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Marine aquarium trade in India: Challenges and opportunities for conservation and policy

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ABSTRACT

The collection of marine taxa for the aquarium trade continues to demand live animals be extracted from reefs, but in doing so, offers economic benefits for local communities. To improve our understanding of the status of marine aquariumtrade in India, information on harvested species and their volume was gathered at the major collection hubs (Tuticorin, Kilakarai and Mandapam) in the Gulf of Mannar region, and compared to the export data. During one year, 87 species of fish (51% belonging to the family Pomacentridae) and 21 species of invertebrates were harvested for the trade. The conservation status of exploited species revealed that nearly 50% (n=43) have not been assessed for their extinction risk by the IUCN, while of the 44 species assessed, 41 were Least Concern (LC), and one each was in the Data Deficient (DD), Near Threatened (NT) and Endangered (EN) categories. While many fish were collected, only a few were exported from India. The sea anemones were the major export as they were of a higher value in the international markets, largely attributed to their color patterns. Price discrepancies within the trade value of marine fishes and invertebrates used for the aquarium trade indicated that price increased approximately 200% at each transition in the value chain (collectors to wholesalers, wholesalers to retailers). Management strategies and conservation plans for India's marine ornamental taxa subjected to exploitation are provided so as to ensure long-term sustainability of the coral reef ecosystems, as well as the livelihood that are dependent on them.

1. Introduction

The marine aquarium trade has developed into a vibrant multi-million dollar industry offering livelihood prospects to people who depend on the coral reef ecosystems [1,2], but ensuring sustainability in this sector has always been contentious in view of its trade-off with biodiversity conservation [3]. 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 [4,5]. Rhyne et al. [6] estimated that around 3002 marine ornamental species (2278 fishes and 724 invertebrates) involved in the trade were imported into the US between the years 2008–2011 (see www.aquariumtradedata.org). 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, molluscs and echinoderms are increasing as a result of the growing interest in keeping mini-reef aquaria [7–9]. Previous studies on marine aquarium trade have focused on the role of Brazil, the Caribbean islands, European Union, Kenya and the United States [2,3,5,10–21], and comparatively very little is known regarding the exploitation and trade in continental Asia [22–25].

In India, a highly biodiverse nation, aquarium fish trade is gaining popularity and becoming an important facet of the fisheries sector. The exploitation and trade of wild-caught freshwater ornamental fishes while contributing to the national economy, has been considered as a major conservation challenge in the biodiversity rich regions of the

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country [26–28]. Although, nearly 400 species of marine ornamental fishes belonging to 175 genera and 50 families are known to occur in India's marine ecosystems [29], very little is known regarding their exploitation and trade. For example, India did not appear on the list of countries that export marine aquarium fish to the US [5].

The Gulf of Mannar Marine Biosphere Reserve (henceforth GOMMBR), on the south-east coast of India is the only coral reef region within the country that can meet the demand for marine ornamental taxa [30]. The collection of marine taxa for the aquarium trade is nevertheless an addition to the increasing anthropogenic stressors, including, but not limited to destructive fishing and near-shore trawling that has already threatened the coral reefs and associated fisheries of this region [31]. Even though, the entry into the GOMMBR islands is restricted to local fishers, collection of various marine taxa continues unabated. Such exploitation is illegal, and continuous exploitation may cause ecological imbalance given there are no laws in effect to protect the coral reef fishes that are harvested for the aquarium trade [32]. In this context, the present study investigated the status of exploitation of marine ornamental taxa from the GOMMBR for the aquarium trade and evaluated the role it plays in supporting local livelihoods. The species-wise harvest volumes were assessed over an entire year (July 2014 to June 2015), determined the conservation status/extinction risk of exploited species and calculated the value of living coral reef organisms along the value chain. The harvest volumes to those being exported were calculated. Finally, in order to improve the overall sustainability of the trade, several conservation and policy options were recommended.

2. Materials and methods

2.1. Study area

The Gulf of Mannar (78°5′ and 79°30′E & 8°45′N and 9°25′N)in the Bay of Bengal (south east coast of India) extending from Rameswaram to Tuticorin (140 km long; 25 km wide; total area of 560 km^2) encompasses a group of almost 21 islands (1. Shingle, 2. Krusasai, 3. Pullivasal, 4. Poomarichan, 5. Manoliputti, 6. Manoli, 7. Hare, 8. Mulli, 9. Valai, 10. Thalaiyari, 11. Appa, 12. Poovarasanpatti, 13. Valimunai, 14. Anaipar, 15. Nallathanni, 16. Puluvinichalli, 17. Upputhanni, 18. Kariyachalli, 19. Vilanguchalli, 20. Koswari, 21. Vaan) that are running parallel to the coastline (Fig. 1). The Gulf of Mannar is exceptionally rich in marine biodiversity [33] and was recognized as the first marine biosphere reserve in South Asia [34].

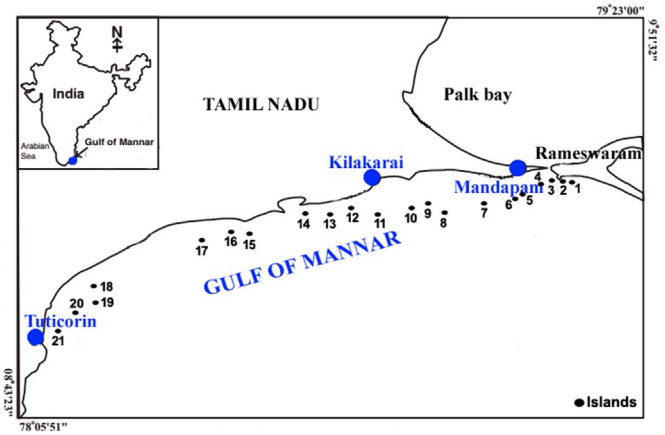

Fig. 1. Map showing the Gulf of Mannar region (21 islands that are running parallel to the coast) and the major hubs for collection of ornamental taxa (Tuticorin, Kilakarai and Mandapam).
Modified from Sundararaju et al. [74].

2.2. Data collection (Field)

Three important towns, viz., Mandapam, Kilakarai and Tuticorin are recognized as major collection hubs for the marine aquarium trade in the GOMMBR, from where the local fishers sell to the wholesalers (Fig. 1). A total of eight major wholesalers were identified i.e. three in Mandapam, four in Tuticorin and one in Kilakarai. A list of species (all marine taxa except gastropods) harvested in GOMMBR was obtained from the wholesalers on a daily basis for a year during July 2014 to June 2015. Initially the common names of the taxa were noted, and subsequently verified with species names available in standard literature [35]. For fishes, FishBase [36] as well as locally relevant species checklists and field guides were used [37,38]. Standard and regionally relevant identification manuals were consulted for invertebrates such as sea anemones, sea stars, worms, nudibranch and shrimps [39–41] and for scleractinian corals [42,43].

2.3. Data collection (export data)

The daily export data of live aquatic animals maintained by TIPS Software Service Private Limited, a company that maintains an Exim (Export-Import) database including foreign trade statistics (see www.dailyexportimportdata.com) were used, and followed the same methodology as adopted by Raghavan et al. [27] for their study on the trade in wild-caught freshwater aquarium fishes. For the present study, the marine ornamental taxa (at species level) that are exported from the Indian airports were sorted out and their value in US$ was calculated based on currency rates available on www.xe.com.

2.4. Market discrepancies

Marine aquarium trade is known to improve livelihoods of coastal communities who are entirely dependent on the collection and supply of coral reef ecosystem-associated taxa [1,44,45]. However, the market/trade values of various species is known to vary significantly during the different phases of the supply chain, as it has to pass through critical stages of quarantine, maintenance, handling and shipping before reaching the hobbyists [1]. Even though the collectors use different methods, the price per individual fish sold by the collectors is known to be constant throughout the study area (P. Sanjeevi, Pers. Observ.). In order to understand the market discrepancy of fishes and invertebrates traded from GOMMBR, and collected the price details of all species involved in the trade, and categorized the costs of each species into landing price (price paid by wholesalers to the collectors), wholesale price (price paid by retailers to the whole salers) and retail price (price paid by hobbyists to the retailers). To understand the benefit for local fishers, wholesalers and retailers, the wholesale price was divided by the landing price, and retail price was divided by the wholesale price, and the profit percentage between them calculated and expressed as:

Eg. Wholesaler cost increase (%) = wholesale cost / landing price x 100.

Retailer cost increase (%) = retail cost / wholesale cost x 100.

2.5. Conservation status and extinction risk

Information on the conservation status/extinction risk of all species included in the study was retrieved from the IUCN's Red List of Threatened Species™ (www.iucnredlist.org), the underlying assessments for which are based on the IUCN Red List Categories and Criteria (Version 3.1) [46].

2.6. Species protected by National legislation

The Indian Wildlife (Protection) Act (WLPA) of 1972 (and amended up to 2011) forms the legal framework for conservation of India's flora