



REPUBLIC OF MOZAMBIQUE
MINISTRY FOR COORDINATION OF ENVIRONMENTAL AFFAIRS
Centro de Desenvolvimento Sustentável para as Zonas Costeiras

Report on the Status and Trends of Rare Marine
Fisheries Species in Mozambique

Reef Associated Aquarium Fish, Seahorse and the Humphead Wrasse

CDS Zonas Costeiras
EAME Project 9F01000

By: Marcos A M Pereira
Associação para Investigação Costeira e Marinha



Xai-Xai, December 2008

Report on the Status and Trends of Rare Marine Fisheries Species in Mozambique

Reef Associated Aquarium Fish, Seahorse and the Humphead Wrasse

CDS Zonas Costeiras
EAME Project 9F01000

Prepared by:
Marcos A M Pereira, MSc.
Associação para Investigação Costeira e Marinha, Maputo.

Suggested Citation:

Pereira, M. A. M. (2008). Report on the Status and Trends of Rare Marine Fisheries Species in Mozambique: Reef Associated Aquarium Fish, Seahorse and the Humphead Wrasse. 15 pp. CDS Zonas Costeiras/MICOA.

This report constitutes AICM's Unpublished Report N° 7.

Xai-Xai, December 2008

© 2008 MICOA (CDS Zonas Costeiras) and Associação para Investigação Costeira e Marinha. All Rights Reserved

Acronyms

AICM – Association for Coastal and Marine Research

CDS-ZC - Center for Sustainable development of Coastal Zones

CITES – Convention for the International Trade of Endangered Species

DINAP – National Directorate for Fisheries Administration

DINATEF – National Directorate for land and Forests

IIP – National Institute for Fisheries Research

MICOA – Ministry for the Co-ordination of Environmental Affairs

SCUBA – Self-sustained underwater breathing apparatus

Table of Contents

Acronyms	ii
0.0. Executive Summary	iv
1.0. Introduction	01
2.0. Reef-associated Aquarium Fish	02
3.0. Seahorses (<i>Hippocampus</i> spp.)	06
4.0. Humphead Wrasse (<i>Cheilinus undulatus</i>)	08
5.0. Conclusion and Recommendations	10
6.0. Acknowledgements	10
7.0. References	11

0.0. Executive Summary

Comparatively to other common, high commercially valued edible fish species, rare fisheries species such as seahorses (*Hippocampus* spp.), the humphead wrasse (*Cheilinus undulatus*) or ornamental fishes are poorly studied, under ill-defined management and protection schemes in Mozambique. This report, presents the results of a literature evaluation of the status of these species in Mozambique. It was commissioned by the Center for Sustainable Development of Coastal Zonas (MICOA) and had the following objectives:

- i) To describe the rare fisheries species including aquarium fish, seahorses, humphead wrasse in Mozambique;
- ii) To describe the status, distribution, legal protection cover and uses including commercialisation of those species.

Data was collected through searches of both grey and peer-reviewed literature. Additionally, requests for information were sent to relevant governmental agencies and tourism operators along the coast.

The diversity of the country's reef-associated fish fauna is high (+900 species) and so is the number of species potentially important for the ornamental trade (ca. 500). Currently, no large-scale exploitation is underway and only small-scale experimental activities are being carried out. A handful number of individuals and restaurants keep reef-associated fishes in small-sized tanks (<1000 l).

About 30 species of pipefishes and seahorses have been identified in Mozambique, but only two seahorse species (*H. borboniensis* and *H. camelopardalis*) have been confirmed to occur in the country and two other (*H. fuscus* and *H. histrix*) are suspected to occur and await confirmation. Seahorses are distributed throughout the country in very low numbers at any particular location. A decline is apparent from certain locations but this needs to be quantitatively verified. Seahorses are typically sold as souvenirs but export of dried specimens to the medicinal Asian market may also occur.

The humphead wrasse is distributed from Inhambane northwards and occurs in very low numbers in the southern part of the country. In the northern part this species is relatively more common. Very few published information information is available in the literature about this species.

None of the species discussed is currently under any form of legal protection in the country, despite the fact that both seahorses and the humphead wrasse were included, in 2004, in Appendix II of the CITES convention. Urgent population assessments are needed for these species, especially seahorses and the humphead wrasse, including their distribution, threats and conservations status. A rigours control and monitoring should be enforced on the reef-associated aquarium fish experimental fishery, in order to provide the much sough-after information to feed into management and conservation of these resources.

1.0. Introduction

Throughout the ca. 2770 km of coastline, Mozambique possesses a great number of marine and coastal biological resources that are of vital importance to almost half of the country's population. Finfish constitutes the major source of animal protein for these communities. For example, the subsistence and artisanal sub-sectors contribute to as much as 70% of the total annual catches (Palha de Sousa, 1996).

While there is a relative bulk of information published on the most common, high commercially valued edible fish species in the country, rare fisheries species such as seahorses (*Hippocampus* spp.), the humphead wrasse (*Cheilinus undulatus*) or ornamental fishes are poorly studied, under ill-defined management and protection schemes. Among these, ornamental fishes have probably received the most attention in Mozambique (e.g. Brichard, 1980; Eichler, 1981; Rodrigues & Motta, 1998; Motta, 2000; Whittington *et al.*, 2000). Live fish for the aquarium trade used to be exported in relatively small amounts from Cabo Delgado and Inhambane up until 1999, when a 2-year moratorium was established by the Ministry of Agriculture and Fisheries due to complaints by tourism operators from Inhambane. These were directed towards the methods and general operation of collection and trade by a company (Monfic, Lda.) operating in the area (Rodrigues & Motta, 1998; Motta, 2000; Whittington *et al.*, 2000).

This report, presents the results of a literature evaluation of the status of these species in Mozambique. It was commissioned by the Center for Sustainable Development of Coastal Zonas (MICOA) and had the following objectives:

- iii) To describe the rare fisheries species including aquarium fish, seahorses, humphead wrasse in Mozambique;
- iv) To describe the status, distribution, legal protection cover and uses including commercialisation of those species.

Data was collected through searches of both grey and peer-reviewed literature. These were not very successful, especially at providing information

at local level. Additionally, requests for information were sent to relevant governmental agencies (i.e. National Directorate for Fisheries Administration and the National Institute for Fisheries Research both at the Ministry of Fisheries, and the National Directorate for Land and Forests at the Ministry for Agriculture and Rural Development – CITES focal point in Mozambique). A short questionnaire (Annex 1) was produced and sent to various tourism operators along the coast. A total of nine questionnaires were filled and returned. Interviews were also conducted with several relevant individuals with experience in the subject.

2.0. Reef-Associated Aquarium Fish

A total of 942 species of reef-associated fishes have been identified in Mozambique, of which, about 500 are potentially important for the aquarium trade (Pereira, 2000; Tupper *et al.*, 2008). The most important families include Pomacentridae (damselfishes), Pomacanthidae (angelfishes), Chaetodontidae (butterflyfishes), Serranidae (rockcods and sea goldies), Labridae (wrasses) among other families.

These species occur throughout the country, concurrently with the distribution of true coral reefs (in the northern part of the country) and subtidal rocky reefs, colonised by coral colonies in the south (Schleyer *et al.*, 1999; Rodrigues *et al.*, 2000; Figure 1) and constitute one of the main attractions for the recreational SCUBA diving community (Pereira & Schleyer, 2005). Other species occurring on seagrass beds (e.g. apogonids) have also potential as a commercially-valuable aquarium species.

Currently, two restaurants in Maputo display aquarium reef-associated fishes in glass tanks of ca. 800 litres (Figure 2). A total of 14 species were observed (Annex 2), with one housing seven species and the other eight with a total of about 10 specimens each. Interviews were conducted to the managers/owners of the restaurants.

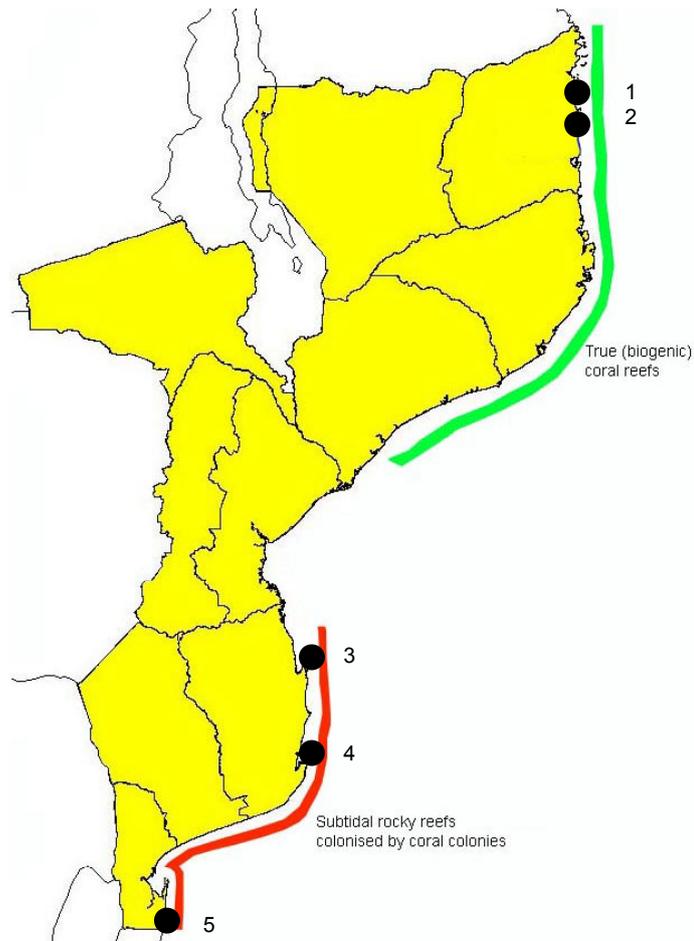


Figure 1. Distribution of coral reefs in Mozambique (adapted from Rodrigues *et al.*, 2000). Red line represent subtidal rocky reef colonized to a varying degree by coral colonies, while green line represent true (biogenic) coral reefs. Dots represent locations where questionnaires were received from. From north to south: (1) Vamizi island and Quilalia; (2) Pemba; (3) Bazaruto Archipelago/Cabo de São Sebastião; (4) Tofo and Paidane; and (5) Ponta do Ouro.



Figure 2. Reef fishes displayed at a restaurant aquarium in Maputo (Photo: Dalila Narane).

The source of these fish was not disclosed and the people interviewed were somehow evasive and not very willing to discuss the issue. The specimens were acquired locally, probably through individual collectors of wild specimens, or through Aquariana, Lda. This, according to the licensing authority (the National Directorate of Fisheries Administration), is the only licensed company to trade aquarium reef fish as part of an experimental project aimed at obtaining further information. A total of 55 specimens, from 18 species (Table 1), were reportedly caught and traded in 2008 by this company. The company does not collect the fish *per se*. According to one employee interviewed, the fish are purchased to fishermen at Inhaca island, and only live by-catch from the beach seine net is kept and traded.

This probably explains the fact that a large number of species in reduced number of individuals was traded and also the fact that no stock is kept by the company. While the terms of the license were not disclosed to the authors, the experimental process does not seem to be closely monitored by the authorities. The number of fish collected and traded is very small and there are problems with fish identification (Table 1), which warrant a closer attention from the authorities.

From the questionnaires filled and returned from tourism operators along the coast, it seems that this activity is restricted to the one already discussed. There are no reports of individuals collecting and/or selling reef-associated aquarium fish from Ponta do Ouro, Tofo, Paindane, Cabo de São Sebastião, Pemba, Quilalia or Vamizi. While some individuals in Maputo, keep marine fish in aquariums at their homes, this practice does not seem to be widespread as maintenance costs and difficulties of maintaining a saltwater fish tank are high.

The collection, trade and export of the ornamental fish industry was unregulated until 1999 when a two-year moratorium by the Ministry of Agriculture and Fisheries was introduced and later reinforced by a Ministerial Decree (of 23 April 2002) which, prohibits the collection of reef and

ornamental fish in Mozambican waters. Additionally, the acquisition, transport, manipulation, processing, storage, export and trade are also prohibited.

Table 1. List of species collected during 2008 by Aquariana, Lda. at Inhaca Island, as part of an experimental fishery (data from the National Directorate for Fisheries Administration).

Family	Species	N° collected	Observation
Chaetodontidae	<i>Chaetodon auriga</i>	5	
	<i>Chaetodon vagabundus</i>	4	
	<i>Heniochus acuminatus</i>	3	
Pomacentridae	<i>Chrisiptera kuiteri</i>	2	Misidentification. Reported species range is restricted to Sri Lanka and Indonesia. Possibly <i>C. annulata</i> .
	<i>Chromis elerae</i>	4	Misidentification. Reported species range is restricted to the Indo-west Pacific. Possibly juvenile <i>Dascyllus trimaculatus</i> .
	<i>Neopomacentrus azysron</i>	7	Misidentification. Species not yet reported to occur in Mozambique. Possibly <i>N. cyanomos</i> .
Haemulidae	<i>Plecthorinchus lineatus</i>	2	
Labridae	<i>Halichoeres blocellatus</i>	6	Misidentification. Species not reported to occur in Mozambique.
	<i>Halichoeres margaritaceus</i>	2	Misidentification. Not a valid species name.
	<i>Stethojulis bandanensis</i>	2	Misidentification. Species not reported to occur in Mozambique nor the Western Indian Ocean region. Possibly <i>S. strigiventer</i> .
	<i>Thalassoma lunare</i>	1	
Holocentridae	<i>Holocentrus hastatus</i>	7	Misidentification. The reported species range is restricted to the western Atlantic. Possibly <i>Myripristis mudjan</i> .
	<i>Myripristis leiognathus</i>	2	Misidentification. The reported species range is restricted to the eastern Pacific. Possibly <i>Myripristis mudjan</i> .
Diodontidae	<i>Chilomycterus schoepfi</i>	1	Misidentification. Reported species range restricted to the western Atlantic.
Apogonidae	<i>Apogon limenus</i>	6	Misidentification. The reported species range is restricted to the southwest Pacific. Possibly <i>A. taeniophorus</i> .
Muraenidae	<i>Echidna nebulosa</i>	1	
Acanthuridae	<i>Acanthurus triostegus</i>	3	
Scaridae	<i>Scarus ventula</i>	2	Misidentification. The reported species range is restricted to the Western central Atlantic. Possibly <i>S. scaber</i> .

3.0. Seahorses (*Hippocampus* spp.)

Seahorses (genus *Hippocampus*) are grouped with pipefishes, pipehorses and seadragons as members of the family Syngnathidae. They are of the same order [Syngnathiformes, cf. Smith & Heemstra (1991), Tupper *et al.* (2008), although some authors included these species in the order Gasterosteiformes – Lourie *et al.* (2004)] as cornetfishes, pegasids (sea moths), snipefishes, sticklebacks and trumpetfishes. Worldwide, 33 species of seahorses are recognised (Lourie *et al.*, 2004). While a complete description of the biology of the seahorses is beyond the scope of this report, a brief summary is provided, based on information obtained from Lourie *et al.* (2004). Seahorses occupy both temperate and tropical coastal waters, with a distribution from about 50° N to 50° S. They may usually be found among corals, macroalgae, mangrove roots and seagrasses, but some live on open sandy or muddy bottoms. Certain species may be found in estuaries or lagoons. Seahorses tend to be patchily distributed at low densities. They are particularly susceptible to habitat degradation from human activities. Most seahorse species studied exhibit high site-fidelity and small home range sizes, at least during the breeding season.

The female deposits eggs into the male's brood pouch, where he fertilizes them, protects them, nourishes them, and regulates their environment. Pregnancy lasts about nine to 30 days, depending on the species, the length increasing with latitude and decreasing water temperature. Males of all species studied go through more than one pregnancy in a breeding season. Males release about 100 –300 young per pregnancy, but brood size can range from as few as five, for the small species *Hippocampus zosterae*, to approximately 2000 young by one *H. ingens* male. Brood size increases with male height across species. Young seahorses look like miniature adult seahorses, are fully independent after birth, and receive no further parental care.

About 30 species of pipefishes and seahorses have been identified in Mozambique (Annex 3), but according to Lourie *et al.* (2004), only two

seahorse species (*H. borboniensis* and *H. camelopardalis*) have been confirmed to occur in Mozambique and two other (*H. fuscus* and *H. hirtix*) are suspected to occur and await confirmation.

Seahorses are distributed throughout the country (Table 2). Almeida *et al.* (1999), found *H. camelopardalis* and *H. hirtix* in very low numbers at Inhaca island, having classified them as an occasional species. In addition to their patchy occurrence and low density, cryptic behavior and excellent camouflage result in very few sightings. The problematic taxonomy of this group also hinders correct species identification. Seahorses are also usually included in the “others” categories during fisheries assessments.

Table 2. Distribution of seahorses (*Hippocampus* spp.) along the Mozambican coastline, as reported in the literature. The validity of the nomenclature should, however, be checked (Lourie *et al.*, 2004).

Location	Species	Source
Quirimbas archipelago	<i>Hippocampus hirtix</i>	Gell & Whittington (2002)
Bazaruto archipelago	<i>H. camelopardalis</i>	Dutton & Zolho (1990)
Morrumbene estuary	<i>H. camelopardalis</i> , <i>H. kuda</i> , <i>H. novaehollandiae</i>	Day (1974)
Inhaca Island	<i>H. camelopardalis</i> , <i>H. hirtix</i> , <i>H. kuda</i> , <i>H. whitei</i>	Smith & Heemstra, (1991); Kalk (1995); Almeida <i>et al.</i> (1999)

According to reports from tourism operators, seahorses are not commonly observed in anyone area (except in the Pomene estuary and mangroves at Praia da Barra – Inhambane Bay). One operator from Pemba, reported seeing seahorses as much as five times in 15 years. At Ponta do Ouro, one operator reported seeing on average, one seahorse every two months. Most observations were made while diving, and one operator reported that a seahorse was found entangled in a plastic fishing net at Ponta do Ouro.

Exception made to the study by Almeida *et al.* (1999), no quantitative studies have been conducted on seahorses in Mozambique. At certain locations, e.g. Inhaca Island a decline is apparent from the absence of dried seahorses being sold as souvenirs (N. Raba, pers. com.; A. Macia, pers. com.; pers. obs.; Figure 3). Besides being used as souvenirs, seahorses are traded internationally especially to supply the Asian medicinal market (China being the largest importer with about 20 tons of dried seahorses yearly; Vincent,

1996). While no information is available for Mozambique, which have been known to export dried seahorses (Vincent, 1996; Wilson & Vincent, 1998), a study conducted by McPherson & Vincent (2004) in East Africa, found that both Kenya and Tanzania exported considerable quantities of dried seahorses to the Asian market (between 0.6 – 2.3 ton / year). There are no reasons to believe Mozambique's case would be any different.



Figure 3. Seahorse from Inhaca island, sold as souvenirs by local women (Photo: Marcos A M Pereira).

Apart from being assigned to the Appendix II (restricted trade) of the CITES convention since May 2004 (Lourie *et al.*, 2004), which Mozambique has been a party since 1981, seahorses are not formally protected by the Mozambican legislation.

4.0. Humphead Wrasse (*Cheilinus undulatus*)

Also known as Napoleon wrasse or Maori wrasse, the humphead wrasse is the largest member of the family Labridae attaining 190 kg and +2 m (Sluka, 2000a-c; Choat *et al.*, 2006; Sadovy, 2006; Sadovy *et al.*, 2003; 2007). The species is a protogynous hermaphrodite (i.e. adults can change sex from female to male), has a low productivity and occurs in naturally low densities in reef-associated areas throughout its geographical range in the Indo-Pacific

(Sadovy *et al.*, 2003; 2007). Recorded maximum adult densities rarely exceed 10 fish/10,000 m² and are at least 10-fold less in areas affected by fishing. The species is one of the most vulnerable to the impacts of fishing in reef fish assemblages. Substantial declines in local abundance have been observed in many locations within the species' range due to several factors, but most prominently because of trade-driven overfishing (Sadovy *et al.*, 2003; 2007). The humphead wrasse has a high value in the live reef food fish markets, with recent average retail prices of live fish in the Hong Kong market reaching 60 USD/kg (Sadovy *et al.*, 2003).

According to the literature and reports from tourism operators, the humphead wrasse is distributed from Inhambane northwards and occurs in very low numbers in the southern limit of its distribution, while reports from Cabo Delgado, were unanimous that this species is relatively more common in this area (Table 3). Apart from the single observation by Maggs *et al.* (2007), no recent published information is available on the peer-reviewed literature about this species, although Smith & Heemstra (1991) reported that the species occurs in the Indo-Pacific, south to Inhaca island.

Table 3. Distribution of the humphead wrasse (*Cheilinus undulatus*) along the Mozambican coast.

Location	Size (cm)	Common?	Source
Vamizi island, Cabo Delgado	+ 80	Yes	Silva, I. M. (pers. com)
Quilalia island, Cabo Delgado	+ 80	Yes	Joubert, B. (pers. com)
Quirimbas archipelago	?	?	Whittington <i>et al.</i> (1998)
Pemba, Cabo Delgado	+ 80	Yes (5 fish together)	Jacobs, P. (pers. com)
12 mile reef, Bazaruto		No (1 fish)	Maggs <i>et al.</i> (2007)
Paindane/Jangamo, Inhambane	40-60	No (< 4)	Bell, A. (pers. com.)

The humphead wrasse is a major attraction for the diving industry and although, it is a highly desired commercial species elsewhere (Sadovy *et al.*, 2003, 2007), its apparent rareness in Mozambique, may imply it is not an important fishery species, although artisanal and subsistence fishermen will consume and also sell it (as reported for Vamizi island; Silva, I. M. pers. com.).

The lack of quantitative information and distribution records in Mozambique prevents any assessment of the status of this species and such a study is reckoned urgent. As is the case of seahorses, the humphead wrasse is currently not protected in Mozambique, although it has been listed in Appendix II of the CITES convention since October 2004 (Sadovy *et al.*, 2007).

5.0. Conclusion and Recommendations

The present report constitutes a preliminary attempt to compile information on the uses, trends and legal status of three largely ignored group of marine fishes: reef-associated aquarium fishes, seahorses (*Hippocampus* spp.) and the humphead wrasse (*Cheilinus undulatus*). There is a general lack of published information and studies in the country, which prevent further analysis of the trends, uses and conservation status of the concerned species. None of the species discussed is currently under any form of legal protection in the country, despite the fact that both seahorses and the humphead wrasse were included, in 2004, in Appendix II of the CITES convention, and there are apparent signs of decline of their populations.

Urgent population assessments are needed for these species, especially seahorses and the humphead wrasse, including their distribution, threats and conservations status. A rigours control and monitoring should be enforced on the reef-associated aquarium fish experimental fishery, in order to provide the much sough-after information to feed into management and conservation of these resources.

6.0. Acknowledgements

A large group of people responded to the questionnaire and contributed with information. In this regard the following are especially thanked: Andrew Bell, Christine Read, Stuart Mather-Pike, Simon Pierce, Andrea Marshal, Isabel Marques da Silva, Pieter Jacobs, Angie Gullan, Brendon Joubert and Marcus Trerup. Eduardo Videira is thanked for discussions and comments to the report.

7.0. References

- Almeida, A. J., L. Saldanha & E. André (1999). Fishes of the seagrass beds of the Inhaca Island (Mozambique): community structure dynamics. *Arquivos do Museu Bocage*, **3**: 265-286.
- Brichard, P. J. (1980). Report to the government of Mozambique on the organization of the ornamental fish trade. Rome, FAO. 57 pp.
- Choat, J. H., C. R. Davies, J. L. Ackerman & B. D. Mapstone (2006). Age structure and growth in a large teleost, *Cheilinus undulatus*, with a review of size distribution in labrid fishes. *Marine Ecology Progress Series*, **318**: 237-246.
- Day, J. H. (1974). The ecology of Morrumbene estuary, Moçambique. *Transactions of the Royal Society of South Africa*, **41**: 43-97.
- Dutton, T. P. & R. Zolho (1990). Conservation master plan for sustainable development of the Bazaruto Archipelago, Republic of Moçambique. 75 pp. WWF/SANF Report.
- Eichler, J. W. (1981). Feasibility of exporting ornamental fish from Mozambique and particularly reactivating their export from lake Nyasa. Rome, FAO. 64 pp.
- Gell, F. R. & M. W. Whittington (2002). Diversity of fishes in seagrass beds in the Quirimba Archipelago, northern Mozambique. *Marine and Freshwater Research*, **53**: 115-121.
- Kalk, M. (ed) (1995). The natural history of Inhaca Island, Moçambique. 3rd edition. Johannesburg, Witwatersrand University Press. 395 pp.
- Lourie, S. A., S. J. Foster, E. W. T. Cooper & A. C. J. Vincent (2004). A guide to the identification of seahorses. Washington, D.C., University of British Columbia/WWF. 114 pp.
- Maggs, J. Q., M. H. Schleyer & E. Videira (2007). Ichthyofauna of the Bazaruto Archipelago: A preliminary study. *ORI Unpublished Report* **245**. Durban, SAAMBR. 13 pp.
- McPherson, J. M. & A. C. J. Vincent (2004). Assessing East African trade in seahorse species as a basis for conservation under international controls. *Aquatic Conservation: Marine and Freshwater Ecosystems*, **14**: 521-538.
- Motta, H. (2000). Ornamental fish and coral trade in Mozambique. Presented at the workshop "Policy Options for the Sustainable Use of Coral Reefs and Associated Coastal Ecosystems". Mombassa, 19-22 June 2000. Kenyan Marine Fisheries Research Institute.
- Palha de Sousa, L. (1996). O estado actual de conhecimento dos recursos pesqueiros de Moçambique - Perspectivas para o futuro. In: Proceedings of the Workshop "O Papel da Investigação na Gestão da Zona Costeira", 24-25 April 1996 Maputo. 50-58 pp. UEM.
- Pereira, M. A. M. (2000). Preliminary checklist of reef-associated fishes of Mozambique. 21 pp. Maputo, MICOA.
- Pereira, M. A. M. & M. H. Schleyer (2005). A diver and diving survey in southern Mozambique. In: Souter, D. & O. Lindén (eds). Coral reef degradation in the Indian Ocean: status report 2005. 184-192 pp. Kalmar, CORDIO.
- Rodrigues, M. J. & H. Motta (1998). A problemática da exploração dos peixes ornamentais. Internal report. Maputo, Unidade de Gestão Costeira – MICOA. 4 pp.
- Rodrigues, M. J., H. Motta, M. W. Whittington & M. Schleyer (2000). Coral reefs of Mozambique. In: McClanahan, T. R., C. Sheppard & D. Obura (eds). Coral reefs of the Indian Ocean: their ecology and conservation, 111-133 pp. New York, Oxford University Press.
- Sadovy, Y. (2006). Napoleon fish (Humphead wrasse), *Cheilinus undulatus*, trade in southern China and underwater visual census survey in southern Indonesia. Gland, IUCN. 25 pp.
- Sadovy, Y., M. Kulbicki, P. Labrosse, Y. Letourneur, P. Lokani & T. J. Donaldson (2003). The humphead wrasse, *Cheilinus undulatus*: synopsis of a threatened and poorly known giant coral reef fish. *Reviews in Fish Biology and Fisheries*, **13**: 327-364.
- Sadovy, Y., A. E. Punt, W. Cheung, M. Vasconcellos, S. Suharti & B. D. Mapstone (2007). Stock assessment approach for the Napoleon fish, *Cheilinus undulatus*, in Indonesia. A tool for quotasetting for data-poor fisheries under CITES Appendix II Non-Detriment Finding requirements. FAO Fisheries Circular, N^o 1023. Rome, FAO. 71pp.
- Schleyer, M. H., D. Obura, H. Motta & M. J. Rodrigues (1999). A preliminary assessment of coral bleaching in Mozambique. Unpublished Report N^o 168. Durban, SAAMBR. 16 pp.

- Sluka, R. D. (2000a). Grouper and Napoleon wrasse ecology in Laamu atoll, Republic of Maldives: Part 1. Habitat, behavior, and movement patterns. *Atoll Research Bulletin*, **491**: 1-26.
- Sluka, R. D. (2000b). Grouper and Napoleon wrasse ecology in Laamu atoll, Republic of Maldives: Part 2. Timing, location, and characteristics of spawning aggregations. *Atoll Research Bulletin*, **492**: 1-15.
- Sluka, R. D. (2000c). Grouper and Napoleon wrasse ecology in Laamu atoll, Republic of Maldives: Part 3. Fishing effects and management of the live fish-food trade. *Atoll Research Bulletin*, **493**: 1-18.
- Smith, M. M. & Heemstra (eds.) (1991). *Smith's sea fishes*. Johannesburg, Southern Book Publishers.
- Tupper, M., A. Tewfik, M. K. Tan, S. L. Tan, L. H. Teh, M. J. Radius, S. Abdullah (2008). ReefBase: A Global Information System on Coral Reefs [Online]. Available from: <http://www.fishbase.org> [data de acesso: 30 Outubro 2008].
- Vincent, A. C. J. (1996). *The international trade in seahorses*. Cambridge, TRAFFIC International. 163 pp.
- Whittington, M. W., C. M. António, M. S. Heasman, M. Myers & D. Stanwell-Smith (1998). *Marine Biological and Resource Use Surveys of the Quirimba Arquipelago, Mozambique. Technical Report 6: Results Summary and Management Recommendations*. 49 pp. Maputo, SEE/MICOA.
- Whittington, M., M. A. M. Pereira, M. Gonçalves & A. Costa (2000). *An investigation of the ornamental fish trade in Mozambique. Phase I: Information macrodiagnostic and project appraisal*. 33 pp. A Report for the Coastal Management Unit – MICOA, Maputo.
- Wilson, M. J. & A. C. J. Vincent (1998). Preliminary success in closing the life cycle of exploited seahorse species, *Hippocampus* spp., in captivity. *Aquarium Sciences and Conservation*, **2**: 179-196.

Annex 1. Questionnaire used to collect data from tourism operators and other relevant individuals along the Mozambican coastline.



Associação para Investigação Costeira e Marinha

MOZAMBIQUE RARE FISH SPECIES SURVEY

QUESTIONNAIRE

The present questionnaire was designed to help AICM assess the status and trends of rare fish species in Mozambique, as part of a project commissioned by the Centre for Sustainable Development of Coastal Zones (MICOA). Please respond to the best of your ability and add further information if necessary. No personal information will be disclosed and is only being collected for clarification purposes. For further information please contact:

Marcos A M Pereira, MSc.

General Director

Associação para Investigação Costeira e Marinha (AICM)

Email: aicm001@gmail.com; marcospereira@gmx.net

Cell: 823996200

Maputo, Mozambique

Thank you.

1. GENERAL DATA

- a. Your Name:
- b. Institution/Lodge/Dive School:
- c. Email:
- d. Cellphone number:
- e. Geographic area you are familiar with:
- f. Your main activity (fishing/diving/etc.):

2. HUMPHEAD (NAPOLEON) WRASSE

- a. Have you ever seen a humphead (Napolean) wrasse in your area? Yes ___ No ___
- b. Where:
Underwater, while diving ___ Caught while fishing ___ Fishermen catches ___ Market ___
- c. Are humphead wrasses common in your area? Yes ___ No ___
- d. What is the average size of humphead wrasses in your area: <40 cm ___ 40-80 cm ___ >80 cm ___
- f. Have you noticed any change in the number of humphead wrasses in the last 5 years?
- g. Any other information on this species you want to share (e.g. prices, etc.)?

3. SEAHORSES

- a. Have you ever seen seahorses in your area? Yes ___ No ___
- b. Where:
Underwater, while diving ___ Fishermen catches ___ Market/curio shop ___
- c. Are seahorses common in your area? Yes ___ No ___
- d. Have you noticed any change in the number of seahorses in your area in the last 5 years?
- e. Any other information on this species you want to share (e.g. prices, etc.)?

4. AQUARIUM REEF FISH

- a. Are you aware of anyone collecting/keeping/selling aquarium reef fish in your area?
- b. If yes, which species?
- c. Does this collection/keeping/selling constitute a problem in your area?

Any other information you want to share on the above?

Do you wish to remain anonymous or we may acknowledge your contribution in the report?

Do you wish to receive the final report arising from this survey?

Many Thanks!

Annex 2. Checklist of aquarium fish species displayed at restaurants in Maputo

Family Chaetodontidae

Heniochus acuminatus

Family Ehippidae

Tripterodon orbis

Family Gobiidae

Youngeichthys nebulosus

Family Haemulidae

Plectorhinchus flavomaculatus

Family Lutjanidae

Lutjanus fulviflamma

Lutjanus kasmira

Family Monodactylidae

Monodactylus argenteus

Family Muraenidae

Echidna nebulosa

Family Pomacentridae

Amphiprion allardi

Dascyllus trimaculatus

Family Scorpaenidae

Pterois miles

Pterois volitans

Family Serranidae

Epinephelus malabaricus

Family Sparidae

Acanthopagrus berda

Annex 3. List of species of the Syngnathidae family (seahorses and pipefishes) recorded in Mozambique (from Pereira, 2000; Tupper *et al.*, 2008).

Latin name	Common name
<i>Acentronura gracilissima</i>	Bastard seahorse
<i>Acentronura tentaculata</i>	
<i>Campichthys nanus</i>	
<i>Choeroichthys sculptus</i>	Sculptured pipefish
<i>Choeroichthys smithi</i>	
<i>Corythoichthys flavofasciatus</i>	Network pipefish
<i>Corythoichthys haematopterus</i>	Messmate pipefish
<i>Corythoichthys schultzi</i>	Schultz's pipefish
<i>Cosmocampus darrosanus</i>	D'Arros pipefish
<i>Doryrhamphus bicarinatus</i>	Narrowstripe pipefish
<i>Doryrhamphus excisus excisus</i>	Bluestripe pipefish
<i>Festucalex erythraeus</i>	
<i>Halicampus matafaae</i>	Samoan pipefish
<i>Halicampus zavorensis</i>	Zavora pipefish
<i>Hippichthys cyanospilos</i>	Blue-spotted pipefish
<i>Hippichthys spicifer</i>	Bellybarred pipefish
<i>Hippocampus borboniensis</i>	Réunion seahorse
<i>Hippocampus camelopardalis</i>	Giraffe seahorse
<i>Hippocampus hystrix</i> *	Thorny seahorse
<i>Hippocampus kuda</i> *	Spotted seahorse
<i>Micrognathus andersonii</i>	Shortnose pipefish
<i>Micrognathus brevis</i>	
<i>Microphis brachyurus millepunctatus</i>	Shorttail pipefish
<i>Nannocampus elegans</i>	Elegant pipefish
<i>Nannocampus pictus</i>	Reef pipefish
<i>Phoxocampus belcheri</i>	Rock pipefish
<i>Siokunichthys breviceps</i>	
<i>Syngnathoides biaculeatus</i>	Alligator pipefish
<i>Syngnathus acus</i>	Greater pipefish
<i>Trachyrhamphus bicoarctatus</i>	Double-ended pipefish

* pending confirmation.