

**Research Article****Checklist of non-piscine ornamental aquatic organisms in Bangladesh**

Md. Noor-E-Ishrak Hossain\* and ABM Mohsin

*Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh***ISSN: 2456-6268****ABSTRACT****ARTICLE INFO**

Received: 29 December 2019  
 Accepted: 10 May 2020  
 Available online: 25 June 2020

**KEYWORDS**

Non-piscine organism  
 Ornamental species  
 Aquarium  
 Aquatic organism

**\*CORRESPONDENCE**

noor11.pro@gmail.com

The present study was conducted in Dhaka, Bangladesh, from March 2018 to February 2019 to generate a complete checklist of non-piscean ornamental aquatic organisms. During the study period, 2 turtle species, 6 snail species, 5 shrimps' species having 8 varieties, 3 crayfish species, 1 amphibian species, 1 crab species, 3 species of coral, mushroom and polyps and 42 species of ornamental plants under 13 orders were found. The number of invertebrates was 18, among them shrimp; snail and crayfish were more popular. On the other hand, the numbers of vertebrates' species were only 3, and the turtle was common. During the study period, species under the order decapod were most available among the invertebrates. Non-piscine species were dominated by invertebrates consists of 86%, followed by vertebrates, which were 14%. Prizing of non-piscine ornamental aquatic organisms varied on species, quantities, and numbers. Consider the findings; it was clearly concluded that the non-piscine ornamental aquatic organisms are becoming more popular day by day and becoming a highly potential sector in Bangladesh.

© 2020 The Authors. Published by [JFLS](http://www.jfls.com). This is an open access article under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by-nc-nd/4.0/>).

**INTRODUCTION**

In recent years, invertebrates, including sea anemones, sea stars, sponges, mollusks, crustacean decapods, echinoderms, among others, are gaining popularity among hobbyists (Paulay, 1997). Among invertebrates, decapod crustaceans play an essential role in the global marine aquarium industry, in addition to providing ecosystem services (Daily *et al.*, 1997). Of the decapods available on the market, marine ornamental shrimps are most popular (Calado *et al.*, 2003). Marine ornamental fish and invertebrates are widely collected from the coral reef habitats throughout the Indo-Pacific, as well as the Caribbean regions, but the exact number of species that are currently available in the trade is still difficult to estimate due to the unorganized, multifaceted and fragmented supply system (Cohen *et al.*, 2013). While fish and corals contribute to the bulk of the trade in terms of quantity and value, demand for invertebrates such as sea anemones, crustaceans, sponges, mollusks, and echinoderms are increasing as a result of the growing interest in keeping mini-reef aquaria. Nowadays, farmers and investors are very interested in moving their business to more diversified fields such as crocodile culture, pearl culture, aquarium fish trades, etc. (Mostafizur *et al.*, 2009). Due to its global scale and economic importance, the aquarium plant trade has become a significant source of invasive species to aquatic ecosystems (Padilla and Williams, 2004). The ornamental

plant trade, on the other hand, deals largely in selected cultivars and hybrids instead of pure natural species (Kasselman, 2003). The precise identification of the economically important plants is, therefore, a fundamentally important task in protecting the interests of the plant breeders and the nations alike (Bhat, 2008). The present study was conducted to generate baseline data.

**MATERIALS AND METHODS**

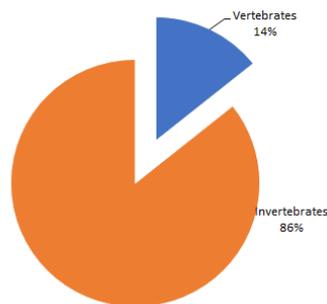
The study was conducted monthly at Katabon aquarium fish market, Tajmahal road, Mohammadpur, Hatirpool road and Kachukhet, Mirpur in Dhaka from March 2018 to February 2019 since it was considered as the hub of aquarium fisheries trade in Bangladesh. The survey's primary data collection was divided into sub-divisions such as eye observation, farm walk, and interview with the help of a questionnaire. Forty different aquarium shops and 40 respondents of aquarium shopkeepers, 20 respondents of aquarium hobbyists, and 5 respondents of aquarium fish breeders were interviewed during the survey. Primary data and the identification of the non-piscine species for creating the checklist were cross-checked slandered taxonomic keys.

**RESULTS AND DISCUSSION**

### Diversity of non-piscine ornamental aquatic organisms

Alongside aquarium fishes, the popularity of non-piscine ornamental aquatic organisms such as turtle, shrimp, crabs, lobster is increasing day by day and creating a potential income sector. So, the study on non-piscine ornamental aquatic organisms was conducted due to its future importance. The study was never done before in Bangladesh, and so the study data is compared with other countries such as India, Turkey, America.

During the study period 2 species of turtle were recorded under 1 order (Testudines) and 2 families (Emydidae and Geoemydidae), 1 amphibian species under 1 order (Urodela) and 1 family (Ambystomatidae), 6 snail species under 3 orders (Neogastropoda, Cycloneritimorpha, Caenogastropoda) and 6 families (Buccinidae, Pisaniidae, Conidae, Neritidae, Viviparidae and Ampullariidae), 5 species of shrimp having 8 species under 1 order (Decapoda) and 1 family (Atyidae), 3 crayfish species under 1 order (Decapoda) and 1 family (Cambaridae), 1 crab species under 1 order (Decapoda) and 1 family (Paguridae), 3 species of coral, mushroom and polyps under 3 orders (Alcyonacea, Corallimorpharia, Zoantharia) and 3 families (Alcyoniidae, Discosomidae and Zoanthidae) (Table 1 and Table 2). During the study period, species under decapod order were most dominant among the invertebrates. Among all the decapods available on the market, marine ornamental shrimps are most common (Calado *et al.* 2003).

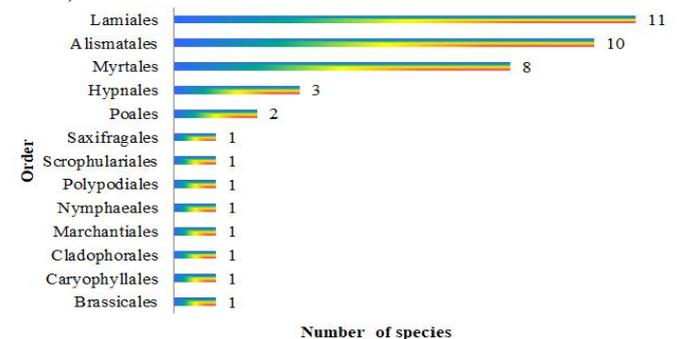


**Fig. 1:** Contribution percentage of vertebrates (turtles and amphibian) and invertebrates' (shrimp, crayfish, crab, snail) species

Non-piscean species were dominated by invertebrates consists of 86%; on the other hand, vertebrates

were 14% (Fig. 1). Simkatis (1958) described data on salt-water aquarium fishes and invertebrates and ideal combination of fishes with hermit crabs. He described sponges, polyps, sea anemones, corals, sea-worms, lobsters, crabs, shrimps, prawns, mollusks, sea-mats (Bryozoa), starfishes, sea urchins, sea cucumbers and fishes. Balaji *et al.* (2007) studied the marine ornamental invertebrates, resources of Parangipettai coastal the waters for the period of March-August 2005, which revealed the occurrence of 28 species of marine ornamental invertebrates belonging to 4 phyla. Turkmen and Karadal (2012) recorded 28 imported freshwater ornamental decapod species in Turkey, in which 15 were shrimps, 9 were crayfish and 4 were crabs. Calado *et al.* (2003) studied the resources of Marine ornamental, Decapods, and it's popular, in global ornamental trade. They recorded 128 of the most heavily traded marine ornamental decapods crustacean species. Jayachandran (2001) noted that many of the palaemonid prawns are brilliantly colored, and they are ornamental values.

Forty-two species of aquarium plants were recorded (Alismatales, Brassicales, Caryophyllales, Hypnales, Cladophorales, Lamiales, Myrtales, Marchantiales, Nymphaeales, Poales, Polypodiales, Saxifragales, Scrophulariales) and 21 families (Fig. 2 and Table 1). The number of species rapidly grew from the 18 species listed by (Fasset, 1955) at the time when aquarium plant trade was developing in South America (Lehtonen and Rodríguez Arévalo, 2005) to the 47 species recognized by 1975 (Rataj, 1975).



**Fig. 2:** Distribution of aquatic aquarium plant species under various orders

**Table 1:** Checklist of aquarium non-piscine species of Bangladesh according their systematic position

Non-piscine species	Order	Family	Scientific name	Common name	Price range (per piece) BDT
Turtle	Testudines	Emydidae	<i>Trachemys scripta</i>	Red-eared slider	380-650
		Geoemydidae	<i>Geoclemys hamiltonii</i>	Black pond turtle	450-850
Snail	Neogastropoda	Buccinidae	<i>Clea helena</i>	Assassin Snail	60-80
		Pisaniidae	<i>Engina mendicaria</i>	Bumble Bee Snail	250-300
		Conidae	<i>Conasprella pagoda</i>	Pagoda snail	130-150
	Cycloneritimorpha	Neritidae	<i>Neritina natalensis</i>	Zebra Snail	180-200
	Caenogastropoda	Viviparidae	<i>Taia naticoides</i>	Piano Snail	120-160
		Ampullariidae	<i>Pomacea bridgesii</i>	Apple Snail	40-60
Shrimp	Decapoda	Atyidae	<i>Caridina cf. cantonensis</i> var. <i>blue tiger</i>	Blue tiger shrimp	650-700
			<i>Neocaridina davidi</i>	Fire Red Shrimp	150-200
			<i>Neocaridina cf. zhangjiajiensis</i> var. <i>white</i>	Snowball Shrimp	500-600
			<i>Neocaridina davidi</i> var. <i>Yellow</i>	Yellow Shrimp	400-450
			<i>Neocaridina heteropoda</i>	Chocolate Shrimp	500-600
			<i>Neocaridina heteropoda</i> var. <i>Orange</i>	Orange Sakura Shrimp	150-180

Crayfish	Decapoda	Cambaridae	<i>Caridina multidentata</i>	Amano Shrimp	280-350
			<i>Neocaridina davidi</i> var. <i>rili</i>	Red rilli Shrimp	250-300
			<i>Procambarus alleni</i>	Blue crayfish	650-750
			<i>Procambarus clarkia</i>	Snow White Crayfish	900-1100
			<i>Cambarellus patzcuarensis</i>	Mexican Dwarf Orange Crayfish	500-650
Amphibian	Urodela	Ambystomatidae	<i>Ambystoma mexicanum</i>	Mexican walking fish	650-800
Crab	Decapoda	Paguridae	<i>Pagurus bernhardus</i>	Hermit Crab	1600-1800
Coral, mushroom and polyps	Alcyonacea	Alcyoniidae	<i>Simularia notanda</i>	Finger leather coral	4500-6500
	Corallimorpharia	Discosomaidae	<i>Actinodiscus cardinalis</i>	Red mushroom	5000-5500
	Zoantharia	Zoanthidae	<i>Protopalmytha mutuki</i>	Green button polyps	2500-6000
Aquarium plant	Alismatales	Araceae	<i>Anubias afzelii</i>	Anubias Afzelii	300-350 (PB)
			<i>Anubias barteri</i> var. <i>glabra</i>	Water aspidistra	300-350 (PB)
			<i>Anubias hastifolia</i>	Anubias hastifolia	350 (PB)
			<i>Anubias heterophylla</i>	Congo anubias	300-350 (PB)
			<i>Cryptocoryne balansae</i>	Balansae plant	250 (PP)
			<i>Cryptocoryne parva</i>	Dwarf crypt plant	250 (PP)
			<i>Cryptocoryne undulates</i>	Cryptocoryne undutalus	250 (PP)
			<i>Cryptocoryne wendtii</i>	Water trumpet	250 (PP)
		Alismataceae	<i>Echinodorus tenellus</i>	Mud babies	200 (PB)
		Hydrocharitaceae	<i>Blyxa japonica</i>	Bamboo plant	200 (PB)
	Brassicales	Brassicaceae	<i>Cardamine lyrata</i>	Japanese cress	200 (PB)
	Caryophyllales	Amaranthaceae	<i>Alternanthera reineckii</i>	Roseafolia	200 (PB)
	Cladophorales	Pithophoraceae	<i>Aegagropila linnaei</i>	Moss ball	200 (PB)
	Hypnales	Hypnaceae	<i>Vesicularia montagnei</i>	Christmas moss	250 (PB)
			<i>Taxiphyllum Barbieri</i>	Java moss	200 (PB)
			<i>Echinodorus bleheri</i>	Broadleaf Amazon Sword	200 (PB)
	Lamiales	Plantaginaceae	<i>Bacopa caroliniana</i>	Blue water hyssop	200 (PB)
			<i>Linnophila aquatic</i>	Giant ambulia	200 (PB)
			<i>Bacopa myriophylloides</i>	Water hyssop	200 (PB)
		Acanthaceae	<i>Hygrophila difformis</i>	Water wisteria	200 (PB)
			<i>Hygrophila polysperma</i>	Indian swamp weed	250 (PP)
			<i>Hygrophila pinnatifida</i>	Miramar weed	200 (PB)
			<i>Hygrophila corymbosa</i>	Giant hygo	250-300 (PP)
		Lamiaceae	<i>Pogostemon helferi</i>	Downoi	200 (PB)
			<i>Pogostemon erectus</i>	Erectus plant	250 (PP)
		Phrymaceae	<i>Glossostigma elatinooides</i>	Glosso	250 (PP)
		Scrophulariaceae	<i>Hemianthus callitrichoides</i>	Cuba	200 (PB)
	Myrtales	Onagraceae	<i>Ludwigia ovalis</i>	Oval ludwigia	200 (PB)
			<i>Ludwigia palustris</i>	Marsh seed box	200 (PB)
			<i>Ludwigia peruensis</i>	Red Star Ludwigia	200 (PB)
			<i>Ludwigia repens</i>	Creeping primrose- willow	200 (PB)
			<i>Ludwigia arcuata</i>	Piedmont primrose- willow	200 (PB)
		Lythraceae	<i>Rotala indica</i>	Indian tooth cup	250 (PB)
			<i>Rotala wallichii</i>	Red wallichii plant	200 (PB)
			<i>Rotala macrandra</i>	Giant red rotnala	200 (PB)
	Marchantiales	Ricciaceae	<i>Riccia fluitans</i>	Floating crystalwort	200 (PB)
	Nymphaeales	Nymphaeaceae	<i>Nymphaea zenkeri</i>	Tiger lotus red	250 (PB)
	Poales	Poaceae	<i>Corynephorus canescens</i>	Hair grass	250 (PB)
		Mayacaceae	<i>Mayaca fluviatillis</i>	Bog moss	200 (PB)
	Polypodiales	Polypodiaceae	<i>Microsorium pteropus</i>	Fern	200 (PB)
	Scrophulariales	Scrophulariaceae	<i>Micranthemum umbrosum</i>	Shade mud flower	250 (PP)
	Saxifragales	Haloragaceae	<i>Myriophyllum aquaticum</i>	Parrot feather watermilfoil	200 (PB)

**Table 2:** Number of recorded Non-piscine species varieties, species, vertebrates, and invertebrates of the present study

Non-piscine species	Number of species	Number of species	Number of Vertebrates species	Number of Invertebrates species
Amphibian	1	1	1	-
Turtle	2	2	2	-
Snail	6	6	-	6
Shrimp	8	5	-	5
Crayfish	3	3	-	3
Crab	1	1	-	1
Coral, mushroom, and polyps	3	3	-	3
<b>Total</b>	<b>24</b>	<b>21</b>	<b>3</b>	<b>18</b>

## CONCLUSION

The findings are clearly indicated that the numbers of species as well species of non-piscine ornamental aquarium organisms are highly increased rapidly. It is concluded that the non-piscine ornamental aquarium keeping practice (hobby and business) is becoming a potential sector in Bangladesh.

## ACKNOWLEDGMENT

We would like to express special thanks of gratitude to all the vendors and those who are connected with this sector for cooperating with us. We also want to acknowledge the researchers of the Department of Fisheries, the University of Rajshahi for their great suggestions throughout the investigation.

## REFERENCE

- Balaji K., Thirumaran G., Arumugam R., Kumaraguruvasagam K.P., and Anantharaman P. 2009. Aquarium Keeping and Maintenance of Marine Ornamental Invertebrates. In: Advances in aquatic ecology, Daya Publishing House, Tri Nagar, Delhi, India, 3.
- Bhat K.V. 2008. DNA Fingerprinting and cultivar identification. In: Parsad, R., Gupta V. K., Bhar L. M. and Bhatia V.K. (Eds.), Advances in Data Analytical Techniques. New Delhi: IASRI., pp. 101- 09.
- Calado R., Lin J., Rhyne A.L., Araujo R. and Narciso L. 2003. Marine ornamental decapods popular, pricey and poorly studied, *J. of Crustacean Biol.*, 23(4): 963-973.

- Daily G.C., Alexander S., Ehrlich P.R., Goulder L. and Lubchenco J. 1997. Ecosystem services: benefits supplied to human societies by natural ecosystems, *Issues in Ecology.*, 2: 2-16.
- Cohen F.P.A., Valenti W.C. and Calado R. 2013. Traceability issues in the trade of marine ornamental species, *Rev. Fish. Sci.*, 21:98-111.
- Fasset N. C. 1955. Echinodorus in the American tropics, *Rhodora.*, 57, 133-156, 174-188, 202-212.
- Jayachandran K.V. 2001. Palaemonid prawns Biodiversity, Taxonomy, Biology and Management. 1<sup>st</sup> (Eds). Science publishers, inc. Enfield (NH) USA., pp: 228.
- Kasselmann C. 2003. Aquarium Plants. Trans. by Ulf Kotlenga and André S.J. van Proosdig. Malabar, FL: Krieger Publishing Company.
- Mostafizur M.R., Rahman S.M., Khairul M.I., Rakibul H.M.I. and Nazmul M.A. 2009. Aquarium business: A case study in Khulna district, Bangladesh, *Bangladesh Research Publication J.*, 2(3): 564-570.
- Padilla D. K. and Williams S. L. 2004. Beyond ballast water: aquarium and ornamental trades as sources of invasive species in aquatic ecosystems, *Frontiers in Ecology and the Environment*, 2, 131-138.
- Paulay G. 1997. Diversity and distribution of reef organisms In Birkeland, C. (ed.), Life and death of coral reefs. New York: Chapman and Hall, pp. 298-353
- Simkatis H. 1958. Salt-water fishes for the home aquarium. Edition I. J. B. Lippincott Company, New York., pp: 254.
- Turkmen G. and Karadal O. 2012. The Survey of the Imported Freshwater Decapod Species via the Ornamental Aquarium Trade in Turkey, *J. of Animal and Veterinary Advances*, 11: 2824-2827.