American Lobster Settlement Index | Update 2023

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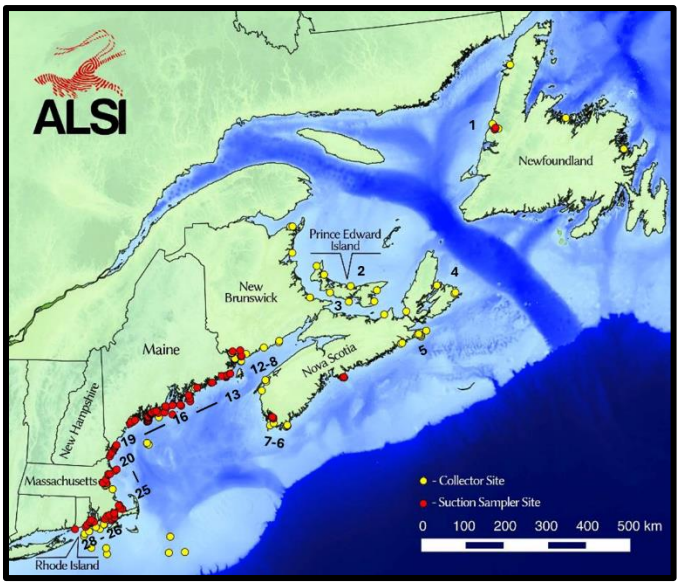
http://umaine.edu/marine/american-lobster-settlement-index-alsi/

From the end of 2022 through 2023 the lobster industry experienced a series of achievements and challenges involving impending changes in management regulations to the US fisheries. The end of 2022 brought relief to many as the US Federal Omnibus Spending Bill paused NOAA's whale regulations for 6 years and established a $23 million fund for states to support research on right whales and R&D on new gear technologies. Meanwhile, the Atlantic States Marine Fisheries Commission approved Addendum XXVII, which would trigger an increase in the minimum legal harvest size of lobster in Lobster Conservation Management Area 1 (Gulf of Maine) if survey-measured abundances of 71-80 mm carapace length lobsters fell below 35% of the 2016-2018 reference level. Continued low recruitment in 2023 caused the trigger index to fall 39% below the reference level, triggering management change more quickly than was anticipated. To provide more time for the US and Canada lobster fisheries to prepare for these management changes, the gauge size increases were postponed until January 2025 (3 5/16") and 2027 (3 3/8").

As for 2023 landings, Rhode Island through Maine continued to decline in volume and were down 5-6%, while Newfoundland continued their upward trajectory, increasing by 18%. Despite the decrease in landings volume, Maine's uptick in ex-vessel price increased revenue by 18%, a welcomed sight after 2022's plummeting price.

Lobster Settlement 2023: The ALSI teams successfully monitored 61 diver and 56 collector sampling sites from Rhode Island to Prince Edward Island, and positive signs of post-larval abundance were seen across many of the northern study sites (**Figure 1**). All Maine sites saw an increase in settlement, most notably for the northeastern regions reaching numbers similar to levels last seen in the mid-2000s. Points south continued to remain at historic low levels while Northern Prince Edward Island surged, yet again, to impressively high densities, one site boasting the highest abundance ever recorded by the ALSI. Not shown are the patterns of settlement in deeper habitats from our industry-led collector surveys in Maine. Most notable has been the reversal in settlement patterns in Casco Bay. Since 2020 the highest young-of-year abundances have been in the deepest study locations (41-60m) rather than in shallow nursery habitats (1-20m). As seafloor temperatures rise it will remain important to monitor changes in habitat use and the role that deeper regions may have on year class strength.



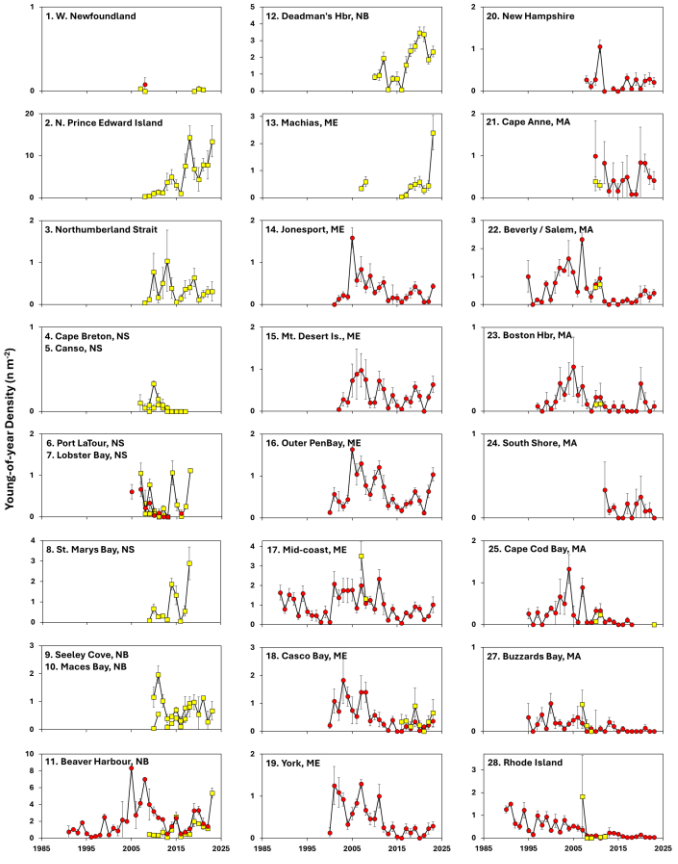


Figure 1. Diver-based suction (red) and vessel-deployed bio-collector (yellow) sampling locations and corresponding young-of-year lobster abundance.

Benthic monitoring to fisheries recruitment forecasting in Canada: Following the promising landings forecasting work with the ALSI indices in the US, colleagues at the University of New Brunswick have been using ALSI indices to generate similar landings forecast models for the Canadian lobster fishery (**Figure 2**). ALSI-based forecasts are rooted in the assumption that trends of young-of-year abundance will track landings trends some 5-9 years in the future, and that annual landings will be comprised of multiple year classes due to differing growth rates among individuals within a population. Using a modeling approach that projects the growth of individual settling lobsters to harvestable size, the team at UNB was able to use regional settlement patterns to generate indices of annual "exploitable biomass," or the mass of lobsters available for harvest. The indices of exploitable biomass were compared to regional fisheries landings, and those relationships were used to produce landings forecast models for three regions in Atlantic Canada: LFA 36 (Bay of Fundy), LFA 22S (Magdalen Islands/Gulf of St. Lawrence), and LFA 23. (Northern New Brunswick/Gulf of St. Lawrence). Strong relationships between indices of exploitable biomass and fisheries landings were found for these regions, highlighting the utility of the ALSI to capture previous, and potential future, changes in the lobster resource across the species' range.

To be sure, modeling is an uncertain enterprise, and testing the predictive skill of models is necessary to determine how far into the future model predictions are useful and accurate. To validate the landings forecast models, skill assessments were conducted to determine each model's accuracy in predicting landings 6 years and 1 year into the future. While LFA 23 had too few settlement observations to produce meaningful out-of-sample comparisons, LFAs 22S and 36 showed positive results. LFA 22S yielded the most accurate models, with both 1- and 6-year models estimating lobster harvest within 13% of actual landings volume. LFA 36's models were most accurate for 1-year predictions, producing harvest estimates within 25% of actual landings, but the 6-year models underestimated landings by 53%. The larger errors observed for LFA 36 were mainly driven by underestimation of landings in recent years and potentially due to the model's greater ability to capture landings for the entire Bay of Fundy, pointing to a spatial scale mismatch between regional settlement abundance and large-scale landings trends. Overall, this modelling work demonstrates the value of benthic recruitment monitoring in estimating future landings trends, and our hope is that it will encourage the continuation and expansion of these programs across Atlantic Canada.

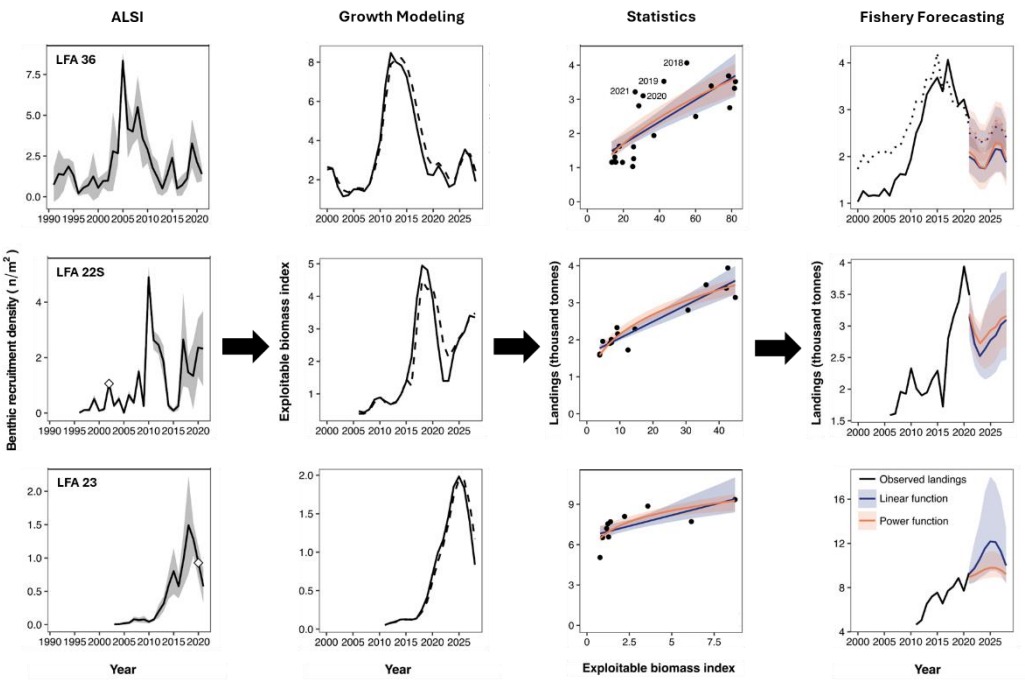


Figure 2. ALSI-based landings forecasting in Canada. An individual-based model predicts the annual amount of lobsters available for harvest (EBI) based on previous years' young of year densities. Relationships between EBI and previous years' landings demonstrate the skill of ALSI to recreate landings trends. Predicted EBI patterns are then used to forecast landings trends up to 6 years into the future.

Lastly, years in the making, a special presentation of PBS NOVA, SEA CHANGE: Gulf of Maine, will premiere on PBS, the PBS app, and the NOVA YouTube channel. This three-part docu-series highlights the Gulf of Maine through the lens of natural history, fisheries, entrepreneurship, and ecosystem change. The first episode will feature scientists and industry members of the Gulf of Maine lobster fishery to shed light on how climate change has impacted the working waterfront and how continued monitoring, like **ALSI**, is critically important to keep a finger on the pulse of this economically- and culturally-important resource.