Annual Project Summary for Endorsed Projects

Sea Duck Joint Venture
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Project Title (SDJV Project #: 78) Delineation of surf scoter (*Melanitta perspicillata*) habitat in Chesapeake Bay, Maryland: macrobenthic and sediment composition of surf scoter feeding sites.

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Project Description:

Surf scoters are one of the least studied waterfowl and surveys have indicated a declining population over the past several decades. Along the Atlantic Coast, the Chesapeake Bay is an important wintering area for surf scoters, containing large numbers from November through April. Over the past century, the Chesapeake Bay has experienced declining environmental conditions that have had a significant effect on the ecosystem. The most widespread effects have typically been due to low oxygen events (hypoxia). Locations with summer hypoxia show a restructured benthic community (Diaz and Rosenberg 1995) and tend to be composed of large numbers of opportunistic species, such as dwarf surf clam (*Mulinia lateralis*). Low oxygen events, combined with the significant loss of oyster habitat (1% of historic levels), have caused a shift in the Bay, from a benthic to a pelagic driven system.

Recent food habits analysis indicate that surf scoters are feeding primarily on dwarf surf clam and hooked mussel (*Ischadium recurvum*) in the Bay. These two estuarine bivalve species typically occur in different habitats, with dwarf surf clam found in soft substrates and hooked mussel found on hard substrates. Additionally, there appears to be differences in food habits along the north-south estuarine salinity gradient in the Bay. A sample of scoters collected from the lower Bay indicate scoters are feeding on higher salinity species, such as false-angel wing (*Petricola pholadiformis*) and jackknife clam (*Ensis directus*).

We sought to determine habitat use of scoters in the Bay and whether these habitats are being affected by degrading environmental conditions.. In order to gain a bay wide perspective, we sampled sites in the in middle and lower Bay that contained feeding surf scoters and compared them against nearby sites that did not contain feeding scoters. Benthos were sampled in summer, fall, and spring at middle Bay sites and in early summer at the lower Bay sites. Sites in the lower Bay will be sampled a final time

in October. Additionally, we determined the sediment grains size, salinity, and dissolved oxygen at each site. Salinity and dissolved oxygen were determined both on site and from nearby water quality monitoring stations.

Objectives:
This project addresses the SDJV priority of delineating important coastal wintering habitats for surf scoters along the Atlantic Coast. Objectives of this study are as follows:

1. Determine the location of feeding surf scoters in the lower (high mesohaline – polyhaline) Chesapeake Bay.
2. Determine the species and biomass composition of benthic invertebrates at sites with feeding surf scoters and sites without feeding scoters (both middle and lower Bay).
3. Describe the abiotic characteristics (sediment, dissolved oxygen, and salinity) at all sites.

Preliminary Results:

Two regions (Pocomoke Sound and the lower Potomac River) in the lower Bay were identified as potential sampling areas from 2005 mid-winter waterfowl surveys and the 2005 seaduck survey in the Bay. Surveys to locate specific sites with feeding scoters were attempted twice in Pocomoke Sound; however weather conditions prevented their completion on both occasions. We then focused on the lower Potomac sub-estuary, where we identified 3 areas of scoter feeding based on three data sets: sustained use by scoters implanted with satellite transmitters, land-based observations, and aerial survey data. Benthic sampling of lower Bay sites began in June and will be repeated in October.

Analysis of habitat usage in the middle Bay indicates that scoters are using a combination of hard substrates (packed clay and degraded oyster bars; Figure 1) as well as substrates comprised predominately of sand. Preliminary results from the lower Bay show similar results, with a larger proportion of oyster beds relative to sand. Much of the hard substrates are extremely patchy, with fossil oyster shell often resting on, and surrounded by sand. This contrasts with locations without feeding scoters which contained predominately mud substrates.

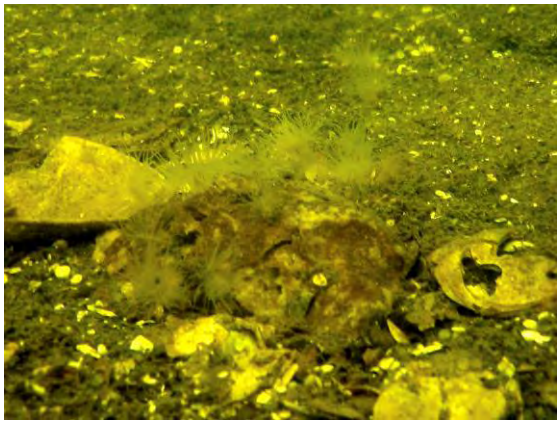

Figure 1. Fossil oyster shell containing anemones (*Diadumene leucolena*) surrounded by shells and sand; typical of degraded oyster bars.

Seasonally, biomass at feeding sites in the middle Bay declined slightly from fall to spring, while the biomass at non-feeding sites increased nearly 4-fold. Much of the decline in biomass at feeding sites was due a significant decrease in hooked mussel densities (Figure 2) which indicates possible localized depletion from scoter foraging. Dwarf surf clam densities were low from summer to fall, but were 20 times higher in spring (Figure 2). Similar increases were found for all other species of bivalves (n=5) at both feeding and non-feeding sites. These increases were due to large late fall larval sets followed by rapid growth over winter. Although analysis of seasonal changes at lower

Bay sites will not be known until the completion of October sampling, preliminary June data indicate similar low densities of hooked mussel in early summer. Mussel densities on restored oyster bars can exceed 3,000 m^{-2}, compared to15 m^{-2} on degraded beds, indicating that successful oyster restoration may benefit scoters through habitat creation.

No differences were found in salinity, dissolved oxygen, or water depth between feeding sites and non-feeding sites in either the middle or lower Bay. Salinity at lower Bay sites averaged higher than the middle Bay (13.5 v. 9.5, respectively), although this difference was not as large as expected. Measured dissolved oxygen at both the lower and middle Bay sites were slightly higher (5.2 and 6.2 mg/l, respectively) than the hypoxic threshold for most species (5mg/l). However, hypoxic conditions were detected during the summer by nearby monitoring stations, especially in the lower Bay where the duration was longer than the upper Bay.

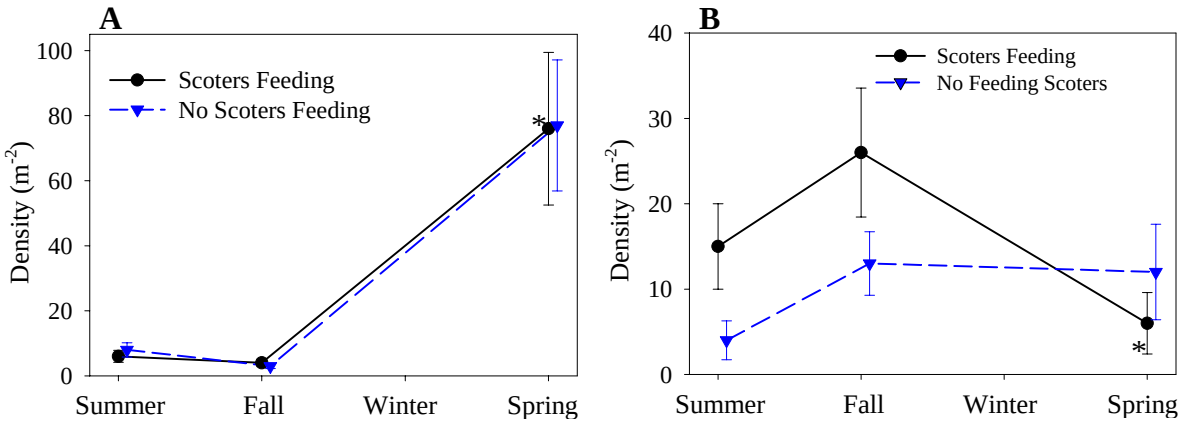

Figure 1. Mean (±SEM) seasonal density (m^{-2}) of dwarf surf clam (A) and hooked mussel (B) at feeding and non-feeding sites in the middle Bay. * $p<0.05$ from prior month within class.

Project Status

Habitat sampling and analysis in the middle portion of the Bay is complete, while work in the lower Bay is continuing. Boat surveys in the lower Bay were hindered on two occasions due to high winds, resulting in hazardous seas and small craft advisories. Continued high frequencies of days with high winds and small craft advisories (including 8 days with gale warnings) prompted a change from a winter-summer sampling regime to a summer-fall regime when conditions are less hazardous. High winds and hazardous seas are frequent on the Bay in winter, but were abnormally high in 2005-2006. Despite this set back, benthic samples obtained in the lower Bay are yielding promising results. Analyses of invertebrate and sediment samples obtained in June 2006 from the lower Bay will be completed in October 2006 and fall sampling will begin in late October. Trials in dive tanks beginning in November 2006 will determine the comparative functional response of surf scoters feeding on variable densities of hooked mussel and dwarf surf clam. Additionally, we will be analyzing samples obtained from divers for grab sampling validation. We are seeking funds to further determine the effects of oyster restoration of surf scoters in Chesapeake Bay.