Novel classification system developed to improve rapid, scoping-level estimates of nearshore nourishment projects to encourage the beneficial use of dredged sediment

CHL researchers evaluated 40 historical nearshore nourishment projects to develop a novel classification system using empirical depth of closure methods that outperforms previous techniques of estimating nearshore nourishment stability and includes the temporal scale of migration. This new classification system will improve rapid, scoping-level estimations of how dredged sediment placed in the nearshore will migrate, leading to improved project outcomes and create more opportunities for the beneficial use of dredged sediment. Results have been published in the Journal of Coastal Research: McPherran, et al., 2025 (in press).

Adding sediment to an active beach profile as a nearshore nourishment can offer various benefits. These benefits frequently relate to cost-effectively providing a dynamic sediment source and potentially dissipating wave energy. Both positive impacts and costs of nearshore nourishments are strongly influenced by depth, so project placement depth is commonly assessed early in project planning. Project depths are often compared to the depth of closure (DOC) and past examples followed an "active" or "stable" classification. Nearshore nourishments are generally defined as "active" if they move quickly and "stable" if they do not move or move slowly (Figure 3). The original classification uses the Hallermeier Inner and Outer Limits (HIL, HOL) to estimate the depth of closure, however, the HIL and HOL are calculated using different parameters and the HIL does not include sediment grain size. This may lead to an Inner Limit that is erroneously deeper than the Outer Limit. The resulting estimation also does not consider the initial size of the nourishment or any temporal scale of migration. Additionally, the definitions of "active" and "stable" vary between studies.

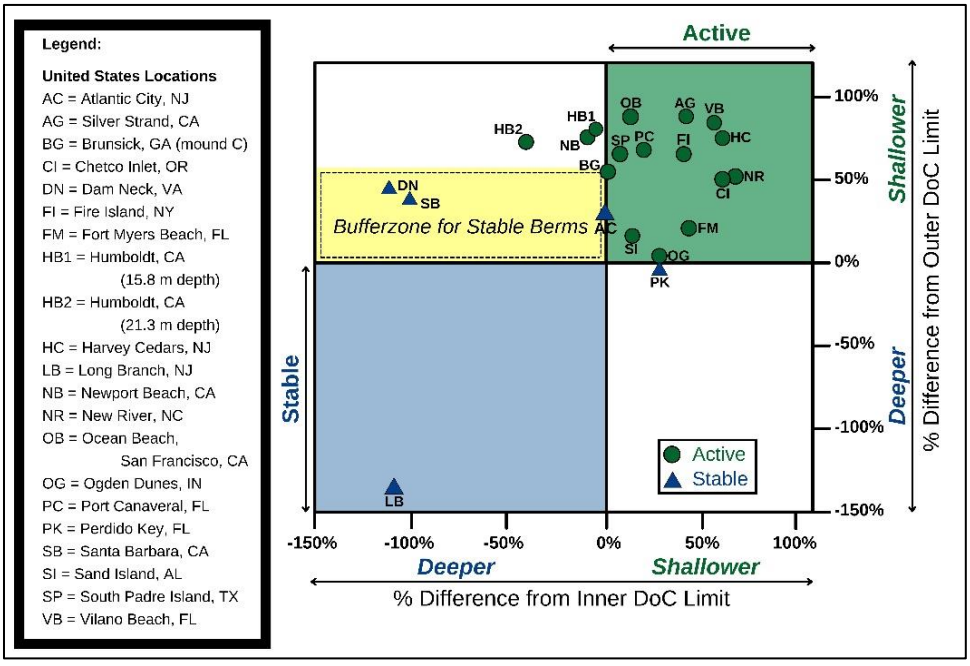

Figure 3: Previous classification system of nearshore placement stability based on the Hallermeier Inner and Outer depth of closure and plotted in the quadrant scheme.

To address the above shortcomings of the current methodology of estimating nearshore nourishment stability based on the depth of closure, the stability concept is revisited with a compilation of 40 case studies and a new classification system is proposed (Figure 4). Using these data, nearshore nourishments are classified as “very active,” “moderately active,” or “stable to slightly active” using two techniques to calculate the depth of closure from sediment characteristics and wave data (Hallermeier Outer Limit [HOL] and the Ahrens and Hands [AH] method of calculating DOC). Measurements of net sediment transport rates decrease between the historical “very active,” “moderately active,” and “stable to slightly active” examples. Substantial variability occurs, but this grouping outperforms previous techniques and contains additional information, including the normalized berm migration rate (NBMR). The NBMR (berm migration rate normalized by initial berm placement length) is taken into consideration in this new classification system, which addresses shortcomings of previous methods by incorporating both the temporal scale of migration and the initial size of the nourishment. The mean NBMRs for “very active,” “moderately active,” and “stable to slightly active” categories were 16.1, 3.1, and 1.3 (m^3/month)/m, respectively. The NBMR for all 40 historical sites ranged over almost two orders of magnitude (0.0–83.7 [m^3/month]/m), highlighting the need for an updated classification system that takes initial berm size and temporal scale into consideration. This new classification system will improve rapid, scoping-level estimations of how dredged sediment placed in the nearshore will migrate, leading to improved project outcomes and create more opportunities for the beneficial use of dredged sediment.

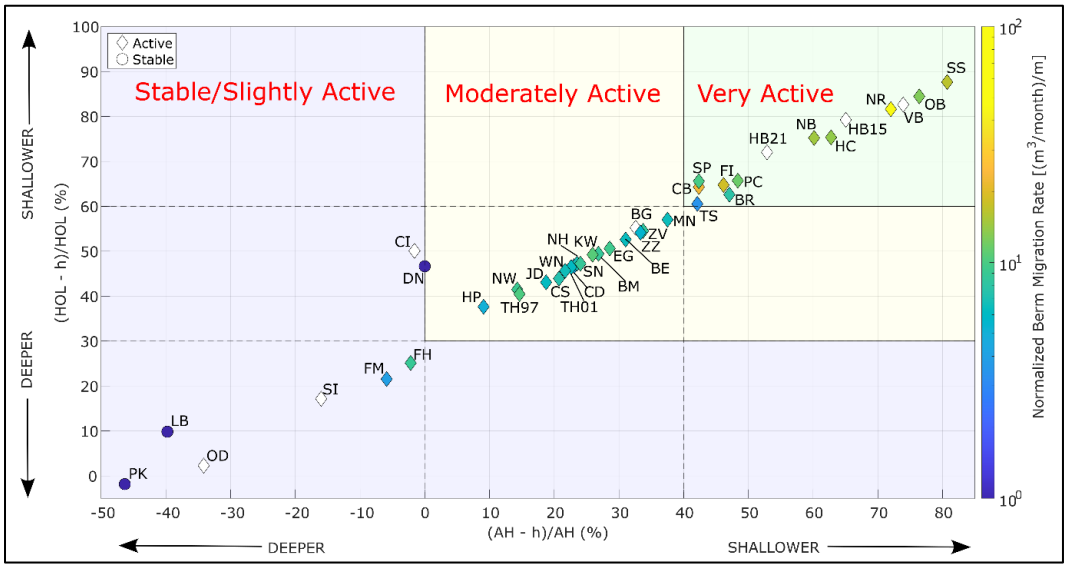

Figure 4: Relationship between placement depth (h) and DOC values calculated using the Hallermeier Outer Limit (HOL) and Ahrens and Hands (AH) methods for the forty nearshore nourishment case study sites. Sites are colored by their NBMR values (berm migration rate normalized by berm length) or left without color if the berm migration rate and or length were unknown. The new classification categories are labeled in red. The designation of “active” or “stable” from the original study are shown as the diamond or circle maker shape.

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Reference: McPherran, K.A.; Krafft, D.R.; McFall, B.C. 2025. “Categorization of Nearshore Nourishment Mobility Using Emprical Depth of Closure Methods.” Journal of Coastal Research (in press). DOI: 10.2112/JCOASTRES-D-25-00009.

Funding: This work was funded by the Dredging Operations and Environmental Research (DOER) Program.

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