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Canadian Science Advisory Secretariat
Maritimes Region **Science Response 2023/006**

STOCK STATUS UPDATE OF LOBSTER (*HOMARUS AMERICANUS*) IN LOBSTER FISHING AREA 35 FOR 2022

Context

The scientific basis for assessing the status of American Lobster (*Homarus americanus*) in Lobster Fishing Area (LFA) 35 was reviewed at an assessment framework review meeting in September 2019 (Cook et al. In press), followed by an assessment of the status of the Lobster resources in LFA 35 in October 2019 (DFO 2021a), and yearly Stock Status Updates (DFO 2021b, DFO 2022). One primary indicator and three secondary indicators that describe changes in Lobster abundance and biomass were defined; reference points for the primary indicator were also defined. A suite of indicators is applied in this update from the 2019 assessment framework to update the stock status to the end of the 2021–2022 fishing season, where data are available. As the fishing season spans two calendar years, each season is referred to using the year the season ended, i.e., the 2021–2022 season will be referred to throughout as the 2022 season.

This Science Response Report results from the Regional Peer Review of September 2, 2022, on the Stock Status Update of American Lobster in Lobster Fishing Area (LFA) 35.

Background

Description of the Fishery

Commercial Lobster fishing in LFA 35 occurs in the Bay of Fundy (Figure 1) and borders the biggest Lobster fishery in the Canadian Northwest Atlantic, LFA 34, which has the highest landings and the most participants of any LFA in Canada. Landings in LFA 35 began a long-term increase in the mid-1990s, with highest landings recorded in 2013–2014. Since that time, landings have decreased but remain well above the long-term average of 1,241 t (1975–2021). A similar increase in landings was also observed in most of the Gulf of Maine regions adjacent to LFAs in Canada, with highest landings ever recorded during the 2010s, leveling off or decreasing in recent years.

The fishery is managed by input controls including a Minimum Legal Size (MLS, 82.5 mm Carapace Length [CL]), prohibition on landing of both egg-bearing and V-notched females (with no setal hairs), limited entry licensing, split fishing season (October 14th–December 31st; last day of February–July 31st), and trap limits (300 per licence). Other management measures include the requirement of vents to allow sub-legal-sized Lobster to escape and biodegradable trap mechanisms to mitigate ghost fishing by lost traps (DFO 2020).

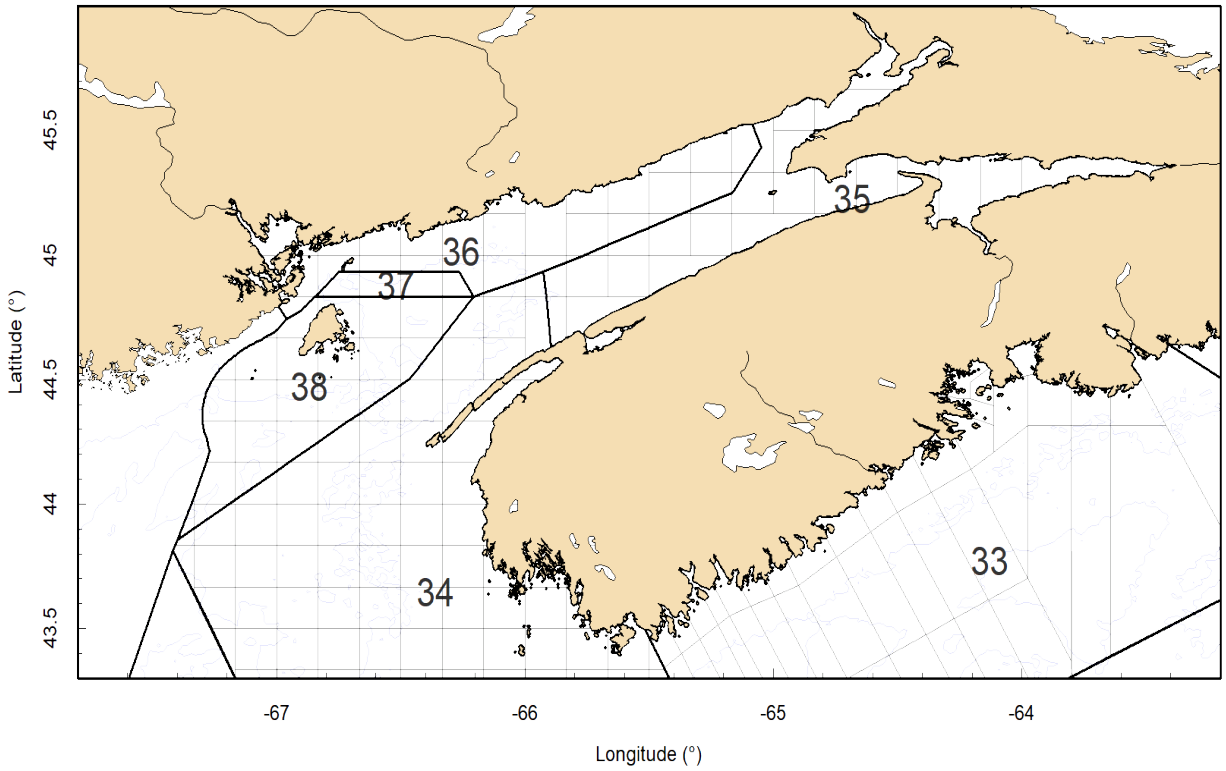

Figure 1. Map of Lobster Fishing Areas (LFAs) 33–38 and adjacent LFAs with logbook reporting grids outlined in grey.

Analysis and Response

Indicators of Stock Status

The stock status of the Lobster in LFA 35 is assessed using primary, secondary, and contextual indicators. This update includes the primary indicator that is used to define stock status in relation to reference points defined in Cook et al. (In press.[1]) and secondary indicators that display time-series trends but do not have reference points. The data sources available for establishing indicators for LFA 35 come from both fishery-dependent and fishery-independent data sources. Fishery-dependent data consist of commercial logbooks that report information on date, location (grid), effort (number of traps hauled), and estimated catch. The fishery-independent data sources are from the DFO Maritimes Region Summer Research Vessel Survey (herein RV survey), and the DFO Inshore Scallop Science survey. Indicators from surveys were updated where data were available.

Primary Indicator

In LFA 35, there is one primary indicator for stock status that describes the time-series trends relative to reference points. The primary indicator for describing stock status is standardized commercial Catch Per Unit Effort (CPUE). There is currently no primary indicator of fishing pressure or exploitation.

Catch Per Unit Effort

Commercial catch rates are a preferred indicator over landings, as they are standardized to account for the level of fishing effort. The commercial fishing data used in the estimation of catch rates were obtained from mandatory logbooks that were put in place in the mid-2000s. It has been well documented that trap-based catch rates vary throughout a fishing season due to factors other than available biomass. These factors include fishing behavior, localized depletion, and environmental conditions (Drinkwater et al. 2006). In an effort to account for these factors, CPUE data were standardized through generalized linear modelling with explanatory variables of Year, Day of Season, Temperature, and the interaction between Day of Season and Temperature. Year was treated as a factor rather than a continuous variable to allow free estimation of inter-annual variability.

Model predictions were made for day 1 of the fishing season at the median day 1 temperature across all years. The available time series covers the current high-productivity period and a lower-productivity period from 2006–2010 (Figure 2). The median of the high-productivity period (2011–2018) was used as the proxy for the biomass at carrying capacity (K). Following the recommendations of DFO (2009), the Upper Stock Reference (USR) and Limit Reference Point (LRP) were set to 40% and 20% of the K proxy. A 3-year running median is used to compare the standardized CPUE to the USR and LRP. This value will dampen the impact of any anomalous years that may occur due to factors outside of changes in abundance.

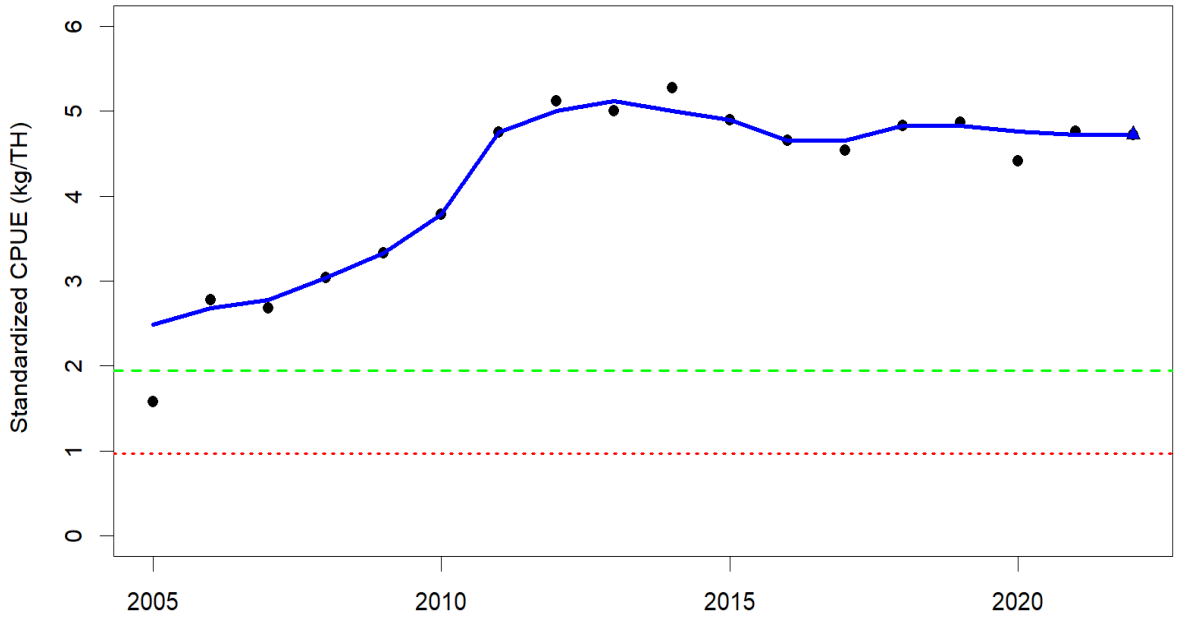

Figure 2. Time series of standardized commercial catch rates (kg/trap haul; black dots) for LFA 35, along with the 3-year running median (solid blue line). The horizontal lines represent the Upper Stock Reference (dashed green line) and Limit Reference Point (dotted red line). The data for the 2021–2022 fishing season are incomplete (blue triangle).

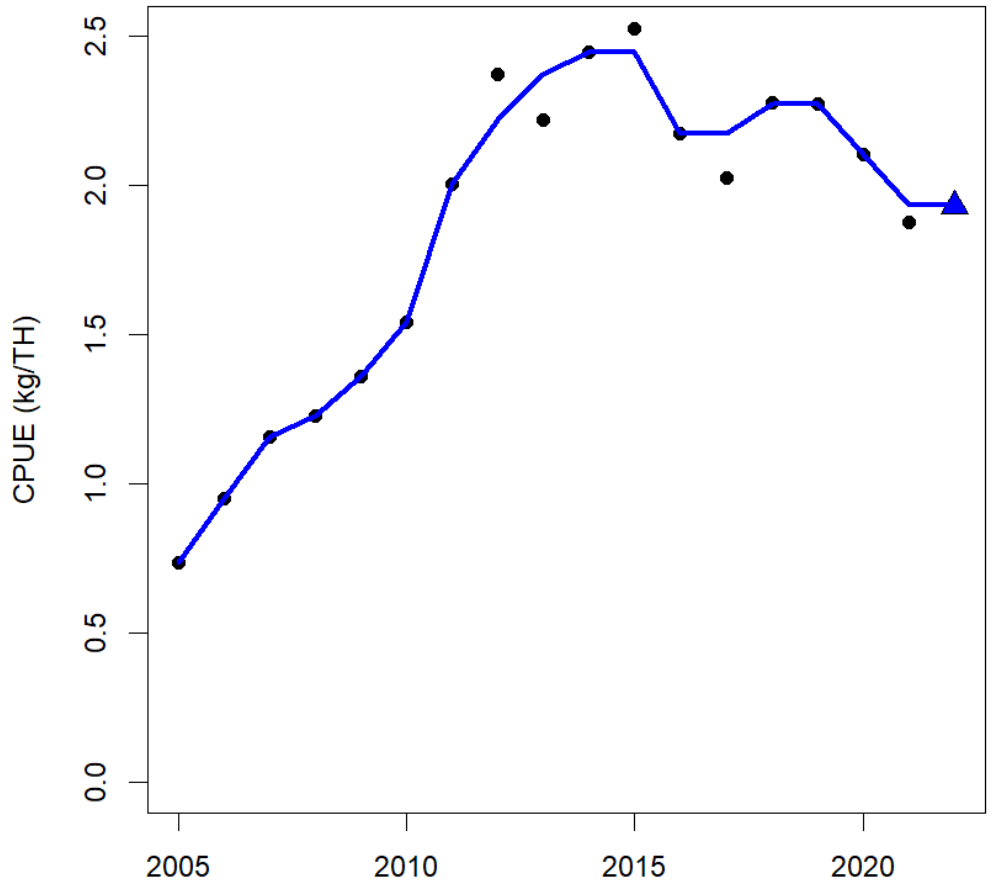

Figure 3. Time series of unstandardized commercial catch rates (CPUE; kg/trap haul; black dots) for LFA 35. The data for 2021–2022 fishing season are incomplete (blue triangle).

The trend in the standardized CPUE indicates that an increase in stock biomass occurred between 2005 and 2012 (Figure 2). Standardized CPUE has remained high (more than twice the USR) since 2011. The 3-year running median for CPUE for the 2022 season is 4.77 kg per Trap Haul (kg/TH), which is above the USR (1.94 kg/TH) and LRP (0.97 kg/TH). The Standardized CPUE estimate for 2022 is preliminary due to outstanding logs; as of August 23rd the monthly reporting rate was between 44% to 88% for the 2021–2022 fishing year. Temperature data incorporated into the standardized CPUE estimates were limited for 2022 at the time of the update, so the model CPUE model only includes temperature data up to 2021. In the standardized CPUE model, the average daily temperatures from the previous 3-years were used for 2022 (Figure 2). Unstandardized CPUE, calculated from logbook data was included for comparison purposes (Figure 3).

Secondary Indicators

Secondary indicators represent time-series trends that are updated annually but do not have defined reference points. The secondary indicators for LFA 35 include the fishery landings and total effort, recruit abundance, commercial biomass, and relative fishing mortality estimates from the DFO RV survey Bay of Fundy region (strata 484, 490–495). Additionally, recruit abundance

from the DFO Inshore Scallop Science survey will be included in this update for the first time since the assessment with available data at the time of the update meeting (DFO 2021).

Landings and Effort

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 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, recorded as the number of Trap Hauls (THs), in the Lobster fishery is controlled by fishing season length, trap limits, and limited number of fishing licences. Consequently, there is a maximum fishing effort that can be deployed; however, this maximum is never met because 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.

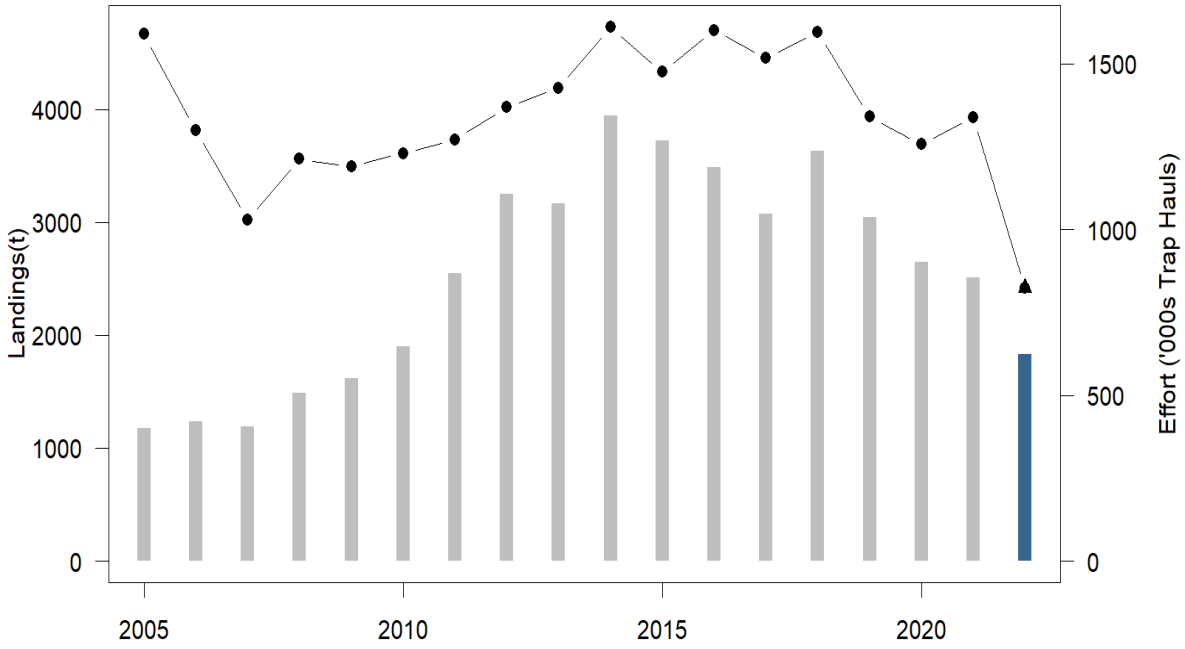

Figure 4. Time series of landings (bars), and effort (sold line with points) for LFA 35. The data for 2021–2022 fishing season is incomplete (blue bar for landings, black triangle for effort).

Historical landings in LFA 35 between 1947 and 1984 had a median of 134 t with a range of 75–184 t, increasing slightly between 1984 and 1994 to a median of 250.5 t (range 226–330 t). In the more recent years, LFA 35 landings have increased substantially with a median from 2010–2022 of 3,072 t (range 1,829 to 3,941 t). Landings have decreased in recent years from the second highest point on record 3,631 t reported following the 2017–2018 season. Landings for the 2021–2022 season are currently 1,829 t but do not represent the total for the season due to the outstanding logs (Figure 4).

Scallop Survey Recruit Abundance

Annual DFO surveys for Sea Scallops have been conducted since the early 1980s to assess abundance (Sameoto et al. 2012, Smith et al. 2012). These surveys started in the Bay of Fundy in 1981 and were extended into southwest Nova Scotia in 1991. Lobster are caught as a bycatch in a subset of the stations and are measured prior to being released. Scallops are typically found on gravel sea bottoms, a habitat not favored by Lobster (Tremblay et al. 2009), but the two species do overlap in some areas. The surveys are primarily conducted in July for the Bay of Fundy (LFAs 35 and 36) and August around Grand Manan Island (LFA 38). Scallop dredges tend to capture Lobster that are under the legal size, and the survey is a useful indicator of recruitment. The abundance of Lobster recruits (70–82 mm CL) from DFO Inshore Scallop Science survey tows within LFA 35 had been increasing after 2008; however, the most recent years (2019 and 2021) have shown a decline. Surveys were not completed in 2020 due to the COVID-19 global pandemic (Figure 5), and 2022 data were not yet available at the time of this update.

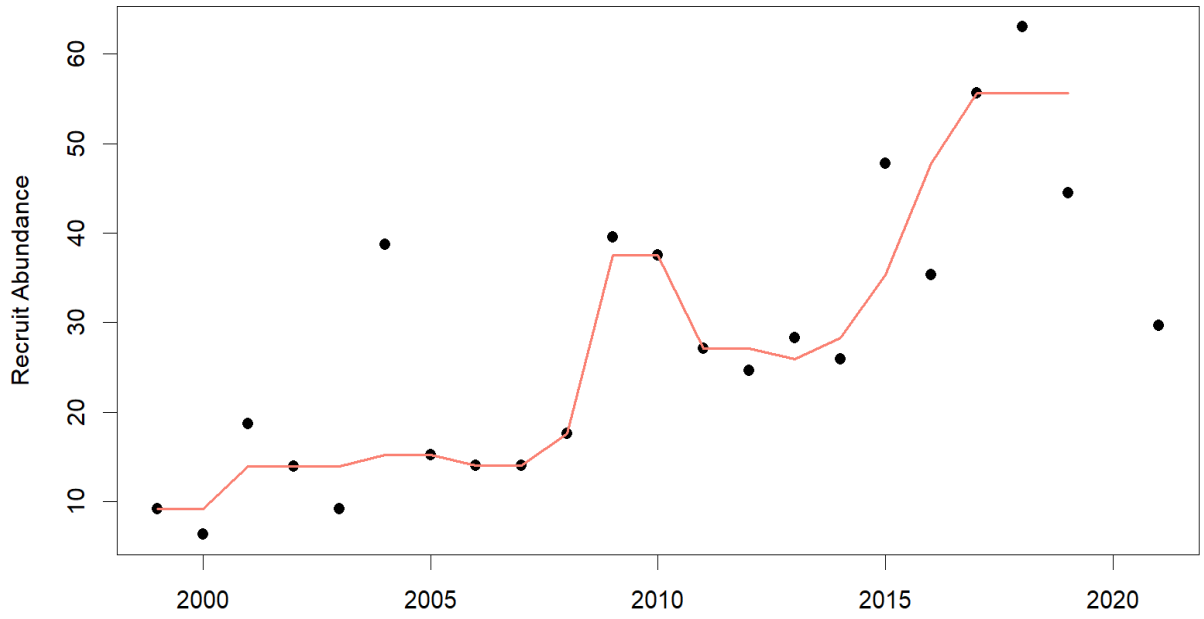

Figure 5. Time series of recruit abundance from the DFO Inshore Scallop Science survey in LFA 35.The red line represents the 3-year running median. Due to missing data in 2020, the 3-year running median could not be continued into 2021.

Conclusions

Since 2011, LFA 35 has been in a high-productivity period and, as of August 2022, the primary indicator of stock status, CPUE, shows a positive signal for LFA 35 and remains well above the USR. Given the reporting rate for landings is currently between 44% to 88% by month, annual landings appear to be on track with recent years.

This update did not include total, commercial and recruit abundance from the DFO RV survey due to incomplete surveys, unavailable trawl calibration coefficients, and unavailable data. The

most up-to-date figures on commercial biomass, recruit abundance and relative fishing mortality can be found in the previous Science Response for LFA 35, updated to 2020 (DFO 2022).

CPUE from the most recent 5 years shows a steady, high estimate of productivity, while recruit abundance from the scallop survey (2020 data not collected and 2022 not yet available) shows highly variable estimates of Lobster recruit abundance, with a decline in the most recent years. The LFA 35 Lobster stock continues to be in a productive period and is currently in the Healthy Zone.

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Sources of Information

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