ICMBIX 2016
Sydney, Australia

ABSTRACT BOOK

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Japanese Tsunami Marine Debris: Potential Transoceanic Rafting of Bivalve Parasites and Pathogens

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One of the most common species surviving transoceanic rafting from Japan to North America and the Hawaiian Islands on Japanese Tsunami Marine Debris (JTMD) is the Mediterranean mussel Mytilus galloprovincialis, itself introduced to Japan in the early 20th century. We examined over 1,200 JTMD mussels for endoparasites and pathogens. All mussels were screened for the parasitic hydroid Eutima japonica (known to cause bivalve mortalities) and other macroparasites that can occur on gills or within the mantle cavity. A subset of mussels was further screened (using molecular genetic analyses) for protistan parasites in the genera Perkinsus, Bonamia, and Haplosporidium, which are known to cause diseases in bivalve mollusks. Detected to date have been Eutima (unknown from the Eastern Pacific and thus unambiguously sourced from Japan), and previously unknown lineages of the potentially pathogenic protist Haplosporidium (whose biogeographic origins remains to be determined relative to point-of-acquisition along the JTMD journey). Highly infected with Eutima were mussels on a large dock originating from the Port of Misawa (Honshu) in March 2011 and landing on the Washington coast in December 2012. Eutima were further detected in mussels arriving between 2012 and 2014 in Oregon and Washington on landings of another Misawa-sourced dock, on a buoy, and on a vessel. As our JTMD samples represent only a small fraction of the actual debris landings, we have initiated surveys to determine if Eutima and the novel strains of Haplosporidium are present in mussels and other bivalves in the Pacific Northwest.

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Barcoding non-indigenous macroalgae in the Azores

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Algae invasions in marine habitats represent a recognized worldwide threat to the integrity of native communities, to economy and even to human health. The emphasis of the present work is on non-indigenous marine macroalgae species in the Azores. This archipelago is situated in the North Atlantic Ocean (37-40N, 25-31W), astride the Mid-Atlantic Ridge and is strongly influenced by the sea-surface pathway from the Gulf Stream; nevertheless the affinities of its native marine algal flora are to the continental coasts of Europe and Africa, the Mediterranean Sea and the other Macaronesian islands. Azorean marine ecosystems are relevant by their uniqueness, geographic position, biogeographic mixed algal flora and insularity, highlighting its

susceptibility for alien species introduction. In fact, over 6% of its macroalgae are considered non-indigenous species in contrast to the 3% introduced macroalgae at a global scale (following Williams and Smith 2007 and Guiry 2012). Of the 26 species of non-indigenous species 7 are in the invasive category for their potential impact: Asparagopsis armata, Asparagopsis taxiformis, Bonnemaisonia hamifera, Caulerpa webbiana, Codium fragile subsp. fragile, Grateloupia turuturu and Symphyocladia marchantioides. The aim of this study is to contribute to improve the knowledge of the non-indigenous species and potential invasive macroalgae in the Azorean archipelago by genetic characterization using the mitochondrial CO1-5P barcode region (cytochrome oxidase 1).

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Forecasting changes in the global shipping network

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The global shipping network (GSN) is the most significant vector of spread for non-native aquatic species. Over the past five years, it has been analyzed in considerable detail such that the connections and dynamics within the GSN are now relatively well understood. This has led to a number of studies venturing to forecast the spread of invasive species through the GSN. Many of these studies focus on climate change as an important driver to consider when forecasting spread. However, overlaying climate change scenarios for the coming decades onto today's GSN assumes the global shipping network will remain unchanged, despite evidence showing global maritime trade has increased over 50% since 2000. Focusing on economic drivers of change, we create a 30-year forecast of the GSN by combining data on 10 years of global shipping movements, 40 years of ship-building trends, and 15 years of monthly bilateral international trade. We analyze and create development curves for groups of economically-similar countries, consider changes in technology (e.g., ship sizes and types), and shipping routes, and also use scenario analysis to explore different possible futures of global economic development. These forecasted trade patterns and resulting changes in shipping traffic will have consequence for the patterns of invasive species transport.

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