Twentieth Meeting of the Scientific Sub-committee of the British/Seychelles Fisheries Commission

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Background Paper: SFA 02

Results of the Catch Assessment Survey (CAS) 2007 and Research Activities for Artisanal Fisheries

Prepared by the Fisheries Research Section, SFA[1], Oct 2008

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1. Artisanal fisheries statistics 2007

1.1 Catch and effort

The total artisanal catch during 2007 was 4,189 metric tonnes (t), representing an increase of 9 % compared to 2006 (Figure 1). The catch was 293 t lower than the long-term (23-years) average annual catch of 4482 t. With respect to the previous year, there was an increase in catch on Mahé (15%), whilst the catches on Praslin/La Digue decreased by 21%.

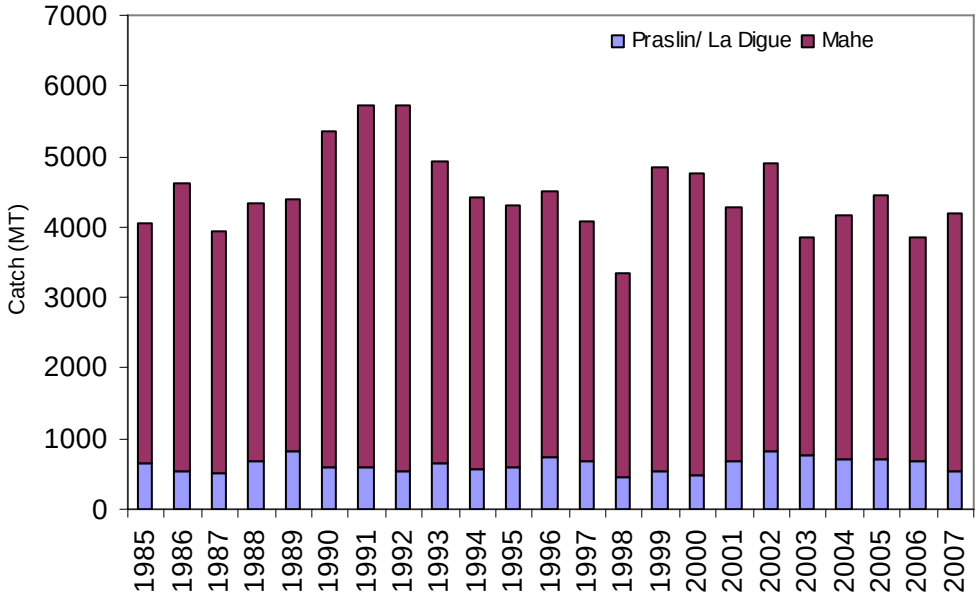


Figure 1. Artisanal catch (t) for Mahé and Praslin/La Digue: 1985 to 2007.

Increase in catches was recorded in only two gear categories in 2007. In terms of handline gear, catches increased by 391 t compared to 2006 (Figure 2: left). Catches in the net fishery also increased from 285 t to 410 t (+31%) in 2007. The trap fishery saw a slight decrease (by 23 %) in catches from the 2006 value (Figure 2: left). Handline and net fisheries were the only two fisheries to record any increase in effort for 2007. The handline fishery showed an increase of 22 %, while the net fishery showed an increase of 31 % (Figure 2: right). As for the trap and harpoon fisheries there was a decline of 15 % and 31 % in effort, respectively, in 2007.

As determined from monthly mean estimates of the number of vessels in operation, whereby the maximum monthly value is used as an indicator of fleet activity for the year, the fishing activities of outboard and whaler vessels both increased in 2007 compared to the previous year (Table 1). The composition of the total artisanal catch by vessel category was dominated by whalers, which was also the only vessel type to record an increase in catches from the previous year (Table 2). Catches by pirogue, outboard and schooner recorded slight decreases in catch during 2007.

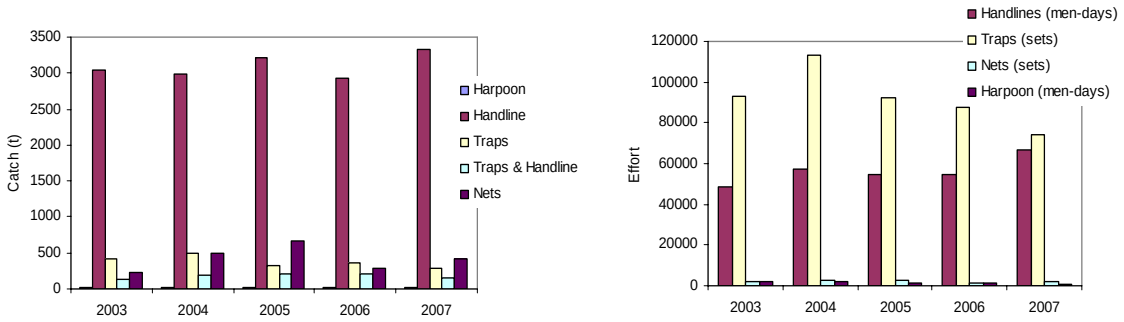


Figure 2. Total catches (left) and fishing effort (right) for the major gear types.

Table 1. Maximum monthly fishing vessels in operation: 2001 to 2007.

Vessel Type	2001	2002	2003	2004	2005	2006	2007
Pirogue*	32	31	30	33	30	27	22
Outboard*	236	234	250	239	234	242	243
Whaler	95	96	109	93	83	94	105
Schooner	14	13	16	20	18	26	22
Sport	40	38	21	**	**	**	**
Dropline	2	1	0	4	2	4	5

*Includes part time fishing vessels. **Data not available due to poor logbook returns.

Table 2. Percentage (%) of annual catch landed by major vessel types, including foot fishermen: 2001 – 2007.

Boat Type	2001	2002	2003	2004	2005	2006	2007
Pirogue	1.2	0.6	1.1	1.3	1.5	2.1	0.7
Outboard	24.9	25.2	27.2	34.3	35	28.2	24.9
Whalers	66.7	68.5	63.8	54.2	52	56.8	63.4
Schooners	6.1	4.5	6.8	9	10.7	11.4	9.3
Foot fishers	1.1	0.6	0.6	0.9	0.7	0	0.3
Dropline vessels	0.1	0	0	0.1	0.1	0.6	1.4
Research vessels	1.7	0.2	0.1	0	0.1	0.1	0.1

1.2 Catch rates of the major fisheries

Catch rates (CPUE) for the handline fisheries declined further in 2007 compared to the previous year (Figure 3a). The whaler handline fishery continued to outperform other vessel types in terms of CPUE, but estimates continue to decrease for this fishery from the peak recorded in 2002. The decline in CPUE since 2002 partly reflects the change in strategy as whalers have increasingly targeted demersal over semi-pelagic species. For the trap fishery there was a slight increase in CPUE for active trap outboard vessels when compared to estimates of the past seven years. The CPUE for static trap whaler vessels was anomalous in 2005 and 2006 and resulted from a CAS error (Figure 3b). CPUE for the encircling gill net fishery increased slightly (5 Kg/set) over the 2006 estimate. CPUE in the harpoon fishery declined by 1Kg/man-hr compared to the previous year (Figure 3d).

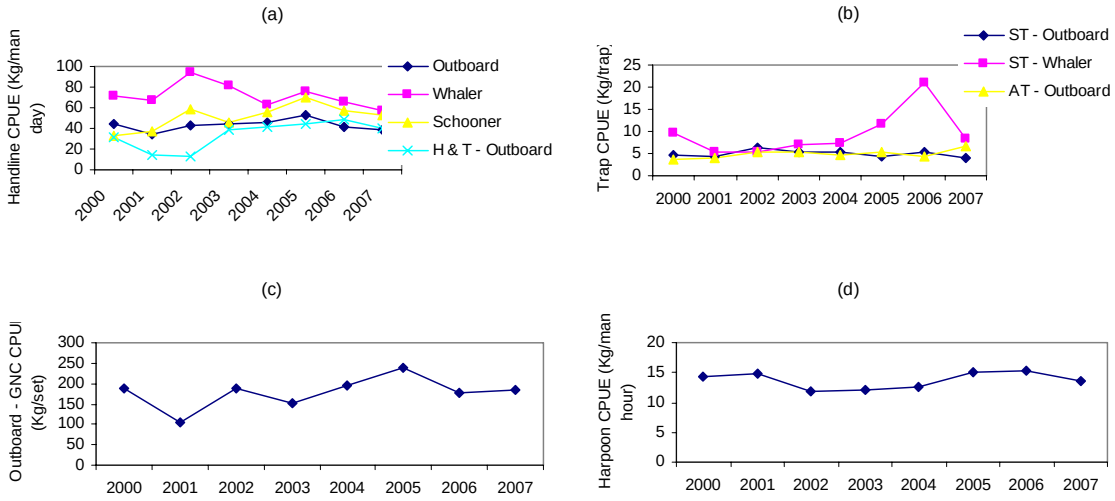


Figure 3. Trends in catch rates (CPUE) for the major vessel and gear combinations in the (a) handline fisheries, (b) trap fisheries, (c) gill net fishery and (d) the harpoon (octopus) fishery for the period 2000-2007.

1.3 Species composition

There was a further increase in the catches of red snappers, which continued to contribute a higher percentage of catches than carangids in 2007 (Table 3; Figure 4a). The catch of bourgeois (*Lutjanus sebae*) for 2007 reached a record 1075 t when compared to a catch of only 213 t seven years ago. Catches of carangids are still on the decline from a high of 41.6 % (2,042 t) in 2002 to a low of 19 % (731 t) in 2007. Catches of job (*Aprion virescens*) increased slightly from 596 t in 2006 to 660 t in 2007, as reflected by their importance to the catch (Table 3; Figure 4c). The grouper catch also increased over the previous year, increasing from 123 to 157.3 t. These trends are related and are due to greater targeting of demersal species by whaler vessels in particular. This has important implications for demersal stocks, as discussed later in this report.

Table 3. Percentage (%) species/species-group composition of artisanal catch for the period 2001-2007

Species Group		Percentage (%) of total annual catch						
English/Scientific	**Kreol**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Trevally (*Carangoides* spp.)	Karang	30	41.6	33.6	28.2	24.1	19.9	19
Red snapper (*Lutjanus* spp.)	Bourzwa, Bordmar	14.1	10	11.5	17.0	24.7	26.7	29.5
Jobfish (*Aprion virescens*)	Zob gri	16.4	12.4	15.8	12.5	10.9	15.5	15.8
Emperors (*Lethrinus* spp.)	Kaptenn	11.3	6.9	6.1	6.2	4.9	4.4	4.6
Bonito (*Euthynnus affinis*)	Bonit	1.2	1.5	3.5	1.9	1.9	1.9	1.9
Groupers (*Epinephelus* spp.)	Vyey	2.5	1.5	2.4	2.3	2.0	3.2	3.8
Rabbitfish (*Siganus* spp.)	Kordonnyen	2.1	4.1	6.6	7.6	5.3	7.2	5.1
Mackerel (*Rastrelliger* sp.)	Makro dou	6.1	7	5.7	11.0	14.2	4.8	7.5
Others		16.3	15.1	14.8	13.3	12.0	16.4	12.8
Total annual catch (MT)		**4,290**	**4,915**	**3,852**	**4,176**	**4,583**	**3,850**	**4,189**

In contrast to the decline in catches of emperor, there was an increase recorded for that species from a low of 168 t in 2006 to 193 t in 2007. The catch of bonito remained stable in 2007 as it has been since 2004 (Figure 4b). The mackerel fishery picked up slightly from a low of 184 t in 2006 to 314 t. Constituting one of the main target groups of the trap fishery, catches of rabbitfish dropped to its lowest level (215 t) for the past five years (Table 3; Figure 4d).

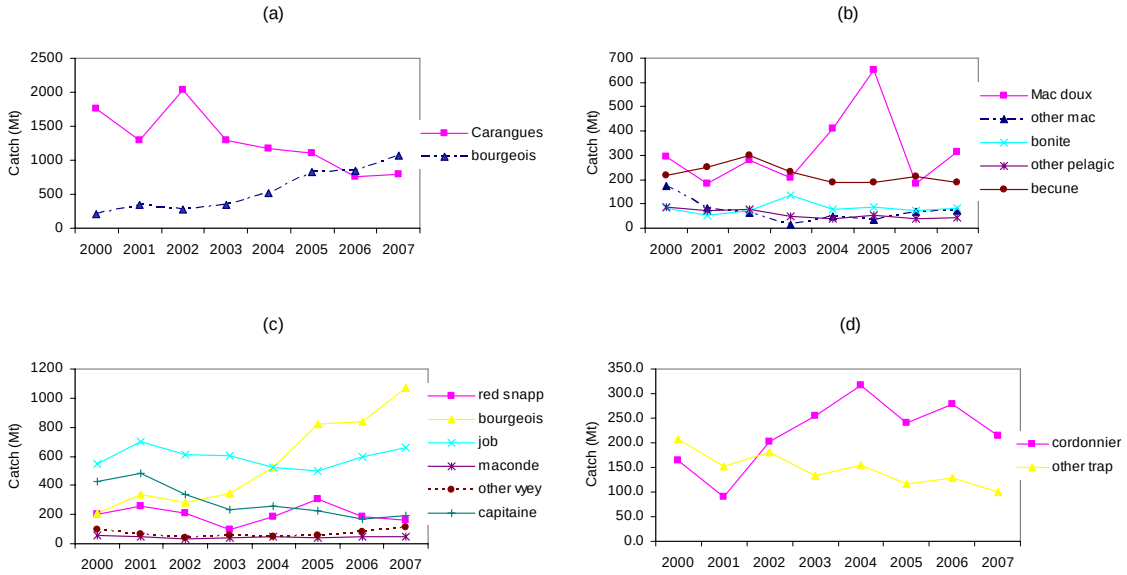


Figure 4. Trends in catches (Mt) for the major species and species groups for the periods 2000-2007, in terms of (a) comparison of the dominant species/groups in the artisanal catch, (b) semi-pelagic fisheries, (c) demersal, and (d) trap fisheries.

1.4. Wholesale and exports

Purchases of pelagic fish by Oceana Fisheries Co. declined slightly in 2007 compared to the previous year, however, the purchase of Bonito and Becune has tripled and doubled, respectively. Similarly, purchases of demersal species by the company decreased (Table 4). In contrast, purchases of pelagic fish by Sea Harvest Fisheries have tripled over 2007, largely due to the increase in the purchase of fish grouped as other pelagic. Bourgeois and red snapper purchases by Sea Harvest Fisheries increased slightly, while those of Job and Maconde decreased. The total purchase of bourgeois by both companies amounted to 344.1 t in 2007, approximately 32% of the total catch of this species.

Exports of the major categories of demersal species landed by artisanal fisheries have declined by 18.2% compared to 2006 (Figure 5). In contrast, there was an increase of 12.4% in the export of pelagic species. The largest decline in exports was for Vielle (-25.2%), there were also declines in the export of bourgeois (-19.5%), capitaine (-16.5%) and job (-8.7%). In contrast, there was an increase of 106.3% in the export of crabs and sharks which are grouped in the ‘others’ category.

Table 4. Purchases by Oceana and Sea Harvest from local vessels in 2006 and 2007 with percentage (%) change.

	Oceana			Sea Harvest		
	2006	**2007**	**% change**	**2006**	**2007**	**% change**
Carangue	35.5	32.1	-9.6	3.9	4.0	2.6
Bonito	0.2	0.5	150	2.5	1.8	-28
Becune	1.3	2.6	100	2.0	3.0	50
Other pelagic	5.5	2.1	-61.8	15.8	63.5	301.9
Red snapper	21.9	18.3	-16.4	18.9	20.5	8.5
Bourgeois	297.7	241.6	-18.8	92.8	102.5	10.5
Job	74.7	54.9	-26.5	35.2	22.6	-35.8
Maconde	12.1	6.7	-44.6	4.6	2.9	-37
Other vielle	20.2	16.2	-19.8	10.7	16.1	50.5
Capitaine	21.3	16	-24.9	8.4	20.0	138.1

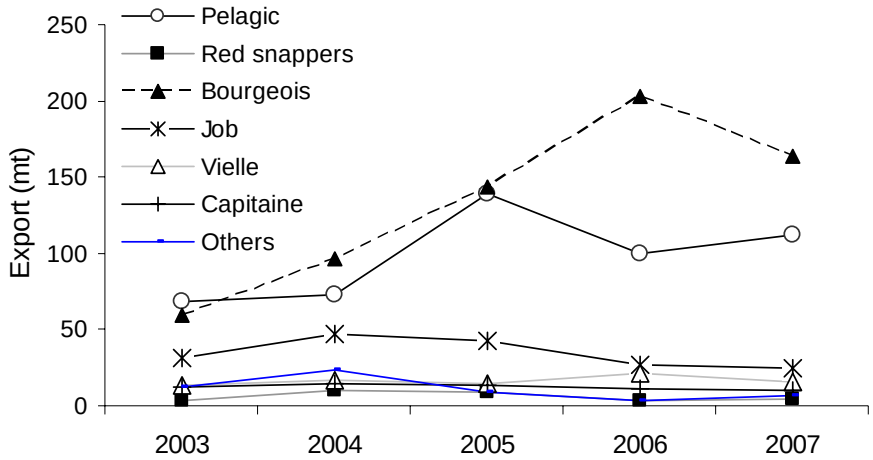


Figure 5. Exports of (fresh and frozen) species/species-groups for the period 2003 to 2007

1.5. Update on the sea cucumber fishery

The total number of sea cucumbers harvested has decreased slightly in 2007 (Table 5). However, the number of white teat, prickly red and pentard harvested has increased compared to 2006. The most significant increase was for the white teat species of which 57,837 units were harvested in 2007 compared to 37,664 in 2006, an increase of 53.6%. The number of prickly red harvested increased by 25.7%, whilst the number of pentard increased by 10.9%.

Table 5. Reported number of sea cucumbers caught for the period 2002 to 2006.

Year	Black teat	Sandfish	White teat	Prickly red	Pentard	Others	Total
2002	6,926	903	41,212	6,561	9,912	46,026	111,541
2003	8,543	33	26,374	15,779	48,506	69,482	168,717

2004	9,417	622	41,221	12,254	59,488	52,181	175,183
2005	11,602	100	45,928	17,194	83,822	98,055	256,701
2006	10,065	2,047	37,664	15,669	163,775	104,801	334,021
2007[1]	7,883	433	57,837	19,693	181,670	63,499	331,015

[1]Data given as presented in the 2007 Annual Report: - some catch and effort forms not submitted

According to export statistics from the Department of Finance, a total of 49.5 MT and an additional 17,250 pieces of dried sea cucumbers were exported in 2007 for a total value of SR 3,956,701. This represents an increase of 13% in net weight and a decrease of 77% in pieces of sea cucumber exported when compared to the previous year. In 2006 a total of 43.7 MT and 74,000 pieces of sea cucumber were exported for a value of SR 1,947,389.

Table 6. Comparison of TAC (No.) against the estimated catch of 2007.

Common Name	Status	TAC (No.)	Estimated Catch 2007
Black teatfish	Under exploited. Some local depletion	228,000	7,883
Sandfish	Over exploited	0	433
White teatfish	Under exploited	94,000	57,837
Prickly redfish	Under exploited	87,000	19,693
Pentard	Over-exploited	71,000	181,670

The data indicate that black teatfish, white teatfish and prickly redfish are all underexploited against the TAC (Table 6). As for sandfish, catches reflect the relatively small exploitable stock, which was used to justify a zero TAC for this species. Pentard has been overexploited against the TAC. The management plan for the sea cucumber fishery has been approved by the Cabinet. However, TACs are not operational as a management measure; this is highly due to the fact that TACs are highly disputed amongst fishermen. The fishery will be open for a period of nine months starting on the 1st of October. There are plans for a new stock assessment in 2009 which will lead to revised TACs.

1.6. Update on the lobster fishery

The 2007/2008 season was opened from December to March inclusive. The total catch for the season was estimated at 3.7 t, compared to 6.1 t the previous season. As per usual, most catches were made with snorkelling gear. Based on logbook submissions, a total of 314 trips were undertaken in the season, comprising 490 man-trips. The estimated CPUE was 11.7 kg/trip, compared to 27.7 kg/trip for the previous season. Typical of previous seasons, the catch composition of lobsters was dominated by pronghorn spiny lobster (*Panulirus penicillatus*), which accounted for 62% of the catch, followed by the long-legged spiny lobster (*Panulirus longipes*) with 34%.

2. Research Activities

2.1. Stock assessments

The number of size data collected in 2007 was low compared to previous years but assessments were attempted for three key indicator species of the demersal handline fishery.

2.1.1. *Aprion virescens*

In 2007, sample size was too small to make any reliable analysis at a fine spatial scale. The same growth parameters were used as previous years: age-based growth parameters derived in FMSP Project R6465 were used in FiSAT II (K=0.1, L_{∞}=89.9, t0=-2.3) to provide estimates of mortality (Z, F, M) and length at first capture (L_{c50}). Two estimates of natural mortality (M) were used, the first (M1) from Pauly (1980) with a temperature of 22°C. Since this method tends to overestimate M for slow growing species, we also used the derivation from Jenson (1996; reviewed in Hoggarth et al., 2006), where M = 1.5K, to estimate this parameter (M2).

Table 7. *Aprion virescens*: Estimates of fishing mortality, and related parameters, for two different estimates of natural mortality (M1 and M2), and corresponding estimates of length at first capture (L_{c50}). Length at first maturity (L_{m50}) estimates and sample sizes (n) also provided.

Parameter	2004	2005	2006	2007
Z	0.49	0.32	0.23	0.32
CI of Z	0.43-0.55	0.14-0.49	0.1-0.35	0.28-0.35
r^2	0.99	0.99	0.98	0.99
M1	0.26	0.26	0.26	0.26
F	0.23	0.06	-0.02	0.06
E	0.47	0.18	-0.09	0.18
L_{c50} (cm) – Logistic	73.47	69.98	71.17	70.70
L_{c50} (cm) – Running av.	68.37	67.67	67.97	68.48
F/M	0.88	0.23	-0.08	0.23
M2	0.15	0.15	0.15	0.15
F	0.34	0.17	0.08	0.17
E	0.69	0.53	0.35	0.53
L_{c50} (cm) – Logistic	73.82	70.09	68.53	70.73
L_{c50} (cm) – Running av.	69.34	67.62	66.69	68.45
F/M	2.27	1.13	0.53	1.13

L_{m50} (Mees 1992; MRAG 1999)	62-64; 65 cm			
n	377	1142	169	88

In 2007 and based on the lower estimate of M (M2), L_{c50} was greater than $L_{m50,}$ as was the case in previous years. Combined with an F/M ratio of 1.13, this suggests that overfishing is unlikely. However, the sample size was small in 2007 which leads to uncertainty in this estimates. Based on these results, YPR analyses were not conducted for this species. Larger sample sizes are being obtained in 2008 which may permit analyses at the level of sector and highlight any concerns at a finer spatial scale.

2.1.2. *Epinephelus chlorostigma*

As with *Aprion virescens*, the sample size for this species was small in 2007. The same growth parameter were used as in previous years, based on average of 3 estimates from Grandcourt (2002), Mees (1992) and Sanders et al. (1988), where K=0.21 and L_{∞}=57.19. L_{c50} was assessed against a published maturity estimate for females (Moussac, 1996), rather than for males, since this species is suspected of protogynous hermaphroditism. Maturity was also calculated from $0.5L_{\infty}$. As was the case with *Aprion virescens*, two estimates of M were applied in the assessment, the first (M1) the standard Pauly (1980) method with a water temperature of 22°C, and the second (M2) calculated using M=1.5K, with K=0.21.

Table 8. *Epinephelus chlorostigma*: Estimates of fishing mortality, and related parameters, for two different estimates of natural mortality (M1 and M2), and corresponding estimates of length at first capture (L_{c50}). Length at first maturity (L_{m50}) estimates, based on $0.5L_{\infty}$ and Moussac (1986), and sample sizes (n) also provided.

Parameter	2004	2005	2006	2007
Z	1.04	0.97	0.85	0.78
CI of Z	-2.77-4.85	-4.00-5.94	-5.69-7.39	-5.04-6.6
r^2	0.92	0.86	0.73	0.75
M1	0.48	0.48	0.48	0.48
F	0.56	0.49	0.37	0.30
E	0.54	0.50	0.43	0.38
L_{c50} (cm) – Logistic	30.76	31.47	31.14	31.26
L_{c50} (cm) – Running av.	33.04	32.53	31.91	31.48
F/M	1.17	1.02	0.77	0.63

M2	0.315	0.315	0.315	0.315
F	0.73	0.66	0.54	0.47
E	0.70	0.68	0.63	0.60
L_{c50} (cm) – Logistic	30.67	31.41	31.07	31.20
L_{c50} (cm) – Running av.	32.83	32.35	31.73	31.29
F/M	2.32	2.10	1.71	1.49

L_{m50} ($0.5L_{\infty}$; Moussac , 1986)	28.95 cm TL; 31 cm TL for females			
n	991	1161	348	78

Coupled with the small sample size, total mortality (Z) estimates were subject to large range in CI leading to considerable uncertainty in estimates of F (Table 8). Mortality rates have declined since 2004. Measured against the indicators (L_{c50}; F/M), the stock did not appear overfished in 2007.

2.1.3. *Lutjanus sebae*

In addition to analyses at the Plateau level, sample data were sufficient to perform analyses of the W-NW (sectors 9 and 10) area only.

Mortality and capture estimates
Due to problems in obtaining reliable performance of the YPR models in the Yield software using point estimates of growth parameters, this year we have used an average of 2 age-based estimates (Grandcourt et al. 2008 and Newman 2000) and 2 length-based estimates (Mees 1996), where K = 0.163; L_{∞} = 88.6; t0 = -0.95. We used an estimate of natural mortality based on an average derived from two methods; M = 1.5K and an age-based estimate derived by Grandcourt et al. (2008) using the Hoenig (1983) empirical equation.

Length at first capture (L_{c50}) was lower than the length at first maturity (L_{m50}) for the W-NW sectors, highlighting cause for concern. While F/M < 2, however, the CI for total mortality is large, adding uncertainty in the estimates. At the plateau level $L_{c50} = L_{m50}$ but F/M > 2, suggesting that overfishing is occurring (Table 9).

Table 9. *Lutjanus sebae*: Estimates of mortality and corresponding estimates of length at first capture (L_{c50}). Length at first maturity (L_{m50}) estimates, based on Mees (1992), and sample sizes (n) also provided.

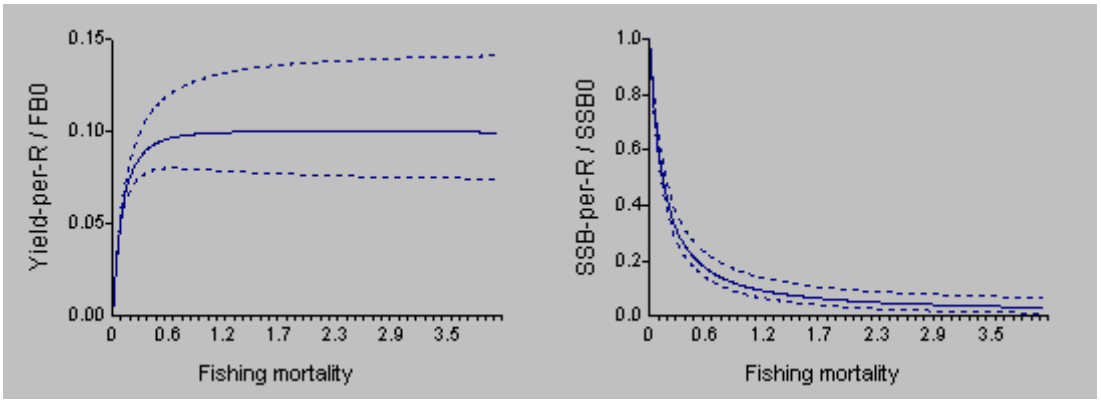
Parameter	**All sectors**	**W-NW (Sectors 9, 10)**
Z	0.55	0.47

CI of Z	0.39-0.71	-0.37-1.31
r^2	0.99	0.98
M	0.182	0.182
F	0.37	0.29
E	0.67	0.61
L_{c50} (cm) – Logistic	62.29	55.32
L_{c50} (cm) – Running av.	62.56	59.37
F/M	2.03	1.59
Maturity	62 cm FL	
n	807	376

Yield per recruit

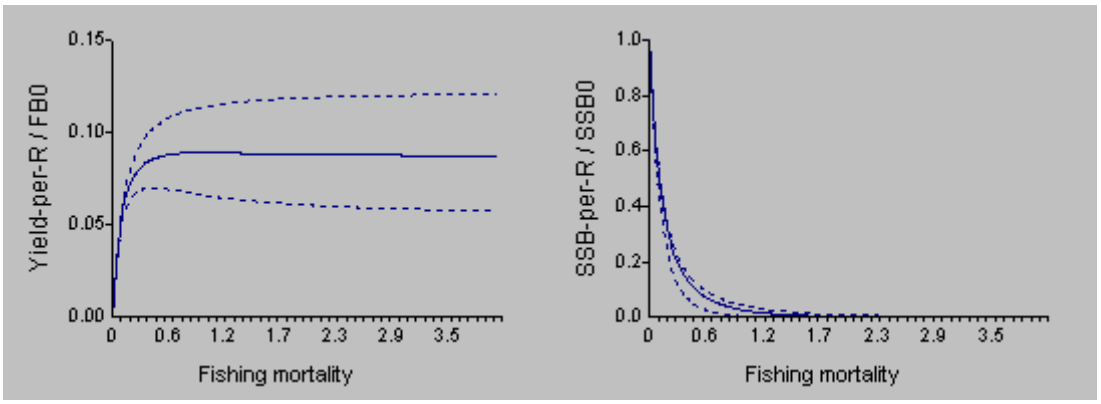
<u>All sectors</u>

YPR indicated that MSY occurs when F is around 0.9-1.1. However, SSB is reduced to less than 20% when F = 0.5. From the histograms (not shown), MSY is also achieved when F is around 1.1. To maintain SSB at 20%, however, F should be in the range 0.14-0.16.



<u>Sectors 9 and 10 (W-NW area)</u>

YPR indicated that MSY occurs when F is around 0.8. However, SSB is reduced to less than 20% when F = 0.4. From the histograms (not shown), MSY is also achieved when F is around 0.7. To maintain SSB at 20%, however, F should be in the range 0.12-0.13.



$F_{current}$ exceeded F_{SSB20} for both the pooled sample and the W-NW sector areas, although in the latter the CI are very large and unrealistic given the negative value at the lower end of the range. In summary, the L. sebae stock on the Mahe Plateau continues to be overexploited.

Table 10. Summary results of the YPR for *Lutjanus sebae*. Estimates of F required to achieve maximum yield per recruit (F_{MSYPR}) and F to maintain spawning stock biomass at 20% of unexploited biomass (F_{SSB20}).

	All sectors	**W-NW (Sectors 9, 10)**
F_{MSYPR}	1.1	0.7
F_{SSB20}	0.14-0.16	0.12-0.13
$F_{current}$ (CI)	0.37 (0.21-0.53)	0.29 (-0.55-1.128)

2.2. Other Research Activities

2.2.1. Reef fish spawning aggregations

No field studies were conducted in 2007 or 2008 to date. A paper reviewing the state of knowledge on reef fish spawning aggregations in the WIO was produced for the CORDIO coral reef status 2007 report (Robinson et al. 2007a). A paper on the dynamics of *Epinephelus fuscoguttatus* and *E. polyphekadion* aggregations at Farquhar was finally accepted for publication in Bulletin of Marine Science (Robinson et al. 2008). At the 5th WIOMSA Scientific Symposium held in Durban in October 2007, SFA gave an oral presentation on 'The *Siganus sutor* aggregation fishery in Seychelles: An example of a sustainable aggregation fishery?'

Work continued on developing a proposal for a regional project (involving SFA, KMFRI, IMS, IRD and CORDIO) and on spawning aggregation research and management. This was submitted for WIOMSA MASMA funding in August 2008 but no decision has been taken to date.

The management measures for the outer island grouper aggregation sites have been prepared as a Cabinet memorandum but still await approval. Management of the Siganus sutor aggregation trap fishery will be addressed as part of a wider co-management project for the trap fishery under the GEF-UNDP Mainstreaming Biodiversity programme, which was finally approved by GEF in 2007 and began implementation in 2008.

2.2.2. Study of the impacts of coral beaching on reef fisheries

SFA and SCMRT-MPA scientists continued their collaboration with an international team of scientists, lead by Nicholas Graham of Newcastle University, on a regional study of the impacts of coral (bleaching) mortality on reef fish communities and fisheries. Analyses relating to the impacts of coral bleaching on Seychelles reef fisheries were completed and published in 2007 (Graham et al. 2007).

A follow-on expedition of Seychelles coral reef communities was conducted with Dr. Graham's team in April 2008 using R/v L'Amitie. The expedition included studies on the impacts of protection (MPAs) on sea cucumber resources, and an evaluation of ecosystem services, their associated benefactors and management implications for the coral reef fisheries of Seychelles.

2.2.3. Fisheries sector climate change projects (for the SNC to the UNFCCC)

Seychelles Ocean Temperature Network (SOTN)
SFA has led this project to establish a national ocean temperature network which comprises national partners and international project partners. Shallow water (<20m) temperature monitoring stations using in-situ loggers have been set up across the archipelago. An online meta-database for the SOTN has been developed and is expected to be online before the end of 2008. A final project report to UNDP, who are responsible for implementing the SNC, is scheduled for November 2008.

The other project under the SNC concerns the industrial purse seine tuna fishery and is reported in Background Paper SFA01.

Socio-economic impacts of climate variability on the tuna industry
The purse seine vessel expenditure database was cleaned for use in 2007 and preliminary analyses of the relationships between economic parameters and climate indices began. In 2008, IRD supplied an economist to assist with the economic modeling and a final draft of the work will be submitted to UNDP, who are responsible for implementing the SNC, by October 15th 2008. The key findings are summarized below:

- The tuna purse seine fishery and related industries were shown to be a major influence on the Seychelles economy.
- On average, 1 SR spent by the PS fleet in P. Victoria will leads to a doubling of inflow for the economy through household, shareholder, State and private company expenditure.

- Overall, it was estimated that the purse seine fishery related industries contribute 600 Million SR to the local economy (14% of GDP; value to exports: 90-95%).
- We estimated that the severe ENSO of 1998 led to a 40% reduction in net revenue for the local economy in terms of direct, indirect and induced effects.
- In terms of expenditures and their respective activities, all are sensitive to ENSO. However, some are more influenced by inter-annual trends (related to landings, unit costs, market policies etc] while port dues, ship chandlery and agency fees are more sensitive to ENSO, although contribute relatively low amounts to the overall revenue.
- The impacts of 1998 on expenditure were above and beyond any other year, including the ENSO years of 1994, 2004 and 2007. This has implications for forecasting, because the strength of the ENSO (and possibly its duration) will likely influence the economic impacts. This is consistent with studies on the impacts of climate oscillations on stocks.
- In terms of the relationships between climate indices and expenditures, two indices (IOI, WTIO) had a strong linkage compared to the others. This has implications for forecasting and planning. In particular, the IOI is now widely accepted as a good index for tracking climate oscillations in the Indian Ocean

2.2.4. Oceanographic research

AMESD

The project 'African Monitoring of the Environment for Sustainable Development' (AMESD) is aimed at helping African Countries to improve management of their natural resources by providing them with suitable environmental information. Environmental information will be derived from state-of-the art earth observation technology. Member countries of the Indian Ocean Commission (Mauritius, Madagascar, Comoros, Reunion and Seychelles) and countries of the Mozambique Channel (Kenya, Tanzania, and Mozambique) are integrated in AMESD under the theme 'Management of Marine Resources and the Coastal Zone'. Implementation of the project will commence early 2009 and SFA was nominated as the National Partner for Seychelles. SFA will be assigned the appropriate equipment to receive and process satellite data and to produce the final products to be distributed to the end users. Satellite data will include chlorophyll-a, sea surface temperature (SST), absolute dynamic topography (ADT), geo-trophic currents, sea surface wind (SSW), significant wave height (SWH), marine meteorological forecasting and oceanographic models. From the data, operational products and services for fisheries monitoring, research and management will be developed. This will improve the access of regional managers of the marine and coastal environment to spatial ocean data through the dissemination of products and provision of services.

2.2.5. Regional sea cucumber project

This project involves 5 countries (Kenya, Tanzania, Madagascar, Réunion and Seychelles) and has a number of components. For the first component, ecology of sea cucumbers – stock assessments, Seychelles is not participating as stock assessments were

undertaken during the FAO TCP project in 2004. In terms of the second component, each country is working on the reproductive biology of one or two species. In Seychelles, the reproductive biology work started in May 2007 with sampling of *Holothuria atra* and was completed in April 2008. Riaz Aumeeruddy is still assisting with the project and is working up the reproductive data.

2.2.6. Deep water shrimp fishery development

Since the first surveys were conducted over 20 years ago, it has been known that commercially important deep water shrimps occur on the slopes of Mahe Plateau and other banks/atoll of the Seychelles archipelago, but a commercial fishery has never developed. Given the increasing local demand for a diverse range of high quality fish products, trials to assess the potential for a deep water shrimp fishery were initiated in 2007. Three surveys were conducted with an initial focus on optimisation of gear and fishing strategy. Strings of pyramidal traps, based on a design used in Mauritius and a few other countries, were set at various depths (390-700 m) around the Mahe Plateau. Catches were dominated by species of the genus *Heterocarpus* (notably *H. lepidus*), many of which were of marketable size and quality. Catch rates varied by depth and trap type (approximately 100-500 g/trap/day), with larger traps covered in material obtaining the highest rates. Now that the gears have been tested, an optimal design will be used in surveys in 2008 to determine biomass and other parameters necessary for the development of a sustainable fishery.

2.2.7. Improvement of the CAS

Under the SFA-IFREMER MOU, assistance was requested for a review of the weaknesses of the CAS. Funded by the French Embassy, Dr. Patrick Berthou of IFREMER conducted the study in October 2007 and made recommendations for improvement of the fisheries sampling systems, the vessel registration system and information system with a view to developing an integrated and flexible system linked to FINSS. ReCoMap, a regional ICZM project of 9th EDF, is funding a more detailed study scheduled for late 2008, also involving IFREMER.

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