



Deep-sea incirrate octopus *Velodona togata* (Chun, 1915) in waters off Mozambique (SW Indian Ocean): Reproductive biology, distribution, and abundance



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ABSTRACT

This is the first study on the reproductive biology, distribution, and abundance of the deep-sea incirrate octopus *Velodona togata* Chun, 1915 in Mozambican waters. Data were obtained from a research survey carried out between March and April 2009, on board the Spanish research vessel Vizconde de Eza. The species was present in the four depth strata (201–400 m, 401–500 m, 501–600 m and 601–700 m depth) and five geographic sectors investigated (from Inhaca to Sofala). The highest abundance was recorded in the southern sector (Inhaca) between 501 and 600 m depth, where maximum and average yields were 37.7 kg/haul h and 9.4 kg/haul h, respectively. The sex ratio was 0.67:1 (Females:Males). Both sexes had similar length-weight relationships and not isometric growth in weight ($b < 3$). Estimated sizes at first maturity were 10 cm for males and 13 cm for females. In males from 140 to 173 mm dorsal mantle length (DML) the number of spermatophores ranged from 5 to 13, with a mean value of 9. In females from 138 to 183 mm DML total fecundity ranged from 72 to 122 eggs, with a mean value of 96 eggs. The low fecundity values and large eggs (maximum size of 30 mm) indicate that *V. togata* produces benthic hatchlings. Although *V. togata* could follow a “simultaneous terminal spawning” strategy, we believe the species spawns over an extended period because we observed large mature eggs alongside smaller ones in the ovaries and because of the wide size range of the sampled population (26 to 195 mm DML).

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1. Introduction

The coast of Mozambique extends for 2740 km along the east of Africa and supports numerous fisheries that mainly target valuable crustacean species on the continental shelf. Despite the importance of such fishing activities, little is known on local benthic and benthopelagic communities.

Shomura et al. (1967) and Gulland (1970) made the first estimates of fish resources in waters off Mozambique. Later, Burczynski (1976) and Birkett (1978) presented abundance estimates based on the swept area method from fishery surveys along the coast of Mozambique on board the research vessel (RV) Professor Mesyatsev. The Soviet trawler Aelita and the German Democratic Republic trawler Kattgat also carried out fishery investigations in Mozambican waters (Budnichenko, 1977; Anonymous, 1978). More recently, the Norwegian Agency for Development Cooperation (NORAD) performed seven surveys on board the RV Dr Fridtjof Nansen over a

period of about 14 years (1977–1990) (Sætersdal et al., 1999), as part of their long-term program to support fisheries research and development in Mozambique. In March–April 1999, the Portuguese RV Capricornio carried out a trawl survey in Mozambican waters (Días et al., 1999) but cephalopods were not the target species. In general, the information about cephalopods available from these surveys is scanty, focused only on a few commercial species and obtained from different areas and sampling gears.

A recent series of annual research cruises was conducted in March–April 2007, 2008, and 2009 on board the Spanish RV Vizconde de Eza to assess the composition and distribution of Mozambican demersal resources down to 700 m depth. The collected data enabled a qualitative and quantitative description of the assemblages identified, analysis of their spatial distribution, and estimation of the abundances of the most important species.

Cephalopod species were present throughout the survey area, being very abundant in certain zones and depths. They were the second most important taxonomic group in terms of catch in all three Spanish surveys. In one of them (Mozambique 0309), the octopod *V. togata* was the second most abundant cephalopod species, showing high yields and wide distribution area, and therefore being a

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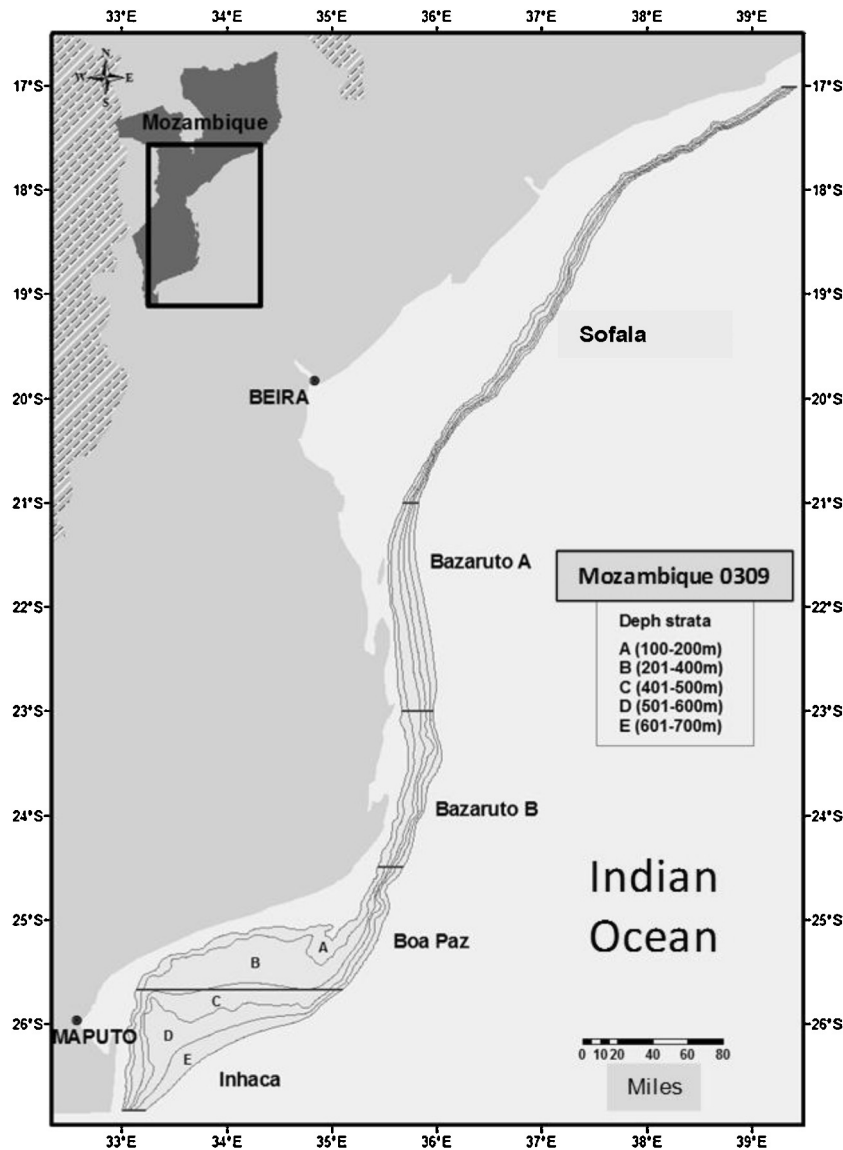


Fig. 1. Study area showing geographic sectors and depth strata.

potentially important species in the bycatch of commercial fisheries. The abundance of this species in this Ocean Indian area was also highlighted in the Mozambique 0307 survey carried out two years before (Silva et al., 2009). However, the biology of this species is unknown. This first biological study of *V. togata* in Mozambican waters provides basic biological information, as well new data on the abundance and distribution of the species, in contribution to the knowledge on the cephalopod fauna in the Southwestern of Indian Ocean.

2. Material and methods

The Mozambique 0309 survey (March 10–April 11, 2009) was conducted over a total area of 44,696 km² between latitudes 26° 50' S and 17° S, and between 200 and 700 m depths, in Mozambican waters. The RV Vizconde de Eza is a stern trawler of 53 m length and 1400 Gross Registered Tonnage, equipped with a standard “Baka” bottom trawl (52 m headline and 32 m footrope). The trawl had a stretched mesh of 46 mm in the codend and was covered internally with a 25 mm mesh liner. Mean headline height and mean wing spread were 1.9 and 0 m, respectively. These were measured by a

Simrad ITI sensor system used to monitor gear performance and geometry during fishing operations

For sampling purposes the area was divided into five geographic sectors, from north to south, as follows: 1 (Sofala), 2 (Bazaruto A), 3 (Bazaruto B), 4 (Boa Paz), and 5 (Inhaca). Within each geographic sector we considered four bathymetric strata: stratum B (201–400 m depth), stratum C (401–500 m), stratum D (501–600 m), and stratum E (601–700 m) (see Fig. 1). The geographic position of the fishing stations was selected according to a stratified random sampling scheme, taking into account the stratification outlined above. The number of hauls per geographic sector and depth stratum was proportional to the trawlable surface adjusted to the ship time at sea. The coverage was approximately 2.44 hauls for every 1000 km². They were performed during daytime, for 30 min at a mean towing speed of three knots. Catch values were standardized to the number of individuals and biomass per 30 min of trawling by sectors and strata for subsequent statistical analysis as described by Cochran (1971). The total biomass and biomass by sectors and strata were calculated using the swept area method (Sparre and Venema, 1997). The hydrographic conditions in the studied area were recorded from 100 to 800 m depth by means of a Seabird-25 CTD probe, deployed along six transects

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