

COASTAL RECREATIONAL FISHING LICENSE
SEMI-ANNUAL PERFORMANCE REPORT

Recipient: Charles H. Peterson

Grant Award #: 002222

Grant Title: Testing alternative designs of planting seed oysters to optimize oyster reef habitat creation

Grant Award Period: 6/1/2009- 6/30/2011

Performance Reporting Period: 6/1/2009-6/30/2010

Project Costs:

Expenditures for the Period:

<u>Category</u>	<u>Expenditures</u>
Personnel	80,369.94
Fringe	10,201.68
Travel	450.00
Equipment	0
Supplies	20,255.77
Construction	0
Contractual	0
Other	8942.61
Total Direct	120,220
Indirect	<u>12,022</u>
TOTAL	132,242

Total Cumulative Expenditures: \$132.242

Total Remaining Balance: \$0

Description of Work:

- (1) In collaboration with the DMF oyster reef habitat sanctuary program, we will conduct field trials in which we will vary oyster seed size (3 size classes) and planting date (three dates from June through Oct) in test plantings on constructed oyster reefs at three sanctuary sites in the Pamlico Sound differing in geographic region and salinity. Monitoring over two years after planting will reveal how size-dependent and season-dependent survivorship of seed and establishment of reef habitat structure varies with sanctuary location and environment.
- (2) We will determine if natural oyster settlement varies across artificial oyster reefs as a function of seeding. Seeding may enhance development of oyster cover and habitat structure through promoting settlement of oyster larvae attracted by biochemical settlement clues. Three different settlement collectors, composed of unaggregated adult shell or PVC plates, will be tested and used to measure natural recruitment of oyster spat on the marl reefs.
- (3) On three dates over the warm season of early seed growth and survival (June through Oct), we will conduct field sampling programs to characterize the abundances and size frequency

distributions of all potential predators on seed and juvenile oysters at each of the three sanctuary locations. Predators of most concern include mud crabs, blue crabs, black drum, sheepshead, and cownose rays.

- (4) To test the hypothesis that predation is the major cause of mortality of seed oysters, we will install seed oysters set on shell inside and outside of predator exclusion cages planted out on each sanctuary reef on three dates distributed across the warm season (June through Oct). Cages are to be made of two mesh sizes, one intended to exclude small predators the size of mud crabs and the other to exclude fishes from the size of small black drum upwards. In addition to testing the role of predation in contributing to mortality of seed oysters, we will also document the spread of space competitors on the surface of the half shell on which seed were introduced, yielding visual evidence of overgrowth and mortality, if it should occur.
- (5) Using the predators captured during sampling of the predator fields at each sanctuary site, we will conduct laboratory experiments in outdoor mesocosms at the UNC IMS laboratory in Morehead City in which we will test for size preferences and size limitations of each predator feeding on seed and juvenile oysters over a range of size classes. These trials will be run using multiple size classes of the predators, as present in the sanctuary sites. Results will be used to evaluate whether survival of seed in field planting trials can be explained by predation risk, as predicted from abundances, size preferences, and feeding rates of the predator field at each date and sanctuary site. The resulting mechanistic understanding of predation risk would allow prediction of the likely success of seeding at prospective new sanctuary sites before investing the resources to actually construct the artificial reef and seed it.

Project Status/Work Accomplished:

For each objective, describe tasks scheduled for the reporting period and the activities undertaken to complete them. Describe the specific accomplishments.

Objective 1

We were not able to measure size-dependent and season-dependent survivorship of seed oyster because DMF's funding to seed oyster was frozen, see Deviations for details.

Objective 2

We expanded this objective to measure oyster settlement at six oyster sanctuaries (Neuse River, West Bay, Middle Bay, West Bluff, Crab Hole, and Ocracoke) as well as in Bogue Sound (UNC-IMS dock). Three different types of collectors were set at 4 sites (Neuse River, West Bluff, Ocracoke, and UNC-IMS) to determine the most efficient settlement collector and allow us to compare larval supply to past studies. Larval supply was measured with one collector at the remaining 3 sites. Collectors were set twice, during each of the two peak oyster spawnings (early June to mid August and mid August to early October).

Objective 3

We conducted predator monitoring at six sites over the warm season of early seed growth and survival (3 times from June through Oct), as well as once during the winter. At each site/time sampling we set research gillnets (sampling fish that are oyster predators), crab pots (sampling crabs and toadfish), and plastic trays filled with oysters (sampling mud crabs, snapping shrimp, and gobies). In addition to the proposed work, we set and collected pot scrubbers ("tuffies"), which sample recently settled crabs and other crustaceans. This enabled us to measure the larval supply of important oyster predators. These data will be compared to abundance of adults caught in trays and pots, as well as to larger fish that eat crabs, to determine importance of indirect effects on oyster survival.

Objective 4

We were unable to test whether predation is the major cause of mortality of seed oysters in the field, because DMF's funding for seeding oyster was cut. See Deviations for further details.

Objective 5

We conducted extensive laboratory experiments in outdoor mesocosms at the UNC IMS laboratory in Morehead City to test for size preferences and size limitations of each predator feeding on seed, juvenile, and adult oysters. We used the grant to purchase and raise a half million larvae that were seeded on adult shell. These seed oysters allowed us to complete this objective without using DMF's seeded shell (Objective 1). Multiple sizes of sheepshead, black drum, toadfish, blue crab, stone crab, and mud crab were tested for oyster consumption. Seeded oysters (1-3 cm) as well as 3 sizes of adult oysters (2.5-8 cm) and 3 sizes of mussels (1-8 cm) were offered to the predators to determine consumption rates and feeding preference.

Deviations:

If there were changes to the goals/objectives during the reporting period, please detail the circumstance and nature of change. Explain any special problems or circumstances which prevented the accomplishment of scheduled tasks. Describe actions to resolve problems encountered and provide the details of any changes made to goals and objectives of the project.

The state budget crisis and response to limited funds in spring 2009 led to a freeze on funds initially allocated to the DMF oyster seeding of sanctuary reefs. Two of our project objectives (Objective 1 and Objective 4) were directly tied to that seeding, which led to the inability to complete those objectives in 2009-10. Instead we allocated our 2009-10 research effort more intensely to the remaining objectives so that we could free time and funds to allow us to conduct the research under Objectives 1 and 4 in the second year (2010-11) using our CRFL funding to provide the seed oysters in 2010 even if state funding for seed oysters is again unavailable. We are able to switch effort between years in this way and find funds for the seed purchase, deployment, and extra field efforts in 2010-11 by replacing some of the Graduate Student salary with funds from another source.

In 2009-10, we completed all research planned under Objectives 2, 3, and 5 for that initial year plus for Objective 5 much of what we planned for the second year (2010-11). Specifically, we used this grant to purchase 500,000 eyed oyster larvae, which we induced to settle on adult shell and then used for predation experiments (Objective 5). To reallocate effort between years, to provide extra effort for Objectives 1 and 4 in 2010-11, we expanded the 2009-10 scope of Objectives 2 and 3 both spatially and temporally. We doubled Objectives 2 and 3 to include 6 oyster sanctuaries (Neuse River, West Bay, Middle Bay, West Bluff, Crab Hole, and Ocracoke). We measured predator abundance (Objective 3) 3 times during the summer and once in the winter at all 6 sites. We will continue to monitor (Objectives 2 and 3) the proposed sites (Ocracoke, West Bluff, and Gibbs Shoal), as well as the additional sites (West Bay, South River, Crab Hole and Middle Bay) in year 2.

The second year of this grant faces the same problems as the first year: DMF's funding for seed oyster has been lost. But, we know this ahead of time this year and have been able to plan for this contingency: we currently have a bid out to purchase 22.5 million eyed oyster larvae. In collaboration with DMF oyster reef sanctuary program (Craig Hardy and Stopher Slade), we plan to set these oysters on unaggregated adult shell in large tanks on the DMF dock. This will allow us to plant small seed (<1 cm SH) on two mounds at three sites (Ocracoke, West Bluff, and Gibbs Shoal) in early June and again in mid-July to test if planting date is an important factor in seed survival. We will grow out oysters that were seeded at the same time as the first deployment and deploy them with the second set (mid-July) to test if planting size alters seed survival. In addition, we will also deploy unseeded shell at two mounds at each site as a control for substrate added by seeded shell, which is an important additional task that was

not proposed. We are also using funds from this grant to pay for deployment, which was originally going to be carried out by DMF until their funding was frozen. Seeding and deploying our own oysters following DMF's protocols will allow us to complete proposed objectives in year 2, giving extra effort to Objectives 1 and 4, which had been necessarily postponed from year 1.