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A RECONNAISSANCE OF THE DEEPER JAMAICAN CORAL REEF FISH COMMUNITIES

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ABSTRACT: A submersible was used to make repetitive dives in Jamaica to depths of 25 m, 50 m, and 100 m. With increasing depth there was a decline in both species and the number of individuals. The territorial damselfish and mixed-species groups of herbivorous fishes were conspicuously absent at 100 m. Few unique species appeared with increasing depth and thus the deep community resembled depauperate versions of the shallower communities. Twelve species were shared between the 3 depths but there was no significant correlation in ranked relative abundance. Thus increasing depth also influenced community organization. **[Keywords: *Jamaica, Caribbean, submarine, submersible, social behavior, habitat*]**

With the advent of SCUBA many studies have appeared on the behavior, diversity, and habitat use of Caribbean coral reef fishes (*e.g.*, see review by Sale 1981). These studies revealed considerable similarity in the species composition on many Caribbean Islands, although quantitative differences apparently reflect differences in habitat (*e.g.*, Gladfelter *et al.* 1980; Kaufman and Ebersole 1984; Alevizon *et al.* 1985; Itzkowitz, *pers. obs.*). However, SCUBA has restricted our knowledge of Caribbean fish communities to depths of less than 30 m, while living coral and the associated fish communities extend much deeper.

Using submersibles, researchers have the potential to investigate the deeper coral reef fish communities. At present, submersibles have been used to broadly census large and/or deep areas (*e.g.*, Colin 1974; 1976; Parker and Ross 1986; Shipp *et al.* 1986). Here we describe a series of repetitive submersible dives from depths of 25 to 100 m on the north coast of Jamaica. The intent of this study was to characterize the fish fauna with changes in depth. Also, making repetitive dives to the same localities, and having the ability to maintain stationary positions, allowed us to examine interspecific behavioral interactions among the species common to each depth.

The behavioral observations were designed to look for similarities as seen in shallow Caribbean communities. In the shallow areas most of the emphasis has been on the behavioral ecology of territorial damselfishes (Bartels 1984; Doherty 1983; Ebersole 1977, 1980; Itzkowitz 1977, 1978, 1979, 1986; Mohoney 1981; Myrberg and Thresher 1974; Robertson 1984; Robertson *et al.*, 1981; Schmale 1981) and on the free-ranging species that often form mixed-species groups (*e.g.*, Buckman and Ogden 1973; Itzkowitz 1974, 1977; Hanley 1984; Ogden and Buckman 1973; Robertson *et al.* 1976). The permanently territorial damselfish have specific, and nearly exclusive, habitat preferences with the same individual often occupying its territory for many months (Itzkowitz 1977, 1986; Schmale 1981). Their vigorous territorial defense is directed again conspecifics and other fish species which may utilize resources within their territories. The aggressive exclusion of herbivorous fishes (*e.g.*, parrotfishes and surgeonfishes) often results in luxuriant growths of algae within damselfish terri-

tories (Brawley and Adey 1977; Irvine 1980; Potts 1977; Sammarco 1983). Besides affecting algal growth, damselfish attacks usually modify the swimming pattern of mixed-species groups and often cause them to fractionate into smaller units (Itzkowitz 1977). In the present study, emphasis was placed on determining (1) if a species exhibited territorial behavior and, if so, which species were chased, and (2) if not territorial, was it consistently found with other individuals/species.

METHODS

This study was performed on the forereef at Discovery Bay, Jamaica. The location was ideal for submersible access as the fringing reefs are within 200 m of the shore and between 300–400 m from shore, the depth quickly drops to over 300 m.

The PC-8 submersible was designed for a pilot and one observer. The observer sat aft and viewed out a plexiglass hemisphere that had a diameter of approximately 1 m. The field of view was greater than 180 degrees and although visual distortion occurred at the periphery, it was minor and did not interfere with the observations. The submersible operated on stored electricity, and had a maximum operating depth of 250 m.

Three depths were selected for study: 25, 50, and 100 m. Although the 25 m sites were within the working range of SCUBA, the submersible was used to allow comparisons to the deeper areas. At each depth, an initial exploration was conducted to locate sites which had fish communities. The three study sites selected typified those habitats supporting fish communities. Given the small sample size per depth and the large areas which did not support fish communities, random site selection was deemed inappropriate for this type of analysis.

At each depth, the three sites were separated by a minimum of 50 m. Each site was marked with a conspicuous float attached to a weight. During July 1984, 5 dives were made to the 25 m, 10 to the 50 m, and 11 to the 100 m depth. Attempts were made to space dives to each depth throughout the month. A single dive involved visiting one depth; the three sites were each observed for 30 min. During the 30 min observation, the submersible hovered or rested between 2 and 4 m from the study site. As discussed below, all study sites were inclined between 60 and 90 degrees. The area of the study site varied depending on light penetration (*e.g.*, turbidity) but attempts were made to keep the area under observation constant (approximately 12 m^2). Submarine lights were used only for momentary identifications and had little affect on the fish community.

Two types of quantitative data are presented in this paper, the presence or absence of a species ("Pres/Abs") within the study site during an observation period and, if present, the numbers of individuals of each species (*i.e.*, "numbers"). These data were then averaged over all observation periods at that study site (*i.e.*, $\bar{\times}$ = 1.0 = always present; $\bar{\times}$ = 0.0 = never present). Means for each of the three sites at a particular depth were then averaged (*i.e.*, mean of means). Unlike Pres/Abs data in which absence of a species was used in the averaging, observations in which a species failed to appear were excluded from calculations of the mean numbers for that species. When considering the Pres/Abs and numbers data, it is possible to determine how often a species was present at a particular depth and, if present, the mean number of individuals. Table 1 provides the binomial nomenclature for the common names used in the text.

As priority was given to monitoring

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Table 1. Genus and species for common names of fishes used in the text.

DAMSELFISHES: dusky (*Stegastes punicans*), bicolor (*Stegastes partitus*), three-spot (*Stegastes planifrons*), cocoa (*Stegastes variabilis*), blue chromis (*Chromis cyanea*), brown chromis (*Chromis multilineata*), sunshine fish (*Chromis insolatus*), Yellowtail (*Microspathedon chrysurus*), *Chromis scotti*
PARROTFISHES: redband (*Sparisoma aurofrenatum*), redtail (*Sparisoma chrysopterum*), stoplight (*Sparisoma viride*), striped (*Scarus iserti*), queen (*Scarus vetula*), rainbow (*Scarus guacamaia*)
GRUNTS: French (*Haemulon flavolineatum*), Margate (*Haemulon album*), smallmouth (*Haemulon chrysargyeum*), sailor's choice (*Haemulon parrai*), tomtate (*Haemulon aurolineatum*)
GOATFISHES: yellow (*Mulloidichthys martinicus*), spotted (*Pseudupeneus maculatus*)
SQUIRRELFISHES: longjaw (*Holocentrus ascensionis*), squirrelfish (*Holocentrus rufus*), longspined (*Flammeo marianus*), soldierfish (*Myripristis jacobus*), reef (*Adioryx coruscus*)
JACKS: bar (*Caranx ruber*), yellow (*Caranx bartholomaei*)
SNAPPERS: mohogany (*Lutjanus mahogoni*), mutton (*Lutjanus analis*), yellowtail (*Ocyurus chrysurus*)
HAMLETS: barred (*Hypoplectrus puella*), butter (*Hypoplectrus puella*), indigo (*Hypoplectrus indigo*), shy (*Hypoplectrus guttavarius*)
PUFFERS: bandtail (*Sphoeroides spengleri*), sharpnose (*Canthigaster rostrata*)
WRASSES: bluehead (*Thalassoma bifasciatum*), yellowhead (*Halichoeres garnoti*), creole (*Clepticus parrai*), Spanish hogfish (*Bodianus rufus*)
BUTTERFLYFISHES: foureye (*Chaetodon capistratus*), reef (*Chaetodon sedentarius*), longsnout (*Prognathodes aculeatus*)
BASSLETS: blackcapped (*Gramma melacara*), fairy (*Gramma loreto*), Heliotrope (*Lipogramma klayi*), ridgeback (*Liopromona mowbrayi*)
SEA BASSES: harlequin bass (*Serranus tigrinus*), coney (*Cephalopholis fulva*), graysby (*Petrometropon cruentatum*), tobacco fish (*Serranus tobacarius*)
MISCELLANEOUS: barracuda (*Sphyraena barracuda*), bigeye (*Priacanthus arenatus*), blue tang (*Acanthurus coeruleus*), cornetfish (*Fistularia tabacaria*), filefish (*Cantherhines sp.*), greater amberjack (*Seriola dumerili*), jacknife (*Equetus lanceolatus*), lizardfish (*Synodus sp.*), rock beauty (*Holocanthus tricolor*), sargassum triggerfish (*Xanthichthys ringens*), scrawled cowfish (*Acanthostracion quadricornis*), spotted drum (*Equetus punctatus*), trumpetfish (*Aulostomus maculatus*), *Verulus sordidus*

species numbers, there were no continuous behavioral observations. Instead, as each species was identified, its general behavioral activities were also recorded. We emphasized the composition of gregarious groups, the location of stationary individuals, and aggressive interactions.

HABITAT DESCRIPTION

Although the shallow coral reefs of Jamaica have been described (*e.g.*, Goreau 1959; Woodley *et al.* 1981) there are no systematic surveys of the corals (both hard and soft), sponges, or algae, for the deeper study sites. Furthermore no concurrent submersible studies describing these habitat were conducted during, or after, the tenure of this study. The superficial habitat descriptions presented here are intended only to provide a general idea of the habitat.

The 25 m sites consisted of large buttresses shaped as oblong mounds of live coral and rubble approximately 10 m wide, 5–20 m high, and 30–50 m long. Wide expanses of loose sand separated these buttresses and may have served as a migration barriers for substrate dwelling species (*e.g.*, damselfishes). Movements among study sites were certainly possible for most other species. The submersible rested on the sand bottom and observations were made along the vertical wall. Considerable living coral was present (*e.g.*, *Madracis mirabilis, Montastrea annularis, M. cavernosa, Porites porites, P. asteriodes, Acropora palmata, A. cervicornis, Agaricia* sp.) along with some tubular and encrusting sponges. Algae were abundant.

Live coral at 50 m had a 60 degree slope cut by large sand channels. The same hard corals observed at the 25 m formed massive colonies. Tubular sponges were more abundant and dead coral rubble was covered with encrusting sponges. Algae were still abundant.

In contrast, the 100 m sites were on a vertical wall with no living hard coral and no algae. Whip, tubular, and fan-like gorgonians were abundant. Tubular and barrel sponges were common and all sheltered areas were covered by encrusting sponges. Sand dripped constantly from shallower depths and collected on narrow ledges.

RESULTS

Fifty-six fish species were observed at the 25 m sites, and 43 and 24 species were observed at the 50 m and 100 m sites, respectively (Table 1 and 2). When considering adjacent depths, shared species always represented a larger portion of the deeper community (Fig. 1). This is especially obvious for the 12 species shared among the three depths and results from disappearance of species with increasing depth.

To compare their relative frequency within a depth, these 12 species were ranked by Pres/Abs values. There was no significant correlation in their ranks among the three depths (Kendall Coef. of Concordance, P>0.05). Only three species were observed exclusively at the 100 m depth. However, we have observed two of these species (the spotted drum and the yellow jack) at depths less than 10 m on other occasions.

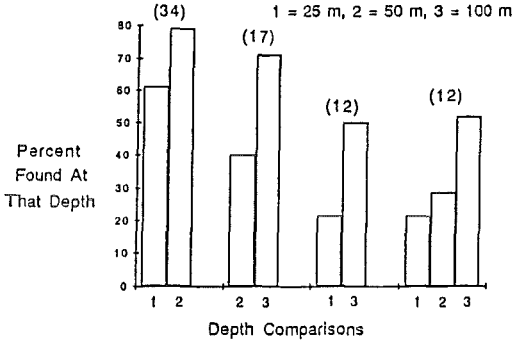

Figure 1. Percentage of species shared among depths. Three bars at right indicate species shared among all three depths. Numbers in parentheses above bars represent the number of species shared among the 2 or 3 depths.

For the most part, species that were present at more than one depth had lower abundances at the greater depth. Of the 34 species shared between the 25 m and 50 m sites (Table 1), 23 declined in numbers while 9 increased (2 remained the same) (Binomial Test, $z = -2.29$, $p<0.022$). Similarly, 11 of the 12 species common to the 25 m and 100 m sites, declined in abundance while 1 increased (Binomial Test, $p<0.006$). However, seven species increased and 8 decreased in numbers between the 50 and 100 m sites (Binomial Test, $p>0.05$).

Comparing the most commonly observed species (*i.e.*, those ranked in the first third of the Pres/Abs values) for the 25 m and 50 m sites revealed eight species in common to both depths (Table 3 a and b). Those species usually found in mixed-species groups (*e.g.*, striped parrotfish, goatfishes, redband parrotfish) were more often observed in small unispecific groups at the 50 m sites. Juvenile sunshine damselfish were frequently observed in large groups hovering above coral heads; they were observed only as adults in the shallow sites. The nocturnally feeding grunts (French, margate, smallmouth, sailor's choice) commonly seen in the shallow sites, were not observed at the 50 m sites. Hovering groups of blue chromis and creole wrasse were still commonly seen but their densities were much lower in comparison to the shallow sites.

At 25 m site, the first third of the ranked species (ranked Pres/Abs values; Table 3 a) included 18 species. These comprise the territorial damselfishes (cocoa and bicolor damselfish), hovering aggregations (blue chromis with creole wrasse and French grunts), and mixed-species groups that include both herbivores and predators (the herbivorous stoplight parrotfish, striped parrotfish, bluetangs, and the predaceous spotted goatfish). The remaining species were

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Table 2. Mean number of individuals of each species observed at the three depths.

SPECIES	MEAN NUMBERS 25 m	50 m	100 m	SPECIES	MEAN NUMBERS 25 m	50 m	100 m
bandtail puffer	1.00	0.00	0.00	margate grunt	30.00	0.00	0.00
barracuda	1.00	1.00	0.00	mohogany snapper	1.00	1.00	0.00
barred hamlet	0.00	1.42	0.00	mutton snapper	2.17	1.00	0.00
blue chromis	73.20	10.18	0.00	queen parrotfish	2.50	1.00	0.00
big eye	1.00	0.00	0.00	rainbow parrotfish	1.50	1.33	0.00
bicolor damselfish	3.02	0.00	0.00	rock beauty	1.71	1.87	2.49
bar jack	3.22	1.17	1.75	rock beauty (juv)	0.00	1.00	0.00
bluehead wrasse	3.25	0.00	0.00	redband parrotfish	2.61	4.10	0.00
blackcapped basslet	0.00	28.99	8.69	redtail parrotfish	2.00	3.00	0.00
blackcapped basslet (juv)	0.00	10.17	0.00	reef squirrelfish	1.00	0.00	0.00
brown chromis	29.50	1.00	0.00	reef butterfly	1.00	0.00	0.00
blue chromis (juv)	0.00	10.17	0.00	ridgeback basslet	0.00	7.33	1.72
butter hamlet	0.00	1.67	0.00	sargassum triggerfish	0.00	3.12	3.07
bluetang	2.11	1.00	0.00	sharpnose puffer	1.32	1.88	1.25
Chromis scotti	0.00	4.50	6.33	squirrelfish	2.42	3.50	1.22
Chromis scotti (juv)	0.00	0.00	9.33	soldier fish	1.75	1.00	0.00
cocoa	4.43	1.44	0.00	spotted goatfish	3.91	3.00	0.00
coney	1.78	1.67	1.17	spotted drum	0.00	0.00	1.00
cornet fish	2.00	0.00	0.00	stoplight parrotfish	2.64	1.97	0.00
creole wrasse	36.49	10.83	1.00	striped parrotfish	3.24	4.51	0.00
creole wrasse (juv)	0.00	12.00	0.00	scrawled cowfish	1.00	0.00	0.00
dusky damselfish	1.00	0.00	0.00	sailor's choice	1.00	0.00	0.00
French grunt	2.95	0.00	0.00	sunshine fish	1.67	2.16	3.46
fairy basslet	9.25	1.00	2.34	sunshine (juv)	0.00	36.85	0.00
filefish	2.00	0.00	1.50	smallmouth grunt	1.00	0.00	0.00
foureye butterfly	1.00	1.53	0.00	spanish hogfish	1.00	0.00	0.00
greater amberjack	0.00	0.00	1.00	tobacco fish	2.32	2.25	0.00
graysby	2.33	2.09	2.08	tobacco fish (juv)	0.00	6.62	0.00
hamlet	2.50	1.53	0.00	three-spot damselfish	1.33	0.00	0.00
harlequin bass	1.66	0.00	0.00	tomtate grunt	1.00	0.00	0.00
harlequin bass (juv)	0.00	6.00	0.00	trumpetfish	2.25	1.42	0.00
heliotrop basslet	0.00	0.00	3.25	yellow jack	0.00	0.00	1.00
indigo hamlet	1.33	1.17	0.00	yellowtail snapper	4.89	2.00	0.00
jacknife	1.00	0.00	1.00	yellowhead wrasse	6.33	2.86	1.61
lizardfish	1.00	0.00	0.00	yellow goatfish	6.39	1.17	2.00
longjaw squirrelfish	0.00	1.00	0.00	yellowtail damselfish	1.00	0.00	0.00
longspined squirrelfish	2.17	1.00	1.70	*Verilus sordidus*	0.00	0.00	1.33
longsnout butterfly	1.00	1.52	1.21				

typically solitary predators. The less frequently observed species (ranked in the lower ⅔) were typical of the Jamaican shallow community (Itzkowitz 1974) and represent additional herbivores (redband parrotfish, redtail parrotfish, and rainbow parrotfish) as well as a wide diversity of carnivores.

Behavioral dynamics at 25 m depth resembled those described previously for shallow areas (Itzkowitz 1974, 1977 a, 1977 b). The territorial cocoa and bicolor damselfishes blanketed the coral wall and continuously chased the schooling and the mixed-species groups. The result of such attacks was to interfere with feeding patterns of gregarious species and cause individuals to scatter.

The cocoa damselfish was the only representative of the genus *Stegastes* at the 50 m sites. They moved over large poorly defended areas resembling home ranges rather than territories. They had no apparent impact on the movement patterns of the small unispecific groups of herbivores (*e.g.*, striped parrotfish) and carnivores (spotted goatfish).

The 100 and 25 m depths shared only

one species in their top one third rank (the graysby) (Table 3a and c) while the 50 m and 100 m depths shared 5 species (Table 3b and c). Species associated with mixed-species groups were priminarily absent in the deep sites (*e.g.*, parrotfish, surgeonfish, goatfish). The wrasses, common in the shallow areas, were uncommon in the deep sites.

The 100 m sites had no aggressive damselfishes, or their behavioral equivalent, that influenced the movements of other species. The sunshine damselfish was extremely common and hovered between 0.5 to 1.0 m away from the substratum with a minimum distance of approximately 1 m between individuals. No overt aggression was observed to maintain this inter-individual distance. No juvenile damselfishes were observed at this depth.

The large aggregations of blue chromis and creole wrasse were absent at the 100 m sites. In comparison to the 50 m sites, *Chromis scotti* had increased in both the number of times observed (Pres/Abs) and number of individuals (numbers). Typically they were seen hovering within 1.5 m of the wall.

The most commonly observed gregarious species were the sargassum triggerfish and rock beauties. Both species were observed to be solitary and in small group of 2 to 6 individuals. Sargassum triggerfish, either as groups or solitary, were rarely seen at the same localities on repetitive dives. However, although solitary rock beauties were not site specific, groups were seen repeatedly at the same location. Groups of black-capped basslets did maintain highly consistent positions.

Solitary longsnout butterflyfish remained as common at the 100 m sites as at 50 m sites. The ridgeback basslet became more common at the 100 m sites. The number of squirrelfishes declined at 100 m.

DISCUSSION

The increasing slope of the substratum and decreasing ambient light intensity were two obvious physical differences from the shallow to deeper study sites. In addition, a decrease in the algae

Table 3 a. Ranking of the mean Pres/Abs (presence or absence of a species) values for species observed at the 25 m sites. 1.00 signifies always observed and 0.00 would signify never observed.

SPECIES	25 m Depth P/A	SPECIES	25 m Depth P/A	SPECIES	25 m Depth P/A
blue chromis	1.00	redband parrotfish	.47	queen parrotfish	.13
cocoa damselfish	.93	bar jack	.40	big eye	.13
indigo hamlet	.93	yellow goatfish	.40	jacknife	.13
stoplight parrotfish	.87	coney	.40	baracuda	.13
tobacco fish	.87	yellowtail snapper	.40	sailor's choice	.07
spotted goatfish	.87	bluehead wrasse	.33	scrawed cowfish	.07
French grunt	.87	yellowtail damselfish	.33	smallmouth grunt	.07
bicolor damselfish	.80	longspined squirrelfish	.33	reef butterfly	.07
yellowhead wrasse	.73	trumpetfish	.27	reef squirrelfish	.07
sharpnose puffer	.67	three-spot damselfish	.27	dusky damselfish	.07
striped parrotfish	.67	soldier fish	.20	mohogany snapper	.07
squirrelfish	.60	sunshine fish	.20	margate grunt	.07
mutton snapper	.60	redtail parrotfish	.20	longsnout butter	.07
creole wrasse	.60	brown chromis	.20	cornet fish	.07
bluetang	.60	rainbow parrotfish	.20	lizardfish	.07
graysby	.60	hamlet	.13	tomtate grunt	.07
fairy basslet	.53	foureye butterfly	.13	bandtail puffer	.07
harlequin	.47	filefish	.13	spanish hogfish	.07
rock beauty	.47				

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Table 3 b. Rankings of the mean Pres/Abs values for species observed at 50 m sites.

SPECIES	50 m Depth P/A	SPECIES	50 m Depth P/A	SPECIES	50 m Depth P/A
blackcap basslet	.96	butter hamlet	.37	brown chromis	.09
rock beauty	.81	bar jack	.37	creole wrasse (juv)	.09
blue chromis	.81	barred hamlet	.35	rainbow parrotfish	.09
graysby	.80	foureye butterfly	.32	queen parrotfish	.09
yellowhead wrasse	.75	trumpetfish	.31	longspine squirrelfish	.09
longsnout butterfly	.73	coney	.28	longjaw squirrelfish	.09
sharpnose puffer	.68	blue chromis (juv)	.23	redtail parrotfish	.08
sunshine (juv)	.67	squirrelfish	.23	mutton snapper	.08
redband parrotfish	.59	tobacco fish	.21	mohogany snapper	.08
sargassum triggerfish	.52	tobacco fish (juv)	.19	yellowtail snapper	.08
cocoa damselfish	.51	sunshine fish	.16	soldier fish	.04
spotted goatfish	.48	indigo hamlet	.16	fairy basslet	.04
creole wrasse	.48	ridgeback basslet	.12	rock beauty (juv)	.04
striped parrotfish	.45	blackcap (juv)	.12	harlequin (juv)	.04
stoplight parrotfish	.44	yellow goafish	.12	bluetang	.04
hamlet	.44	*Chromis scotti*	.12	barracuda	.04

abundance, and an increase in the numbers of gorgonians and sponges was observed. At the 100 m sites, the only areas free of encrusting sponges were those not protected from the continual dripping of sand which may have precluded larvae settlement. The large barrel-shaped sponges were located primarily on the sheer walls.

The most conspicuous social systems on the shallow reefs, *i.e.*, territorial damselfishes and mixed-species groups, were absent in the deep areas. This closely parallels the disappearance of algae which serves as a food source for the herbivorous parrotfishes and surgeonfishes. The shallow territorial *Stegastes* damselfishes are often associated with algal mats (*e.g.*, Brawley and Adey 1977; Sammarco 1983) which may also account for the fishes disappearance at the deeper sites.

With increasing depth, the fish community shifted to planktivores and other forms of predation. This was most obvious in the damselfishes which were entirely represented by the planktivorous *Chromis* species. However, shallow-water *Chromis* species were replaced by the sunshine and reef damselfish. Although the sunshine and reef damselfish appeared to feed on the plankton, as did the shallow-water blue and brown chromis, their behavior differed. The sunshine fish in the deep areas appeared territorial as individuals were uniformily spaced in stable locations. The reef damselfish were found in clusters, close to the wall,

Table 3 c. Rankings of the mean Pres/Abs values for species observed at 100 m sites.

SPECIES	100 m Depth P/A	SPECIES	100 m Depth P/A	SPECIES	100 m Depth P/A
sunshine fish	1.00	longspined squir	.35	spotted drum	.08
blackcapped bass	.89	chromis scotti	.33	*Chromis scotti* (juv)	.08
rock beauty	.71	*Verilus sordidus*	.31	filefish	.06
sargassum trigger	.69	bar jack	.22	jacknife	.06
longsnout butter	.63	sharpnose puffer	.20	creole wrasse	.03
ridgeback basslet	.63	yellowhead wrasse	.20	greater amberjack	.03
graysby	.57	heliotrop basslet	.15	yellow goatfish	.03
fairy basslet	.49	coney	.11	yellow jack	.03
squirrelfish	.38				

and thus more closely resembled the behavior of the shallow *Chromis* species.

The remainder of the deep community consisted of substrate oriented predators of both active and sessile prey. These species were observed at all depths. However, the sargassum triggerfish and the rockbeauty were most prominent at the deep site while *Verilus sordidus* (tentatively identified) were seen only in deep areas.

In general numbers and densities of species declined with increasing depth. The few unique species at deep sites suggests a process of gradual attrition with depth. However, the Pres/Abs rankings for shared species changed between depths suggesting a more basic restructuring of the community. Further work is necessary to clarify the significance of these changes.

The lack of a distinct fish community at the 100 m sites may indicate that this community is a selective "spill-over" from the shallow community. One test of this hypothesis would be to compare the fish communities on other Caribbean islands that have a more diverse shallow reef community with the expectation that the deeper communities would also be more diverse. For example, in comparison to Jamaica, the shallow reefs of Providenciales in the Turks and Caicos Islands appeared to have a more diverse fish community. One preliminary dive to 100 m in Providenciales revealed a fish community similar to that of Jamaica. If this one dive is representative of Providenciales, the obvious differences between the shallow communities of these two islands is not reflected in their deeper areas. Further work is clearly needed to determine if the deep coral reef fish communities are, in fact, independent of the shallower fish communities.

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