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Article *in* African Journal of Marine Science · November 2006

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African Journal of Marine Science 2006, 28(3&4): 535–551
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AFRICAN JOURNAL OF MARINE SCIENCE
EISSN 1814–2338

Towards the declaration of a large marine protected area: a subtidal ichthyofaunal survey of the Pondoland coast in the Eastern Cape, South Africa

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A subtidal marine ichthyofaunal survey was carried out on shallow reefs (1–30m deep) in the Pondoland region between the Mtamvuna River and Port St Johns in the Eastern Cape, South Africa. The purpose of this survey was to provide the baseline data required for the zonation of a large marine protected area proposed for the region. Survey work was carried out in May and June during 2002 and 2003. A seafloor map based on earlier seismic-reflection profiling data, coupled with fishers' co-ordinates of known reefs in the area, was used to plan the survey. An underwater visual census (UVC), using the point-count method, assessed fish diversity, relative abundance and size structure. During the UVC, a total of 261 point fish-counts, covering an area of 14 288m², was completed. A total of 138 fish species from 49 different families was identified and a relatively high proportion of endemic species (26.6%) were recorded. As a result of the turbid conditions encountered south of Mbotyi, numbers and diversity of fish species observed declined with increasing latitude. Endemic sparid linefish species, which are overexploited in other areas, were particularly abundant in this region, and a number of new range distributions of various species were recorded during the survey. The results of this survey contributed towards the zonation of the Pondoland Marine Protected Area, which was proclaimed in June 2004.

Keywords: Eastern Cape, fisheries management, ichthyofaunal survey, marine protected area, point counts, Pondoland coast, underwater visual census

Introduction

The marine environment along the Pondoland coast of South Africa between the Mtamvuna River south of Port Edward and the Msimvubu River at Port St Johns has been identified as part of a broad transition zone between the subtropical biogeographic province to the north and the warm-temperate province to the south (Emanuel *et al*. 1992, Turpie *et al*. 2000). More recent work has classified the Pondoland coast as part of the Natal Bioregion, which extends from Cape Vidal to the Mbashe River (Lombard *et al.* 2004). The area is characterised by a rich diversity of marine flora and fauna and a relatively high percentage of endemic species (Turpie *et al*. 2000, Awad *et al*. 2002).

Prior to June 2004, <3% of the Natal Bioregion (in terms of coastline length) fell within no-take marine protected areas (MPAs). Although there was a small MPA in the Pondoland region, namely the Mkambati Marine Reserve, biodiversity protection was inadequate. The reasons for this were that the Mkambati Marine Reserve was too small (12km of coastline extending 11km out to sea) to make a substantial contribution towards biodiversity conservation or fishery enhancement, and there was a lack of marine management capacity to enforce this MPA (Mann 1998). Motivation for the establishment of a MPA in the Pondoland region included the fact that a large protected area was urgently needed in this region to fulfil the functions of biodiversity protection, fisheries management and sustainable utilisation of marine resources. In terms of biodiversity protection, Pondoland was identified as a significant gap in the current distribution of large MPAs along the South African coast (Attwood *et al*. 1997, Turpie *et al*. 2000, Awad *et al*. 2002). Furthermore, in terms of fisheries management, establishment of this MPA was identified as one of the most feasible management options to rebuild depleted linefish stocks and ensure the seeding of adjacent exploited areas (Griffiths *et al*. 1999, Penney *et al*. 1999, Fennessy *et al*. 2003). Establishment of a large MPA along the Pondoland coast was thus identified as a high priority (*inter alia* Marine Reserves Task Group 1997, Nicolson 1997, Mann 1998, SANParks 2001).

The overall aim of this project was to undertake a subtidal marine biodiversity survey of the Pondoland coast to provide the biological and physical habitat information necessary for the establishment and informed management of a large MPA in the region. This paper reports on the

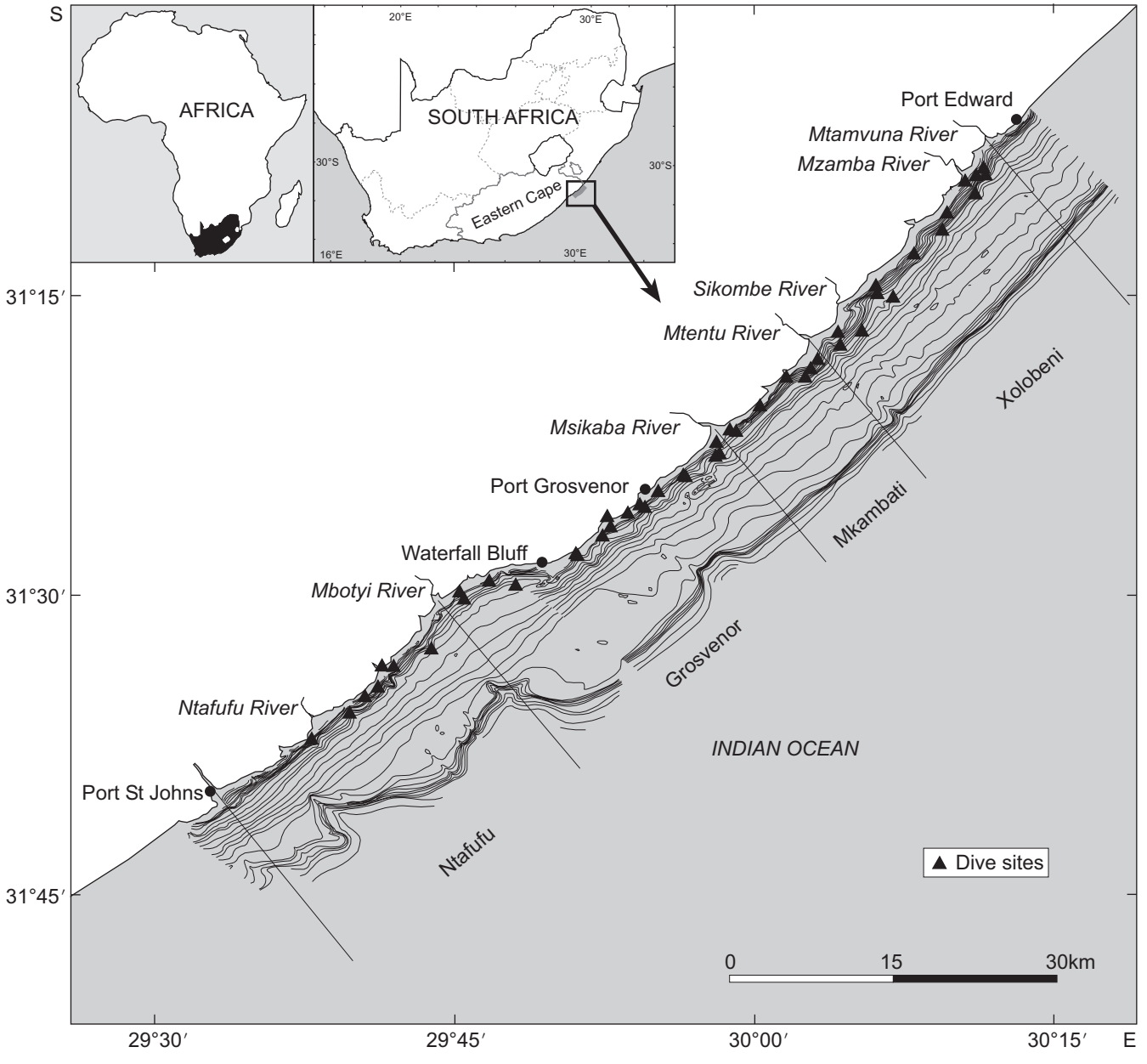

Figure 1: A bathymetric map of the Pondoland coast between the Mtamvuna River south of Port Edward and the Mzimvubu River at Port St Johns showing the 58 dive sites on shallow reefs (<31m) where fish point counts were conducted. The four main sampling areas are also shown. The break in bathymetry between Waterfall Bluff and the Mbotyi River represents an incompatibility between two datasets (Birch 1996). Bathymetry was provided by the Council for Geoscience (2001)

findings of the ichthyofaunal survey, while a second paper (Celliers *et al*. in press) reports on the results of the benthic survey that was done simultaneously.

Material and Methods

Seafloor morphology

Figure 1 shows a digital bathymetric map of the area between Port Edward and Port St Johns. This map was based on data acquired during seismic-reflection profiling conducted during the late 1970s (Birch 1996). The map was used as the template onto which all biodiversity information collected was overlaid using a Geographical Information System (GIS). Unfortunately, the map did not provide sufficient detail on the location of inshore reefs in depths <30m (accepted safe no-decompression limit for SCUBA diving). For this reason, additional information on the location of shallow reefs was obtained from the Natal Sharks Board and from commercial fishers operating in the area. Reef positions were also obtained from a previous survey of the area's coastal resources conducted by the Oceanographic Research Institute in 1993 (Fielding *et al*. 1994). Other reefs in the area were located during the

current survey by searching the sea bottom with an echosounder or during short 'bounce' dives in shallow areas. However, with the absence of side-scan sonar data, and the generally poor water visibility that prevented the use of aerial photography, it was not possible to definitively map the size or extent of the reefs in the area.

Fieldwork

Four field trips were undertaken to conduct diving surveys of the region (14–24 May 2002, 11–19 June 2002, 20–27 May 2003 and 18–26 June 2003). This time of year was selected because of the generally better prevailing weather conditions. The first two trips (2002) were based at Port Grosvenor and the area between the Mtentu and Mbotyi rivers (39km) was surveyed (Figure 1). The third trip (May 2003) was based at Port Edward and the area between the Mtamvuna and Mtentu rivers (23km) was surveyed, whereas the fourth trip (June 2003) was based at Port St Johns and the area between Port St Johns and the Mbotyi River (24km) was surveyed (Figure 1). Each field trip involved a four- to six-man diving team and an inflatable boat with two outboard motors capable of being launched through the surf.

Fish survey

An attempt was made to survey as many reefs as possible within safe diving depths (<30m) in an even spread along the coastline. Reefs were located using a differential GPS and an echosounder. One pair of SCUBA divers undertook an underwater visual census (UVC) of ichthyofauna on (and in the water column above) the reef using a modified version of the stationary point-count method (Thresher and Gunn 1986, Samoilys 1997). Between one and three 5-minute counts (interval counts) were conducted by each diver on each dive (the two divers maintained visual contact with one another throughout the dive for safety reasons). Sites on the reef were randomly selected according to a set number of fin strokes (30) between sites and the GPS position of each site was recorded on the boat when the divers signalled by pulling on the surface marker buoy. Although the total area of reef was unknown, the area of reef in which each count was conducted was quantified by measuring the radius of the count circle using a tape measure at the end of each count. Counts were limited to a maximum radius of 5m, but were often less due to poor visibility (i.e. variable distance point counts). Underwater visibility was measured using a tape measure held between the two divers. A brief description of the reef habitat (i.e. high or low relief and benthic cover) was recorded before the start of each count. All fish observed within the area were identified to species level, counted and the size of each fish was estimated to the nearest 5cm size-class and recorded on diving slates. This provided a relative index of abundance of the fish species observed (Thresher and Gunn 1986). In an attempt to avoid bias from counting those species attracted to divers, abundant species (e.g. *Pomadasys olivaceum*, *Boopsoidea inornata* and *Diplodus sargus capensis*) were counted first, followed by other suprabenthic species and finally semi-cryptic species were counted by carefully searching the reef within the count area (Burger 1990). Additional fish species seen while swimming between point-count stations were recorded separately to obtain a more comprehensive inventory of all fish species observed in the area. Only four divers were used to undertake fish counts, all of whom were familiar with the majority of fish species found in the area and who had been trained in estimating fish size underwater. If an unknown species was encountered, it was identified immediately following the dive using Smith and Heemstra (1986), van der Elst (1988), King (1996) or King and Fraser (2002). It is possible that a few of the rarer fish species encountered may have been misidentified, although this error is believed to be minimal. Fish-count data were captured onto an MS Access database as described by Samoilys (1997) for analysis of species and size composition, abundance/density estimates, and comparison of fish diversity and abundance between areas. To compare diversity between different areas, the coast was divided into four zones, which roughly corresponded with the areas sampled during the four field trips. These four areas included: between the Mtamvuna and Mtentu rivers (Xolobeni), the Mtentu and Msikaba rivers (Mkambati), the Msikaba and Mbotyi rivers (Grosvenor) and the Mbotyi and Mzimvubu rivers (Ntafufu) (Figure 1).

During rough weather, when diving was not possible, opportunistic rotenone sampling of intertidal rock pools was undertaken to further increase knowledge of the diversity of fish species found in the Pondoland region.

Results

Seafloor morphology

The bathymetric map produced by the Council for Geoscience (2001) of the Pondoland region between Port Edward and Port St Johns (~86km) is shown in Figure 1. The continental shelf in this region is relatively narrow and averages 10km in width to the shelf break, being widest off Waterfall Bluff (14km) and narrowest just north of Port St Johns (6km) (Birch 1996). Five large submarine canyons incise the shelf viz. the Mtamvuna, Mtentu, Egosa, Mbotyi and Mzimvubu canyons (Birch 1996). Birch (1981, 1996) provide a detailed description of the bathymetry and geomorphology of the continental shelf in this region. Of interest from a biodiversity perspective are the submerged coast-parallel palaeo-dune cordons forming reef complexes that extend along most of the KwaZulu-Natal (KZN) and Transkei coastline (Birch 1981, 1996, Flemming 1978, 1980, 1981, Ramsay 1991, 1996, Bosman *et al*. 2005). Along the southern KZN and Pondoland coast this relict ridge system varies markedly in width (1.2–3.6km) and relief (1–26m; Birch 1996). Between Port Edward and the Mtentu River it has minimal relief (<5m), but increases to 10m southwards of Port Grosvenor where it also trends shoreward (Birch 1996). One of the most noticeable (and well known) offshore reef areas in the Pondoland region is just south of Msikaba (Figure 1) and, according to Birch

Table 1: Fish species counted during an underwater visual census (n = 261 point counts) conducted along the Pondoland coast in May and June 2002 and 2003. Fish are listed in phylogenetic order according to Smith and Heemstra (1986)

Family	Species	Common name	Number	Mean density (1 000m^{-2})
Triakidae	*Mustelus mustelus*	Smooth-hound	1	0.10
Scyliorhinidae	*Poroderma pantherinum**	Leopard catshark	1	0.04
Odontaspididae	*Carcharias taurus*	Spotted ragged-tooth	1	0.10
Torpedinidae	*Torpedo fuscomaculata*	Blackspotted electric ray	3	0.16
Rhinobatidae	*Rhinobatos annulatus**	Lesser guitarfish	1	0.14
Dasyatidae	*Dasyatis brevicaudata*	Short-tail stingray	1	0.11
Muraenidae	*Gymnothorax undulatus*	Leopard moray	1	0.12
Clupeidae	*Etrumeus teres*	East Coast round herring	15	0.73
Ariidae	*Galeichthys* sp.*	Black seacatfish	51	5.75
Berycidae	*Centroberyx spinosus**	Short alfonsino	1	0.05
Serranidae	*Acanthistius sebastoides**	Koester	2	0.33
	Pseudanthias squamipinnis	Sea goldie	196	15.72
	*Epinephelus andersoni**	Catface rockcod	40	4.12
	Epinephelus marginatus	Yellowbelly rockcod	55	4.09
	Epinephelus rivulatus	Halfmoon rockcod	83	7.61
	Serranus cabrilla	Comber	7	0.51
Pseudochromidae	*Pseudochromis dutoiti*	Dutoiti	1	0.05
	Pseudochromis natalensis	Natal dottyback	1	0.05
Priacanthidae	*Priacanthus hamrur*	Cresent-tail bigeye	1	0.05
Apogonidae	*Apogon kallopterus*	Spinyhead cardinal	1	0.08
	Apogon quadrifasciatus	Twostripe cardinal	41	2.01
	Apogon taeniophorus	Ninestripe cardinal	1	0.08
	Archamia mozambiquensis	Mozambique cardinal	2	0.15
	Cheilodipterus lineatus	Tiger cardinal	1	0.05
Pomatomidae	*Pomatomus saltatrix*	Elf	37	4.83
Haemulidae	*Plectorhinchus chubbi*	Dusky rubberlip	13	0.75
	Pomadasys olivaceum	Piggy/Pinky	3 514	400.93
	Pomadasys striatum	Striped grunter	482	27.38
Dinopercidae	*Dinoperca petersi*	Cavebass	19	1.13
Caesionidae	*Caesio teres*	Beautiful fusilier	4	0.20
Sparidae	*Boopsoidea inornata**	Fransmadam	678	75.63
	Cheimerius nufar	Santer	16	1.13
	*Chrysoblephus anglicus**	Englishman	150	7.56
	*Chrysoblephus laticeps**	Roman	3	0.19
	*Chrysoblephus puniceus**	Slinger	976	50.69
	*Cymatoceps nasutus**	Black musselcracker	92	5.79
	*Diplodus cervinus hottentotus**	Zebra	302	22.94
	*Diplodus sargus capensis**	Blacktail	630	66.59
	Lithognathus mormyrus	Sand steenbras	22	1.68
	*Pachymetopon aeneum**	Blue hottentot	96	8.62
	*Pachymetopon grande**	Bronze bream	497	36.58
	*Pagellus bellottii natalensis**	Red tjor-tjor	90	5.46
	*Polyamblyodon germanum**	German	114	7.18
	*Polysteganus praeorbitalis**	Scotsman	73	4.46
	*Porcostoma dentata**	Dane	155	15.40
	*Rhabdosargus holubi**	Cape stumpnose	126	12.23
	Rhabdosargus sarba	Natal stumpnose	3	0.23
	*Rhabdosargus thorpei**	Bigeye stumpnose	2	0.17
	Sarpa salpa	Strepie	117	16.61
	*Sparodon durbanensis**	White musselcracker	1	0.08
	*Spondyliosoma emarginatum**	Steentjie	209	11.32
Lethrinidae	*Lethrinus nebulosus*	Blue emperor	214	11.10
	Monotaxis grandoculis	Bigeye barenose	1	0.05
Coracinidae	*Dichistius multifasciatus**	Banded galjoen	5	0.49
Scorpididae	*Neoscorpis lithophilus**	Stonebream	9	1.74
Monodactylidae	*Monodactylus falciformis*	Cape moony	13	2.30
Mullidae	*Mulloides flavolineatus*	Yellowstripe goatfish	10	0.57
	Parupeneus indicus	Indian goatfish	1	0.08
	Parupeneus macronema	Band-dot goatfish	4	0.20
	Parupeneus rubescens	Blacksaddle goatfish	176	10.48
Sciaenidae	*Argyrosomus japonicus*	Dusky kob	13	0.94
	Umbrina robinsoni	Baardman	35	2.43

Table 1 (cont.)

Family	Species	Common name	Number	Mean density (1 000m^{-2})
Pomacanthidae	*Apolemichthys kingi**	Tiger angelfish	1	0.05
	Centropyge acanthops	Jumping bean	3	0.15
	Centropyge multispinis	Dusky cherub	1	0.05
	Pomacanthus rhomboides	Old woman	118	8.22
Chaetodontidae	*Chaetodon blackburnii*	Brownburnie	77	6.33
	Chaetodon dolosus	Blackedged butterflyfish	4	0.22
	Chaetodon kleinii	Whitespotted butterflyfish	1	0.05
	Chaetodon lunula	Halfmoon butterflyfish	1	0.05
	*Chaetodon marleyi**	Doublesash butterflyfish	14	0.77
	Chaetodon vagabundus	Vagabond butterflyfish	1	0.17
Oplegnathidae	*Oplegnathus conwayi**	Cape knifejaw	110	8.56
	*Oplegnathus robinsoni**	Natal knifejaw	37	2.08
Carangidae	*Alepes djedaba*	Shrimp scad	100	7.62
	Caranx sexfasciatus	Bigeye kingfish	31	2.36
	Pseudocaranx dentex	White kingfish	6	0.29
	Seriola lalandi	Cape yellowtail	1	0.05
	Seriola rivoliana	Longfin yellowtail	2	0.10
Cirrhitidae	*Cirrhitus pinnulatus*	Marbled hawkfish	1	0.05
	Cyprinocirrhites polyactis	Swallowtail hawkfish	2	0.10
Cheilodactylidae	*Cheilodactylus pixi**	Barred fingerfin	11	2.60
	*Chirodactylus brachydactylus**	Twotone fingerfin	87	7.00
	*Chirodactylus jessicalenorum**	Natal fingerfin	215	14.95
Pempheridae	*Pempheris adusta*	Dusky sweeper	98	6.65
Pomacentridae	*Abudefduf sordidus*	Spot damsel	1	0.16
	Chromis dasygenys	Bluespotted chromis	73	3.64
	Chromis dimidiata	Chocolate dip	12	0.59
	Chromis nigrura	Blacktail chromis	64	3.26
Labridae	*Anampses meleagrides*	Yellowtail tamarin	4	0.20
	*Anchichoerops natalensis**	Natal wrasse	6	0.33
	Bodianus bilunulatus	Saddleback hogfish	24	1.32
	Bodianus perditio	Goldsaddle hogfish	4	0.22
	Cheilinus bimaculatus	Two-spot wrasse	6	0.38
	Cheilio inermis	Cigar wrasse	12	0.59
	Coris caudimacula	Spottail coris	70	3.79
	Coris gaimard africana	African coris	1	0.05
	Halichoeres cosmetus	Adorned wrasse	2	0.10
	Halichoeres lapillus	Jewelled wrasse	12	0.67
	Labroides dimidiatus	Bluestreak cleaner wrasse	11	0.58
	Pseudojuloides cerasinus	Smalltail wrasse	2	0.10
	Stethojulis interrupta	Cutribbon wrasse	71	4.26
	Thalassoma amblycephalum	Twotone wrasse	40	2.50
	Thalassoma herbraicum	Goldbar wrasse	7	0.36
	Thalassoma lunare	Crescent-tail wrasse	35	2.58
	Thalassoma purpureum	Surge wrasse	3	0.42
	Thalassoma trilobatum	Ladder wrasse	2	0.10
Mugiloididae	*Parapercis punctulata*	Spotted sandsmelt	3	0.17
Blenniidae	*Plagiotremus rhinorhynchos*	Twostripe blenny	11	0.54
	Plagiotremus tapeinosoma	Piano blenny	14	0.74
Clinidae	*Pavoclinus graminis**	Grass klipfish	2	0.10
Acanthuridae	*Acanthurus blochii*	Tailring surgeon	3	0.19
	Acanthurus dussumieri	Pencilled surgeon	3	0.20
	Acanthurus nigrofuscus	Brown surgeon	1	0.05
	Zebrasoma gemmatum	Spotted tang	1	0.30
Scombridae	*Euthynnus affinis*	Eastern little tuna	6	0.29
Istiophoridae	*Istiophorus platypterus*	Sailfish	1	0.05
Balistidae	*Sufflamen fraenatus*	Bridle triggerfish	4	0.19
Monacanthidae	*Cantherhines dumerilii*	Whitespotted filefish	1	0.05
Tetraodontidae	*Arothron hispidus*	Whitespotted blaasop	1	0.05
	Arothron immaculatus	Blackedged blaasop	1	0.05
Total: 43	121		10 846	

* Endemic

(1996), it is most likely part of the palaeo-dune cordon. Coast-parallel relict ridges also occur south of Msikaba, and unconsolidated sediments forming a spit-like feature (coined the 'Mfihlelo Spit' by Birch 1996) extend southwards from Waterfall Bluff.

The positions of all reefs dived during the fish survey are shown in Figure 1, with most dives being within a kilometre of the shore because of the steep gradient of the shelf (no dives were deeper than 31m). There was an abundance of inshore reefs between Mzamba and Lupatana. No inshore reefs were located off Waterfall Bluff owing to the extensive accumulation of sediment in that area. However, deeper reefs located farther offshore on the Mfihlelo Spit were surveyed. Between Mbotyi and Port St Johns poor underwater visibility hampered reef surveys and only shallow reefs off rocky headlands could be dived. The nature and structure of inshore reefs is often similar to the immediate coastal geology, especially off the rocky headlands (see Maud 1985 and Visser 1998 for a description of the coastal geology in this region). Along the entire coastline, the reefs dived farther offshore, in depths >20m, tend to be of fairly low relief and are most likely composed of sandstone. However, these could not be assigned to their proper lithostratigraphic unit. Celliers *et al*. (in press) describe the benthic communities associated with all the reefs surveyed.

Fish survey

A total of 261 point fish-counts, covering 14 288m^2 of reef, was completed during 58 dives between the Mtamvuna River (Port Edward) and the Mzimvubu River (Port St Johns) (Figure 1). Depths ranged between 3m and 31m, underwater visibility was extremely variable (ranging from 2m to 20m) and consequently radii of point counts ranged between 2m and 5m. Counts were conducted between 07:00 and 17:00.

A total of 121 fish species from 43 families (10 846 individual fish) was counted and estimated for size during point counts (Table 1). A further 17 species from 14 families were observed during dives in between point counts (Table 2), bringing the total to 138 species from 49 families. Of the species observed, 37 (26.6%) were endemic to southern African waters with 17 of these belonging to the family Sparidae. Counts of most species were extremely variable, a feature common in UVC results (Samoilys and Carlos 2000). Furthermore, as a result of changing the size of the point-count area with changing water visibility (variable distance counts), counts were not directly comparable owing to changes in associated variance. For this reason, only the mean abundance data (density of fish 1 000m^{-2}) are presented in Table 1 and the unrepeatable variance data are not presented. Fish abundance was dominated by two families, the Haemulidae and the Sparidae (Figure 2). Overall, *Pomadasys olivaceum* dominated the species composition by number, comprising 32.4% of the total number of fish counted.

Length-frequency histograms of some of the more important linefish species counted during the UVC are shown in Figure 3. Although all fish lengths were estimated in 5cm size-classes, accuracy diminishes with larger fish (i.e. it is more difficult to estimate the exact size of larger fish), but this method nevertheless represents a useful way to assess the size structure of the fish populations surveyed (Samoilys 1997).

Fish species diversity decreased from north to south (Figure 4). Whereas some decrease was expected with increasing latitude, especially in a transition zone between warm subtropical waters and cooler warm-temperate waters, these results were greatly amplified by the water visibility experienced during the survey. Point counts in the Xolobeni area had an average underwater visibility of 13.3m ± 4.9 SD, Mkambati was 5.6m ± 1.6 SD, Grosvenor was 5.8m ± 2.4 SD and Ntafufu was 2.8m ± 0.8 SD. This

Table 2: Additional fish species identified while swimming between point counts during an underwater visual census conducted along the Pondoland coast between May and June 2002 and 2003. Fish are listed in phylogenetic order according to Smith and Heemstra (1986)

Family	Species	Common name
Carcharhinidae	*Carcharhinus brachyurus*	Copper shark
	Carcharhinus leucas	Zambezi shark
Sphyrnidae	*Sphyrna lewini*	Scalloped hammerhead
Rhinobatidae	*Rhinobatos leucospilus**	Greyspot guitarfish
	Rhynchobatus djiddensis	Giant guitarfish
Mobulidae	*Manta birostris*	Manta
Dasyatidae	*Taeniura melanospilos*	Round ribbontail ray
Clupeidae	*Sardinops sagax*	Pilchard
Scorpaenidae	*Pterois miles*	Devil firefish
Haemulidae	*Plectorhinchus flavomaculatus*	Lemonfish
Lutjanidae	*Aprion virescens*	Green jobfish
Mullidae	*Parupeneus cinnabarinus*	Redspot goatfish
Carangidae	*Gnathanodon speciosus*	Golden kingfish
	Seriolina nigrofasciata	Blackbanded kingfish
Labridae	*Gomphosus caeruleus*	Birdfish
Mugilidae	*Liza tricuspidens**	Striped mullet
Clinidae	*Clinus superciliosus**	Super klipfish
Total: 14	17	

* Endemic

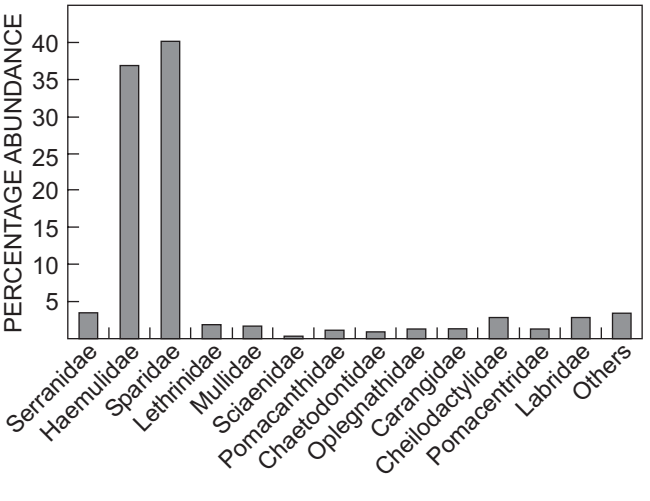

Figure 2: Percentage abundance (by number) of dominant fish families counted during the underwater visual census of Pondoland reefs

meant that the point-count areas were substantially smaller in the more turbid water in the Ntafufu zone and far fewer fish species were seen, particularly those not attracted by divers. Nevertheless, species composition did vary markedly with species such as *Chrysoblephus puniceus*, *P. olivaceum* and *Pomadasys striatum* dominating counts on the Xolobeni reefs. *P. olivaceum*, *B. inornata*, *D. s. capensis* and *Pachymetopon grande* were most abundant on the Mkambati and Grosvenor reefs and *P. olivaceum* overwhelmingly dominated Ntafufu reefs, comprising 81% of the fish counted in this area (Figure 5).

Physical difficulties associated with visually assessing fish abundance underwater also affected assessment of differences in species diversity between depths. The greatest number of species was found on reefs between 10m and 20m depth (Figure 6). However, this was where

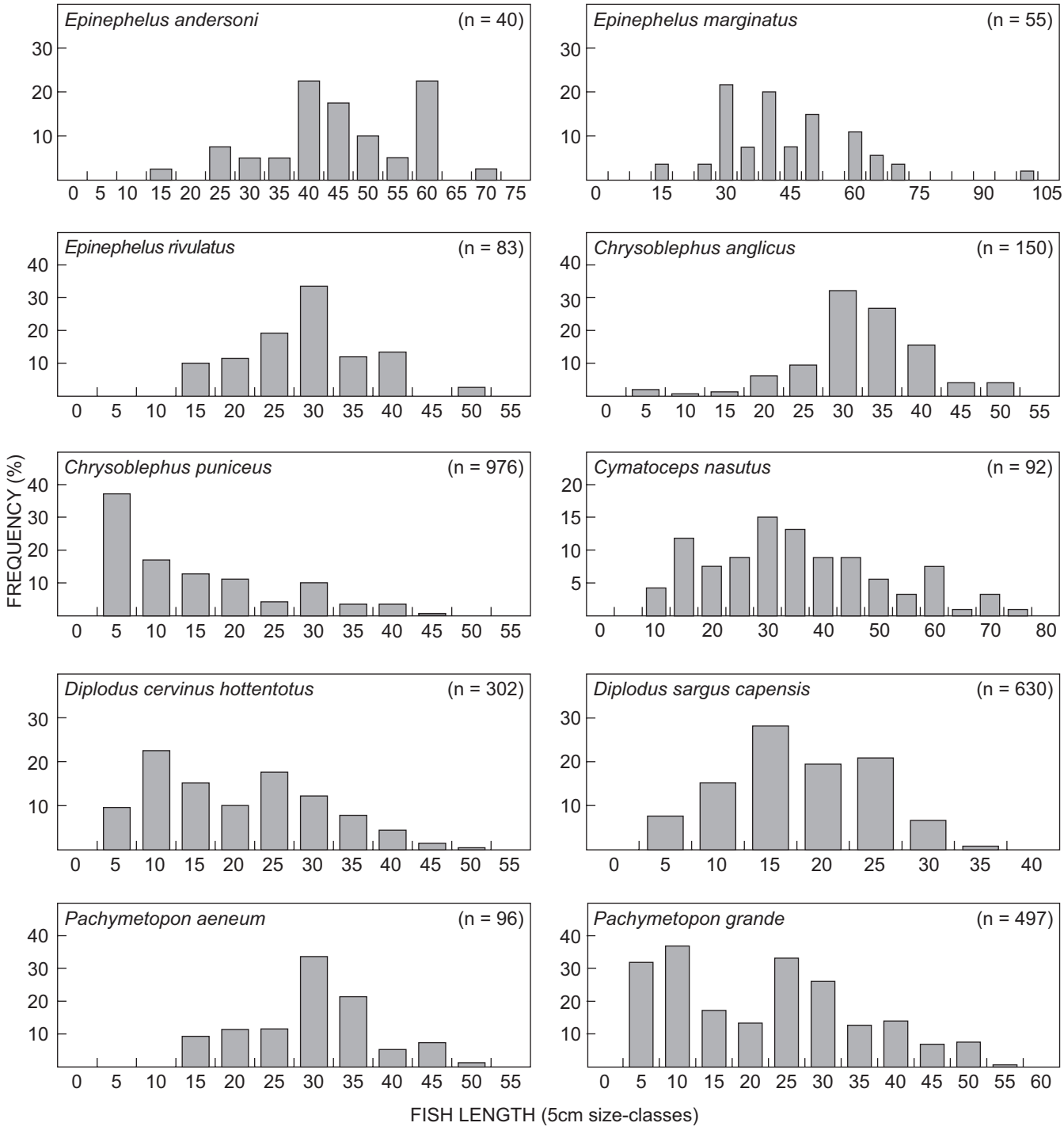

Figure 3: Length-frequency histograms of 10 important linefish species counted during the underwater visual census on Pondoland reefs

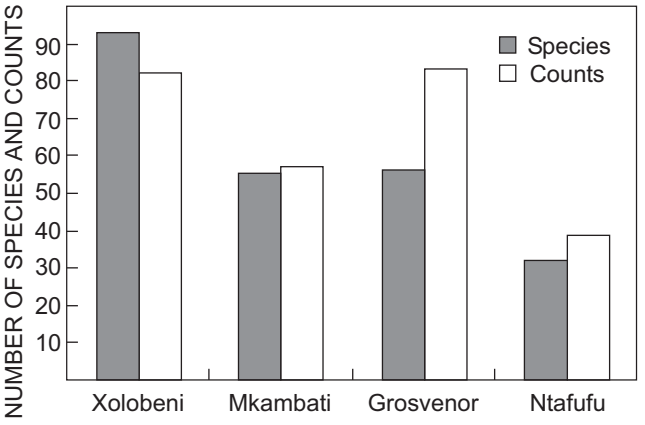

Figure 4: Trends in species diversity and the number of point counts conducted in four areas along the Pondoland coast from the north (Xolobeni) to the south (Ntafufu) (n = 261 counts)

most fish counts were done as the shallower reefs <10m were difficult to sample due to strong wave action and surge, whereas counts on reefs deeper than 20m were limited by dive time and generally poorer visibility at depth. Species composition on shallow reefs was dominated by species such as *P. olivaceum*, *D. s. capensis*, *P. grande*, *Diplodus cervinus hottentotus* and *Sarpa salpa*. Mid-depth reefs were characterised by *P. olivaceum*, *B. inornata*, *D. s. capensis* and *P. grande*, whereas deeper reefs were dominated by *C. puniceus*, *P. striatum*, *P. olivaceum* and *B. inornata* (Figure 7).

As expected with a greater diversity of habitats and potential food availability (Buxton and Smale 1989), fish density was substantially higher on high relief reefs (1 499 fish 1 000m^{-2} ± 1 249 SD) compared with low relief reefs (589 fish 1 000m^{-2} ± 348 SD). A single factor ANOVA revealed that these differences were highly significant ($p = 0.0026$).

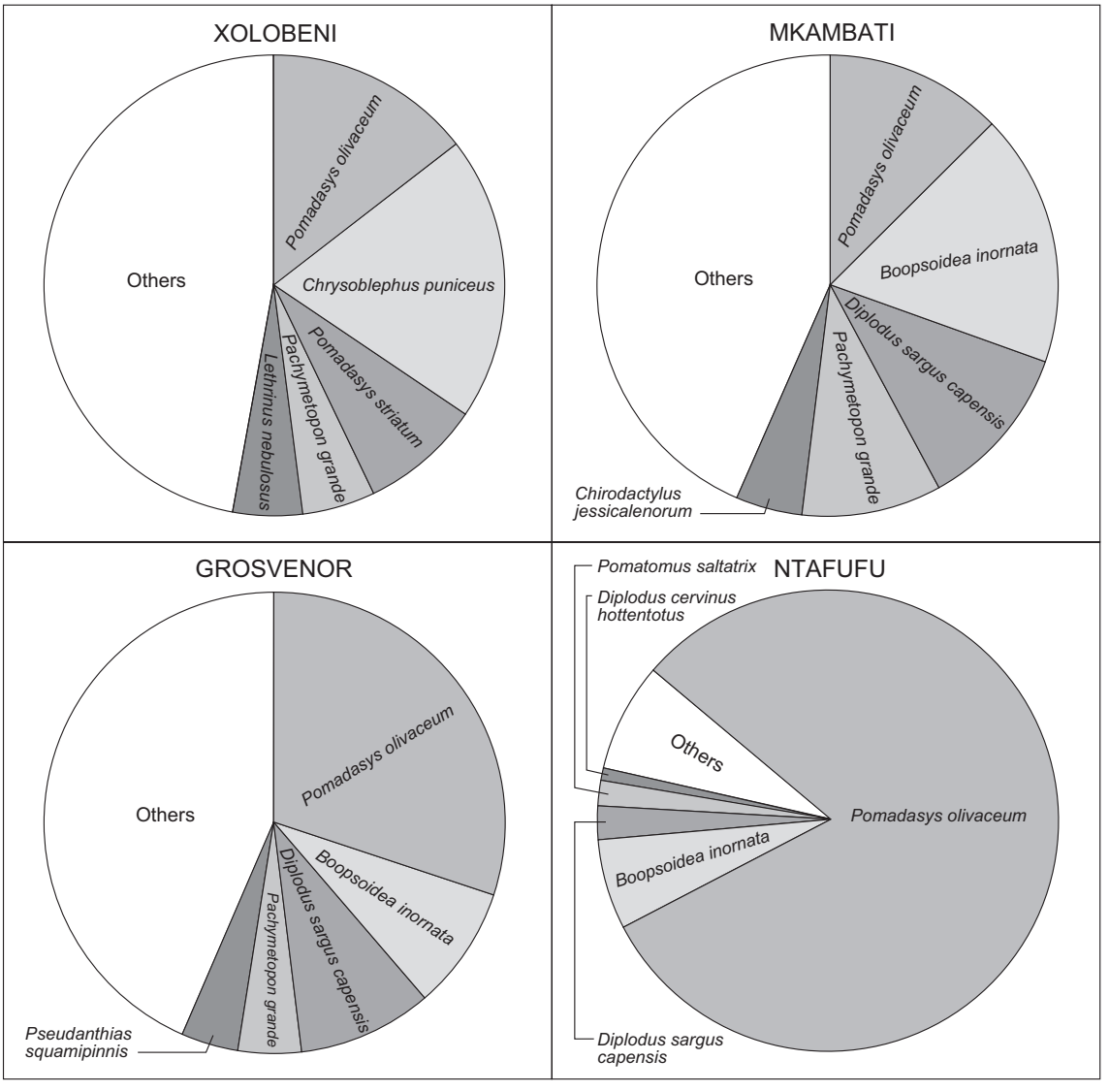

Figure 5: Species composition (by number) of fish counted on reefs between 3m and 31m deep in four different areas along the Pondoland coast between Mtamvuna and the Mzimvubu rivers

In order to compile a more complete inventory of the fish species found along the Pondoland coast, commercial and recreational skiboat catches recorded from the area during the National Linefish Survey conducted during the period 1997–1998 (Fennessy *et al*. 2003) are shown in the Appendix. Similarly, shore-angling catches recorded along the northern Transkei coast during the National Linefish Survey conducted in 1997 (Mann *et al*. 2003) and voluntarily submitted catches from shore-angling competitions held in the Pondoland region and recorded on the National Marine Linefish System database (Pradervand 2004) are also shown in the Appendix. The results of the opportunistic intertidal rock pool fish collections conducted during the current survey are also included. Combining the results of these studies with the results of the UVC, a species list of 235 species from 69 families has been recorded from the Pondoland coast of which 52 species (22.1%) were endemic (see Appendix).

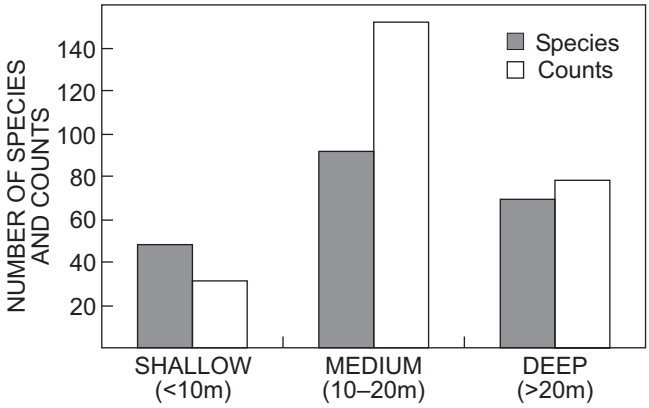

Figure 6: Fish species diversity and number of point counts conducted on reefs in different depths along the Pondoland coast

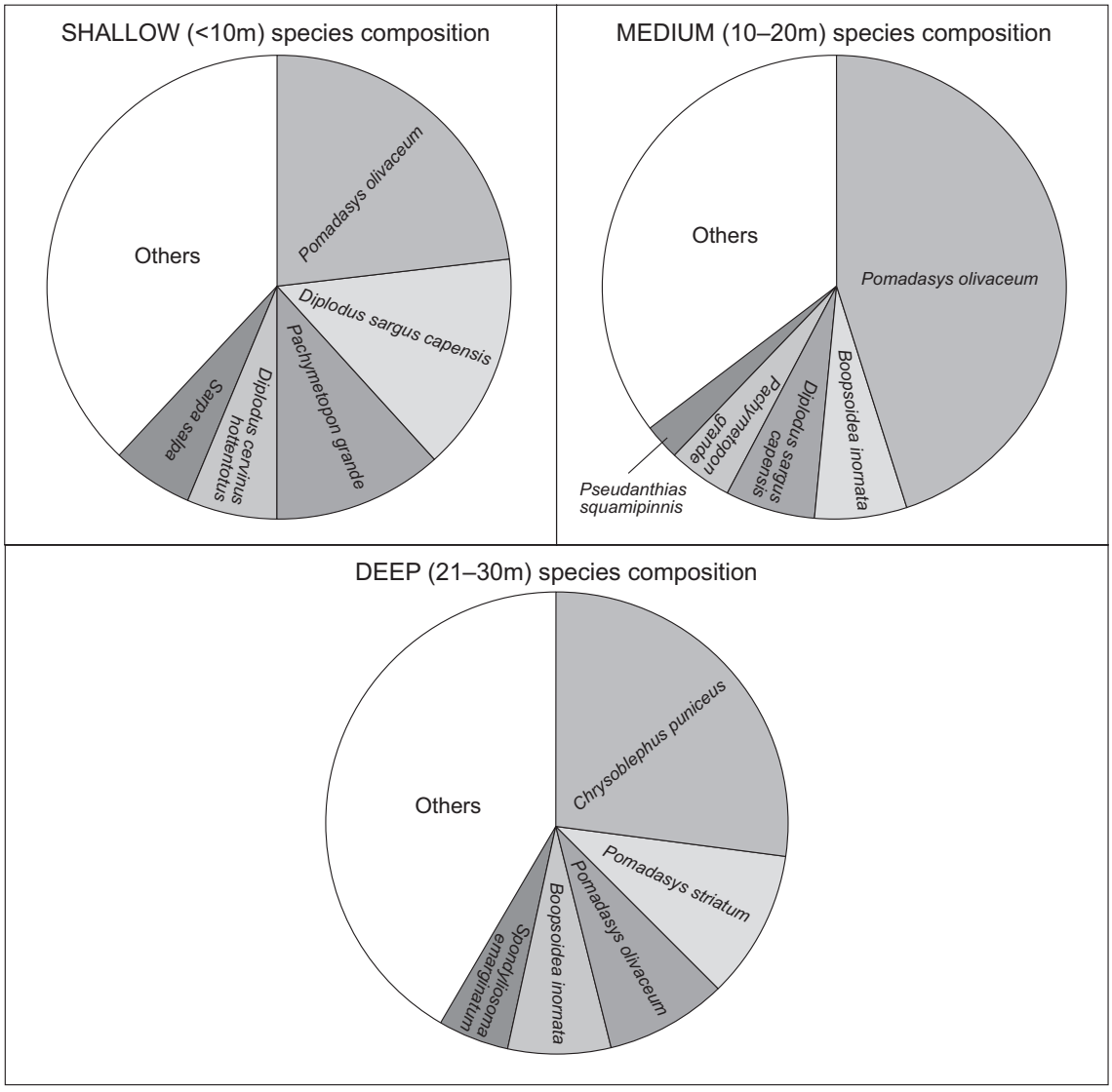

Figure 7: Species composition (by number) of fish counted on reefs in three different depth zones along the Pondoland coast between the Mtamvuna and Mzimvubu rivers

Discussion

Ichthyofauna

In order to survey as much as possible of the subtidal reef habitat between the Mtamvuna and Mzimvubu rivers in a relatively short time, point counts rather than strip transects were used; the former can be employed in about 70% of the time taken for transects and few significant differences have been found between the two methods (Samoilys and Carlos 2000). Instantaneous point counts were rejected as a suitable technique because they did not allow the divers enough time to record all the species present, let alone estimate lengths of all the individuals seen. Unfortunately, the necessary modification of the point-count method used in this study to allow for different underwater visibility meant that the results of this study are not strictly comparable with other studies, because the variance of point counts differs depending on the point-count area used. This, coupled with the fact that the point counts were interval counts conducted for five minutes, enabled calculation of an index of relative abundance and not exact density because fish continuously moved through the sample area (Thresher and Gunn 1986). A further bias of the five-minute point counts conducted in this study is that they tended to overestimate abundance of fish attracted to divers, even though these species were counted first. The above sampling errors precluded our ability to perform meaningful multivariate analysis on the data because the results were biased by variable water visibility and the size of the point-count areas. These are important lessons learned and should be taken into account when planning similar studies in the future.

The results of this survey confirmed that the ichthyofauna along the Pondoland coast are characteristic of the transition between the warmer subtropical waters off KZN and the cooler warm-temperate waters off the Eastern Cape, with a relatively high proportion of endemic species (22.1%). By comparison, Chater *et al*. (1993) recorded a total of 399 fish species (1.7% endemic) on shallow reefs (<45m) by fishing and UVC in the St Lucia and Maputaland Marine Reserves off northern KZN, whereas Wood *et al*. (2000) recorded a total of 202 fish species (53.5% endemic) in the Tsitsikamma National Park in the Southern Cape. However, in addition to fishing and UVC, Wood *et al.* (2000) also included cryptic estuarine and larval fish species that were sampled with a range of different gear types. Although sampling of subtidal cryptic species using an ichthyocide such as rotenone during the current survey would undoubtedly have revealed greater numbers of fish species, especially from families such as the Gobiidae and Blenniidae, this was not attempted because of the limited time available during the survey and the strong surge encountered in most of the areas dived.

During this study, a number of Indo-Pacific species were found at their southernmost limit of distribution and, according to distribution ranges given by Smith and Heemstra (1986), some potentially represent new distribution records although these could be classified as vagrants (Table 3). Similarly, a number of species endemic to KZN were also found at the southernmost limit of their distribution including *Rhinobatos leucospilus*, *Rhabdosargus thorpei*, *Anchichoerops natalensis*, *Apolemichthys kingi* and *Oplegnathus robinsoni*. In addition, some warm-temperate species were observed at the northernmost limit of their distribution range in the Pondoland region, i.e. *Mustelus mustelus*, *Cheilodactylus pixi*, *Chrysoblephus laticeps* and *Clinus superciliosus*.

Importantly, the Pondoland region represents the centre of distribution for a number of overexploited endemic linefish species such as *Cymatoceps nasutus*, *Petrus rupestris* and *Polysteganus undulosus* (Mann 2000), and adult fish of these species are known to spawn in the area (Garratt 1988, BQM pers. obs.). Although *P. rupestris* and *P. undulosus* were not observed during the current survey, because adults of these species are generally found at depths >50m (Mann 2000), relatively large numbers of juvenile and sub-adult *C. nasutus* were encountered (Table 1 and Figure 3). Furthermore, fairly high numbers of other overexploited linefish species such as *Polysteganus praeorbitalis*, *Chrysoblephus anglicus* and *Epinephelus marginatus* were also counted (Table 1),

Table 3: Vagrant Indo-Pacific fish species observed during the underwater visual census or collected in intertidal rotenone samples along the Pondoland coast during the current study, which represent potential new distribution records. Fish are listed in phylogenetic order according to Smith and Heemstra (1986)

Family	Species	Common name
Dasyatidae	*Taeniura melanospilos*	Round ribbontail ray
Clupeidae	*Etrumeus teres*	East Coast round herring
Pseudochromidae	*Pseudochromis dutoiti*	Dutoiti
	Pseudochromis natalensis	Natal dottyback
Apogonidae	*Apogon taeniophorus*	Ninestripe cardinal
	Archamia mozambiquensis	Mozambique cardinal
	Cheilodipterus lineatus	Tiger cardinal
Caesionidae	*Caesio teres*	Beautiful fusilier
Lethrinidae	*Monotaxis grandoculis*	Bigeye barenose
Mullidae	*Parupeneus macronema*	Band-dot goatfish
Pomacanthidae	*Centropyge multispinis*	Dusky cherub
Chaetodontidae	*Chaetodon vagabundus*	Vagabond butterflyfish
Carangidae	*Alepes djedaba*	Shrimp scad
	Gnathodon speciosus	Golden kingfish
Pomacentridae	*Chromis dasygenys*	Bluespotted chromis
	Chromis dimidiata	Chocolate dip
Labridae	*Anampses meleagrides*	Yellowtail tamarin
	Bodianus bilunulatus	Saddleback hogfish
	Bodianus perditio	Goldsaddle hogfish
	Cheilinus bimaculatus	Two-spot wrasse
	Coris gaimard africana	African coris
	Gomphosus caeruleus	Birdfish
	Halichoeres cosmetus	Adorned wrasse
	Halichoeres lapillus	Jewelled wrasse
	Pseudojuloides cerasinus	Smalltail wrasse
Mugiloididae	*Parapercis punctulata*	Spotted sandsmelt
Acanthuridae	*Acanthurus blochii*	Tailring surgeon
	Acanthurus dussumieri	Pencilled surgeon
	Zebrasoma gemmatum	Spotted tang
Balistidae	*Sufflamen fraenatus*	Bridle triggerfish
Total: 15	30	

particularly in the area between the Sikombe and Mbotyi rivers. The high relative abundance of these, and other overexploited species, provided strong justification for the improved protection of the Pondoland region for the benefit of these species. In this regard, no-take MPAs can potentially increase yield by supplying more recruits to adjacent fished areas from increased reproduction within the MPA and, in some cases, by exporting adult biomass (Roberts and Polunin 1991, Roberts *et al*. 2001). They can also insure against catastrophic stock collapse from recruitment failure and potentially protect the genetic diversity of exploited populations from the selective effects of fishing (Bartholomew and Bohnsack 2005).

Based on the UVC, the size structure of most of the fish populations surveyed was typically bell-shaped (Figure 3). On the left-hand side, the absence of small juveniles is either because these individuals did not occur in the areas sampled, or because they have cryptic colouration and were difficult to see. The right-hand side is indicative of adult mortality rate or emigration out of the survey area (e.g. onto deeper reefs), or possible diver avoidance by larger fish. Interesting contrasts to the bell-shaped size distribution were observed for *Chrysoblephus puniceus* and to a lesser extent *Pachymetopon grande*, in which large numbers of juvenile fish in the 5cm size-class dominated counts (Figure 3). This is the first record of large numbers of juvenile *C. puniceus* <5cm total length (TL) being observed in the wild (Garratt 1993). Numbers of juvenile *P. germanum*, *C. anglicus* and *Polysteganus praeorbitalis* <5cm TL were also observed, indicating that the reefs off the Pondoland coast function as an important nursery area for a number of juvenile sparid species.

MPA zonation

Based on the bathymetric map of the area and the knowledge gleaned from the diving survey, the most prolific reef areas are situated between the Sikombe and Mbotyi rivers. This area included the old Mkambati MPA between the Mtentu and Msikaba rivers. It probably also represents the least fished area along this stretch of coastline (judging from the size and abundance of endemic reef fish species), being a considerable distance away from the main launch sites in the area (20km south of Port Edward and 24km north of Port St Johns). It was therefore proposed that the area between the Sikombe and Mbotyi rivers (~42km) be zoned as an offshore 'no-take' area, which stretches offshore to the 1 000m isobath (approximately 15km offshore). It was also proposed that this no-take zone should specifically prohibit all types of vessel-based fishing activities or any kind of offshore extractive use of both living and non-living marine resources. The purpose of these recommendations was to ensure that reef fish species in this area were given complete protection from fishing to enable stock recovery and the seeding and replenishment of adjacent fished areas (Buxton and Smale 1989, Roberts and Polunin 1991, Russ and Alcala 1996, Roberts *et al*. 2001, Brouwer *et al.* 2003). The size of the area closely conforms to the recommendations made by Griffiths and Wilke (2002) for adequate protection of warm-temperate reef fish species in southern Africa (i.e. minimum reserve length of 45km).

Clearly, zonation of this nature will impact directly on skiboat fishers who launch from Msikaba, Mkweni and Mbotyi (and other unregistered boat launching sites in the area). To mitigate against this, it was recommended that controlled fishing (i.e. the number of fishing vessels can be limited) continue to be allowed north of the Sikombe River and south of the Mbotyi River to enable commercial and recreational skiboat fishers based at Port Edward and Port St Johns to continue to fish south and north of their launch sites respectively (skiboat fishing and direction of travel in these areas is often wind related). The northern (Mzamba to Sikombe rivers) and southern (Mbotyi to Mzimvubu rivers) zones would thus be buffer zones for controlled extractive use on either side of the core no-take zone.

As a result of data gathered during this survey, and other work done in the area, the Pondoland MPA was proclaimed on 4 June 2004 (Government Gazette No. 26430, Notice No. 694) under Section 43 of the Marine Living Resources Act (Anon. 1998). Although proclamation of the MPA preceded the final write-up and completion of this biodiversity survey, the recommendations discussed above were incorporated into the proclamation. This proclamation represents a significant achievement for marine conservation and brings South Africa a step closer to achieving the 2002 World Summit on Sustainable Development's ambitious targets of creating a national network of MPAs protecting 20% of the Exclusive Economic Zone by 2012 and of rebuilding exploited fisheries by 2015 (United Nations 2002). The next step is to ensure the development and effective implementation of a sound management plan for the Pondoland MPA.

Acknowledgements — We thank our colleagues Angus Macdonald, Mike Schleyer, Tim Kay, Mike Burgin and Duane Boshoff for their assistance and camaraderie during the diving survey. Pat and Karen Goss and John Costello are thanked for providing us with accommodation and logistical support. We are grateful to Kevin Cox from the Natal Sharks Board and other fishers who provided information on the locality of reefs in the area. Paul Zammit and Nikki James are thanked for assisting with aspects of database design and analysis. Charl Bosman and Rio Leuci (Marine Geoscience Unit) are thanked for creating the bathymetric map of the Pondoland region and for their comments on the seafloor morphology of the area. The Marine and Coastal Management (MCM) branch of the Department of Environmental Affairs and Tourism, and the South African Association for Marine Biological Research, are gratefully acknowledged for providing the necessary funding. Finally we would like to thank Dr Colin Attwood (MCM) for his support and encouragement throughout this project.

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Manuscript received August 2005; accepted May 2006

Appendix: Fish species recorded in the northern Transkei (Port Edward to Coffee Bay) from commercial and recreational skiboats (SB; Fennessy *et al*. 2003), shore-anglers (SA; Mann *et al*. 2003), shore-fishing competitions (CO; Pradervand 2004), intertidal rock pool collections (RP) and the UVC conducted during this study. Fish are listed in phylogenetic order according to Smith and Heemstra (1986)

Family	Scientific name	Common name	SB	SA	CO	RP	UVC
Chondrichthyes							
Orectolobidae	*Stegostoma fasciatum*	Zebra shark			Y		
Carcharhinidae	*Carcharhinus brachyurus*	Copper shark			Y		Y
	Carcharhinus brevipinna	Spinner shark			Y		
	Carcharhinus leucas	Zambezi shark			Y		Y
	Carcharhinus limbatus	Blackfin shark			Y		
	Carcharhinus obscurus	Dusky shark			Y		
	Carcharhinus plumbeus	Sandbar shark			Y		
	Carcharhinus sealei	Blackspot shark			Y		
	Rhizoprionodon acutus	Milk shark			Y		
Triakidae	*Mustelus mustelus*	Smooth houndshark			Y		Y
	*Scylliogaleus quecketti**	Flapnose houndshark			Y		
	*Triakis megalopterus**	Spotted gullyshark		Y	Y		
Scyliorhinidae	*Halaelurus lineatus*	Banded catshark			Y		
	*Haploblepharus fuscus**	Brown shyshark			Y		
	*Poroderma pantherinum**	Leopard catshark			Y		Y
Sphyrnidae	*Sphyrna lewini*	Scalloped hammerhead shark			Y		Y
Odontaspididae	*Carcharias taurus*	Spotted raggedtooth shark			Y		Y
Torpedinidae	*Torpedo fuscomaculata*	Blackspotted electric ray					Y
	Torpedo sinuspersici	Marbled electric ray			Y		
Rhinobatidae	*Rhinobatos annulatus**	Lesser lesser guitarfish		Y	Y		Y
	*Rhinobatos leucospilus**	Greyspot guitarfish			Y		Y
	Rhynchobatus djiddensis	Giant guitarfish			Y		Y
Myliobatidae	*Aetobatus narinari*	Spotted eagleray			Y		
	Myliobatis aquila	Eagle ray			Y		
	Pteromylaeus bovinus	Duckbill ray		Y	Y		
Mobulidae	*Manta birostris*	Manta					Y
Dasyatidae	*Dasyatis brevicaudata*	Short-tail stingray					Y
	Dasyatis chrysonota chrysonota	Blue stingray		Y	Y		
	*Gymnura natalensis**	Diamond ray			Y		
	Himantura gerrardi	Brown stingray			Y		
	Himantura uarnak	Honeycomb stingray			Y		
	Taeniura melanospilos	Round ribbontail ray					Y
Osteichthyes							
Elopidae	*Elops machnata*	Springer		Y	Y		
Congridae	*Conger cinereus cinereus*	Blackedged conger				Y	
Muraenidae	*Gymnothorax undulatus*	Leopard moray		Y		Y	Y
Albulidae	*Albula vulpes*	Bonefish			Y		
Clupeidae	*Etrumeus teres*	East Coast round herring	Y				Y
	Sardinops sagax	Pilchard					Y
Ariidae	*Galeichthys* sp.*	Black seacatfish	Y	Y	Y		Y
Plotosidae	*Plotosus nkunga**	Eeltail barbel		Y	Y		
Synodontidae	*Synodus variegatus*	Variegated lizardfish				Y	
Berycidae	*Centroberyx spinosus**	Short alfonsino					Y
Holocentridae	*Sargocentron punctatissimum*	Speckled squirrelfish				Y	
Scorpaenidae	*Pterois miles*	Devil firefish					Y
	Scorpaena scrofa	Bigscale scorpionfish	Y			Y	
Platycephalidae	*Platycephalus indicus*	Bartail flathead		Y	Y		
Kuhliidae	*Kuhlia mugil*	Barred flagtail		Y		Y	
Polyprionidae	*Polyprion americanus*	Wreckfish	Y				
Serranidae	*Acanthistius sebastoides*	Koester					Y
	Pseudanthias squamipinnis	Sea goldie					Y
	Cephalopholis sonnerati	Tomato rockcod			Y		
	*Epinephelus albomarginatus**	White-edged rockcod	Y				
	*Epinephelus andersoni**	Catface rockcod	Y	Y	Y		Y
	Epinephelus chabaudi	Moustache rockod	Y				
	Epinephelus chlorostigma	Brownspotted rockcod	Y				
	Epinephelus flavocaeruleus	Yellowtail rockcod	Y				
	Epinephelus marginatus	Yellowbelly rockcod	Y	Y	Y	Y	Y
	Epinephelus poecilonotus	Dot-dash rockcod	Y				
	Epinephelus rivulatus	Halfmoon rockcod	Y		Y		Y
	Serranus cabrilla	Comber					Y

Appendix (cont.)

Family	Scientific name	Common name	SB	SA	CO	RP	UVC
Grammistidae	*Grammistes sexlineatus*	Sixstripe soapfish				Y	
Pseudochromidae	*Pseudochromis dutoiti*	Dutoiti					Y
	Pseudochromis natalensis	Natal dottyback					Y
Priacanthidae	*Priacanthus cruentatus*	Glass bigeye	Y				
	Priacanthus hamrur	Crescent-tail bigeye					Y
Apogonidae	*Apogon kallopterus*	Spinyhead cardinal					Y
	Apogon quadrifasciatus	Twostripe cardinal					Y
	Apogon taeniophorus	Ninestripe cardinal					Y
	Archamia mozambiquensis	Mozambique cardinal					Y
	Cheilodipterus lineatus	Tiger cardinal					Y
Pomatomidae	*Pomatomus saltatrix*	Elf	Y	Y	Y		Y
Haemulidae	*Plectorhinchus chubbi*	Dusky rubberlip	Y				Y
	Plectorhinchus flavomaculatus	Lemonfish		Y	Y		Y
	Plectorhinchus playfairi	White-barred rubberlip	Y				
	Pomadasys commersonnii	Spotted grunter		Y	Y		
	Pomadasys kaakan	Javelin grunter		Y	Y		
	Pomadasys olivaceum	Piggy		Y			Y
	Pomadasys striatum	Striped grunter					Y
Dinopercidae	*Dinoperca petersi*	Cavebass	Y	Y	Y		Y
Lutjanidae	*Aprion virescens*	Green jobfish					Y
	Etelis coruscans	Ruby snapper	Y				
	Lutjanus argentimaculatus	River snapper			Y		
	Lutjanus rivulatus	Speckled snapper			Y		
Caesionidae	*Caesio teres*	Beautiful fusilier					Y
Sparidae	*Acanthopagrus berda*	Riverbream		Y	Y		
	*Boopsoidea inornata**	Fransmadam	Y				Y
	Cheimerius nufar	Santer	Y				Y
	*Chrysoblephus anglicus**	Englishman	Y				Y
	*Chrysoblephus cristiceps**	Dageraad	Y				
	*Chrysoblephus gibbiceps**	Red stumpnose	Y				
	*Chrysoblephus laticeps**	Roman					Y
	*Chrysoblephus puniceus**	Slinger	Y				Y
	*Chrysoblephus lophus**	False englishman	Y				
	*Cymatoceps nasutus**	Black musselcracker	Y	Y	Y		Y
	*Diplodus cervinus hottentotus**	Zebra	Y	Y	Y		Y
	*Diplodus sargus capensis**	Blacktail		Y	Y	Y	Y
	*Lithognathus lithognathus**	White steenbras		Y	Y		
	Lithognathus mormyrus	Sand steenbras					Y
	*Pachymetopon aeneum**	Blue hottentot					Y
	*Pachymetopon grande**	Bronze bream	Y	Y	Y		Y
	Pagellus bellottii natalensis	Red tjor-tjor					Y
	*Petrus rupestris**	Red steenbras	Y				
	*Polyamblyodon germanum**	German	Y				Y
	Polysteganus coeruleopunctatus	Blueskin	Y				
	*Polysteganus praeorbitalis**	Scotsman	Y	Y	Y		Y
	*Polysteganus undulosus**	Seventy-four	Y				
	*Porcostoma dentata**	Dane	Y				Y
	*Rhabdosargus globiceps**	White stumpnose			Y		
	*Rhabdosargus holubi**	Cape stumpnose	Y	Y	Y		Y
	Rhabdosargus sarba	Natal stumpnose		Y	Y		Y
	*Rhabdosargus thorpei**	Bigeye stumpnose					Y
	Sarpa salpa	Strepie		Y			Y
	*Sparodon durbanensis**	White musselcracker		Y	Y		Y
	*Spondyliosoma emarginatum**	Steentjie	Y				Y
Lethrinidae	*Lethrinus nebulosus*	Blue emperor	Y				Y
	Lethrinus olivaceus	Longnose emperor	Y				
	Monotaxis grandoculis	Bigeye barenose					Y
Coracinidae	*Dichistius capensis**	Galjoen		Y	Y		
	*Dichistius multifasciatus**	Banded galjoen		Y	Y		Y
Kyphosidae	*Kyphosus bigibbus*	Grey chub			Y		
Scorpididae	*Neoscorpis lithophilus**	Stonebream		Y	Y	Y	Y
Monodactylidae	*Monodactylus falciformis*	Cape moony			Y		Y

Appendix (cont.)

Family	Scientific name	Common name	SB	SA	CO	RP	UVC
Mullidae	*Mulloides flavolineatus*	Yellowstripe goatfish					Y
	Parupeneus cinnabarinus	Redspot goatfish					Y
	Parupeneus indicus	Indian goatfish					Y
	Parupeneus macronema	Band-dot goatfish					Y
	Parupeneus rubescens	Black-saddle goatfish	Y				Y
Malacanthidae	*Branchiostegus doliatus*	Ribbed tilefish	Y				
Sciaenidae	*Argyrosomus japonicus*	Dusky kob	Y	Y	Y		Y
	*Argyrosomus thorpei**	Squaretail kob	Y		Y		
	Atractoscion aequidens	Geelbek	Y		Y		
	Otolithes ruber	Snapper kob			Y		
	Umbrina robinsoni	Baardman	Y		Y		Y
Pomacanthidae	*Apolemichthys kingi**	Tiger angelfish					Y
	Centropyge acanthops	Jumping bean					Y
	Centropyge multispinis	Dusky cerub					Y
	Pomacanthus rhomboides	Old woman					Y
Chaetodontidae	*Chaetodon auriga*	Threadfin butterflyfish				Y	
	Chaetodon blackburnii	Brownburnie					Y
	Chaetodon dolosus	Blackedged butterflyfish					Y
	Chaetodon kleinii	Whitespotted butterflyfish					Y
	Chaetodon lunula	Halfmoon butterflyfish				Y	Y
	*Chaetodon marleyi**	Doublesash butterflyfish					Y
	Chaetodon vagabundus	Vagabond butterflyfish					Y
Oplegnathidae	*Oplegnathus conwayi**	Cape knifejaw	Y		Y		Y
	*Oplegnathus robinsoni**	Natal knifejaw					Y
Carangidae	*Alepes djedaba*	Shrimp scad					Y
	Carangoides ferdau	Blue kingfish			Y		
	Carangoides gymnostethus	Bludger			Y		
	Caranx ignobilis	Giant kingfish			Y		
	Caranx sexfasciatus	Bigeye kingfish			Y		Y
	Gnathanodon speciosus	Golden kingfish					Y
	Lichia amia	Leervis		Y	Y		
	Pseudocaranx dentex	White kingfish		Y			Y
	Scomberoides commersonnianus	Talang queenfish			Y		
	Seriola lalandi	Cape yellowtail	Y		Y		Y
	Seriola rivoliana	Longfin yellowtail					Y
	Seriolina nigrofasciata	Blackbanded kingfish					Y
	Trachinotus africanus	Southern pompano			Y		
	Trachinotus botla	Largespotted pompano			Y		
Coryphaenidae	*Coryphaena hippurus*	Dorado	Y				
Rachycentridae	*Rachycentron canadum*	Prodigal son			Y		
Cirrhitidae	*Cirrhitichthys oxycephalus*	Spotted hawkfish				Y	
	Cirrhitus pinnulatus	Marbled hawkfish					Y
	Cyprinocirrhites polyactis	Swallowtail hawkfish					Y
Cheilodactylidae	*Cheilodactylus pixi**	Barred fingerfin					Y
	*Chirodactylus brachydactylus**	Twotone fingerfin		Y			Y
	*Chirodactylus jessicalenorum**	Natal fingerfin	Y				Y
Pempheridae	*Pempheris adusta*	Dusky sweeper					Y
Pomacentridae	*Abudefduf notatus*	Dusky damsel				Y	
	Abudefduf sordidus	Spot damsel		Y		Y	Y
	Abudefduf sparoides	False-eye damsel				Y	
	Abudefduf vaigiensis	Sergeant major				Y	
	Chromis dasygenys	Bluespotted chromis					Y
	Chromis dimidiata	Chocolate dip					Y
	Chromis nigrura	Blacktail chromis					Y
	Plectroglyphidodon leucozonus	Sash damsel				Y	
Labridae	*Anampses meleagrides*	Yellowtail tamarin					Y
	*Anchichoerops natalensis**	Natal wrasse					Y
	Bodianus bilunulatus	Saddle-back hogfish	Y				Y
	Bodianus perditio	Goldsaddle hogfish					Y
	Cheilinus bimaculatus	Two-spot wrasse					Y
	Cheilio inermis	Cigar wrasse					Y
	Coris caudimacula	Spottail coris					Y
	Coris gaimard africana	African coris					Y

Appendix (cont.)

Family	Scientific name	Common name	SB	SA	CO	RP	UVC
	Gomphosus caeruleus	Birdfish					Y
	Halichoeres cosmetus	Adorned wrasse					Y
	Halichoeres lapillus	Jewelled wrasse					Y
	Labroides dimidiatus	Bluestreak cleaner wrasse					Y
	Pseudojuloides cerasinus	Smalltail wrasse					Y
	Stethojulis interrupta	Cutribbon wrasse				Y	Y
	Thalassoma amblycephalum	Twotone wrasse				Y	Y
	Thalassoma herbraicum	Goldbar wrasse		Y			Y
	Thalassoma lunare	Crescent-tail wrasse					Y
	Thalassoma purpureum	Surge wrasse		Y		Y	Y
	Thalassoma quinquevittatum	Fivestripe wrasse				Y	
	Thalassoma trilobatum	Ladder wrasse				Y	Y
Scaridae	*Scarus ghobban*	Bluebarred parrotfish				Y	
Mugilidae	*Liza tricuspidens**	Striped mullet		Y			Y
Sphyraenidae	*Sphyraena* sp.	Barracuda	Y				
Mugiloididae	*Parapercis punctulata*	Spotted sandsmelt					Y
Blenniidae	*Antennablennius australis*	Moustached rockskipper				Y	
	Antennablennius bifilum	Horned rockskipper				Y	
	Cirripectes castaneus	Muzzled rockskipper				Y	
	Istiblennius dussumieri	Streaky rockskipper				Y	
	Istiblennius edentulus	Rippled rockskipper				Y	
	Plagiotremus rhinorhynchos	Twostripe blenny					Y
	Plagiotremus tapeinosoma	Piano blenny					Y
Tripterygiidae	*Helcogramma obtusirostre*	Hotlips triplefin				Y	
Clinidae	*Blennioclinus stella**	Silverbubble klipfish				Y	
	*Clinus superciliosus**	Super klipfish					Y
	*Pavoclinus graminis**	Grass klipfish				Y	Y
Gobiidae	*Bathygobius cocosensis*	Coco frillgoby				Y	
	Bathygobius laddi	Brownboy goby				Y	
	*Caffrogobius caffer**	Banded goby				Y	
	Hetereleotris zonata	Goggles				Y	
	Priolepis cincta	Convict goby				Y	
Acanthuridae	*Acanthurus blochii*	Tailring surgeon					Y
	Acanthurus dussumieri	Pencilled surgeon					Y
	Acanthurus nigrofuscus	Brown surgeon				Y	Y
	Acanthurus triostegus	Convict surgeon				Y	
	Ctenochaetus striatus	Striped bristletooth				Y	
	Zebrasoma gemmatum	Spotted tang					Y
Scombridae	*Euthynnus affinis*	Eastern little tuna	Y				Y
	Scomber japonicus	Mackerel	Y				
	Scomberomorus commerson	King mackerel	Y		Y		
	Scomberomorus plurilineatus	Queen mackerel			Y		
	Thunnus albacares	Yellowfin tuna	Y				
Istiophoridae	*Istiophorus platypterus*	Sailfish					Y
Balistidae	*Sufflamen fraenatus*	Bridle triggerfish					Y
Monacanthidae	*Cantherhines dumerilii*	Whitespotted filefish					Y
Tetraodontidae	*Amblyrhynchotes honckenii*	Evileye toby		Y			
	Arothron hispidus	Whitespotted blaasop					Y
	Arothron immaculatus	Blackedged blaasop					Y
	Canthigaster amboinensis	Spotted toby				Y	
Total: 69	235		54	41	78	41	138

* Endemic