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CHECKLIST OF REEF FISHES OF DIANI AND GALU, KENYA

K.R. Bock
P.O. Box 641, Ukunda, Mombasa, Kenya

ABSTRACT

This paper provides a checklist of the 195 species of coral reef fish observed in Diani Lagoon between April 1990 and November 1991, and the 203 species observed in Galu Lagoon between October 1991 and March 1994. Community structure, species richness and relative abundances were similar between Diani and Galu. A comparison of species richness reported here with that of 1971 suggests diversity has been maintained, and is of much the same composition as it was over twenty years ago.

INTRODUCTION

The first checklist of fishes of Diani Lagoon (Bock, 1972) was published over 20 years ago. During this period Diani Beach has developed into one of the major tourist areas of the Kenya Coast, the number of hotels increasing from four in 1971 to 14 in 1991. Diani is also heavily fished (Samoilys, 1988; McClanahan and Muthiga, 1988) and is considered by the latter authors to be under a certain amount of threat.

The checklist presented here has enabled a comparison to be made between species diversity or richness in 1971 and that prevailing in 1991, seen against the background of intensive tourist development and continuing exploitation by fishermen.

To the south of Diani Lagoon and confluent with it is Galu Lagoon. Galu is probably as heavily fished as Diani, but the two lagoons differ in a number of physical respects and the northern reaches of Galu are relatively free from possible direct impacts of tourism. Galu Lagoon was studied between October 1991 and March 1994 and the resulting checklist of fishes is included here for comparison with that of Diani.

METHODS

Nomenclature

A great deal of taxonomic revision has been effected since 1970, and over one third of the scientific names of species recorded in the first checklist, which were used by Smith and Smith (1963) and Smith (1965), have been changed (table 1). Species names used in this checklist are taken from Smith and Heemstra (1986), which lists as synonyms those names given in the two reference cited above. A few species, however, which occur outside Southern Africa, are not included in Smith and Heemstra. For these I have used several recent sources, but mainly the series *Indo-Pacific Fishes*. The relevant publications of this series are cited in the references. Author citations for species have not been given: reference to Smith and Heemstra (1986) should be made for these if needed. There have also been major changes in the sequence of families. I follow here the sequence of Randall, Allen and Steene (1990).

Table 1. Species names appearing in the preliminary Diani checklist (Bock, 1972) which have since been changed (either because of taxonomic changes, or because the identifications were based on misidentifications of Smith & Smith (1963) or Smith (1965)).

Family	In Bock 1972	Now changed to
Muraenidae	*Lycodontis* spp	*Gymnothorax* spp
Clupeidae	*Sardinella melanura*	*S. gibbosa*
Plotosidae	*Plotosus arab*	*P. lineatus*
Antennariidae	*Antennarius chironectes*	*A. pictus*
	A. oligospilos	*A. pictus*
Holocentridae	*Holocentrus sammara*	*Neoniphon samara*
	H. diadema	*Sargocentron diadema*
Aulostomidae	*Aulostomus valentini*	*A. chinensis*
Fistulariidae	*Fistularia petimba*	*F. commersonii*
Syngnathidae	*Corythoichthys fasciatus*	*C. haematopterus*
Scorpaenidae	*Pteropterus antennata*	*Pterois antennata*
	Pterois volitans	*Pterois miles*
Apogonidae	*Apogonichthyoides nigripinnis*	*Apogon nigripinnis*
	Ostorhynchus angustatus	*Apogon angustatus*
	O. fleurieu	*A. aureus*
	O. cyanosoma	*A. cyanosoma*
	O. savayensis	*A. savayensis*
	Paramia quinquelineata	*Cheilodipterus quinquelineatus*
Haemulidae	*Gaterin* spp	*Plectorhinchus* spp
Ephippidae	*Platax pinnatus*	*P. orbicularis*
Pomacanthidae	*Pomacanthodes imperator*	*Pomacanthus imperator*
	Pomacanthodes semicirculatus	*Pomacanthus semicirculatus*
Pomacentridae	*Abudefduf saxatilis*	*A. vaigiensis*
	A. annulatus	*Chrysiptera annulata*
	A. leucopoma	*Chrysiptera leucopoma*
	A. lacrymatus	*Plectroglyphidodon lacrymatus*
	A. cingulum	*P. leucozonus*
	Amphiprion ephippium	*Amphiprion allardi*
	Pomacentrus pulcherrimus	*P. caeruleus*
Cirrhitidae	*Cirrhitichthys aprinus*	*C. oxycephalus*
Sphyraenidae	*Sphyraena jello*	*S. flavicauda*
Labridae	*Coris angulata*	*C. aygula*
	Gomphosus varius	*C. caeruleus*
	Halichoeres centiquadrus	*H. hortulanus*
	H. kawarin	*H. nebulosus*
	Stethojulis axillaris	*S. albovittata*
Scaridae	*Xanothon margaritus*	*Scarus sordidus*
Blenniidae	*Runula rhinorhynchos*	*Plagiotremus rhinorhynchos*
Acanthuridae	*Zebrasoma veliferum*	*Z. desjardinii*
Ostraciidae	*Ostracion tuberculatus*	*O. cubicus*
	O. lentiginosum	*O. meleagris*

1. As in Smith and Smith 1963 and Smith 1965
2. As in Smith and Heemstra 1986

Study Areas

Observations were made at three separate sites in Diani Lagoon and one in Galu.

Diani Site 1

This was the same area of Diani Lagoon as that surveyed during the compilation of the first checklist (Bock, 1972). It lies to the immediate south of Kaskazi Beach Hotel, consisting of the southern flank of the channel leading to a gap in the fringing reef, the lagoon, and several reef platform pools, southwards to a point opposite Trade Winds Hotel.

Diani Site 2

This was the area of Diani Lagoon and associated reef platform pools between Diani Sea Lodge and the northern boundary of Africana Sea Lodge. This area, about 1.5 km south of Site 1, is of some interest as it contains the study site of Khamala (1971) and Muthiga and McClanahan (1987).

Diani Site 3 (situated within Site 2)

This was a particular reef platform pool opposite Diani Sea Lodge. This pool, of only moderate size, about 20 m long and 1–15 m wide but of highly irregular shape and depth (0.5–1.5 m) is isolated from the surge zone of the fore reef at low spring tides by an elevated rocky sill. Roughly half of the substrate is sand and half more or less densely covered with *Sargassum* seaweed. It was subjected to periodic violent disturbance by fishermen, either spearing the substrate in search of octopus of shells, or working as a team of three, two sweeping the pool with a net, the third driving fish towards the net by beating the water with a large pole.

The North Galu Site

This was an area of lagoon about 6 km south of the Diani site, situated between Galu Sea Lodge and the southern boundary of the residence of Dr V. Kahr. Unlike the Diani study sites, Galu Lagoon has two broad, deep channels between the shoreline and reef: these are aligned parallel to the shore. The reef is more distant and the reef platform is barely exposed at low spring tides. Scattered throughout the lagoon are large eroded rocky outcrops, mostly set in the channels in comparatively deep water.

Observations

Observations were made using mask and snorkel, and were confined to low spring tides during daylight hours. Identification of most species was by underwater observation only, and this occasionally presented obvious difficulties.

At Site 1, ten meandering transects of the lagoon, each of 60–90 min. duration, were made during October, November, December 1991. In addition, surveys of reef pools were included on four of these ten occasions.

At Site 2, 16 similar lagoonal transects were made, plus a further five separate surveys of reef pools, a total of 21 observational visits.

At Site 3, recordings were made on 3, 5 and 20 November 1990, and again one year later, on 7 and 23 November and 7 December 1991.

At Galu, a total of 19 transects were made at intervals between October 1991 and March 1994. Two of these were restricted to the zone of dissected rock immediately inshore of the reef platform, two were confined to reef platform pools, and the remainder were lagoonal. Other records were species recorded from fishermen's nets and spear-gun catches taken within the Galu site. Catches were not studied at Diani.

Species abundance

In the 1971 checklist subjective approximations of species abundance were made. Species were described as occurring commonly in moderately high densities (Category C), fairly commonly but generally less abundantly (Category P), or as encountered only infrequently (Category R).

In the checklist presented below, the number of site visits out of a total of ten on which a species was recorded is given for Diani Site 1. For those species present in both 1971 and 1991 subjective category (C, P or R) is fore-fixed for comparison and ease of reference. At Diani Site 2, the maximum possible number of visit sightings for any one species is 21. Similarly for Galu, the maximum possible number of recordings of any given species is 19. These records are also entered in the checklist, enabling immediate comparisons of approximate species abundance between Diani and Galu respectively.

Species number or densities were not recorded, nor was frequency of separate sightings of the same species in any one visit. Nonetheless, the figures provide a rough guide to the relative status of each species at Diani in 1991 and at Galu between 1991 and 1994.

It should be noted that the list is by no means a complete inventory of species present. There is no doubt that a detailed systematic search would result in the addition of very many more, especially in such families as the Blenniidae, Gobiidae and Scorpaenidae, and other cryptic species in general.

RESULTS

Changes in littoral habitat at Diani

In 1971 the northern reaches of the shoreline of Diani Site 1 consisted of old eroded coral rock containing many shoreline pools, the only recorded habitat of a number of species present at that time. Such areas along the Coast are subject to sand movement, which may cover the rock and thus obliterate pools. Prior to the 1991 survey sand movement had occurred, resulting in a loss of this particular habitat. In addition to sand deposition, the northern shoreline and shallow inshore areas of the lagoon were covered with variable but often heavy overlying deposits of fine sediment.

Misidentification in the first checklist

Bock (1972) based his identifications on those of Smith and Smith (1963) and Smith (1965). Some of them have subsequently proved to be misidentifications.

Canthigaster margaritatus (a synonym of *C. margaritata*) is apparently endemic to the Red Sea. *C. margaritatus* in Smith and Smith (1963) and Smith (1965) was a misidentification of *C. solandri* (Smith and Heemstra, 1986). This species was confirmed as present in Diani in 1991.

Lutjanus johni apparently does not occur along the East African coast (Allen and Talbot, 1985). This species closely resembles and has been confused with *L. ehrenbergii* (Smith and Heemstra, 1986). *L. ehrenbergii* is present at Diani and is included in this checklist. It is assumed therefore that *L. johni* was a misidentification of *L. ehrenbergii*.

Myripristis pralinus (a synonym of *M. pralina*) does not occur along the East African coast (Randall, Allen and Steene, 1990). Previous records were based on a misidentification of *M.*

kuntee (Smith and Heemstra, 1986). *M. pralinus* (Bock, 1972) therefore correctly refers to *M. kuntee*, confirmed as present in this checklist.

Pempheris oualensis does not occur along the East African Coast (Randall, Allen and Steene, 1990). Both *P. vanicolensis* and *P. schwenkii* are common at Diani, and it is probable that the record in Bock (1972) refers to either of these two species.

Pomacentrus taeniurus was a misidentification by Bock (1972) of *Neopomacentrus azysron*, which is at present common to abundant in suitable habitats in Diani Lagoon.

Pomacentrus tripunctatus was identified by Bock (1972) from the illustrations in Smith and Smith (1963) (Plate 68, I and J). This species, misidentified by the Smiths, has only recently been described as new and named as *P. baenschi* (Allen, 1991).

Siganus oramin, identified on the basis of illustrations in Smith and Smith (1963) and Smith (1965), is in fact *S. sutor* (Woodland, 1990).

Zebrasoma flavescens as recorded in Bock (1972) almost certainly was a misidentification of juveniles of *Ctenochaetus strigosus*, which are similar in shape and also bright yellow. Both juveniles and adults of *C. strigosus* were observed at Diani during the studies presented here; *Z. flavescens* was not recorded.

DISCUSSION

The increase in number of species of fish recorded in Diani Lagoon, from 137 in 1971 to 195 in 1991, is due in part at least to the greater ability and confidence of the author in species identification. This has been enhanced by the exceptionally high standard of descriptions and illustration contained in several recent publications, especially those of Randall (1983), Masuda *et al.* (1984), Smith and Heemstra (1986), Randall, Allen and Steene (1990), and Allen (1991).

Forty-five of the fifty families represented in Diani Lagoon in 1971 remained present in 1991. The five missing families were each represented in 1971 by a single species. Two (Duleidae and Mugilidae) suffered a loss of shoreline habitat. Species of a further two (Chirocentridae and Leiognathidae) were present in Galu Lagoon. The fifth family (Solenostomidae) includes small cryptic fishes, which could easily have been overlooked.

One hundred and thirty seven species were recorded from Site 1 in 1971. Of this total, two are synonyms: *Gomphosus caeruleus* and *G. varius* are male and female respectively of *G. caeruleus*. *Antennarius chironectes* and *A. oligospilos* are now considered synonyms of *A. pictus* (Smith and Heemstra, 1986). In addition, six species were recorded from shoreline pools only, a habitat which was subsequently lost.

For comparative purposes, therefore, the 1971 total of 137 species is reduced by eight to 129. Of these, 94 were still present in 1991. A further 11, though not recorded in Site 1, were present in Site 2, and an additional nine were present at Galu. It may, therefore, be assumed that at least 114 out of 129 species (about 88%) entered in the first checklist are present in the lagoon today.

Of the ten species of Apogonidae recorded in 1971, three were not observed in 1991 and populations of all but one (*Cheilodipterus quinquelineatus*) have apparently decreased. However, five additional species were present in 1991, one of which (*Archamia fucata*)

occurred in high numbers. The family thus remains well represented in species. It is possible that this general decline may be due to the effect of frequent and massive disturbance associated with beach seine fishing on a group of specialised mouth brooders.

Thirteen of the missing 20 species were encountered only infrequently in 1971: some of them may possibly still be present in very low population densities. Four species listed as occurring in moderately high densities, however, were not observed in Diani or Galu: *Abudefduf septemfasciatus, Apogon fraenatus* (*Pristiapogon fraenatus* is a synonym), *Gobiodon rivulatus* and *Scorpaenodes* sp.

In 1971 over one third of all species (49/135, 36%) were contained in four families, the Pomacentridae, Labridae, Acanthuridae and Apogonidae. These four families were also predominant in 1991, when they accounted for a similar proportion (76/195, 39%). With the exception of the Apogonidae, individual species occurred in more or less similar population densities to those of 1971. They were also predominant at Galu, where an almost identical range of species accounted for an almost identical proportion of the total (72/203, 35%).

The 70 species recorded in one reef platform pool at Diani is a measure of the species richness of this particular habitat, where damselfishes, wrasses and surgeonfishes were abundant and were collectively represented by 39 species (about 56% of the total): 58 species were recorded in both years of observation. Disturbance to and removal of fish from this habitat appeared to have no effect on species richness. Small, shallow pools are numerous on the reef platform and often contain dense populations of small juveniles: it is thus likely that replenishment is more or less continuous.

Of the 195 species recorded at Diani in 1991, 132 were common to both site 1 and site 2; 29 additional species were observed only in Site 1 and 34 only in Site 2. Similarly 47 species recorded at Galu were not observed at Diani, while 39 Diani species were not found at Galu. This somewhat patchy distribution, in low population densities, of about one third of the 242 species found in both areas may be attributable to one or more of at least five factors:

(1) Some species may occur naturally at low or very low population densities only;

(2) There were localised habitat differences between sites (for example, Diani Site 1 included the southern flank of a deep channel leading to a gap in the fringing reef: there was no comparable habitat in Site 2 or in the areas studied at Galu);

(3) Populations of some species may fluctuate markedly, their densities being dependent on factors affecting recruitment such as reproductive success and subsequent random dispersal in areas remote from the study sites;

(4) Some species were vagrants or strays from habitats not represented in Diani or Galu lagoons (such as rich lagoonal coral gardens);

(5) Low densities in several species have almost certainly been induced by overfishing and by continuous disturbance with seine net (*juya*) fishing.

Four broad components to the community of reef fish may be recognised in Diani and Galu lagoons.

The first includes species that occur habitually in shoals in shoreline sandy shallows, mostly as juveniles or immatures. These are subject to fine-mesh net fishing, especially during the northeast monsoon.

The second component includes species that frequent lagoonal areas dominated by a mosaic of sand and seagrass with scattered rubble patches of low relief. It is these areas which are most subject to seine net fishing, and it is to be expected that populations inhabiting them will be vulnerable to over-exploitation or at least to massive disturbance. Included in this component are the relatively few species of important food fish that occur in shallow lagoons. In the list of these, which follows, the three figures in parentheses refer to the number of occasions on which each species was recorded, expressed as a percentage of the total number of site visits made at Diani Site 1, Diani Site 2 and Galu, respectively: *Plectorhinchus flavomaculatus* (30, 15, 40), *Lutjanus fulviflamma* (60, 10, 45), *Siganus sutor* (40, 25, 20), *Cheilinus trilobatus* (60, 35, 15), *Leptoscarus vaigiensis* (40, 55, 25), *Lethrinus harak* (70, 50, 65), *Cheilio inermis* (60, 70, 55) and *Pseudupeneus macronema* (90,60,90). While all these species thus still remain in evidence, frequency of sighting, the observed size of individuals (juveniles or sub-adults), and the small aggregations (2–4) of species that might be expected to occur in somewhat larger schools, suggest some depletion of stocks.

The third component includes the small, often attractively coloured species that inhabit, and are largely restricted to, areas that afford protective cover such as rocky outcrops, eroded rocky substrates and isolated coral heads. Fishermen usually avoid these areas because of the risk of snagging and thus damaging their nets. Some of these species are occasionally trapped in nets and utilised as food and a few are taken with spearguns, but the majority cannot be described as being fished deliberately. The high population densities of species in this component, exemplified by the Pomacentridae and the smaller species of Labridae, have not changed by much in 20 years.

The fourth distinctive component includes populations of species in reef platform pools, at present the most species-rich habitat at Diani and Galu. The reef platform constitutes an area of great significance, not only in the number of different species but also because the pools serve as important nurseries, and thus replenishment points, for a multitude of lagoonal species.

In assessing fish species richness or abundance, it therefore seems necessary to take these four components into account. For example, random linear transects across the lagoon over seagrass and sand mosaic would be appropriate for species such as *Leptoscarus vaigiensis* and certain schooling species such as the Siganidae, but this method would be entirely inappropriate for assessing stocks of a multitude of others, including Pomacentridae, Labridae, Holocentridae, Pempheridae and Scorpaenidae, the distribution of which is non-random in many.

Diani and Galu lagoons, for example, are both heavily fished and have been so for a number of years. While there is an apparent depletion of stocks for some of the food fishes, many species of Pomacentridae and Labridae and others remain common to abundant. In order to evaluate these properly, recourse must be made to detailed censuses of rocky outcrops, dissected rocky areas and reef platform pools.

Samoilys (1988) found, for the outer reef slopes, that while biomass was reduced by fishing pressure, there was no relationship between species richness of coral fish and fishing pressure in the unprotected areas she studied. It seems this may also be so for the shallow lagoons: in spite of an intervening period of over 20 years of continuously heavy exploitation, species richness appears not to have been greatly affected.

A comparison of the 1971 and 1991 checklists thus indicate that overall species richness has been maintained and is of much the same composition and structure as it was in 1971. McClanahan and Muthiga (1988) have suggested that perceived increase in populations of the sea urchin *Echinometra mathaei* have reduced species richness. The checklist presented in

this paper appears to be at variance with their hypothesis, at least in regard to species richness of fish.

SPECIES CHECKLIST, DIANI AND NORTH GALU LAGOONS, 1990-1994

			D1	D2	D3a	D3b	G
Rhinobatidae							
	Rhinobatos sp.		0	0	0	0	GF
Dasyatidae							
	Dasyatis kuhlii		0	0	0	0	GF
	Taeniura lymma		1	1	0	0	GF
Albulidae							
	Albula vulpes (juveniles)		0	0	0	0	GF
Muraenidae							
*	*Echidna nebulosa*	C	1	1	0	0	0
*	*E. zebra*	R	0	1	0	2	0
*	*Gymnothorax flavimarginatus*		0	2	0	0	0
	G. permistus	C	0	1	0	0	0
	G. undulatus		1	1	0	0	0
*	*Siderea grisea*	C	0	2	0	0	3
	S. picta		4	1	0	1	1
Ophichthidae							
*	*Myrichthys colubrinus*	C	2	1	0	0	2
*	*M. maculosus*	R	2	4	1	1	5
Clupeidae							
	Herklotsichthys quadrimaculatus		0	0	0	0	GF
	Sardinella ? albella		0	0	0	0	GF
	Sardinella gibbosa		0	0	0	0	GF
	Spratelloides gracilis		0	0	0	0	GF
Engraulidae							
	Stolephorus sp.		0	0	0	0	GF
	Thryssa vitrirostris		0	0	0	0	GF
Chirocentridae							
	Chirocentrus dorab (juveniles)		0	0	0	0	GF
Plotosidae							
*	*Plotosus lineatus*	P	0	4	0	0	2
Synodontidae							
	Saurida gracilis		0	0	0	0	GF

		D1	D2	D3a	D3b	G
* *Synodus variegatus*	C	6	8	1	2	5
Antennariidae						
* *Antennarius pictus*	P	0	0	0	0	0
Hemiramphidae						
* *Hemiramphus far*	P	0	2	0	0	1
Hyporhamphus ? affinis		1	0	0	0	GF
Belonidae (Tylosuridae)						
* *Tylosurus* sp.	C	0	1	0	0	1
Holocentridae						
Myripristis adusta		1	0	0	0	3
* *M. kuntee*	C	3	0	0	0	1
M. murdjan		4	9	0	3	5
* *Neoniphon sammara*	C	2	6	0	0	3
* *Sargocentron diadema*	C	8	16	2	3	12
Aulostomidae						
* *Aulostomus chinensis*	R	1	4	0	0	7
Fistulariidae						
* *Fistularia commersonii*	R	2	1	0	0	2
Centriscidae						
Aeoliscus punctulatus		0	0	0	0	3
Syngnathidae						
* *Corythoichthys haematopterus*	C	3	7	0	0	8
Dactylopteridae						
Dactyloptena orientalis		0	0	0	0	GF
Scorpaenidae						
Dendrochirus brachypterus		0	0	0	0	1
? *Parascorpaena mossambica*		0	0	0	0	1
* *Pterois antennata*	C	4	2	0	0	2
* *P. miles*	C	5	14	0	0	9
* *P. radiata*	P	1	0	0	0	3
Sebastapistes cyanostigma		1	0	0	0	1
S. mauritiana		0	1	0	0	0
Platycephalidae						
* ? *Platycephalus* sp.	R	0	0	0	0	GF
Serranidae: subfamily Anthiinae						
Anthias squamipinnis		0	3	3	1	0

			D1	D2	D3a	D3b	G
Serranidae: subfamily Epinephelinae							
	Cephalopholis argus		1	0	0	0	2
	Epinephelus hexagonatus		1	1	0	0	0
	E. macrospilos	R	0	1	0	0	0
*	*E. merra*	R	1	1	0	0	1
Grammistidae							
*	*Grammistes sexlineatus*	C	9	14	1	3	8
Teraponidae							
*	*Terapon jarbua*	C	0	0	0	0	GF
Apogonidae							
*	*Apogon angustatus*	C	2	2	0	0	3
*	*A. aureus*	C	0	4	0	0	3
	A. cookii		5	0	1	3	9
*	*A. cyanosoma*	C	1	3	0	0	7
	A. fragilis		1	0	0	0	4
	A. kallopterus		1	4	0	0	3
*	*A. nigripes*	C	2	2	0	0	7
*	*A. nigripinnis*	P.	2	1	0	0	0
*	*A. savayensis*	C.	0	2		0	0
	Archamia fucata		4	9	0	0	14
	A. mozambiquensis		1	2	0	0	0
*	*Cheilodipterus lineatus*	C	3	1	0	0	17
*	*C. quinquelineatus*	C	4	13	0	0	9
Carangidae							
	Caranx melampygus		0	0	0	0	1
*	*Gnathanodon speciosus*	R	2	1	0	0	5
Lutjanidae							
	Lutjanus bohar		1	5	0	2	6
*	*L. ehrenbergii*	C	1	8	0	0	5
*	*L. fulviflamma*	C	6	3	0	0	9
	L. gibbus		4	12	0	0	6
	L. kasmira	P	0	0	0	0	4
	Macolor niger	R	0	0	0	0	3
Caesionidae							
	Caesio caerulaureus		1	0	0	2	1
	C. lunaris		0	0	0	0	2
	Pterocaesio sp.		0	0	0	0	1
Gerreidae							
	Gerres oyena		1	1	0	0	2
	G. ? acinaces		0	0	0	0	GF

			D1	D2	D3a	D3b	G
Haemulidae							
*	*Plectorhinchus flavomaculatus*	C	3	3	1	1	8
	P. gaterinus		2	10	0	0	6
*	*P. orientalis*	P	3	3	0	0	1
	P. playfairi	R	0	0	0	0	2
	P. ? schotaf		1	0	0	0	0
Lethrinidae							
	Gnathodentex aurolineatus		0	1	0	0	0
	Lethrinus harak		7	10	0	0	0
	L. ? lentjan		1	1	0	0	1
	L. nebulosus		0	0	0	0	GF
	L. sanguineus		1	6	0	0	GF
	L. ? variegatus		0	1	0	0	0
	Monotaxis grandoculis		4	11	0	0	0
Nemipteridae							
	Scolopsis ghanam		0	0	0	0	2
Mullidae							
	Mulloides vanicolensis		0	2	0	0	0
	Parupeneus barberinus		0	0	0	0	5
	P. bifasciatus		5	4	3	2	3
	P. cyclostomus		0	1	0	0	0
	P. indicus		1	2	0	0	3
*	*P. macronema*	C	9	12	3	3	18
	P. rubescens		3	0	0	0	3
Pempheridae							
*	*Pempheris schwenkii*	C	2	11	0	0	18
	P. vanicolensis		5	10	0	0	9
Kyphosidae							
	Kyphosus cinerascens		0	0	1	0	1
*	*K. vaigiensis*	R	1	1	0	0	0
Leiognathidae							
	Leiognathus equula	C	0	0	0	0	GF
	Secutor insidiator		0	0	0	0	GF
Ephippidae (Platacidae)							
*	*Platax orbicularis*	P	0	1	0	0	1
	P. teira		0	0	0	0	4
Monodactylidae							
*	*Monodactylus argenteus*	P	1	1	0	0	GF

			D1	D2	D3a	D3b	G
Chaetodontidae							
*	*Chaetodon auriga*	C	9	16	3	3	17
*	*C. guttatissimus*	R	1	0	0	0	4
	C. kleinii		4	1	0	0	6
*	*C. leucopleura*	R	6	7	0	0	3
*	*C. lunula*	C	8	8	3	3	6
	C. madagaskariensis		0	0	3	0	0
	C. trifascialis		0	0	0	0	1
	C. trifasciatus		0	7	0	0	6
Pomacanthidae							
*	*Centropyge multispinis*	C	2	1	0	0	9
	Pomacanthus chrysurus		0	0	0	0	4
*	*P. imperator*	R	0	3	0	0	0
*	*P. semicirculatus*	R	5	7	1	2	10
Pomacentridae							
*	*Abudefduf sexfasciatus*	C	9	12	0	0	12
*	*A. sparoides*	C	9	3	0	0	1
*	*A. vaigiensis*	C	8	14	3	3	8
	Amblyglyphidodon leucogaster		0	1	0	0	2
*	*Amphiprion allardi*	C	6	5	0	0	7
*	*Chromis dimidiata*	P	8	10	3	3	16
*	*C. nigrura*	R	8	5	1	2	3
	C. viridis		0	3	0	1	8
	C. weberi		9	14	3	3	19
*	*Chrysiptera annulata*	C	7	2	0	0	2
	C. glauca		5	4	3	3	0
*	*C. leucopoma*	C	9	6	3	3	3
	C. unimaculata		5	5	0	0	7
	C. biocellata		5	0	0	0	0
*	*Dascyllus aruanus*	C	1	10	0	0	9
	D. carneus		0	0	0	0	7
*	*D. trimaculatus*	C	9	14	0	0	15
	Neoglyphidodon melas		0	1	0	0	1
*	*Neopomacentrus azysron*	C	7	7	3	3	19
	Plectroglyphidodon dickii		1	0	0	0	2
	P. imparipennis		3	0	0	0	2
*	*P. lacrymatus*	P	9	10	0	0	16
*	*P. leucozonus*	C	5	8	1	3	3
*	*Pomacentrus baenschi*	C	8	7	2	2	4
*	*P. caeruleus*	C	9	11	1	1	13
*	*P. pavo*	C	4	13	0	0	14
	P. trilineatus		7	15	3	3	8
	P. sulfureus		2	0	0	0	0
	Stegastes fasciolatus		5	5	2	3	3
	S. nigricans		6	6	0	0	14

			D1	D2	D3a	D3b	G
Cirrhitidae							
	Cirrhitus pinnulatus		1	0	0	0	0
*	*Cirrhitichthys oxycephalus*	R	0	1	0	0	0
*	*Paracirrhites forsteri*	R	2	1	0	0	1
Sphyraenidae							
*	*Sphyraena flavicauda*	R	1	3	0	0	3
Polynemidae							
	Polydactylus ? sexfilis		0	0	0	0	GF
Labridae							
	Anampses caeruleopunctatus		0	0	3	3	1
*	*A. meleagrides*	P	4	1	3	3	2
	Bodianus axillaris		1	0	0	0	2
*	*Cheilinus trilobatus*	R	6	7	3	3	3
*	*Cheilio inermis*	C	6	14	2	2	11
*	*Coris gaimard africana*	P	2	3	3	1	1
*	*C. aygula*	P	7	4	1	3	5
*	*C. caudimacula*	C	8	11	3	3	6
*	*C. formosa*	P	9	7	3	3	13
	Epibulus insidiator		0	1	0	0	0
*	*Gomphosus caeruleus*	C	9	8	2	3	17
*	*Halichoeres hortulanus*	C	9	11	3	3	15
*	*H. nebulosus*	C	5	5	3	3	3
	H. marginatus		4	5	2	3	3
	H. scapularis		9	18	3	3	11
	Hemigymnus fasciatus		2	2	0	0	4
	H. melapterus		0	7	0	0	0
	Labroides bicolor		0	0	0	0	5
*	*L. dimidiatus*	C	9	14	3	3	19
	Pseudocheilinus hexataenia		1	2	0	0	4
*	*Stethojulis albovittata*	C	9	13	3	3	10
	S. interrupta		0	5	2	0	1
	S. strigiventer		2	2	0	0	0
	Thalassoma amblycephalum		6	5	2	3	5
	T. hardwicke		7	2	0	0	4
*	*T. hebraicum*	C	9	15	3	3	19
*	*T. lunare*	C	4	12	0	0	14
	T. purpureum		3	3	3	3	3
	Xyrichtys pavo		0	0	0	0	1
Scaridae (Callyodontidae)							
	Calotomus carolinus		3	1	0	2	1
	Leptoscarus vaigiensis		4	11	2	3	5
	Scarus falcipinnis (juveniles)		0	0	0	0	1
	S. frenatus (juveniles)		0	0	0	0	3
	S. ghobban		4	0	0	0	6

			D1	D2	D3a	D3b	G
	S. psittacus		1	2	0	0	1
*	*S. sordidus*	R	8	7	3	3	13
Pinguipedidae (Mugiloididae)							
	Parapercis hexophthalma		0	2	0	0	0
Blenniidae							
	? *Entomacrodus striatus*		0	0	0	0	1
	? *Cirripectes castaneus*		1	0	0	0	1
*	*Meiacanthus mossambicus*	P	3	7	0	0	9
*	*Plagiotremus rhinorhynchos*	C	5	3	1	2	11
	P. tapeinosoma		3	3	1	0	10
*	*Istiblennius impudens*	C	1	0	0	0	2
Gobiidae							
	Amblygobius albimaculatus		0	0	0	0	1
	? *Bathygobius fuscus*		0	0	0	0	1
	? *Cryptocentrus cryptocentrus*		0	2	0	0	3
Microdesmidae							
	Ptereleotris evides		0	1	0	0	6
Acanthuridae							
*	*Acanthurus leucosternon*	C	2	3	0	3	3
*	*A. lineatus*	C	4	4	3	3	3
	A. nigricauda		0	0	0	0	3
	A. nigrofuscus		8	4	3	3	11
*	*A. triostegus*	C	9	9	2	3	11
*	*A. xanthopterus*	P	3	7	2	3	1
	Ctenochaetus striatus		7	11	3	3	16
*	*C. strigosus*	R	2	1	0	0	4
	Zebrasoma scopas		2	13	0	0	7
*	*Z. desjardinii*	P	0	12	0	0	8
Zanclidae							
*	*Zanclus cornutus*	P	5	14	2	1	14
Siganidae							
	Siganus argenteus		1	1	0	0	4
	S. luridus		1	3	1	3	9
*	*S. sutor*	P	4	9	0	0	4
Cynoglossidae							
	Cynoglossus sp.		0	0	0	0	GF
Bothidae							
	Bothus pantherinus		1	0	0	0	0

			D1	D2	D3a	D3b	G
Soleidae							
*	*Pardachirus marmoratus*	P	1	1	0	0	2
Balistidae							
*	*Rhinecanthus aculeatus*	C	4	1	0	0	0
	Pseudobalistes fuscus		1	0	0	0	0
	Sufflamen chrysopterus		0	2	0	0	0
Monacanthidae							
	Aluterus scriptus		0	0	0	0	1
	? *Amanses scopas*		1	0	0	0	0
	Cantherhines pardalis		4	4	3	2	2
	Oxymonacanthus longirostris		0	0	0	0	1
*	*Paraluteres prionurus*	R	1	0	0	0	1
Ostraciidae							
*	*Lactoria cornuta*	P	3	0	0	0	0
*	*L. fornasini*	R	2	2	0	0	1
*	*Ostracion cubicus*	P	5	3	1	1	12
*	*O. meleagris*	R	9	6	3	3	12
Tetraodontidae							
Subfamily Tretraodontinae							
	Arothron hispidus		0	0	0	0	1
	A. mappa		0	0	0	0	GF
*	*A. meleagris*	R	1	0	0	0	0
	A. immaculatus		1	0	0	0	1
	A. nigropunctatus		1	0	0	0	1
Subfamily Canthigasterinae (Canthigasteridae)							
*	*Canthigaster bennetti*	C	7	12	2	3	15
*	*C. janthinoptera*	R	2	8	1	3	5
*	*C. solandri*	P	1	1	0	0	0
*	*C. valentini*	C	8	14	0	0	15
Diodontidae							
	Cyclichthys orbicularis		4	0	0	0	1
	Diodon holocanthus		3	6	3	2	4
*	*D. hystrix*	C	1	3	0	0	1

Explanation of Symbols

*	Species recorded in Diani Lagoon in 1971 (Bock, 1972) still present in 1991.
C, P, R	Relative subjective species abundance 1971, see text.
D1	Diani Site 1, number of occasions out of 10 on which a species was recorded.

D2 Diani Site 2, number of occasions out of 21 on which a species was recorded.

D3a, D3b Diani Site 3 (reef pool), number of occasions out of three on which a species was recorded in 1990 (a) and 1991 (b) respectively.

G Galu Site, number of occasions out of 19 on which a species was recorded.

GF Species recorded in fishermen's net and spear-gun catches taken within the Galu site. Catches were not studied at Diani.

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Editor's note:

The untimely death of Dr Bock made it no longer possible for us to consult him on some of the queries we had about his manuscript. We took the liberty to correct the few spelling mistakes in the scientific names, using Smith and Heemstra (1986) as a reference, as Ken

Bock would have done. We did not change the family names, except for Blenniidae, which was spelled Blennidae in Bock's manuscript. After the publication of this reference, several names have been changed; any such changes that have been included in FishBase (1997) are listed below.

Anthias squamipinnis	*Pseudanthias squamipinnis* (Peters 1855)
Apogon savayensis	*Apogon fuscus* Quoy & Gaimard 1825
Caesio caerulaureus	*Caesio caerulaurea* Lacepède 1801
Coris formosa	*Coris frerei* Günther 1867
Echidna zebra	*Gymnomuraena zebra* (Shaw & Nodder 1797)
Gnathodentex aurolineatus	*Gnathodentex aureolineatus* (Lacepède 1802)
Istiblennius impudens	*Istiblennius bellus* (Günther 1861)
Leiognathus equula	*Leiognathus equulus* (Forsskål 1775)
Lethrinus sanguineus	*Lethrinus mahsena* (Forsskål 1775)
Lutjanus fulviflamma	*Lutjanus fulviflammus* (Forsskål 1775)
Mulloides vanicolensis	*Mulloidichthys vanicolensis* (Valenciennes 1831)
Parapercis hexophthalma	*Parapercis hexophtalma* (Cuvier 1829)
Plectroglyphidodon leucozonus	*Plectroglyphidodon leucozona* (Bleeker 1859)
Zebrasoma desjardinii	*Zebrasoma veliferum* (Bloch 1795)

The status of *Z. desjardinii* is not clear: some authors regard it as a separate species, others (including Smith and Heemstra (1986) and FishBase (1997)) treat it as a synonym of *Z. veliferum*. Since Bock lists *Z. desjardinii*, he must have considered it a valid species.

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FishBase (1997). FishBase 97 CD ROM. ICLARM, Manila
Smith & Heemstra [see main article]