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# American Lobster Settlement Index Update 2012

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# American Lobster Settlement Index



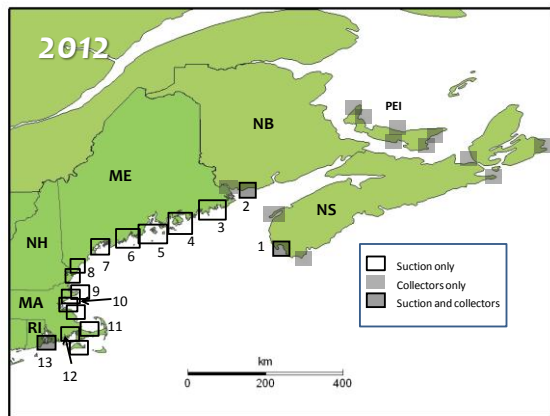
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<http://www.umaine.edu/marine/people/sites/rwahle/ALSIPage.htm>

In a year that might be remembered as the one that brought climate change close to home for the lobster industry, lobster larvae in 2012 continued to settle mostly in the patterns we've seen before. The ocean heat wave that broke all the records and triggered an early shedder season does not seem to have had a corresponding positive effect on lobster settlement. Once again Maine's lobster fishery boasted another year of historically high lobster landings, just as southern New England lobstermen still struggle with how to manage the fishery in a world of shell disease and dwindling recruitment. This issue of the *Update* summarizes the regional time trends in the settlement index and examines the first steps we're taking in evaluating ALSI as an early warning system for the fishery.

**Settlement 2012:** In 2012 lobster settlement was down from the previous year in virtually all areas from Lobster Bay, NS, to Rhode Island (Figs. 1 & 2). The striking contrast between southern and northern regions evident a few years ago seems to be weakening. Barely detectable settlement seems now to be the norm for the area south of Cape Cod, with many sites reporting zero settlers and diminishing juvenile populations, and new sampling sites near Martha's Vinyard, MA, only reinforce this pattern. Encouragingly, in Rhode Island a few settlers reappeared in 2012 where none were found in 2011, a first in 22 years.



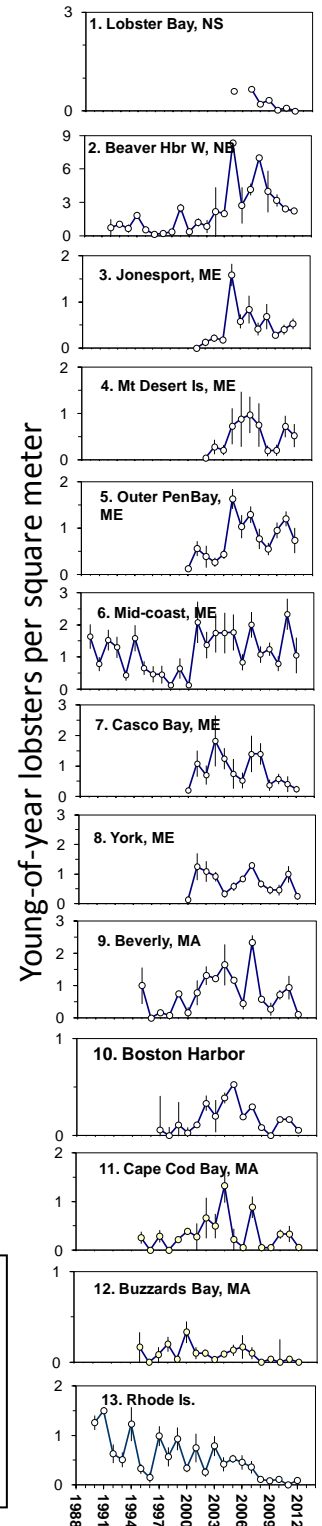
**Figure 1.** Lobster settlement data were collected in 2012 by suction sampling, passive collectors, or both methods. Numbered boxes surround suction sampling sites used for study area time series in Fig. 2.

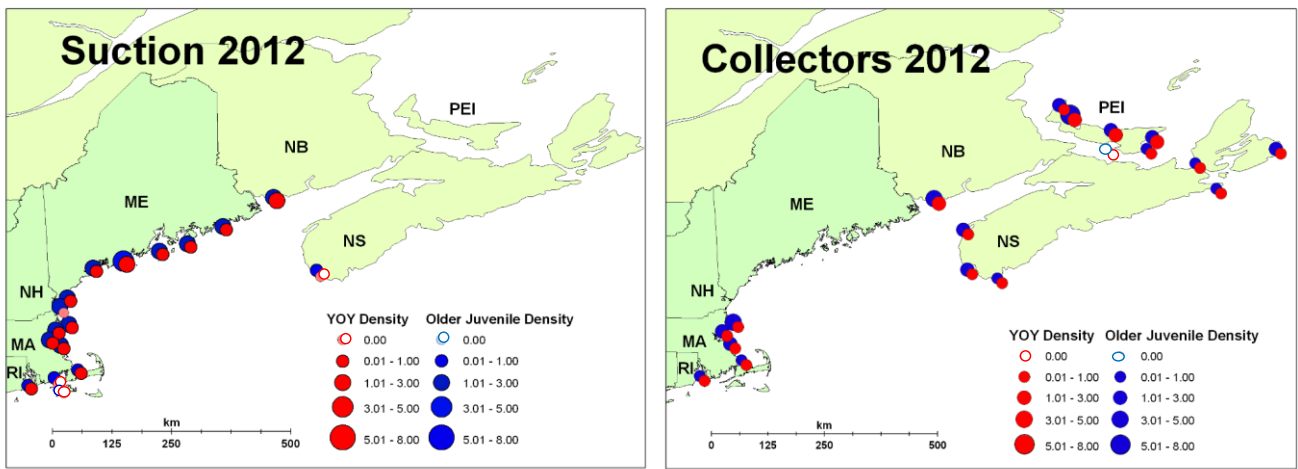
are falling off the highs they've seen in the recent past. Given the impact of dwindling settlement on the fishery in southern New England, there now may be reason to wonder whether the days are numbered for the historic boom in lobster abundance in the Gulf of Maine.

Even in the northeast Gulf of Maine/Fundy region, from Lobster Bay, NS, to Jonesport, ME, settlement has been sliding off the highs of 4 to 7 years ago. Given that trend, this year's numbers may not have been too surprising, but it was a wake-up call to see zeros in Lobster Bay. Does this bode for a reversal in that region's historic surge in landings?

In the broad midsection of the survey area, from Mt Desert, ME, to Cape Cod Bay, 2012 was decidedly a down year. In short, after a wave of widespread strong settlement years over the past decade, many locations

**Figure 2.** Complete time series of settlement, expressed as mean densities of young-of-year (YoY) lobsters at the 13 study areas with the longest suction sampling time series.

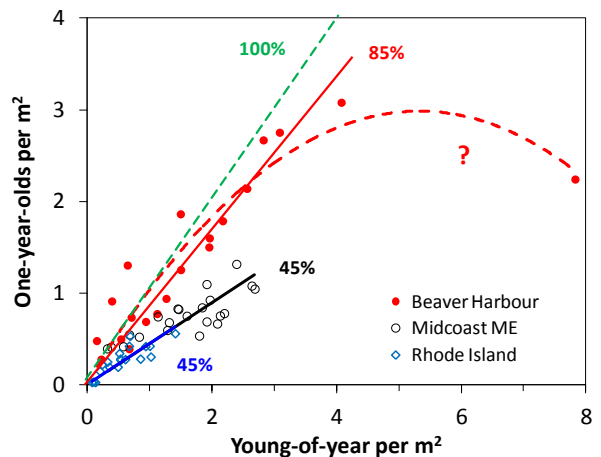




**Figure 3. Spatial patterns.** Average densities of young-of-year (red) and older juvenile lobsters (blue) found in suction samples (left), and collectors (right) deployed in 2011. Symbols represent multi-site averages for each study area.

Vessel-deployed collectors have become the preferred method of monitoring lobster settlement in the southern Gulf of St. Lawrence, and eastern Nova Scotia. Time series are accumulating in these areas that will enable us to evaluate trends in the near future. Collector-based sampling also complements suction sampling in southwest Nova Scotia, Fundy and southern New England permitting access to locations that are impractical or unsafe for divers (Figs. 1 & 3). Our analysis of both suction and collector samples indicates that the number of older juveniles is strongly correlated with settlement. The long standing question has been to what extent does settlement determine the numbers of older lobsters and harvests in any given region?

**First Steps in Forecasting:** In 2012, Maine Sea Grant, the Atlantic Lobster Sustainability Foundation, and a subset of ALSI participants sponsored research to evaluate the predictive power of the settlement index for time trends in the fishery. The first analysis in that effort takes a necessary baby step before taking the bold stride to forecast fishery recruitment. That all-important first step determines if we can predict the abundance of 1-year-olds from newly settled young-of-year of the previous year. Figure 3 illustrates how suction sample data are used to track the fate of more than 20 year-classes over their first year on the sea bed in three well-studied regions. Interestingly, the range of settlement densities increases from south to north, with Beaver Harbour, NB, boasting one extraordinarily strong year class (2005) with a density of almost 8 YoY-per-m<sup>2</sup>. As might be expected, the number of 1-year-olds tends to be proportional to settlement the previous year, except in the extreme case of the 2005 year class where survival appears to have been disproportionately low, perhaps from crowding effects. In other words, the relationship between YoY and resulting 1-year-olds is essentially linear for the range of observed settlement densities up to about 4 YoY-per-m<sup>2</sup>. With any luck, a few more strong year classes like 2005 will give us a better understanding of how the line flattens at high densities. But Fig. 4 also suggests first-year survival in Beaver Harbour, NB, is usually considerably higher (85%) than in the other two regions (45%). These estimates assume we have correctly assigned ages to lobsters in our samples, and that emigration/immigration is trivial during the first year, sources of uncertainty that bear further testing. Nonetheless, these estimates are consistent with previous studies showing settlers do well if they live in good habitat. Uncertainty aside, the high survival at Beaver Harbor is impressive, and may reflect high quality nursery habitat and low predator numbers. Also surprising are the virtually equal survival rates at mid-coast Maine and Rhode Island despite the contrasting ecology of northern and southern New England. This underscores the need to understand post-settlement processes that affect survival as we begin to assess the predictive power of the index for time trends in the fishery.  $\theta$



**Figure 4. First year survival.** Fitted linear relationships and survival estimates from plots of YoY and resultant 1-year-olds the next year for three regions with the longest time series. The linear fit for Beaver Harbour excludes the extremely strong 2005 year class, but the red dashed curve shows one non-linear fit that includes that year class. As a reference, the green dashed line is 100% survival.