
The current project is to develop a semi-commercial scale hatchery system for the green sea urchin, Strongylocentrotus droebachiensis, to demonstrate the feasibility of stock enhancement and sea ranching urchins in the Gulf of Maine. This project is just the latest phase of a continuing progression of studies on sea urchins which began with demonstrating the feasibility of a sea urchin fishery in the Gulf of Maine in the mid-1980's when sea urchin populations had exploded and altered much of the shallow water benthic communities of the Gulf of Maine. Further studies to develop approaches for a sustainable fishery were soon superseded by the realization that the fishery would not be sustainable with current management practices. The focus then changed to aquaculture as a means for stock replacement and/or sea ranching urchins. Continuing studies of recruitment of urchins has demonstrated a decline in settling juvenile urchins that matches the decline in urchin landings that began in 1994 (Harris, et al, 2001). The present project seeks to demonstrate an integrated system of larval culture, juvenile grow out and winter out planting (Harris, 2000). A series of studies are underway that will be described in the following paragraphs that involve each aspect of the hatchery system.

Larval Cultivation.

Five sets of larval cultures were successfully reared through metamorphosis, beginning in Feb. 2000. The urchins were obtained at the Isles of Shoals and spawned at a culture facility in Spaulding Hall. The
resulting larvae were fed two species of phytoplankton, Isochrysis and Rhodomonas, also grown in the lab. The juvenile urchins obtained from these cultures are now being used in growth studies at the Coastal Marine Laboratory. An enlarged larval culture system is being developed in a former lobster pound associated with Portsmouth Scuba Shop. The owner of Portsmouth Scuba, Mr. J. Gingrich, holds an aquaculture lease site in Little Harbor, NewCastle. Two other fishermen with urchin lease sites in Maine, Mr. Steve Whitney and Mr. Chris Hill, are collaborating on the development of the hatchery system.

Juvenile Growth Studies.

Sea urchins obtained from settlement panels in 1998 and 1999, as well as, those grown from larvae in the spring of 2000, are presently in culture at the Coastal Marine Laboratory. The 2000 urchins are being tested for growth rates in flow through troughs in the lab as well as in mesh cages suspended in the estuary. The goal is to find the most cost efficient method for raising urchins to a size, >10mm, where they can be out planted with high survivorship during the upcoming winter months. A raft system with flow through troughs is being developed to hold young urchins where natural light and water flow can provide algal growth on panels with a minimum of labor for maintenance and feeding. A prototype raft system was developed by a group of students through the Sea Grant supported Ocean Projects Course. Support for the project was also provided by Keller Industries of Manchester, NH. Further development of the raft system is planned for the 2000-2001 academic year.

Out Planting.

Previous studies have demonstrated that small urchins can be out planted in the winter months when predators are inactive in the highly seasonal waters of the Gulf of Maine. Additional out planting studies are planned for the winter of 2000-2001. The Japanese have a system of stock enhancement that involves releasing urchins after they have reached 20+ mm. Our results suggest that animals of 10 mm can have high (>70%) survival if out planting occurs in the winter months.

Future Efforts

The immediate goal is to continue the growth studies with small urchins and to expand the larval culture systems so that a semi-commercial level of effort is underway during Feb. to April, 2001. Out planting experiments will also be conducted during the coming winter. Additional
funding is being sought through the Department of Agriculture and the Northeastern Regional Aquaculture Center (preproposal accepted and full proposal in review). Work on a manuscript on juvenile growth studies is underway and two presentations have been made since February, 2000. The manuscript (Harris, L. G., M. Tyrrell, C. T. Williams, C. Chester, C. Sisson and S. Chavanich, 2001. Declining sea urchin recruitment in the Gulf of Maine: is overfishing to blame? In: M. Barker (ed.) Proceedings of the 10th International Echinoderm Conference, Dunedin, New Zealand. A. A. Balkema, Rotterdam. (in press)) was presented at the 10th International Echinoderm Conference in Dunedin, NZ in February. An invited talk and report titled "Sea ranching green sea urchins: a system for larval culture, juvenile grow out and out planting" was given at The Workshop on Co-ordination of Green Sea Urchin Research in Atlantic Canada", which was held at the University of Moncton, New Brunswick, Canada on 1-2 June, 2000.

The current grant has been funding a former undergraduate student, Ms. Tricia Madigan, who has proven to be most effective at the cultivation of algae, urchin larvae and juveniles. She will be a co-author on two papers relating to juvenile growth and larval culture systems.