

ALIEN DECAPODS IN THE MEDITERRANEAN SEA - WHICH, WHEN, WHERE, WHY?

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Abstract

The presence and the spatio-temporal spread of 66 alien decapod and stomatopod species in the Mediterranean Sea were studied. The majority of aliens in the eastern Mediterranean entered through the Suez Canal, whereas mariculture and shipping are powerful means of introduction in the northwestern Mediterranean and in the Adriatic Sea. Most aliens are thermophilic species. The possible causes for the epic scale of invasion in the Mediterranean Sea are discussed in relation to a complex of stressors and climatic factors.

Keywords : *Species Introduction, Crustacea.*

Introduction

Growing awareness worldwide that bioinvasions constitute one of the most significant components of global change, with often harmful effects on biodiversity, economy and human health, coupled with the opportune misfortune of a handful of invasive aliens noted for their conspicuous impacts on the native Mediterranean biota, have drawn the attention of scientists, management and media. It was widely perceived that the littoral and infralittoral biota of the sea had been undergoing a rapid and profound change. A series of CIESM Atlases summarize the extant knowledge of the scale and impact of 'Exotic species in the Mediterranean' (www.ciesm.org/atlas/).

Discussion

WHICH? A geographic classification of the alien decapods and stomatopods shows that their native range is most commonly the Indo-Pacific Ocean, the Indian Ocean, and the Red Sea (80%). Caution should be exercised: the true origin of Mediterranean populations of a species widely distributed in the Indo-Pacific Ocean may be its population in the Red Sea, or much further afield, or secondarily from established southern Levantine populations. However, it is quite clear that most of the alien crustaceans are thermophilic, originating in tropical seas. This flies against the widely held assumption that successful bioinvasions originate in similar latitudes [1]. A classification according to the means of introduction shows that the majority of alien crustaceans entered through the Suez Canal (73%), followed by vessels (15%). Here too, caution should be exercised when using this data: only rarely the means and route of introduction are known from direct evidence.

WHEN? The number of alien crustaceans has been increasing steadily. A surge in the records in the 1920s reflects the publication of the results of 'The Cambridge Expedition to the Suez Canal'. There seem to be more introductions recorded in the first years of the 21st C than in the 1980s and 1990s. Since the 1950s major political, economical and societal changes have occurred in the peri-Mediterranean countries. Their impact on the rate and means of introduction is apparent: though the Suez Canal remained the main access route for alien species, the rate of introductions by vessels and mariculture has been higher. The increase in vessel-transported aliens may be attributed to the increase in shipping volume throughout the region, the changing trade patterns that result in new shipping routes, improved water quality in port environments, augmented opportunities for overlap with other introduction vectors, and rising research effort. Similarly, the increase in intentional and unintentional mariculture introductions.

WHERE? The bulk of the alien species recorded in the Mediterranean are littoral and sublittoral benthic or demersal species. Since the shallow coastal zone has been extensively studied, the chances that new arrivals will be encountered and identified are higher. Also, the species most likely to be introduced by the predominant means of introduction (Suez Canal, vessels, mariculture) are shallow water species. A comparison of alien decapods and stomatopod species between the Mediterranean coasts of Spain and France, and an equivalent coastline from Egypt to Turkey, shows marked differences in their numbers, origin and means of introduction. There are five times as many alien species along the Levantine coast (49) as in the westernmost Mediterranean (9). The majority of aliens in the Levant entered through the Suez Canal (92%), whereas mariculture (78%) is the main means of introduction in the western Mediterranean. Consequently, the native ranges of the western Mediterranean aliens are spread over 'the seven seas', while the Levantine aliens mostly originate in the tropical Indo-Pacific or parts thereof (IP 61%, IO 14%, RS 5%).

WHY? The extraordinary physiography and climatic history of the Mediterranean left it with vast vacant "climatic" niches. Modern shipping, the Suez Canal, and mariculture breached the biotic isolation of the sea and provided the major pathways for alien marine organisms to enter and occupy those niches. Most alien species in the Mediterranean had not originated in similar latitudes like marine bioinvasions elsewhere, but are thermophilic, mostly tropical, species [2, 3]. Rising seawater temperature may change the pool of species which could establish themselves in the Mediterranean, enable the warm stenothermal species (native and alien) to expand beyond their present distributions, and may impact on a suite of population characteristics (reproduction, survival) that determines interspecific interactions, and, therefore, the dominance and prevalence patterns of both native and alien species, and provide the thermophilic aliens with a distinct advantage over the native biota. However, concurrent alien invasion and rise in the sea surface temperature do not themselves imply causation: the complexity of the ecosystem and the difficulty in assessing and understanding the biological response to climate forcing caution against simplistic unidimensional interpretations. The epic scale of invasion in the Mediterranean Sea may be explained as the consequence of a synergetic complex of stressors - pollution, eutrophication, destruction and fragmentation of habitats, fisheries overexploitation, and climate change - a catastrophic anthropogenic ecosystem shift - superimposed on a unique physiographical and climatic history.

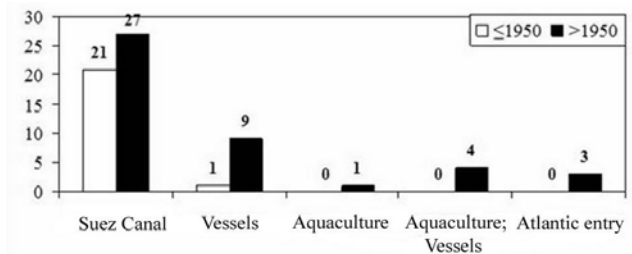


Fig. 1. Number of alien crustaceans in the Mediterranean, presented by means of introduction, before and after 1950.

References

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