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Community Structure and Trophic Ecology of Fish Assemblages in an Ephemeral Polychaete Reef on a Tropical Mudflat

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Abstract

Information regarding the vagile fish fauna and their use of rare polychaete reefs as habitat or feeding area is almost unheard of in the tropics. Of great interest is whether the construction of such biogenic reefs in an otherwise featureless habitat such as a mudflat increases structural complexity thereby enhancing fish abundance and ecological functioning. The Jeram polychaete reef (Straits of Malacca) is unique and recurrent; on the mudflat, it emerges, grows, and decimates within a year. We tested the hypothesis that the enhanced reef resources (prey) modify the reef ichthyofauna in terms of community structure and trophodynamics. The largely juvenile fish that visited the reef totaled 69 species from a 9-month study. Although sharing 57 common species, the reef fish assemblages had less species and diversity than the mudflat (90 species) and also lower abundance and biomass. Temporal variability in the reef's fish community structure appeared to be tied to the reef dynamics, food availability, and environment. Stable isotope (C and N) results suggest a food web of five trophic levels emanating from phytoplankton and benthic diatoms as basal sources, similar to the mudflat. The enhanced prey resources modified the ichthyofauna, but did not impact reef fish trophodynamics in terms of feeding guild, trophic level, and dietary carbon. Although the polychaete feeding guild was distinct in the reef, most reef fishes as well as mudflat fishes were generalist predators. The reef supports local fisheries, functioning as a feeding and habitat area for 58 fish species of commercial importance.

Keywords Biodiversity · Trophodynamics · Stomach content · Stable isotopes · Ichthyofauna · Coastal habitats

Introduction

Marine tube-building polychaetes (e.g., sabellarids, serpulids) can form dense biogenic concretions called biogenic reefs. Serpulids secrete tubes of calcium carbonate (Neff 1969), whereas sabellarids secrete mucoproteinaceous substances that mold sand particles together to form tubes (Le Cam et al. 2011). Eventually, worm tubes coalesce to form larger masses or clumps that often feature the reef. Sabellarid reefs are often found in intertidal or shallow subtidal waters where wave energy is sufficient to resuspend the source sand particles for reef lithification (McCarthy et al. 2003). In temperate regions, *Sabellaria alveolata* reefs may occupy large areas (reaching 300 ha) in sheltered bays such as the Mont Saint-Michel Bay in France (Gruet 1986), although reefs in the same bay have recently shown very strong spatial decline such as the main Sainte-Anne reefs covering 61.5 ha (Noernberg et al. 2010).

Sabellarid polychaetes are regarded as "ecological engineers" that cause structural changes to the environment and "directly or indirectly modulate the availability of resources to other species" (Jones et al. 1994). The engineered structures of *S. alveolata* enhance benthic primary production and create an original assemblage of macrofauna linked to the sedimentary changes in and around the reef structures (Jones et al. 2018). It is thought that sabellarid reefs trap and stabilize sediments (Lisco et al. 2017; Bruschetti 2019), while their tubes provide structurally complex habitat for a diversity of organisms (Dubois et al. 2002; Dubois et al. 2006). Thus, polychaete reefs may provide refuge and additional food sources for benthic fauna and vagile fish, hence playing a role in trophic webs (Bruschetti 2019). However, it is generally accepted that

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