

Article

Exotic crustaceans of the Turkish coast

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Received 24 November 2012; Accepted 28 December 2012; Published online 1 March 2013

IAEES

Abstract

A total of 50 exotic species (19 Brachyura, 19 Natantia, 2 Stomatopoda, 6 Amphipoda, 1 Cumacea, 2 Isopoda, and 1 Cirripedia) of crustaceans are reported from the Turkish coast. Exotic crustaceans of the Turkish Seas comprises of approximately 48% of the fauna constituted by invasive species, introduced from the Levantine basin of the Mediterranean. About 34% of invasive crustaceans found on the Turkish coast are Indo-west Pacific origin. Decapods constitute majority of the species with a dominance of 38%. Lowest dominance (2%) was related to orders, Cumacea and Cirripedia a being that were represented by single species. When Levantine basin was compared to the Turkey coast, the shrimp species reported on the Turkish coast were 70% of the shrimp species of all Levantine basin. The exotic migrant crab of Indo-West Pacific, *Charybdis helleri* was found abundant on the entire Turkish coast of the Mediterranean. Brachyuran crab, *Eurycarcinus integrifrons* and the oisk shrimp, *Palaemonella rotumana* are the latest records of exotics for the Turkish Seas.

Keywords exotic crustaceans; Turkish Seas.

1 Introduction

Penetrating of species to a different ecosystem is crucial and affects adversely the biological diversity (Zhang and Chen, 2011). The impacts of exotic species on native environments include restructuring established food chains and competition with native species for food (Çınar et al, 2005; Zhang and Chen, 2011). Turkey has a long coastline by four seas which have different hydrographical features. A ship traffic has been observed in the Dardanelles and Bosphorus. However, the important commercial harbours on the coast of Turkey are susceptible points for the migration of the exotic. Most of exotic species have been penetrated to ecosystem of the Mediterranean Sea by means of two different pathways (i.e. the Suez Canal and shipping). The proximity of Turkey to the Suez Canal and Gibraltar has resulted in dense settlements of exotics, especially for the habitats on the Mediterranean coast of Turkey. Lessepsian migration are the ongoing migration of marine species by the Suez Canal, usually from the Red Sea to the Mediterranean. Lessepsian species belong mainly to fish, decapod crustaceans, molluscs, and polychaetes. These species have the populations in the eastern Mediterranean, usually following the coast of Israel, Lebanon, Syria, Cyprus, and Turkey.

A total of 955 alien species is reported from the Mediterranean, the vast majority of them having being introduced in the EMED (775), less in the WMED (308) and CMED (249) and least in the Adriatic (190)

(Zenetos et al., 2012). The most of the exotic crustaceans in the list of Turkish coast have been reported in the Anatolian coast of the Black Sea, the Sea of Marmara, the Turkish Aegean Sea, especially on the Mediterranean coast of Turkey. Recently, some of exotic crustaceans such as *Alpheus rapacida* de Man, 1908 have expanded their geographical distributional ranges to various regions of the Aegean Sea (Kapiris et al., 2012).

The present paper is on the exotic crustaceans recorded found from the Turkish Seas before and constitutes the primary database for the next faunistic studies.

2 Material and Method

Data belonging to this study are only reported data regarding exotics along the Turkish coasts have been taken into account. Data presented are based on all species' records until 2010.

3 Results

Around 34% of Indo-West Pacific originated alien crustaceans penetrate to the Turkish coasts via Suez Canal. Ship vector for this introducing has a percentage of 15%. A total of 50 exotic species (19 Brachyura, 19 Natantia, 2 Stomatopoda, 6 Amphipoda, 1 Cumacea, 2 Isopoda, and 1 Cirripedia) of crustaceans are present on the Turkish coast (Fig. 1). 34% of invasive crustaceans found on the Turkish coast are Indo-west Pacific originated. Decapod crustaceans constitute majority of the species with a dominance values of 76%. 7 species of exotic decapod crustaceans (*Callinectes sapidus*, *Marsupenaeus japonicus*, *Melicertus hathor*, *Metapenaeus monoceros*, *Metapenaeus stebbingi*, *Penaeus semisulcatus*, *Portunus segnis*) having commercial value for fisheries are commercially important for fisheries. Penaeid shrimp, *Penaeus kerathurus* are largely captured by fishermen fished in the Gulf of Iskenderun. However, the location of the this native species was occupied by exotic species, *M. japonicus* in course of time. Up to date, only pilumnid crab, *Pilumnus hirsutus* was reported as exotic species from the Anatolian coast of the Black Sea.

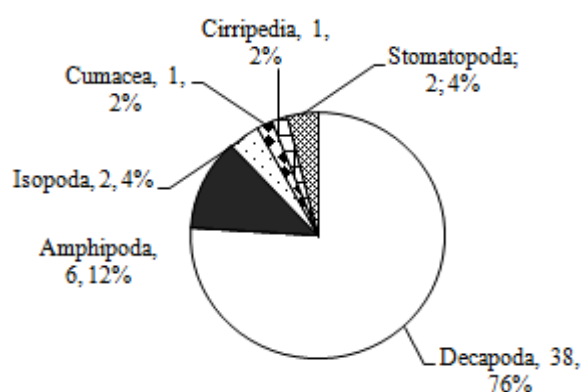


Fig. 1 Dominance values of exotic crustaceans found on the Turkish coast.

Components of exotic crustaceans in the Turkish Seas are composed from the Atlanto-Mediterranean migrants (etc. *Callinectes sapidus*) by Gibraltar Strait and the Indo-Pacific migrants (etc. *Charybdis longicollis*) by Suez Canal. Portunid crab, *Charybdis longicollis* introduced from Red Sea and it constitutes dense populations on the Mediterranean coast of Turkey. Following the opening the Suez Canal in 1869, most Indo-

Pacific originated species penetrated to the eastern Mediterranean. The migration route of these species is from the south to north (towards to Turkish coast) (Fig. 2). Table 1 shows a list of exotics reported on the Turkish coast.



Fig. 2 The migration route of the lessepsian migrants in the eastern Mediterranean (Drawn by Ateş).

A total of 50 exotic crustacea species introduced to the Turkish coast by different vectors (Fig. 3). Some species decline west part of the Turkish Mediterranean Sea. Whereas, the migrant crab, *Charybdis longicollis* comprises dense populations along the entire Turkish shores of the Mediterranean. *Eurogosquilla massavensis* (Kossmann, 1880) was reported from the Sea of Marmara by Katagan et al. (2004) and Turkish Aegean Sea coast by Özcan et al. (2008).

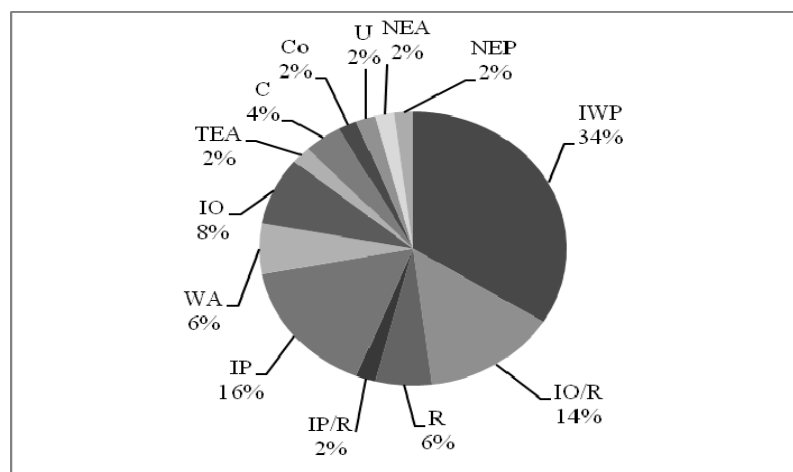


Fig. 3 The origin of the exotic crustaceans occurred in the Turkish Seas. **IP:** Indo-Pacific, **R:** Red Sea, **IO:** Indian Ocean, **WA:** West Atlantic, **TA:** Tropical Atlantic, **IO/R:** Indian Ocean/Red Sea, **IWP:** Indo West Pacific, **NEA:** North East Atlantic, **NEP:** North East Pacific, **C:** Circumtropical, **Co:** Cosmopolitan.

Table 1 List of exotic crustaceans found in the Turkish Seas

Cirripedia	Origin
<i>Amphibalanus eburneus</i> (Gould, 1841)	West Atlantic
Cumacea	
<i>Eocuma sarsii</i> (Kossmann, 1880)	Indo-Pacific/Red Sea
Isopoda	
<i>Paradella diana</i> Menzies, 1962	North-East Pacific
<i>Sphaeroma walkeri</i> Stebbing, 1905	Indian Ocean
Amphipoda	
<i>Elasmopus pecteniscrus</i> (Bate, 1862)	Circumtropical
<i>Gammaropsis togoensis</i> (Schellenberg, 1925)	Cosmopolitan
<i>Maera hamigera</i> Haswell, 1879	Indo-Pacific
<i>Monocorophium sextonae</i> (Crawford, 1937)	Unknown
<i>Parhyale explorator</i> Arresti, 1989	North-East Atlantic
<i>Stenothoe gallensis</i> Walker, 1904	Circumtropical
Decapoda	
<i>Alpheus audouini</i> Coutiere, 1905	Indo-West Pacific
<i>Alpheus inopinatus</i> Holthuis & Göttlieb, 1958	Indian Ocean/Red Sea
<i>Alpheus migrans</i> Lewinsohn & Holthuis, 1978	Red Sea
<i>Alpheus rapacida</i> de Man, 1908	Indo-West Pacific
<i>Atergatis roseus</i> (Rüppell, 1830)	Indo-Pacific/Red Sea
<i>Calappa hepatica</i> (Linnaeus, 1758)	Indo-Pacific
<i>Callinectes sapidus</i> Rathbun, 1896	West Atlantic
<i>Carupa tenuipes</i> Dana, 1851	Indo-Pacific
<i>Charybdis helleri</i> (A. Milne Edwards, 1867)	Indo-West Pacific
<i>Charybdis longicollis</i> Leene, 1938	Indian Ocean/Red Sea
<i>Coleusia signata</i> (Paulson, 1875)	Indo-West Pacific
<i>Daira perlata</i> (Herbst, 1790)	Indo-West Pacific
<i>Eucrate crenata</i> de Haan, 1835	Indo-Pacific
<i>Eurycarcinus integrifrons</i> De Man, 1879	Indian Ocean/Red Sea
<i>Fenneropenaeus merguensis</i> (De Man, 1888)	Indo-West Pacific
<i>Ixa monodi</i> Holthuis and Göttlieb, 1956	Red Sea
<i>Leptochela pugnax</i> De Man	Indo-West Pacific
<i>Macrophthalmus graeffei</i> A. Milne Edwards, 1873	Indo-West Pacific
<i>Marsupenaeus japonicus</i> (Bate, 1888)	Indo-Pacific
<i>Melicertus hathor</i> (Burkenroad, 1959)	Indian Ocean
<i>Metapenaeopsis aegyptia</i> Galil & Golani, 1990	Indo-Pacific
<i>Metapenaeopsis mogiensis consobrina</i> (Nobili, 1904)	Indo-West Pacific
<i>Metapenaeus affinis</i> (H. Milne Edwards, 1837)	Indo-West Pacific
<i>Metapenaeus monoceros</i> (Fabricius, 1798)	Indo-West Pacific
<i>Metapenaeus stebbingi</i> (Nobili, 1904)	Indian Ocean
<i>Micippa thalia</i> (Herbst, 1803)	Indo-West Pacific
<i>Myra subgranulata</i> Kossmann, 1877	Indian Ocean/Red Sea
<i>Ogyrides mjoebergi</i> (Balss, 1921)	Indo-West Pacific
<i>Palaemonella rotumana</i> (Borradaile, 1898)	Indo-West Pacific
<i>Penaeus semisulcatus</i> de Haan, 1844	Indo-West Pacific
<i>Percnon gibbesi</i> (H. Milne Edwards, 1853)	Western Atlantic
<i>Pilumnopus vauquelini</i> (Audouin, 1826)	Indian Ocean/Red Sea
<i>Pilumnus minutus</i> De Haan, 1835	Indo-Pacific
<i>Portunus segnis</i> (Förskal, 1775)	Indian Ocean
<i>Processa macrodactyla</i> Holthuis, 1952	Tropical East Atlantic
<i>Thalamita poissonii</i> (Audouin, 1826)	Indo-West Pacific
<i>Trachysalambria palaestinensis</i> (Steinitz, 1932)	Red Sea
<i>Urocaridella pulchella</i> Yokes & Galil, 2006	Indo-Pacific
Stomatopoda	
<i>Clorida albolitura</i> Ahyong & Naiyanetr, 2000	Indo-West Pacific
<i>Erugosquilla massavensis</i> (Kossmann, 1880)	Indian Ocean/Red Sea

The appropriate ecological conditions such as sea temperature, salinity, and type of substrate in the Turkish Mediterranean Sea supported to establish significant populations for the Indo-Pacific migrants. Isopod, *Sphaeroma walkeri* is a thermophilic species and known as indigenous to the Indian Ocean. It was reported in Izmir Bay, 1976 by Kocataş, 1978 (Galil, 2008). The amphipod, *Stenothoe gallensis* Walker, 1904 is a cosmopolitan species found in warm temperate and tropical areas (Thomas, 1993). This species was reported for the first time from the Fethiye Bay (the Turkish Mediterranean coast) by Kocataş and Katağan (1978). The cirriped, *Amphibalanus eburneus* (Gould, 1841) which is originated with the western Atlantic was reported by Cinar et al. (2008) from the İzmir Bay (the eastern Aegean Sea). Its first record in the Mediterranean is from the coasts of Alexandria, Egypt (El Komi, 1991). The banana prawn, *Fenneropenaeus merguensis* (De Man, 1888) and the caridean shrimp, *Palaemonella rotumana* (Borradaile, 1898) were recently reported from the Turkish coast. *Processa macrodactyla* was introduced to the Mediterranean via the Gibraltar Strait and it was recorded only on the Turkish coasts of the Aegean Sea. This species was also recorded in the Spanish waters (García Raso and Salas Casanova, 1985). Grapsoid crab, *Percnon gibbesi* (H. Milne-Edwards, 1853) and the shrimp, *Urocaridella pulchella* (Yokes and Galil, 2006) were reported from the coasts of Kas Peninsula (the south part of Turkey) by Yokes and Galil (2006). Yokes and Galil (2004) found the exotic shrimp, *Metapenaeopsis mogoensis consobrina* (Nobili, 1904) on Kas Peninsula coasts (the Turkish Mediterranean). The latest addition to the inventory of the marine decapod species in the EMED is the pilumnid crab, *Eurycarcinus integrifrons* (Özcan et al, 2010).

Gammaropsis togoensis occurs in the east and west Atlantic Ocean (Florida, Mexico, Belize, Venezuela, Brazil), Indian Ocean, Pacific Ocean, and the Mediterranean Sea. This species is only reported from coast of Israel in the Mediterranean and now, it is known on the Turkish coasts (Bakır et al, 2007). *Paradella diana* is found in the north American Pacific and the Atlantic coasts, Australia, the Arabian Sea and the Mediterranean Sea. Its first record was given from İzmir Bay for the Turkish coasts by Çınar et al (2008) (Kırkim et al, 2010).

4 Discussion

Some of the impacts of exotic species are loss of biodiversity, habitat, hybridization with native species, and alteration of food chains (Hasan and Noel, 2007). We can clarify the results of Lessepsian migration in the coastal waters of Turkey with two major consequences. These are ecological and economic consequences. The ecological impact of the lessepsian immigrants is crucial on the Turkish coast and it includes the modification of ecological niches, the functioning of the ecosystem, and the replacement of the endemic species. Several migrants such as *Charybdis longicollis* and *Eurogosquilla massavensis* penetrated to the eastern Mediterranean and established dense populations on the Turkish coast. So, their abundance, most probably modified the operation of the infralittoral zone.

Economic consequences comprises the positive results (migrants having commercial value in terms of fisheries) and negative results (replacement of endemic species with economic interest). Commercial exotic shrimp, *Marsupenaeus japonicus* penetrated to the eastern Mediterranean via Suez Canal and replaced the endemic species, *Melicertus kerathurus*. Migration of several exotics in the Turkish Seas constitutes several serious problems. These are economic impact, change of ecosystem, and Alteration of the biodiversity. The control of Lessepsian migration can be difficult because there are no hydrological barriers between the eastern Mediterranean and Red Sea. To reduce this migration, a detailed knowledge on the fauna of Suez Canal and Red Sea should be well known, the control of migrants must be controlled, the studies on their biological features should be carried out and finally, the environmental characteristics of the areas cited should be known.

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