent to 30% of the small salmon return), identical to the formula for calculating large salmon losses in the recreational fishery since 1984. After accounting for harvests in aboriginal food, social, and ceremonial fisheries and losses from recreational fisheries, eggs from small salmon and large salmon spawners combined were equivalent to 76% of the conservation requirement for the

Miramichi River overall, 83% of the conservation requirement for the Southwest Miramichi River, and 60% of the conservation requirement for the Northwest Miramichi River (Fig. 6).

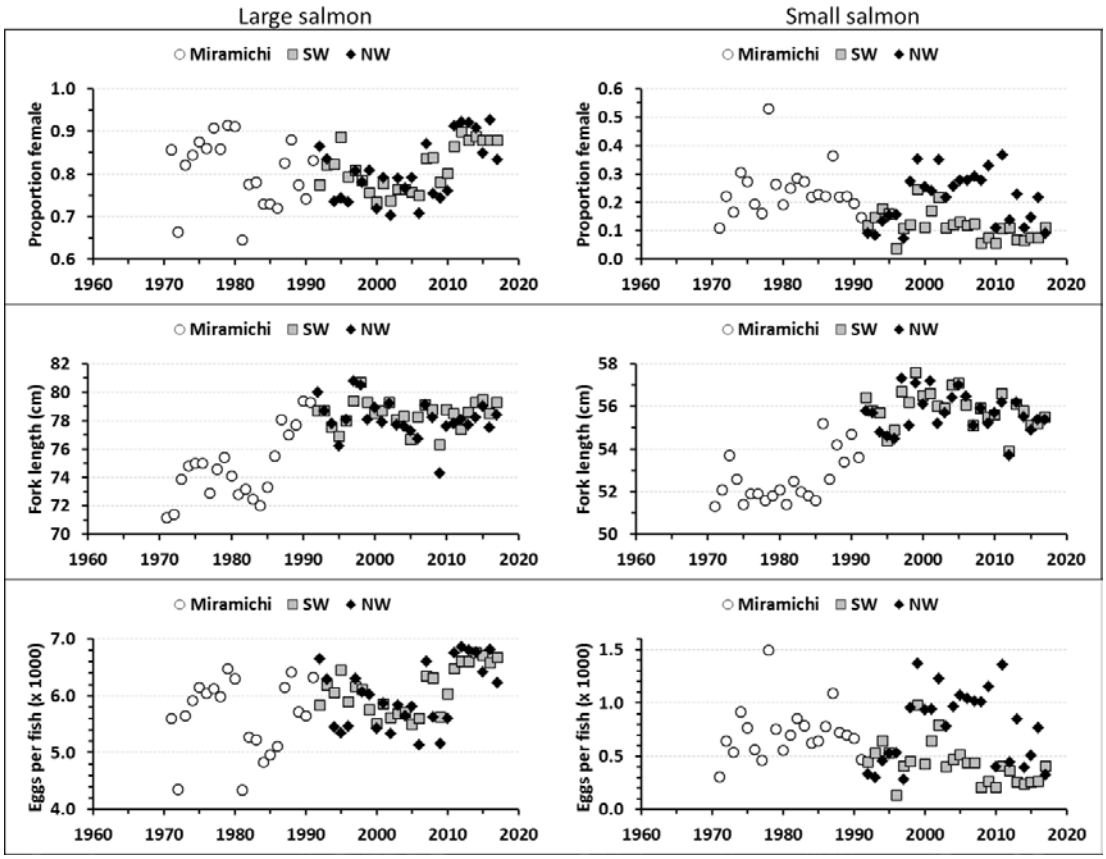

Figure 5. Biological characteristics of Atlantic Salmon by size group (large salmon left panels; small salmon right panels) including proportion female (upper panels), mean length (cm, middle panels), and eggs per fish (lower panels) from the Miramichi River overall (1971 to 1991) and the Southwest and Northwest Miramichi rivers, 1992 to 2017.

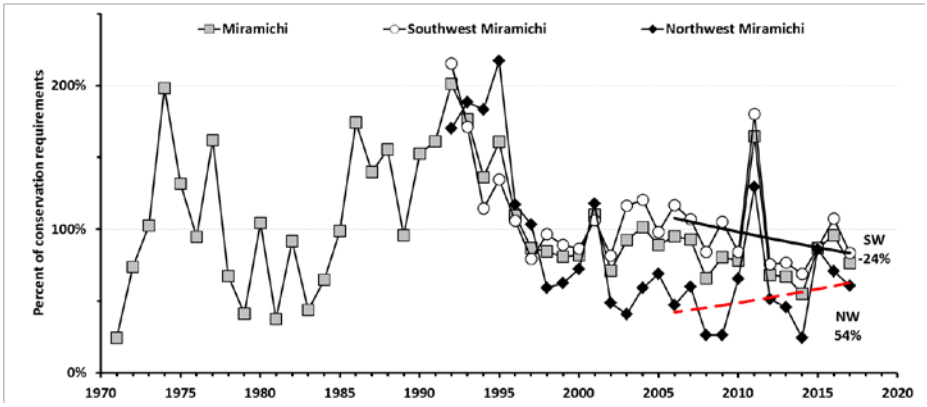

Figure 6. Percentages of the conservation requirements (eggs) attained for small salmon and large salmon spawners combined for the Miramichi River overall (1971 to 2017), the Southwest Miramichi (1992 to 2017) and the Northwest Miramichi (1992 to 2017) rivers. The trend lines (exponential regressions) for the Northwest Miramichi (red) and the Southwest Miramichi (black) and their corresponding percent change over the twelve year time period (2006 to 2017) are also shown.

Conservation requirements for both major branches and the Miramichi River overall were last achieved in 2011 although the Southwest Miramichi exceeded conservation in 2016. The eggs in combined small salmon and large salmon spawners in the Southwest Miramichi River exceeded the conservation requirement in eight of the last 20 years and in three of the last 10 years. The eggs in the combined small salmon and large salmon spawners in the Northwest Miramichi River were sufficient to meet or exceed the conservation requirement in two of the last 20 years and once in the last 10 years (Fig. 6).

Conclusions

Returns of large salmon to the Miramichi River and both major branches in 2017 were lower than 2016 levels and lower than the average returns for the time series in those rivers. Small salmon returns to the Miramichi overall and the Southwest Miramichi were lower in 2017 compared to 2016 and lower than the average return of the time series for those rivers. Small salmon returns to the Northwest Miramichi were improved over levels in 2016 but remained below the average for the time series.

The estimated number of eggs in the returns of large salmon and small salmon combined were insufficient to meet the conservation requirements of the Miramichi River overall or its two main branches. Combined eggs of large salmon and small salmon spawners attained 76%, 83%, and 60% of the conservation requirement for the Miramichi, Southwest Miramichi, and Northwest Miramichi rivers, respectively.

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Sources of information

This Science Response Report results from the Science Response Process of December 19, 2017 on Update of indicators to 2017 of adult Atlantic Salmon for the Miramichi River (NB), Salmon Fishing Area 16, DFO Gulf Region. No additional publications from this process are anticipated.

DFO. 2014. Stock status of Atlantic salmon (*Salmo salar*) in DFO Gulf Region (Salmon Fishing Areas 15 to 18) to 2013. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2014/057.

DFO. 2015a. Update of stock status of Atlantic Salmon (*Salmo salar*) in DFO Gulf Region (New Brunswick Salmon Fishing Areas 15 and 16,) for 2014. DFO Can. Sci. Advis. Sec. Sci. Resp. 2015/008.

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DFO. 2016. Update of stock status of Atlantic Salmon (*Salmo salar*) in DFO Gulf Region (Salmon Fishing Areas 15 to 18) for 2015. DFO Can. Sci. Advis. Sec. Sci. Resp. 2016/018.

DFO. 2017. Update of stock status of Atlantic Salmon (*Salmo salar*) in DFO Gulf Region Salmon Fishing Areas 15 - 18 for 2016. DFO Can. Sci. Advis. Sec. Sci. Resp. 2017/013.

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MPO. 2018. Mise à jour jusqu'en 2017 des indicateurs des adultes du saumon Atlantique de la rivière Miramichi (N.-B.), zone de pêche du saumon 16 de la Région du Golfe du MPO. Secr. can. de consult. sci. du MPO, Rép. des Sci. 2017/043.