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Canadian Science Advisory Secretariat
Maritimes Region **Science Response 2021/016**

STOCK STATUS OF AMERICAN LOBSTER (*HOMARUS AMERICANUS*) IN LOBSTER FISHING AREAS 27-32 FOR 2019

Context

The scientific basis for assessing the status of American Lobster (*Homarus* americanus) in Lobster Fishing Areas (LFAs) 27-33 was examined at a framework meeting in January 2018, followed by an assessment of the status of the Lobster resources in LFAs 27-32 in February 2019. This update applies a suite of indicators from the 2018 framework to the stock status up to the end of the 2019 season wherever possible. Primary stock status indicators for Lobster in LFAs 27-32 meet the intent of the Department of Fisheries and Oceans (DFO) precautionary approach and allow for the evaluation of stock status.

This Science Response Report results from the Science Response Process of February 11th, 2020, on the Stock Status Update for American Lobster in Lobster Fishing Areas (LFAs) 27-32.

Background

Description of the Fishery

The commercial fishery for American Lobster has been active for over 100 years in LFAs 27-32. Lobster Fishing Areas (LFAs) 27-32 cumulatively cover 62,800 km2 from Cape Breton to Hartland Point. Although the LFAs extend out to 92 km (50 nautical miles), colder water temperatures with increasing depth generally limit fishing to 5 km off shore in northern Cape Breton and to within 20 km from shore in the south. The fishery is effort controlled, with restrictions on the number of licences, the number of traps per licence (250 in LFA 28-32 or 275 in LFA 27), the minimum legal size (MLS) (82.5 mm in LFA 27, 30-32 and 84 mm in LFAs 28 and 29), and the retention of berried females (Cook et al. 2020).

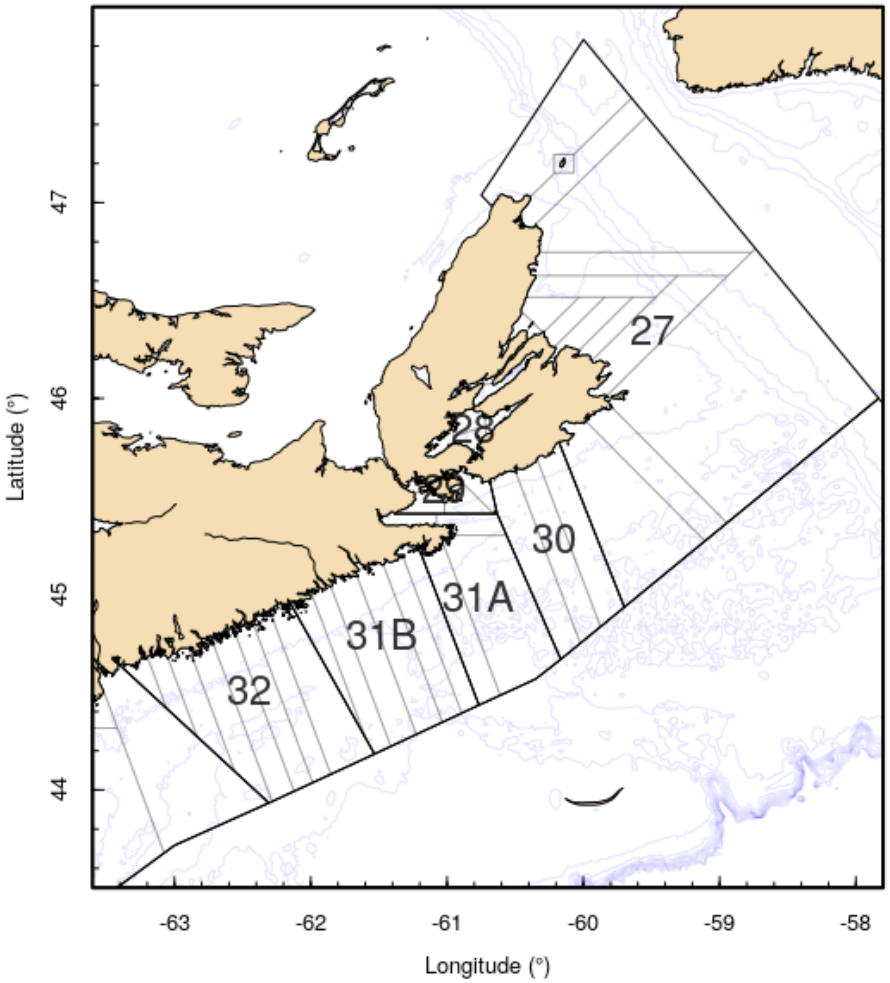

Figure 1. Map of Lobster Fishing Areas 27-32 with logbook reporting grids outlined in grey.

Analysis and Response

Indicators of Stock Status

The status of the Lobster stocks in LFAs 27-32 are assessed using primary, secondary, and contextual indicators. This update will include the primary indicators that are used to define stock status in relation to reference points defined in Cook et al. (2020), and secondary indicators that display time series trends but do not have reference points. The data sources available for establishing indicators for LFAs 27-32 are primarily fishery dependent. Commercial logbooks report information on date, location (grid), effort, and estimated catch.

Primary Indicators

In LFAs 27 and 29-32, there are two primary indicators: one to define stock status and one to describe the level of fishing pressure. Both indicators are compared to reference points. Due to the lack of data for LFA 28, it was not possible to estimate the primary indicator to describe the level of fishing pressure. The primary indicator for describing stock status is the commercial

Catch Per Unit Effort (CPUE). Fishing pressure is described using an exploitation index estimated from the Continuous Change in Ratio (CCIR) method (Claytor and Allard 2003).

Stock Status: Catch Per Unit Effort

In LFAs 27-32, the time series of commercial catch rates comprise two data sources: (1) voluntary logbooks, which began in the 1980s and continued until 2013; and (2) mandatory log books, which have been in place since the mid-2000s and provide a more complete data set to evaluate changes in catch rates (Tremblay et al. 2012). In years where both voluntary and mandatory logbooks were available, the magnitude and trends over time were similar (Tremblay et al. 2013); both datasets were used as a continuous time series. The combined catch rate data series from 1990–2016 was used to define the Upper Stock Reference (USR) and Limit Reference Point (LRP). This period represents both low and high productivity time periods and covers approximately 2 generations. The median of this time series was used as a proxy of biomass at maximum sustainable yield (B_{MSY}). Following the recommendations of DFO (2009), the USR and LRP were set to 80% and 40% of the B_{MSY} proxy. The 3-year running median is used to compare the commercial catch rates to the USR and LRP. This value will dampen the impact of any inter-annual variability, which may occur due to factors outside of changes in abundance.

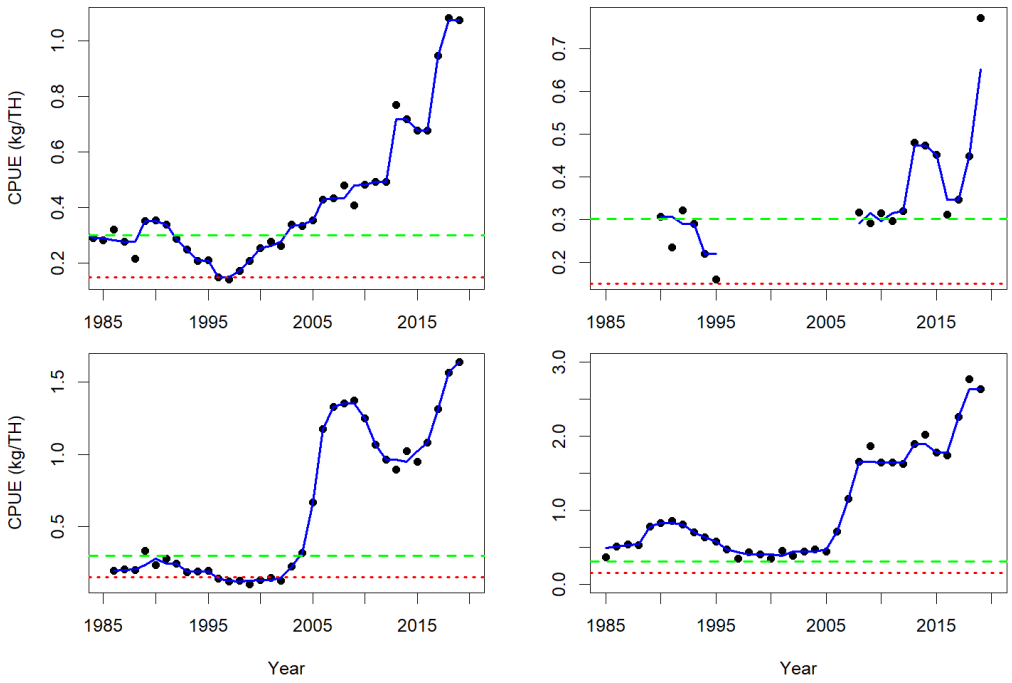

Figure 2. Time series of commercial catch rates (black points), along with the 3-year running median (solid blue line). The horizontal lines represent the Upper Stock Reference (dashed green line) and Limit Reference Point (dotted red line).Top row: left–LFA 27, right–LFA 28. Bottom row: left–LFA 29, right–LFA 30. Note: Different scales used on y-axis.

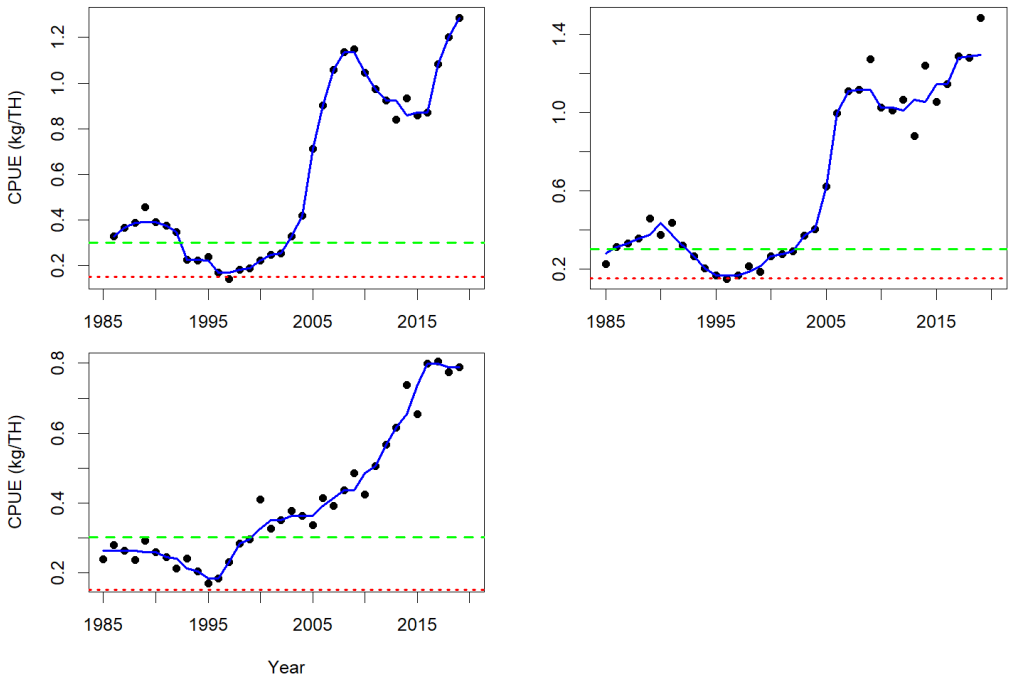

Figure 3. Time series of commercial catch rates (black points), along with the 3-year running median (solid blue line). The horizontal lines represent the Upper Stock Reference (dashed green line) and Limit Reference Point (dotted red line).Top row: left–LFA 31A, right–LFA 31B. Bottom row: left–LFA 32. Note: Different scales used on y-axis.

CPUE trends for LFA 27 indicate a constant increase in biomass since a low in 1997, with dramatic increases in the last 3 years. In LFA 28 CPUE continues to rise after a dip in 2016. CPUE for LFA 29 has been rising since 2016 after a dip between 2011 and 2016. The trend in CPUE for LFA 30 had continued to increase since 2016. In LFA 31A, the trend in CPUE has increased since 2016 and is currently at the highest it has ever been for the area. CPUE increases began in 2004 in LFA 31B and it continues to rise in 2019. LFA 32 has experienced a steady increase in CPUE since an extreme low in 1995. For all LFAs from 27-32, CPUE is well above the USR and LRP, and CPUEs are among the highest levels in the time series.

Fishing Pressure: Continuous Change In Ratio

The CCIR method is used as an indicator of fishing pressure. It is based on recruitment trap data and reflects trends in exploitation in the inshore portion of the LFAs, where the majority of the fishery occurs. It provides indices of exploitation by modelling the change in proportion of two monitored components of the population, consisting of a reference (non-exploited) component and an exploited component. The premise of this method is the proportion of reference individuals within the population will increase with the cumulative removals from the exploitable component (Claytor and Allard 2003). This approach does not rely directly on fishery-dependent landings data, thus, the CPUE indicator is based on a time series independent of the time series on which the CPUE indicator is based.

The CCIR method will not be included in this update as 2019 data were not yet available. The CCIR models up to 2018 are annually variable; however, the 3-year running median has indicated exploitation has been relatively stable in all LFAs, where data are available. The most

recent calculation of CCIR indicators can be found in the Assessment of Lobster in LFA 27-32 (DFO 2020).

Secondary Indicators

Secondary indicators represent time-series trends that are tracked individually, without defined reference points. The secondary indicators for LFAs 27-32 are landings and total effort, as well as the recruitment trap sub-legal and legal catch-rate series.

Landings and Effort

Levels of commercial landings are related to population biomass as fishery controls are input (effort controls) rather than output based (total allowable catch). There are many factors that can affect this relationship, including changes in levels of fishing effort, catchability (including the effects of environment, gear efficiency), Lobster size distribution, and the spatial overlap between distribution of Lobster and effort.

Fishing effort can be used as a proxy for fishing pressure. It is an indicator of fisheries performance as changes in landings can be due to changes in commercial size biomass or fishing effort, or both. Fishing effort, recorded as the number of Trap Hauls (THs), in the Lobster fishery is controlled by fishing season length, trap limits, and a limited number of fishing licences. Consequently, there is a maximum fishing effort that can be deployed; however, this maximum is never met as factors such as weather conditions, seasonally variable catch rates, and fishing partnerships limit the total number of THs. Total fishing effort is calculated from mandatory logbooks but, prior to their widespread adoption effort, was calculated from CPUE and total catch.

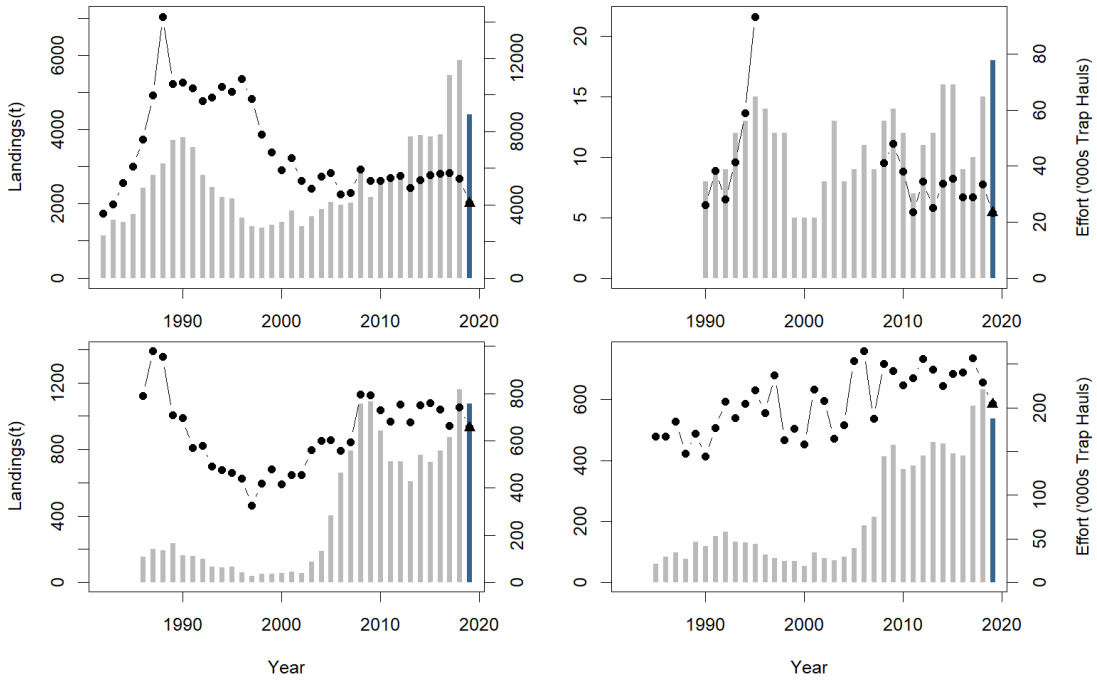

Figure 4. Time series of landings in tonnes (grey bars) and effort (line with points). Data for 2019 are incomplete (blue bar, triangle). Note: Different scales used on both x and y-axis. Top row: left–LFA 27, right–LFA 28. Bottom row: left–LFA 29, right–LFA 30. Note: Different scales used on y-axis.

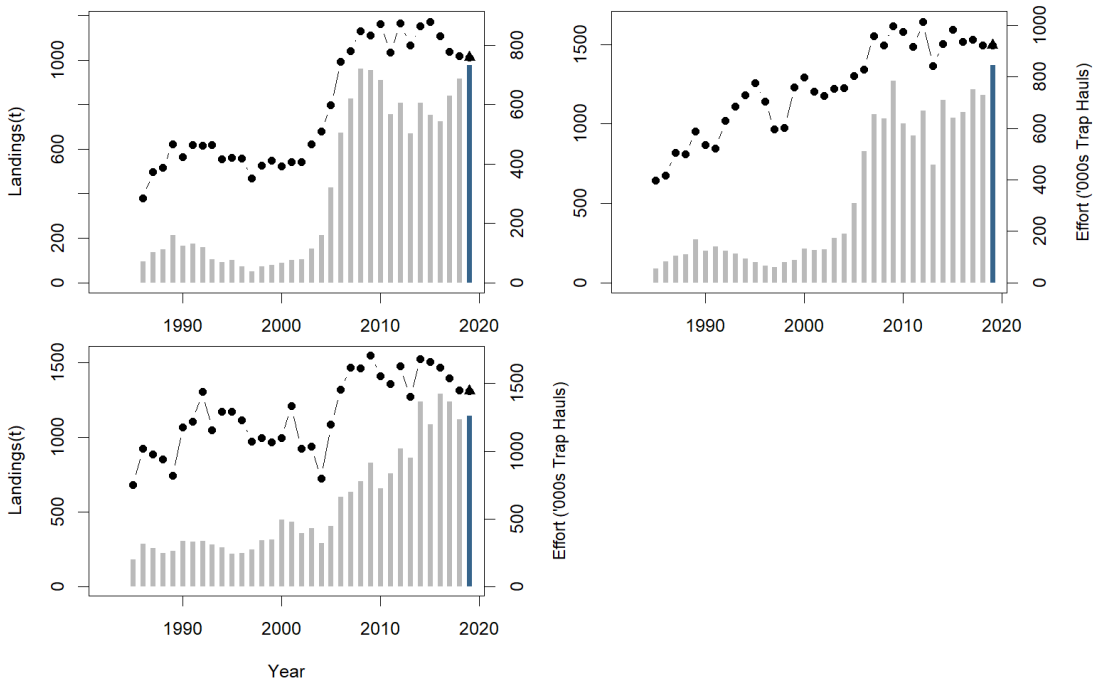

Figure 5. Time series of landings in tonnes (grey bars) and effort (line with points). Data for 2019 are incomplete (blue bar, triangle). Note: Different scales used on both x and y-axis. Top row: left–LFA 31A, right–LFA 31B. Bottom row: left–LFA 32. Note: Different scales used on y-axis.

The 2019 landings for LFAs 27-32 are preliminary (as of January 15th,2020) as there remains outstanding logbooks, and 2019 landings in LFA 27 do not include information from the Gulf. Landings in LFA 27 are on track with recent years, with 2018 being an all-time high for the area. In LFA 28, even with incomplete data, the landings for 2019 already exceed recent years. Landings in LFA 29 and 30 remain comparable to previous years with 2018 being an all-time high for both areas (Figure 4). Landings in LFA 31A and 31B show an all-time high in the time series, and landings in LFA 32 are comparable to most recent years (Figure 5). In recent years, effort has remained relatively consistent within each LFA with only minor fluctuations.

Recruitment Trap Legal and Sub-legal Catch Rates

The recruitment trap survey provides the best available information on the abundance of sub-legal-size Lobsters. It is also the only source of abundance data for LFAs 27-32 that is collected in a standardized manner. In this Science Response report, recruitment trap catch rates will not be included because 2019 data were not available at the time of meeting. The most recent calculation of recruitment trap catch rates can be found in the Assessment of Lobster in LFA 27-32 (DFO 2020). Up to 2018, the trends in sub-legal catch rates were similar to the trends in CPUE in LFA 27, with an increase in legal-sized Lobster catches in 2018. In LFA 28, there is no participation in the recruitment trap project. LFA 29 showed trends in legal and sub-legal catches similar to the CPUE and landings trends. LFA 30 also showed similar trends in legal-sized catch rates to CPUE and landings but with fewer sub-legal-sized Lobsters caught in recent years. Sub-legal catch rates in LFA 31A were similar to CPUE with increases in sub-legal abundance observed one year prior to the commercial fishery. Legal-sized catch rates were similar to CPUE in LFA 31A. In both LFAs 31B and 32, legal- and sub-legal-sized catch rates were similar to CPUE and landings.

Bycatch

At-sea sampling data collected during commercial fishing were used to estimate the incidental catch in the Lobster fishery. For each bycatch species, mean weight per trap haul was estimated using the observed number at length and length-weight conversion factors for each LFA. The fishery-level bycatch estimates were calculated by prorating the mean weight per trap haul to the total fishery effort (trap hauls). The estimated weight of the top five bycatch species are presented for recent fishing seasons.

The total fishery effort used in the calculation of bycatch estimates is obtained from logbook data for all LFAs except LFA 27. To calculate bycatch estimates in LFA 27, effort was estimated from the combined Gulf logbooks and Maritimes logbooks using the median CPUE and landings from the Gulf logbooks and logbook effort from the Maritimes Region. Gulf landings for 2019 in LFA 27 are calculated by adding estimated slip landings based on previous years to the logbook landings. The 2019 bycatch estimates for LFAs 27-32 are preliminary due to outstanding logbooks, and bycatch estimates for LFA 28, 29, 30, and 32 are not able to be calculated due to low sampling numbers or no data available.

Table 1. Bycatch estimates (tonnes) for LFA 27.

Species	2012	2013	2014	2015	2016	2017	2018	2019
Atlantic Cod	36.05	5.10	5.68	4.69	16.14	20.96	13.00	6.49
Atlantic Rock Crab	64.54	10.13	4.92	3.46	21.05	9.45	13.73	3.58
Cunner	6.65	1.90	1.89	4.84	16.39	24.33	22.55	17.67
Sea Raven	5.92	0.87	2.15	3.11	19.01	10.39	19.29	9.36
Shorthorn Sculpin	48.86	5.18	5.93	9.43	25.19	20.64	29.26	27.47

Table 2. Bycatch estimates (tonnes) for LFA 31A.

Species	2015	2016	2017	2018	2019
Atlantic Cod	2.11	2.27	5.71	2.60	1.11
Atlantic Rock Crab	6.95	7.57	5.85	8.21	7.04
Cunner	1.89	4.71	2.28	2.13	3.82
Sculpin (NS[1])	8.18	12.07	9.96	17.40	6.65
Sea Raven	0.36	0.39	0.11	0.81	1.01

[1] Not Specified (contains Longhorn and Shorthorn Sculpin)

Table 3. Bycatch estimates (tonnes) for LFA 31B

Species	2012	2013	2014	2015	2016	2017	2018	2019
Atlantic Cod	6.61	2.68	2.51	12.40	7.95	21.94	6.03	2.99
Atlantic Rock Crab	3.95	8.08	1.06	15.65	16.72	9.67	12.82	10.59
Cunner	0.87	0.13	0.00	0.14	1.44	1.02	1.85	1.09
Sculpin (NS[1])	6.37	4.35	0.88	12.55	17.51	7.83	17.32	12.35
Jonah Crab	7.07	1.39	0.31	0.20	0.32	0.77	2.02	0.41

[1] Not Specified (contains Longhorn and Shorthorn Sculpin)

Conclusions

The primary indicator of stock status, CPUE, shows a positive signal for all LFAs. CPUE remains at very high levels, at or near the highest value in the time series for each LFA, and remains well above the USR and LRP. Landings, though not yet complete, remain high in all LFAs for their respective time series, with effort staying relatively consistent. For the LFAs where bycatch was estimated, 2019 shows a decrease for most species recorded.

Contributors

Victoria Howse (Lead)	DFO Science, Maritimes Region
Cheryl Denton	DFO Science, Maritimes Region
Adam Cook	DFO Science, Maritimes Region
Heath Stone	DFO Science, Maritimes Region
Tara McIntyre	DFO Science, Maritimes Region
Verna Docherty	DFO Resource Management, Maritimes Region

Approved by

Alain Vézina
Regional Director of Science, Maritimes Region
Dartmouth, Nova Scotia
Ph. 902-426-3490
Date: March 6th, 2020

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Center for Science Advice (CSA)
Maritimes Region
Fisheries and Oceans Canada
Bedford Institute of Oceanography
1 Challenger Drive, PO Box 1006
Dartmouth, Nova Scotia B2Y 4A2

Telephone: 902-426-7070
E-Mail: MaritimesRAP.XMAR@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

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