

A Summary of the meeting “Turning the tide of lobster enhancement- A critical discussion of enhancement efforts”

Michael Tlusty, New England Aquarium, Central Wharf, Boston MA 02110

Rick Wahle, Bigelow Laboratory for Ocean Sciences, P.O. Box 475; 180 McKown Point Road, West Boothbay Harbor, ME 04575-0475

Nearly 100 years ago, Herrick (1911) assessed the state of the North American lobster fishery, and concluded with the following recommendations:

1. Adopt a double gauge or length limit
2. Protect the "berried" lobster on principle
3. Abolish the closed season if it still exists
4. Wherever possible, adopt the plan of rearing the young to the bottom-seeking stage before liberation
5. 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, and positively impacting 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, efforts continue, with the exception that the Homarus Group in Shippagan NB appears to have demonstrated success in that a pulse of lobsters reared and returned to the wild could still be detected three years post-release.

On 18 Dec, 2007, a group of 24 interested participants (detailed list is at the end of this summary), 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 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 DFO NB. 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 seminar work at the turn of the 19th century.

Overall- the 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), frozen food and dry feed (NB) or the more modifications of the enclosure system described by Herrick (Beal Island) in which natural zooplankton are consumed. All are labor-intensive efforts, however. The current cost per postlarva is ~ \$0.75 to \$1.00. The goal of Homarus is to produce postlarvae for \$0.25 each. The rearing system will be critical, as questions were raised about the overall health of the animals being released. Thus more work needs to define health of post-settlement lobsters, where health can be assessed as quality of the animal (and probability of surviving once released), bacteria and pathogen assessments, as well as behavioral. In general, the assessment of health needs to be tied into a cost-effectiveness as well as a risk assessment of the release. While Mallet offered that limiting the time in the hatchery will minimize the “artificial” impacts on the lobsters, it should

be noted that work with artificial feeds for larvae demonstrated carry-over effects into stages IV-VI (Fiore and Tlusty 2005, *Aquaculture*. 243:291– 303). The NB group is evaluating how artificial feed regimes influence larval condition and behavior (Thériault and Pernet, in press).

Surficially, it appears that the fate of the released animals is different between NB and Maine, yet the two programs differ in every aspect, thus direct comparisons are difficult, if not impossible. In NB, Comeau et al. observed a pulse of cohorts (released as 4th stage) 2, and 3 years after release, with animals appearing to move into nearby sites after 2 years. During the first releases of stage 4s 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 5s in 2007 were more productive; lobsters from those releases have been recovered out to 2 months later, the most recent surveys only a few weeks prior to this meeting. Visual surveys (larger spatial scale, but perhaps overlooked newly released lobsters) were used in NB, while ME used suction sampling (smaller spatial scale, but higher lobster size resolution). Discrepancies also exist in the reporting of the data, where ME releases and surveys cobble habitat, and density is expressed for solely this habitat, while the NB group assesses more habitat types on the order of km². 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. Although Rick Wahle and Diane Cowan explained that in many areas of Maine, there was an abundance of larval settlers, this did not appear to be the case in inner Penobscot Bay ME 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). In addition to limiting settlement, the question was raised as to survival to the settled lobsters, and if there is a significant factor between settlement and recruitment to the fishery that is significantly reducing population numbers. 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* program utilized approximately 600 with them segregated by area. This was lauded as a good start, but did not dispel all concern.

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 significant marking technologies could be offered, and will continue to be stymied by continual loss of hard tissue.

Ultimately, questions still surround the efficacy of American lobster enhancement. While the experimental seeding site in NB 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, long term monitoring of larval settlement is necessary to better elucidate the source-sink question, factors driving settlement (temperature, high level atmospheric influences), and to determine populations demonstrating decline and in need of assistance. This long term monitoring will also help to determine healthy populations that should be allowed to operate naturally without enhancement.

In terms of active enhancement work, program guidelines need to be developed. Loosely termed “standards”, Best Management Plans, criteria for defining health of potential releases, and operational quality of the programs need to be elucidated. A significant need is for each program to have an operational goal. Enhancement is too vague a term, and the chasm between settlement and recruitment to the fishery large and unwieldy. It is 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, many issues being germane to the American lobster. It would also be prudent to compare lobster efforts to those occurring with the blue crab in the Chesapeake.

As with any stakeholder meeting such as this, more questions were raised than answers were provided. Yet the questions help define where future effort should be directed. It is clear that if any hatchery effort is to be funded, additional resources will need to be directed toward understand the effect of these introduced animals on the natural populations. This monitoring will also be necessary to define populations that are in need of assistance and need to be recovered. It is also clear that while we have been offered a modest glimpse of success through hatchery-based releases, we do not fully understand the mechanisms behind that success, and if it can be repeated. However, with current lobster harvests significantly greater than long term averages, this is the time to invest in assuring that the mechanics of rearing lobsters in hatcheries for subsequent release is sound. This is analogous to insurance for the lobster industry. The time required to refine the mechanics of this work needs to be invested now before any crisis situation occurs. Localized population depletions can be used to test the mechanics prior to full scale implementation. Ancillary benefits of investment in hatchery rearing include research, education,

and participation by the fishermen. In both NB and ME, current hatchery work has been driven by stakeholder participation through the fishery.

With current lobster landings at all-time highs, this is the perfect time to invest in an “insurance” program. While enhancement is feasible, much more work needs to be conducted. There are a variety of new technologies to be developed, such as genetic finger printing that will better enable researchers to determine hatchery efficacy. It is also necessary to harmonize field-survey methods so that programs can be judiciously and effectively compared to one another. These difficulties are best sorted prior to any crisis so that when called upon, hatchery releases can be economically and biologically effective. Moreover, there are pockets where larval settlement and recruitment to the fishery are demonstrably poor. This provides suitable opportunity to conduct research on this topic. However, even with a demonstrated need in the most economically important fishery in northeastern North America, there is still a significant lack of funding for this type of work. This is a situation that must be rectified.

In summary, the success of the *Homarus* group in NB 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. This optimism warrants further work at improving all aspects of an integrated program.