서로 다른 배지에서의 성장률 결과를 이용해서 선박평형수를 통해 유입되는 식물플랑크톤이 잠재적 침입 위협 가능성 평가

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Assessment of the invasion risks of phytolankton as examined from growth in different media

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1. Introduction

For marine invasions, a ship's ballast water has long been cited as a major vector for transfer of non-native organisms to new habitats due to the repeated discharge of the sheer volume of ballast water into the same locations. The invasibility of organisms in marine environments, once they are successfully discharged in a new environment, will depend on multiple factors including the physiological state of the invading populations, and environmental suitability (e.g., temperature, salinity, and trophic condition, and potential predation). Therefore, in this study, we investigated the possibility of invasion success by phytoplankton assemblages as defined by growth rates in media representative of ballast water, shipside seawater, and eutrophic waters under various scenarios of port water dilution rates, and taking into account the time delay for exponential growth of the plankton.

2. Materials and Methods

The growth potential of introduced phytoplankton from ballast water after discharge into various port waters of Korea was investigated from a total of 12 vessels that were undertaking international voyages. In brief, some live phytoplankton samples were collected and reintroduced in ballast water, shipside port water, and nutrient-enriched F/2 medium and incubated in various water temperatures over 2 weeks. Assessment of phytoplankton invasion and establishment was conducted by taking into account of various scenarios of port water dilution rate and time delay for exponential growth of the plankton.

3. Results and Discussion

Our incubation experiments showed that phytoplankton species discharged from ballast tanks can survive and establish a population if the physiochemical conditions (e.g., temperature, salinity, and nutrient concentrations) of the pier side seawater is not overly detrimental (e.g., low temperature). But, phytoplankton community showed extended delayed growth for almost all cases of culture conditions including incubation in nutrient-rich F/2 medium. Ordered logistic regression analysis also showed that nutrient concentration is most important factor for improved phytoplankton growth with shorter a lag period, with the highest odd ratio. Water temperature had a slight effect, but the effect of salinity was not significant.

4. Conclusions

Our results indicate that high nutrient concentrations and water temperatures may significantly shorten the period before exponential growth takes place, increasing the potential for invasion.

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