Aldabra Marine Programme

Phase V

Report on the 2004 Aldabra Marine Programme Research

Raymond Buckley, Ben Stobart, Nigel Downing and Kristian Teleki

INDIAN OCEAN EXPLORER

Phase V

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April 2004

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AMP Mission Statement

To undertake a long term research programme of the Aldabra marine environment that supports its management and conservation, and to strengthen Aldabra's regional and global status as an exceptional location of biodiversity and natural history in the Indian Ocean

Executive Summary

The Aldabra Marine Programme's fieldwork in 2004 was restricted to two weeks in March, with a reduced team of scientists. The main purpose was to retrieve the in-water temperature data loggers deployed in 2003. However, partial fish transects using one diver, and coral video transects were conducted at most of the Aldabra sites, and at Assomption, Astove, and St. Pierre. Cosmoledo and Alphonse were also visited and surveyed for the first time by AMP. The coral transects at Aldabra reveal there has been a slight, although insignificant increase in hard coral cover since measurements were last taken in 2003. Any increase in overall coral cover was driven by the soft coral *Rhytisma.* Encrusting algal cover has decreased due to the increase in *Rhytisma.* At Assomption and Astove, there was little change in live coral cover. Recovery at St. Pierre, however, continues to be steady, and is still dominated by *Pocillopora eydouxi.* In shallow water there is evidence of considerable storm damage at St. Pierre. The partial fish transects do not allow direct comparisons with previous years' surveys, but they do reveal equivalent densities of fish and a vibrant and diverse fish community. The temperature data loggers all performed well. There was no evidence of excessively high water temperatures at any of the sites. There was no evidence of coral bleaching or mortality. Refresher training for the station ranger Marvin Aglae in fish identification and underwater fish transects was successfully competed.

In November 2004 AMP undertook a Darwin Initiative (DEFRA, UK) funded visit to the Seychelles as a pre-project assessment for a study of the Aldabra lagoon. A presentation was given at the National Education Centre. Two AMP papers were published in the Transactions of the Royal Society, and a further paper was presented at the International Coral Reef Society conference in Okinawa, Japan. A paper will appear in the proceedings.

Introduction

Aldabra Marine Programme activities in 2004

In January 2004 the Aldabra Marine Programme (AMP) presented two posters at the Royal Society "Atmosphere-ocean-ecology dynamics in the Western Indian Ocean" meeting in London. Two papers based on the posters have since been published in the Transactions of the Royal Society (Stobart et al. 2004; Downing et al. 2004). The AMP also gained funds from the Fondation d'Enterprise Total to send one team member to the International Coral Reef Society conference in Okinawa, Japan. Dr. Nigel Downing attended the conference and made a presentation of AMP work for the past five years. A paper on this work has been accepted for publication in the forthcoming proceedings.

In April 2004 two members of the AMP team returned for a short visit to Aldabra and the islands of Assomption, Astove and St. Pierre. The main objective of the expedition was to download the 40 temperature data loggers deployed in May 2003. The 2004 logger download was essential in order to assess the reliability of the new loggers deployed in May 2003, and to ensure continuous temperature data colletion up to the planned full expedition in April 2005.

At the end of July team members met in the UK to plan future research activities. During this meeting it was recognised that in order to proceed further the AMP needed a strategic plan and mission statement that would help plan research and fundraising activities in a coherent manner. Since the meeting a mission statement has been set (as displayed at the beginingof this report) and a **draft** strategic plan written and presented to Seychelles authorities for feedback.

Long term goals of the AMP include the application for Darwin funding (DEFRA, UK) to study the lagoon at Aldabra. Very few studies have been conducted inside the lagoon at Aldabra, yet information on this key ecosystem is vital for the successful management of the atoll by the Seychelles Islands Foundation. In 2004 the AMP was awarded a Darwin Pre-project grant to visit the Seychelles and gain support for a future Darwin application. The AMP visited the Seychelles between the 22nd and 28th November. During this visit a presentation was given at the National Education Center and was well attended. The AMP met with the Ministry of Environment, Seychelles Centre for Marine Research and Technology – Marine Parks Authority, the Seychelles Islands Foundation, the Islands Development Company and the British High Commissioner. All parties expressed their support for the intended Darwin funding bid.

During this visit the AMP also sought support from the relevant Seychelles authorities for the **draft** strategic plan. Initial reaction was very positive and copies were handed out for comment and input from relevant parties which is still forthcoming.

In November 2005 two new pages were added to the AMP website, one making photographs available to all those interested, and another for up-to-date news on AMP activities. Future regular updates are planned to make information on Aldabra more readily available, but these are subject to obtaining the necessary funds.

The 2004 Aldabra Marine Programme PhaseV

Phase V of the Aldabra Marine Programme took place between the 15th and 30th of March 2004. Due to timing and funding constraints this expedition was limited to two team members, and the primary objectives were to:

Download forty temperature data loggers that had been deployed at selected sites in May 2003;

Carry out repeat video transects and visual fish censuses at as many sites as possible with the limited time available;

Determine which sites would need metal stakes and lead core line changing during the planned 2005 expedition;

Re-measure juvenile corals tagged at Aldabra and St. Pierre;

Assess the suitability of Cosmoledo atoll for new permanent monitoring sites;

Refresh Seychellois ranger training at Aldabra and train two rangers in the use of temperature data logger software and logger deployment.

Location Information

All AMP sites are located in the southern Seychelles Islands Group about 200-300 nautical miles to the north of Madagascar and 300-450 miles east of Africa (Figure 1). Basic locations are provided below but more detailed descriptions of the locations can be found at www.aldabra.org.

Aldabra Atoll

Aldabra atoll (9°24'S, 46°20'E) is one of the world's largest raised coral atolls (34km long, maximum 14.5km wide, area 155km^2). It is located 1150km southwest of Mahé, Republic of Seychelles, and 426km north of Madagascar (Figures 1 and 2)

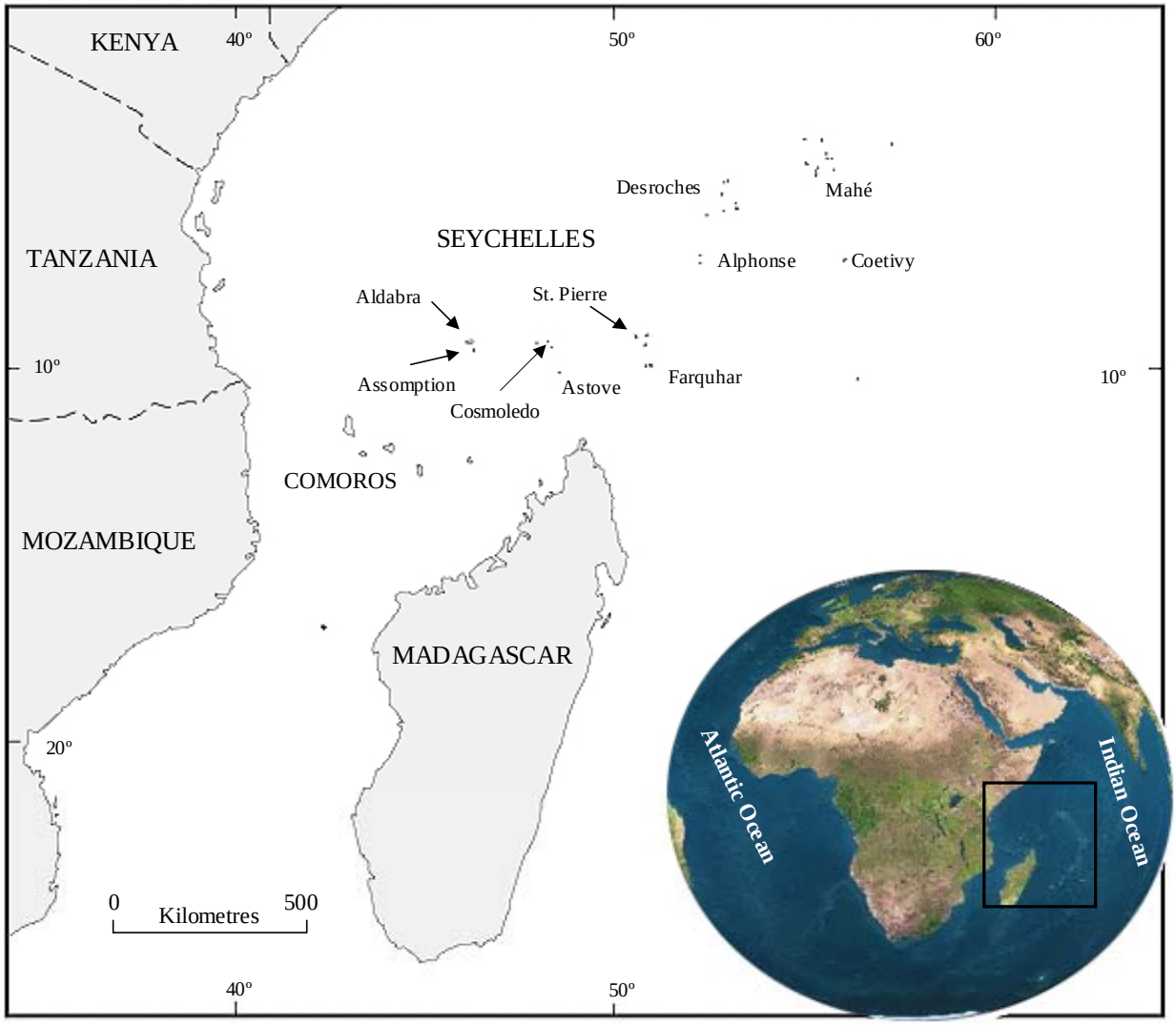


Figure 1. Location of AMP sites in the Western Indian Ocean.

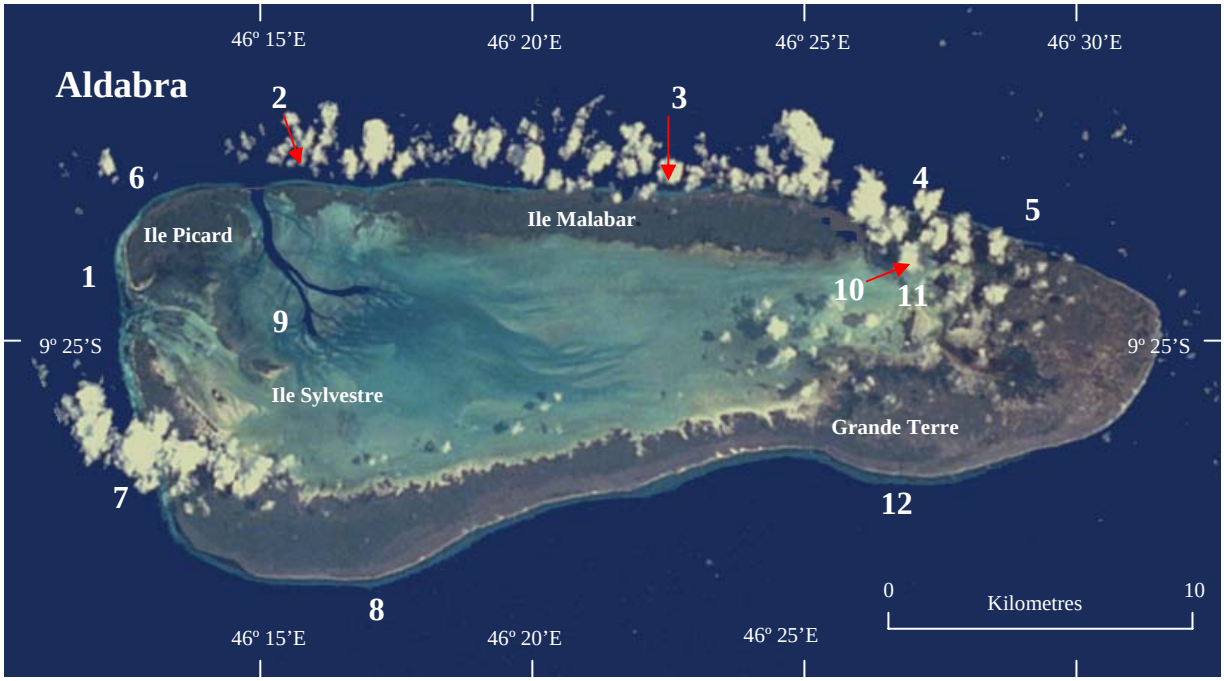


Figure 2. Aldabra atoll satellite Image with AMP monitoring sites.

Assomption, Astove, Cosmoledo and St. Pierre

Assomption, Astove, Cosmoledo and St. Pierre lie east of Aldabra (see figures 1, 3 & 4). Assomption island is situated approximately 37km south of the eastern tip of Aldabra (9°43'S, 46°31'E). Astove lies 1056km from Mahé and approximately 185km ESE of Aldabra (10°04'S, 47°44'E). Cosmoloedo lies approximately 180km east of Aldabra (09°20'S, 50°43'E).

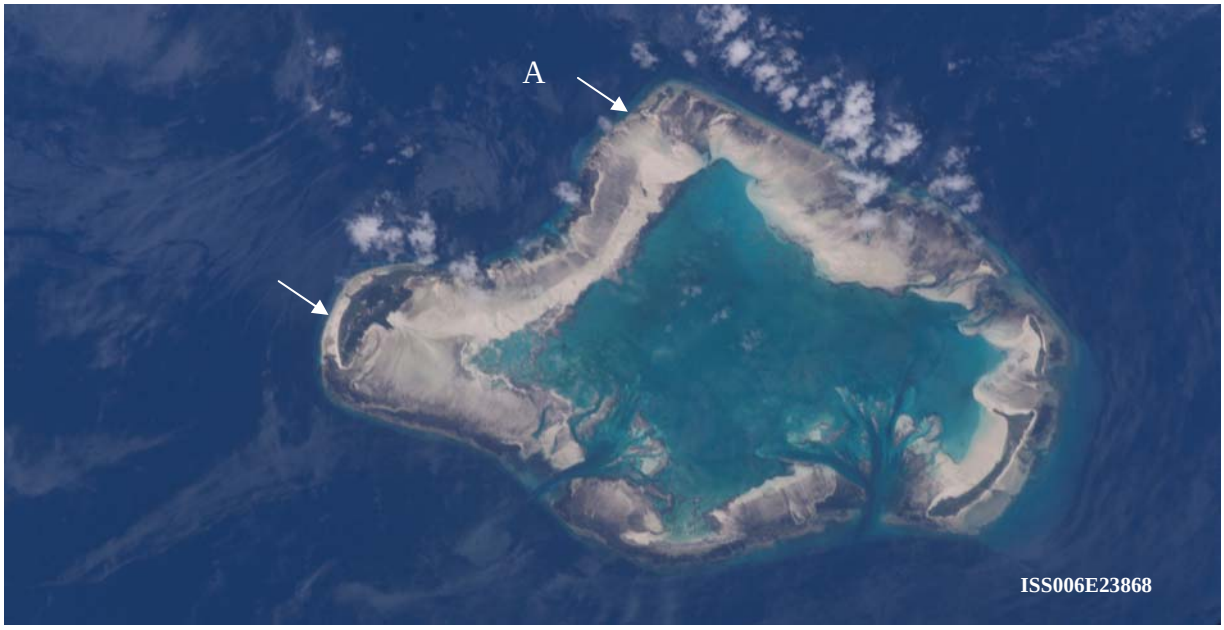
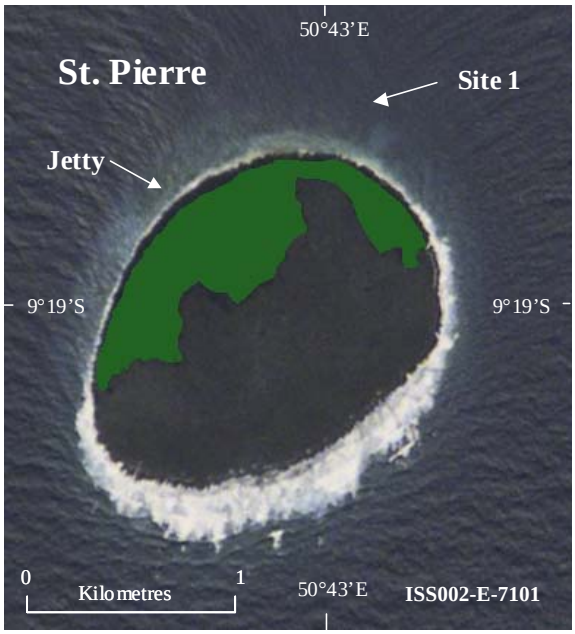


Figure 3. Satellite view of the Cosmoledo Group with sites visited by the AMP in March 2004 marked with arrows. Point A indicates fish survey site *Note: Photo courtesy of NASA, code on bottom right of image.*



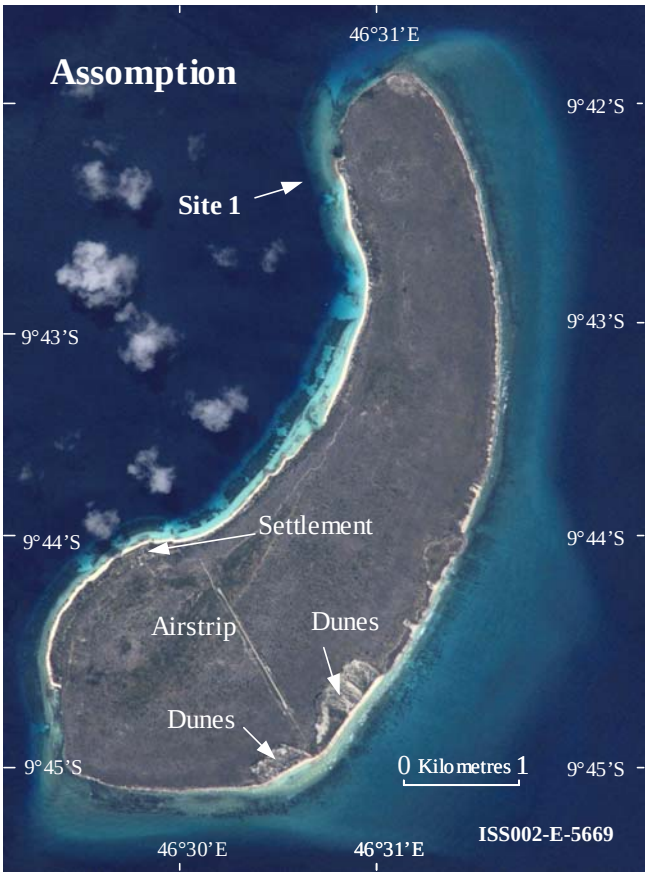


Figure 4. Astove, Assomption and St. Pierre site locations. Green zone on image of St. Pierre indicates extent of *Casuarina* forest. *Note: Photos courtesy of NASA, code on bottom right of images.*

Methodology

Coral and Fish Transects

The procedures used in the 2004 AMP survey to locate and mark permanent survey sites, and the methods used to quantify corals and fishes on the transects, replicated those used in AMP Phase I (Teleki *et al*. 1999), AMP Phase II (Stobart *et al*. 2001) and AMP Phase III (Stobart *et al.* 2002) and Phase IV (Downing *et al*. 2003). All previous AMP reports are available online at www.aldabra.org. During this 2004 expedition the visual fish censuses were only carried out by one diver, as opposed the usual two, due to time and personnel constraints. At Aldabra surveys were only conducted at AMP Sites 1, 2, 4, 6, 7 and 8. Surveys were also conducted at Assomption at Site 1, at Astove at Site 2, and at St. Pierre at Site 1. The AMP standards for fish transect procedures are for two divers to survey $100m^2$ on the 20m transect line starting at 10:00hrs, and $200m^2$ on the 10m transect line starting at 14:00hrs, for a total of $300m^2$ surveyed at each Site. Since there was only time for one survey dive at all of these sites, and only one diver to conduct the fish transects, the fish survey dives were started at opportunistic times, and surveys along the 20m and 10m depth transects were conducted consecutively. Each survey covered only $50m^2$ at each depth, by surveying a 2m wide strip along the first 25m length of each line, for a total of $100m^2$ surveyed at each site. Off-transect fish species counts were not conducted in 2004.

Fish surveys were also conducted at two new locations: Cosmoledo atoll (09º39'S, 47º34'E) on a transect line established along the 10m depth-contour at the northern point of the atoll (Figure 3); and Alphonse on 10m and 20m depth transect lines established at Huto Point. The survey at Cosmoledo covered $75m^2$ as a 2m wide strip along the first 37.5m length of the line. The fish surveys at Alphonse (06º59'S, 52º43'E) were conducted consecutively on the 20m and 10m depth transect lines, and covered $50m^2$ at each depth by surveying a 2m wide strip along the first 25m length of each line.

Temperature data loggers

AMP Phase V used the HOBO Water Temp Pro® temperature data logger as the primary recording system, and the StowAway TidbiT® temperature data logger as a back-up, to meet the objective of establishing a long-term sea temperature monitoring system at all the AMP research locations. In May 2003 these temperature loggers, both manufactured by Onset

Computer Corporation, were deployed in pairs at 10m and 20m depths at Aldabra, Assomption, Astove and St. Pierre. The HOBO Water Temp Pro® measures water temperatures ranging from 0ºC to +50ºC, with an accuracy of ±0.2ºC, and can record up to 21,580 temperature measurements at a programmable interval. The StowAway TidbiT® loggers measure water temperatures ranging from -20ºC to +50ºC, with an accuracy of ±0.8ºC, and can record up to 32,520 temperature measurements at a programmable interval. To further guard against the loss of the temperature data, as was experienced in 2001 with the flooding of the Optic StowAway Temp® data loggers, the StowAway TidbiT® loggers were deployed in waterproof plastic cases containing desiccant packs.

The temperature loggers were programmed to record data at 30-minute intervals, beginning at 18:00 hrs local time on the day of deployment. Both models were attached near the base of the 10m and 20m transect line stakes that mark the start of the transect lines. The data loggers were not placed inside protective plastic-mesh cages as was done in previous years, because tests indicated there was minimal risk of loosing loggers to damage from large fishes grazing on encrusting organisms.

HOBO Water Temp Pro® and StowAway TidbiT® (in white housing) temperature data loggers

Ranger Training

The surveys at Aldabra included refresher training for Station Ranger Marvin Aglae in the fish survey techniques provided by AMP in May 2003. This covered standard AMP fish survey protocols, and underwater identification of the butterflyfish (Chaetodontidae) and groupers (Serranidae).

Research Resources

In 1999 AMP provided the Station Library with several current reference books on identification of the coral reef fishes found at Aldabra. These books contained thousands of colour photographs of the local fish, along with their scientific (Latin) names and notes on their habitats, which assisted the rangers in accurately identifying and naming the fish found in their underwater surveys. Correct identification of the fish species, and the use of their scientific names, are the two most important aspects of reporting the results of visual underwater surveys.

In 2001 AMP provided the station laboratory with temperature data loggers together with the computer software and hardware for deploying and downloading the loggers on the outer reef and in the lagoon. A long-term and continuous record of the water temperatures at the atoll is a vital piece of information that is needed to understand an important environmental affect on the fish and corals. In 2003 AMP updated the temperature loggers and computer software and hardware at the Station Laboratory.

In 2004 AMP made a funding contribution to the National Museum of Natural History, Smithsonian Institution, to have the Atoll Research Bulletin sent to the station library. This will provide the station with current and many back issues of the Bulletin, which is an excellent reference source for the rangers to use in learning how to report on the results of their surveys. The Bulletin publishes the results of research and monitoring studies that record the status of atoll resources, and distributes the information world-wide.

Results

Coral Transects and Benthic Habitats

Live coral cover (hard and soft coral combined) at the five sites surveyed in 2004 ranged from 13% to 60% in shallow water and 19% to 55% in deep water (Figure 5), showing only a 2% and 3% increase in maxima respectively from the previous year. Results for these sites show that hard coral cover has not increased significantly from the previous year, both at the shallow and deep transects (Figure 6). The highest increase in hard coral cover occurred at Site 7 (6m depth), but was only 4% for the year. The small increase coral cover detected (hard and soft coral combined) was once again driven by the soft coral *Rhytisma* that continued to increase in cover at all sites surveyed, Site 4 being the exception where its cover remained relatively unchanged (Figure 6). In shallow water the dramatic increase in *Rhytisma* of previous years at Site 6 appears to have slowed, with only a 2% increase in the year. Other sites of note are Sites 2 and 7 with a 12% and 8% increase respectively in shallow water. In deep water the maximum increase occurred at Site 6 with a 5% increase. Other soft corals showed little change, with the exception of Site 8 where there has been a 6% decline in soft corals (other than *Rhytisma*) in deep water since February 2002 when it was last surveyed (Figure 6). The decline at Site 8 may be due to storm surge as there was considerable evidence of damage to the transect lines at the 20m depth.

Macroalgal cover has remained relatively constant at both depths since May 2003, while encrusting algae has continued to decline at all sites (Figure 7). The decline in encrusting algae is primarily due to the continuing increase in *Rhytisma*.

There has been little change in live hard coral cover at Assomption and Astove since last surveyed 10 months earlier (Figure 8). St. Pierre is notable for its steady increase in live hard coral cover over the past two years, particularly in shallow water where coral growth has been dominated by *Pocillopora eydouxi* and has increased by 18% between February 2002 and March 2004. In deep water at this site the increase has been a more modest 10% during the same period. It is noteworthy that in shallow water (10m) there was evidence of considerable storm damage to corals at St. Pierre during this survey, and many new colonies had been dislodged which may lead to a decline in coral cover during future surveys.

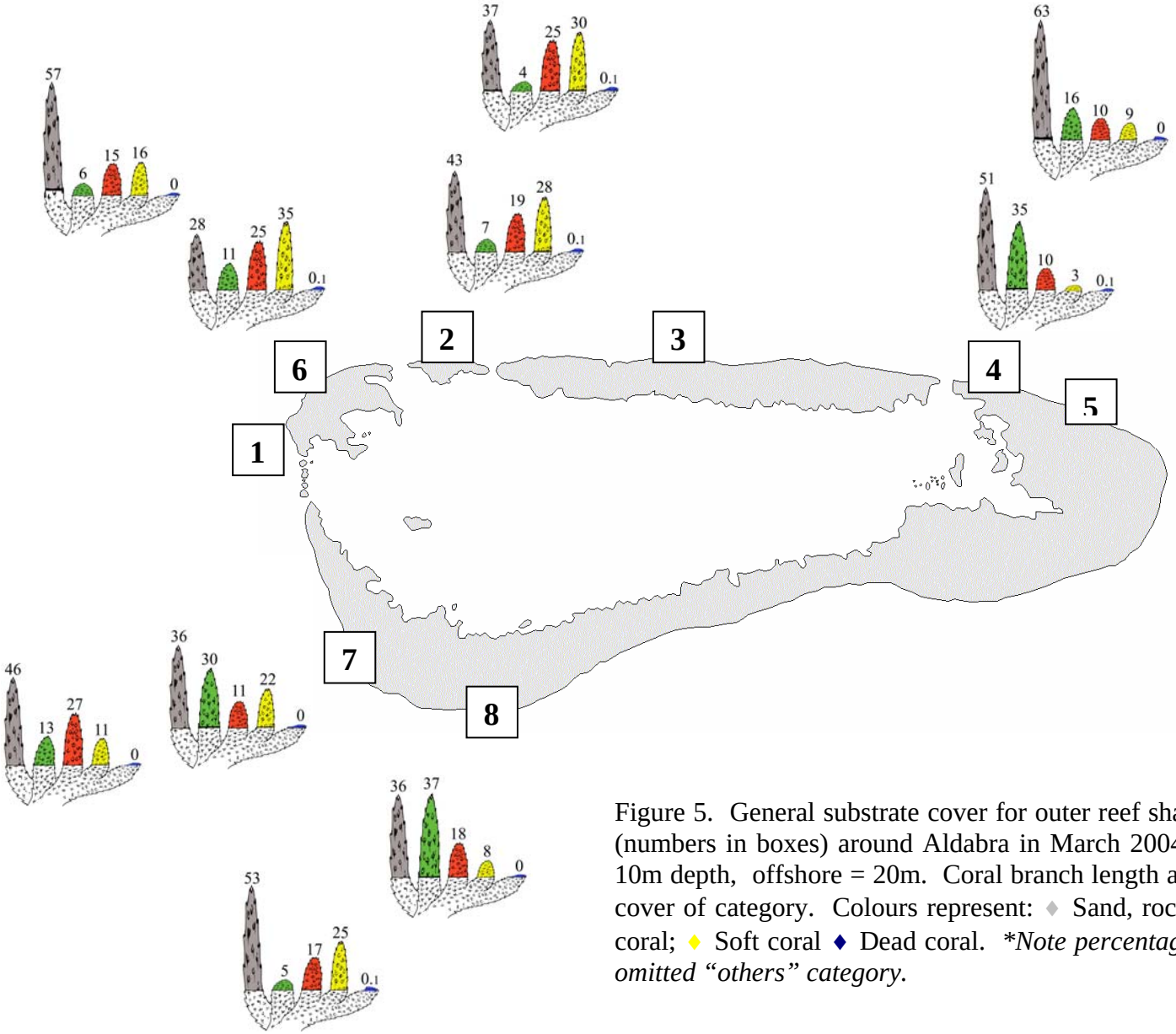


Figure 5. General substrate cover for outer reef shallow and deep transect sites (numbers in boxes) around Aldabra in March 2004. Shoreward coral graph = 10m depth, offshore = 20m. Coral branch length and numbers indicate percent cover of category. Colours represent: ♦ Sand, rock, rubble; ♦ Algae; ♦ Hard coral; ♦ Soft coral ♦ Dead coral. **Note percentages do not add to 100 due to omitted "others" category.*

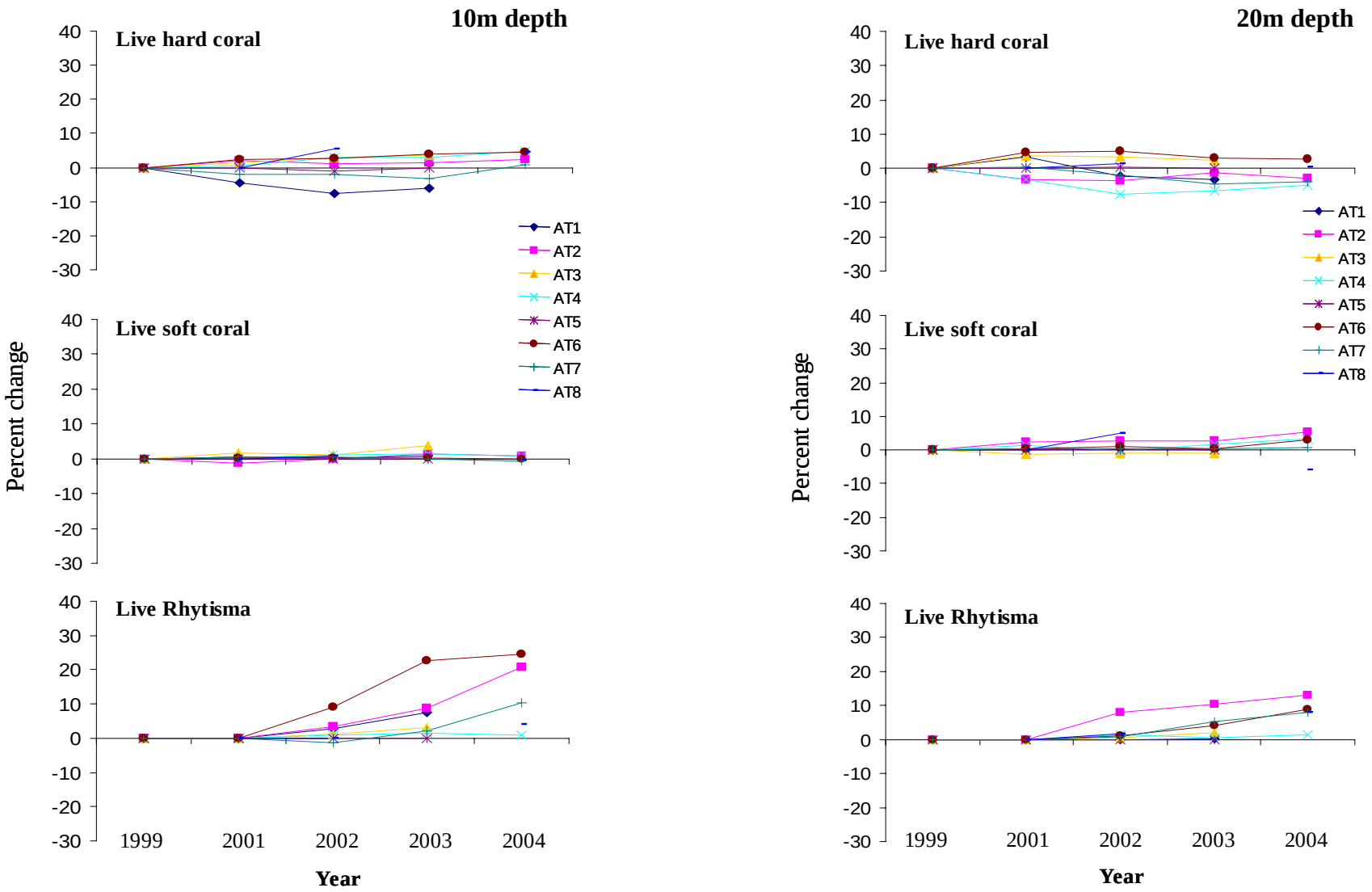


Figure 6. Percent change in coral cover at Aldabra between 1999 and 2004 in shallow (10m) and deep (20m) water. Legend shows site number by colour and symbol.

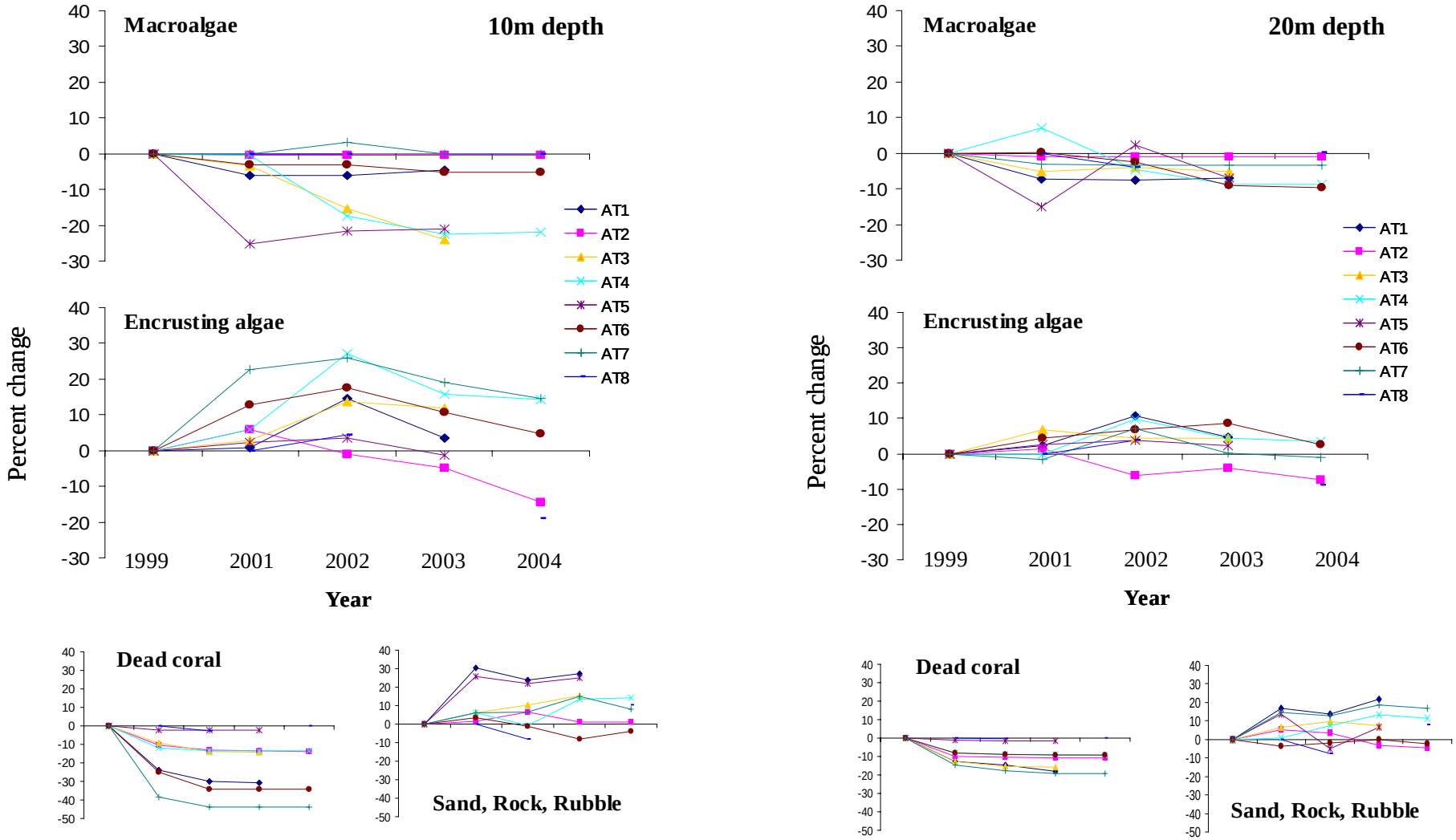


Figure 7. Percent change in algal cover, dead coral and sand, rock and rubble at Aldabra between 1999 and 2004 in shallow (10m) and deep (20m) water. Legend shows site number by colour and symbol.

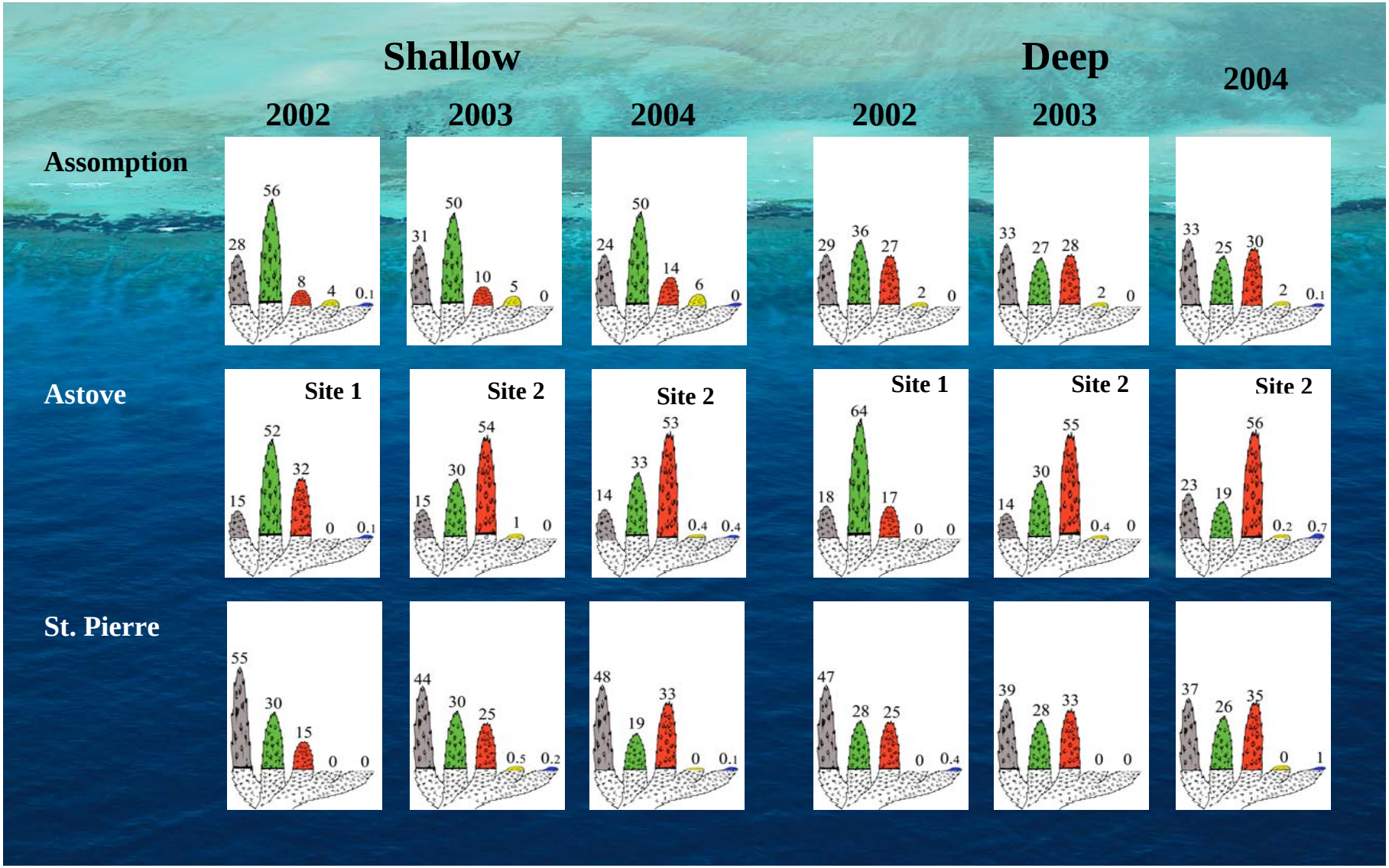


Figure 8. Calculated general substrate cover for shallow (10m) and deep (20m) sites, and pattern of fish species distribution, at Assomption, Astove and St. Pierre in February 2002, May 2003 and March 2004. Coral branch length and numbers indicate percent cover of category. Colours represent: ♦ Sand, rock, rubble: ♦ Algae: ♦ Live hard coral: ♦ Live soft coral: ♦ Dead coral. *Note site differences at Astove.*

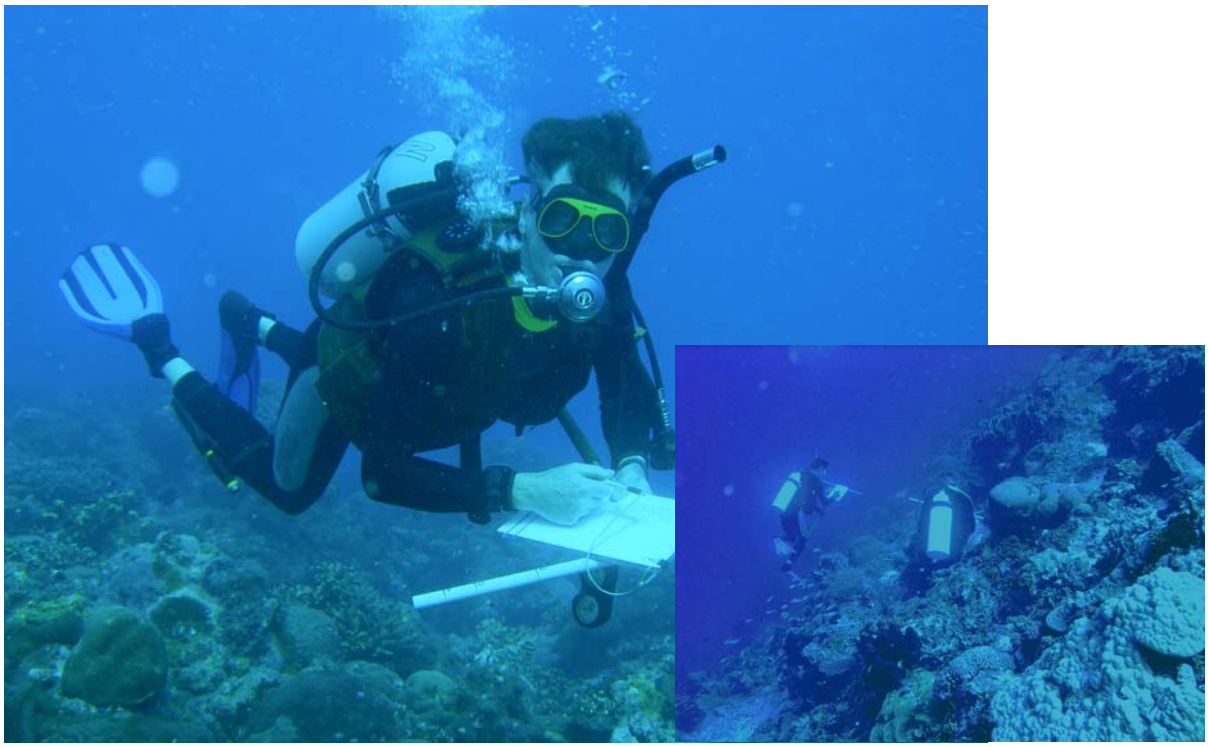
Fish Transects

Aldabra Atoll

The species and number of fish counted at Aldabra in 2004, are presented in Appendix 1 by total length (TL) size intervals of <1-10cm, >10-20cm, and >20cm, and 10m and 20m depths. A summary of is given in Table 1. The number of families and species, and the fish/100m^2, surveyed in 2004 provide a useful comparison with AMP surveys at Aldabra in previous years (Table 2). It is important to note that AMP Sites 3 and 5, which typically have the lowest counts for fish/100m^2 of all the Aldabra Sites, were not surveyed in 2004.

Table 1. Summary of the March 2004 AMP fish surveys on portions of Aldabra Sites 1, 2, 4, 6, 7 and 8.

Survey Transect Depths	**10 m (Site 7 = 5m)**				**20 m (Site 7 = 15m)**				**10m + 20m**
Total Area Surveyed	**300 sq m**				**300 sq m**				**600 sq m**
Fish Size Group (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**Total**
Number of Families	19	19	15	24	18	16	18	21	29
Number of Species	54	46	36	95	51	48	47	105	131
Fish/100m^2	506	11	12	3172	161	23	3	1128	2150



Divers counting fish.

Table 2. Summary of the AMP fish transect surveys at Aldabra in April 2004, May 2003, February 2002, February 2001 and November 1999.

	2004	**2003**	**2003**	**2002**	**2002**	**2001**	**2001**	**1999**	**1999**
	Sites[1] 1,2,4,6, 7,8	**SITES 1-7**	**SITES 1-7**	**SITES 1-8**	**SITES 1-8**	**SITES 1-8**	**SITES 1-8**	**SITES 1-7**	**SITES 1-7**
	In Trans.	**In Trans.**	**Off Trans.**	**In Trans.**	**Off Trans.**	**In Trans.**	**Off Trans.**	**In Trans.**	**Off Trans.**
Total Fish Counted	(21610)[1]	39154		71999		34901		61939	
Total Area Surveyed	600 sq m	2100m^2		2400m^2		2325m^2		2100m^2	
Fish/100m^2	3602	1864		3000		1501		2949	
Total Number of Species Identified[2]	131	183	20	179	42	191	14	165	46
Total Nº families Identified	29	34		37		45		40	
Total Nº Species Identified	131	203		221		205		211	

1] Only partial surveys were conducted at each Site. See text for qualifiers on comparisons with previous years.

2] Includes in-Transect and Off-transect surveys in 2002 and 2003. Off-transect surveys were not conducted in 2004.

Assomption, Astove and St. Pierre

The total numbers of fish counted in 2004 at Assomption, Astove and St. Pierre are presented in Appendices 2-4, respectively, by total length size intervals of <1-10cm, >10-20cm, and >20cm, and 10m and 20m depths. As noted for the Aldabra fish surveys, the 2004 survey results for Assomption, Astove and St. Pierre are not directly comparable with AMP surveys at these locations in previous years due to the different survey protocols (see Methods, Fish Transects), but do provide important data from which important comparisons can be made (Table 3 – Assomption; Table 4 – Astove; Table 5 – St. Pierre; Table 6 – year comparisons).

Table 3. Summary of the March 2004 AMP fish surveys of a portion of Assomption Site 1.

Survey Transect Depths	**10 m**				**20 m**				**10m + 20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Group (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**Total**
Number of Families	**11**	**10**	**7**	**17**	**8**	**9**	**7**	**17**	**19**
Number of Species	**24**	**14**	**9**	**41**	**17**	**14**	**10**	**37**	**57**
Fish/100m^2	**506**	**11**	**12**	**3172**	**161**	**23**	**3**	**1128**	**2150**

Table 4. Summary of the March 2004 AMP fish surveys of a portion of Astove Site 2.

Survey Transect Depths	**10 m**				**20 m**				**10m + 20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Group (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**Total**
Number of Families	9	8	10	17	9	12	3	14	19
Number of Species	20	21	14	51	19	25	6	44	69
Fish/100m2	1468	45	9	9134	1041	36	3	6480	7807

Table 5. Summary of the March 2004 AMP fish surveys of a portion of St. Pierre Site 1.

Survey Transect Depths	**10 m**				**20 m**				**10m + 20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Group (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**Total**
Number of Families	3	9	9	13	7	6	9	16	16
Number of Species	12	16	16	41	17	16	19	49	65
Fish/100m^2	1099	44	11	6924	1683	59	11	10518	8721

Table 6. Summary of the AMP fish transect surveys at Assomption, Astove and St. Pierre in March 2004, May 2003, and February 2002.

	Assomption			**Astove**			**St. Pierre**		
	Site 1[1]	**Site 1**	**Site 1**	**Site 2[1]**	**Site 2**	**Site 1**	**Site 1[1]**	**Site 1**	**Site 1**
	2004	**2003**	**2002**	**2004**	**2003**	**2002**	**2004**	**2003**	**2002**
Total Fish Counted in Transects	(2150)[1]	7291	5336	(7807)[1]	5902	6147	(8721)[1]	26146	17534
Total Transect Area Surveyed	100m^2	300m^2	300m^2	100m^2	300m^2	300m^2	100m^2	300m^2	300m^2
Fish/100m^2 in Transects	2150	2430	1779	7807	1967	2049	8721	8715	5845
Number of Species in Transects	57	88	91	69	88	83	65	110	107
Number of Families in Transects	19	25	24	19	23	21	16	24	25

1] Only partial surveys were conducted at each Site. See text for qualifiers on comparisons with previous years.
2] Includes in-Transect and Off-transect surveys in 2002 and 2003. Off-transect surveys were not conducted in 2004.

Alphonse and Cosmoledo

The total numbers of fish counted in 2004 at Alphonse and Cosmoledo are presented in Appendices 5 and 6, respectively, by total length size intervals of <1-10cm, >10-20cm, and >20cm, and by survey depths. These were the first fish surveys conducted by AMP at Alphonse (Table 7 - 10m and 20m depths) and Cosmoledo (Table 8 - 10m depth).

Table 7. Summary of the March 2004 AMP fish surveys at Alphonse.

Survey Transect Depths	**10 m**				**20 m**				**10m + 20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Group (Total Length)	<1-10cm	>10-20cm	>20cm	Total	<1-10cm	>10-20cm	>20cm	Total	Total
Total Fish Counted	556	21	36	613	515	25	26	566	1179
Number of Families	9	6	9	14	6	5	5	12	17
Number of Species	23	14	14	48	16	10	9	32	60
Fish/100m^2	185	7	12	1226	172	8	9	1132	1179

Table 8. Summary of the March 2004 AMP fish survey at Cosmoledo.

Survey Transect Depths	**10 m**			
Total Area Surveyed	**75sq m**			
Fish Size Group (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**
Total Fish Counted	426	65	89	580
Number of Families	7	11	8	14
Number of Species	16	20	13	42
Fish/100m^2	142	22	30	773

Ranger Fish Surveys

To date the surveys of butterflyfishes showed little variation in the number of fish counted and the number of species during July and August 2003, and during July to October 2004 (Figure 9). The high count (27) of fish in September 2004 may indicate an increase in abundance due to feeding or spawning, but it could also be due to tidal or other oceanographic factors at the time of the survey. This cannot be determined without the information from repeated surveys. The surveys of groupers showed little variation in the number of species noted during both July and August 2003 and July to October 2004 (Figure 10). The high counts of fish in late August 2003 (17) and 2004 (13) may be an increase in abundance during this time of year due to spawning or feeding. However, again the lack of information from repeated surveys makes it impossible to validate these increases as a true seasonal response.

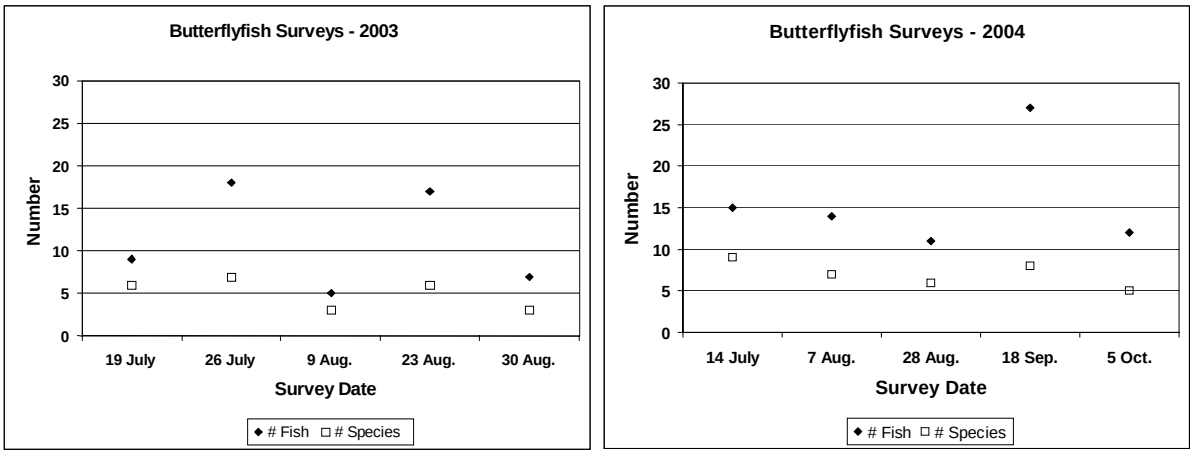


Figure 9. Number of butterflyfish, and number of butterfly fish species counted by Aldabra Rangers during July and August 2003, and during July to October 2004.

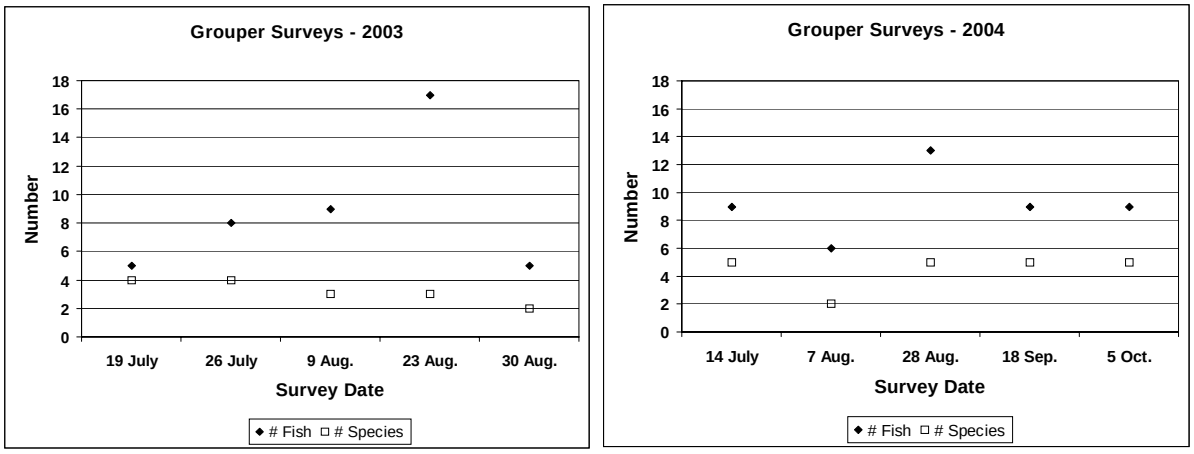


Figure 10. Number of groupers, and number of grouper species counted by Aldabra Rangers during July and August 2003, and during July to October 2004.

Temperature Data Loggers

All temperature data loggers recovered were still recording data, and were downloaded and reset successfully, with the exception of one tidbit data logger that was missing at Assomption (20m depth). Unfortunately the backup Hobo Pro logger from the same depth was lost during recovery. Temperature data for Aldabra indicates that average seawater temperatures for 10m and 20m depth are very similar most of the year, suggesting good mixing between these depths and the lack of a thermocline (Figure 11). Temperatures at both depths remain below 25ºC between July and October, and above 27ºC between December and May. A weak thermocline may be established during the cyclone season when there are periods of good weather, as suggested by the divergence in 10m and 20m depth temperatures between December and April. The cyclone season is characterised by mostly calm seas and a shift from strong southeasterly winds to sporadic and generally weak northwesterly winds, with the risk of occasional cyclones (though their passage through this area is rare). Average temperatures at both depths remained well below the estimated thermal threshold of 29.2ºC at which many coral bleach during the recording period (Hoegh-Guldberg 1999), with the exception of one or two peaks.

Temperatures did not vary much between sites at Aldabra, though fluctuations at Site 6 seem to be higher than at other sites, perhaps due to its proximity to the main channel into the lagoon (Figure 12).

Comparison of average temperatures at Aldabra with those of single sites at Assomption, Astove and St. Pierre indicates a similar seasonal variation (Figure 13). Worth highlighting are the cold water inputs at St. Pierre 20m during the cyclone season, and the consistently cooler temperatures (approximately 0.5 ºC) at Astove, particularly during the southeasterly monsoon. The cold water inputs at St. Pierre are probably caused by deep water upwelling during poor weather, a feature noted several times by AMP divers when diving on the 20m transect.

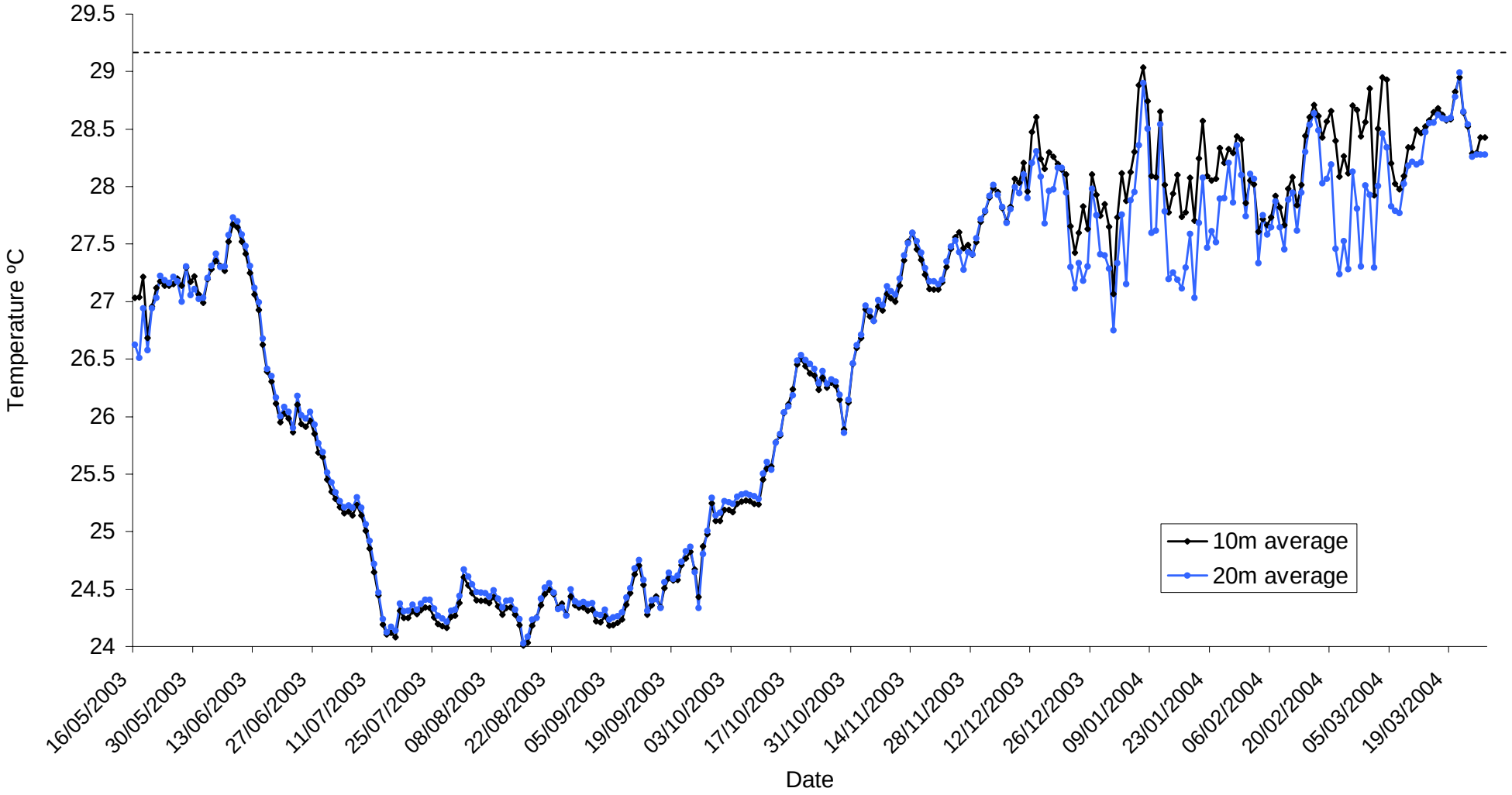


Figure 11. Average daily temperature records (n = 48 temperature readings per day) for Aldabra Sites 3, 4 and 6 at 10m and 20m depth. Legend indicates depth. Dotted line indicates estimated thermal threshold of 29.2ºC at which many corals bleach (Hoegh-Guldberg 1999).

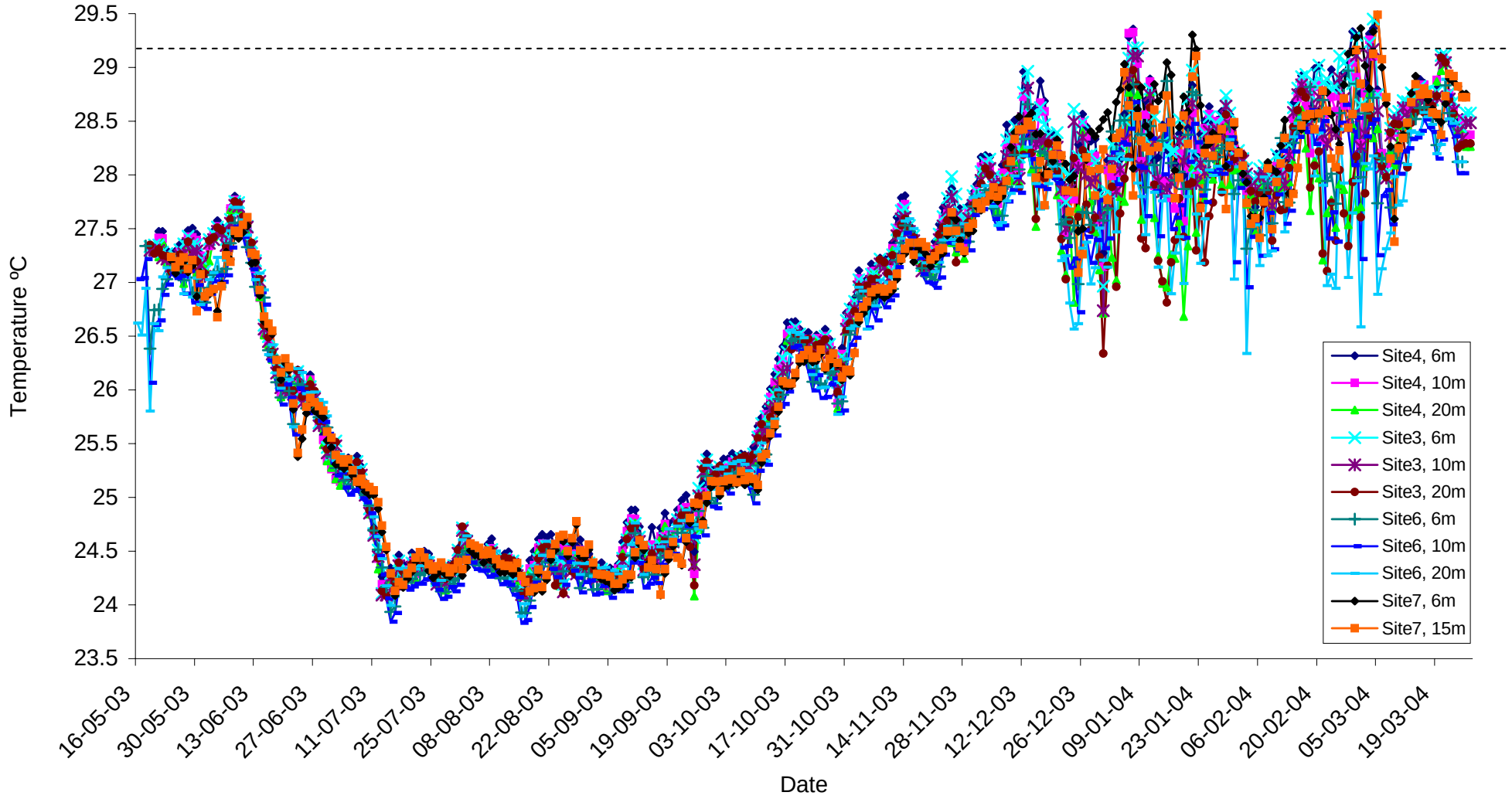


Figure 12. Daily temperature records (n = 48 temperature readings per day) for Aldabra Sites 3, 4, 6 and 7 at 6m, 10m and 20m depth. Legend indicates depth. Dotted line indicates estimated thermal threshold of 29.2ºC at which many corals bleach (Hoegh-Guldberg 1999).

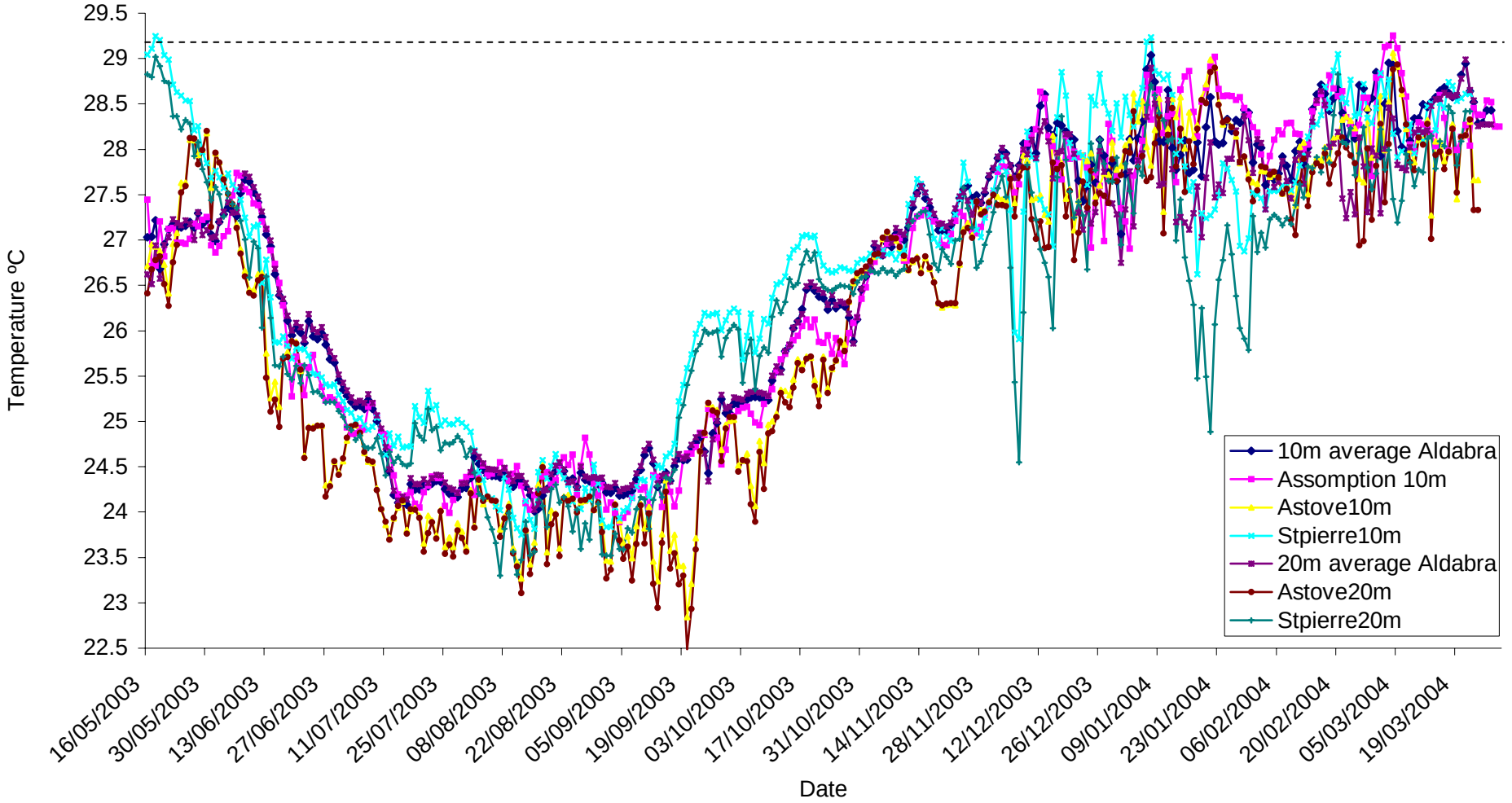


Figure 13. Comparison of averaged daily temperature records for Aldabra sites 3, 4, 6 and 7 at 6m, 10m and 20m depth (n = 48 temperature readings per day and site) with those of single sites at Assomption, Astove and St. Pierre (n = 48 temperature readings per day and site). Legend indicates depth. Dotted line indicates estimated thermal threshold of 29.2ºC at which many corals bleach (Hoegh-Guldberg 1999).

Discussion

Coral Community

There has been little change in hard coral cover between May 2003 and March 2004 at all of the sites surveyed. The only exception is the shallow site at St. Pierre that continues to show a steady increase in hard coral cover from year to year, and in 2004 it had increased further in spite of evident storm damage. At Aldabra the soft coral *Rhytisma* continues to increase its cover and range, most noticeably at sites 2 and 7 (as opposed to Site 6 in 2003).

Evidence of coral recovery at Aldabra and nearby islands remains scarce, in spite of indications that recruitment was healthy in previous years. The continuing high incidence of *Rhytisma* may be hindering hard coral recovery at several sites, but other sites in which it is scarce have also failed to recover. Future AMP expeditions will search for possible factors that are limiting the recovery of reefs in this region.

Fish Communities

The quantified fish surveys at Aldabra, Assomption, Astove and St. Pierre in 2004 cannot be used for direct between-year comparisons with previous AMP surveys, because they included only 33% of the standard area surveyed at each survey Site ($100m^2$ vs $300m^2$). Also, the surveys were not conducted at the standard survey times for each depth. While the number of families and species, and the fish/$100m^2$, from the 2004 surveys can be used for comparisons with previous years, these comparisons could be misleading. For example, at Aldabra Sites 3 and 5, which typically have the lowest counts for fish/$100m^2$ of all the Aldabra sites, were not surveyed in 2004. The elimination of these low-count sites may have artificially inflated the fish/$100m^2$ totals, and may have reduced the family and species totals. Another source of comparison-errors could be that the (25m) portions of the transects lines surveyed at the 10m and 20m depths at Aldabra, Assomption, Astove and St. Pierre in 2004 included, or lacked, habitat that attracted higher densities of fishes, compared to the remaining portions of the transect lines that are covered in standard AMP surveys.

Recognizing these potential qualifiers on comparisons between years, it appears that at Aldabra the 2004 surveys (Table 2) found a total density of fishes (3602 fish/$100m^2$) that was at least at the same level as the high densities found in the AMP surveys in 2002 (3000 fish/$100m^2$) and

1999 (2949 fish/100m^2). The true density of fishes at Aldabra in 2004 may have even been the highest recorded in AMP surveys as the number of species recorded (131) in the partial transects in 2004 was lower than in complete transects in any previous surveys (range of 165-191 species in 1999-2003; Table 2). The densities of fishes found at Assomption (2150 fish/100m^2) and at St. Pierre (8721 fish/100m^2) in the partial surveys in 2004 were remarkably similar to the densities found in the complete surveys at these locations in 2003 (2430 and 8715 fish/100m^2 , respectively, Table 6). In contrast, the density of fishes found at Site 2 at Astove (7807 fish/100m^2) in the partial surveys in 2004, was almost four times greater than the density in the 2003 survey at this Site (Table 6). This increase resulted from an unusually high abundance of the pomacentrid, *Lepidozygus tapeinosoma*, which accounted for 77% of the fish surveyed at Astove in 2004 (Appendix 4). It is interesting that the partial transect surveys at Astove in 2004 also found three species that were new to AMP surveys at this location, *Myripristis kuntee* (Holocentridae), *Abudefduf sparoides* (Pomacentridae) and *Cantherinus dumerilii* (Tetraodontidae).

Ranger Fish Surveys

One of the primary goals of AMP is to increase scientific information about the marine environment at Aldabra Atoll by providing training for Aldabra Station rangers to conduct marine surveys on the outer reef and in the lagoon. AMP surveys are conducted only during one month each year and these surveys cannot capture vital information on the natural annual cycles in the marine environment at the atoll. Also the AMP surveys cannot monitor all of the important biological and oceanographic processes in the marine system that need to be considered for conservation of Aldabra's resources. The rangers stationed on Aldabra are in a unique position to conduct this monitoring research after having had training in the proper scientific survey techniques.

AMP has informed the Rangers of the need to follow the fish survey protocols designed to provide information on the environmental factors (season, time-of-day, tide stage, etc) that cause natural variation in fish counts. This information is vital to increase the value of the fish surveys at Aldabra. AMP will conduct a refresher training course in survey techniques and fish identification in April 2005.The ranger training provided by AMP also includes assisting the rangers in analysing the information from their surveys, and preparing manuscripts on the survey for the rangers to publish in scientific journals as contributions from Aldabra Station.

Temperature Data Loggers

In 2004 the AMP retrieved data from the substantial network of loggers deployed in May 2003. The new loggers proved reliable and should provide valuable in situ data for the coming years. Most notable for the period retrieved was the lack of any excessively high temperatures that could have caused coral bleaching, and not surprisingly there was no evidence of coral bleaching or mortality.

Publications in 2004

During 2004 the AMP published three refereed papers:

- Downing, N., Stobart, B., Buckley, R., and Teleki, K. (2004). Recovery of coral and fish following the 1998 El Niño event at Aldabra Atoll, southern Seychelles: a site with minimal anthropogenic influence. 10th International Coral Reef Symposium, Okinawa (in press).
- Stobart, B., Teleki, K., Buckley, B., Downing, N., and Callow, M. (2004). Coral recovery at Aldabra Atoll, Seychelles: five years after the 1998 bleaching event. Phil Trans R Soc Lond. A **363**, 1-5.
- Downing, N., Buckley, R., Stobart, B., LeClair, L., and Teleki, K. (2004). Fish community structure at Aldabra Atoll, Seychelles: five years after the 1998 bleaching event. Phil Trans R Soc Lond. A **363**, 6-10.

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Underwater observations are difficult to record at the best of times. This has proved to be much easier with the use of ICI Imagedata's 'permanent paper' (2EP169). We would like to thank ICI Imagedata, and particularly Godfrey Moore, who kindly arranged for this to be donated to AMP.

We thank Onset Computer Corporation for their cooperation and support in resolving the problems associated with establishing the critical long-term water temperature monitoring system at AMP research locations.

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Appendices

Appendix 1. Number of fish counted at Aldabra, by transect depths and fish size groups, during the AMP surveys in March 2004 (Sites 1,2,4,6,7,8)

Survey Transect Depths	**10m (Site 7 = 5m)**				**20m (Site 7 = 15m)**				**10m+20m**
Total Area Surveyed	**300 sq m**				**300 sq m**				**600 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
MURAENIDAE									
Gymnothorax breedeni			1	1					1
SYNODONTIDAE									
Synodus variegatus	1	2		3					3
HOLOCENTRIDAE									
Myripristis adusta							1	1	1
Myripristis berndti	10		37	47	1	38	86	125	172
Sargocentron caudimaculatum	1	3	6	10			7	7	17
SERRANIDAE									
Aethaloperca rogaa							1	1	1
Cephalopholis argus							4	4	4
Cephalopholis leopardus		2	1	3			1	1	4
Cephalopholis miniata			11	11			9	9	20
Cephalopholis nigripinnis		13	7	20		4	7	11	31
Epinephelus fasciatus							1	1	1
Epinephelus spilotoceps			1	1					1
Epinephelus tukula							1	1	1
Gracilia albomarginata			5	5			4	4	9
Variola louti			1	1			4	4	5
Nemanthias carberryi	3700			3700	2940			2940	6640
Pseudanthias evansi					643	4		647	647
Pseudanthias squamipinnis	428			428	396			396	824
APOGONIDAE									
Apogon apogonoides	2800			2800	302	5		307	3107
Apogon nigrofasciatus					1			1	1
Cheilodipterus artus						1		1	1
LUTJANIDAE									
Aphareus furca		4	3	7			3	3	10
Lutjanus bengalensis	15			15	80			80	95
Lutjanus bohar			6	6		3	3	6	12

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Survey Transect Depths	**10m (Site 7 = 5m)**				**20m (Site 7 = 15m)**				**10m+20m**
Total Area Surveyed	**300 sq m**				**300 sq m**				**600 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
Lutjanus fulvus			3	3					3
Lutjanus kasmira							300	300	300
Malcolor niger							1	1	1
CAESIONIDAE									
Caesio xanthonota							100	100	100
Pterocaesio tile					100		1000	1100	1100
MULLIDAE									
Parupeneus barberinus		3		3					3
Parupeneus bifasciatus							4	4	4
Parupeneus cyclostomus	1	1	3	5	1		1	2	7
Parupeneus macronema	15	13		28	12	29		41	69
PEMPHERIDAE									
Pempheris vanicolensis					1	2		3	3
CHAETODONTIDAE									
Chaetodon auriga		3		3		3		3	6
Chaetodon falcula		3		3		2		2	5
Chaetodon guttatissimus	4			4	4	1		5	9
Chaetodon kleinii		2		2		4		4	6
Chaetodon lineolatus			1	1					1
Chaetodon lunula						2		2	2
Chaetodon meyeri		2		2					2
Chaetodon trifasciatus	2	5		7					7
Forcipiger flavissimus	1	4		5	1			1	6
Hemitaurichthys zoster	17			17	9	23		32	49
Heniochus acuminatus						2		2	2
Heniochus diphreutes							1	1	1
LETHRINIDAE									
Gnathodentex aureolineatus	30			30					30
Lethrinus nebulosus									
Monotaxis grandoculis		2	1	3	3	5	2	10	13
EPHIPPIDAE									
Platax orbicularis		3	2	5			1	1	6

Appendix 1. Number of fish counted at Aldabra, by transect depths and fish size groups, during the AMP surveys in March 2004 (Sites 1,2,4,6,7,8)

Survey Transect Depths	**10m (Site 7 = 5m)**				**20m (Site 7 = 15m)**				**10m+20m**
Total Area Surveyed	**300 sq m**				**300 sq m**				**600 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
POMACANTHIDAE									
Apolemichthys trimaculatus						3		3	3
Centropyge multispinis	45	1		46	15	2		17	63
Pomacanthus imperator		1	1	2		1	3	4	6
Pygoplites diacanthus			1	1		1		1	2
Centropyge bispinosa	1			1					1
POMACENTRIDAE									
Chromis dimidiata	365			365	332			332	697
Chromis lepidolepis									
Chromis nigrura	328			328	80			80	408
Chromis ternatensis	21			21		7		7	28
Chromis weberi	10	12		22	6	20		26	48
Dascyllus carneus					13			13	13
Dascyllus trimaculatus					8			8	8
Lepidozygus tapeinosoma	5210			5210	640			640	5850
Plectroglyphidodon dickii	6			6					6
Plectroglyphidodon johnstonianus	9			9	1			1	10
Plectroglyphidodon lacrymatus	20			20					20
Pomacentrus caeruleus	18			18	2			2	20
Chromis xutha					12			12	12
LABRIDAE									
Anampses lineatus					2			2	2
Anampses meleagrides		6		6		2		2	8
Bodianus axillaris	1	3		4		1		1	5
Bodianus diana	1	4	1	6	5	9	3	17	23
Cirrhilabrus exquisitus	22			22	51			51	73
Coris cuvieri					1			1	1
Coris formosa					1	2		3	3
Gomphosus caeruleus	6	6		12	1	3		4	16
Halichoeres cosmetus	16	11		27	2	10		12	39
Halichoeres hortulanus		3	3	6		10	3	13	19
Hemigymnus fasciatus							1	1	1
Labroides bicolor					2	3		5	5
Labroides dimidiatus	36			36	53			53	89
Labropsis xanthonata		1		1	1	2		3	4
Macropharyngodon bipartitus					6			6	6
Pseudocheilinus evanidus	12			12	22			22	34

Appendix 1. Number of fish counted at Aldabra, by transect depths and fish size groups, during the AMP surveys in March 2004 (Sites 1,2,4,6,7,8)

Survey Transect Depths	**10m (Site 7 = 5m)**				**20m (Site 7 = 15m)**				**10m+20m**
Total Area Surveyed	**300 sq m**				**300 sq m**				**600 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
Pseudocheilinus hexataenia	51			51	12			12	63
Pseudocheilinus octotaenia		1		1		1		1	2
Pseudodax moluccanus		1	3	4	1	1	2	4	8
Thalassoma amblycephalum	18	1		19		1	1	2	21
Thalassoma hebraicum	1	19	6	26		13	3	16	42
Thalassoma janseni		12		12					12
Thalassoma lunare		6		6	1	9	1	11	17
Cheilinus fasciatus			1	1					1
Oxycheilinus digrammus			2	2					2
Bodianus anthioides							1	1	1
Stethojulis albovittata	4	4		8	1			1	9
CIRRHITIDAE									
Cirrhitichthys oxycephalus	7			7	4			4	11
Amblycirrhites bimaculata	1			1					1
Paracirrhites arcatus	4	1		5					5
Paracirrhites forsteri	2	2		4	3	2		5	9
SCARIDAE									
Scarus sordidus	2	10	8	20		5	3	8	28
Scarus rubroviolaceus			5	5					5
Scarus strongylocephalus			3	3					3
CARANGIDAE									
Caranx melampygus			1	1			9	9	10
BLENNIIDAE									
Ecsenius midas	1	2		3					3
Plagiotremus tapeinosoma	12			12	5			5	17
Cirripectes auritus	3			3					3
GOBIIDAE									
Gunnellichthys curiosus	12	1		13	4			4	17
ACANTHURIDAE									
Acanthurus leucocheilus							1	1	1
Acanthurus leucosternon	6	26		32	3	2		5	37
Acanthurus thompsoni		4		4	14	29	23	66	70
Ctenochaetus striatus	8	6		14		4	1	5	19

Appendix 1. Number of fish counted at Aldabra, by transect depths and fish size groups, during the AMP surveys in March 2004 (Sites 1,2,4,6,7,8)

Survey Transect Depths	**10m (Site 7 = 5m)**				**20m (Site 7 = 15m)**				**10m+20m**
Total Area Surveyed	**300 sq m**				**300 sq m**				**600 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
Ctenochaetus truncatus	46	44		90	1	25		26	116
Naso brevirostris			22	22			4	4	26
Naso lituratus			1	1					1
Zebrasoma scopas	8			8	5	4		9	17
Acanthurus nigricauda			1	1			1	1	2
Acanthurus tennenti	1			1			3	3	4
Naso vlamingii							1	1	1
Zebrasoma desjardinii			1	1					1
Acanthurus nigrofuscus		1	1	2					2
ZANCLIDAE									
Zanclus cornutus		1		1		2		2	3
BALISTIDAE									
Balistapus undulatus	1			1		2		2	3
Balistoides viridescens							1	1	1
Melichthys indicus	1	4	18	23		1	14	15	38
Odonus niger		1	6	7					7
Sufflamen bursa						1		1	1
Sufflamen chrysopterus					1	1		2	2
OSTRACIIDAE									
Ostracion meleagris	1			1					1
TETRAODONTIDAE									
Arothron meleagris							2	2	2
SIGANIDAE									
Siganus stellatus			2	2			2	2	4
PRIACANTHIDAE									
Priacanthus hamrur							1	1	1
KYPHOSIDAE									
Kyphosus cinerascens							75	75	75
MICRODESMIDAE									
Nemateleotris magnifica	8			8	11			11	19

Appendix 1. Number of fish counted at Aldabra, by transect depths and fish size groups, during the AMP surveys in March 2004 (Sites 1,2,4,6,7,8)

Survey Transect Depths	**10m (Site 7 = 5m)**				**20m (Site 7 = 15m)**				**10m+20m**
Total Area Surveyed	**300 sq m**				**300 sq m**				**600 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
Total Fish Counted	**13350**	**260**	**176**	**13786**	**5816**	**307**	**1701**	**7824**	**21610**
Number of Families	**19**	**19**	**15**	**24**	**18**	**16**	**18**	**21**	**29**
Number of Species	**54**	**46**	**36**	**95**	**51**	**48**	**47**	**105**	**131**
Fish/100m^2	**4450**	**87**	**59**	**4595**	**1939**	**102**	**567**	**2608**	**3602**

Appendix 2. Number of fish counted at Assomption, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
HOLOCENTRIDAE									
Myripristis berndti			24	24		28		28	52
Sargocentron caudimaculatum		1		1					1
SERRANIDAE									
Cephalopholis argus							1	1	1
Cephalopholis miniata							1	1	1
Gracilia albomarginata			1	1			1	1	2
Variola louti							1	1	1
Pseudanthias evansi					80			80	80
Pseudanthias squamipinnis	120			120	130			130	250
Cephalopholis nigripinnis			2	2					2
LUTJANIDAE									
Aphareus furca							1	1	1
Lutjanus bohar			1	1					1
MULLIDAE									
Parupeneus barbarensis		3		3					3
Parupeneus macronema	3			3		1		1	4
PEMPHERIDAE									
Pempheris vanicolensis					1	2		3	3
CHAETODONTIDAE									
Chaetodon falcula		1		1					1
Chaetodon lunula						2		2	2

Appendix 2. Number of fish counted at Assomption, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
Forcipiger flavissimus					1			1	1
Hemitaurichthys zoster	2			2	2	3		5	7
LETHRINIDAE									
Monotaxis grandoculis		1		1					1
POMACANTHIDAE									
Pomacanthus imperator							1	1	1
Pygoplites diacanthus			1	1		1		1	2
Centropyge bispinosa	1			1					1
POMACENTRIDAE									
Chromis dimidiata	180			180	120			120	300
Chromis nigrura	30			30	10			10	40
Chromis ternatensis	31			31					31
Chromis weberi					5			5	5
Lepidozygus tapeinosoma	1100			1100	110			110	1210
Plectroglyphidodon johnstonianus	2			2					2
Plectroglyphidodon lacrymatus	5			5					5
Chromis xutha					6			6	6
LABRIDAE									
Anampses meleagrides		5		5					5
Bodianus diana	1	4		5		3		3	8
Halichoeres cosmetus	1			1		1		1	2
Halichoeres hortulanus						1	1	2	2
Labroides bicolor					2			2	2
Labroides dimidiatus	5			5	2			2	7
Pseudocheilinus evanidus	10			10					10
Pseudocheilinus hexataenia	17			17	3			3	20
Pseudodax moluccanus			2	2	1	1		2	4
Thalassoma amblycephalum	1			1					1
Thalassoma hebraicum		3		3					3
Thalassoma lunare		1		1					1
Oxycheilinus diagrammus			2	2					2
CIRRHITIDAE									
Amblycirrhites bimaculata	1			1					1
Paracirrhites forsteri	1			1	1			1	2

Appendix 2. Number of fish counted at Assomption, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
SCARIDAE									
Scarus sordidus		2	1	3		1		1	4
GOBIIDAE									
Gunnellichthys curiosus		1		1	2			2	3
ACANTHURIDAE									
Acanthurus leucosternon	1	1		2					2
Acanthurus thompsoni						22		22	22
Ctenochaetus truncatus	2	6		8		3		3	11
Zebrasoma scopas	1			1					1
Acanthurus tennenti							1	1	1
ZANCLIDAE									
Zanclus cornutus		1		1		1		1	2
BALISTIDAE									
Melichthys indicus	1	2	1	4			1	1	5
OSTRACIIDAE									
Ostracion meleagris	1			1					1
PRIACANTHIDAE									
Priacanthus hamrur							1	1	1
MICRODESMIDAE									
Nemateleotris magnifica	2			2	8			8	10
Total Fish Counted	**1519**	**32**	**35**	**1586**	**484**	**70**	**10**	**564**	**2150**
Number of Families	**11**	**10**	**7**	**17**	**8**	**9**	**7**	**17**	**19**
Number of Species	**24**	**14**	**9**	**41**	**17**	**14**	**10**	**37**	**57**
Fish/100m^2	**506**	**11**	**12**	**3172**	**161**	**23**	**3**	**1128**	**2150**

Appendix 3. Number of fish counted at Astove, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/***Genus species***									
SYNODONTIDAE									
Saurida gracilis		2		2					2
HOLOCENTRIDAE									
Myripristis berndti		35		35		9	1	10	45
Myripristis vittata						31		31	31
Neoniphon sammara		5		5					5
Sargocentron caudimaculatum			1	1			1	1	2
Myripristis kuntee		7		7					7
SERRANIDAE									
Cephalopholis argus							1	1	1
Cephalopholis leopardus			1	1					1
Cephalopholis miniata			1	1			2	2	3
Epinephelus tukula			3	3			3	3	6
Pseudanthias evansi					60	7		67	67
Pseudanthias squamipinnis	500			500	161			161	661
Cephalopholis nigripinnis						4		4	4
LUTJANIDAE									
Aphareus furca			1	1					1
Lutjanus bohar			1	1					1
Lutjanus monostigma			6	6					6
PEMPHERIDAE									
Pempheris vanicolensis						3		3	3
CHAETODONTIDAE									
Chaetodon auriga		2		2					2
Chaetodon bennetti		1		1					1
Chaetodon guttatissimus	2			2	4			4	6
Chaetodon lunula		2		2		1		1	3
Chaetodon meyeri		1		1		1		1	2
Chaetodon trifasciatus		2		2		2		2	4
Forcipiger flavissimus						1		1	1
LETHRINIDAE									
Monotaxis grandoculis			1	1					1

Appendix 3. Number of fish counted at Astove, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/***Genus species***									
POMACANTHIDAE									
Pygoplites diacanthus			2	2		1		1	3
Centropyge bispinosa					4			4	4
POMACENTRIDAE									
Chromis dimidiata	150			150	300			300	450
Chromis nigrura	130			130					130
Chromis ternatensis	75			75					75
Chromis weberi						1		1	1
Dascyllus trimaculatus	1			1					1
Lepidozygus tapeinosoma	3500			3500	2550			2550	6050
Plectroglyphidodon dickii	2			2					2
Plectroglyphidodon johnstonianus	1			1					1
Abedefduf sparoides		4		4					4
Abudefduf sexfasciatus		40		40					40
LABRIDAE									
Bodianus axillaris						2		2	2
Bodianus diana		1		1		3		3	4
Gomphosus caeruleus	3	1		4		1		1	5
Halichoeres cosmetus	1			1		1		1	2
Halichoeres hortulanus		2		2		1		1	3
Labroides bicolor						1		1	1
Labroides dimidiatus	8			8	3			3	11
Labrobsis xanthonata					1			1	1
Pseudocheilinus evanidus	5			5	11			11	16
Pseudocheilinus hexataenia	16			16	6			6	22
Pseudocheilinus octotaenia	1			1					1
Pseudodax molucanus		2		2					2
Bodianus anthioides						2		2	2
CIRRHITIDAE									
Cirrhitichthys oxycephalus					2			2	2
Paracirrhites arcatus	1			1					1
Paracirrhites forsteri					3	1		4	4
SCARIDAE									
Scarus sordidus	1	5		6		2	1	3	9
Cetoscarus bicolor			1	1					1

Appendix 3. Number of fish counted at Astove, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/***Genus species***									
CARANGIDAE									
Caranx melampygus			4	4					4
BLENNIIDAE									
Plagiotremus rhinorhynchos					1			1	1
Plagiotremus tapeinosoma	1			1	1			1	2
ACANTHURIDAE									
Acanthurus leucosternon					1	2		3	3
Acanthurus thompsoni		10		10	1	28		29	39
Ctenochaetus truncatus	1	9		10	7			7	17
Naso brevirostris			1	1					1
Zebrasoma scopas		3		3	2			2	5
ZANCLIDAE									
Zanclus cornutus						2		2	2
BALISTIDAE									
Balistapus undulatus		1		1					1
Melichthys indicus		1	3	4		1		1	5
Sufflamen bursa						1		1	1
TETRAODONTIDAE									
Cantherinus dumerilii			2	2					2
MICRODESMIDAE									
Nemateleotris magnifica	4			4	4			4	8
Total Fish Counted	**4403**	**136**	**28**	**4567**	**3122**	**109**	**9**	**3240**	**7807**
Number of Families	**9**	**8**	**10**	**17**	**9**	**12**	**3**	**14**	**19**
Number of Species	**20**	**21**	**14**	**51**	**19**	**25**	**6**	**44**	**69**
Fish/100m2	**1468**	**45**	**9**	**9134**	**1041**	**36**	**3**	**6480**	**7807**

Appendix 4. Number of fish counted at St. Pierre, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10 m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
MURAENIDAE									
Gymnothorax flavimarginatus							1	1	1
HOLOCENTRIDAE									
Myripristis berndti		20		20			1	1	21
Myripristis vittata						110		110	110
Sargocentron caudimaculatum			5	5					5
SERRANIDAE									
Cephalopholis miniata			8	8			4	4	12
Epinephelus tukula							1	1	1
Gracilia albomarginata							3	3	3
Variola louti							1	1	1
Nemanthias carberryi	1000			1000					1000
Pseudanthias evansi					10			10	10
Pseudanthias squamipinnis	150			150	400			400	550
Cephalopholis nigripinnis		2	1	3					3
HAEMULIDAE									
Plectorhinchus orientalis							1	1	1
LUTJANIDAE									
Aphareus furca			1	1			2	2	3
Lutjanus bohar		1		1			2	2	3
Lutjanus gibbus							1	1	1
Lutjanus monostigma							1	1	1
MULLIDAE									
Parupeneus bifasciatus		3		3					3
Parupeneus macronema		1	1	2					2
CHAETODONTIDAE									
Chaetodon auriga		2		2		2		2	4
Chaetodon guttatissimus					1			1	1
Chaetodon lunula						1		1	1
Chaetodon meyeri						2		2	2
Forcipiger flavissimus						1		1	1

Appendix 4. Number of fish counted at St. Pierre, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10 m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
LETHRINIDAE									
Gnathodentex aureolineatus						15		15	15
Monotaxis grandoculis						1		1	1
Lethrinus obsoletus			1	1					1
POMACANTHIDAE									
Centropyge acanthops					2			2	2
Centropyge multispinis	10			10	2			2	12
Pomacanthus imperator			1	1					1
POMACENTRIDAE									
Chromis dimidiata	50			50	110			110	160
Chromis nigrura	70			70					70
Lepidozygus tapeinosoma	2000			2000	4500			4500	6500
Plectroglyphidodon dickii	7			7	3			3	10
LABRIDAE									
Anampses meleagrides		1		1		1		1	2
Bodianus axillaris	1	2		3					3
Bodianus diana						1		1	1
Cheilinus undulatus							1	1	1
Coris formosa			1	1					1
Gomphosus caeruleus		2		2	1	2		3	5
Halichoeres cosmetus	1			1	3	1		4	5
Halichoeres hortulanus			1	1	1	1		2	3
Hemigymnus fasciatus			1	1					1
Labroides bicolor	1			1					1
Labroides dimidiatus	5			5	4			4	9
Labropsis xanthonata					1			1	1
Pseudocheilinus hexataenia					1			1	1
Thalassoma hebraicum		1		1					1
Cheilinus fasciatus			1	1					1
Stethojulis albovittata	1			1					1
CIRRHITIDAE									
Paracirrhites arcatus					1			1	1
Paracirrhites forsteri					4			4	4

Appendix 4. Number of fish counted at St. Pierre, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10 m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
SCARIDAE									
Scarus sordidus		4		4			1	1	5
Scarus strongylocephalus			2	2			1	1	3
CARANGIDAE									
Caranx melampygus			6	6			3	3	9
ACANTHURIDAE									
Acanthurus leucocheilus							1	1	1
Acanthurus leucosternon		2		2		4		4	6
Acanthurus thompsoni		75		75		30		30	105
Acanthurus xanthopterus							3	3	3
Ctenochaetus truncatus		10		10		4		4	14
Naso brevirostris			1	1					1
Naso lituratus			1	1			2	2	3
Naso unicornis									
Zebrasoma scopas		5		5	5			5	10
Naso vlamingii			1	1			3	3	4
ZANCLIDAE									
Zanclus cornutus		2		2		1		1	3
Total Fish Counted	**3296**	**133**	**33**	**3462**	**5049**	**177**	**33**	**5259**	**8721**
Fish/100m2	**1099**	**44**	**11**	**6924**	**1683**	**59**	**11**	**10518**	**8721**
Number of Families	**3**	**9**	**9**	**13**	**7**	**6**	**9**	**16**	**16**
Number of Species	**12**	**16**	**16**	**41**	**17**	**16**	**19**	**49**	**65**

Appendix 5. Number of fish counted at Alphonse, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10 m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
HOLOCENTRIDAE									
Myripristis berndti			16	16			9	9	25
Sargocentron caudimaculatum			5	5			6	6	11
Sargocentron spiniferum			2	2					2

Appendix 5. Number of fish counted at Alphonse, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10 m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
SERRANIDAE									
Cephalopholis argus							3	3	3
Cephalopholis miniata			1	1			1	1	2
Cephalopholis nigripinnis		3		3		6	2	8	11
Epinephelus fasciatus							1	1	1
Nemanthias carberryi	50			50	60			60	110
Pseudanthias cooperi	180			180	110			110	290
Pseudanthias squamipinnis	90			90	200			200	290
Epinephelus areolatus			1	1					1
LUTJANIDAE									
Lutjanus bohar						1		1	1
Lutjanus monostigma			1	1					1
MULLIDAE									
Parupeneus bifasciatus			1	1					1
Parupeneus macronema	2			2					2
CHAETODONTIDAE									
Chaetodon auriga		2		2					2
Chaetodon guttatissimus	2			2					2
Chaetodon meyeri		1		1					1
Forcipiger flavissimus		1		1					1
MALACANTHIDAE									
Malacanthus brevirostris						1		1	1
POMACANTHIDAE									
Centropyge multispinis					2			2	2
POMACENTRIDAE									
Chromis dimidiata	40			40	45			45	85
Chromis nigrura	80			80					80
Chromis weberi	22			22	30			30	52
Lepidozygus tapeinosoma	50			50	20			20	70
Pomacentrus caeruleus	1			1					1
LABRIDAE									
Bodianus diana		1		1		1		1	2
Cirrhilabrus exquisitus	11			11	4			4	15

Appendix 5. Number of fish counted at Alphonse, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10 m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
Coris formosa					2	2		4	4
Epibulus insidiator			1	1					1
Gomphosus caeruleus		1		1					1
Halichoeres cosmetus	6	1		7	7	1		8	15
Halichoeres hortulanus			1	1					1
Hemigymnus fasciatus		1		1			1	1	2
Labroides bicolor	2			2					2
Labroides dimidiatus	2			2	4			4	6
Macropharyngodon bipartitus	2			2					2
Pseudocheilinus evanidus					1			1	1
Pseudocheilinus hexataenia	5			5	1			1	6
Pseudocheilinus octotaenia	2			2					2
Thalassoma amblycephalum					20			20	20
Thalassoma hebraicum		1		1			2	2	3
Thalassoma janseni		1		1					1
Cheilinus fasciatus			1	1					1
Stethojulis albovittata	1			1					1
CIRRHITIDAE									
Paracirrhites forsteri					1			1	1
SCARIDAE									
Scarus sordidus	2	1		3					3
CARANGIDAE									
Caranx melampygus			1	1			1	1	2
BLENNIIDAE									
Plagiotremus tapeinosoma	1			1					1
GOBIIDAE									
Gunnellichthys curiosus	2			2					2
ACANTHURIDAE									
Acanthurus leucocheilus						2		2	2
Acanthurus leucosternon		1		1					1
Ctenochaetus striatus						1		1	1
Ctenochaetus truncatus	1	5		6		9		9	15
Acanthurus nigricauda						1		1	1
Zebrasoma desjardinii			1	1					1

Appendix 5. Number of fish counted at Alphonse, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10 m**				**20m**				**10m+20m**
Total Area Surveyed	**50 sq m**				**50 sq m**				**100 sq m**
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**	**TOTAL**
FAMILY/*Genus species*									
BALISTIDAE									
Balistapus undulatus		1		1					1
Melichthys indicus			3	3					3
TETRAODONTIDAE									
Arothron meleagris			1	1					1
MICRODESMIDAE									
Nemateleotris magnifica	2			2	8			8	10
Total Fish Counted	**556**	**21**	**36**	**613**	**515**	**25**	**26**	**566**	**1179**
Number of Families	**9**	**6**	**9**	**14**	**6**	**5**	**5**	**12**	**17**
Number of Species	**23**	**14**	**14**	**48**	**16**	**10**	**9**	**32**	**60**
Fish/100m^2	**185**	**7**	**12**	**1226**	**172**	**8**	**9**	**1132**	**1179**

Appendix 6. Number of fish counted at Cosmoledo, by transect depths and fish size groups, during the AMP survey in March 2004.

Survey Transect Depths	**10 m**			
Total Area Surveyed	**75 sq m**			
Fish Size Groups (Total Length)	**<1-10cm**	**>10-20cm**	**>20cm**	**Total**
FAMILY/*Genus species*				
HOLOCENTRIDAE				
Myripristis berndti		12		12
Myripristis murdjan			3	3
Sargocentron caudimaculatum			3	3
SERRANIDAE				
Cephalopholis miniata		1	1	2
Cephalopholis nigripinnis		2	1	3
Pseudanthias squamipinnis	57			57
LUTJANIDAE				
Aphareus furca			1	1
Lutjanus bohar		2	2	4

Appendix 6. Number of fish counted at Cosmoledo, by transect depths and fish size groups, during the AMP survey in March 2004.

MULLIDAE				
Parupeneus macronema		1		1
CHAETODONTIDAE				
Chaetodon auriga		1		1
Chaetodon guttatissimus	7			7
Chaetodon trifasciatus		2		2
Forcipiger flavissimus		1		1
Hemitaurichthys zoster		9		9
LETHRINIDAE				
Gnathodentex aureolineatus			60	60
Lethrinus obsoletus			1	1
POMACANTHIDAE				
Apolemichthys trimaculatus		1		1
Centropyge multispinis	6			6
Pygoplites diacanthus			2	2
POMACENTRIDAE				
Chromis dimidiata	50			50
Chromis nigrura	55			55
Chromis ternatensis	25			25
Chromis weberi		1		1
Lepidozygus tapeinosoma	185			185
Plectroglyphidodon dickii	1			1
Plectroglyphidodon lacrymatus	1			1
LABRIDAE				
Anampses lineatus		2		2
Halichoeres cosmetus	4	4		8
Halichoeres hortulanus		2	1	3
Hemigymnus fasciatus		1		1
Pseudocheilinus hexataenia	21			21
Pseudocheilinus octotaenia	3	2		5
Thalassoma amblycephalum	3			3
Stethojulis albovittata	1			1
CIRRHITIDAE				
Paracirrhites forsteri	1			1
SCARIDAE				
Scarus sordidus		7	4	11
Scarus strongylocephalus			1	1

Appendix 6. Number of fish counted at Cosmoledo, by transect depths and fish size groups, during the AMP survey in March 2004.

ACANTHURIDAE				
Acanthurus leucosternon		12		12
Acanthurus thompsoni		1		1
Naso brevirostris			9	9
BALISTIDAE				
Sufflamen bursa		1		1
MICRODESMIDAE				
Nemateleotris magnifica	6			6
Total Fish Counted	**426**	**65**	**89**	**580**
Number of Families	**7**	**11**	**8**	**14**
Number of Species	**16**	**20**	**13**	**42**
Fish/100m2	**142**	**22**	**30**	**773**