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TITLE: Global Invasions of Marine and Estuarine Habitats by Non-Indigenous Species: Mechanisms, Extent, and Consequences

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ABSTRACT:

Non-indigenous species (NIS) are increasingly conspicuous in marine and estuarine habitats throughout the world, as the number, variety, and effects of these species continue to accrue. Most of these NIS invasions result from anthropogenic dispersal. Although the relative importance of different dispersal mechanisms varies both spatially and temporally, the global movement of ballast water by ships appears to be the largest single vector for NIS transfer today, andmany recent invasions have resulted from this transfer. The rate of new invasions may have increased in recent decades, perhaps due to changes in ballast water transport. Estuaries have been especially common sites of invasions, accumulating from tens to hundreds of NIS per estuary that include most major taxonomic and trophic groups. We now know of approximately 400 NIS along the Pacific, Atlantic and Gulf coasts of the U.S., and hundreds of marine and estuarine NIS are reported from other regions of the world. Although available information about invasions is limited to a few regions and underestimates the actual number of NIS invasions, there are apparent differences in the frequency of NIS among sites. Mechanisms responsible for observed patterns among sites likely include variation in supply of NIS, and perhaps variation in properties of recipient or donor communities,but the role of these mechanisms has not been tested. Although our present knowledge about the extent, patterns and mechanisms of marine invasions is still in its infancy, it is clear that NIS are a significant force of change in marine and especially estuarine communities globally. Taxonomically diverse NIS are having significant effects on many, if not most, estuaries that fundamentally alter population, community, and ecosystems processes. The impacts of most NIS remain unknown, and the predictability of their direct and indirect effects remains uncertain. Nonetheless, based upon the documented extent of NIS invasions and scope of then effects, studies of marine communities that do not include NIS are increasingly incomplete

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