

## Resource assessment of the holothurian populations in the Seychelles

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### Background

The holothurian fishery in the Seychelles has seen a rapid development during the past seven to eight years due to the high demand for beche-de-mer on the international market, and higher prices offered (Aumeeruddy and Payet 2004b). This has turned a previously unimportant and unregulated fishery into one where fishers have increased their fishing efforts. By 1999 the fishery was showing signs of population depletion, including lower volumes of high value species, fishers having to travel farther to collect sea cucumbers, and concerns raised regarding the sustainability of the fishery.

The Seychelles Fishing Authority (SFA), the national body responsible for fisheries management, started regulating the fishery in 1999 by the introduction of a licensing system for sea cucumber fishers and processors. Because there was no baseline data on the fishery, a precautionary approach was adopted: the number of licenses was limited to 25 fishing vessels, and each vessel was limited to four divers. One of the conditions of the licenses is that the licensees must furnish fisheries-related data (catch, effort) to the management authority on a monthly basis.

The SFA was asked to undertake a resource assessment of the holothurian population that would be used in the preparation of a management plan for the fishery. Funding was secured for that exercise in late 2003 through a Technical Cooperation Project of the FAO. Initial studies started in December 2003, and several surveys were completed in 2004. The project is expected to be completed by mid-2005. Details of the objectives of the project can be found in the last edition of the Beche-de-Mer Bulletin (Aumeeruddy and Payet 2004a).

### Methodology

Due to the Seychelles' extensive EEZ (1.4 Mkm<sup>2</sup>), it was decided to concentrate the surveys on the two main fishing grounds, the Seychelles Bank (where the main inhabited islands are located), and the Amirantes Plateau.

The study area was subdivided, or stratified, by:

- bathymetry, including the following classes: outline of the shallow reefs, the 20 m isobath, and all areas below 20 m depth;
- "bio-geographic regions" mostly drawn from a substrate map (only available for the Seychelles Bank); and
- limits of marine national parks.

This was done with a geographical information system (GIS) package, which produced a table of possible combinations of layers of spatial physical data. This process gave a final count of 14 bioregions or strata. These strata were then used to produce the sample design. The stratification and estimates of holothurian density and variance were used in an optimal allocation procedure. This procedure allocated sampling effort among the strata in the most efficient manner for producing the best stock estimate for all commercial holothurians combined. A total of 329 survey sites were obtained by this means.

Visual surveys are done to estimate the standing stock of sea cucumbers (Conand 1990). For sites less than 30 m deep, transects are surveyed by a pair of divers swimming along a transect line 100 m long and 8 m wide. All sea cucumbers within that belt are collected and brought to the surface, where they are identified, measured, weighed and photographed. Other information is also collected during the dive, including: substrate type, coral cover, seagrass and algal cover, estimates of other invertebrates (e.g. lobsters, urchins, starfish, pearl oysters) that have either a commercial interest or which pose an environmental threat when they occur in large quantities.

For sites deeper than 30 m, a video camera is lowered to the bottom and the research vessel is allowed to drift for 15 minutes. Data are recorded on-board the vessel on a video recorder, and the transect position is given from GPS coordinates that are overlaid on the data tape. This helps calculate the length of the transect; the width is estimated from the video recording.

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### Sea cucumber surveys

Three surveys were conducted. A pilot survey was organised in December 2003 on the Seychelles Bank, with the main aim of testing the equipment and to train the divers in survey methods. Twenty-nine sites were surveyed by divers, mostly in shallow areas, and 19 different species of sea cucumbers were collected. Average abundance of all holothurians varied significantly between sites, ranging from 12.5 to 113 individuals per hectare; for high value commercial species the average abundance ranged from 6.25 to 43.33 individuals per hectare.

The main full-scale survey took place in March and April 2004 for four weeks on the Seychelles Bank and the Amirantes Plateau. For this survey, both diver transects and video transects were done. A total of 156 sites were surveyed, including 109 video transects and 47 diver transects. When the weather and sea conditions were good, the video proved to be capable of surveying at depths greater than 60 m.

It was not possible to sample all the sites during this survey due to bad weather, unavailability of some specific gear, and the relatively slow speed of the research vessel. It was thus decided to conduct another two-week survey in November 2004, when the weather was expected to be calm. This has just

been completed, and data have not yet been analysed. Another 65 (43 videos and 22 dives) sites were surveyed during that period (Fig. 1, Table 1), bringing the total number of sites surveyed to 250 (152 videos and 98 dives). This is still short of the 329 sites allocated during the sampling design. The main limitation in reaching the target number of sites was bad weather during part of the surveys that restricted both diving and video recordings, and the long distances the research vessel had to travel between two sample sites. Once the data has been analysed, we will decide whether the results are statistically robust enough, or whether there is a need to do another trip to survey the remaining sites. The species list now stands at 23, with a total number of specimens of 597 having been collected during the three surveys. However, it should be noted that some species have been difficult to identify with certainty, and have been given tentative names. There is definitely a need for taxonomic work on these species, but this is outside the scope of this project.

### Other activities

Several other activities have also been taking place since the start of the project, and are still ongoing.

A geographical information system (GIS) has been set up where fisheries-related data submitted by the fishers, and all data collected during the sur-

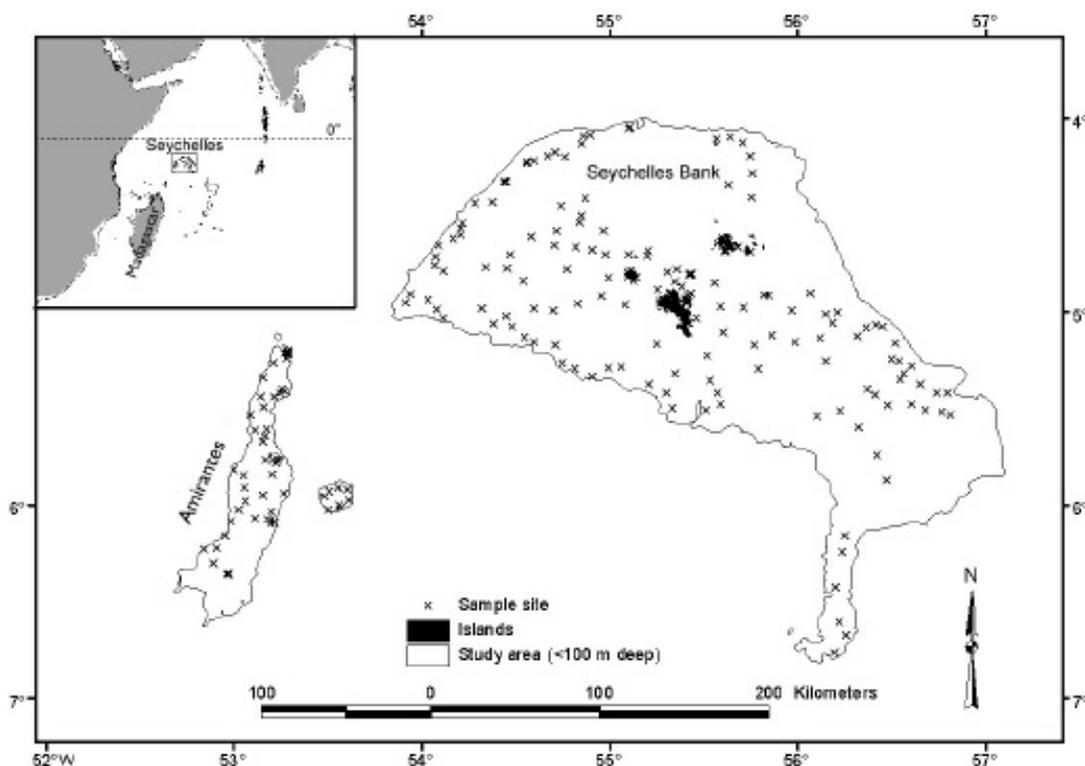


Figure 1. The study sites

**Table 1.** Data collected during the surveys

Survey	Dates	No. sites surveyed	Dive transects		Video transects	
			No. dives	No. sea cucumbers collected	No. videos	No. sea cucumbers observed
Pilot	1–5 Dec. 2003	29	29	129	0	0
Main 1	23 Mar.–02 Apr., and 13–23 Apr. 2004	156	47	257	109	138
Main2	3–16 Nov. 2004	65	22	66	43	32
<b>Total:</b>		250	98	452	152	170

veys will be incorporated. This will give the management access to up-to-date and geo-referenced data that will help in the decision-making process.

An assessment of the socioeconomic importance of the fishery is being conducted, based on interviews of the different stakeholders involved in the fishery (e.g. divers, boat owners, processors). The results of this assessment will be helpful in the preparation of the management plan.

A communication exercise has also started, targeting mainly those involved in the fishery, but also the general public. One meeting has been organised with the licensed sea cucumber fishermen and processors to explain the objectives of the project, and another is planned soon. The local television station has produced a documentary on the sea cucumber fishery, which has already been broadcasted on the local television network. In addition, a poster on the project has been produced and displayed during an underwater festival organised in October 2004.

It is now expected that complete results of the surveys will be available during the first quarter of 2005, and a draft management plan can then be tabled for discussions with all stakeholders.

## References

- Aumeeruddy R. and Payet R. 2004a. Management of the Seychelles sea cucumber fishery: Status and prospects. SPC Beche-de-mer Bulletin 19:13.
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