Responses of Benthic Invertebrate Assemblages to the Asbury-Manasquan Inlet Beach Nourishment Project, Northern New Jersey

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Forty seven kilometers of exposed, high-energy beaches extending from Manasquan Inlet to Highland Beach, New Jersey were nourished as part of a shoreline protection project jointly sponsored by the U.S. Army Corps of Engineers, New York District and the State of New Jersey, NJ Department of Environmental Protection. Approximately 19 million m^3 of sand was placed on the beaches making this one of the largest such nourishments (in terms of volume) ever constructed. As part of the biological monitoring program (BMP) instituted to address concerns about potential ecological impacts due to beach nourishment, intertidal, nearshore, and offshore borrow area infauna were sampled. Environmental impacts from beach nourishment are typically confined to the borrow (dredge) and beach (fill) areas and include reduced abundance of infauna, altered infaunal community structure, increased turbidity, and altered feeding habits among fish and other commercially important species which rely on infauna as forage. Previous studies have concluded that, in most cases, impacts from beach nourishment to intertidal infauna are short-term, minor and are outweighed by benefits to flood protection and recreation. Impacts to borrow area infauna are much longer with recovery times of approximately 2-3 years. However, most previous studies were conducted at sites geographically distant from New Jersey (e.g., southeastern U.S) and their applicability has been questioned. The overall objective of the project has been assess the impact of the dredging and filling operations and to apply these findings to assessments of subsequent renourishment operations and other similar projects in the New York-New Jersey area.

The study area was divided into three sections: Manasquan Inlet to Shark River which was nourished in 1997 (South), Shark River Inlet to Asbury Park which was nourished in 1999 (Middle)-2000, and a section of completely unnourished beach extending from Asbury Park to the northern edge of Deal (North). A total of ten sampling transects were established in each section and samples were collected at Mean Low Water (MLW), MLW-1m, and MLW-3m (Nearshore). Three infaunal samples were taken at each intertidal depth with a 7.5 cm ($44cm^2$) corer to a depth of 10 cm. A sample for grain size analysis was taken at the same time. Nearshore samples were taken with a Smith MacIntyre Grab sampler ($0.1m^2$). Samples were taken twice a year (Spring and Fall) from June 1994 to May 2000. Samples at MLW were collected on a monthly schedule at six sites during nourishment in 1997 and again in 1999-2000. Three offshore borrow areas were also sampled on a semiannual basis to detect potential impacts resulting from the sand mining operation.

Twenty infaunal and sediment samples were taken at each of three borrow areas between June 1994 and May 2000.

The intertidal infaunal assemblage was similar to those reported from other mid-Atlantic coast sandy beaches with rhynchocoels, the polychaetes *Scolelepis squamata, Protodriloides* (LPIL), and *Microphthalmus* spp., oligochaetes, the mole crab *Emerita talpoida*, and a number of haustoriid amphipods dominating abundance. The nearshore assemblage included many of the same taxa, but was dominated by the wedge clam, *Donax variabilis*, the polychaetes *Magelona papillicornis* and *Asabellides oculata*, the bivalves *Spisula solidissima* and *Tellina agilis,* and the amphipods *Acanthohaustorius millsi* and *Psammonyx nobilis.*

Intertidal abundance was generally highest in the summer and lowest in mid-winter. Impacts to intertidal infauna included short-term declines in abundance, biomass, and taxa richness. Recovery was complete at MLW within 2-6.5 months after filling (the same time period noted in previous studies) and differences in recovery rates were most likely due to differences in the timing of when nourishment was complete. There was no detectable impact to MLW-1m and Nearshore assemblages in 1997 however, in 1999-2000 impacts were still obvious 6 months after the conclusion of filling. Notably, abundance and biomass values were no lower at this time than values encountered during baseline (unnourished) conditions.

The offshore infaunal assemblage was typical of other medium sand habitats in the New York Bight. It was numerically dominated by the archiannelid polychaete *Protodrilus* (LPIL), the amphipod *Pseudunciola obliquua*, and the tanaid *Tanaissus psammophilus*. Biomass was dominated by the sand dollar *Echinarachnius parma* as well as *S. solidissima*, *Ensis directus*, and the tellinid *T. agilis*, or a suite of polychaetes including *M. papillicornis*, paraonids, cirratulids, and nepthyids. Dredging resulted in decreased total abundance, biomass, taxa richness, and the average size of sand dollars. Species and biomass composition were altered in similar manners by each dredging operation: immediately after dredging the relative contribution of echinoderm biomass declined and the abundance of the spionid polychaete *Spiophanes bombyx* increased. Abundance recovered quickly after both dredging operations (1997 and 1999) with no detectable difference between dredged and undisturbed areas by the following spring. Total biomass and the average size of sand dollars required 2-2.5 years for recovery.