Meeting Summary: "Turning the tide of lobster enhancement - a critical discussion of enhancement efforts"

From Michael Tlusty and Rick Wahle

Nearly 100 years ago, the famous lobster biologist Herrick assessed the state of the North American lobster (*Homarus americanus*) fishery, and concluded with the following recommendations:
Adopt a double gauge or length limit
1. *Protect the "berried" lobster on principle*
2. *Abolish the closed season if it still exists*
3. *Wherever possible, adopt the plan of rearing the young to the bottom-seeking stage before liberation*
4. *License every lobster fisherman, and adopt a standard trap or pot which shall work automatically, so far as possible, in favor of the double gauge*

While these five points have each been addressed, #4 - rearing larvae, remains the elusive recommendation as until recently, there has been a lack of demonstrated success in rearing lobsters with positive impacts on populations or the fishery. This lack of success is not for a lack of trying, as up to 30 hatcheries were operational in eastern North America during the last century. To this day, enhancement efforts continue and one group - *The Homarus Group* in Shippagan, New Brunswick (CANADA) – has shown that a pulse of lobsters reared and returned to the wild could still be detected three years post-release.

On 18 December 2007, 24 participants met at the New England Aquarium to discuss the present day status of North American lobster enhancement efforts. Presentations were provided on current rearing efforts by Martin Mallet of *The Homarus Group* and Ted Ames of the *Zone C Hatchery*. Efforts on tracking the released lobsters were described by Rick Wahle of Bigelow Laboratory and Michel Comeau of Division of Fisheries and Oceans, New Brunswick. Diane Cowan of *The Lobster Conservancy* provided an overview of natural settlement of lobsters in the intertidal zone, while Stan Cobb educated the group with a historical view of FH Herrick's work at the turn of the 19th century.

Our ability to rear lobsters to the 4th stage and beyond is well developed, however, the most effective manner in which to do so is subject to debate. The currently favored production systems rely on live algae and brine shrimp (*Zone C Hatchery*), frozen food and dry feed (New Brunswick), or via modifications of the enclosure system described by Herrick (Beal Island) in which natural zooplankton are consumed. All are labor intensive efforts and the current cost per postlarva is ~ $0.75 to $1.00US. The goal of *The Homarus Group* is to produce postlarvae for $0.25 each. The rearing system is critical, as questions were raised about the overall health of the animals being released. Thus more work needs to define the health and probability of survival of post-settlement lobsters released into the wild, including bacterial, pathogen, and behavioral assessments. Health assessment must also be tied to cost-effectiveness and risk assessment. Mallet offered that limiting the time in the hatchery will minimize "artificial" impacts on the lobsters, recent work suggests that artificial feeds for larvae can cause carry-over effects into stages IV-VI (Fiore and Tlusty 2005). The NB group is evaluating how artificial feed regimes influence larval condition and behavior (Thériault and Pernet, in press).

Superficially, it appears that the fate of the released animals is different between NB and Maine, yet the two programs differ in many aspects making comparisons difficult. In NB, Comeau el al. observed a pulse of cohorts (released as 4th stage) 2 and 3 yrs after release, with animals appearing to move into nearby sites after 2 yrs. During the first releases of stage 4 larvae in Maine during 2006, the pulse of lobsters was consistently lost one day after release, but stage 5 releases proved more promising. Switching to releases of stage 5 larvae in 2007 were more productive; lobsters from those releases have been recovered out to 2 months later. Visual surveys were used in NB, while in Maine suction sampling was used (smaller spatial scale, but higher lobster

size resolution). Discrepancies also exist in the reporting of the data. Maine larval releases and surveys are in cobble habitat, so density is expressed solely for this habitat, whereas the NB group assesses more habitat types on the order of km^2. Another factor is the natural suitability for the environment to support newly settled lobsters. The third year after the NB release, natural settlement increased greatly, and thus environmental parameters may have been suitable for newly settled lobsters at the time the NB animals were being released. Rick Wahle and Diane Cowan explained that in many areas of Maine, there were an abundance of larval settlers, but this did not appear to be the case in inner Penobscot Bay, Maine where the Zone C lobsters were placed.

The discussion turned to natural settlement, and the question if there are limitations based on resource availability, maximal densities, or other biotic and abiotic factors (temperature, predators, etc). For example, eastern Penobscot Bay has relatively poor settlement and local fishery landings per unit coastline have been less productive than the regions immediately to the west. It is likely the coastal circulation, namely, the Eastern Maine Coastal Current, starves eastern regions of a larval supply and enriches Maine's midcoast. A better understanding of larval source–sink dynamics is necessary.

As it currently stands, enhancement efforts are augmenting natural populations by a very small percent. Comeau estimated that in 2004 there were 5.4×10^6 natural settlers in North East NB, and 53,000 stage IV were released. Ted Ames estimated 1.5×10^9 larvae and 16×10^6 settlers in the Gulf of Maine. Thus the overall impact of current enhancement programs will be a tiny fraction of the total population. Yet, even with this small production, concerns were raised about the genetics implications of an enhancement program based on a small number of females. *The Homarus Group* utilized approximately 600 females in their enhancement program and kept them segregated by area. This was lauded as a good start, but did not dispel all concerns.

Substantial time was also devoted to the discussion of tools that may be useful in determining the success of any enhancement program. The genetic work conducted by Towle and Gerlach using genetic finger printing was offered as a way to genetically distinguish enhanced lobsters. In 2008-2009 Wahle and Gerlach will be undertaking a Sea Grant project to explore the utility of genetic fingerprinting approaches as a tool to distinguish hatchery from wild stock. If successful this approach would sidestep the prohibitive undertaking of tagging hundreds of thousands of lobsters and thereby streamline the process of evaluating the impact of hatcheries. The utility of microwire tags were also discussed, and while of limited utility in assessing the initial success of the IV lobsters, once the lobsters have grown, this is a feasible method to track the older animals, as demonstrated by Cowan in Maine (see also Bannister and Addison, 1988, Bull Mar Sci 62:369-387). No other appropriate marking technologies appear to be currently available.

Questions still surround the efficacy of American lobster enhancement. While the experimental seeding site in New Brunswick demonstrated a positive effect, this success has not yet been demonstrated elsewhere. Ted Ames eloquently pointed out that enhancement was a tool to recover subunits of a system, and the goal was to work toward restoration of the functional system without harming other subunits. Thus in terms of next steps, the populations most in need of enhancement need to be identified and long term monitoring of larval settlement established throughout the species range to better elucidate the source-sink question and identify the factors driving settlement (temperature, high level atmospheric influences) and areas where natural recruitment is sufficient and should be allowed to operate without enhancement. Guidelines must also be developed for enhancement work. Enhancement "standards", "Best Management Practices", criteria for defining health of potential releasees, and the operational goals of the programs need to be developed. It was suggested that "restoration of damaged populations" be the refocused goal of current programs.

Finally, it is clear that increased communication needs to occur between the groups represented here, as well as other crustacean enhancement efforts. Brad Stevens provided ample experience from development of a stock enhancement effort with the blue crab in the Chesapeake and many issues experienced in that endeavor are germane to the American lobster.

In summary, the success of the Homarus group in New Brunswick has offered optimism that hatchery reared lobsters can be successfully released and survive. It has not yet been determined if these animals will recruit to the fishery. This optimism needs to be tempered by the large number of questions still surrounding this body of work. It is unknown whether these efforts will be successful everywhere, and furthermore, it is important to clearly define the criteria by which we measure success. Furthermore, a full risk-assessment has yet to be conducted, and in particular, are there deleterious effects on healthy populations. Work needs to be directed at determining program outcomes, and standards relating to program quality and best management plans.

LITERATURE CITED

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AMUSEMENTS

Are You in the Book of Lobster World Records?

From Win Watson

Every baseball fan recognizes the magical numbers 56, 61 and 715. Basketball fans are enamored with 23 and 100. Pele's number 10 jerseys still fetch thousands at auctions. Most Americans alive today react to 9/11 and SciFi connoisseurs have been raised on 1984 and 2001. But what about lobster scientists?

Soon 18, 117 and 217 will be etched in our brains. Next time you sit down to eat a lobster you won't be able to avoid thinking about Ehud Spanier eating 18 different species of lobsters in his career. When you pull up your next trap and joke that it must be so heavy because it is full of lobsters, think of Sara Ellis sorting through 117 of them from one ventless trap. Think that jumbo American lobster in the local aquarium is big? Try pulling up a 217 mm CL male while SCUBA diving (I think it was actually larger than Peter Lawton). How can you possibly forget these milestones?

Are you worried you will? Me too. So, I am creating a repository for these interesting facts and figures, The Lobster Book of World Records (actually, it will be a website soon). Since the International Lobster Conference in PEI this fall, records have been pouring into our office. However, there is no doubt that we are only dealing with the tip of the iceberg. The purpose of this article is to urge you to help me expand and refine the Record Book. All records you submit should have some type of validation (testimony from dive buddy, reference, Xerox of page from data book, etc.). We welcome pictures of records as well as record holders, to enhance the website.

Below is just a small sampling of the records we have and the types of records we seek. As an indication of