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## **A PRELIMINARY ASSESSMENT OF IMPORTS OF EXOTIC AQUATIC SPECIES TO THE MALTESE ISLANDS (CENTRAL MEDITERRANEAN)**

### **Abstract**

*The increasing reliance of human societies on globalised maritime trade has spearheaded the spread of exotic aquatic species worldwide, with the Mediterranean Sea being one of the regional seas mostly affected by the phenomenon of Non-Indigenous Species (NIS) introductions, by virtue of its geographical location. This study attempts to characterise the flow of exotic aquatic biota being imported from non-EU countries to the Maltese Islands by assessing the information contained within a sample of importation licenses.*

**Key-words:** maritime trade, exotic aquatic species, NIS, importation licenses

### **Introduction**

Invasive species are ranked as the second most common cause of species extinctions (Bax *et al.*, 2003; Bellard *et al.*, 2016). A number of introduction pathways mediate the transmission of these species from the region of origin to the region of invasion, with global trade being one of the most prominent of these pathways. In fact, the magnitude of merchandise imports is a significant determinant of the number of species, as well as the rate of new species introductions of a wide range of alien taxa (Hulme, 2009). Despite the globalisation of trade and our increasing reliance on maritime routes for global trade, holistic investigations of the databases of imported exotic species are rare, with studies often focusing on individual importation drivers only (e.g. aquarium/pet industry). EU Regulation 1143/2014 lists the Invasive Alien Species (IAS) of Union Concern which should be the target of management measures and in which no commercial trade is allowed. Currently, this Regulation lists only terrestrial and freshwater species, and not marine ones. This study represents a preliminary attempt at characterising the exotic aquatic biota imported to the Maltese Islands by using data extracted from twelve months of importation licenses.

### **Materials and Methods**

The authors were given access by the Environment and Resources Authority (ERA), as the responsible national authority handling these aspects, to a twelve-month excerpt from the importation license database, stretching from September 2016 to September 2017, for all aquatic species imported to the Maltese Islands from non-EU countries. The total of 498 licenses issued by the ERA over the period under scrutiny were provided in raw format such that all salient information had to be extracted and transcribed online manually.

### **Results**

The exotic aquatic species featured within the importation licenses studied were exported to Malta from thirty-six different countries located in six different continents, of which

the continents with the highest representation in terms of country of origin of the same imports were Asia (fourteen countries), Africa (eleven countries) and South America (five countries) The three countries from which most imports to the Maltese Islands originated were Oman, Senegal, Mauritania, Singapore, Morocco, Sri Lanka and Indonesia, whilst Africa exhibited the highest number of exotic aquatic species exported to Malta (412), followed by Asia (203) and North America (15). Although the economic value of imports of exotic aquatic species to Malta for Fisheries purposes was the highest, the Aquarium/Pet Industry was responsible for the highest number of imported individuals, i.e. 570,000, although most probably this number represents the maximum number of exotic individuals for which importers were licensed, rather than the actual number of exotic aquatic individuals imported to Malta. The vast majority of imported exotic species (494) are of marine affinity, whilst 94 imported species are reported to have a marine/brackish water affinity and 40 species a freshwater one. The vast majority of imported species were fish, followed by crustaceans, echinoderms (sea urchins and sea cucumbers), molluscs (largely cephalopods) and even jellyfish.

### **Discussion and Conclusions**

In terms of openings for future work, one would recommend strengthening further the current risk assessment processes in relation to the trade in flora and fauna, possibly with more comprehensive risk analyses using the protocols adopted within global databases for NIS, including DAISIE and EASIN. On the basis of the data extracted from the importation licenses, a number of preliminary considerations to this effect can be made. For instance, although (1) the vast majority of aquatic biota imported to the Maltese Islands from non-EU countries for non-aquarium purposes (e.g. fisheries, aquaculture, research and the food industry, which might represent a higher probability of escape into the wild) consisted of dead individuals, a small number of these imports consisted of live specimens, and these belonged to the following species: *Homarus* spp. *Palinurus regius*, *Palinurus mauritanicus*, *Sparus aurata*, *Oreochromis niloticus* and *Thunnus thynnus*. Legal obligations and mitigation measures are in place to avoid potential introduction of NIS into the marine environment from land-based operations. Notwithstanding this, a number of species imported to the Maltese Islands have actually already been recorded from the wild from the same region as range-expanding species, including *Acanthurus monroviae* and *Cephalopholis taeniops* (imported to Malta from Senegal and Tunisia), whilst the *Lutjanus* sp. cited on the importation licenses and introduced from the same two countries might refer to *Lutjanus fulviflamma* already recorded from Maltese waters.

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