SEDIMENT MOBILITY ON THE LONG ISLAND CONTINENTAL SHELF

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Fixed offshore infrastructure, like outfalls or windfarms, are affected by sedimentary processes on the sea floor. Potential sediment mobility was assessed on the Long Island Shelf given the grain-size of the sediment and based on the maximum stress on the sea floor caused by waves combined with that of the tide. Normal shelf sediment transport in a region, like the migration of bed forms and ridges, can scour, bury or expose seabed infrastructure. In addition, fixed offshore structures will change the flow of bottom water and hence sediment transport patterns in and around the structure (Yamini et al. 2018; Coughlin et al. 2020). Resultant changes to both the sea floor composition and morphology will impact both the submerged structure's stability and, perhaps, functioning as well as change the benthic habitat and local ecology (e. g. Coates et al. 2014).

Tidal currents, storm-driven currents, surface waves and internal waves all provide a stress on the sea floor that can move sediment (e.g. Butman et al. 2006). Low-relief sand ridges or sand waves are known to migrate on the shelf most likely mobilized by currents during storms (Trowbridge 1995, Calvete 2001). These features have been observed to move at rates of several meters per year (to the west; Liu et al. 2018). Redistributions of modern sands has been continuous and widespread (Lashley 2018).

The distribution of grain sizes was made from 9,438 discrete samples from the U.S. Geological Survey's usSEABED dataset from Block Island south along the New Jersey coast. These were converted to the distribution of the critical Shield's parameter needed to mobilize sand, based on the grain size (Cao et al. 2006). Wave data from The National Data Buoy Center (Buoy 44025) between 2007 and 2016 was used to identify extreme conditions. Simulating Wave at Nearshore (SWAN) was used to calculate the wave stress (skin friction) on the sea floor during extreme conditions. The maximum skin-friction due to the tide was added from a coastal circulation model Finite Volume Community Ocean Modeling system (FVCOM; Egbert and Erofeeva 2002) for currents The critical shear stress was compared with the maximum of combined stress caused by extreme waves and currents to estimate the sediment mobility.

In both the summer and winter, the sediment surface of the entire shelf is susceptible to being mobilized by waves supplemented by currents. As expected the most mobile areas are near the shoreline but moderate mobility was found along oblique shore-attached, sand ridges offshore of western Fire Island and Jones Island, also in the inner New York Bight and along the finer-grained margins of the Hudson Shelf Valley. A region of high potential sediment mobility occurred also about 80 km south of Montauk Point due to a region of finer sediment associated with Block Island Shelf Valley sediment lobes and probably a Mud Patch southwest of Nantucket Shoals (Dalyander et al. 2012).

This research was supported by the New York State Department of Environmental Conservation.

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LIGeologistFeb2022 ‘