

In the WIO, there are numerous invertebrate fisheries that an MPA may have to consider. Two of the commonest and most valuable are octopus and sea cucumber. Both of these are artisanal fisheries, both are poorly documented, and both are being over-exploited. This sheet provides some suggestions as to how MPAs might assist in their sustainable management.

Artisanal fishing for octopus and sea cucumbers is an important economic and subsistence activity throughout the WIO. Both are fished from intertidal reef flats and subtidal reefs during low water spring tides. With the arrival of marine product processors and foreign buyers in recent years, fishing intensity for both groups has risen markedly, placing greater pressure on these resources.

OCTOPUS

Octopuses have been collected for centuries in the WIO and are a favoured food item. *Octopus cyanea* is the main target species and usually comprises 99% of the catch. Octopuses are collected either by walking over the lower reaches of the intertidal reef flat or by snorkelling along the reef edge. There is little information on the WIO fishery but an estimated 600 tonnes are taken each year in Tanzania.

Octopuses grow extremely fast, increasing in weight by as much as 200g in only ten days, and thus potentially supporting a highly productive fishery. This is only possible if it is well managed, which requires a good understanding of the life-history. When females are ready to spawn, which happens only once in their lifetime, they barricade their den. Following spawning, they attach the eggs to the den roof, clean and aerate them for about 30 days, and then die. The 'brooding' is essential for successful hatching, and so a reduction of fishing pressure during this season is highly recommended. Furthermore, as females normally brood at their largest size, fishing of large individuals could reduce recruitment and eventually stock size. In heavily fished areas both size and weight of octopus is often low, and reproductive output may already be affected.

A licensing scheme, agreed jointly by octopus fishers and relevant government departments, would help to provide the information on catch and effort that is needed for management. It would also permit regulation of fishing effort by restricting numbers of licences. Maximum size limits should also be considered, although this might be difficult to implement as the value of octopus increases with weight.

SEA CUCUMBER

About 80 species of sea cucumber occur in shallow waters of the Indian Ocean. They have been collected since the 1940s in the WIO, when commercial collection started in Madagascar. While not consumed in the region, at least 24 species are dried and exported to South-East Asia where they are considered a delicacy, the main ones being: *Thelenota ananas*, *Stichopus hermanni*, *S. chloronotus*, *Holothuria scabra*, *H. atra*, *H. nobilis*, *H. fuscogilva*, and *Bohadrschia sp.*. Dried sea cucumber is known as 'trepang'

or 'bêche-de-mer'. As sea cucumbers are sessile and defenceless (apart from sticky threads some species exude) they are hand collected on the intertidal reef flat when walking, and in deeper water either by snorkelling or using SCUBA.

Due to their ease of collection, these important detritivores are prone to localised overfishing yet the effects of their removal are not fully understood. Size limits may be appropriate for some species of sea cucumber, and the potential for listing sea cucumbers under CITES is being discussed. Few countries have regulations for the fishery, but in the Great Barrier Reef Marine Park, sea cucumbers are managed as one of several 'harvest fisheries' which means that a permit is needed, numbers issued are restricted, and certain areas are closed to fishing.



Octopus being sun-dried on Rodrigues Island.

M. Richmond

POTENTIAL MANAGEMENT ACTIONS

Monitoring programmes for sea cucumber and octopus fisheries should be established where possible, with catch and effort data collected for at least one spring tide per month, although a quarterly time scale may be adequate. Local data collection teams could be used, if trained and supervised. A regional training course on identification would probably be necessary as sea cucumber taxonomy is complex. Data should be analysed at least annually to provide regular assessments of the fishery and to determine the management actions needed.

O. cyanea has been shown to brood year round but with seasonal peaks (June-August in Tanzania) in spawning activity. During such peaks it would be beneficial to either stop fishing or reduce fishing intensity in the main brooding zone (sub-tidal areas). Further research may find similar spawning peaks in sea cucumbers' reproductive cycles, and seasonal closures could similarly be recommended.

Fishing could also be restricted to a maximum of six days over the spring tide with no fishing allowed during neap tides. This would ensure a minimum number of no-fishing days during which octopus and sea cucumbers could recover. Rotational fishing regimes with a different area exploited each day during the spring tide would also help to maintain a healthy size range and stock size. In Mafia Island Marine Park, Tanzania, octopus fishing is already prohibited during neap tides and there is a maximum size limit of 500g.

KEY POINTS FOR THE MPA

- ❑ **Initiate a monitoring programme for sea cucumbers and octopus (the ReefCheck protocol includes sea cucumbers as an indicator species – see sheet G3).**
- ❑ **Include the issue of over-exploitation of sea cucumbers and octopus in awareness raising materials produced by the MPA.**
- ❑ **Support research on sea cucumbers and octopus, especially where this will contribute to understanding the role that MPAs might play in their conservation and management.**
- ❑ **Where exploitation is allowed within an MPA, consider limiting it to spring tides and/or introducing seasonal closures and rotational fishing regimes.**

Sources of further information

Boyle, P.R., & Rodhouse, P.G., (in press). *Cephalopods*. Iowa State University Press, 1st edition, 352pp.

Bruckner, A.W., Johnson, K.A. & Field, J.D. 2003. Conservation strategies for sea cucumbers: Can a CITES Appendix II listing promote sustainable international trade? *SPC Bêche-de-mer Info. Bull.* **18**.

Conand C, 1999. *Manuel de qualité des holothuries commerciales du Sud-Ouest de l’Océan Indien*. PRE/COI: 39pp.

Conand, C. 2001. Overview of sea cucumbers fisheries over the last decade - what possibilities for a durable management? In: Barker (ed.) *Echinoderm 2000*, Swets & Zeitlinger: p. 339-344.

Guard, M. & Mgaya, Y.M. 2000. The artisanal fishery for *Octopus cyanea* Gray (1949) in Tanzania. *Ambio* **31** (7-8): 528-536.

Lovatelli, A. et al. (eds.) In press. *Advances in sea cucumber aquaculture and management*. FAO, Rome.

Marshall, N., Milledge, S.A.H. & Afonso, P.S. (eds.) 2001. *Stormy Seas for Marine Invertebrates: trade in sea cucumbers, sea shells and lobsters in Kenya, Tanzania and Mozambique*. TRAFFIC East/Southern Africa, Nairobi, Kenya.

Norman, M.D. 2000. *Cephalopods: A World Guide*. Conchbooks, Germany.

Samyn, Y. 2000. Conservation of aspidochirotid holothurians in the littoral waters of Kenya. *SPC Bêche-de-mer Info. Bull.* **13**: 12-17.

South Pacific Commission *Bêche-de-mer Information Bulletins* 1-19. Noumea New Caledonia. (English and French) www.spc.int/coastfish/

Great Barrier Reef Marine Park Authority www.gbrmpa.gov.au – information on sea cucumber fishery regulations.

CASE STUDY

Using an MPA to help manage invertebrate fisheries in Madagascar

Nosy Atafana Marine Park, in north-east Madagascar, is part of the UNESCO Biosphere Reserve of Mananara-Nord. The Marine Park is small (10 sq km), but covers three islands and their surrounding reefs. The area is important for artisanal fishing and reef fish, but also for a number of invertebrates including octopus, sea cucumbers, lobsters, and bait. All these activities were unregulated prior to gazettment of the Marine Park.

The Marine Park was established through an agreement between the Mananara Biosphere programme and the local community. It has a central core zone where no activities are allowed and a buffer zone where fishing is regulated. The agreement stipulates that the Marine Park is open to fishing on three days of the week only, that fishing is restricted to fishers from four adjacent villages, and that fishing for lobsters and sea cucumbers is prohibited throughout the area. Two park rangers patrol the Park on days when fishing is permitted to check that fishing gear and catches are in compliance with the regulations that are part of the joint agreement. Contravention of regulations is punished with a ban on fishing in the Park for two weeks to three months, depending on the nature of the offence. The catches are monitored from landings at the fishing villages.

Octopus is an important resource for many of the fishermen, and for some it is their sole source of income. They are collected on foot with a harpoon, and there were concerns that this was resulting in damage to live coral on the reef flat. With the reduction in the number of days that the area is fished, it is thought that some recovery of the reef flat is occurring, and that there has been an increase in reef fish catches. In addition, the Mananara Biosphere Programme is running trials with bamboo octopus traps with a view to introducing these as a less destructive fishing method.

Grandcourt, E., Andrianarivo, C., Rene de Roland, L. and Rajaonarison, R. *Status and Management of the Marine Protected Areas in Madagascar*. Report to Eastern African Component of ICRAN – International Coral Reef Action Network.



Thelenota ananas, one of more than 20 species of sea cucumber collected in the WIO.

M. Richmond