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The striped soldier shrimp *Plesionika edwardsii* (Crustacea: Decapoda: Pandalidae) from the Cape Verde Islands – Assessment and recommendations towards sustainable exploitation

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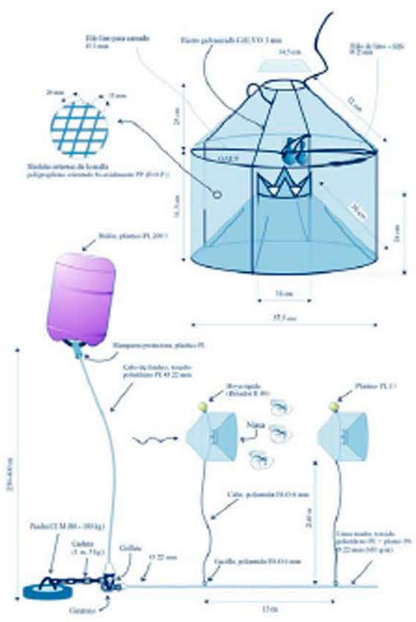
Introduction

This study is part of the PROACTIVA 1-2 (2009-2012) and MARPROF-CV (2010-2014) projects, in the framework of the Canary Islands Government and UE PCT MAC 2007-2013 programmes respectively. Research has mainly focused on the stock assessment of the striped soldier shrimp, *Plesionika edwardsii* (Brandt, 1851), because it has shown moderate to high levels of fishing yield and abundances compatible with the development of a new sustainable fishery in the Cape Verde Islands.

Material and Methods

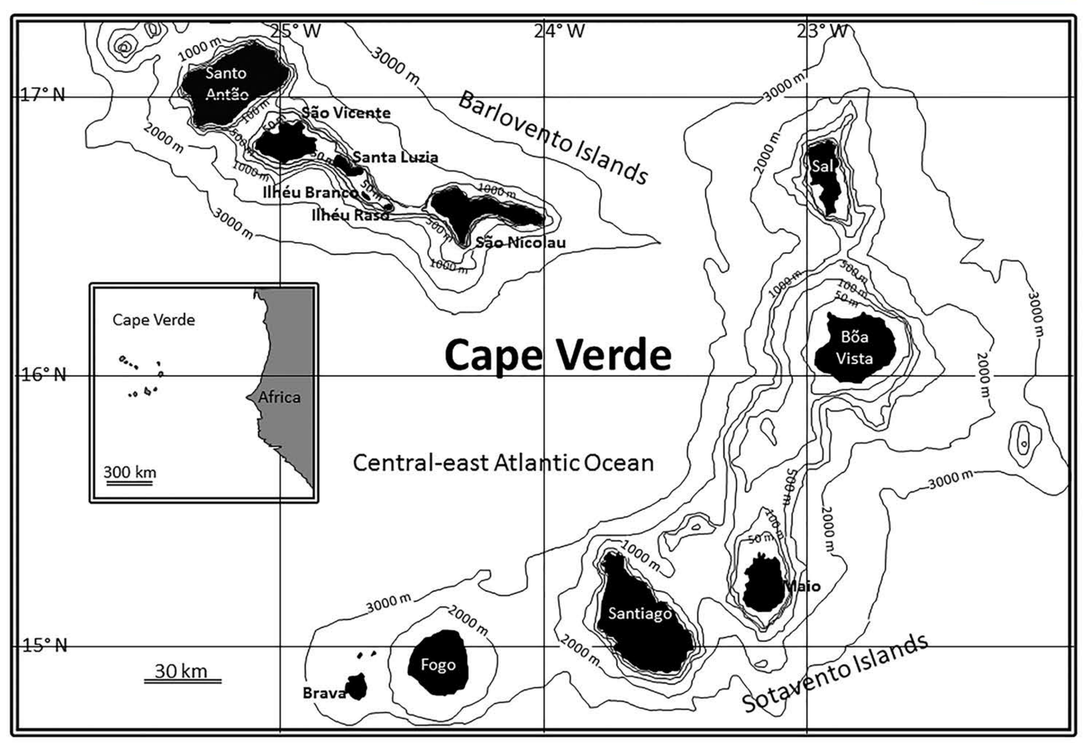
Cruises took place on board the R/V *Profesor Ignacio Lozano*. Four 15-day surveys were conducted: Cabo Verde 2010-04 (April 2010), Camarão-1 (November 2011), Camarão-2 (March 2012) and Camarão-3 (July 2012). An innovative fishing gear so-called multiple semi-floating shrimp trap (MSFST) was used. Traps were covered by a white plastic rhombic mesh of 15x20 mm. Each fishing line was composed by 40-65 traps operating around 2.4 m above the seafloor, using *Decapterus macarellus* (Carangidae) as unique bait of the traps. Fishing depth was 66-458 m, and efective fishing time was 16-18 h. Each trap was attached to the main bottom line every 15 m, and the maximum attraction of this bait was established to be 100 or 150 m, according to the experience gained from the local fishery for deep-sea lobsters. So density by area was calculated assuming two different areas of attraction of the fishing gear. Initial biomass was estimated from depletion experiments at different abundance stations by applying the Leslie & Davis (1939) method, modified by Ricker (1975). Each fishing operation was classified according to its yield (CPUE in g/trap/night). The potential fishing planar area was estimated between the isobathymetric lines between 90 and 220 m. Total biomasses (Bt) were calculated from areas (km^2) and mean minimum/maximum densities (kg/km^2). Maximum sustainable yield (MSY) was estimated from Bt using the Beddington and Cooke (1983) model by entering natural mortality (0.6), growth rate ($0.53\ year^{-1}$) and recruitment age (1.32 year), which are the published parameters for this species in the Canaries. These parameters estimate a biological exploitation rate (β) of 0.262. Interpolations were applied to estimate MSY for insular stocks representing lesser than 5% of the total fishing grounds for this species in the Cape Verde archipelago.



Results and Discussion

MSY values estimated by depletion were: 30.5 tons/year for the stock of São Vicente, Santa Luzia, Ilheus and São Nicolau, 10 tons/year for the stock of Santiago, 138.8 tons/year for the stock of Boa Vista and Maio, and 5.6 tons/year for the stock of Sal. The small stocks estimated by interpolation were: 4.5 tons/-year for the stock of Santo Antão, 1.3 tons/year for the stock of Fogo, and 1.8 tons/year for the stock of Brava and Ilheus. Total MSY for the striped soldier shrimp around the islands of the Cape Verde archipelago was 192 tons/year, occupying a total area of 1,918 km^2 of new fishing grounds between 90 and 220 m of depth. In comparison with the traditional bottom trap used in the Canary Islands, the MSFST was proved to be more selective for pandalid shrimps, minimizing the gear impact on the seafloor as well as the by-catch by reducing discards. Depletion methods are based on the assumption of a closed system, that is with minimum or zero immigration between neighbouring areas. The straight forward decline of CPUEs obtained during the depletion experiments seems to confirm that *P. edwardsii* is a low mobility species, making this assumption valid at least during short-time periods. Because of the bathymetric profile of these islands, the depth range is from very close (few nautical miles in Santiago) to far away (10-12 n.m. in Boa Vista) to the coastline.

PARAMETERS FOR STOCK ASSESSMENT	*P. edwardsii* stocks evaluated							TOTAL Cape Verde Archipelago
	São Vicente + Santa Luzia + Ilheus + São Nicolau	Sal	Santo Antão + Banco Noroeste	Boa Vista + João Valente + Maio	Santiago	Fogo	Brava + Ilheus	
Average density (kg/km^2)	530.26	193.10	193.10	406.39	247.33	247.33	247.33	-
Potential fishing area 90-220 m (km^2)	219.70	111.20	89.00	1,303.80	154.00	19.50	27.70	**1,918.10**
Percentage of useful area (%)	11.50	5.80	4.60	68.00	7.70	1.00	1.40	**100.00**
Total biomass (kg)	116,497.33	21,472.95	17,186.08	529,847.06	38,089.44	4,823.01	6,851.15	-
Biological exploitation rate (%)	26.20	26.20	26.20	26.20	26.20	26.20	26.20	**26.20**
Maximum sustainable yield (tons/year)	30.52	5.63	4.50	138.82	10.00	1.26	1.80	**192.50**
Stock assessment method	Depletion	Depletion	Depletion	Depletion	Interpolation	Interpolation	Interpolation	-



Fishing effort should be controlled on the basis of quotas, number of fishing vessels and a precautionary approach in order to ensure that catching is commensurate with sustainable levels of exploitation. MSY estimates suggest that this new Capeverdean fishery should be carried out by specialized medium-sized fishing vessels. During the last decades a combination of shrimp trawling and industrial trapping activity has threatened over-exploitation in the Mediterranean fisheries targeting on *P. edwardsii*; currently the shrimp collapse has conducted to the decline of these fisheries. Can the Cape Verde regulatory bodies and all the stakeholders involved learn the lessons this teaches us about this resource management?

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