



## STOCK STATUS UPDATE OF AMERICAN LOBSTER (*HOMARUS AMERICANUS*) IN LOBSTER FISHING AREA 41 (4X + 5Zc)

### Context

Lobster in Lobster Fishing Area (LFA) 41 is assessed on a multi-year assessment schedule, with stock framework and assessment science advisory processes conducted approximately every five years and stock status updates conducted in the interim years. The status of the lobster resource in LFA 41 was last assessed in September 2017 (DFO 2018, Cook et al. 2017). The 2017 assessment was based on two primary indicators that describe changes in lobster biomass reproductive potential and contextual indicators that show broad trends and ecosystem changes. This update applies the primary indicators from the 2017 assessment to the stock status up to summer 2018.

This Science Response Report results from the Science Response Process of November 16, 2018, on the Stock Status Update of American Lobster in Lobster Fishing Area 41.

### Background

Commercial lobster fishing in LFA 41 (Figure 1) occurs offshore, from the 50 nautical mile line (92 km) to the upper continental slope, within Northwest Atlantic Fisheries Organization (NAFO) Divisions 4X and 5Zc.

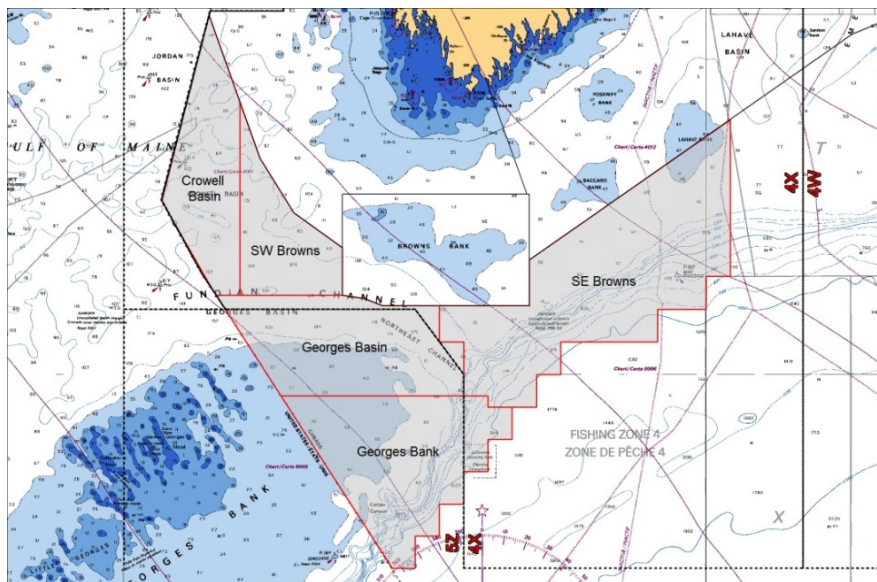


Figure 1. Map showing LFA 41 offshore subareas for primary indicators (4X – Crowell Basin, Southwest Browns, and Southeast Browns, and 5Z – Georges Basin and Georges Bank).

The LFA 41 fishery operates under the Offshore Lobster and Jonah Crab Integrated Fisheries Management Plan. It is the only lobster fishery in Canada that is managed under a Total Allowable Catch (TAC). The minimum legal size is 82.5 mm carapace length, and there is a prohibition on landing berried and v-notched females. The fishery operates year round. Currently, there is no trap limit. The fishery has maintained Marine Stewardship Council (MSC) certification since 2010.

The annual TAC (720 t) was established in 1985 based on historical landings. Annual landings from 2002 to 2018 are presented in Figure 2. In recent years, the TAC has been managed under a three-year management cycle that allows for quota overruns and carry-forward of uncaught quota. At the end of the third year of a cycle, no more than three times the annual quotas (i.e. no more than 2,160 t) may be landed (with an allowance for small operational adjustments).

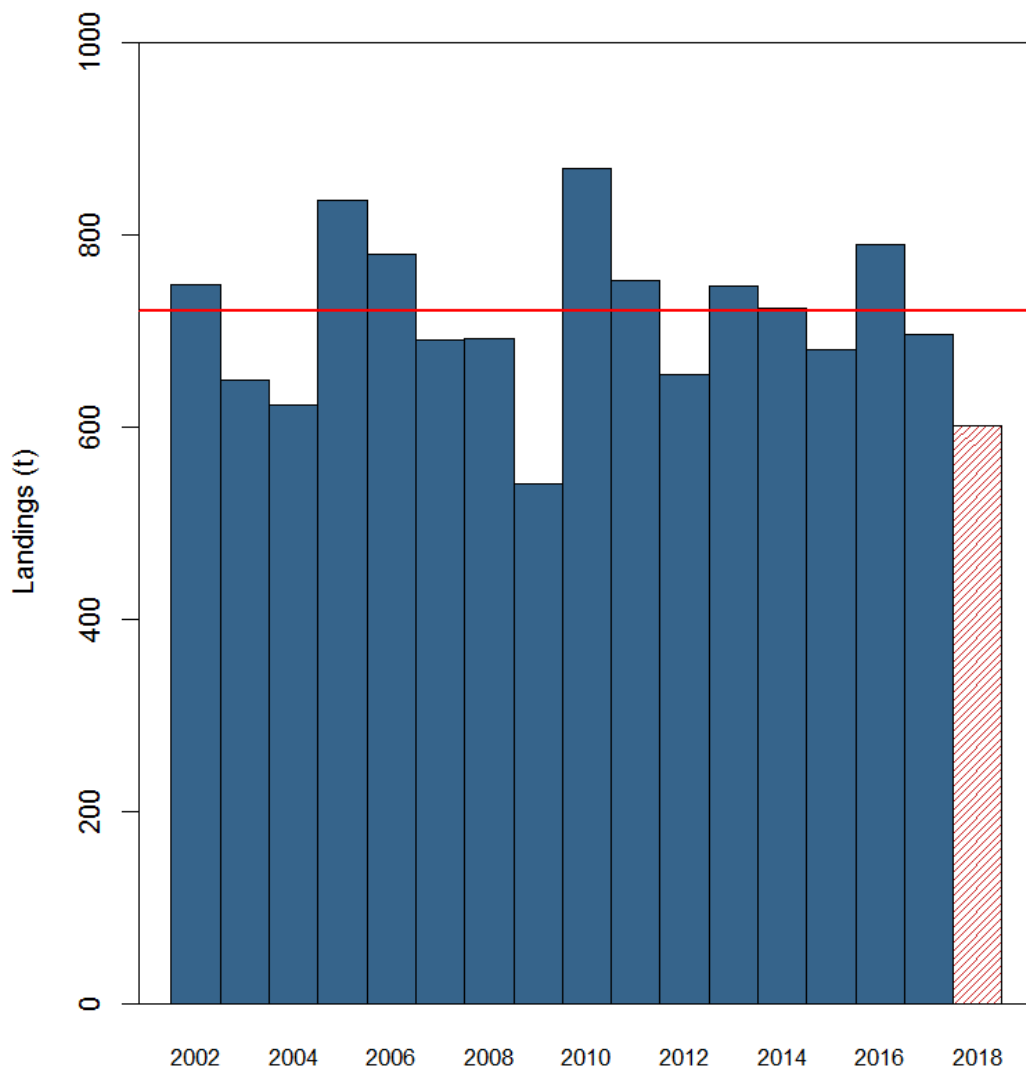


Figure 2. Landings (tonnes) for Lobster Fishing Area 41 from 2002-2018 against a Total Allowable Catch of 720 t (solid horizontal line). Note: Landings for 2018 are incomplete (red hashed bar).

## Analysis and Response

### Indicators of Stock Status

The status of the lobster stock in LFA 41 is assessed using two indicators of stock health: survey biomass and reproductive potential. The reference points defining the Healthy, Cautious and Critical zones – the Upper Stock Reference (USR) and the Limit Reference Point (LRP) – are based on the survey biomass.

Both indicators use fishery independent data available from four ecosystem surveys, two conducted by DFO and two conducted by the Northeast Fisheries Science Centre (NEFSC). The DFO Summer Research Vessel Survey (RV41) covers the offshore portions on the Scotian Shelf, and the DFO Spring Research Vessel Survey (GB) covers the offshore portions on Georges Bank. The NEFSC surveys cover the Gulf of Maine (NSpr41) and Georges Bank (Naut41) in the spring and autumn. Both DFO and NEFSC surveys have survey strata boundaries that do not conform to stock boundaries of LFA 41. As such, the survey strata were pruned to match the LFA 41 boundaries. A running median was chosen over the more commonly used running mean as it is more resistant to influential data points.

### Primary Indicators

#### *Commercial Biomass from Research Vessel Surveys*

Lobster biomass is measured by four surveys from which commercial biomass indices are used to determine overall stock health. The commercial biomass is calculated for each survey and a three-year running median is used to assess stock status relative to reference indicators. The Limit Reference Indicator (LRI) for each index is defined as the median of the five lowest non-zero biomasses in the time series. The Upper Stock Indicator (USI) is defined as 40% of the median of the higher productivity period (i.e. 2000-2015). For the stock to be considered in the Healthy Zone, the commercial biomass indices for at least three of the four surveys must be above their respective USIs (Figure 3). Currently, all four surveys are above their respective USIs. Therefore, the stock is considered to be in the Healthy Zone, and it has been since 2002.

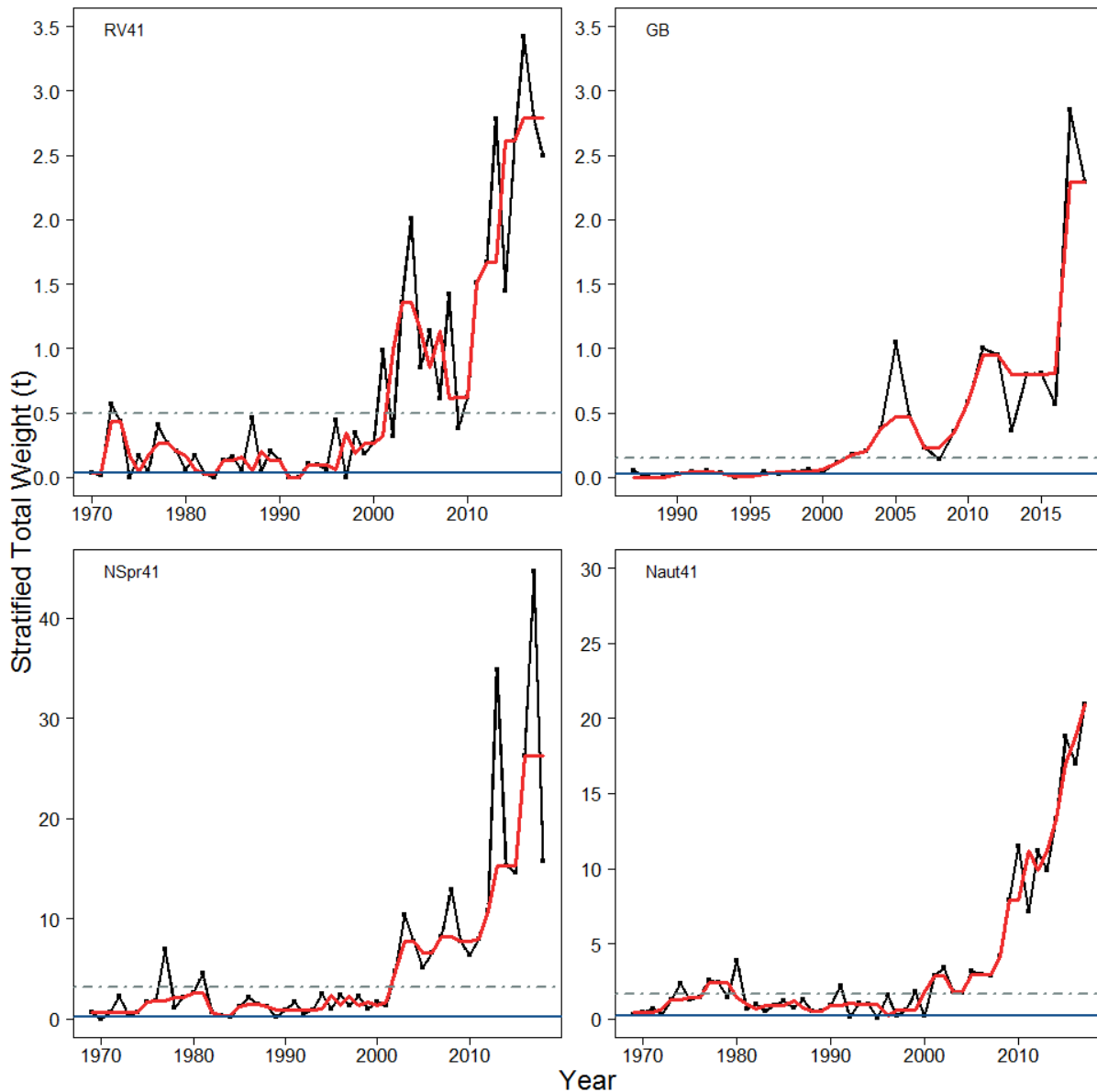


Figure 3. Commercial biomass time series (solid black line) along with the 3-year running median (solid red line), the median of the 5 lowest non zero biomasses (LRI: solid blue line), and 40% of the median of the higher productivity period (2000-2015; USI, dotted grey line). Top row: left- RV41, right – GB. Bottom row: left –NSpr41, right – Naut41. Note: Different scales used on x-axis and y-axis.

### Reproductive Potential

Reproductive potential consists of an integrated index combining female abundance at size, fecundity at size, and size-at-maturity. It represents an estimate of total eggs produced within the stock area and can also be viewed as a surrogate for Spawning Stock Biomass (SSB). An Upper Boundary (UB) and Lower Boundary (LB) have been set (where sufficient data is available) to help gauge the significance of changes in egg production. Reproductive potential is above the long-term average and the respective UBs in all survey indices. Estimates of

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reproductive potential are at or near the highest values on record (Figure 4). An increase in overall abundance was the main driver of the increase in reproductive potential despite a decrease in median size of the lobsters observed in the at-sea samples.

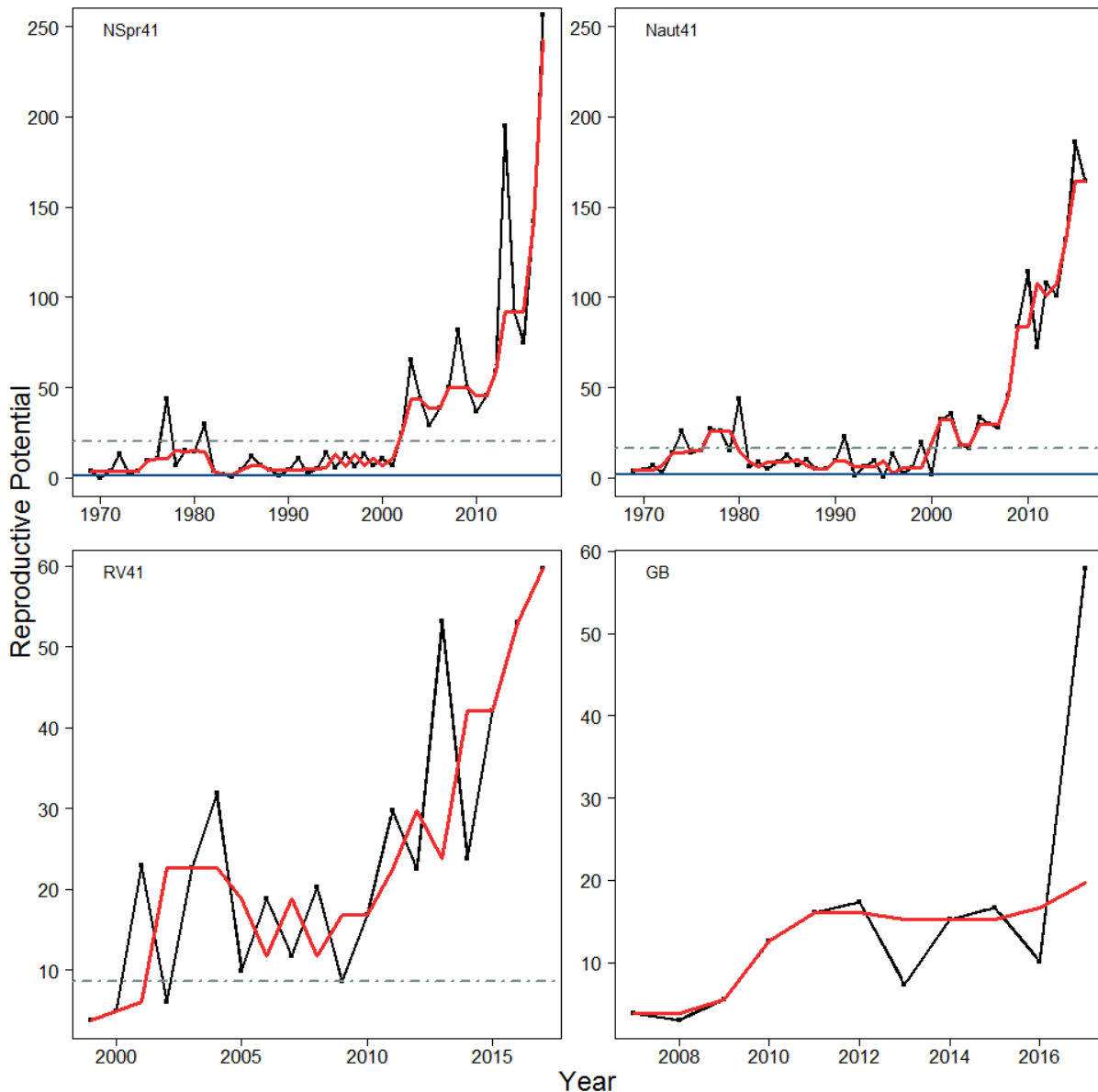


Figure 4. Reproductive potential in millions of eggs (solid black line) estimated from the 4 surveys covering LFA 41 along with the 3-year running median (solid red line). Where they have been developed, the median of the 5 lowest non zero biomasses (lower boundary; solid blue line) and 40% of the median of the higher productivity period (upper boundary; dotted grey line) are shown. Top row: left- NSpr41, right – NAut41. Bottom row: left – RV41, right – GB. Note: Different scales used on x-axis and y-axis.

## Bycatch

At-sea observer data is aggregated by three-year time blocks to represent bycatch estimation in LFA 41 (Table 1). Bycatch amounts for Cancer Crabs, Cusk, and Atlantic Cod have decreased consistently since 2009. Non-retained lobster catch consists of undersized, berried, v-notched

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and potentially cull (one or zero claws), soft and jumbos ( $\geq 140$  mm Carapace Length (CL)). The target for observed trips is 6 per season for LFA 41. The total number of trips, observed trips, and the percent of observer coverage are reported in Table 2.

*Table 1. The 3-year averages for total estimated bycatch and non-retained lobster in kilograms (kg) for LFA 41. Only lobster and the top 8 bycatch species are presented representing 99% of the total bycatch by weight.*

| <b>Species</b>         | <b>2009-2011</b> | <b>2012-2014</b> | <b>2015-2017</b> |
|------------------------|------------------|------------------|------------------|
| American Lobster       | 189,143          | 117,398          | 187,206          |
| Crabs (Cancer species) | 80,060           | 18,156           | 2,032            |
| Cusk                   | 14,340           | 12,466           | 3,353            |
| Atlantic Cod           | 8,346            | 5,866            | 3,229            |
| White Hake             | 5,007            | 7,991            | 2,497            |
| Red Hake               | 299              | 1,928            | 1,217            |
| Sea Raven              | 172              | 1,187            | 241              |
| Haddock                | 2,337            | 171              | 193              |

*Table 2. Number of observed trips per year from 2009 to 2017 for LFA 41.*

| <b>Year</b> | <b>Total Number of Trips</b> | <b>Observed Trips</b> | <b>% of Observer Coverage</b> |
|-------------|------------------------------|-----------------------|-------------------------------|
| 2009        | 78                           | 4                     | 5.12                          |
| 2010        | 76                           | 3                     | 3.95                          |
| 2011        | 51                           | 3                     | 5.88                          |
| 2012        | 32                           | 5                     | 15.62                         |
| 2013        | 36                           | 6                     | 16.67                         |
| 2014        | 35                           | 6                     | 17.14                         |
| 2015        | 34                           | 4                     | 11.76                         |
| 2016        | 36                           | 6                     | 16.67                         |
| 2017        | 34                           | 4                     | 11.76                         |

## Conclusions

Based on the Commercial Biomass indicator, the Lobster stock in LFA 41 was considered to be in the Healthy Zone up to summer 2018. The 3-year running medians of commercial biomass of the 4 RV surveys were above their respective USIs. Reproductive potential was also above the upper bounds where defined. Cancer Crabs, Cusk, and Atlantic Cod bycatch have decreased consistently since 2009. The bycatch coverage for the 2017 year was 4 out of 34 trips or 11.76%.

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### Sources of Information

Cook, A.M., Cassista Da-Ros, M., and Denton, C. 2017. Framework Assessment of the Offshore American Lobster (*Homarus americanus*) in Lobster Fishing Area (LFA) 41. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/065. viii + 186 p.

DFO. 2018. Assessment of Lobster (*Homarus americanus*) in Lobster Fishing Area 41 (4X + 5Z) for 2016. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2018/004.

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