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The Survey of the Imported Freshwater Decapod Species via the Ornamental Aquarium Trade in Turkey

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Abstract: In this study, the situation with imported freshwater decapod species via the live aquarium ornamental trade in Turkey was investigated year round during 2011. The scientific and common names, native geographic regions, import sizes and prices were recorded. Among the 28 imported freshwater decapod species recorded in this survey, 15 are shrimps, 9 are crayfish and 4 are crabs. Those imported species might have escaped or have been released into the wild due to misguided cultural habits or incorrect conservation concepts. The objective of this study is to raise awareness of imported freshwater decapods and to present a list of the species currently traded in the aquarium industry in Turkey.

Key words: Aquarium, freshwater decapod, import, shrimps, species, Turkey

INTRODUCTION

Aquarium keeping is amongst the most popular of hobbies with millions of enthusiasts worldwide. Today, ornamental fish comprise a very large and diverse global industry with trading in >4,500 species of freshwater fish, 1,450 species of marine fish and >650 species of corals and other marine invertebrates (Miller-Morgan, 2010). The FAO statistical database provides information from 1976 onwards. In 1976, 28 countries reported exports of ornamental fish. Since then, the number of exporting countries (including re-exporting) has gradually grown to 146 in 2004 (Ploeg, 2007). On the other hand, aquarium and ornamental species industry is growing by 14% annually worldwide. Singapore is currently specialized in farming freshwater species but also serves as a major reexpector of fish from other Asian countries. European Union is the largest market for ornamental fish however the United States is the single largest importer of ornamental fish in the world (Padilla and Williams, 2004).

In recent years, internet trade in ornamental species via on-line retailers and hobbyist sites are getting more popular. There are >11 million hobbyists in the US alone supporting a $25 billion year^{-1} worldwide industry in aquarium and aquatic ornamental species most of which are available through mail order and over the internet (Kay and Hoyle, 2001; Padilla and Williams, 2004).

Not only finfishes but also a wide range of invertebrates are found good to be kept in captivity. In fact, new species are now being introduced to hobbyists at a remarkable pace, especially freshwater decapod crustaceans such as shrimps, crayfish and crabs. There are many different reasons for maintaining these decapods in the home aquarium. The burrowing behaviors of some species contribute to the turning of the aquarium substrate and the cycling of detritus. Compared to other aquatic and semi-aquatic animals they only require the simplest living conditions with filters and air pumps being optional extras rather than essential pieces of kit.

The ornamental aquarium trade in Turkey started to develop as an industry after 1980s. After this period, a large number and type of aquarium fish have been started to import (Turkmen and Alpbaz, 2001). Although, keeping decapods in freshwater aquariums is a new popularity in Turkey, many shrimp, crayfish and crab species commonly seen for sale in virtual pet stores. The objective of this study is to raise awareness of imported freshwater decapods and to present a list of the species currently traded in the aquarium industry in Turkey.

MATERIALS AND METHODS

In order to evaluate the number of freshwater decapod species currently traded in the aquarium industry monthly surveys were conducted year round during 2011. Method used for the present study described for marine ornamental decapods by Calado *et al.* (2003) and Morrisey *et al.* (2011) and for ornamental aquarium trade by Lin *et al.* (2006). Information was gathered from seven Turkish aquarium wholesalers six retail stores by field surveys and ten virtual pet stores on the world wide web in Turkey. The scientific name and common name of each

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imported species were recorded. For unidentified species, pictures were taken and their taxonomic characters were recorded for future identification. This preliminary list was complemented with the freshwater ornamental decapod species listed in Hobbs and Hart (1982), Chace (1997), Debelius (1999), Gilpin (2006) and Cai *et al.* (2007). In addition, one crayfish species from Turkish inland waters was included because recent internet resources have revealed the potential use of such species in the freshwater aquarium trade. The average unitary retail value of the most heavily traded ornamental decapods was estimated based on the prices presented by virtual pet stores on the world wide web. Species were grouped according to the classification proposed by Martin and Davis (2001).

RESULTS AND DISCUSSION

At the end of the study, 15 shrimp, 9 crayfish (1 native and 8 imported) and 4 crab species under 7 different families exhibiting in ornamental aquarium trade in Turkey have been recorded (Table 1-3). Caridean shrimp species (15) clearly outnumber other decapod groups with the Atyidae family alone accounting for 14 species. Astacidean crayfish is the next most imported group with 4 species of Cambaridae, 4 species of Parastacidae, 1 species of Astacidae, respectively. Brachyuran crabs is the last imported group with 2 species of Gecarcinidae and 2 species of Sesarmidae.

Whereas the prices of freshwater shrimp vary from $1-28, the prices of crayfish and crabs are between $4 and 14. When it comes to origins, except for fan shrimp (*Atya gabonensis*), all freshwater shrimp species originate from Southeastern Asia. The species of pearl shrimp (*Neocaridina zhangjiajiensis*) is a kind of hybrid originally bred in Germany, however its wild origin is believed to be Southern China. In Crayfish, 4 species originate from each America and Australia. Turkish crayfish (*Astacus leptodactylus*) is also a species from Turkish inland waters.

Globalisation provides vastly expanded opportunities for species to be transported to new locations through a wide range of pathways. Those alien species for ornamental purposes may have serious negative

Table 1: Imported shrimp species via the ornamental aquarium trade in Turkey

Species	Family	Common name	Origin	IS (cm)	P ($/ind.)
Atya gabonensis	Atyidae	Fan shrimp	Western Africa	9	20-22
Atyopsis moluccensis	Atyidae	Bamboo shrimp	Asia	10	6-8
Caridina babaulti	Atyidae	Green shrimp	India	1.5	3-4
Caridina breviata	Atyidae	Bumblebee shrimp	Hong Kong	1-2	2-3
Caridina brevicarpalis	Atyidae	Red nose shrimp	Indonesia	2-3	3-4
Caridina cantonensis	Atyidae	Tiger shrimp	China	1.5-2	3-11
Caridina gracilirostris	Atyidae	Mosquito shrimp	India	4	5-6
Caridina japonica	Atyidae	Algae eater	Japan	2-3	3-4
Caridina multidentata	Atyidae	Amano shrimp	Japan	2-3	2-3
Caridina propinqua	Atyidae	Orange shrimp	Indonesia	1.5-2	3-4
Caridina serrata	Atyidae	Crystal shrimp	Japan	1-1.5	7-28
Neocaridina denticulata	Atyidae	Red cherry shrimp	Taiwan	1.5-3.5	1-2
Neocaridina heteropoda	Atyidae	Cherry shrimp	Taiwan	1.5-3.5	1-3
Neocaridina zhangjiajiensis	Atyidae	Pearl shrimp	Hybrid	1.5	2-3
Palaemonetes antennarius	Palaemonidae	Ghost shrimp	Taiwan	1.5	1-2

IS: Import Size (cm); P: Price (US dollar/Individual)

Table 2: Imported crayfish species via the ornamental aquarium trade in Turkey

Species	Family	Common name	Origin	IS (cm)	P ($/indv.)
Astacus leptodactylus	Astacidae	Turkish crayfish	Turkey	-	6-8
Cambarellus patzcuarensis	Cambaridae	Mexican dwarf orange crayfish	Mexico	3.5	8-14
Cambarus diogenes	Cambaridae	Devil crayfish	Eastern U.S.	7-8	4-6
Cherax albertisii	Parastacidae	Lobster blue tiger	Indonesia	7-9	12-14
Cherax boesemani	Parastacidae	Red brick	Papua New Guinea	6-8	11-14
Cherax peknyi	Parastacidae	Zebra crayfish	Papua New Guinea	7-8	11-14
Cherax quadricarinatus	Parastacidae	Red claw crayfish	Northern Australia	5-15	11-12
Procambarus alleni	Cambaridae	Electric blue crayfish	Florida	6-8	6-8
Procambarus clarkii	Cambaridae	Red swamp crayfish	Louisiana	6-10	4-6

IS: Import Size (cm); P: Price (US dollar/Individual)

Table 3: Imported crab species via the ornamental aquarium trade in Turkey

Species	Family	Common name	Origin	IS (cm)	P($/indv.)
Cardisoma armatum	Gecarcinidae	Moon crab	Africa	6-8	4-11
Gecarcinus quadratus	Gecarcinidae	Rainbow crab	Central America	4	4-6
Geosesarma bicolor	Sesarmidae	Vampire crab	South Asia	4	4-6
Perisesarma bidens	Sesarmidae	Red clawed crab	Indo-Pacific	4	11-14

IS: Import Size (cm); P: Price (US dollar/Individual)

effects on the environment and native species such as displacement of native species, transfer of disease, consumption of fish eggs, reduction of fish stocks, consumption of large amounts of macrophytes, indirect and direct effects on other invertebrates (Ploeg, 2008). Aquarium release is one of the top avenues for introduction of non-native invasive species (Ruiz *et al*., 1997). In earlier years in Taiwan, *P. clarkii* was imported for aquaculture or the aquarium trade but this species escaped or was released into freshwater ecosystems and has successfully established new local populations (Gao and Hong, 2001). Tur results showed that the aquarium trade in Turkey imports freshwater decapod species with species numbers and taxonomic diversity. Therefore, this taxonomic diversity may represent serious invasive potential for the aquatic ecosystems of Turkey. There has been no report related to invasive species in Turkish inland waters so far, yet it is necessary to take precautions in advance.

For the aquarium ornamentals trade the important risk assessment of post-importation invasion mechanisms include distance between the nearest water body and the aquarium ornamental store as well as the handling of discharged tank water (Weigle *et al*., 2005). In Turkey, there are no rules regulating how aquarium ornamental stores discharge tank water. Therefore, the distance between the nearest water body and the stores is the most-important risk. Aquarium ornamental stores in Turkey are usually in the major cities which are not far away from the inland water resources. This means that untreated tank water is always discharged directly into freshwater channels or rivers where most freshwater species might survive.

CONCLUSION

In this study, the results shows that importing of a nonnative freshwater decapod species into Turkey could be very critical. Regulation of imports of ornamental animals stock should involve quarantine and inspection protocols. In order to prevent biological invasion, the authorities concerned should establish multi-aspect invasion risk assessments and continue annual surveys of imported aquarium ornamental invertebrates as a long-term activity. Researches showed that nonindigenous species in the Hawaiian Islands (Cowie, 2001) and Taiwan (Lin *et al*., 2006) are increasing per year. This indicates that surveys of imported aquarium ornamental invertebrates should be continued as a long-term activity. Annual updates and reassessment of the record are necessary issues.

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