Fisheries Research 168 (2015) 105–108

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

Short Communication

Elasmobranch capture by commercial small-scale fisheries in the Bijagós Archipelago, Guinea Bissau

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ARTICLE INFO

Article history:
Received 28 February 2014
Received in revised form 1 March 2015
Accepted 22 March 2015
Handling Editor George A. Rose
Available online 28 April 2015

Keywords:
Bijagós
Elasmobranchs
Small-scale fishing

ABSTRACT

A standardised survey is used to investigate elasmobranch capture during commercial small-scale fishing operations in the Bijagós Archipelago (West Africa). Data refer to 211 landing episodes attributed to four main gears. Results show that elasmobranchs can constitute up to 10% of total capture. Five orders are identified and catch-per-unit-effort peaks for large-hook long-lines. The presence of both adult and neonate elasmobranch catch suggests fishing may occur inside nursery habitat.

1. Introduction

Elasmobranchs (sharks, skates, rays and guitarfishes) show certain 'slow' life history traits (Dulvy et al., 2008; Dulvy and Forrest, 2010) which coupled with their high monetary value, has contributed to the 'threatened' status of many species (Fowler et al., 2009). In particular, they rely upon shallow coastal waters as pre and post-natal nursery areas, where fishing also proliferates (Lucifora et al., 2011; Dulvy et al., 2014). In this work, elasmobranch capture in West African small-scale commercial fishing gear is evaluated. This can occur through either targeted or incidental practices, but is commonly rewarded by financial incentives to supply a Far-Eastern market no longer able to support Asian demand (Clarke et al., 2004, 2007). With West African SSF landings at their lowest in twenty years (Belhabib et al., 2014) this investigation aims to supplement existing longer-term data in a region where both fisher-migrations and elasmobranch capture are synonymous with financial gain (Diop and Dossa, 2011).

2. Materials and methods

In the UNESCO held Bijagós Archipelago, regional in-migrants have managed and controlled commercial SSF operations out of seasonal settlements or fishing camp enclaves, for several decades (Campredon and Cuq, 2001; Binet et al., 2012; Cross, 2015). They include fishers, processors and traders who transform the catch through sun-drying, smoking and salting before transhipment to numerous mainland markets. A specific tendency for Senegalese Nhyominka fishers, to focus on sharks and rays has been described (Dulvy et al., 2008). Between 2009 and 2010 twenty-eight elasmobranch species were documented in Guinea-Bissau (Jung et al., 2011); yet despite the regions diversity, the 'critically endangered' sawfishes continue to receive greatest attention (Robillard and Séret, 2006; Leeney and Poncelot, 2013). Most recent sawfish sightings have now been dated back to the 1980s and more contemporary studies link their demise with a growth in commercial SSF (Leeney and Poncelot, 2013). The indigenous occupants of the archipelago (Bijagós Islanders) are subsistence agriculturalists rather than fishers (Haakonsen, 1991; Tvedten, 1990; Baekgaard and Overballe, 1992). Their animistic beliefs; reverence of spirits (imbued within natural phenomena) and the age-structured sociocultural system which governs their secret initiation process, have all been used to highlight a 'cultural connection' with their environment (Robillard and Séret, 2006). Many areas across the archipelago are locally sacred and attempts are made to restrict fishing at certain times. The islands therefore provide an interesting case, for not only investigating elasmobranch capture but also understanding more 'traditional' ways of managing fishing effort.

A SSF camp on Uno Island (Fig. 1) was visited regularly between 2008 and 2010. This site was purposefully chosen on account of proximity and trade, between the camp and neighbouring Bijagó villages. This facilitated a cross-cultural livelihood analysis (Cross, 2014). A landing-survey documenting the temporal and physical specifics of fish capture: including date and time of landing; gear-type; gear duration inside the water; fishing ground; habitat-type and commercial catch quantities was devised for the purpose of

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http://dx.doi.org/10.1016/j.fishres.2015.03.018

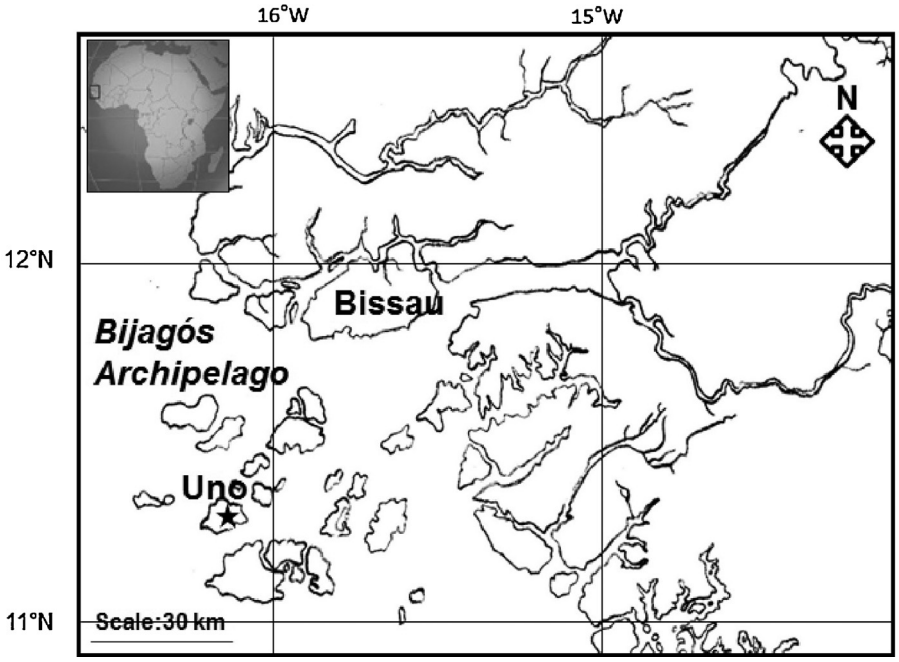

Fig. 1. (Insert) Location of Guinea-Bissau on the West African Coast; (Main Map) Location of the capital city Bissau, the offshore Bijagós Archipelago and study-site Uno Island.

this study. Data presented here refer to four main gears; fine-mesh monofilament nets (P-MN), gillnets (GN), small-hook (SH-LL) and large-hook (LH-LL) longlines (Table 1). The definitions of catch per unit effort (CPUE) are gear-specific, referring to '*kilograms of fish/per 1000 m^2 net area/tide*' (for the P-MN and GN) and '*kilograms of fish/per 1000 hooks/tide*' (for both SH and LH longlines). Landed fish were separated inside the camp into major groups including bonga-shad (*Ethmalosa fimbriata*), sea catfish (*Arius* spp.), croakers (*Pseudutolithus* spp.), elasmobranchs and other miscellaneous fish (such as mackerel, snapper, jack and grunt). These groups are distinguished in the analysis. Given the commercial nature of the SSF operations on Uno, landing survey data-collection was designed to have minimal disruption. As a result, four caveats are observed. Firstly, landings of bonga, catfish and other miscellaneous fish (all smoked produce) were measured in 'pans'; a generic term describing metal fish-carrying containers. One pan of either bonga or other miscellaneous fish was said to weigh 10 kg; in contrast, one pan of catfish held 12 kg. Given that it was not possible to weigh every pan at landing, the surveys instead summarise catch in terms of pan measures and then convert these to kilogram equivalents. Secondly, elasmobranchs were identified as possible using the Eastern Tropical Atlantic identification guide (Séret, 2006). However, sub-adult sharks are notoriously difficult to identify (Beerkircher et al., 2002) and accurate identification usually necessitates dissection, particularly of the head or jaw (Séret pers. Comm. 2009). Given the commercial nature of fishing, dissection was not possible and elasmobranch landings are here differentiated into three broad groups: skates/rays, sharks and guitarfishes. Thirdly in only very few instances, have specimens of elasmobranch been measured. A total length (TL) measure (linear distance from the tip of the snout to the distal edge of the longer pelvic fin) was used for the sharks. A disc width (DW) measure (linear distance across the widest portion of the disc) has been used for skate, rays and guitarfishes (Bizzarro et al., 2007). Finally, the surveys exclude any landing events made following multiple-day fishing trips (known as 'campaigns'). These trips were usually undertaken by motorised gillnet fishers who described setting and hauling numerous sets of gear in various fishing locations across the archipelago. Factorial ANOVA tests (IBM SPSS Version 21) have been used to investigate variation in elasmobranch CPUE between gear-types. Tests are also performed for gear selectivity on individual elasmobranch weight and size metrics.

Table 1
Gear dimensions and characteristics of the four gear-types.

Description	Nets		Lines	
Gear name	Monofilament net (paddle-powered)	Gill-net	Long-line (small-hook)	Long-line (large-hook)
Abbreviation	P-MN	GN	SH-LL	LH-LL
Crew size	2–3	2–3	2–3	2–3
Position in water column	Pelagic (near-surface)	Mid-Water	Demersal (deep water)	
Gear operating strategy	Nets set straight; 1–2 sets per trip (more during rainy season); sets left for 6 h (max) before haul	Nets set straight; 1 set per trip; sets left for up to 8 days before haul	Lines set straight; up to 4 sets per trip (more during dry season); sets left for up to 2 days before haul	
Number of nets	30	2–10	–	–
Size of mesh/or hook	28–32 mm	240 mm	Hook size: 7,8 (3–4 cm)	Hook size: 3,4,5 (5–7 cm)
Average gear area/number of hooks	500–2500 m^2	450–4500 m^2	1200–2000	450–1100
Engine power (HP)	–	6/8/40	6/15	8/15