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Canadian Science Advisory Secretariat
Newfoundland and Labrador Region | Science Advisory Report 2018/010

STOCK ASSESSMENT OF MONKFISH *(LOPHIUS AMERICANUS)* IN NAFO DIVISIONS 3LNO AND SUBDIVISION 3PS

Image: Monkfish (Lophius americanus, Valenciennes 1837)

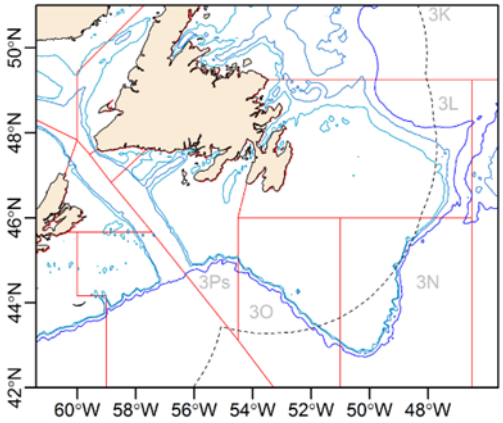

Figure 1. NAFO Divisions 3LNO and Subdivision 3Ps management areas (thin solid lines).

Context:

Monkfish in Northwest Atlantic Fisheries Organization (NAFO) Divisions (Divs.) 3LNO and Subdivision (Sibdiv.)3Ps was last assessed in 2003 (DFO 2003). The present assessment was requested by the Department of Fisheries and Oceans Canada (DFO) Fisheries Management Branch (Newfoundland and Labrador [NL] Region), to provide the Minister with advice that will inform management decisions regarding Monkfish for the 2018 fishing season.

This Science Advisory Report is from the November 1, 2017 Divs. 3LNO and Subdiv. 3Ps Monkfish Stock Assessment. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SUMMARY

- NAFO-reported average landings from Divisions 3LNOPs over 2007-16 were 258 t (171 t by Canada).
- NAFO-reported landings from Divisions 3LNOPs were 160 tons and 374 t in 2015 and 2016 (respectively; 37 t and 89 t by Canada), and predominantly as bycatch from the Witch Flounder-directed trawl fishery.
- DFO-NL Campelen spring survey indices of Divs. 3LNOPs Monkfish abundance fluctuated from 0.9 to 1.7 million fish, and biomass between 3,500 t and 6,500 t in 2007-17. In 2017, the abundance index was 1.0 million fish, and the biomass index was 5,000 t.

- The area occupied by Monkfish remained relatively constant throughout DFO-NL surveys in both spring and fall; found primarily along the shelf edge in Div. 3O and Subdiv. 3Ps, and occasionally along the shelf edge in Div. 3N.
- Recruitment of Age 3 Monkfish in Divs. 3LNOPs over 2014-17 was less than 50% of the 2001-17 time-series' average, and the lowest during this period.
- The relative fishing mortality index for Divs. 3LNOPs peaked during 2002-03, and then remained below the 1996-2016 average since 2007.
- Ecosystem signals observed in Subdiv. 3Ps in recent years indicated that structural changes are occurring, and overall ecosystem productivity may be low. Although the direct impacts of these changes on Monkfish life stages (i.e., pelagic eggs and larvae, bottom-dwelling juveniles and adults) are unknown, they imply that at least some aspects of Monkfish productivity may be affected.
- A proxy limit reference point (LRP) of 2,000 t was accepted for Divs. 3LNOPs Monkfish, based on the geometric mean of DFO-NL Campelen spring surveys over 2007-13.
- The Monkfish biomass index for Divs. 3LNOPs (B_{2017}=5,010 t) was estimated to be 2.5 times larger than the accepted LRP (2,000 t).

INTRODUCTION

Monkfish *(Lophius americanus*, Valenciennes 1837) is distributed in the Northwest Atlantic from Florida (USA) to Cape Chidley, Labrador (Scott and Scott 1988). Though widely dispersed, very limited research has been conducted on this species. Assessments of Monkfish have previously been conducted for the Grand Banks and St. Pierre Bank in NAFO Divisions 3LNO and Subdivision 3Ps (Kulka and Deblois 1996; Kulka and Miri 2001, 2003). Monkfish in Divs. 3LNO and Subdiv. 3Ps constitute one biological stock.

This document provides information on the current status of Monkfish in Divs. 3LNO and Subdiv. 3Ps (Fig. 1), using commercial fisheries and DFO-NL research survey data.

Oceanography and ecosystem Overview

Oceanographic conditions in Div. 3O and Subdiv. 3Ps are influenced by several factors: local atmospheric climate conditions, advection by the Labrador Current from the east and warmer and saltier Gulf Stream waters from the south, and complex bottom topography in the region. The extent of bottom areas where water temperatures exceed 3°C (Monkfish are primarily found in 3-9°C), although close to normal in 2017, has been increasing over the past two decades, and warm slope water intrusions have elevated temperatures to near 10°C in some offshore areas in recent years.

Compared with those in 1998-2017, the spring phytoplankton bloom was observed later, of shorter duration, and reduced in magnitude during 2015-17, while zooplankton biomass was at its lowest level in this time-series.

Ecosystem signals observed in Subdiv. 3Ps in recent years indicated that structural changes are occurring, and overall ecosystem productivity may be low. Although the direct impacts of these changes on Monkfish life stages (i.e., pelagic eggs and larvae, bottom-dwelling juveniles and adults) are unknown, they imply that at least some aspects of Monkfish productivity may be affected.

Fisheries

The status of Monkfish in Divs. 3LNO and Subdiv. 3Ps was first assessed in 1996 (DFO 1996), and later in 2000 (DFO 2000), and 2003 (DFO 2003). Monkfish in Canadian waters was taken only as bycatch in other groundfish-directed fisheries, and was usually discarded at sea until the early 1990s; after which a directed fishery was developed on the Grand Banks as a mixed mobile- and fixed-gear fishery for Monkfish, Thorny Skate (*Amblyraja radiata)*, and White Hake (*Urophycis tenuis*). A precautionary quota of 200 tonnes was adopted in 1995, but discontinued after 1997. Since then, this fishery has been regulated only by gear, restrictions on bycatch of major commercial species and species under moratoria, and fishing season closures.

Commercial fisheries removals of Monkfish in Divs. 3LNO and Subdiv. 3Ps were examined for 1960-2016, using three data sources: NAFO STATLANT-21A landings (1960-2016), as reported by NAFO-member countries; DFO-NL Zonal Interchange File Format (ZIFF) landings (1985-2016), as recorded in logbooks by Canadian fishers operating in Canada's EEZ; and Canadian at-sea fisheries observers' (ASOs) reported catch and discards (1978-2016). It must be noted that Canadian ASOs constitute the sole source of data on total catch (= landings + discards) by species at sea.

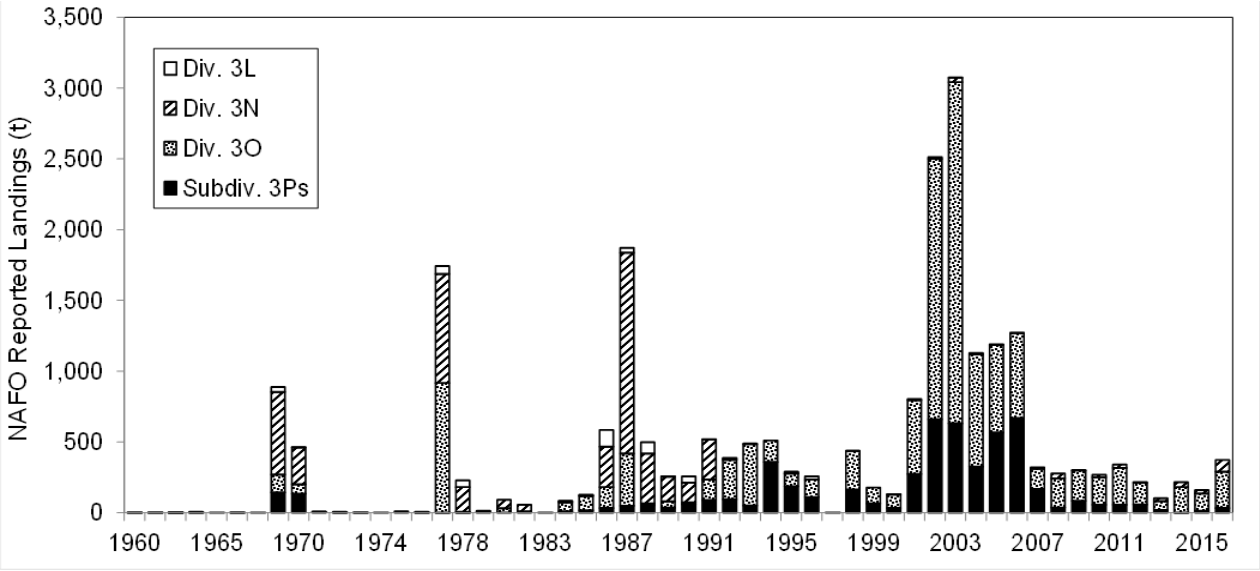

Figure 2. NAFO-reported landings (tonnes) of Monkfish by member countries in Divs. 3LNO and Subdiv. 3Ps, 1960-2016 (STATLANT-21A).

NAFO-reported landings of Monkfish from Divs. 3LNOPs (member countries combined) indicated that there was a very limited directed fishery in 1960-81: annual landings were less than 10 t in most years (Fig. 2). Over 1982-2000, the Monkfish fishery was modest, with annual landings averaging 366 t (of which 181 t was reported by Canada). In 2001-06, average landings increased to 1,664 t (1,568 t by Canada), then declined to 255 t over 2007-14 (198 t by Canada). Monkfish landings were 160 t (37 t by Canada) and 374 t (89 t by Canada) in 2015 and 2016 (respectively). Overall, the majority of NAFO-reported landings were from Div. 3O.

DFO-NL ZIFF-reported landings of Monkfish in Divs. 3LNOPs were almost exclusively caught by gillnets in 1998-2013, then the majority by otter trawls over 2014-16 (Fig. 3). In 2001-12, the Monkfish-directed fishery reported more than 70% of the annual landings. Over 2014-16, Canadian landings were mainly from bycatch fisheries targeting other commercial species such as Atlantic Cod (*Gadus morhua*), Atlantic Halibut (*Hippoglossus hippoglossus*), redfish (*Sebastes* spp.), skates, White Hake, and Witch Flounder (*Glyptocephalus cynoglossus*; Fig. 4).

In 1998-2004, the skate-directed fishery reported the majority of Monkfish landings, then the White Hake fishery in 2006-12, and the Witch Flounder fishery over 2013-16.

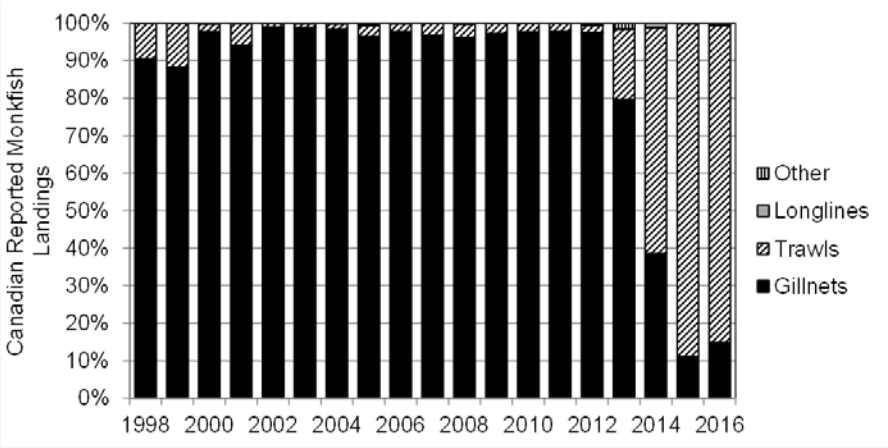

Figure 3. DFO-NL ZIFF-reported Canadian landings of Monkfish by gear in Divs. 3LNO and Subdiv. 3Ps, 1998-2016.

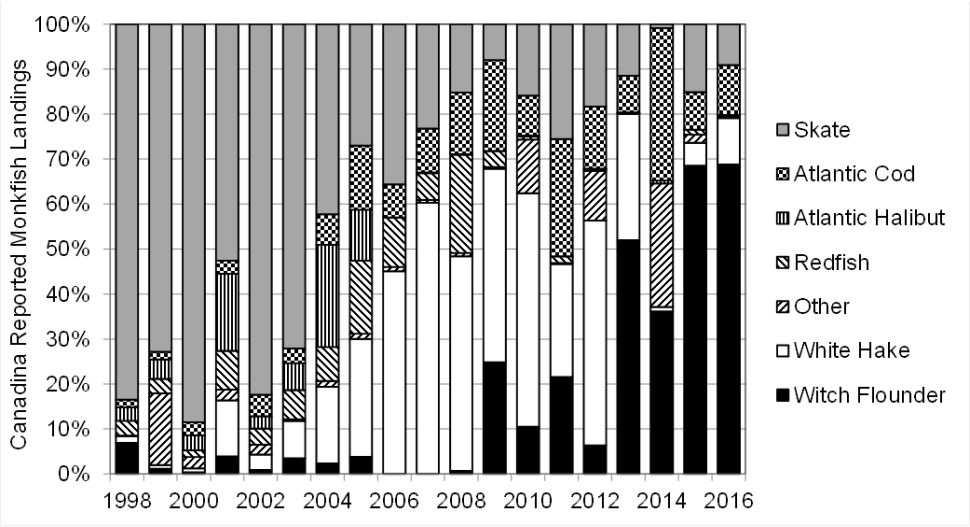

Figure 4. DFO-NL ZIFF-reported landings of Monkfish bycatch by directed species in Divs. 3LNO and Subdiv. 3Ps, 1998-2016.

ASSESSMENT

In Divs. 3LNO over 1973-82 (Yankee trawl; Fig. 5, top-left panel), relative abundance from DFO-NL spring surveys indicated an increasing trend to a peak in 1982. In 1984-95 (Engel trawl), this abundance index fluctuated substantially and reached a peak of 0.4 million fish in 1994. Over 1996-2017 (Campelen trawl), relative abundance fluctuated with a peak in 2003, then appeared to follow a decreasing trend to 0.1 million Monkfish in 2017: its lowest estimate since 1999. Relative biomass (Fig. 5, bottom-left panel) also suggested an increasing trend in Divs. 3LNO over 1973-82, with a peak of 1,231 t in 1982. In 1984-88, this biomass index fluctuated with a peak of 2,370 t in 1988 and a smaller peak in 1994. Over 1996-2017, relative biomass fluctuated along an increasing trend to a peak of 3,797 t in 2013, then appeared to decline to 804 t in 2017: its lowest estimate since 1998.

In Subdiv. 3Ps over 1972-82 (Fig. 5, top-right panel), the abundance index from spring surveys was relatively stable. In 1983-95, relative abundance fluctuated around four peaks of approximately 0.4 million fish, then appeared to decrease to an average of 0.2 million over 1992-95. Over 1996-2016, relative abundance fluctuated with a peak of 1.1 million Monkfish in 2010.This index reached a smaller peak of 0.9 million fish in 2017. Relative biomass (Fig. 5, bottom-right panel) suggested a decreasing trend in Divs. 3LNO over 1972-82, with a peak of 1,221 t in 1975 and its lowest estimate of 218 t in 1982. In 1983-95, this biomass index fluctuated substantially with its lowest estimate of 569 t in 1993. Over 1996-2016, relative biomass fluctuated with a peak of 3,445 t in 2007. This index reached its largest peak of 4,207 t in 2017. It must be noted that Subdiv. 3Ps estimates in isolation do not represent any changes or trends in indices for the entire Divs. 3LNOPs Monkfish stock.

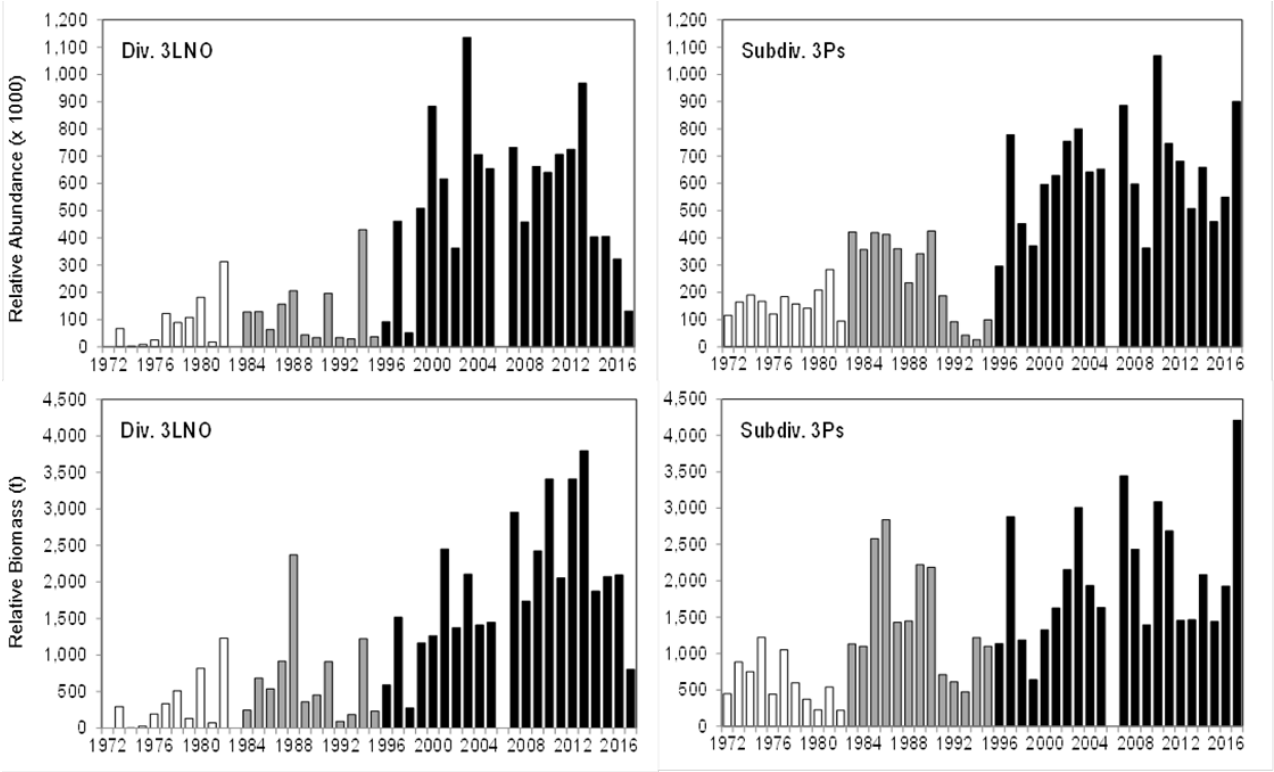

Figure 5. Annual estimates of abundance (top panels) and biomass (tonnes; bottom panels) for Monkfish from DFO-NL spring research surveys in Divs. 3LNO (left column) and Subdiv. 3Ps (right column), 1972-2017. Note that there is no conversion factor between Yankee (white columns), Engel (gray columns), and Campelen (black columns) time-series. Most of Subdiv. 3Ps and depths >103 m in Divs. 3NO were not surveyed in spring 2006, due to Canadian research vessels' mechanical difficulties.

In Divs. 3LNOPs (i.e., the biological stock) over 1996-2017, the abundance index from spring surveys appeared to follow an increasing trend to a peak of almost 2 million Monkfish in 2003, then fluctuated along a decreasing trend to approximately 0.9 million fish in 2015-16 (Fig. 6, left panel). In 2017, abundance was 1.0 million fish. The biomass index indicated an increasing trend to a peak of 6,500 t in 2010, then decreased to a 2014-16 average of 3,800 t (Fig. 6, right panel). In 2017, biomass was estimated to be 5,000 t.

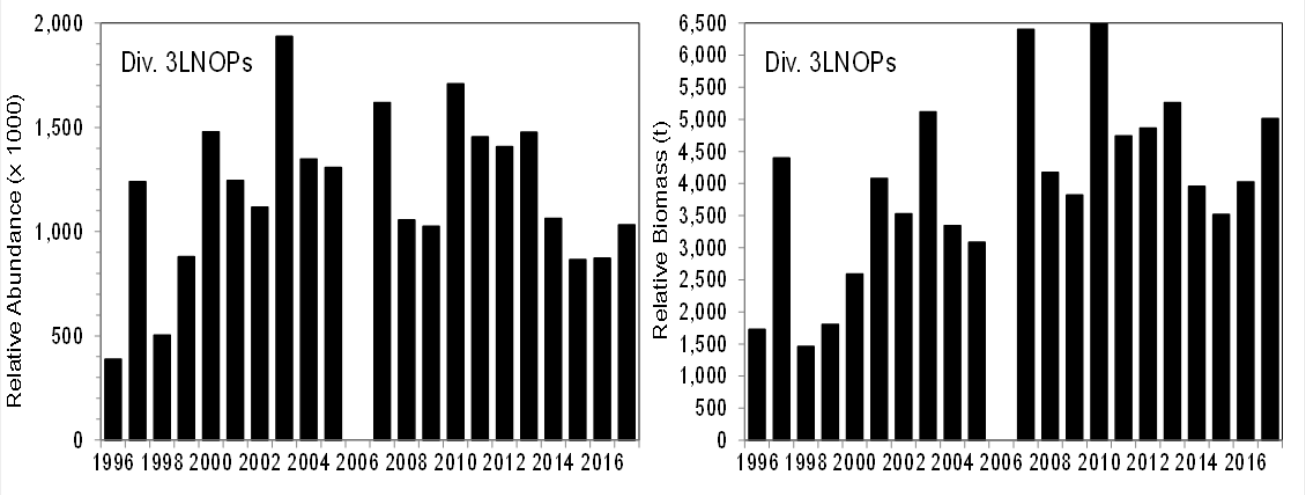

Figure 6. Annual estimates of abundance (left panel) and biomass (tonnes; right panel) for Monkfish from DFO-NL Campelen spring surveys in Divs. 3LNOPs, 1996-2017. Most of Subdiv. 3Ps and depths >103 m in Divs. 3NO were not surveyed in spring 2006, due to Canadian research vessels' mechanical difficulties.

Catch rates in DFO-NL spring surveys of Div. 3LNO indicated peaks in mean number of 0.06/tow and mean weight of 0.23 kg/tow in 1982 (Yankee), 0.08 fish and 0.21 kg in 1994 (Engel), 0.11 fish and 0.20 kg in 2003 (Campelen), and 0.09 fish and 0.37 kg in 2013 (Fig. 7, left column). Over 2014-17, mean number and mean weight per tow decreased to an annual average of 0.02 Monkfish and 0.13 kg, respectively.

Catch rates in Subdiv. 3Ps showed decreasing trends from 1975-1982 (Yankee; Fig. 7, right column). In 1983-95 (Engel), mean number per tow fluctuated around four peaks of approximately 0.32 fish/tow, while mean weight reached a peak of 2.17 kg in 1986; both followed a decreasing trend afterwards. Over 1996-2016 (Campelen), mean number per tow fluctuated along an increasing trend to a peak of 0.39 fish in 2010, and mean weight to a peak of 1.27 kg in 2007; both then followed a decreasing trend. While adundance in Subdiv. 3Ps was estimated at 0.33 fish/tow in 2017, biomass reached its largest peak of 1.47 kg per tow in this time-series.

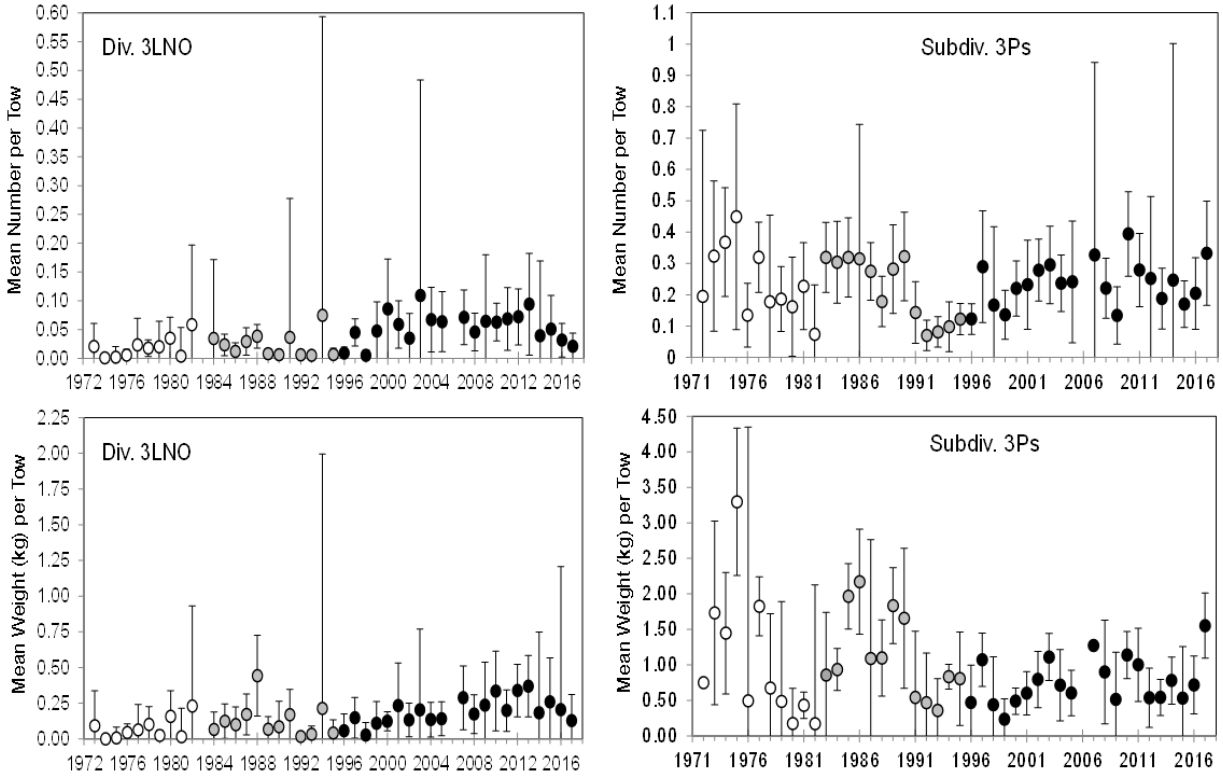

Figure 7. Monkfish mean numbers (top panels) and mean weights (kgs; bottom panels) per tow (+/- 95% CI) from DFO-NL spring surveys in Divs. 3LNO (left column) and Subdiv. 3Ps (right column), 1972-2017. Note that there is no conversion factor between Yankee (white circles), Engel (gray circles), and Campelen (black circles) time-series. Most of Subdiv. 3Ps and depths >103 m in Divs. 3NO were not surveyed in spring 2006, due to Canadian research vessels' mechanical difficulties. Bounds of some error bars in the panels extend below the graph limits.

In Divs. 3LNO over 1990-94 (Engel trawl; Fig. 8, top panel), relative abundance from DFO-NL fall surveys appeared to be stable at low levels, averaging 0.1 million Monkfish. Over 1995-2016 (Campelen trawl), this index fluctuated along an increasing trend to peaks of approximately 1.0 million Monkfish in 2007-08, then seemed to follow a decreasing trend to 0.1 million fish in 2016: its lowest estimate since 1998. Relative biomass (Fig. 8, bottom panel) also appeared to be stable at low levels over 1990-94, averaging 405 t. In 1995-2016, this index fluctuated substantially along an increasing trend to a peak of 3,948 t in 2008, and then followed a decreasing trend to 473 t in 2016: its lowest estimate since 1999. It must be noted that Subdiv. 3Ps is not surveyed in the fall.

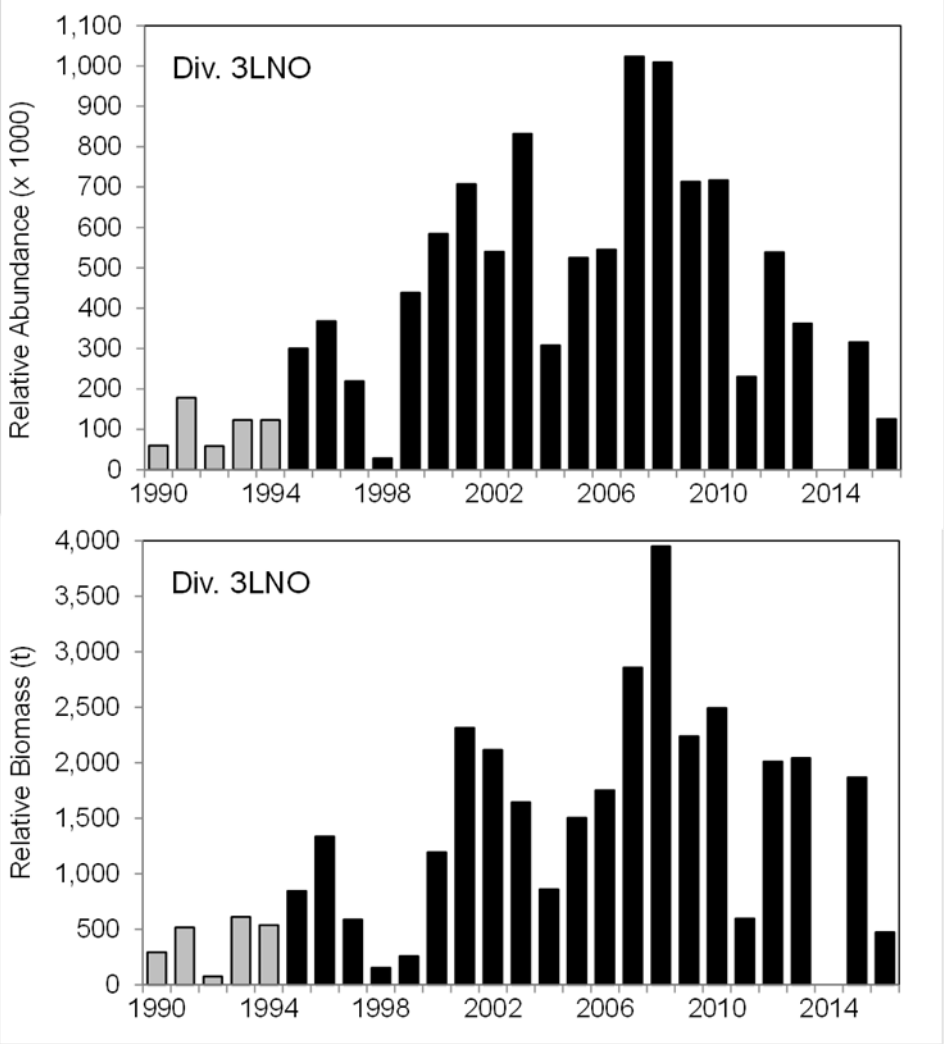

Figure 8. Annual estimates of abundance (top panel) and biomass (tonnes; bottom panel) for Monkfish from DFO-NL fall research surveys in Divs. 3LNO, 1990-2016. Note that there is no conversion factor between Engel (gray columns), and Campelen (black columns) time-series. Deep strata of Divs. 3NO were not surveyed in 2003, 2004, 2006, 2008, and none of Divs. 3NO was surveyed in 2014.

Geo-referenced mean numbers per tow from DFO-NL spring surveys were used to assess the spatial distribution of Monkfish in Divs. 3LNOPs. Distributions of this species over 2013-17 were consistent with historic data; indicating that Monkfish in Newfoundland and Labrador waters were found primarily along the shelf edge in Div. 3O and Subdiv. 3Ps, and occasionally along the shelf edge in Div. 3N (Fig. 9).

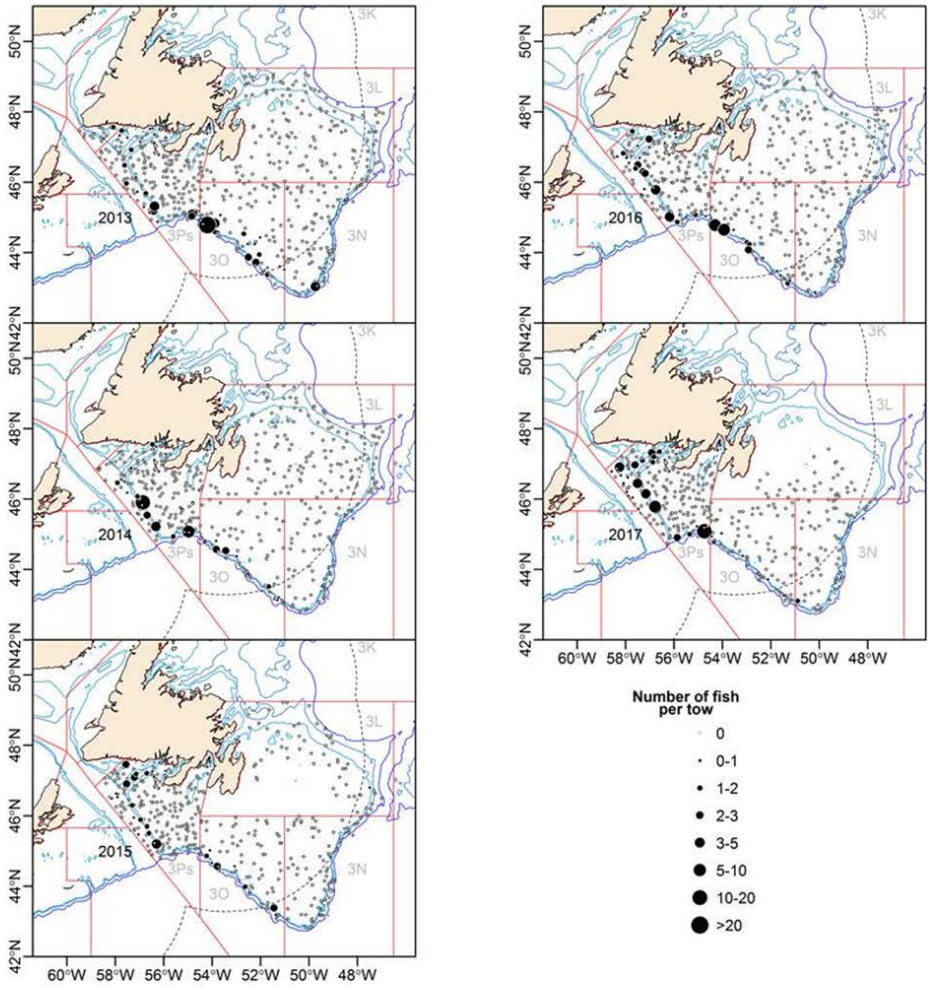

Figure 9. Distribution of Monkfish (mean numbers per tow) in Divs. 3LNOPs, based on DFO-NL spring surveys in 2013-17.

In DFO-NL spring surveys, Monkfish are not aged; therefore, a length proxy from research conducted on the Northeastern USA population (Richards et al. 2007) was applied to Divs. 3LNOPs survey length measurements. The number of Monkfish 21-30 cm was assumed to be an index of Age 3 fish. Monkfish enter the directed fishery at 40+ cm; therefore, the number of Age 3 Monkfish represents fish entering the following season's fishery. Age 3 recruitment was large in 2005 and less so in 2010, but over 2014-17 was less than 50% of its 2001-17 average, and the lowest in this time-series (Fig. 10).

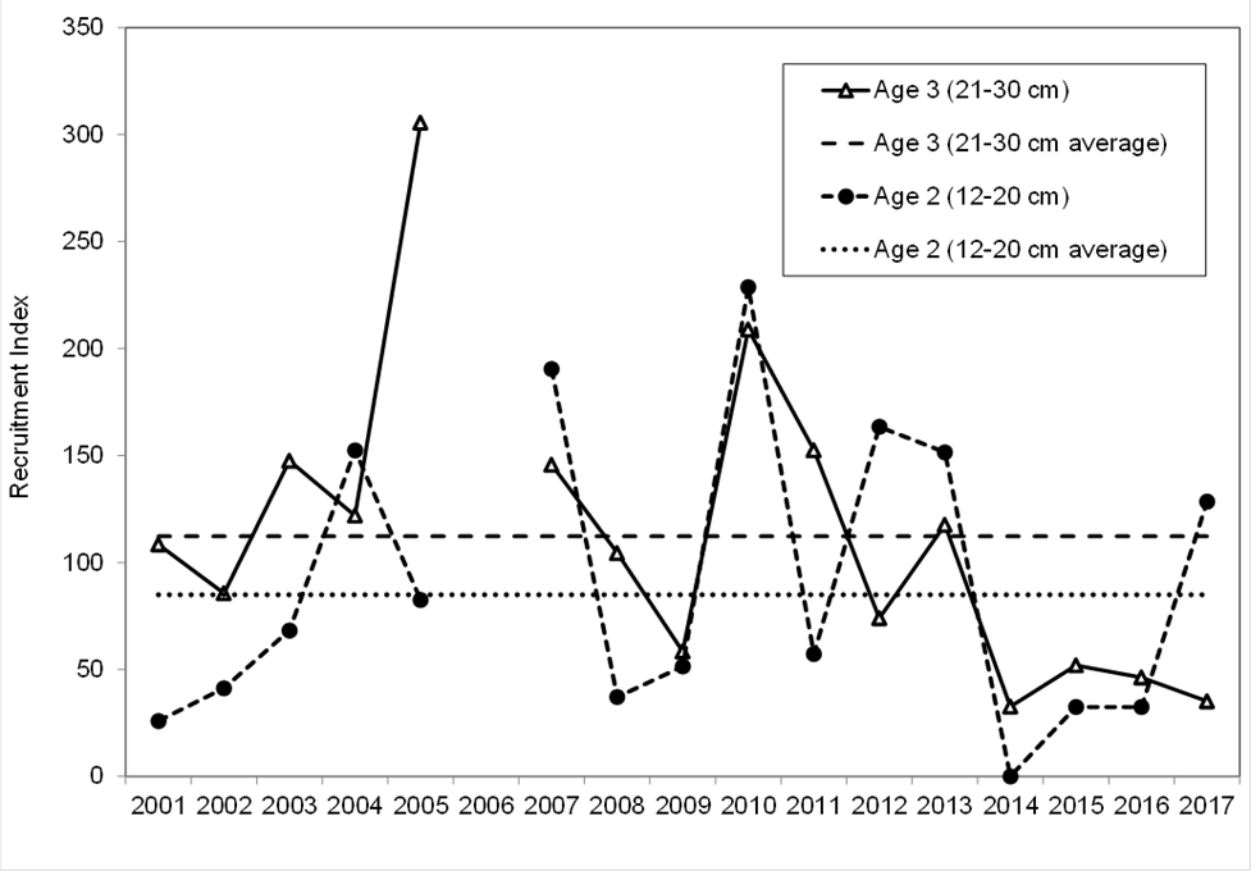

Figure 10. Monkfish recruitment index for Age 3 males and females (combined) from DFO-NL Campelen spring surveys in Divs. 3LNO and Subdiv. 3Ps, 2001-17. Estimates from 2006 are not shown, since survey coverage in that year was incomplete.

Estimates of relative fishing mortality (Relative F = NAFO-reported landings/DFO-NL spring survey biomass index) were calculated for Monkfish in Divs. 3LNO and Subdiv. 3Ps. The Relative F index for Divs. 3LNO peaked in 1998 at 1.00 and 2002-03 at 1.26, then decreased and remained below its 1996-2016 average index of 0.30 since 2007 (Fig. 11, top panel). For Subdiv. 3Ps, Relative F peaked in 2002 at 0.31 and 2005 at 0.35, then decreased and remained below its 1996-2016 average of 0.10 since 2007 (Fig. 11, bottom panel).

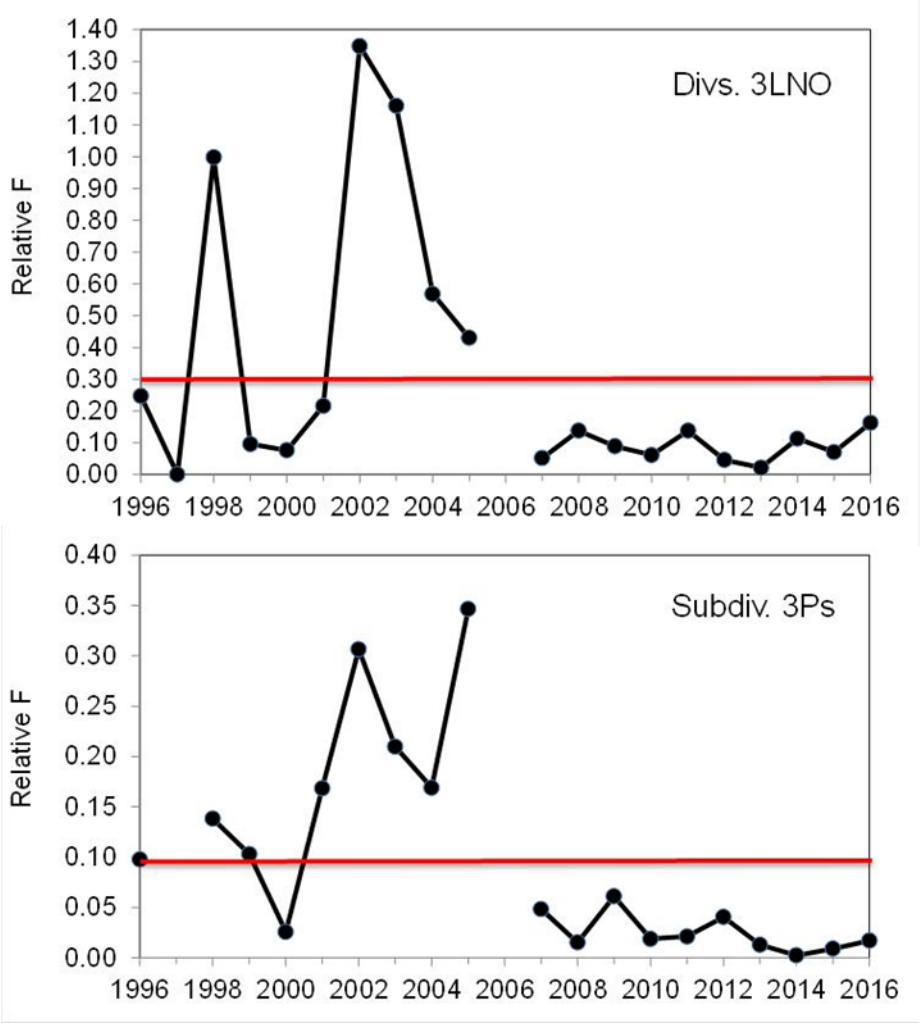

Figure 11. Relative F index (=NAFO-reported commercial landings/DFO-NL Campelen spring survey biomass) for Monkfish in Divs. 3LNO (top panel) and Subdiv. 3Ps (bottom panel), 1996-2016. Thick horizontal line depicts the average over these years. Note that most of Subdiv. 3Ps was not surveyed in 2006, due to Canadian research vessels' mechanical difficulties.

Using the DFO-NL Campelen spring survey in Divs. 3LNOPs, various proxies for Monkfish biomass at maximum sustainable yield (B_{MSY}) were derived as geometric means using:

1. the entire Campelen spring survey time-series (1996-2017);
2. a period of high productivity (successive years of high stock biomass; 2007-13);
3. the highest annual biomass estimate (B_{MAX}); and
4. the two highest biomass estimates.

These proxies were then used to calculate probable values for limit reference points (LRPs); resulting in B_{MSY} proxies ranging from 3,706 t to 6,448 t, and LRPs of 1,430 t to 2,579 t (Fig. 12). A proxy LRP of 2,000 t was then accepted for Divs. 3LNOPs Monkfish, based on the geometric mean of DFO-NL Campelen spring surveys in 2007-13.

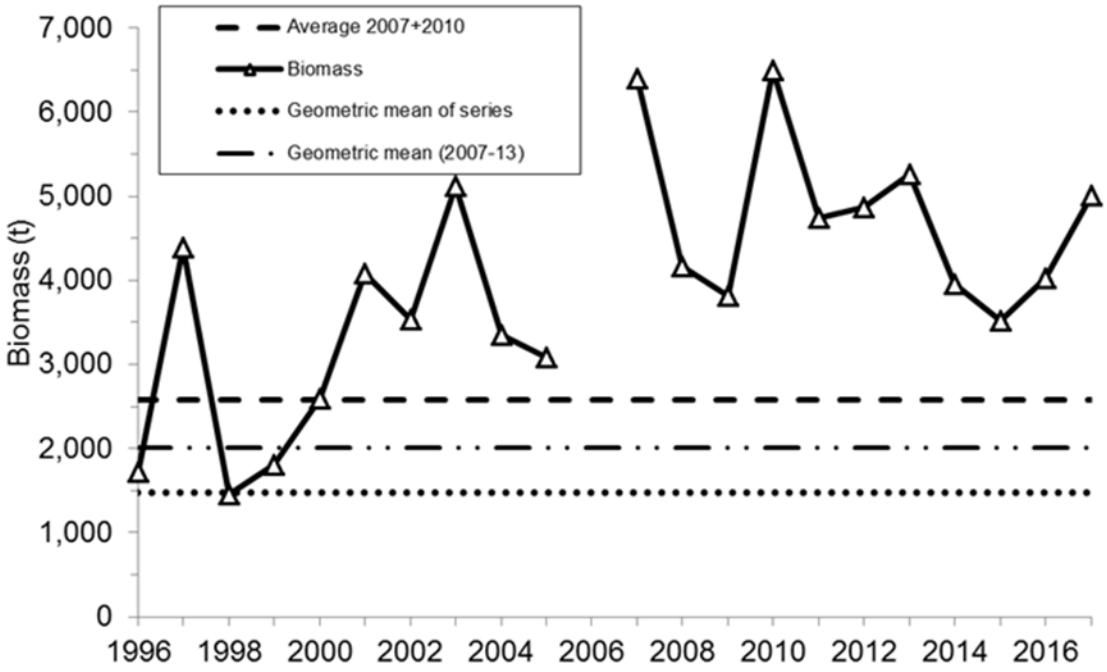

Figure 12. Empirical reference points (40% B_{msy}) for Divs. 3LNOPs Monkfish, based on proxy B_{msy} estimates using the DFO-NL Campelen spring survey biomass index, 1996-2017.

Sources of Uncertainty

- Discarding at sea of Monkfish bycatch remains unreported or very poorly reported in Canadian and other fisheries. Canadian at-sea fisheries observers constitute the sole source of data on total catch (= landings + discards) by species at sea. However, there is very low at-sea observer coverage in most Canadian Atlantic fisheries; thereby grossly underestimating fishery impacts on this stock, and preventing at-sea collections of important biological data on Monkfish (length, weight, sex, maturity, otoliths).
- Monkfish age data are not available from DFO-NL research surveys. In addition, data on length, weight, and maturity of Monkfish in DFO-NL survey catches are incomplete.
- Although recruitment of Divs. 3LNOPs Monkfish was large in 2005 and less so in 2010, this index over 2014-17 was less than 50% of the 2001-17 average, and the lowest in this time-series.
- Ecosystem signals observed in Subdiv. 3Ps in recent years indicated that structural changes are occurring, and overall ecosystem productivity may be low. Although the direct impacts of these changes on Monkfish life stages (i.e., pelagic eggs and larvae, bottom-dwelling juveniles and adults) are unknown, they imply that at least some aspects of Monkfish productivity may be affected.
- Impacts of anthropogenic activities (e.g., marine plastics pollution, seismic surveys, oil and gas drilling, oil pollution) and climate change (i.e., increasing ocean temperatures, decreasing salinities, decreasing marine dissolved oxygen) on Monkfish life stages and their habitats remain unknown.

CONCLUSIONS AND ADVICE

Given that recruitment for Divs. 3LNOPs Monkfish over 2014-17 was less than 50% of the 2001-17 average (and the lowest in this time-series), commercial fishing pressure should be regulated by a TAC set at a level that will allow survival and growth to maturity of larger year-classes. This strategy (coupled with enforcement) is crucial to rebuilding this stock; especially given that their lowest Divs. 3LNO abundance and biomass indices in both spring and fall surveys were seen in 2017. In addition, if increased landings result from the increasing commercial interest in harvesting Monkfish due to declining stocks of other groundfish and shellfish in this region, inhibitive pressures on the Divs. 3LNOPs stock may be further exacerbated.

In 2017, the Monkfish biomass index for Divs. 3LNOPs (5,010 t) was estimated to be 2.5 times larger than the accepted limit reference point of 2,000 t.

In the absence of a TAC, regulations that limit the amount of Monkfish bycatch for other groundfish-directed fisheries in Canada's EEZ could also be implemented.

Given that Canadian at-sea fisheries observers constitute the sole source of data on total catch (= landings + discards) by species at sea, annual observer coverage of Canadian Monkfish-directed and bycatch fisheries should be increased to improve the reliability and representativeness of estimates of total removals of this species due to fishing, and allow at-sea collections of important biological data on Monkfish (length, weight, sex, maturity, otoliths).

A five-year assessment schedule is recommended for Divs. 3LNOPs Monkfish. Although more frequent updates on this stock may be required as a consequence of an ongoing (but greatly reduced) Canadian Monkfish-directed gillnet fishery, the Canadian Witch Flounder trawl fishery (which more than doubled its bycatch landings of Monkfish in 2016), and renewed interest in the Canadian Thorny Skate fishery (which historically landed 50-90% of reported Monkfish bycatch), the annual review of DFO-NL research survey data (Rideout et al. 2017) should mitigate any negative outcomes. A full assessment should be triggered if its major population indicator (i.e., DFO-NL spring survey biomass index) statistically changes by more than two standard deviations. This re-assessment may result in revised landings advice for Monkfish-directed and bycatch fisheries. Furthermore, interim-year assessments should also be triggered by an increase in annual landings of two standard deviations above the 2001-to-current average landings - without a significant, concomitant positive change in the DFO-NL spring survey biomass index for this species.

SOURCES OF INFORMATION

This Science Advisory Report is from the November 1, 2017 NAFO Divs. 3LNO and Subdiv. 3Ps Monkfish Stock Assessment. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

DFO. 1996. Monkfish in Divisions 3L, 3N, 3O and 3Ps. DFO Science Stock Status Report 96/89E. 3 p.

DFO. 2000. Monkfish (*Lophius americanus*) in NAFO Divisions 3L, 3N, 3O and Subdivision 3Ps. DFO Sci. Stock Status Report A2-20 (2000). 4 p.

DFO. 2003. Monkfish (*Lophius americanus*) in NAFO Divisions 3L, 3N, 3O and Subdivision 3Ps. DFO Sci. Stock Status Report 2003/045. 5 p.

Kulka, D.W., and Deblois, E.M. 1996. Non traditional groundfish species on Labrador Shelf and Grand Banks – Wolffish, Monkfish, White Hake and Winter Flounder. DFO Atl. Fish. Res. Doc. 96/97. 49 p.

Kulka, D.W., and Miri, C.M. 2001. The status of Monkfish (*Lophius americanus*) in NAFO Divisions 2J, 3K, 3L, 3N, 3O and Subdivision 3Ps. DFO Atl. Fish. Res. Doc. 2001/004. 42 p.

Kulka, D.W., and Miri, C.M. 2003. The status of Monkfish (*Lophius americanus* Valenciennes 1837; Lophiidae) on the Grand Banks, NAFO Divisions 3L, 3N, 3O, and Subdivision 3Ps. DFO Can. Sci. Advis. Secr. 2003/100. 67 p.

Richards, A., Nitschke, P., Cadrin, S., Rago, P.,and Maguire, J.-J. 2007. Population Assessment of Monkfish (Lophius americanus) in the Northeastern USA. ICES CM 2007/K:15. 42 pp.

Rideout, RM., Power, D., Ings, D.W., Wheeland, L. and Healey, B.P. 2017. Canadian multi-species bottom trawl surveys in NAFO subarea 2 + Divisions 3KLNO: Vessel performance, catch distribution and survey biomass trends of key finfish resources with emphasis on 2016. NAFO SCR 17/044. Serial Number N6700.

Scott, W.B., and Scott, M.G. 1988. Atlantic Fishes of Canada. Can. Bull. Fish. Aquat. Sci. 219: 731 p.

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