

THE RELATIVE IMPORTANCE OF AQUACULTURE AND SHIPPING AS VECTORS OF INTRODUCTION OF MARINE ALIEN SPECIES: THE CASE OF OLBIA (SARDINIA)

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Abstract

The macroinvertebrate assemblage in Olbia (Sardinia, Italy) was analysed for occurrence of marine alien species. Two main vectors of introduction operate in this area: vessels and aquaculture. The comparison with alien species assemblages of other three Italian localities connected to Olbia by different pathways (vessels: Genoa, Leghorn; aquaculture: Venice) suggests that shellfish stocking is a major vector operating in Olbia.

Keywords: *Alien species, Aquaculture, Tyrrhenian Sea, Zoobenthos*

Introduction

The assessment of marine alien species distribution, the areas at high risk of introduction, the main pathways and vectors of introduction are essential elements in designing an effective management and conservation program [1]. We present the results of a study on alien macroinvertebrate assemblages in the harbour of Olbia, a coastal town in North-East Sardinia (Italy) affected by two main pathways of introductions: vessels and aquaculture. Olbia is one of the most important passenger seaports in the Mediterranean Sea (2 million passengers per year), as well as an important trading harbour (4 million tons of traffic volume every year). Ferries and cruises connect Olbia with other Mediterranean harbours on the western coast of Italy (www.olbiagolfoaranci.it/indexen_GB.php?carattere=p, Accessed Feb. 2016). Olbia is also a major site for mussel farming; about 15% of mussels grown in Olbia are imported from the other sites of mussel cultivation in Italy [2]. In this work, we compare the marine alien species assemblages of Olbia with those of other three Italian localities (Fig. 1): Venice (Adriatic Sea), Genoa and Leghorn (Western Mediterranean Sea), in order to assess the relative importance of shipping and aquaculture as pathways of introduction.

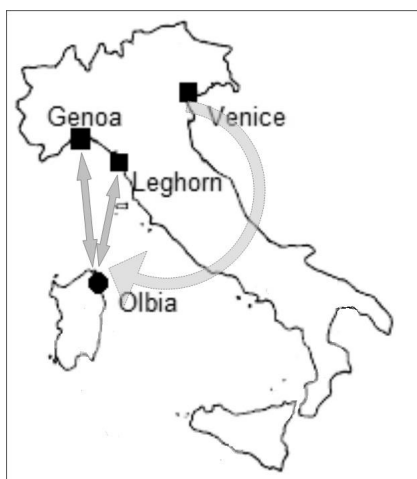


Fig. 1. The harbour of Olbia (Sardinia) is connected with Genoa and Leghorn by ferries and commercial ships (straight arrows). Moreover, Olbia receives stocks of mussels for cultivation from the North Adriatic region (round arrows).

Methods

In summer 2014 we collected 12 samples from 4 distinct areas in the harbour of Olbia; artificial hard substrates (e.g. docks, floating pontoons) were scraped and macroinvertebrates removed for further laboratory identification. Data from other localities, to be used for comparisons, were obtained from samples collected with similar methodology from our research team in the years 2012-2013. A similarity analysis was conducted to compare alien species assemblages in the 4 localities, using the software

PRIMER 6.1.13.

Results

A total of 24 marine alien species were identified: 13 in Olbia, 19 in Venice, 13 in Genoa and 11 in Leghorn. Olbia displays an alien species pool more similar to Venice (average similarity: 52.3%) and Leghorn (53.0%) than to Genoa (43.9%). Olbia shared with Venice two alien crustaceans not recorded in the other localities: *Ianiropisis serricaudis* Gurjanova, 1936 and *Rhithropanopeus harrisi* (Gould, 1841). On the other hand, the bryozoan *Celleporaria brunnea* (Hincks, 1884) was present in the three Western Mediterranean localities but did not occur in Venice samples.

Discussions and Conclusion

Our results show that the alien species pool of Olbia strongly depends on importation of mussels for restocking: the alien invertebrates of Olbia have a high similarity with those of Venice, and there are species shared by the two localities, such as *I. serricaudis*, that have not been recorded anywhere else so far. Globally, the role of aquaculture in introducing and spreading marine alien species is perceived as declining, compared to shipping and boating. However, we have shown that in the Mediterranean region the transfer and restocking of cultured species, including native mussels, is still contributing to the spread of marine alien species, especially when stocks originate from hotspots of introduction such as Venice [3]. Movement of vessels from and to Olbia can then support the further spread of these aquaculture hitchhikers. The combined effects of these human activities are increasingly homogenizing the Mediterranean marine fouling communities; for this reason, programmes of awareness raising and biosecurity control are urgently needed, in order to reach an effective management plan of marine alien species in the region.

References

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