FISH INVASION OF THE MEDITERRANEAN - RETROSPECTIVE AND PROSPECTIVE

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Abstract

The rate of fish invasion into the Mediterranean has continued without showing any sign of deceleration. Since the publication of the CIESM Exotic Fish Atlas in 2002, 18 new exotic fish species have been recorded and many species have extended their distribution range. Two distinct periods (1977-1982 and 2000-2005) of population explosion were documented for nine cases of invasive fish species just following initiation of invasion. In light of the supposition that the rate of invasion will continue steadily, it is suggested that future research should concentrate on comparative studies of the ecology and life history strategies of the invasive species and their closely related Mediterranean indigenous species as well as application of population dynamics and genetics.

Keywords : Fishes, Species Introduction, Western Mediterranean, Eastern Mediterranean.

Bio-invasion is considered to be one of the main factors influencing alteration of species diversity and faunistic structure. The Mediterranean Sea, as an enclosed sea heavily affected by anthropogenic actions such as intense fishing activity, pollution and tourism, is pervious to the invasion of alien species. The bio-invasion of the Mediterranean encompasses nearly all the major marine taxonomic groups. Three of these, namely, Fish, Crustaceans and Molluscs, have been the subject of recent publications of CIESM (www.ciesm.org/atlas/). The scientific study of fishes has an advantage over the other groups, since commercial fishery exploitation provides extensive quantitative and qualitative data in "samples from the local marine environment, in addition, the taxonomy of fishes is relatively clear.

Fish invade the Mediterranean via three pathways: 1) via the Straights of Gibraltar; 2) via the Suez Canal and 3) via direct human activity (e.g., ship-mediated transport, mariculture, etc). Unlike other groups, the third way of direct human activity is of lesser importance regarding fishes.

Since the publication of the CIESM Fish Atlas in 2002 [1], 18 new exotic fish species have been recorded, reaching a total of 108 representing 61 families, of which 37 were new to the Mediterranean ichthyofauna. This represents an increase of 20% within only four years (Fig 1). In addition, many established species extended their distribution range. The most substantial range extensions were observed for *Etrumeus teres*, *Sphyraena flavicauda*, *Petroscirtes ancylodon*, *Callionymus filamentosus* and *Lagocephalus suzensi*s from Rhodes [2], *Upeneus pori* and *Scomberomorus commerson* from Tunis [3], *Fistularia commersonii* [4] and *Siganus luridus* from the Tyrrhenian Sea; *Pseudupeneus prayensis* progressed to the northwestern Mediterranean while *Seriola fasciata* reached the eastern Mediterranean.

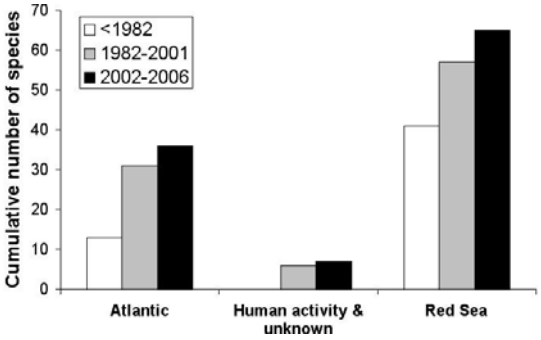

Fig. 1. Cumulative number of alien species in the Mediterranean by origin.

Invasive fish species succeeded in colonizing almost every available niche, including sandy and muddy bottom, pelagic and rocky, the first two of which were considered to be the most vulnerable to colonization [5]. The deepwater environment has been invaded to date only by Atlantic species; deepwater Red Sea species have been unable to reach the Mediterranean due to the shallow Bay of Suez. The general pattern of population growth of invasive fish species in the Mediterranean is characterized by a small founder group that gradually expands its population. However, there have been some instances of invasive fish species experiencing a population explosion shortly after invasion initiated. Two distinct periods of population explosion were observed. Between 1977-1982 four species, *Pempheris vanicolensis*, *Sillago sihama*, *Oxyurichthys petersi* and *Sphoeroides pachygaster* expanded their populations rapidly. Another wave of population explosion occurred between 2000-2005 regarding the species *Fistularia commersonii*, *Plotosus lineatus*, *Hippocampus fuscus*, *Lagocephalus sceleratus* and *Decapterus russelli*.

The impact of invasive fish on the Mediterranean indigenous species has been addressed by several authors who have noted cases where alien fish displaced, replaced or out-competed native species. However, except for the individual cases of Mullidae and Synodontidae, no other direct comparative studies of invasive fish species and their closely related indigenous species sharing a similar niche have been reported; thus, such sweeping conclusions regarding the vast majority of invasive fish species are of a speculative nature only. Future directions in research will need to deepen our knowledge of the impact of invasive species in the Mediterranean. One of the main challenges to future research on invasive species is to conduct comparative studies on the ecology and life history strategies of invasive versus that of their closely related indigenous species with similar ecological life traits. Another important research topic is to monitor the rate of invasion, since there is no sign that this rate will lessen in the foreseeable future. Other subjects for future studies may include the causal relation between population dynamics and species invasion, including genetic studies at the molecular level.

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