VIENNA, AUSTRIA SEPTEMBER 18-21, 2023

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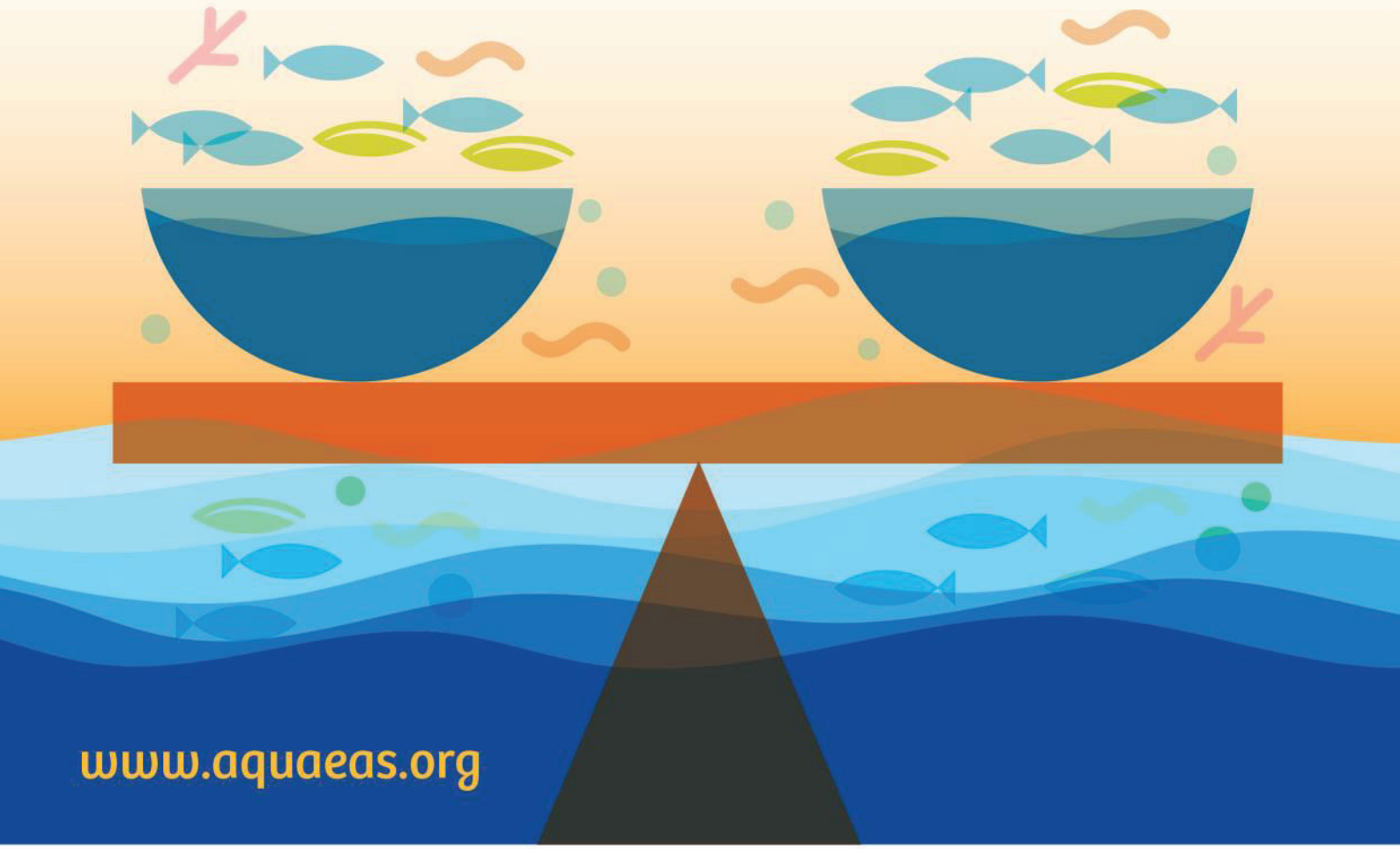

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INVASIVE ASCIDIANS, SPONGES & RAPANA WHELKS MANAGEMENT IN CE MEDITEARRANEAN MUSSEL FARMING, GREECE

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Introduction

The aim of the present study is to provide, in the CE Mediterranean, information on species' biofoulings in the Greek mussel farms, and to describe the best management strategies that will reduce the costs of the end-product while controlling biofoulings' populations.

The information provided by the professionals consists of one of the most direct approaches to activate the links between mussel farmers and scientists to upgrade the quality of the information and data provided, especially in data-poor areas such as those of shellfish farms.

Material and Methods

Local Ecological Knowledge on changes in the composition of species biofoulings in their installations, as well as production fluctuations over time retrieved from the operating management of mussel farmers empirical knowledge. Working protocols for questionnaire/interviews design based on Theodorou et al. (2022, 2023).

Results

The major problem in the Greek shellfish farms was ascidians and to a lesser extent the sponges. The surface size covered by a shellfish farming unit was also significantly and negatively correlated with the time of appearance of invasive ascidians, where ascidians appeared earlier in the larger units. The problem was more intensive in farm units covering an area between 2.0 and 2.5 ha, whereas it seemed moderate in units over 5.0 ha. This might be explained by the fact that the low-sized farms have built-in routine technologies (e.g., regular cleaning, etc.) as mitigation measures for the establishment of biofoulings. Ascidians also exhibited the highest intensity during the last 20 years, whereas gastropods were the invasive species with the highest intensity in the recently established/operated farms (since 2015). In terms of the final product, ascidians exhibited the most significant impact, whereas sponges showed a moderately negative impact, with the effect of the reduced amount of flesh being the most important.

The inherent challenges in shellfish farms, where management interventions are costly and difficult to implement, the rapid invasive parasite recolonization, and the potential for off-target effects pose regulatory barriers to many mitigation measures. Our results showed that the cost of farming management rises for ascidians and sponges, mostly impacted by damages to maintenance and labor, and to a lesser extent to fuel. The studied invasive species affected the operational cost of production at a rate of 21%-50% peaking from July to September, whereas the months previous (June) or following (October) were identified as the second most significant temporal influence on production. The greatest impact of the presence of invasive species was focused on repairs—maintenance, labor, fuel, maintenance, and service during the harvest season. Extra labor during May-June due to the invasive ascidians added extreme threats to the profitability of a shellfish farm with additional economic costs.

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Conclusions

Management interventions can result in significant net economic benefits. Monitoring on mussels' production could provide an empirical quantitative estimate of the economic impact of invasive species impacts. Although there are many variations of integrated invasive organism management, the basic principles are combined risk assessment and risk management activities based on five main pillars: a thorough understanding of invasive organism ecology, bioeconomic cost-benefit relationships, continuous monitoring at the right scales, active prevention, and reactive control. These principles could be applied to shellfish farming, with experts' judgment knowledge playing a critical role in a long-term approach to invasive organism management. When it comes to understanding the ecology of invasive organisms, the effects of both bio-pollution and invasive organisms also tend to vary spatially, temporally, and/or demographically. Thus, site-to-site variation factors, such as species' plasticity to adapt to different environmental conditions, could also help to predict and assess the risk in farmed areas exposed to invasive organisms.

Acknowledgements

This is a part of the project «Development of the best control practices of invasive ascidians in mussel farming infrastructures and remediation of economic effects of invasion» (Code MIS: 5048463) funded by the EU-Greece Operational Program of Fisheries, EPAL 2014–2020.

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