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Maritimes Region

Canadian Science Advisory Secretariat
Science Response Report 2023/040

STOCK STATUS UPDATE OF LOBSTER (*HOMARUS AMERICANUS*) IN LOBSTER FISHING AREA 35 FOR 2023

Context

The Fisheries Management Branch of Fisheries and Oceans (DFO) has requested an update to stock status for the Lobster Fishing Area (LFA) 35 American Lobster. This Science Response Report is from the regional peer review of August 28, 2023, on the Stock Status Update for Lobster Fishing Area (LFA) 35.

Science Advice

Status

- The 2023 standardized Catch Per Unit Effort (CPUE) index is above the Upper Stock Reference (USR), placing the stock in the Healthy Zone.

Trends

- Standardized CPUE indicates an increase in stock biomass occurred between 2005 and 2012 followed by a decrease from 2014 to 2020. Since 2020 the primary indicator shows a positive signal; however, incomplete data for 2023 leads to higher uncertainty, and the point estimate is likely biased high.
- Landings have been steadily decreasing since the high in 2013–2014. Landing in 2022–2023 remain uncertain due to a high proportion of outstanding logbook submissions.
- Recruitment trends have been highly variable but are decreasing in recent years.
- Research Vessel (RV) Survey Commercial Biomass in the Bay of Fundy experienced a large decline in 2019 and have remained low.
- Relative fishing mortality has been variable in recent years.

Environmental and Climate Change Considerations

- Bottom water temperatures have been increasing in the Gulf of Maine and Bay of Fundy over the past decade. There has been increasing incidence of extreme warm water events since 2011 within the area. The impacts of the increased temperature on Lobster productivity have not been formally evaluated in LFA 35. Bottom temperature is incorporated in the CPUE estimate through standardization.

Stock Advice

The LFA 35 lobster stock is in the healthy zone; however, declines in landings and survey indicators persist. This is in contrast to the estimates of CPUE which remain high. A full evaluation of the stock assessment and stock status indicators is warranted.

Basis for Assessment

Year Assessment Approach was approved: October 1, 2019. (DFO 2021).

Assessment Type: Interim Year Update

Most Recent Assessment Dates

1. Last Full Assessment: October 1, 2019 (DFO 2021).
2. Last Interim Year Update: September 2, 2022 (DFO 2023).

Assessment Approach:

1. Index-based (including fishery-dependent and fishery-independent indices).

Stock Structure Assumption

The LFA 35 is a management-based stock unit and does not represent a biological unit.

Reference Points

1. Limit Reference Point (LRP): 0.972kg / trap haul (0.4 x B_{MSY_proxy}).
2. Upper Stock Reference (USR): 1.94 kg / trap haul (0.8 x B_{MSY_proxy}).
3. Removal Reference (RR): N/A.
4. Target (TRP): N/A.

Data

- Commercial sales slips (Landings 1885–2023).
- Commercial Logbook data (CPUE): 2005–2023.
- DFO RV Survey: 1970–2022.
- DFO Inshore Scallop Science Survey: 1999–2019; 2021–2022.

Data changes:

- Commercial Logbook data is incomplete in 2023. As of August 21st, 2023, the monthly reporting rate was between 49% to 90% for the 2022–2023 fishing year.
- DFO Inshore Scallop Science Survey: Survey not completed in 2020.
- DFO RV Survey: Data unavailable for 2021, and not yet available for 2023.

Assessment

History of Landings and Effort

Landings more than doubled between 2009–2010 and 2013–2014 to a record high of 3,941 t. In recent years, landings have decreased from the record high, but remain well above the 30-year median of 1,412 t, despite a large proportion of landings not being entered into DFO databases for this past season (Table 1).

Estimates of fishing effort as total trap hauls are calculated using total landings and catch per unit effort. In recent years the estimates of effort in LFA 35 have been decreasing (Figure 1A).

Estimates of fishing effort do not reflect changes in fishing behaviour or practices and should, therefore, be treated as highly uncertain.

Table 1. Seasonal landings in LFA 35 from 2000–2023. Landings for the 2022–2023 season are incomplete.

Fishing Season	LFA 35 Landings (t)
2000–2001	1,074
2001–2002	1,219
2002–2003	1,234
2003–2004	1,337
2004–2005	1,172
2005–2006	1,235
2006–2007	1,191
2007–2008	1,488
2008–2009	1,617
2009–2010	1,898
2010–2011	2,546
2011–2012	3,247
2012–2013	3,168
2013–2014	3,941
2014–2015	3,723
2015–2016	3,482
2016–2017	3,072
2017–2018	3,631
2018–2019	3,047
2019–2020	2,645
2020–2021	2,513
2021–2022	2,395
2022–2023	***2,032***

Historical and Recent Stock Trajectory and Trends

Biomass – Proxy of commercial biomass estimated from a standardized commercial catch per unit effort has been increasing over the past three seasons and remains at or near all time highs and is well above the USR (Figure 1B). This is in contrast with the other commercial biomass indicator from the RV survey which suggests a decline over the past three years within the Bay of Fundy (Figure 2D).

Recruit Abundance – RV survey recruit abundance in the Bay of Fundy (70–82 mm Carapace Length [CL]) and Scallop survey in LFA 35 exhibited increases between 2010–2013 and 2018. Both surveys have experienced decreases in the index of recruit abundance since that time (Figure 1D, 2B).

Relative Fishing Mortality – Relative fishing mortality (relF) is not specifically estimated for LFA 35 as survey coverage is low; however, a broader spatial index using the RV survey commercial biomass estimates and landings from LFA 35–38 was used. The estimates of relF

reflect the variation in the commercial biomass index, as seen with the dramatic decline in the early 1980s due to few sampling stations with low and variable catches. Decreases in relF were observed between the late 1990s and early 2000s coincided with the increase in lobster biomass from the survey, increased to 2010, then decreased to 2013 with variable, but low, estimates of relF between 2013 and 2018. Relative fishing mortality has been higher since 2018 than in the previous 8 years.

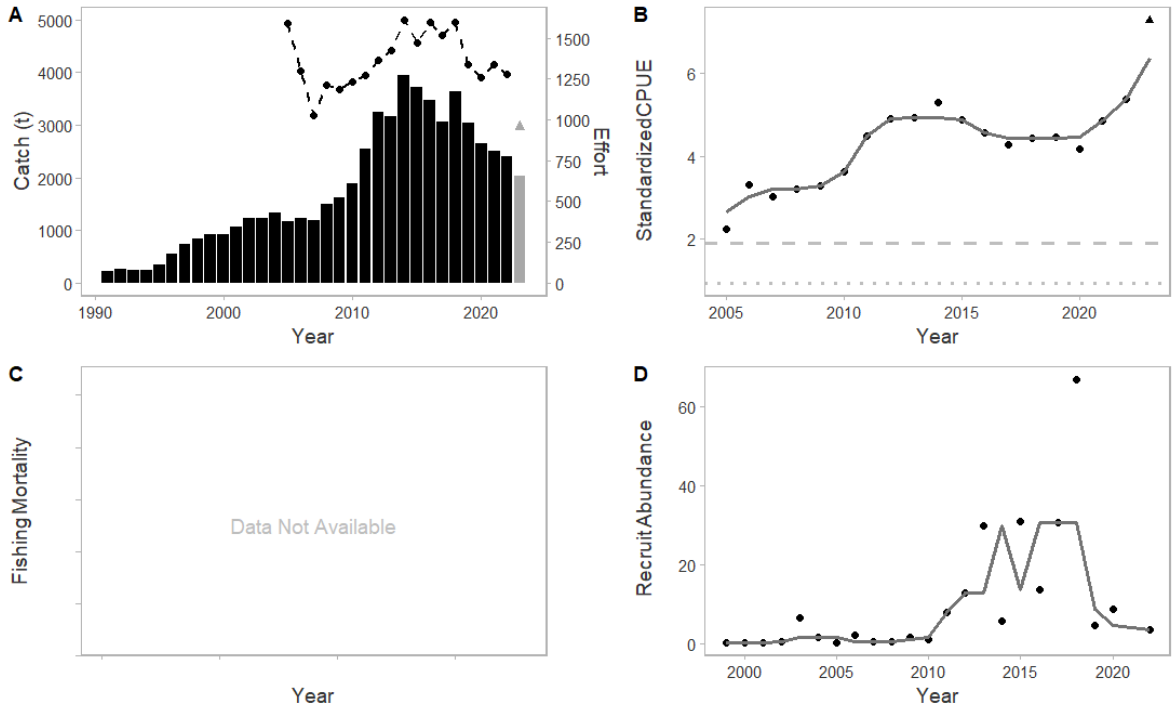

Figure 1.(A) Time series of landings (t; bars) and effort ('000s trap hauls; line), note the gray bar and gray triangle in 2023 denotes incomplete landings and effort; (B) Standardized commercial catch rates in kilograms per trap haul (kg/TH; black dots) in relation to the Limit Reference Point (LRP, dotted) and Upper Stock Reference (USR, dashed), note the triangle denotes incomplete data for the 2023 fishing season; (C) there is no Fishing Mortality index in LFA 35; (D) stratified total recruit abundance (70–82mm carapace length) index from RV survey for LFA 35, 36 and 38. In panels B and D the solid lines represent 3-year running medians.

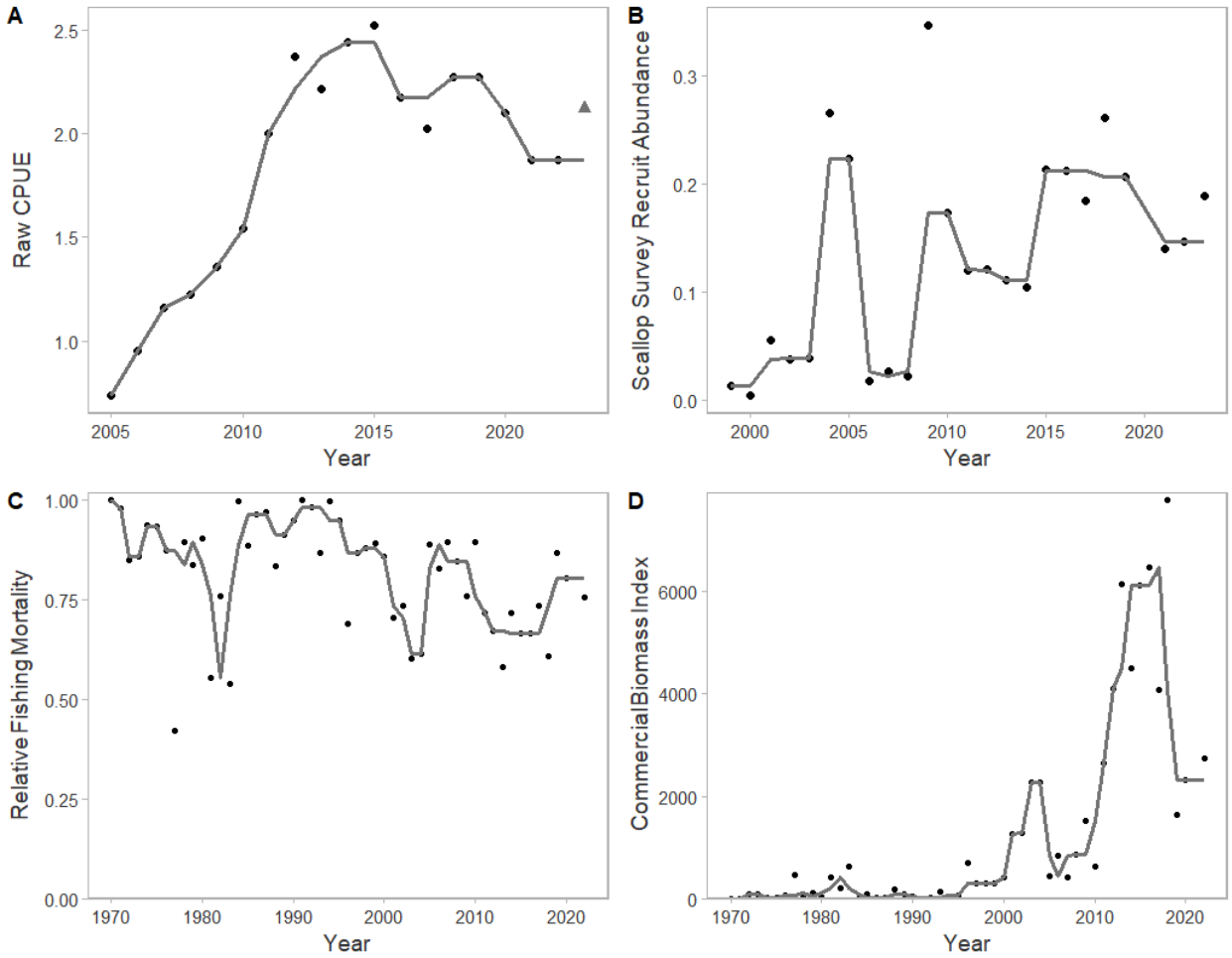

Figure 2. (A) Time series of unstandardized commercial logbook reported CPUE (kg/TH), gray triangle in 2023 represents incomplete data; (B) Recruit abundance (70–82mm; stratified mean numbers per station) from DFO Inshore Scallop Science survey; (C) Relative Fishing Mortality (relF) from LFA 35–38; (D) Commercial biomass index from LFAs 35–38 portion of the RV survey, prior to 1999 commercial biomass was treated as a fixed proportion of total lobster catch. In each panel the solid lines represent 3-year running medians.

Ecological and Climate Change Considerations

Climate change (bottom temperature) is directly linked in the primary stock status indicator, standardized CPUE. This effect was included to account for the relationship between Lobster catchability and temperature. The standardized annual index, therefore, accounting for seasonal and interannual changes in temperature.

The impacts of changing climate on Lobster biology, physiology and phenology have been studied, but are currently not used in this stock assessment. The decline in the abundance of the American Lobsters at their southernmost extent in southern New England states has been linked to warming waters associated with climate change. Predator release has been hypothesized as a contributing factor to the increase in overall Lobster abundance and distribution following the demise of many groundfish stocks. Although many groundfish species remain at low levels of abundance, recovery of predators, or changing species composition associated with invasive species, or range expansion may increase levels of predation mortality.

Projections or Simulations

Projections or simulations have not been developed for this assessment as it is index-based and data driven.

Sources of Uncertainty

The primary stock status indicator for LFA 35 comes from fisheries dependent commercial catch per unit effort. Despite standardization, there remain unaccounted-for processes in this type of index such as changes in fishing behavior or unreported fishing pressures.

The impacts of bycatch and non-commercial fisheries removals are not quantified, nor are their effects on the population.

The contrasting trends seen in the high estimates of CPUE with declines in landings and survey indices are currently unexplained. This uncertainty will be addressed with a full evaluation of the stock assessment and indicators of stock status.

Contributors

Name	Affiliation
Victoria Howse (Lead)	DFO Science, Maritimes Region
Adam Cook	DFO Science, Maritimes Region
Cheryl Denton	DFO Science, Maritimes Region
Geraint Element	DFO Science, Maritimes Region
Caira Clark	DFO Science, Maritimes Region
Tiffany Small	DFO Science, Maritimes Region
Rabindra Singh	DFO Science, Maritimes Region
Michelle Greenlaw	DFO Science, Maritimes Region
Danny Ings	DFO Science, National Capital Region
Stephanie Sardelis	DFO Science, National Capital Region
Ian McLean	DFO Resource Management, Maritimes Region
Verna Docherty	DFO Resource Management, Maritimes Region

Approved by

Francine Desharnais
Regional Director of Science
DFO Maritimes Region
Dartmouth, Nova Scotia

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Sources of Information

DFO. 2021. Assessment of American Lobster (*Homarus americanus*) in Lobster Fishing Areas 35–38. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2021/020.

DFO. 2023. Stock Status Update of Lobster (*Homarus americanus*) in Lobster Fishing Area 35 for 2022. DFO Can. Sci. Advis. Sec. Sci. Resp. 2023/006.

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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

E-Mail: MaritimesRAP.XMAR@dfo-mpo.gc.ca
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