



American Lobster Settlement Index | Update 2020

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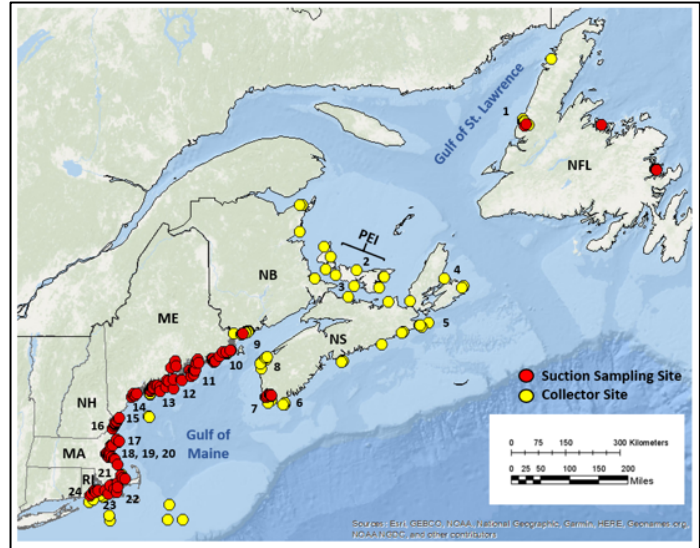
<http://umaine.edu/wahlelab/current-projects/american-lobster-settlement-index/>

As we look back at the past year of the pandemic, it is remarkable how well the lobster industry pivoted to confront the unprecedented crisis. While the spring 2020 season got off to an especially slow start as the full impact of the crisis sunk in, the industry quickly made up for lost ground over the rest of the season. Direct sales and creative marketing helped keep demand up so that by the end of the year the price of lobster rebounded well from an early slump, and total volume was either on par or had slipped only a few percent from the year before. The southern Gulf of St. Lawrence, Quebec and Newfoundland even boasted all-time high harvests. But how do 2020's landings compare to those predicted by ALSI years earlier? We anticipated the ALSI-based forecast would be overly optimistic, given the impact of the pandemic. In *Update 2018*, we examined how well ALSI predicted trends in the fishery from Fundy to Rhode Island. In this *Update*, we revisit the ALSI forecast six of our long-standing study areas from Fundy to southern New England to see how reported 2020 landings compared to our predictions.

Settlement 2020: It's impressive that the 2020 ALSI survey even happened! Hats off to all the ALSI partners for their perseverance, despite the pandemic. The only ALSI survey canceled in 2020 was Cape Cod Bay's, and that was for white shark sightings!

As for the survey results, the biggest news of 2020 came from our northernmost partner: Newfoundland collector surveys reported their first records of YoY, if only in small numbers (Fig 1). The mounting numbers of older juveniles in the same collectors and record-breaking landings (not shown here) are testimony to the rising lobster populations in this new frontier. Further south, in the Gulf of St. Lawrence, the north shore of PEI slipped for the second year from its astronomical peak of 2018, and settlement in Northumberland Strait dropped to levels on par with historic lows.

In the Gulf of Maine and Fundy region, although the good news in 2019 was a widespread upturn in settlement from Beaver Harbour to Cape Anne, in 2020 most of those areas through New Hampshire saw a slight downturn, except the Massachusetts north shore from Cape Anne to Boston Harbor. South of Cape Cod, only Rhode Island reported a detectable upturn. Although Nova Scotia has



Young-of-year lobsters per square meter

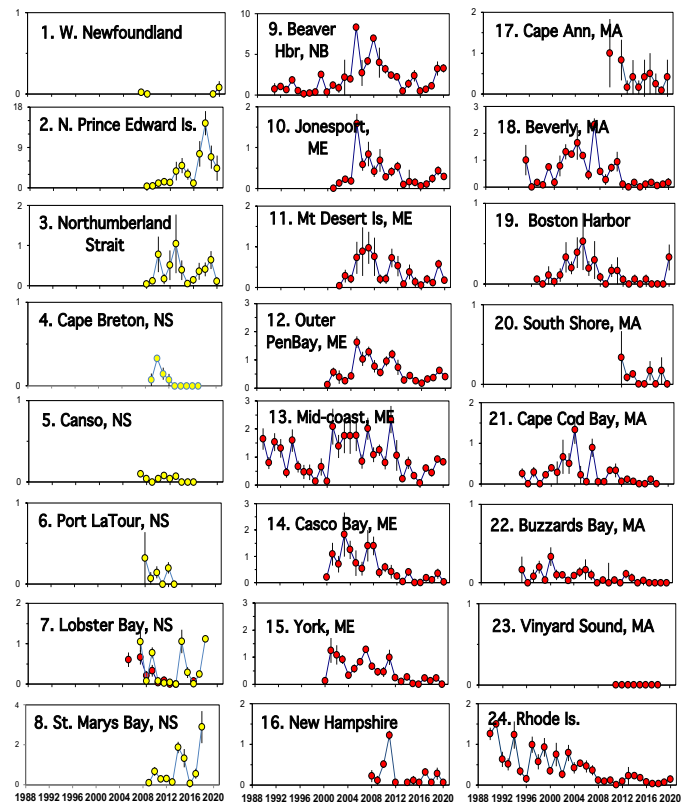


Figure 1. ALSI sampling in New England and Atlantic Canada. Diver-based suction (red) and vessel-deployed bio-collector (yellow) sampling locations and corresponding time series of young-of-year (YoY) settlement for selected groups of sites in 24 study areas from Rhode Island to Newfoundland.

not participated in the ALSI survey in the past two years, parallel landings trends in Maine and SW Nova Scotia might suggest similar recruitment histories.

Testing the forecast model: ALSI-based landings forecasts are grounded in the premise that Young-of-year (YoY) recruitment trends determine landings trends some 5-9 years later, once adjusted for variable growth and mortality. Because there are fast growers and slow growers, a single year-class enters the fishery over several years. To include the fractional contributions of all year classes to the fishery in a given year, the best we can do is project six years out.

First, let's look at how our Model 2013 performed. Remember, this version of the model is based YoY trends through 2013 (Fig. 1A). That year we could evaluate the statistical significance of the relationship between our model-predicted landings trend (blue band) and reported landings (black line) through 2013. On the strength of that "hindcast," we then forecast landings 6-year out through 2019 (orange segment), and year-by-year, we observe how well reported landings compared to our forecast. By 2019 we found the 2013 model forecasts were mostly on par with reported landings, except for northern Massachusetts, where reported landings continued to rise despite predictions. In that case, we speculate that a subsidy of lobsters may be contributing to landings either through immigration or expanded fishing range.

Now, let's look at the updated Model 2019, which projects landings trends through 2025. As of 2019, observed landings trends correlated well with the model-predicted trend, except again for northern MA. But how did 2020 reports compare to our forecast? At this writing, we can only examine that question for Maine, as 2020 landings data are not yet available for Massachusetts or New Brunswick. In Maine, while the ALSI model predicted landings to continue a downward trend, observed landings were either on target or above model predictions, suggesting these fisheries did an admirable job making up for lost ground early in 2020, despite the pandemic.

In the end, we emphasize that forecasting models over-simplify reality. Try as we might, we can never capture all the mechanisms at work. Indeed, the great statistician George E.P. Box had it about right: "All models are wrong, but some are useful." They are always a work in progress. Still, prediction remains a worthy aspiration because it equips us to consider informed choices as we confront an uncertain future. **θ**

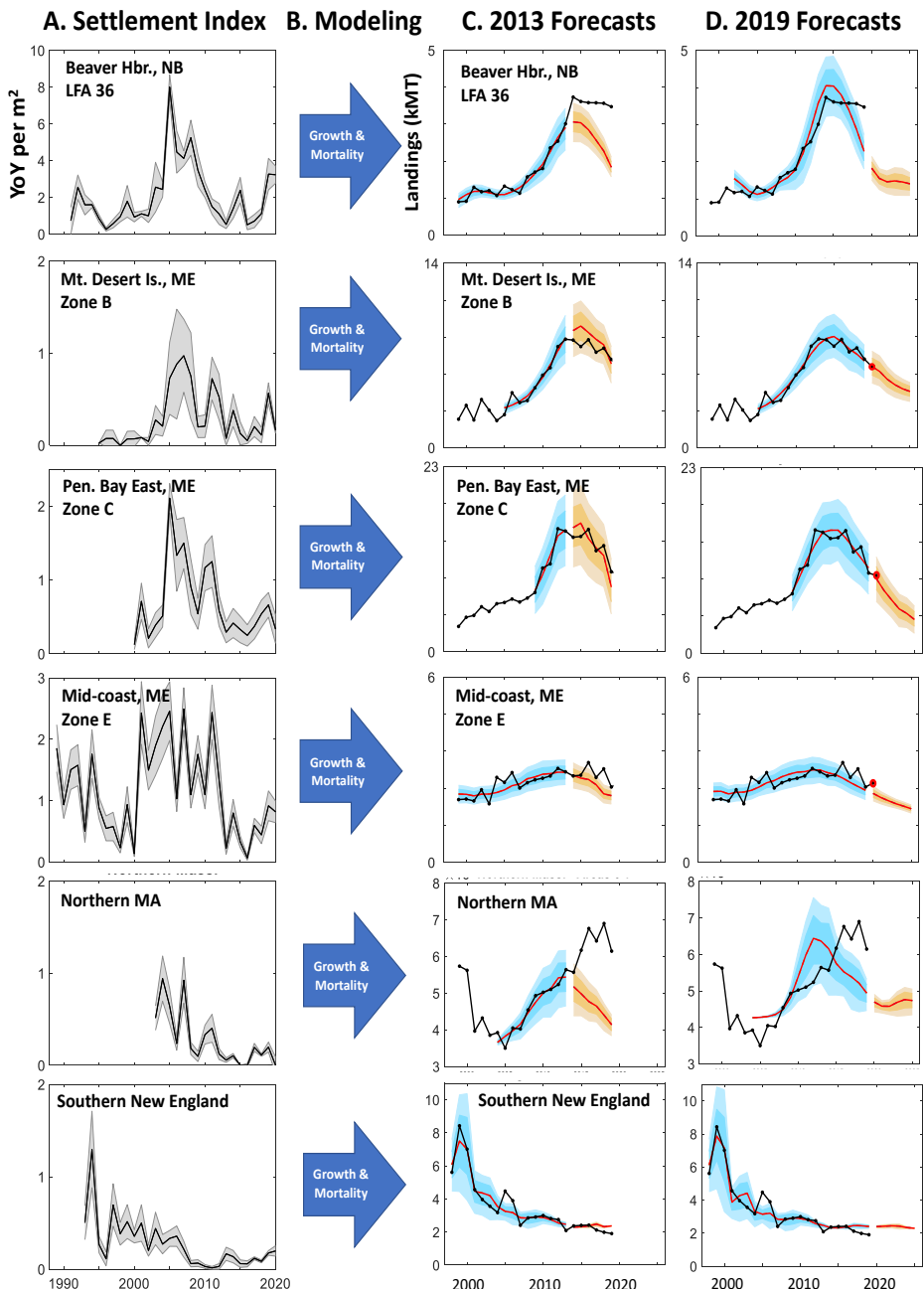


Figure 2. ALSI Forecast. (A) The settlement index is the primary input to the predictive model. Here we show six of our longer ALSI time series through 2020 from areas representing a range of environments and settlement histories. (B) The model, represented by a simple arrow here, includes mathematical expressions for growth and mortality tailored to each study area. (C) **Hindcast, forecast and skill assessment** of the 2013 model. On the strength of hindcast (red line with blue confidence interval) using data in hand in 2013, we forecast landings in the out-years through 2019, (red line with orange confidence interval). The "skill" of the forecast is assessed as landings accumulate beyond 2013. (D) **The 2019 model** includes hindcasts through 2019. Skill assessment to date for 2020 landings shown for the three study areas in Maine (black points encircled in red).