

RESEARCH NOTE

A STUDY OF THE REEF FISH COMMUNITY OF LAZARUS ISLAND, SINGAPORE

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ABSTRACT

Visual estimates of coral reef fish at 3 m and 10 m depths of two sites along the fringing reef slope of Lazarus Island showed a higher diversity and abundance at 3 m than at the 10 m depth. The fish community structure for both sites were similar, with a total record of 32 species from 17 families. Six species were new records to the fish species list compiled by Lim and Chou (1991). Physico-chemical parameters measured were normal for the waters around Singapore. These data can be used as a baseline to study the effects of planned tourism development on the island.

Key Words: fish community, Lazarus Island, Singapore, tourism.

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INTRODUCTION

Lazarus Island, also known as Pulau Sakijang Pelepah, is located about 4 km off the southern coast of the main island of Singapore at 1°13'60" N, 103°51'20" E. Presently covering an area of 0.47 km², the island was reclaimed in 1976 to provide artificial beaches and lagoons. It is bounded by P. Seringat to the north, Kusu Island to the east, and St. John's Island to the west. Current flow is generally in the east-west direction, flowing along the channels between the islands. These islands are under the management of the Sentosa Development Corporation, a quasi-government organization. St. John's Island and Kusu Island have been developed for recreational purposes, with chalets and camping grounds on the former and a temple for pilgrims on the latter. Lazarus Island is at present uninhabited; it has a radio beacon at its highest point. It has been marked for future development as a resort island (MOCI, 1986; Chia *et al.*, 1988).

This is the first study of the reef fish community at Lazarus Island—the results are meant to establish baseline information for future monitoring of reef fish population changes. The data collected will also be useful for comparison with similar studies conducted at other reefs west of Lazarus Island and in monitoring reef changes as tourism development proceeds on the island.

MATERIALS AND METHODS

The fish visual census method (Dartnall and Jones, 1986) was used to survey the reef fish community at two sites, L2 and L4, of the fringing reef. Site L4 is on the eastern side of the island facing Kusu Island, while site L2 is on the western side facing St. John's Island. The surveys were conducted in April, 1990; surveying was conducted between 1000 and 1500 h. The census involved laying a 150 m parallel-to-shore transect line along the reef slope at sites at depths of 3 m and 10 m (measured from the reef crest) at both sites; these four transects were labelled L2-3 (3 m depth), L2-10 (10 m depth), L4-3, and L4-10.

One observer swimming along the transect line visually identified and counted all fishes observed 3 m to the left, to the right, and above the transect line. Each transect took 45 minutes to sample, and no replicate samples were conducted. Fish species observed were grouped into three categories (Dartnall and Jones, 1986): "indicator fish" from the family Chaetodontidae (being indicators of reef health); "target fish" from the families Haemulidae, Lethrinidae, Lutjanidae and Serranidae (economically important fish); and "major families," encompassing other major fish families. Actual counts of indicator and target fish were recorded, and length was visually estimated for the latter. The abundance of species from the major families was estimated using log₄ abundance categories (Table 1).

Live coral cover was also measured at each site using the line-intercept transect method (Dartnall and Jones, 1986). A 100 m tape was laid parallel to the reef slope at depths of 3 m and 10 m, and the lengths of live coral transecting the tape were recorded. Overall environmental conditions, such as temperature and salinity, were measured at the surface and at 10 m depth using a YSI Model 33 salinity-temperature meter. Light intensity was measured using a LI-COR underwater light sensor, and light penetration was measured with a Secchi disk.

RESULTS

A total of 32 species of reef fish from 17 families were observed in the survey (Table 1). There were two species of chaetodontids, three species of target fishes, and 27 species from the major families. The diversity of fish observed was higher at the shallower depths, with 19 species from 12 families at L2-3 and 17 species from 10 families at L4-3. Abundance was also higher at 3 m depth, especially for *Lutjanus* sp., *Caesio teres*, and species of the families Labridae and Pomacentridae. The deeper transects were less populated, exceptions being *Caesio teres* and some labrid and pomacentrid species, notably *Halichoeres dussumieri* and *Pomacentrus cuneatus*. Site L4-10 had a higher species diversity (15 species from 13 families) than L2-10 (nine species from eight families).

Only two species of "indicator" fish were encountered: *Chelmon rostratus* and *Chaetodon octofasciatus*. Of the "target" species observed, juvenile snappers (*Lutjanus* sp.) were common but present only at the shallower transects. Four families abundantly dominant at Lazarus Island were Caesionidae, Carangidae, Labridae and Pomacentridae. The former two also had the highest species diversity. Subadult indi

Table 1. Results of the fish visual census conducted in April, 1990, at 3 m and 10 m depths for Lazarus Island. Figures for indicator and target fish are actual counts, while those for major families are in Log4 abundance categories.

Family	Species	Site:	3 meters depth:		10 meters depth:	
			L2-3	L4-3	L2-10	L4-10
INDICATOR FISH						
Chaetodontidae	<i>Chaetodon octofasciatus</i>		1		1	3
	<i>Chelmon rostratus</i>		6	3		
TARGET FISH						
Lutjanidae	<i>Lutjanus</i> sp. 1 (juv.)		2	20		
Serranidae	<i>Cephalopholis boenack</i>			4	1	
	* <i>Plectropomus maculatus</i>					1
MAJOR FAMILIES**						
Apogonidae	<i>Apogon compressus</i>			3		
	* <i>A. cyanosoma</i>		3	4		4
Caesionidae	<i>Caesio teres</i>		5	5	5	6
Carangidae	<i>Selaroides leptolepis</i>		4			4
	<i>Carangid</i> sp. 1			3		
Gobiidae	<i>Goby</i> sp. 1		1			1
Grammistidae	<i>Diploprion bifasciatus</i>		1	3	1	2
Labridae	<i>Choerodon anchorago</i>			2		1
	<i>C. shoeneleini</i>			2		
	<i>Halichoeres chloropterus</i>		2			
	<i>H. dussumieri</i>		3		3	4
	<i>H. hoeveni</i>		2	4		
	<i>H. scapularis</i>		1			
Monacanthidae	<i>Monacanthus chinensis</i>		1			
Mugiloididae	<i>Parapercis clathrata</i>					2
Nemipteridae	* <i>Pentapodus setosus</i>					2
Pomacentridae	<i>Abudefduf bengalensis</i>			1		
	<i>Amblyglyphidodon leucogaster</i>			4		
	<i>Neopomacentrus filamentosus</i>		5			3
	<i>N. nemurus</i>		5	5	1	
	* <i>Pomacentrus cuneatus</i>		3	4	4	4
	* <i>P. littoralis</i>		3	3		
Pomacanthidae	<i>Chaetodontoplus mesoleucus</i>		2	2		3
	<i>Pomacanthus sexstriatus</i>				1	
Scaridae	<i>Scarus</i> sp.					1
Siganidae	* <i>Siganus virgatus</i>			2		
Sphyracidae	<i>Sphyracna</i> sp.(juv)		1			
Total number of families			12	10	8	13
Total number of species			19	17	9	15

* indicates a new record

** Log4 abundance categories:

Category	Number	Number of fishes
1		1
2		2 - 4
3		5 - 16
4		17 - 64
5		65 - 256
6		257 - 1024
7		1025 - 4096
8		4097 - 16384

438. The Reef Fish Community of Lazarus Island

viduals of *Caesio teres* were recorded at all four transects and formed the most numerous species. Schooling *Selaroides leptolepis* were also apparent, with approximately 50 juveniles observed at L2-3 and about 30 adults and semi-adults at L4-10. Six fish species encountered in this survey (Table 1) were additions to those listed by Lim and Chou (1991). Three species could not be identified to species and one could be identified only to family.

Salinity ranged from 23-26 ppt at the surface between sites and from 26-27 ppt at the deeper depths of the two sites. This was slightly lower than the norm of 30-31 ppt (Chuang, 1961; Chou and Teo, 1985). Water temperature showed little variation between the sites and depths and were normal for the area surveyed (Chuang, 1961; Chou and Teo, 1985). Light intensity was reduced by 85% from the surface to 10 m; much of this loss can be attributed to high sediment levels—up to 20 mg/cm²/day in these waters (Lane, 1991). Light penetration (Secchi depth) at both sites was to 3.8 m.

DISCUSSION

The number of species recorded at the two sites represented less than half of the 76 reef species recorded to date in Singapore waters (Lim *et al.*, 1990; Lim and Chou, 1991). It is possible intense recreational activities on adjacent islands, and the earlier reclamation of Lazarus itself, have affected fish abundance.

In the reefs surrounding Lazarus Island, coral cover was not related to species abundance (Table 2). The inability to effectively correlate coral cover with the fish population in Singapore reefs was highlighted by Lim and Chou (1991), who stated that a combination of factors—the turbidity of the waters, the narrowness of the reef belt, and the lack of topographical structures—were also important in determining the distribution patterns of Singapore reef fish. Comparison of live coral cover and fish diversity with two other sites in the southern islands showed that live coral cover for Lazarus was very poor, and this was reflected in the reef fish diversity and abundance.

The ubiquitous *Pomacentrus cuneatus* may have been incorrectly identified by previous researchers as *P. brachialis* (Lim and Chou, 1991) and as *P. albimaculus* (Low and Chou, 1992). This dusky-brown damselfish has previously been recorded only from the Ambon Islands in Indonesia (Allen, 1991).

Table 2. Summarized data of live coral cover and fish abundance of Lazarus Island.

Site/Depth	Coral cover (%)	Number of fish species
L2/3m	19.64	19
L2/10m	0.50	9
L4/3m	0.63	17
L4/10m	0.05	15
Total number of species for the different sites:		
	Site L2	22
	Site L4	26

The reef fish community at Lazarus Island represents a reef that has been affected by high recreational and development pressures. Surveys in the future will provide an insight to the effects of this pressure on the reef fish population.

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