



American Lobster Settlement Index | Update 2021

Compiled by: R. Wahle, A. Goode and K. Kleman

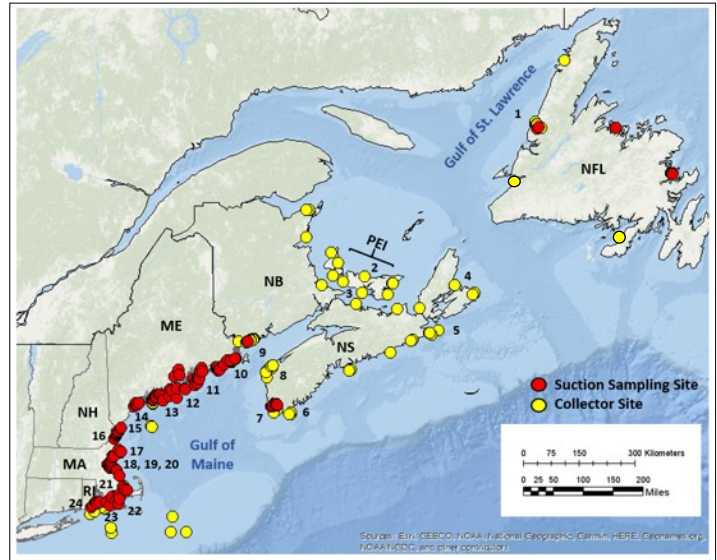
Participants: ME DMR (K. Reardon, R. Russell), MA DMF (D. Perry, T. Pugh), C. Brown (Ready Seafood Co.), J. Drouin (Little River Lobster Co.), RI DMF (S. Olszewski, C. McManus), NH F&G (J. Carloni), DFO Canada (A. Rondeau, N. Asselin, J. Gaudette, P. Lawton, S. Armsworthy, A. Cook), UNB, St. John (R. Rochette), PEIFA (L. Ramsay, M. Giffin), PEI DAF (R. MacMillan), Fishermen & Scientists Research Society (S. Scott-Tibbets), Memorial University (A. Le Bris)

<http://umaine.edu/wahlelab/current-projects/american-lobster-settlement-index/>

At the close of 2021, the US and Canadian lobster industry was emerging from the second year of the pandemic with relatively steady landings volume, but dramatic increases in total value as lobster prices soared. Maine's 2021 harvest saw a modest 10% increase in volume over 2020, but it boasted a 75% spike in total dollar value. Same in Canada: with nearly steady landings volume, the Maritime provinces enjoyed a 48% surge in value, topping CAN\$1 billion. Quebec and Newfoundland's fishery expanded again by a few percent in volume, but nearly doubled in value! At this writing, southern Gulf of St. Lawrence landing volume also held steady, but value reports were not yet available. Bear mind that along with the apparent windfall in value came significant increases in the cost of fishing with inflating prices of fuel, bait and supplies. With so much happening, there's always interest in the near-term landings outlook, and we continue to evaluate ALSI's ability to provide a projection for the next few years based on the strength of upcoming year classes. In last year's *ALSI Update* we tested the skill of forecasts developed in 2013 to look ahead as far as 2019. In this *Update*, we visit the ALSI-based forecast once again to see how our predictions are affected by aggregating study areas and adjusting for temperature effects and differences in depth-wise patterns of settlement gained from our industry collaborations. First, let's take a look at how 2021 stacked up.

Settlement 2021: The ALSI sampling teams from Rhode Island to Newfoundland persevered through the pandemic to cover virtually all locations except Cape Cod Bay and Vineyard Sound, MA where sharks continued to be a risk to divers. Nova Scotia discontinued sampling in 2019.

In general, 2021 settlement was similar to recent years (Figure 1). In Newfoundland, settling young-of-year remain on the fringe of detection at this northern extreme and none were counted in 2021, but the building numbers of older juveniles (not shown) is a positive sign of continued recruitment to coastal nurseries. In the southern Gulf of St. Lawrence, the north shore of PEI and Northumberland Strait saw a modest uptick. New Brunswick's Fundy shore and most of the Gulf of Maine remained at historically low levels, except for the Massachusetts north shore, which saw modest upturns. South of Cape Cod, settlement remained at historic lows where they have been for more than a decade.



Young-of-year lobsters per square meter

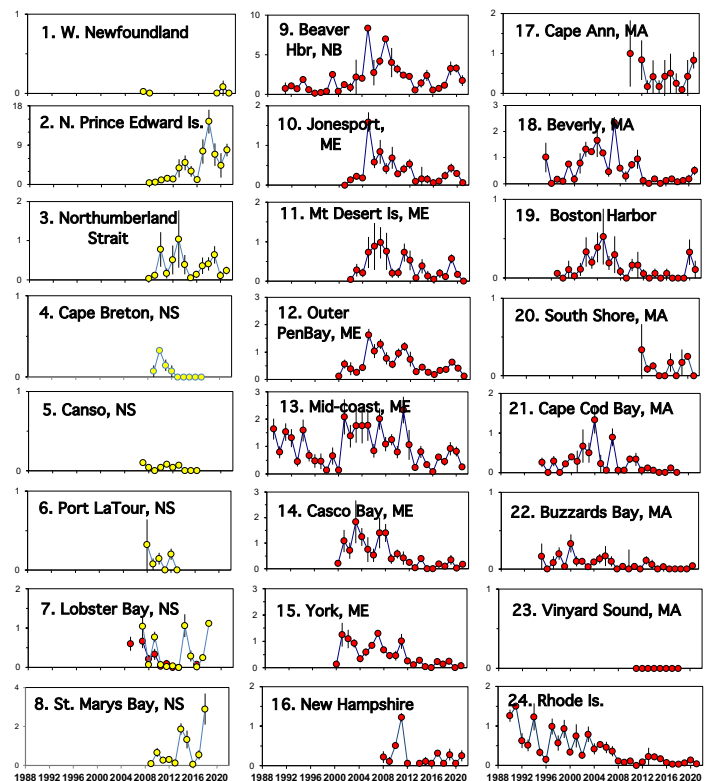


Figure 1. ALSI sampling in New England and Atlantic Canada. Diver-based suction (red) and vessel-deployed bio-collector (yellow) sampling locations and corresponding time series of young-of-year (YoY) settlement for selected groups of sites in 24 study areas from Rhode Island to Newfoundland.

Forecast update: In last year's *Update* we evaluated the skill with which the ALSI-based forecast of 2013 predicted landings out to 2019. We showed the analysis for 6 of 9 areas to illustrate that the forecasts accurately predicted landings for most of the areas, but we underpredicted landing for others, such as northern MA and LFA 36 where landings were higher than predicted based on settlement density alone. For those cases we speculated a subsidy of lobster might be immigrating from outside areas.

With this year's *Update* we continue to tune our previous forecasts by accounting for settlement at depth and aggregating some areas into larger, more inclusive, spatial units. We credit our industry collaborators for their help deploying deep-water collectors that provide critical insight on depth-wise patterns of settlement as they related to changes in the thermal regime by depth along the coast. **Figure 2** above illustrates how the optimal thermal habitat for lobster settlement changes under warm and cool summer thermal regimes; two contrasting years are presented. In a cool regime, typical of earlier years, suitable thermal habitat covers large areas and into the protected bays of SNE, but is restricted to nearshore areas further north into the GoM. Under the warm regime, optimal habitat recedes from shallow bays south of Cape Cod, just as it expands in northeastern areas. The inset graphs in **Figure 2** illustrate the availability of thermal habitat over a range of depths and the relative settlement of lobster over those depths based on collector deployments.

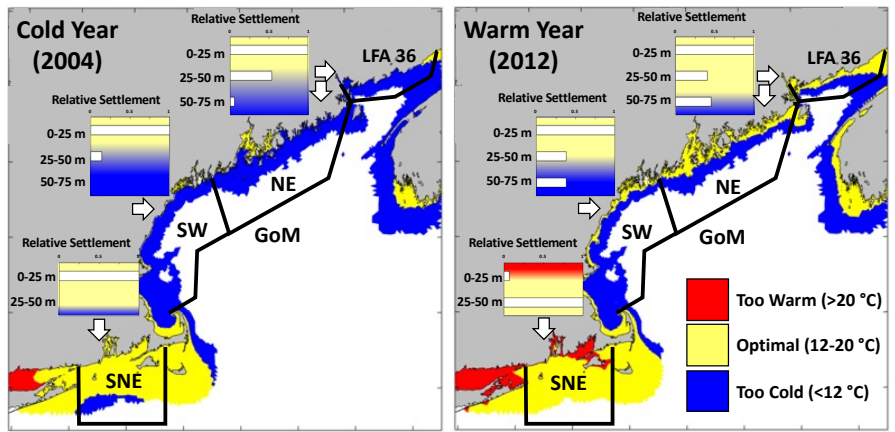


Figure 2. Changing habitat. Habitat suitability in southern New England (SNE), the Gulf of Maine (GoM) and Fundy (LFA 36) based on lobster optimal thermal range inside 100 m depth. Inset bar graphs depict relative settlement strength at 3 depth strata based on industry deployed collectors.

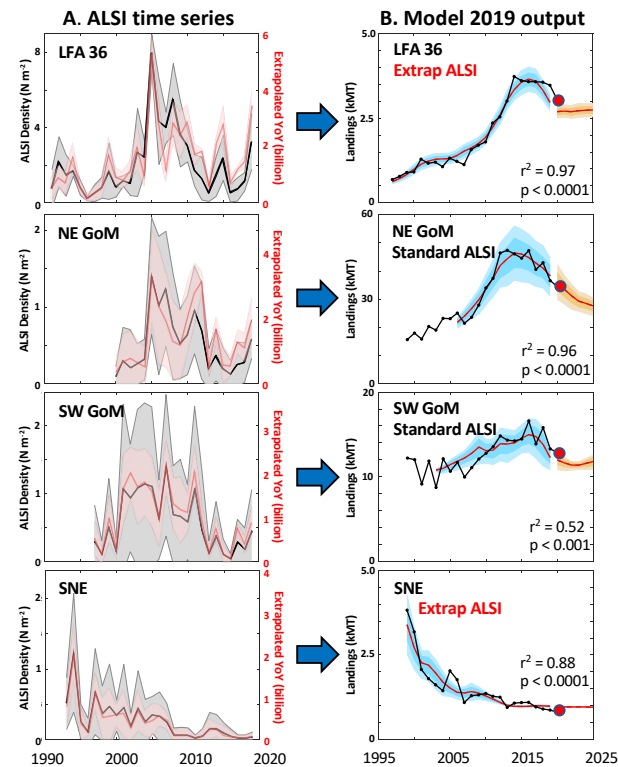


Figure 3. Model 2019 (A) Standard (black) and depth-extrapolated (red) settlement index for aggregated areas. This is the primary input to the ALSI predictive model. The model, represented by a simple arrow here, also accounts for regional differences in growth and mortality. (B) Hindcast, forecast and early skill assessment of the 2019 model based on settlement and landings relationship through 2019 (blue segment). The skill of the 2019 forecast (orange) is assessed as landings accumulate. So far, 2020 landings are shown for the four areas (red dots).

In **Figure 3A** we first depict the standard (black) and depth-extrapolated (red) settlement index for the four areas. To the right (**Figure 3B**) are the updated ALSI 2019 landings forecasts for these areas out to 2025 using the version of the settlement time series giving the best fit to observed landings through 2019. As with previous forecasts, we continue to account for regional differences in mortality, and variable growth rates such that the prediction for a given year comprises the contribution of a mix of ages ranging from about 5-9 years. These modifications considerably improved the fit to observed landings trends. In fact, the predictions for the GoM are consistent with Maine's fishery-independent surveys, and the trends in the NE GoM even align strongly with landings trends in SW Nova Scotia (LFA 34). In the two cases where the area size remained unchanged, LFA 36 and SNE, adjusting for depth-wise settlement improved the fit to observed landings, but did not entirely resolve the under/over-prediction problem. Data are still limited on depth distributions and habitat use for settlers, and work remains to better inform these forecasts.

Nonetheless, our 2019 model for the more inclusive areas that account for settlement at depth are less pessimistic than the 2013 model and project a more moderate decline and a leveling of landings through 2025. Hopes are that the higher price of lobster will help offset those declines. Observed landings volume for 2020 (red dots in **Figure 3B**), our first out-of-model skill assessment for the 2019 model, suggest the longer time series and the new modifications are doing a better job of capturing the dynamics of the fishery. Again, with all same cautions about the uncertainty of forecasting, time will tell. Stay tuned for further updates and a wider application of the forecasts. **Θ**