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## RISK ASSESSMENT OF MARINE BIOINVASION VIA BIOFOULING: RECENT DEVELOPMENT AND APPROACHES

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### RESUMO

Maritime shipping has been recognized as the main pathway of species transference throughout the world. Ballast water or fouling on vessels have become the main vectors of aquatic species transportation back and forth coastal marine ecosystems, which can lead to the establishment of non-native species around the areas of destination. The perception of public and government agencies about marine invasions has increased and in 2011 the International Maritime Organization (IMO) recommended guidelines for the control and management of biofouling on vessels, in order to minimize the transfer of invasive aquatic species. The document suggested the implementation of risk assessment analysis as a prevention tool to support biofouling management practices. The analysis aims to identify a non-native species in the pre-boarder stage, i.e. before the introduction event happens, but it can also be employed to support post-board management options (control and mitigation). The use of risk assessments is a relatively new approach and several frameworks to perform this kind of analysis were proposed. In order to evaluate the methods and models that have been developed concerning risk assessment of marine bioinvasion via biofouling, a bibliographic survey was carried out, focusing on two guiding questions: (a) what are the main risk assessment types?; and (b) which data are often used in risk assessment? Was compiled a list of scientific articles that were published until May 31st 2023 using the Scopus database, where were applied the following filters for all fields: "Risk assessment" OR "Risk analysis" AND "Biofouling" OR "Fouling" AND "Non-indigenous species" OR "Bioinvasion" AND "Marine" OR "Ocean" AND "Guidelines" OR "Act" OR "Law" OR "Plan" AND "Regulation" OR "Legislation" OR "Policy" limited to original/review articles in English language. The results were classified into two main categories: multi-criteria decision analysis and probabilistic modeling. As for the parameters applied in these analyses, which vary considerably depending on the approach adopted, they were generally

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categorized into four components: introduction potential; establishment potential; species status and impact potential; and uncertainties. Considering these components, future steps include the development of a risk assessment framework to improve the Brazilian legislation on this matter. Even though the use of risk assessment as a tool to manage biofouling on vessels and maritime units is still under development, it has proven to be promising. It can guide stakeholders to decision-making processes regarding prevention and control of non-native species thus reducing the financial and environmental costs associated with their arrivals.

**PALAVRAS-CHAVE:** Risk management, non-indigenous species, risk model, biological invasions, biosecurity

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