Seychelles' sea cucumber fishery: Data on processed products and other parameters

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Abstract

The sea cucumber fishery in the Seychelles has recently experienced rapid development. In order to implement a management plan for this fishery, more data are needed on the fished products, their processing and general socioeconomics. In this article, we present new data on the sea cucumber products obtained from the five main holothurian species fished. These data will also be useful for a description of species characteristics and for the market grades. The recent data on catch, effort, and catch per unit of effort are also presented and discussed.

Introduction

Because the sea cucumber fishery has recently expanded in the Indian Ocean, a regional Marine Science for Management (MASMA) Project, funded by the Western Indian Ocean Marine Science Association (WIOMSA), was set up in collaboration with five countries (Kenya, La Reunion, Madagascar, Seychelles and Tanzania). The main objectives for the biology and socioeconomic portion of the project were presented by Conand et al. (2006)

Reports of beche-de-mer exports from the Seychelles date back to the late 1800s (Aumeeruddy, in Conand and Muthiga in press). However, the quantities fished were fairly low and it wasn't until the late 1990s that the fishery experienced rapid development. The main reasons for this increase were the high demand for beche-de-mer on the international market, and higher prices offered for the product (Aumeeruddy and Payet 2004). The fishery has evolved from one in which fishers collect sea cucumbers while walking, to a more sophisticated fishery in which divers use scuba gear to do most of the harvesting. This is because the most valued commercial sea cucumber stocks have been overfished in the shallow coastal areas, and fishermen must now harvest them from deeper fishing grounds (i.e. to depths of 40 m). Many fishers have only entered the fishery in the last eight years. The Seychelles Fishing Authority (SFA) implemented some management measures in 1999 in response to local depletion of some species. These measures included a licensing system for fishing and processing sea cucumbers, a quota on the number of fishing licenses allocated each year, and a limit of four divers for each fishing license. Before the recent interest in the fishery, very little was known about holothurians from the Seychelles.

In May 2007, as part of the MASMA project, a visit was organised by SFA in Mahé (Seychelles) for two of the project's scientists. The main goals were to collect data on the processed products and to analyse the socioeconomic organisation of this fishery through interviews with key stakeholders. The socioeconomic information will be used at a later stage to develop a regional approach to the management of the holothurian fishery in the western Indian Ocean. The socioeconomic aspects of the Seychelles fishery will also be presented in another contribution to this bulletin. Other data on the fishery are presented here.

Material and methods

Interviews and measurements of the products were conducted at the main processors' stores in May 2007.

The main species targeted by the fishery were identified. The appearance of the sea cucumbers — first "in salt" (i.e. gutted sea cucumbers preserved in salt) when they are brought back from the sea, then processed and dried — was observed and photos were taken (Fig. 1).

The length and weight distribution of the processed sea cucumbers were measured for a large sample. Correlations between length and dried weight were calculated for the main species.

Other data collected by SFA were also compiled and analysed. Fishing effort is expressed as the number of dives, catch is expressed as the number of speci-

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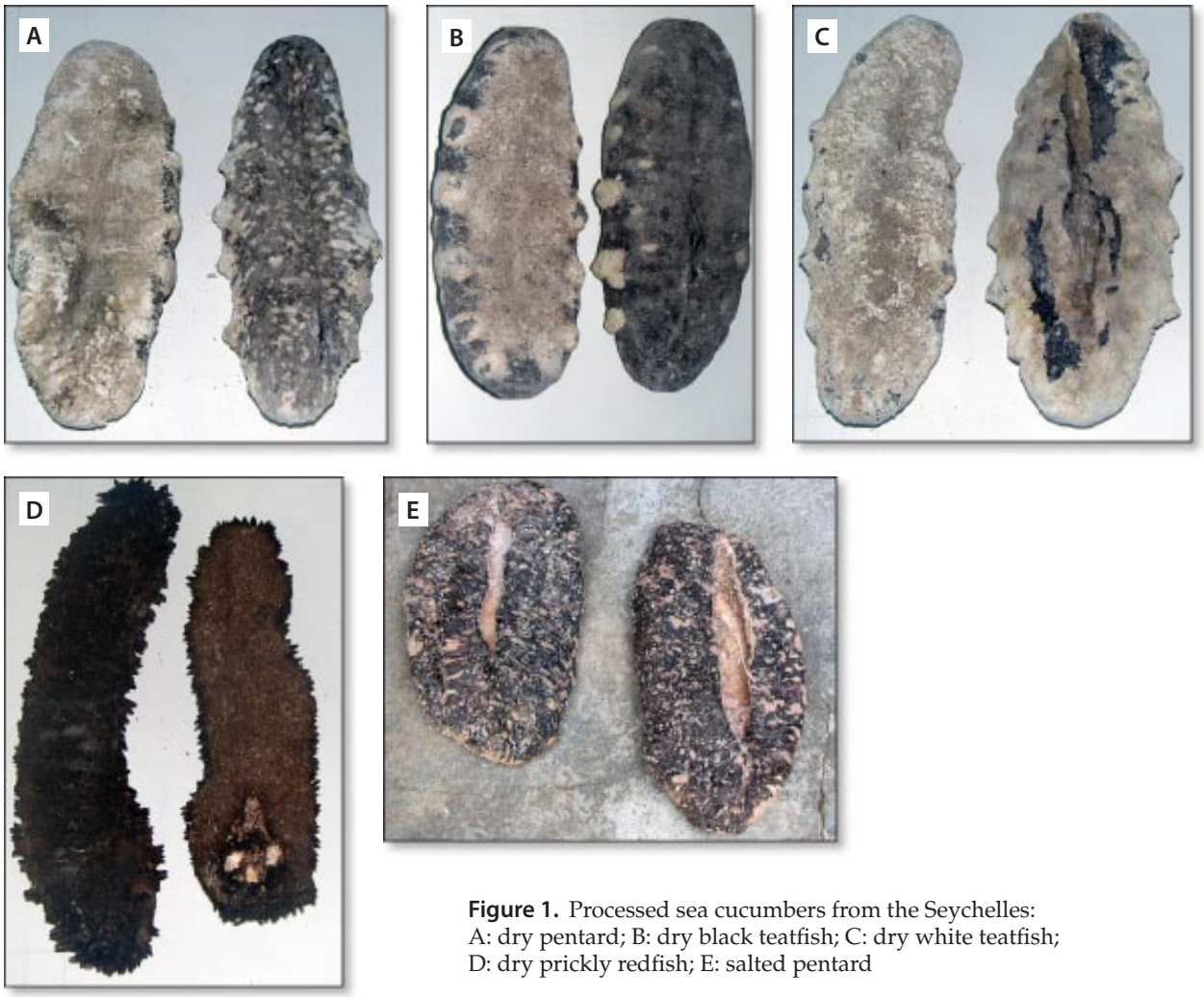


Figure 1. Processed sea cucumbers from the Seychelles: A: dry pentard; B: dry black teatfish; C: dry white teatfish; D: dry prickly redfish; E: salted pentard

mens for each species, and catch per unit effort (CPUE) is defined as the number of sea cucumbers of each species collected per dive.

Results

Parameters of the main species

Black teatfish *H. nobilis*, white teatfish *H. fuscogilva*, prickly redfish *T. ananas*, and the yet undescribed teatfish locally called "pentard", were the most common species (Fig. 1). Blackfish, *Actinopyga miliaris*, was also relatively abundant. More information on the species collected is given in Aumeeruddy (in press), Aumeerruddy et al. (2005) and Aumeeruddy and Payet (2004).

The mean size and weight of the products, as well as the reduction in size and weight during processing, are shown in Table 1.

The "pentard" is the most targeted species and dominates the purchases of the two main processors. The sizes are rather similar in the two stores and correspond to large dried specimens (166 g mean weight, or approximately 6 pieces per kg). This is grade A, the most expensive on the market. The products "in salt" are larger than the processed ones; the loss in weight and the loss in length from salted to dried products are calculated (Table 1C). The dried product is only 43% in length and 29% in weight for the prickly redfish; 53% and 42%, respectively for the black teatfish; and around 63% and 33%, respectively for the white teatfish and pentard.

In Figure 2, the size and weight distribution frequencies (and statistical parameters) are presented for the different species. They will be useful for monitoring the fishery as they present the minimum and maximum values and the calculated mode. If a decrease is found in these values in the following years, further management measures will be necessary.

Finally, the length–weight relationships were calculated from these samples (Fig. 3). The regression

Table 1. Mean parameters of sea cucumbers from the Seychelles fishery, May 2007.

A. Dried products			
species	market name	mean length (cm)	mean weight (g)
Holothuria "pentard" (1)	flower teatfish	17.4	167.7
Holothuria "pentard" (2)	"	16.8	165.3
Holothuria fuscogilva	white teatfish	18.9	219.5
Holothuria nobilis	black teatfish	14.3	163.1
Thelenota ananas	prickly redfish	17.8	132.0
Actinopyga miliaris	blackfish	12.2	51.6
B. "In salt" products			
species	market name	mean length (cm)	mean weight (g)
Holothuria "pentard" (1)	flower teatfish	27.5	655.2
Holothuria "pentard" (2)	"	28.2	482.3
Holothuria fuscogilva	white teatfish	29.5	610.0
Holothuria nobilis	black teatfish	27.0	390.0
Thelenota ananas	prickly redfish	41.0	458.0
C. Reduction in length and weight			
species	market name	% length dried/salt	% weight dried/salt
Holothuria "pentard" (1)	flower teatfish	63	26
Holothuria "pentard" (2)	"	60	34
Holothuria fuscogilva	white teatfish	64	36
Holothuria nobilis	black teatfish	53	42
Thelenota ananas	prickly redfish	43	29

(1): Processor 1; (2): Processor 2.

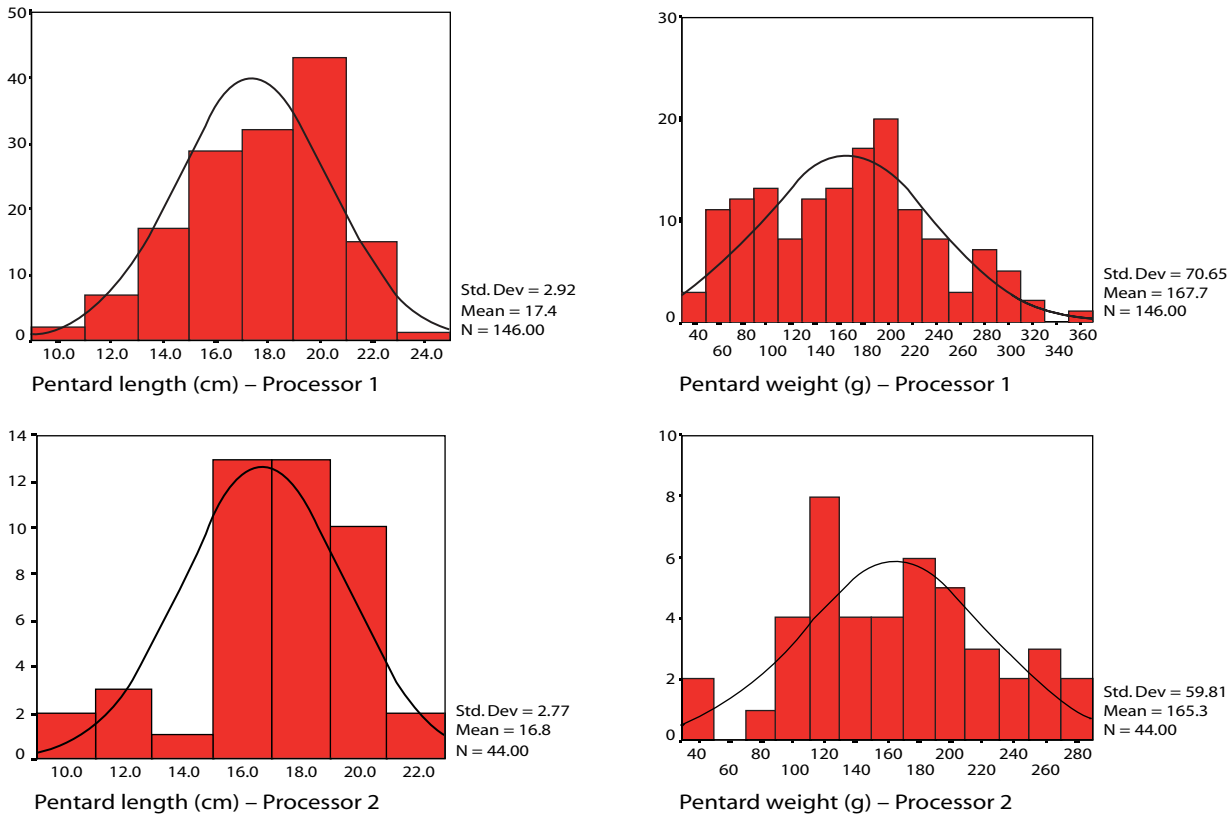
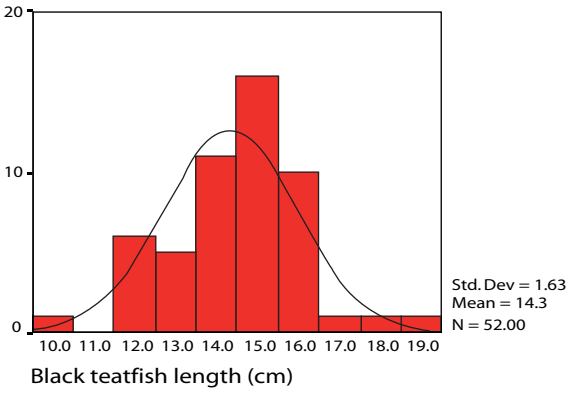
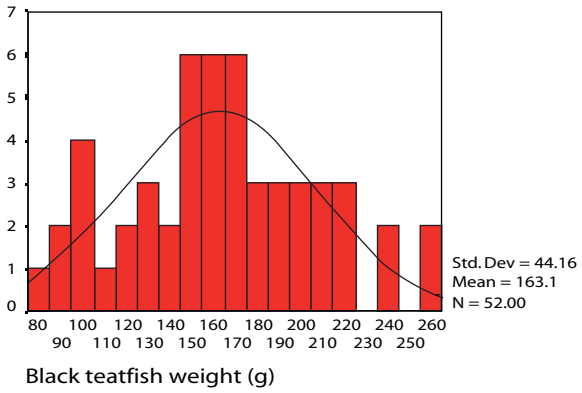


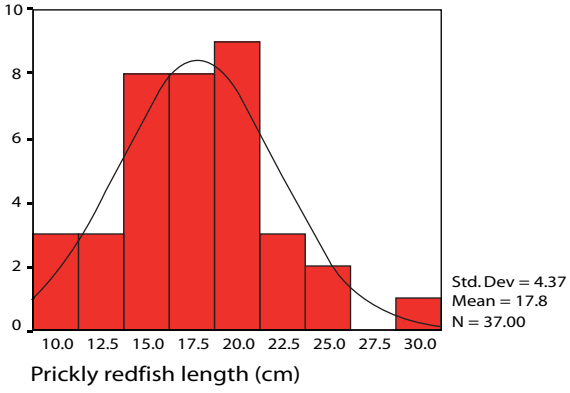
Figure 2. Length and weight distribution frequencies of dried beche-de-mer for the main species fished in Seychelles.



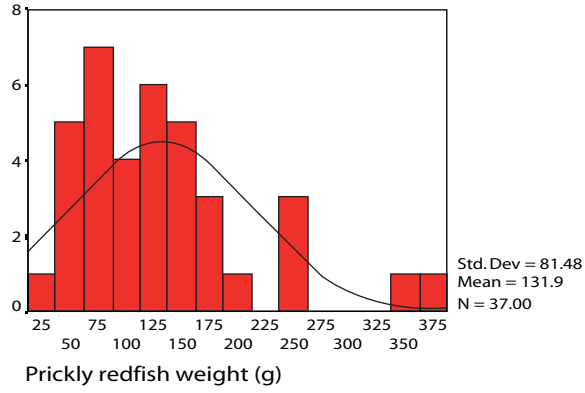
Black teatfish length (cm)



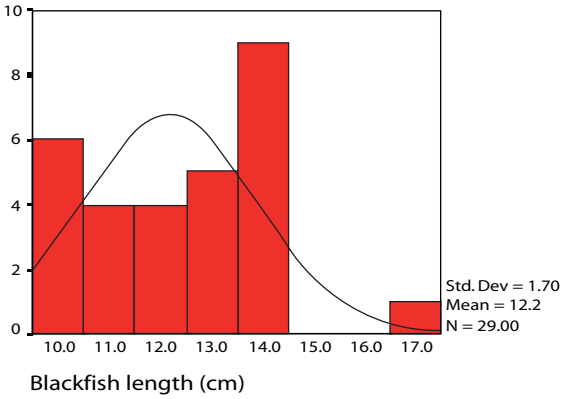
Black teatfish weight (g)



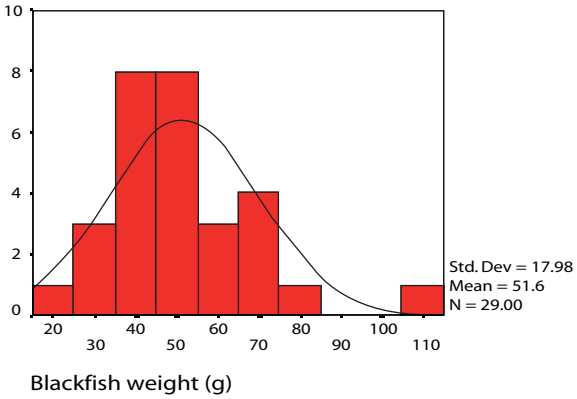
Prickly redfish length (cm)



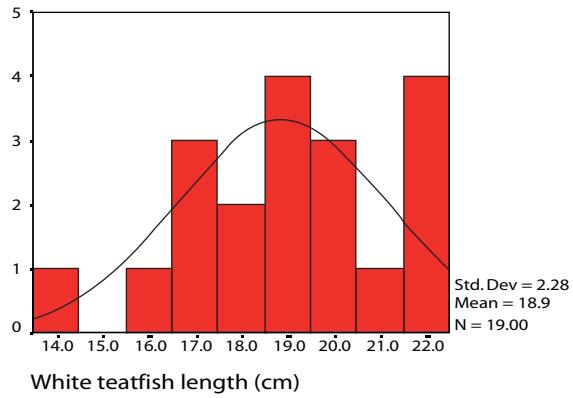
Prickly redfish weight (g)



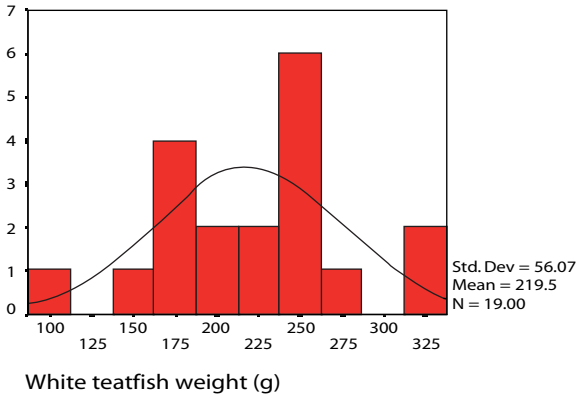
Blackfish length (cm)



Blackfish weight (g)



White teatfish length (cm)



White teatfish weight (g)

Figure 2 (continued). Length and weight distribution frequencies of dried beche-de-mer for the main species fished in Seychelles.

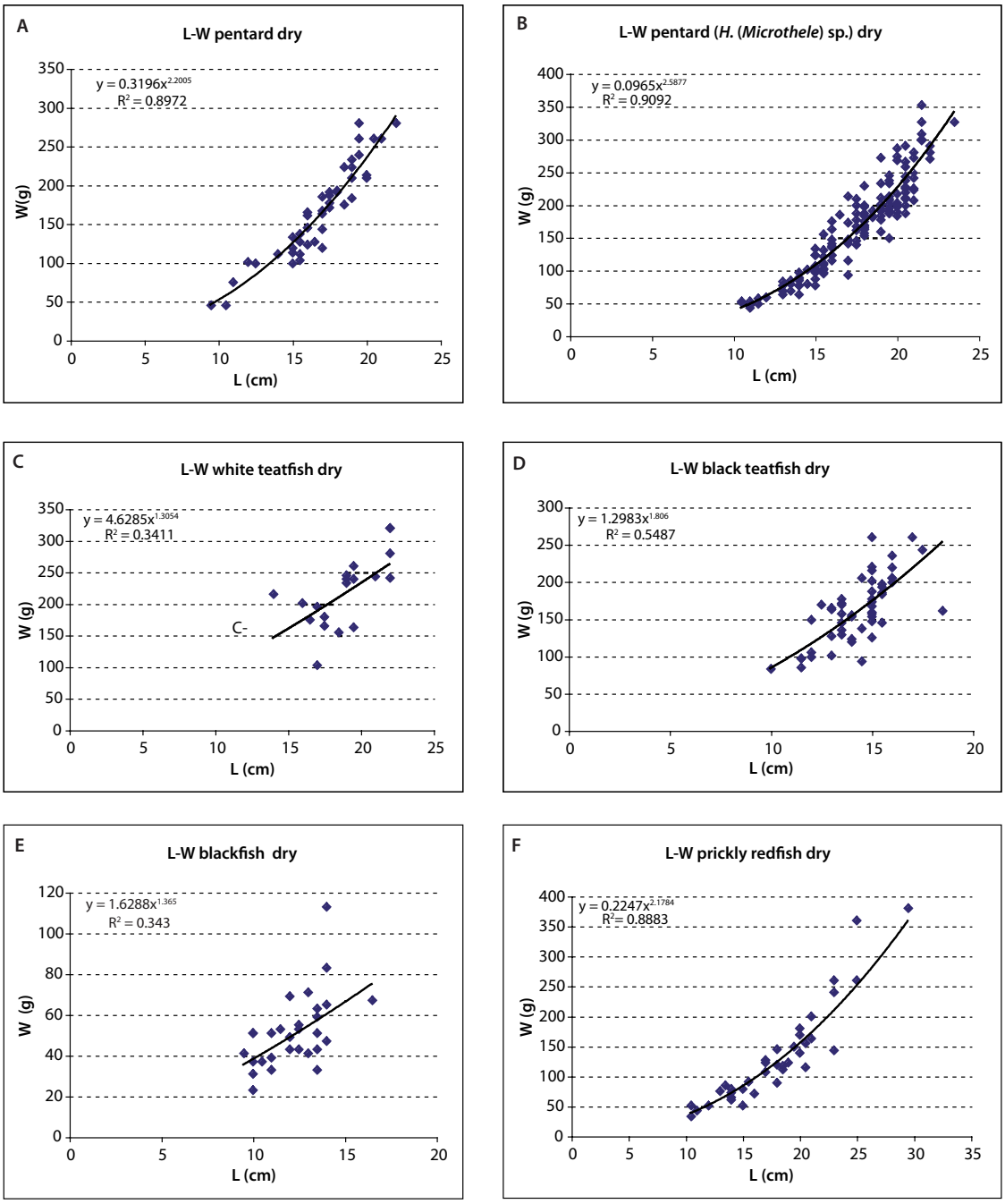


Figure 3. Length-weight relationships and correlations of dried beche-de-mer for the main species fished in Seychelles.

coefficients are highly significant for the pentard, *H. nobilis* and *T. ananas*. Other data are still necessary for the blackfish as the sample measured was small.

Recent data on the fishery

Total effort for the years 2001–2006 is described as the number of dives, and the catch for each species is described as the number of specimens (Table 2). Effort has increased considerably during this period. The pentard is largely dominant but the category "other species" is also important.

Monthly variations in effort are presented for the years 2004–2006 (Fig. 4). The fishery has been increasing during these years, but the fishing season is the same, taking place from October to May, in relation with climatic conditions.

CPUE was calculated from the data presented in Table 2. The results (Table 3) indicate a regular decrease for all the species, with the exception of the pentard. This result is very important for the fishery and management measures must be followed, as overfishing appears for most species.

Discussion and conclusion

Sea cucumber species were present in two forms at the processors' stores in May 2007: "in salt" as they were bought from the fishers, and dried after processing. The processing was done very carefully, following the standard methods (SPC 1984).

The size and weight frequency distribution of the products give information on the mean values of the dried products for each species and therefore their grade on the international market. This parameter is also important for future monitoring in order to evaluate stock status and socioeconomic aspects of the fishery. The loss of length and weight during processing is calculated here from the "in salt" product; this was previously obtained from the fresh weight (see Conand 1979 for New Caledonia) as the animals were not placed in salt because the fishers were going out for one day only and brought the animals back alive.

Statistics on effort and catches are very important. It is recommended that SFA inspectors collecting these data receive training in the taxonomy of the commercial species. It is necessary, with the increase of the catch in the "other species" category, to detect shifts in the fishery, which can result in overexploitation. Some important species that are today classified as "other species" should be identified to the species level to identify trends in their exploitation.

In conclusion, there is a need to control the effort in the fishery, and to monitor it closely. A number of recommendations have been proposed to maintain a sustainable fishery, and are as follows (from Aumeeruddy in press):

1) Control fishing effort so that catches do not exceed recommended total allowable catches (TACs). Management measures should be designed to control effort on the higher value species and to spread effort to lower value species.
2) Control fishing effort in areas close to the main islands of the Mahé Plateau for high value species to alleviate local depletion of these species.
3) Continue to protect all sea cucumber populations in the designated marine parks.
4) Formulate, enforce and educate about minimum size limits for all species in the catch. Minimum size limits should be designed in order to protect individuals until they have spawned once.
5) Monitor the catch and effort of the fishery through suitable logbooks and processor returns. Information should be gathered for all species in the catch.
6) Carry out periodic monitoring surveys to assess the performance of the current management strategies and modify if required.

Table 2. Data on effort (total no. of dives) and catch (no. of specimens) for the Seychelles fishery (2001–2006).

Year	No of dives	Black teatfish	Sandfish	White teatfish	Prickly redfish	Pentard	Other species	Total catches
2001	576	4117	114	16758	2802	2784	3427	30002
2002	1349	6411	708	40555	6302	9875	40173	104024
2003	2559	8243	33	25510	15579	47810	69482	166657
2004	5154	9388	622	41141	12249	59331	52181	174912
2005	7609	11600	100	45928	17187	83798	98032	256645
2006	9340	9821	1753	36817	13375	151459	94127	307352

Table 3. CPUE (no. ind dive^{-1}) for the main holothurians fished in Seychelles (2001–2006).

Year	Black teatfish	Sandfish	White teatfish	Prickly redfish	Pentard	Other species
2001	7.15	0.20	29.09	4.86	4.83	5.95
2002	4.75	0.52	30.06	4.67	7.32	29.78
2003	3.22	0.01	9.97	6.09	18.68	27.15
2004	1.82	0.12	7.98	2.38	11.51	10.12
2005	1.52	0.01	6.04	2.26	11.01	12.88
2006	1.05	0.19	3.94	1.43	16.22	10.08

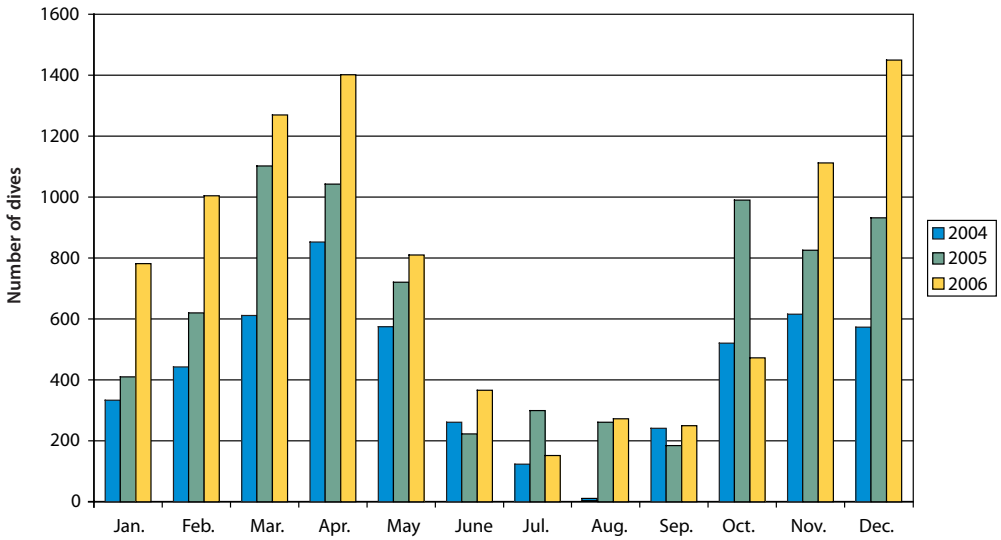


Figure 4. Monthly variations of effort (no. of dives) in the Seychelles sea cucumber fishery.

A management plan has been proposed based on the results of the resource assessment (Aumeeruddy et al. 2005). Following meetings with stakeholders, the plan was finalised in August 2005, and is based on a mix of input controls (limited number of fishing licenses) and output controls (TAC for each commercial species) (Payet 2005). It was agreed to continue with a limit of 25 fishing licences, which was implemented as a precautionary measure in 2001. TAC was calculated based on maximum sustainable yield (MSY) for each species (Aumeeruddy et al. 2005). The total TAC for all species has been calculated at 1707 t landed weight (gutted), from which high value species represent 425 t landed weight, medium value species (e.g. blackfish) made up 121 t (7.1%), and low value species (e.g. lollyfish) made up 1161 t (68.0%).

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