

# HOTSPOTS OF INTRODUCTION OF MARINE ALIEN SPECIES IN ITALIAN SEAS

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## Abstract

A group of Italian marine biologists, covering most taxa, has been volunteering for collecting data on the distribution of alien species for several years. Starting from mid twentieth century, the lagoon of Venice and the Mar Piccolo di Taranto have resulted as the main hotspots of introduction, with 40 and 24 alien species, respectively. High numbers of introduced species are related to the presence of ports, marinas, aquaculture facilities, and of disturbed environmental conditions. The intensity of observations during scientific research programs may have added a bias in the evaluation of hotspots.

**Keywords:** *Alien species, Species Introduction*

## Methods

Distribution of alien species has been assessed for the whole Italian coast, gathering literature records for the following taxa: Macrophyta, Porifera, Ctenophora, Cnidaria, Annelida, Mollusca, Crustacea, Picnogonida, Bryozoa, Tunicata and Vertebrata. Only species of "recent" introduction (after 1945) have been taken into account. The data have been checked by experienced taxonomists of the group, and compared to recent findings in the Mediterranean at large [1]. The number of total records has been calculated for the most representative locations, in order to identify sites where the introduction of alien species is more likely to occur along the Italian coast.



Fig. 1. Hotspots of introduction of alien species

## Results & Discussion

Fig. 1 shows the main hotspots of introduction along the Italian coasts. Circle diameter is proportional to the number of introduced aliens. Three main hotspots can be clearly identified: the Lagoon of Venice, Taranto and Sicily. Fig. 2 shows the distribution of main ports, aquaculture sites and research institutions where SIBM members operate. It is obvious that in many cases there is a correlation between such factors, explaining the high numbers of recorded aliens. For example, 10-15 species have been recorded in each of the three sites with important commercial, military and recreational ports (Genoa, Naples, Otranto), having also been studied by experienced teams of marine biologists.

**Lagoon of Venice (N-Adriatic Sea)** - Venice is the main hotspot of introduction in Italy, and probably one of the most important in the whole Mediterranean: 40 alien species have been recorded here since 1945. In the Venice lagoon there is a unique combination of factors that have favoured such a massive introduction of non-native organisms. Venice hosts commercial and tourist ports, recreational marinas, aquaculture facilities. It has experienced rapid environmental changes over the past decades, with detrimental effects on the native biota, which has easily been replaced by invaders brought by shipping and aquaculture [2]. Furthermore, in Venice there is an uncommon concentration of research institutions displaying taxonomic expertise in most taxa and constantly monitoring its fragile ecosystem and its biota.

**Taranto (N-Ionian Sea)** - The Gulf of Taranto, containing the coastal lagoon "Mar Piccolo" and the second most important commercial port in Italy, is another hotspot, where 24 species of alien species have been introduced. As for the Lagoon of Venice, the factors that favour introductions are: shipping,

aquaculture activity, degraded environment; an active research group based in Taranto [3] has performed routine surveys in the area.

**Sicily (S-E Tyrrhenian and Straits of Sicily)** - In the main island of the Mediterranean Sea, Sicily, also including smaller islands, the number of alien species has been increasing throughout the investigation period. While aquaculture industry is less developed there than in other parts of Italy, the geographic location might be viewed as the main determinant for the spotting of a large number of alien species: 11 in Catania, 13 in the S-Thyrrhenian (Aeolian islands and Ustica), and 18 in the Straits of Sicily (Pantelleria and Pelagian islands). Located at the crossroads between the Eastern and Western sectors of the Mediterranean, Sicily is interested by an intense maritime traffic including fisheries and recreational fleets made of relatively small vessels. It also presents climatic conditions favouring the establishment of species until recently restricted in the Levantine waters. The presence of many marine biology centres based in Sicily is an obvious counterpart.

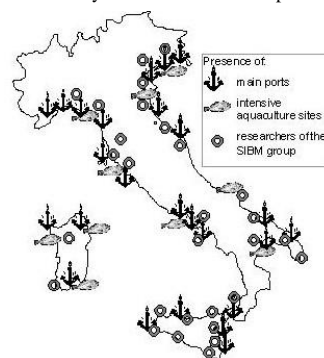


Fig. 2. Distribution of main ports, aquaculture sites and research institutions where SIBM members operate

## Conclusions

A total of 163 alien species introduced has been recorded in Italian waters (Occhipinti-Ambrogi et al., in preparation), following a trend common for the whole Mediterranean Sea [1]. Some localities have yielded a very high number of species, and can be considered hotspots for present and future bioinvasions. Intense ship traffic in large ports and non voluntary transport of species connected with aquaculture activities are common in the three main hotspots examined, but the high number of species identified is also a consequence of the concentrated marine biological monitoring effort by expert teams.

## References

- 1 - Galil B.S., 2009. Taking stock: inventory of alien species in the Mediterranean sea. *Biol. Inv.*, 11: 359-372.
- 2 - Occhipinti-Ambrogi A., 2000. Biotic invasions in a Mediterranean lagoon. *Biol. Inv.*, 2: 165-176.
- 3 - Cecere E. and Petrocelli A., 2004. Floristic and biogeographic considerations about the benthic macroalgal flora in the Gulf of Taranto. *Biogeographia*, 25: 7-18.