

Management of the aquarium fishery in the Republic of the Maldives

M. Saleem¹, F. Islam¹

1) Marine Research Centre, Male', Republic of Maldives

Abstract. The marine aquarium trade of Maldives started around 1979 when most of the exports were sent to Sri Lanka. As the fishery matured, Europe became the major destination as the earnings related to quantity shipped increased. In 2007, there were seven registered companies, trading approximately 140 species of fish and 5 species of invertebrates. The contribution of the marine aquarium trade to the total value of marine exports is 0.55% and worth US\$590,530 in 2007. The Maldives is a popular destination for snorkelers and divers and the collection of aquarium could impact dive tourism. Presently, a species based quota system is in effect that is derived from export data from the Maldives Customs Services, knowledge of the abundance of each species and knowledge of its tolerance to captivity. Random checks of the fish exports are scheduled for implementation following the introduction of a fish guide software. There are no specifically designated areas for collection of aquarium fish and the collection moved from one area to another as stocks declined. This pattern of resource use may act as indirect time area closures and aid in the replenishment of fish stocks. The last aquarium fish stock assessment survey was performed this year.

Key words: Economic value, ornamental fish trade, MPA

Introduction

The marine aquarium trade of Maldives is believed to have started around 1979 (Adam 1996). During the early years most exports were to Sri Lanka (Edwards and Shepherd 1992), and over the years the fishery has expanded, Europe becoming the major destination. In 2007, there were 7 registered companies, trading a total of about 140 species of fish and 5 species of invertebrates. Export of corals is banned in the Maldives and thus the trade does not include coral species. The only exception to this ban is the export of organ pipe coral (*Tubipora musica*), a species which is not traded in the aquarium fishery but nonetheless exported for pharmaceutical purposes, mainly to India.

Only a few species in the aquarium trade are directly exploited for other purposes, and aquarium species are probably the highest value-added product that is collected from coral reefs (Wabnitz et al. 2003). In 2007, 358,378 fish and invertebrates were exported from the Maldives, earning a total of Rf 7,529,266 (US\$590,530) and making up 0.55% of total value of marine exports. Although the numbers of fish taken are relatively small, there is a potential for conflict of interest between the fishery and tourism, the major source of foreign exchange earnings. Tourism in the Maldives is essentially marine based and therefore heavily dependent on the rich diversity of this environment. The species that are collected by the aquarium trade are also an important attraction for

tourists who visit the Maldives. As collection of fish is allowed on many of the tourist dive sites, there is the possibility of the two activities occurring simultaneously, thus increasing the conflict. Until recently, a few minor bait species were collected for the aquarium trade. Live baitfish is required by the pole and line tuna fishery, the primary fishery of Maldives. Juveniles of some species of edible reef fish such as *Variola louti* (Lunar tailed grouper) and *Cephalopholis miniata* (Vermillion rock cod) which are eaten locally or targets of the live food fish trade are also collected by the aquarium fishery. However, the quantity exported through this trade is insignificant compared to the amount landed at the fish market or exported as live food fish. For example, 23 juveniles of *C. miniata* and none of *V. louti* were exported in the aquarium trade between May and September of 2003. During the same period, 11,888 individuals of *C. miniata* and 12,992 of *V. louti* were exported in the live food fish trade (MRC unpublished data, 2003).

Due to such matters, along with concern of potential ecological and environmental impacts arising from the fishery, the Government of Maldives has closely monitored the trade since its inception (Adam 1996). In 1988, a blanket quota of 100,000 was set for maximum total number of exports of all species of fishes by Maldives Customs Services in consultation with the Marine Research Section (currently named Marine Research Centre) (Edwards 1988). While such

a quota system is simple and could be easily enforced, it could also lead to overexploitation of sought after species even when total exports are below the blanket-quota level, especially since about 20 species makes up about 70% of the trade (Edwards and Shepherd 1992). Thus, a provisional species based quota system was adopted for 22 species (Edwards and Shepherd 1992) but adherence and enforcement was lacking. More recently a species-based quota system for the majority of the species traded has been implemented. This has strengthened monitoring of the trade and aided management of the fishery.

Material and Methods

The data for this report was obtained from export information collected by Maldives Customs Services (MCS). The quantity of fish exported and the revenue derived each year is compiled by MCS. The trend in exported quantity and value of exports was obtained using the MCS information. The species data was compiled from 286 proforma sheets filled out by the exporters. This data set was not complete but gave quite a clear representation of the total exports.

Interviews were carried out with managerial staff of the two major exporting companies to investigate the processes involved in the trade, management issues and to identify difficulties with data collection. Information on the process of fish and invertebrate collection was gathered during a field visit to the aquarium of the largest exporting company, Sub Tropical Exotic Paragon (STEP) in 2000 and subsequently in 2004 and 2008. Fish collectors and staff of the aquarium were interviewed during these visits.

Status of the Trade

Over the years, the fishery fluctuated with Europe becoming the major destination (Figure 1). In 2007, there were seven licensed companies in the aquarium trade. However, 54% of the exports were by one company, earning 66% of the total revenue. Approximately 90 people are employed in the trade of which only a small number are expatriates working in the managerial and administrative positions. This is in contrast to the mid-90s when majority of the work force were Sri Lankans working essentially as divers (Adam 1996). This transformation was probably due to enforcement of Clause 14 of the Fisheries Law (Law No. 5/87) which states that only Maldivians have the right to carry out fishing activities in the fishing grounds most commonly used by Maldivian fishermen, which represents an area within 75 miles of the outer atoll rim. This was triggered as a consequence of the increasing use of moxy nets, a destructive method of fishing which was introduced to the fishery by the Sri Lankan divers (Adam 1996).

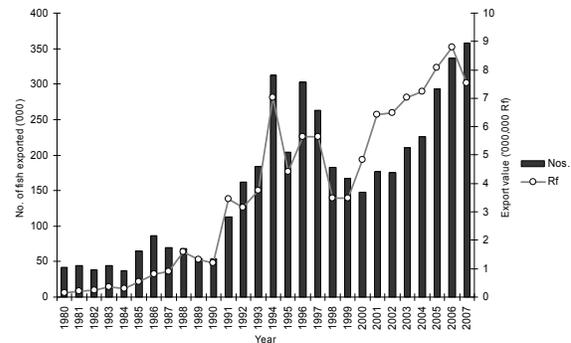


Figure 1: Trends in the export of aquarium fish from 1980 – 2007 showing the number of individuals exported and revenue earned. Source: ERSS/MoFAMR and MCS.

Species Based Quotas

The species-based quota system that is in effect at present was based on MCS export data and on general information of species such as rarity in the natural environment, as well as tolerance of species to captivity. Such a selective quota system is difficult to establish, as information on population characteristics such as abundance and boundaries of habitats in collection areas and species densities is required to understand maximum sustainable yields, and to identify those species that are susceptible to overexploitation.

There are three categories adopted in this system. Category A includes 17 individual species that are banned from export. Category B includes 66 species that are subject to an export quota. Category A includes species that do not survive well in captivity such as *Chaetodon meyeri*, *C. trifasciatus* and *C. triangulum* (Wood 1985) and those that are locally rare like the Armitage's angelfish (*Apoemichthys armitagei*). In addition to Category A listed species, it is an offence to export any species of parrot fishes, puffer fishes, porcupine fishes, eels or giant clams. Category B include species from families Pomacanthidae, Ehippidae, Ostraciidae, several Chaetodontidae and Pomacentridae, Cirrihidae, Monacanthidae, Serranidae, several Labridae, Balistidae, Plesiopidae and Scorpaenidae. Category C which consist of 71 species that can be freely exported up to a maximum total number of 300,000 individuals. There is also a ban on exporting any species utilized as live bait in the pole and line tuna fishery. In compliance with this regulation, the most traded species globally, *Chromis viridis* (Blue-green damselfish) (Wabnitz et al. 2003), is not exported from Maldives.

The current system appears to be quite effective, although there are still some difficulties in monitoring the trade. The system was administered through the use of proforma aquarium fish export forms as

recommended by Edwards and Shepherd (1992). The form lists species' scientific and common names that are commonly exported in the trade. It also allocates a code name to each species and the exporters fill out one proforma sheet per consignment. The problem with this system lies in effectively monitoring the quotas as there are different agencies involved in the process. While the Marine Research Centre (MRC) sets the quotas, Ministry of Economic Development and Trade (MTI) issues export licenses and MCS collects the proforma sheets filled out by the exporting companies. MCS compiles data summaries such as quantity of fish and revenue from each consignment as well as the destination and dates.

Copies of these sheets are forwarded to MRC where the species data is compiled. Thus clarity of responsibilities with regards to monitoring quota balances is lacking. As a result, every year a few species in Category B are exported in excess of the quotas set for these species. Although infrequent, a few individuals in Category A are also exported occasionally.

Another problem is the use of a wide variety of common names to identify the different species. It is not clear how reliable the data collected from the proforma export forms is. One of the exporting companies reported that they were not very familiar with the species names and therefore were not very confident when filling out the proforma sheets.

Nonetheless, in the absence of species catch and effort data, the species based quota system provides reliable estimates of the trade including numbers of fish exported, revenue derived from the trade, destinations, species data and unit prices.

Licensing scheme

The mandate to regulate the export trade lies within the Ministry of Economic Development and Trade (MEDT). They are responsible for issuing export licenses to the aquarium fish exporting companies and this license is based on the export value, which is determined by the exporter. The minimum value is Rf 100 (Rf12.75 =US\$1.00) and there is no upper limit for the maximum value. There is a 0.1% tax on the value of the exported fishes. The quota for Category B species is determined by MRC for the year and is divided up, and a part is given out under the license. The license is valid until the last day of the year it was issued. As the license is based on the value of the exports, once the license value is reached, it has to be renewed even though some export quota is remaining under that particular license. If a species has been exported up to the quota issued with the license, the quota is renewed provided that the overall yearly quota set for that species by MRC is still remaining.

A major problem with a value based licensing

system can be under quoting of prices of fish by exporting companies in an attempt to maximize the number of fish exported per license. This would have consequences on the assessments of the annual revenue from the fishery as well as average unit prices. Thus the present system of licensing should be eliminated and a quota based system put in its place. For this to be achieved, all species traded in the industry need to be given a yearly quota including those in Category C.

Collection areas

Aquarium fish collection can be carried out on any reef except resort house reefs and the 25 protected dive sites which were established in 1995 and 1999. In the beginning, collection areas were concentrated around Male' due to the dependence of the trade on an international airport, with direct flights to Europe and other destinations (Edwards and Shepherd 1992). With the establishment of regional airports in the northern and southern atolls and the introduction of faster boats, collection has spread to other atolls including Baa in the north, Male and Vaavu atolls in the central region and Gaafu Alifu and Gaafu Dhaalu in the south (Fig. 2).

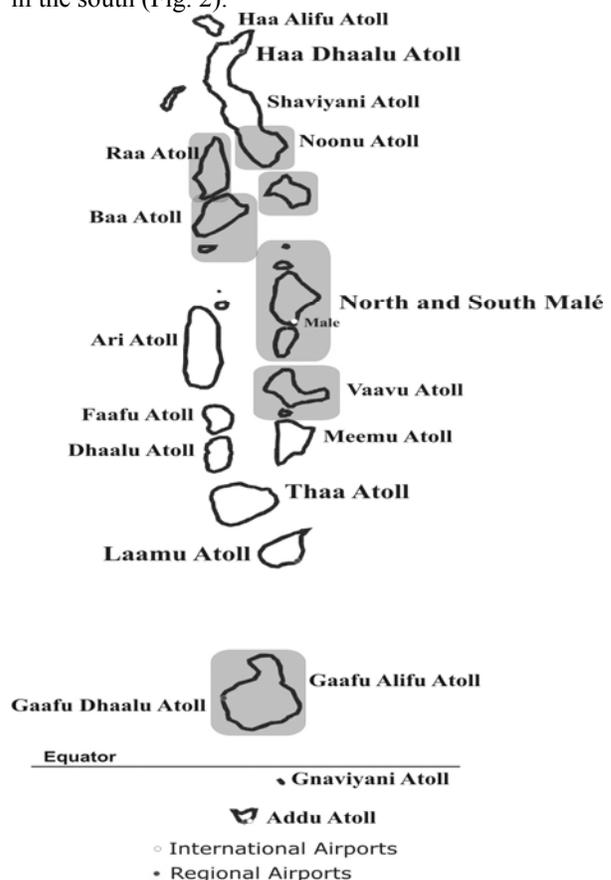


Figure 2: Map of the Maldives showing areas of collection 2008 (shaded areas)

The collected fish are brought by domestic planes and speed boats to the holding facilities in Male' atoll and conditioned before sending them abroad. A maximum of 50 l of fuel is used per day on the boat to get to collection sites and return to base. This suggests that collection is carried out in an estimated area that can be reached within a 1 hr boat ride.

There have been changes in collection areas over time. In 2000, collection was carried out in Haa Dhaalu, Male', Laamu and Thaa atolls while the collection areas were in Baa, Male' and Vaavu atolls in 2004. More recently collection occurs in Noonu, Raa, Baa, Lhaviyani, Male', Vaavu and Gaafu Alif and Gaafu Dhaalu atolls. This pattern of resource use may act as temporary area closures and aid in the replenishment of fish stocks.

At present there are no designated areas for collection of aquarium specimens. From a scientific point of view it is very important to have designated areas for collecting aquarium fish. Edwards and Shepherd (1988) recommends a fishing area of 20% and the remaining 80% closed to fishing, thus acting as marine reserves. Such a system would ensure that a recruiting stock is available to replenish the fished areas, minimizing overexploitation (Palumbi 2003) and extinction of sought after species. In the past few decades, marine reserves have been advocated as a tool to replenish overexploited stocks of species targeted by food fisheries (Russ and Alcala 1996, MacClanahan and Mangi 2000). A study carried out in Hawaii on aquarium fish collection and marine reserves found that aquarium fish increased in newly established Fishery Replenishment Areas (FRAs) while there was a significant decrease in those areas open to collection (Tissot et al. 2002). These two sets of sites were compared to control sites for evaluation of effectiveness of FRAs in management of the aquarium fishery.

Awareness initiatives

A guide to fish identification was prepared by MRC in 1996 to aid those involved in the fishery, including Customs officials, fish collectors and managerial staff. More recently an online fish guide has been developed to aid with fish identification and strengthen monitoring. It is hoped that better informed people will yield more accurate data filled out by the exporters. In addition to the guide, workshops are being held for exporters and MCS officials involved in the trade to increase awareness of the fishery and to provide information on strengthening data collection and monitoring. Workshops introducing the fish guide are being planned for this year and the first of the series was held in September 2008 for the MCS officials. Similar workshops will be held for the

exporter and the staff of the Ministry of Economic Development and Trade later in the year.

Licensing and data analysis

An important component of monitoring and regulating the trade is to carry out regular reviews of the data, to assess trends and to assess whether existing levels of exploitation are sustainable. An example is the case of the poison goby and the long nose filefish. Disappearance of these species was not detected until a review was done in 2000, two years after the bleaching event. This could have been avoided if the species data are regularly analysed.

At present, quotas are given out to the exporters by MEDT. The exporters are required to present the relevant license with each consignment. MCS keeps tally of the numbers of each species exported to ensure that fish are not exported beyond the quotas given under that particular license. However, in 2002, eight species in Category B were exported beyond their respective quotas. This can be avoided through frequent analysis of species data from the proforma sheets, which would show if the export numbers are approaching quotas set for the year. MRC could play a larger role in monitoring quotas using data from the proforma sheets. However, the data transfer process between MRC, MEDT and MCS needs to be strengthened to make sure that all information is available to MRC in a timely manner in order to carry out the analysis.

Resource Assessment Survey

A resource assessment survey of selected species in the B Category of the quota list was carried out in June 2008. Impact and control sites were selected in Baa Atoll, North and South Male' Atolls and Vaavu Atoll. Timed swims were employed to estimate abundances of fish species while reef resilience techniques were used to assess the status of the habitat and the benthic environment. Results of the survey are expected to be available in August 2008. This survey was carried out to re-assess the quotas allocated for the different species. As the present quotas were based on information from only Male' atoll and since collection has spread to the outer atolls, it was felt that quotas for some species could be adjusted depending on their resource status.

Recommendations

The following recommendations are based on our observations and analysis:

- Establish designated areas for collection of fish for the aquarium trade
- Increase consistency of names used by exporters, collectors, clients and the government agencies

- Introduce daily log books to obtain information on collection areas, hours spent on collection, mortality of fish
- Develop a code of conduct for fish collectors
- Develop criteria or acceptable standards for holding facilities
- Develop criteria for providing certification to exporters from the government
- Carry out a stock assessment of the species exported in the aquarium trade
- Strengthen monitoring of the exports and regulation of the trade through increasing transparency of responsibilities of the different agencies involved in the trade
- Set quotas for all species traded including those in Category C
- Substitute the present system of value based licensing with quota based licenses.

Acknowledgement

Marine Research Centre of the Ministry of Fisheries, Agriculture and Marine Resources supported this research. The Atoll Ecosystem Conservation (AEC) Project funded my travel and accommodation expenses to the IICRS. A very big thanks to Shahaama Abdul Sattar, Dr. Mohamed Shiham Adam and all at MRC who helped out in the study. A special thanks to the export staff at Maldives Customs Services, the staff of Statistics section at MoFAMR and Ahmed Fazeeh of Subtropical Exotic Paragon for their cooperation and for all the

information provided for this study. Last but not least, I express my gratitude to Dr. Norman Quinn who encouraged me to publish this paper and helped me with review, layout and formatting.

References

- Adam MS (1996) The aquarium fishery of the Maldives. in Nickerson DJ, Maniku MH (eds) Workshop on integrated reef resources management in the Maldives. Bay of Bengal Program, Madras, India, pp 93-115
- Edwards AJ (1988) Preliminary report on the aquarium fish export trade in the Republic of Maldives. Report to Marine Research Section, Ministry of Fisheries, Republic of Maldives, pp 21
- Edwards AJ, Shepherd AD (1992) Environmental implications of aquarium fish collection in the Maldives, with proposals for regulation. *Environmental Conservation* 19(1):61-72
- Grutter A, Murphy JM, Choat JH (2003) Cleaner fish drives local fish diversity on coral reefs. *Current Biology* 13:64-67
- Kuiter RH (1998) *Fishes of Maldives*. Atoll Editions. Victoria, Australia
- McClanahan TR, Mangi S (2000) Spillover of Exploitable Fishes from a Marine Park and its Effects on the Adjacent Fishery. *Ecological Applications* 10(6):1792-1805
- Palumbi SR (2003) Marine Reserves: A Tool for Ecosystem Management and Conservation. PEW Ocean Commission
- Russ GR, Alcala AC (1996) Do marine reserves export adult fish biomass? Evidence from Apo Island, central Philippines. *Marine Ecology Progress Series* 132:1-9
- Tissot BN, Walsh W, Hallacher LE (2002) The effectiveness of marine protected areas and the impacts of aquarium fish collecting in Hawai'i: Final Report Year 2001. Hawaii Coral Reef Initiative, Honolulu, HI and NOAA, Silver Springs, MD, pp 24
- Wabnitz C, Taylor M, Green E, Razak T (2003) From Ocean to Aquarium. UNEP-WCMC, Cambridge, UK pp 64