

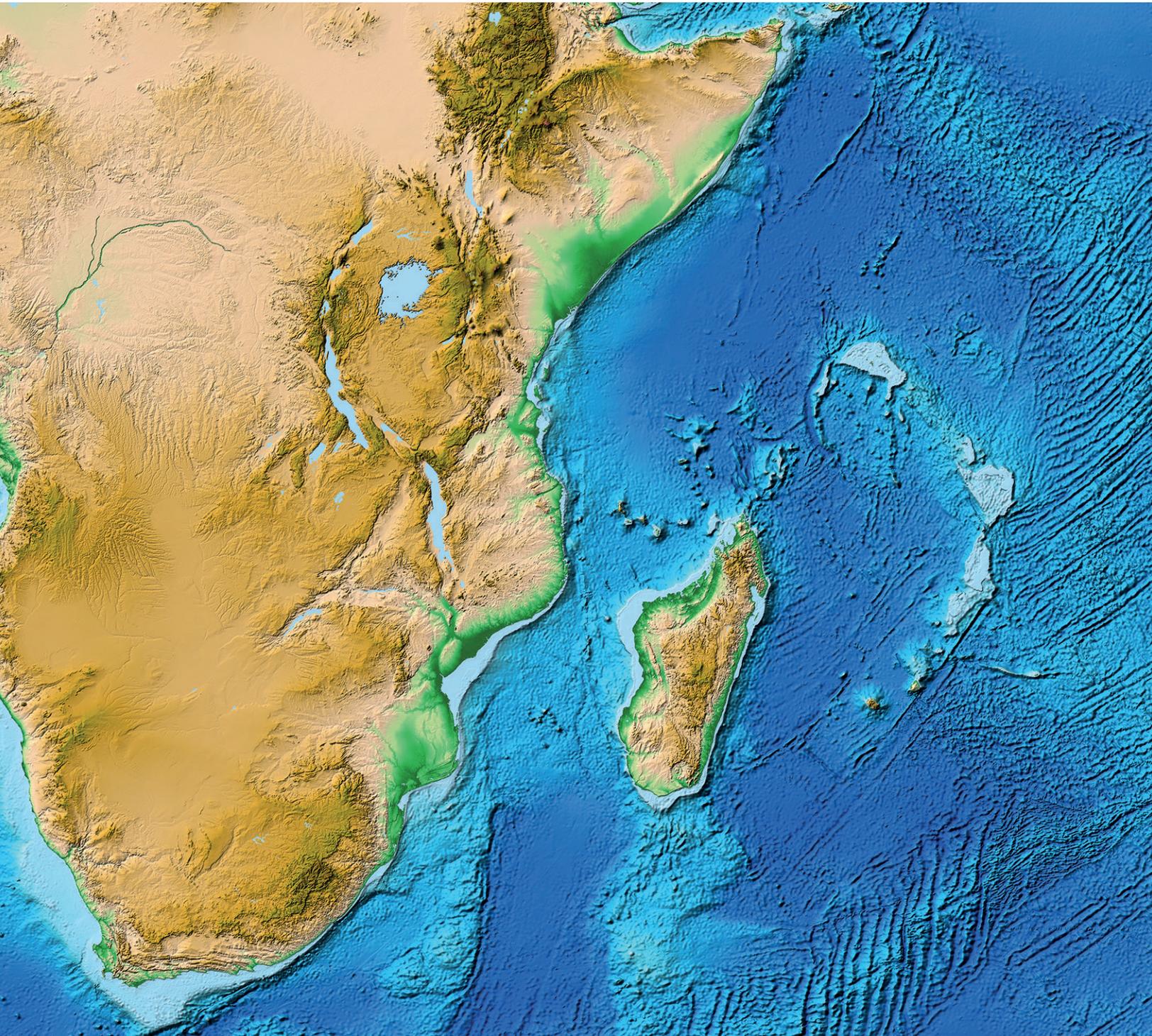
Western Indian Ocean

JOURNAL OF

Marine Science

Volume 14 | Issue 1 & 2 | Jan – Dec 2015 | ISSN: 0856-860X

Chief Editor José Paula



Western Indian Ocean JOURNAL OF Marine Science

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ISSN 0856-860X



A preliminary assessment of the status and habitat preference of the grouper (Serranidae) population of Chumbe Island Coral Park, Zanzibar, Tanzania

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Abstract

A census of the six most commonly occurring grouper (Serranidae) species was conducted on Chumbe Island off the coast of Unguja, Zanzibar, Tanzania in late 2014. The species were *Plectropomus laevis*, *Cephalopholis argus*, *Cephalopholis miniata*, *Epinephelus fuscoguttatus*, *Aethaloperca rogae* and *Anyperodon leucogrammicus*. Results showed that, in general, larger individuals and species inhabit the deeper waters of the reef slope, while smaller species (and juveniles) inhabit the shallower back reef. The combined mean biomass recorded, derived from the mean biomass of all six species, was 43.96 kg over 12.5 ha, highly concentrated at the reef slope.

Keywords Grouper, Serranidae, Fringing Reef, Indian Ocean, Zanzibar

Introduction

Chumbe Island is located approximately 5 km off the western shores of Unguja Island, the principle island among the Zanzibar archipelago (Fig. 1). It is a small, 1 km long, rocky island of 22 ha size, covered in semi-arid coral-rag forest. On the western shores it is bordered by a fringing coral reef with an adjacent shallow back-reef. The island and reef gained protected status in 1991 and the western coral reef area was designated as the Chumbe Reef Sanctuary in 1994 (Gössling, 2003), and became known as the Chumbe Island Coral Park (CHICOP) (Fig. 1). The coral reef has been closed to all fishing and extractive activities, anchoring, and recreational scuba diving for over twenty years, complying with the criteria of a no-take-area (Nordlund *et al.*, 2013), and making it one of the Marine Protected Areas (MPAs) in Tanzania with the longest history of no fishing within a coral reef habitat.

Initial studies in 1994 reported 343 fish species from 49 families within CHICOP (Fiebig, 1994), including the six species evaluated in this study. The current

CHICOP fish species list now includes a total of ten grouper species. Unfortunately, no previous fish investigations documented the numbers of individuals of each grouper species, thus historic biomass estimates are also lacking. Among the groupers of CHICOP, *P. laevis* (black-saddled grouper) is classified as Vulnerable (IUCN Red-List). The aim of this study was to establish an inventory of the larger groupers on the CHICOP coral reef that will serve as a baseline for future monitoring of these apex predators.

Materials and Methods

Surveys were conducted during October and November 2014, with a single survey defined as an underwater visual census swim either along the entire reef slope (1,000 m length) or a serpentine swim through the shallow back reef, at depths from 0-10m. The north end of the survey was at 6° 16' 31" S, 39° 10' 30" N, and the south end of the survey was at 6° 17' 01" S, 39° 10' 31" N, covering approximately 12.5 ha (Fig. 2). The prevailing currents (mainly tidal) were used to aid surveys; being north to south on the ebb, and south to

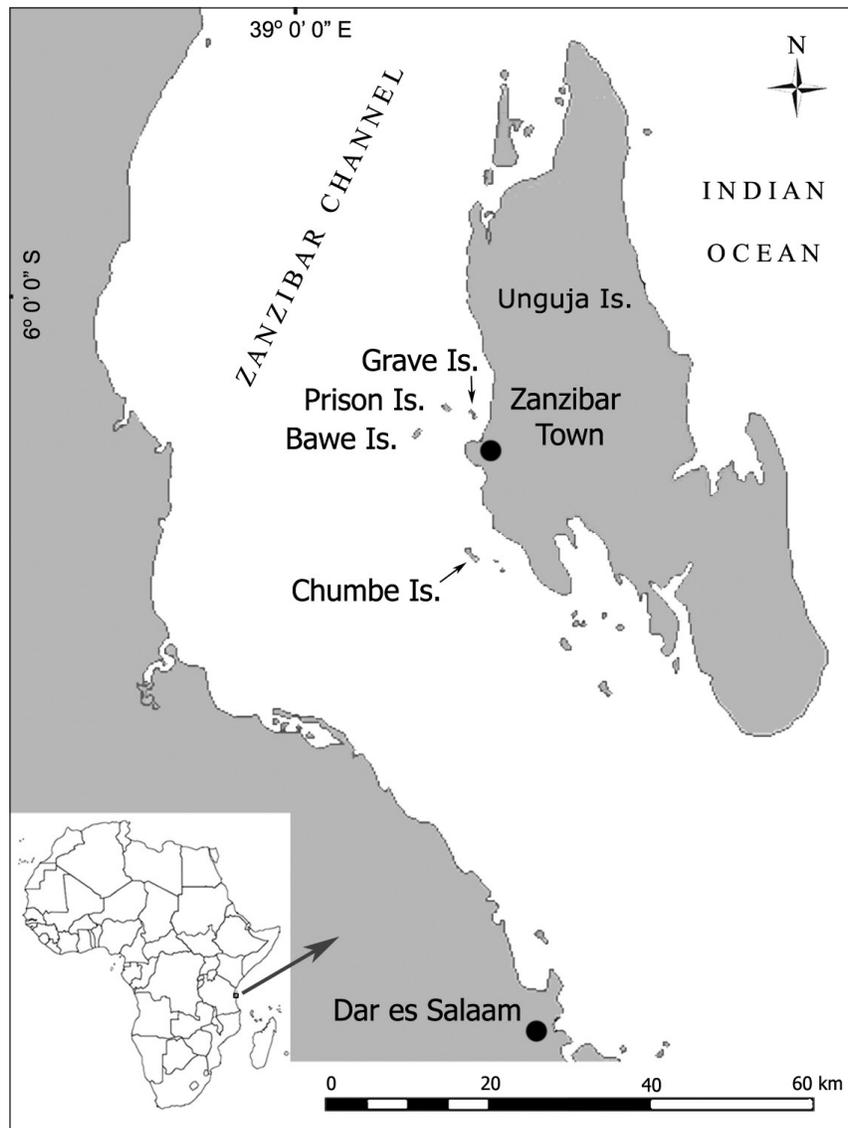


Figure 1. Location of Chumbe Island in relation to Unguja Island and mainland Tanzania.

north during the flood. Length was determined based on visual estimation, and biomass calculated using a series of length/weight categories for each species using data from Fishbase.org. Surveys were timed, ranging from 1.25 to 1.5 hours, conducted during the day between 0800 and 1600 hours. Notes were taken on individual habitat preferences for each species.

Results and Discussion

The western reef slope was surveyed thirteen times, and the inner back reef was surveyed four times. A total of 318 individual sightings were recorded from the reef slope with 60 from the back reef (Table 1). From the combined total of 378 individual sightings of groupers, overall most species were found among higher densities of coral, closer to, or on, the reef slope (Fig. 2).

The *P. laevis* population showed a strong habitat preference, with large adults inhabiting the bottom of the reef slope, approximately 6-8 m deep, with juveniles in shallower water, approximately 2-5 m deep. *C. argus* were more concentrated on and around the reef slope, and were not seen at depths below 6 m. This species had a specific concentration at the southernmost point of the Chumbe reef (Fig. 2), yet adults were observed all around the reef, in both reef slope and back reef areas. *C. miniata* were always recorded in water deeper than 4 m, close to the edge of the reef slope, especially concentrated where the slope was steepest (Fig. 2), but not seen in the back reef area (Table 1). *E. fuscoguttatus* was also absent from the back reef and seen to favour specific areas of the reef, with the highest concentration being the northernmost extent of the reef, where the coral becomes sparse (Fig. 2). *A. rogae* had a wide

Table 1. Details of grouper species sighted and their distribution in Chumbe Island Coral Park (reef slope n = 13 back reef n = 4); mean sighting values = mean number seen per survey.

Species	Common English name	IUCN Red List Category	Total sightings			Biomass (kg/12.5 ha)	
			Reef Slope (mean)	Back Reef (mean)	Maximum count (times recorded)	Reef Slope (mean)	Back Reef (mean)
<i>Plectropomus laevis</i>	Blacksaddled	Vulnerable	71 (5)	4 (1)	12 (2)	23.8	0.34
<i>Cephalopholis argus</i>	Peacock	Least Concern	117 (8)	22 (5)	19 (1)	2.76	1.43
<i>Epinephelus fuscoguttatus</i>	Brown marbled	Near Threatened	20 (1)	0	4 (1)	9.05	0
<i>Aethaloperca rogaea</i>	Redmouth	Data Deficient	84 (9)	24 (6)	14 (2)	3.66	1.94
<i>Cephalopholis miniata</i>	Coral	Least Concern	26 (3)	0	8 (1)	0.61	0
<i>Anyperodon leucogrammius</i>	Slender	Least Concern	0	10 (2)	2 (1)	0	0.37
Total			318 (24)	60 (14)	59	39.88	4.08

distribution that covered both the reef slope as well as the back reef where larger individuals and smaller ones were observed, respectively. They were generally concentrated in the middle of the reef, more along the dense coral of the reef slope than the sparse coral of the back reef. *A. leucogrammicus* was only observed in the back reef areas, always associated with table corals, and not seen on the reef slope.

The overall impression on the distribution of adults and juveniles for four species was that larger individuals were more common on the reef slope and smaller individuals the shallower back reef. The absence of adult *P. laevis* or *E. fuscoguttatus* in the back reef further confirms that mature individuals exclusively inhabit the reef slope. Once the large individuals reach a certain size, they can no longer seek refuge in shallow water to ambush prey, so must move to deeper water where larger coral formations occur. The combined mean biomass density of the six grouper species was 43.96 kg, with a biomass density of 39.88 kg on the reef slope and 4.08 kg on the back reef (Table 1).

The finding of this survey presents a baseline on the abundance, size, habitat distribution, and biomass of the six principle grouper species, for the main coral reef area (12.5 ha) within CHICOP. This also demonstrates that CHICOP has succeeded in protecting a small section of fringing reef to the extent that after 20 years a number of apex predators are now commonly observed, at a time when neighbouring coral reefs are witnessing significant declines in diversity

and standing stock (Muthiga *et al.*, 2008). The relatively small, 1 km-long, western reef of CHICOP at present supports a population of at least twelve *P. laevis* individuals among a total grouper population of 59 individuals, and a mean standing stock estimated at

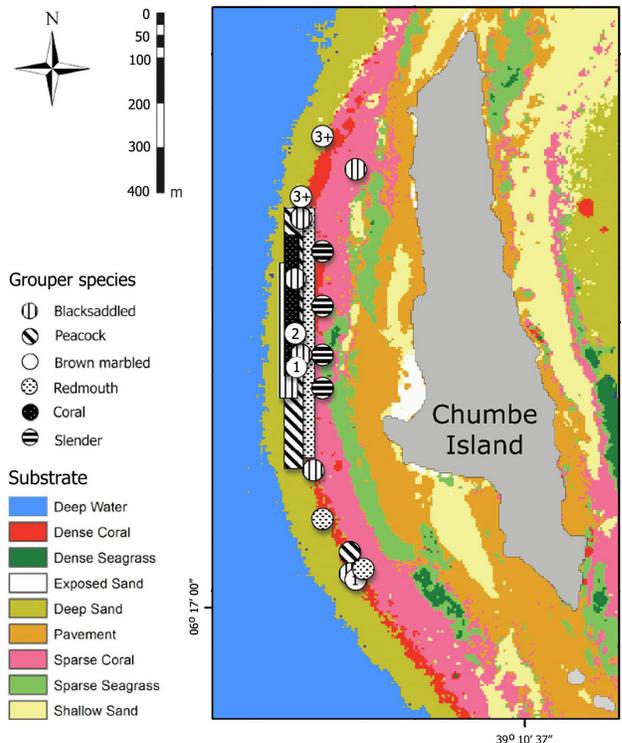


Figure 2. Marine habitats of Chumbe Island's western reef area (CHICOP) showing location of grouper species sighted in the present study (circles are areas of high or regular occurrence; rectangle indicates the broader territory of a species; and numbers in circles indicate the number of individual Brown marbled groupers (*E. fuscoguttatus*) observed at each location).

43.96 kg. This is an important contribution to grouper stocks, not only for Zanzibar and Tanzania, but for the region as a whole.

Further understanding of the movements of these large fish would also be beneficial, particularly combined with photo-identification of individuals to help better establish the precise territories of individual fish. Understanding the egg production capacities of each species within CHICOP, in terms of larvae export, would contribute to the debate on how MPAs replenish fish stocks outside their boundaries.

Acknowledgements

Ulli Kloiber deserves our thanks for allowing KN to conduct this research on Chumbe Island, for her guidance and for sharing historic and current fish lists and the GIS habitat base map used to map species distribution. We are also thankful to Sue Wells for useful critical comments on the manuscript, and lastly, we would

like to thank Helen Peeks for her efforts in arranging the stay of KN on Chumbe and for her incredible support during her time in Zanzibar.

References

- Fiebig S (1994) Marine biologists' managerial report. Activities on Chumbe Island reef, July-December 1994. (Unpublished)
- Gössling S (2003) The political ecology of tourism in Zanzibar. In: *Tourism and development in tropical islands: political ecology perspectives*. Edward Elgar: Cheltenham
- Muthiga N, Costa A, Motta H, Muhando C, Mwaipopo R, Schleyer M (2008) Chapter 6. Status of Coral Reefs in East Africa: Kenya, Tanzania, Mozambique and South Africa, p. 91-104
- Nordlund L M, Kloiber U, Carter E, Riedmiller S (2013) Chumbe Island Coral Park—governance analysis. *Marine Policy* 41: 110-117