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TITLE: Towards an urban marine ecology: characterizing the drivers, patterns and processes of marine ecosystems in coastal cities

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ABSTRACT:

Human population density within 100 km of the sea is approximately three times higher than the global average. People in this zone are concentrated in coastal cities that are hubs for transport and trade ? which transform the marine environment. Here, we review the impacts of three interacting drivers of marine urbanization (resource exploitation, pollution pathways and ocean sprawl) and discuss key characteristics that are symptomatic of urban marine ecosystems. Current evidence suggests these systems comprise spatially heterogeneous mosaics with respect to artificial structures, pollutants and community composition, while also undergoing biotic homogenization over time. Urban marine ecosystem dynamics are often influenced by several commonly observed patterns and processes, including the loss of foundation species, changes in biodiversity and productivity, and the establishment of ruderal species, synanthropes and novel assemblages. We discuss potential urban acclimatization and adaptation among marine taxa, interactive effects of climate change and marine urbanization, and ecological engineering strategies for enhancing urban marine ecosystems. By assimilating research findings across disparate disciplines, we aim to build the groundwork for urban marine ecology ? a nascent field; we also discuss research challenges and future directions for this new field as it advances and matures. Ultimately, all sides of coastal city design: architecture, urban planning and civil and municipal engineering, will need to prioritize the marine environment if negative effects of urbanization are to be minimized. In particular, planning strategies that account for the interactive effects of urban drivers and accommodate complex system dynamics could enhance the ecological and human functions of future urban marine ecosystems.

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