Final Report (Part I)
Submitted to the
Commercial Fisheries Research Foundation
15 December 2013

1. Project Title: A Fisherman-Scientist Collaboration to Re-assess Lobster Nurseries in Narragansett Bay After Two Decades of Environmental Change

2. **NOAA Award** # NA09NMF4720414, and # NA10NMF4720285
   **CFDA** #11.472

3. **Project Team:**
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4. **Period of Project:** July 1, 2011 to June 30, 2013

5. **Supporting Institutions:**
   University of Maine
   Rhode Island Division of Fish and Wildlife
   Rhode Island Lobstermen’s Association

6. **Total amount of sub-award:**
   UMaine (includes RIDFW subaward): $152,839
   Industry component: $46,588
   **Total** $199,427

7. **List of equipment purchased** ($5,000 or more in value) during project
   None

8. **Summary of tasks scheduled**
   During the two-year project we achieved the following objectives
Objective 1: Repeat a comprehensive sampling survey of lobster nurseries in Narragansett Bay and Rhode Island’s outer coast using diver-based visual surveys at 17 sites and suction sampling at a subset of 6 of those sites, as had been done in 1990. This was done both years of the project.

Objective 2: Deploy passive post-larval collectors the same sites where suction sampling is conducted, thereby enabling side-by-side comparisons of the sampling efficiency of the two methods. This was done both years of the project.

Objective 3: Expand the survey to include sites of interest to the lobster fishing industry, two new sites each year.

9. Summary of tasks accomplished

All project objectives and associated tasks were accomplished.

We also initiated periodic near-bottom monitoring of water temperature at a subset of study sites spanning the bay, and conducted water column temperature profiles when lobster surveys were conducted. In 2012 a one-time surface-bottom comparison of all sites for temperature, salinity, dissolved oxygen and pH was undertaken.

10. Explanation of problems encountered or differences between the scheduled and accomplished tasks.

Problems: No insurmountable problems were encountered. In 2011, Hurricane Irene caused losses of a total of 20 passive collectors and attached temperature loggers, and therefore some loss of data.

Deviation from plan: In 2012, we added a third-industry selected site (Fort Wetherill), beyond the originally planned two sites, to evaluate lobster densities in deeper water.

11. Summary of major project results (excerpted from Final Report – Part II)

- Diver-based visual surveys and suction sampling that were used in 1990 and again in 2011-2012 indicate significant declines in the abundance, distribution and size composition of juvenile lobsters in Narragansett Bay since 1990. Whereas in 1990 juvenile lobsters extended from the outer coast well into the mid-sections of the bay, in 2011 and 2012 they were largely restricted to the outer coast and deeper water at the mouth of the bay.
- Young-of-year lobsters were conspicuous in their rarity from nursery habitats in keeping with declining trends in long-term monitoring along Rhode Island’s outer coast.
- Patterns of lobster abundance and size composition recorded by passive collectors agreed with patterns generated by suction sampling, further validating the use of collectors as a tool in lobster settlement monitoring, despite sometimes remarkably high numbers of predatory fish also found in the collectors.
- Collections made at five industry-selected sites largely mirrored the results observed at the historically sampled sites, with one exception. A deeper site on the outer coast (15-17 m depth), harbored some of the highest lobster densities observed in the surveys, supporting the hypothesis that lobsters are more restricted to deep and outer coastal waters than they were two decades ago.
- Although no hydrographic survey was conducted during the 1990 lobster survey, measurements taken during 2011 and 2012 indicate that shallow water temperatures (<5m) at all locations...
sampled exceeded the 20°C thermal benchmark for lobsters during at least several weeks of the summer, even on the outer coast. Upper Narragansett Bay reached 25°C by mid-summer. The bay stratifies thermally during the summer, so that while conditions may be thermally stressful for lobsters in the shallowest waters, cool water conditions are generally within reach for mobile organisms within a short distance down-slope.

- Dissolved oxygen and pH levels were generally lower near the sea bed, likely reflecting benthic oxygen demand. DO and pH were strongly correlated, probably reflecting the effect of heightened near bottom CO₂ concentrations on acidification. Near-bottom pH values as low as 7.8 were recorded which falling with the projection range of ocean acidification at the end of the 21st century. The implications of this degree of acidification for the health of the lobster population are unclear.

- The Asian shore crab is a relative new-comer to the crustacean assemblage that was not present in the 1990 survey. As an aggressive intertidal and shallow subtidal crab that has impacted green crab populations in southern New England, we cannot rule out the possibility that they may be interacting with lobsters in shallow nurseries. However, this crab prefers shallow, warm water and does not overlap with lobsters in water deeper than a few meters.

- Not counting hermit crabs and caridean shrimp, our collections from suction sampling and passive collectors included seven species of crab, and one species of mud lobster.

- Fish were diverse and abundant in the passive collectors. Some 16 species of demersal and benthic fish were collected. Cunner, black sea bass, toadfish, and sculpins, all known lobster predators, were among the most abundant.

- Because juvenile and adult lobsters appear to be increasingly restricted to deeper and outer coastal waters of southern New England, further monitoring of settlement and nursery habitat in deep water is warranted.

- Future attempts to quantify population-level significance of deep water lobster nurseries will require combined effort of deepwater monitoring with higher resolution mapping of available nursery habitat.