Evaluation of Mechanical Marine Debris Removal on Sandy Beach Macroinvertebrates in Hawai‘i

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Photo Credit: Sustainable Coastlines

Barber Surf Rake

Ocypode pallidula, 'Ghost Crab' Credit: Keoki Stender

Cherrington

Introduction

Hawai‘i is renowned for the beauty of its beaches. Unfortunately, these beaches are being inundated with increasing amounts of marine debris, which include small, persistent, man-made debris that are difficult to clean by hand. On some Hawai‘i beaches, mechanized cleaning is used to remove these small marine debris particles, and community pressure exists to expand mechanized beach cleaning. However, concerns also exist about the impact of cleaning; studies conducted in other locales have shown mechanised grooming can alter beaches and the ecosystem services they provide, largely via impacts to sand-dwelling organisms (Schooler *et al.* 2019, Dugan *et al.* 2003). This pilot study will evaluate the effects of mechanized marine debris removal on intertidal infaunal communities of Hawaiian Island sandy beaches.

Methods

Research methods include surveys on a Kaua`i beach pre- and post-mechanical cleaning, adapting methods by Schooler *et al.* (2019) and Dugan *et al.* (2003). To estimate infaunal community structure and biodiversity, a series of 10 cm core samples are collected to a depth of 20 cm at uniform intervals along three shore normal transects. Cores are then pooled in mesh bags of 1mm aperture, rinsed, and archived. We also collect sea water samples that are poured through pooled bulk sand samples. Identification of infaunal diversity is performed via targeted amplicon metabarcoding (i.e. “Environmental DNA”) using techniques developed for Hawaiian biodiversity surveys (Timmers *et al.* in review). Pre-cleaning samples were collected Summer 2020 and are undergoing Environmental DNA analysis.

Status and Anticipated Outcomes

We anticipate that this research will advance our understanding of the macroinvertebrate assemblages living in the sandy beaches of Hawai`i and provide evidence as to the possible anthropogenic impacts to these communities resulting from mechanized marine debris removal. Results will contribute to the evaluation of whether mechanical marine debris removal is appropriate for the Hawai`i sandy beach environment. Results are also likely to inform the timing and spacing of any mechanical removal efforts in order to mitigate deleterious effects on infaunal assemblages and maintain ecosystem functioning.

Dugan, J.E., Hubbard, D.M., McCrary, M.D., Pierson, M.O., 2003. The response of macrofauna communities and shorebirds to macrophyte wrack subsidies on exposed sandy beaches of southern California. Estuary. Coast. Shelf Sci. 58, 25–40. https://doi.org/10.1016/s0272-7714(03)00045-3.

Schooler, Nicholas K, Dugan, Jenifer E., Hubbard, David M. 2019. No Lines in the Sand: Impacts of intense maintenance regimes on sandy beach ecosystems span the intertidal zone on urban coasts. Ecological Indicators 106 (2019) 105457.

Timmers, M., C.P. Jury, K. Bahr, J. Vicente, R.J. Toonen (In review). Cryptic reef biodiversity shuffles, but does not decline, under the combined stressors of ocean warming and acidification. Proceedings of the National Academy of Sciences USA.