

REVIEW ARTICLE

Is Turkey ready to face with lionfish (*Pterois* spp.) invasion?

Murat Bilecenoglu

Department of Biology, Faculty of Arts and Sciences, Adnan Menderes University, Aydın, TURKEY

Corresponding author: mbilecenoglu@adu.edu.tr

Abstract

Turkey has long been subjected to intensive alien species introductions, owing to its proximity to the Suez Canal and dense maritime traffic taking place through the Turkish Straits System. Although Turkey has experienced numerous cases of marine invasions, some of which led severe consequences, precautionary measures taken so far were rather insufficient to successfully practice prevention, early detection and mitigation of impacts of noxious invaders. Given the sudden introduction of lionfish (*Pterois* spp.) to the Mediterranean Sea ecosystems, Turkey has doubtlessly to be more prepared than ever for a potential invasion process. In order to find out a satisfactory answer to whether Turkey is currently ready to face with lionfish invasion or not, existing information related to various aspects of invasion biology (i.e. national policies, management strategies, available relevant databases) were briefly analyzed.

Key words: *Pterois volitans*, *Pterois miles*, invasive species management

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Introduction

Extensive research on alien species carried out so far have presented us two very important facts: 1) no marine ecosystem on earth is resistant to the introduction of non-native organisms, 2) species movements beyond their natural historical distributions are most likely to continue. These two unfavorable phenomena enforce countries not only to manage already established alien taxa, but also to take effective precautions for potential invaders.

Majority of the disastrous outcomes of invasions have occurred either in terrestrial or freshwater ecosystems, while only a few marine species have so far been included to the "100 of the world's worst invasive alien species" list (Lowe

et al. 2000). However, marine invasions are increasing at an alarming rate and may have substantial impacts on the stability of ecosystems (Ruiz *et al.* 1997).

Regarding the Mediterranean Sea, there has been a couple of documented cases in which an introduced species has become a major invasive threat, drastically impacting on socio-economic values, fisheries, biodiversity and human health (such as *Caulerpa taxifolia*, *Lagocephalus sceleratus* etc., see Streftaris and Zenetos (2006)). Two new potentially detrimental Indo-Pacific species have recently been introduced to the eastern Mediterranean Sea (*Pterois miles* and *P. volitans*), which may unfavorably affect the structure and function of local ecosystems. Although it was questionable at first whether the noxious newcomers could invade the region like they do in the western Atlantic, current observations made in various parts of the Levant basin indicate clear signs of increasing abundance and rapid range expansion of *P. miles* (Turan and Öztürk 2015; Kletou *et al.* 2016), while *P. volitans* is still known by a single specimen (Gürlek *et al.* 2016).

Turkey has long been subjected to intensive alien marine species introductions, however, precautionary measures of the government taken so far were rather insufficient and the degree of overall invasion impact through the Turkish coastline still remains unknown. To find out whether Turkey is ready to face with a lionfish invasion, some key concepts were briefly analyzed.

Species Inventories

According to the CBD (Convention on Biological Diversity) guiding principles, countries should assist in the development of an alien species inventory and synthesis of relevant databases, including taxonomic and specimen databases, and the development of information systems.

The first attempt on creating a database on Turkish biological diversity, in which information on alien and invasive species take place, was carried out by the collaborative project of TÜBİTAK (The Scientific and Technological Research Council of Turkey) and State Planning Organization (of today's Ministry of Development) two decades ago. Main weakness of this inventory was its content, being restricted only to the terrestrial and aquatic vertebrates. The second effort was made by the Ministry of Forestry and Water Affairs (MFWA) and a national biodiversity database (titled Noah's Ark) was developed within the framework of the Biodiversity and Natural Resource Management Project (GEF-II). Noah's Ark became active in 2007 under MFWA. The database collects all observations on Turkey's biodiversity, primarily for the purpose of conservation. The Biodiversity Monitoring Unit's work involves facilitating or undertaking active data entry to Noah's Ark, coordinating the validation of data by experts and developing database interfaces, which support the processes of biodiversity conservation. The

database is open to experts and the public (MFWA 2011), but has no specific interface related to invasive alien species.

Until now, two comprehensive inventories particularly on alien marine species of Turkey were published. The first scientific paper included 277 species (Çınar *et al.* 2005), and its updated version listed 400 species (Çınar *et al.* 2011). None of these studies have yet been integrated to any of the existing governmental databases.

Alien Species Experts

Alien species expert inventory is another key component of the invasive species management programs, whose importance was also mentioned by the CBD. A very good example is the DAISIE (Delivering Alien Invasive Species In Europe) project, funded by the 6th framework of European Commission, which includes 2440 experts on biological invasions in Europe (nearly dozen of which are Turkish scientists, studying on marine invasions). Such an inventory does not currently exist in Turkey, yet to be integrated to the forthcoming alien species databases.

At present, there are about 200 universities in Turkey, comprising 150,000 full time academicians. In over a hundred biology departments and over 20 fisheries faculties, 3000+ researchers have been employed, but the number of staff devoted to the study of alien marine species is remarkably low, i.e. two dozen at most, according to the numbers of active scientists regularly producing papers on alien organisms during the last decade. Scarcity of the number of alien species experts and marine biologists are major problems of Turkey to be solved. Apart from the shortage of experts, the number of graduate students within relevant departments are also decreasing; for example, the number of registered students within fisheries faculties have been reduced by 80% during the last 3 years, in line with the decision of Council of Higher Education (YÖK). The existing situation also caused severe declines in the number of post-graduate students dealing with marine biology.

National Policy

With reference to the governmental approach to biodiversity and all other related topics, the alien species has never been a priority issue of Turkey, despite the presence of compulsory statements exclusive to prevention and mitigation of invasive alien species in international treaties signed so far (such as the Bern, Barcelona and Biological Diversity Conventions).

The department of Vulnerable Areas of General Directorate of Nature Conservation and National Parks is officially in charge to carry out all kinds of research on any alien or invasive species, likely to pose risk to the Turkish

marine ecosystems. The directorate has long been operated with insufficient number of alien species experts and was able to organize a few workshops to date and published a couple of booklets on invasive species to increase public awareness. Nevertheless, the National Biological Diversity Strategy and Action Plan (2007) prepared by the directorate was a landmark step, which includes overview of the alien marine species in Turkey and gaps and needs of the local biodiversity were determined. According to the action plan, "effective methods for the identification and observation of alien species should be developed and implemented; regulations on the entry of alien species into new ecosystems, in particular, should be reviewed and made agreeing to the international conventions; and strict controls should be exercised to prevent invasive species". In this context, some specific objectives and strategic actions were identified, as follows (MEF 2007):

Objective 1.3: To prevent or minimize as far as possible any pressures on and threats to biological diversity

Strategic action 1.3.4: Taking appropriate legal and institutional measures, including the improvement of human resources, for the identification of the alien species that are introduced or most probably will be introduced into Turkey, the prevention of the introduction of invasive alien species, the determination of any possible adverse impacts of them on biological diversity and the elimination

Objective 4.3: To prevent or minimize as far as possible any pressures on and threats to agricultural biological diversity which come from the genetically modified organisms (GMO's) and the alien species

Strategic action 4.3.5: The collection of information about the invasive alien species which are introduced or most probably will enter to Turkey, and the monitoring of those species and control of those impacts

Despite of the above mentioned objectives, Turkey, however, could implement only a part of the guidelines on the alien species, since institutional coordination has yet to be developed. Achievement of the objectives certainly require multidimensional action of the government.

Conclusive Remarks

Invasive species are a global problem, so unilateral action of limited number of countries can never be enough to prevent unwanted introductions. Common problems require regional and international cooperation, but yet many Mediterranean countries face similar constraints in the invasive species efforts, such as low public awareness, shortage and inaccessibility of scientific information (for species identification, risk analysis, detection and mitigation

techniques etc.), absence of clear and agreed priorities for action, inadequate monitoring capacity, lack of effective emergency response measures, outdated or inadequate legislation and poor co-ordination between government and other stakeholders (Genovesi and Shine, 2004).

Prevention is always better than the cure, but since we do not have any chance to completely close the Suez Canal, Indo-Pacific and Red Sea species will continue to their influx. It is yet possible to prevent invaders at source, where Turkey needs to review existing border controls and quarantine systems, without neglecting to implement capacity building programmes and training of customs officials (employment of biologists is crucial). There is wealth of scientific information on how to exercise early detection, rapid response and mitigation of impacts, so Turkey must align its national legislation on invasive species with globally accepted standards (i.e. EU Regulation 1143/2014 on Invasive Alien Species). Right now, the ratification of Ballast Water Management Convention (The International Convention for the Control and Management of Ships' Ballast Water and Sediments) by Turkey is currently our most important asset towards halting the spread of invasive aquatic species.

At present, Turkey seems to be unprepared not only for the potential lionfish invasion, but also for any kind of marine invasions. To briefly summarize the deficiencies, a national coordination mechanism does not exist, invasive alien species strategy has not been developed, management goals are currently undefined, no action plans have been made so far, and the degree of public awareness is questionable. Tracking the lionfish population, conducting more research, educating the public and making regulations to control further alien species introductions require vigorous steps to be taken by Turkey.

Türkiye aslanbalığı (*Pterois* spp.) istilasına hazır mı?

Öz

Süveyş Kanalı'na yakınlığı ve Türk Boğazlar Sistemindeki yoğun deniz trafiği nedenleriyle, Türkiye uzun zamandır yoğun bir yabancı tür etkisine maruz kalmaktadır. Çok ciddi olumsuz sonuçlara neden olan deniz istilacı türlerinin varlığına rağmen, Türkiye'nin bugüne kadar yabancı tür girişlerini engelleyici veya istilacıların erken safhada fark edilmesine ve muhtemel olumsuz etkilerinin engellenmesine yönelik tedbirleri yetersiz kalmıştır. Aslan balıklarının Akdeniz ekosistemine beklenmedik ve ani katılımları nedeniyle, Türkiye bu muhtemel istila sürecine her zamankinden daha fazla hazırlıklı olmalıdır. Bu çalışmada Türkiye'nin aslan balığı istilasıyla yüzleşmeye hazır olup olmadığı, biyolojik istilaların yönetimine dair bazı önemli sorulara yanıt aranarak (örneğin ulusal mevzuat, yönetim stratejileri, mevcut yabancı tür veritabanları vs.) kısaca analiz edilmiştir.

Anahtar Kelimeler: *Pterois volitans*, *Pterois miles*, istilacı tür yönetimi

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