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TITLE: Invasion history and vector dynamics in coastal marine ecosystems: A North American perspective

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ABSTRACT:

The known extent of biological invasions exhibits strong variation with respect to space, time, taxonomic group, and vector. Using a synthesis of nonindigenous species (NIS) occurrences in North America, we characterized the invasion history for coastal marine ecosystems by invertebrates and algae through 2010, to evaluate variation and existing patterns at a continental scale. This study updates a previous analysis of invasions for the same taxonomic groups in North America, providing a first assessment of changes in the last 11 year period (2000?2010). Overall, we documented 450 marine and estuarine NIS that are considered to have established populations in tidal waters of North America, representing a 51% increase in NIS richness compared to the earlier analysis. Of the 152 species added, 71 species (47%) have first documented records since the year 1999, and 81 species (53%) were additions attributed to earlier time periods due to recent reports and further analysis. Across all time periods, taxonomic groups with the largest contribution were Crustaceans (112 species) and Molluscs (80 species), together providing 43% of the total species richness for North America. Species richness was unevenly distributed among coasts, with most documented on the Pacific Coast (310 species) and fewer on the Atlantic Coast (189 species) and Gulf Coast (88 species). Commercial ships have contributed between (a) 44?78% of the initial (primary) invasions of all nonindigenous species to North America and (b) 52?82% of NIS in the last 30-year time interval, being driven by transfers associated with ballast water and hull biofouling. Importantly, invasion dynamics are a shifting landscape, where the past may not predict the future, especially with emerging trade patterns and global to local environmental changes. Thus, effective management to reduce future invasions requires a dynamic and multi-vector approach, instead of single vector strategies based on past history alone.

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