Building capacities and knowledge to underpin the conservation of threatened sharks in rays in Cabo Verde, West Africa




TECHNICAL REPORT 2016
MARALLIANCE, CABO VERDE

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ii. About MarAlliance

MarAlliance is a small international NGO registered in Belize and the US (as a 501 (c) (3). MarAlliance began working in Cabo Verde in 2015 in response to a shortage of scientific information on elasmobranchs and a growing synergy of anthropogenic threats currently facing the region. Beginning in Boa Vista; where we are still based, this has subsequently expanded to include Sal and Maio.

Our mission is to improve the status of threatened marine wildlife, its critical habitats and dependent communities. We use a variety of proven scientifically robust methods, capacity building and outreach & education to generate robust and reliable data and cultivate viable long-term conservation from the bottom up.

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SUMÁRIO EXECUTIVO

1. Concluímos a monitorização de linha de base de peixes grandes, incluindo os tubarões e as raias nas ilhas do Sal, Boa Vista e Maio, contando com a participação de 8 pescadores e 4 parceiros. Esta iniciativa serve como passo para a realização de linhas de base em todo o arquipélago e tem como alvo a avaliação das mudanças na diversidade e das populações de peixes grandes ao longo do tempo.

2. Registámos 16 espécies de elasmobrânquios durante a monitorização da linha de base nos habitats costeiros de Cabo Verde. A maior diversidade foi observada na ilha de Boa Vista com maior abundância ao longo das costas de barlavento. Por outro lado, a nossa pesquisa revela que as costas de sotavento são mais utilizadas pelos tubarões juvenis e espécies que preferem habitats arenosos. Durante a monitorização mensal offshore identificámos 34 mega-planctívoros, de 2 espécies (*Rhincodon typus* e *Manta birostris*). Através da pesca científica apanhámos e marcámos 4 espécies bem como iniciamos a investigação de alguns habitats chave.

3. Identificar e compreender o papel dos habitats críticos é fundamental para a gestão e conservação das espécies de peixes durante um período de vida vulnerável. Locais utilizados como viveiro são particularmente importante, especialmente em um ambiente insular onde o autorecrutamento para a população é provavelmente elevado. A gestão sustentável destes lugares em conjunto com pescadores locais é uma prioridade para a sustentabilidade destas populações.

4. As pescarias tradicionais em Cabo Verde e, em especial, a pescaria de tubarões, não são bem definidas. Os inquéritos realizados com 150 pescadores ajudaram a compreender melhor o foco e a sazonalidade das pescarias costeiras, bem como as ameaças e percepções de tubarões e raias. Os resultados iniciais sugerem que, embora o *'finning'* tenha sido significativamente reduzido, a exploração de tubarões de pequena escala ocorre frequentemente. Isso, destaca a importância da monitorização e revela potenciais oportunidades para sensibilização e educação das comunidades piscatórias.

5. Educação e capacitação são componentes-chave para a criação de um melhor entendimento da vida marinha silvestre, nomeadamente tubarões. Um programa de educação e extensão foi desenvolvido e implementado em 2015-2016, atingindo 1400 crianças do ensino primário e 19 professores. Enquanto isso, a formação de campo e a gestão de recursos para 10 pescadores está a aumentar a sensibilização para os elasmobrânquios e identificar meios de promoção de uma maior sustentabilidade nas pescarias artesanais em Cabo Verde. Uma melhoria na gestão das pescarias artesanais demonstra benefícios para a comunidade *e* para a biodiversidade.

iii. EXECUTIVE SUMMARY

1. We completed the baseline monitoring for large fish including sharks and rays in the islands of Sal, Boa vista and Maio with a broad team of 8 fishers and 4 partners. This initiative serves as a stepping-stone for the completion of baselines throughout the archipelago and to assess changes in diversity and populations over time.

2. We recorded 16 species of elasmobranchs during our baseline monitoring in Cabo Verde's coastal habitats. The highest diversity was noted around the island of Boa Vista with greatest abundances along windward coasts. Conversely the leeward coasts were more utilised by juvenile sharks and species preferring sandy habitats. During offshore monthly monitoring we identified 34 mega-planktivores from two species (*Rhincodon typus* and *Manta birostris*). Through conducting scientific longline sets we caught and tagged sharks of 4 species and began to investigate some of their key habitats.

3. Identifying and understanding the role of critical habitats is key to management and conservation of fish species during a vulnerable period of life. Nursery sites are particularly important especially in an insular environment where auto-recruitment into the population is likely high. Sustainably managing these sites in conjunction with local fishers is a priority for the sustainability of these populations.

4. Traditional fisheries in Cabo Verde and for sharks are not well characterized. Fisher surveys conducted with 150 fishers helped to better understand the focus and seasonality of coastal fisheries, as well as threats and perceptions of sharks and rays. Initial results suggest that although finning has been significantly reduced, small-scale exploitation of sharks widely occurs. This emphasises the importance of continued monitoring and presents potential opportunity for outreach and education.

5. Education and capacity building are key components of fostering greater understanding of marine wildlife, notably sharks. A program of education and outreach in 2015-2016 was developed and implemented for 1400 children of late primary students and 19 teachers. Field and resource management training for 10 fishers is both raising awareness for elasmobranchs and identifying means of fostering greater sustainability in small-scale fisheries in Cabo Verde. Improved management of artisanal fisheries demonstrates benefits for communities and biodiversity.

1. INTRODUCTION

The importance of apex predators in maintaining healthy marine ecosystems is widely recognised (Myers *et al.,* 2007; Estes *et al.,* 2011; Roff *et al.,* 2016). Yet, globally, many shark populations have declined by as much as 90% (Baum & Myers, 2004, Myers*,* 2005; Heithaus, 2008; & Ferretti, 2010) and 24% of the 1100 known species of elasmobranchs (sharks and rays) are currently threatened with extinction according to the IUCN.

Elasmobranchs are often associated with targeted fisheries: shark fin, manta ray gill-raker and recreational fishing; and non-targeted fisheries through high incidences of bycatch in higher value finfish fisheries (Musick *et al.,* 2000). Habitat destruction is also significant factor. Nonetheless, their ability to withstand exploitation is exacerbated due to their low levels of fecundity and late maturation. In a recent report the FAO stated that approximately 30% of marine fish stocks are currently fished beyond sustainable levels (FAO, 2016), though there are concerns that failing to fully consider artisanal fisheries has vastly underestimated the extent of the problem.

In Cabo Verde anecdotal reports suggest shark populations have experienced massive declines in the last 50 years as sharks continue to be exploited at unsustainable levels, yet reliable scientific data is in short supply. On one hand, in recent years the European Union fleet has recorded between 60-90% of catches being made up of sharks in the targeted tuna fishery alone (C. Monteiro 2016, INDP, pers. comm., 29 June). Seemingly following the trend of exploitation in the Spanish swordfish fishery in the North East Atlantic a decade earlier (Mejuto *et al*., 2005; Hareide *et al*., 2007). On the other hand, the extent to which clandestine fishing occurs remains largely unknown and there are insufficient means to effectively combat the problem. Even authorised boats are speculated to be removing hundreds of sharks independent to recorded catches daily (C. Eizaguirre 2015, pers. comm., 10 July) emphasising the urgent need for specialist on-board observers.

The Eastern islands of Sal, Boa Vista and Maio have some of the most productive fishing grounds in the archipelago. These territorial waters are used by local artisanal fishers primarily targeted yellow fin tuna (*Thunnus albacares*), wahoo (*Acanthocybium solandri)* and African hind (*Cephlophalis taeinops*). To what extent elasmobranchs are being exploited in still unknown. Nonetheless, there is growing pressure from other islands (most noticeably Santiago), through the movement of artisanal and semi-industrial fishing boats to Maio and the south of Boa Vista.

Given the economic and cultural importance of artisanal fisheries to the islands and the role large-bodied apex predators have in maintaining ecosystem health (Roff *et al.,* 2016; Mccauley *et al.,* 2016) and sustaining resilient fish populations, there is reason enough to want conserve these populations. Additionally, the socioeconomic value healthy populations of sharks can have for the local community (Topelko and Dearden 2005; Simpfendorfer *et al.,* 2011) through the dive industry and potential shark encounter tourism provides further emphasis of their potential value.

Despite this there is a dearth of scientific information available and insufficient management measures in place. Although shark finning at sea was prohibited in 2005 (Decreto-lei N.º 53/2005) it is still speculated to widely occur (C. Eizaguirre 2015, pers. comm., 10 July). In Boa Vista existing protected areas currently afford negligible protection to

sharks and rays since there is limited zoning or gear restrictions. Additionally, where legislation exists there are few resources to effectively enforce regulations.

Given the increasing pressures facing the sub-region (namely industrial fishing and mass-tourism), robust scientific monitoring is urgently needed to better understand shark and ray populations, their ecology and their role in artisanal fisheries. Only by improving our understanding of these extant populations will we be better able to manage and conserve their populations and enhance the sustainability of our fisheries.

Context

In Cabo Verde 'Services' account for 76.2% of GDP (2015) with tourism providing most of the the country's revenue. Santa Maria on Sal has seen the focus of this development though efforts are now shifting to Boa Vista. Such reliance on 'all-inclusive' tourism has seen rapid development though this has not been homogenous nationwide and many of the jobs are low skilled, short-term and prone to seasonal variations.

In the last 10 years Boa Vista has seen substantial growth in the '*package tourism*' industry and this trend is predicted to continue (R. Scott 2014, pers. comm., 14 August 2014). This rapid development, in the insular environment of Cabo Verde, will likely have a significant impact on local marine resources (Lima and Martins, 2009) and highlights the need for quantitative assessments to be made as soon as possible (Worm *et al.,* 2006; Simpfendorfer *et al.,* 2011).

Although tourism has generated a large amount of employment in Cabo Verde, such rapid expansion often fails to prioritise the environment and much of the revenue generated does not stay to benefit the economy. Furthermore, migration, from other islands and continental Africa in search of job opportunities is putting increasing pressure on marine resources as well as limited public services and sanitation.

The expansion of the Spanish-owned RIU hotels and the on-going construction of the *Meliá White Sands* hotel on Santa Monica beach by the Resort Group PLC are expected increase pressures on the island's resources. Such developments are likely to increase boat traffic and recreational fishing and put further stress on inshore critical habitats and artisanal fisheries. Additionally, such growth is likely to catalyse the development of shark eco-tourism. This could provide many potential benefits for the local economy but needs to be carefully considered. Thus emphasising the need to establish monitoring of these important populations.

The three windward (or Eastern) islands of Sal, Boa Vista and Maio all possess similar terrestrial and marine ecology, which is characterised by their sub-tropical arid climate and warms seas (22-29°C). However, they are starkly contrasted through their level of development, through the expansion of tourism. The northernmost of the three, Sal, has the most established tourism industry in the country – responsible for 41.5% of all guests. To the South, the island of Boa Vista is in the process of rapidly developing and currently contains 5 expanding all-inclusive resorts accounting for 32.9% of guests. Maio on the other hand remains relatively undeveloped though it is thought large-scale tourism will eventually continue its movement south along this gradient.

Marine species and fisheries

These Eastern islands of Sal, Boa Vista and Maio may contain some of the least exploited fisheries in Cabo Verde and consequently represent important areas for elasmobranch populations both within Cabo Verde and the wider Eastern Tropical Atlantic. Nonetheless, very little is known about their elasmobranch populations and there is limited research conducted. Equally a lack of resources hinders effective management of artisanal fisheries and the extent to which elasmobranchs are currently being exploited remains uncertain.

Maio's proximity to the main island of Santiago remains a significant factor in relation to its pressure on marine resources. Although small artisanal '*boca aberta'* boats are legally prohibited from travelling beyond 3nm and therefore from moving between islands, it is not enforced. Fishers from Santiago likely significantly outnumber locals. This trend is increasingly true in Boa Vista though its relative isolation has slowed this trend.

Boa Vista was traditionally used as an island for livestock and as a result had seen very limited development. This has ensured that the population and consequent fishing effort has historically remained relatively small (14,451, INE, 2015). Instead most of the fishing community have themselves migrated from other islands, principally Santiago, during the last 20 years. Such immigration has invariably affected the identity of the fishers and lead to a shortage of cohesion in fisheries management exemplified by the current lack of a fishing cooperative. Migration is now being further catalysed by the expansion of the hotel industry with movement from mainland Africa (notably Senegal). Such impacts are inevitably driving further exploitation of marine resources.

Sal has a significant port serving small artisanal *boca aberta* boats (*botes)* and foreign recreational fishing boats in Santa Maria and a more established harbour in Palmeiras from which semi-industrial seiners operate. Together they constitute a more developed fishery than that of Boa Vista and Maio. Additionally, the narrow shelf around Sal ensures productive ocean currents are closer to the island. This bathymetry may result in larger numbers of baitfish (notably '*caxoreta'*; *Auxis thazard*) being locally abundant. It's proximity to offshore seamounts notably Senghor in the northeast is of potential significance.

Environmental Conditions

Cabo Verde's relative isolation in the Eastern Tropical Atlantic ensures that the sea state remains highly volatile and it is subjected to both northern and southern hemisphere events. In particular, the level of wind is a constant consideration during planning. Between November and April there are very few days with average wind speed lower than 16mph. Although this may not preclude all work it does prevent certain methodologies from being appropriate; namely scientific longline. Although sharks can be caught in rough seas the ability to safely handle them, take accurate data and reduce stress and mortality can be compromised. These sea state conditions can be challenging for other surveys that rely on the ability to spot animals often underwater and therefore greatly affect 'effort'. Even during the summer months (May-October) winds can be strong and tropical storms need to be taken into further consideration between August and October.

Such strong winds and variable sea state inevitably affects water visibility. Boa Vista is subjected to strong northern swells much of the year, which due to the long

shallow shelf, can rapidly reduce visibility to a couple of metres. Low visibility prevents research with specific methods such as Underwater Visual Census (UVC) from being appropriate and needs to be considered when utilising others (i.e. Baited Remote Underwater Video (BRUV)). Consequently, we prioritise all surveys during the summer months (May-August) and BRUV prior to the rainy season. This appears to be when many species of sharks are more locally abundant nonetheless; this is not homogeneous for all species and may explain some variations.

2. SCIENCE: RESEARCH AND MONITORING

Elasmobranch species targeted in our studies have involved all shark and rays species that utilise the coastal zone around the islands of Cabo Verde. This has included many species threatened to extinction as per IUCN's Red Listing assessments and included in CITES Appendices indicating the need to monitor, regulate and /or prohibit trans-boundary trade.

The predominate focal species include:

Neonate sharks – Scalloped hammerhead (*Sphyrna lewini*), black-tip shark (*Carcharhinus limbatus*); milk shark (*Rhizoprionodon acutus*); nurse shark (*Ginglymostoma cirratum*); lemon shark (*Negaprion brevirostris)* & Atlantic weasel shark (*Paragaleus pectoralis*).

Juvenile and Adult sharks – Tiger shark (*Galeocerdo cuvier*); black-tip shark (*Carcharhinus limbatus*); Scalloped hammerhead (*Sphyrna lewini*); smooth hammerhead (*S. zygaena*); nurse shark (*Ginglymostoma cirratum*); lemon shark (*Negaprion brevirostris)* & Atlantic weasel shark (*Paragaleus pectoralis*).

Mega- planktivores – Whale shark (*Rhincodon typus)* and Oceanic Manta ray *(Manta birostris);* though there may also prove to be sympatry with the reef manta ray *(M. alfredi);* individuals pertaining to the *Mobulidae* (likely *Mobula tarapacana*) are also seen breaching though less often encountered in-water.

2.1 METHODS

We utilise a variety of qualitative and quantitative methodologies to generate more robust data both dependent and independent of fisheries. By replicating standardised methods developed in Belize we can draw upon our significant experience and compare sites according to effort (CPUE). These data will allow us to better understand the situation regarding elasmobranch species / populations in Cabo Verde as well as the main threats and their potential impact.

2.1.1 BRUV surveys.

In 2016 we conducted 122 Baited Remote Underwater Video (BRUV) replicas focusing on the islands of Maio, Sal and expanding work in Boa Vista. Owing to some issues with stability

encountered with the recycled BRUV systems in 2015 we developed a more robust iron model. The new model was subjected to rigorous testing prior to first deployment to analyse its performance and rule out there being an effect of the 'system' on shark presence. Nonetheless, all replicas maintained the standardised methodology to allow for further replication and analysis [soak time: at least 65 minutes, bait species; weight 1kg; horizontal angle [1]] and were conducted by MarAlliance country coordinator, Zeddy Seymour and artisanal fishers Zé Luís and Angelito Monteiro in conjunction with local fishers from the islands involved.

All BRUVs were deployed using a free diver to guide the system down and minimise any damage to the benthos. Time, GPS position and site conditions were recorded before leaving the area in order not to influence the environment.

The bait used was 1kg of *Auxis thazard;* known locally as *caxoreta.* Fish were sourced fresh where possible or frozen due to limited availability. After being macerated to maximise the amount of blood and oil in the current known as the 'bait plume'. 1kg of bait was then placed inside a pouch on the end of a bait arm measuring 1.25m.

GPS points were randomly positioned within the suitable area (0 – 14.9m zone). Neighbouring points were then separated according to depth to produce a similar number of replicas across different depth classes; with these being divided into:

1). 0 - 14.9m;
2). 15.0 - 29.9m;
3). 30.0 – 44.9m &
4). 45.0 - 60.0m.

No two points were located within 1000m of one another to ensure independence of results and prevent potential interference of bait plumes.

All videos were watched in regular speed playback by 2+ specialist observers (Thomas Meyer, Amanda Resterer and Zeddy Seymour). All elasmobranch observations were recorded and each individual was identified to the lowest taxonomic level. When possible, the animal's sex was also recorded and size estimations were made utilising the 30cm T-bar on the end of the bait arm as a scale.

2.1.2 Artisanal fisher surveys

112 fisher interviews were conducted in Maio (n=52) and Sal (n=60). These were focused in the main population centres (Porto Ingles / Vila do Maio and Espargos / Palmeiras). Though other significant fishing communities were also interviewed. All interviews were voluntarily and conducted by a local interviewer (Edvaldo Lopes da Silva and Edgar Gazim Lima). Surveys contain 56 questions and conducted on a one-on-one basis to help derive information to characterize fisheries and traditional knowledge of elasmobranch species and seasonality.

1 *Owing to the wide angle of the new models of *GoPro Hero 3* and *GoPro Hero 4* we utilised a 95° angle to maximise coverage.

2.1.3 Scientific longline

Scientific longline (SLL) is the most effective method of quantifying shark populations (Simpendorfer, 2002) and distinguishing between certain similar species (Santana-Garcon *et al*., 2014), which might not always be possible during BRUV video analysis (i.e. *Carcharhindae spp*.). Furthermore, SLL permits accurate morphological measurements and DNA samples to be taken as well as individual sharks to be tagged. In conjunction with other calibrated more passive methodologies scientific longline allows for the collection of more robust and accurate data.

We used a variety of surface and bottom-set longlines and drumlines (DL) depending on the target species. For adult sharks we used surface set longline and hanging drumlines, whereas when targetting neonate sharks in shallow habitats the line was set on the bottom. Lines contained between 1 and 18 hooks.

In each case the longline was anchored at one end and the line strung out for 30-200m. Hooks of equal size were clipped to the main line by way of a metal gangion and separated by 10m intervals. Each hook was baited with a piece of *caxoreta (A. thazard),* which was cut depending on the size of the hook and species being targeted. The line was held in place by a series of buoys and /or anchors. GPS position at the start and end of the line, time, depth and conditions were recorded and the line was left to 'soak'.

The 'soak time' and hook size invariably changed depending on the species being sought. For adult sharks we used 16/0 and a soak time of 60 minutes. For juvenile and neonate individuals hook size 10/0 and 8/0 and a soak time of 10-30 minutes depending on abundance.

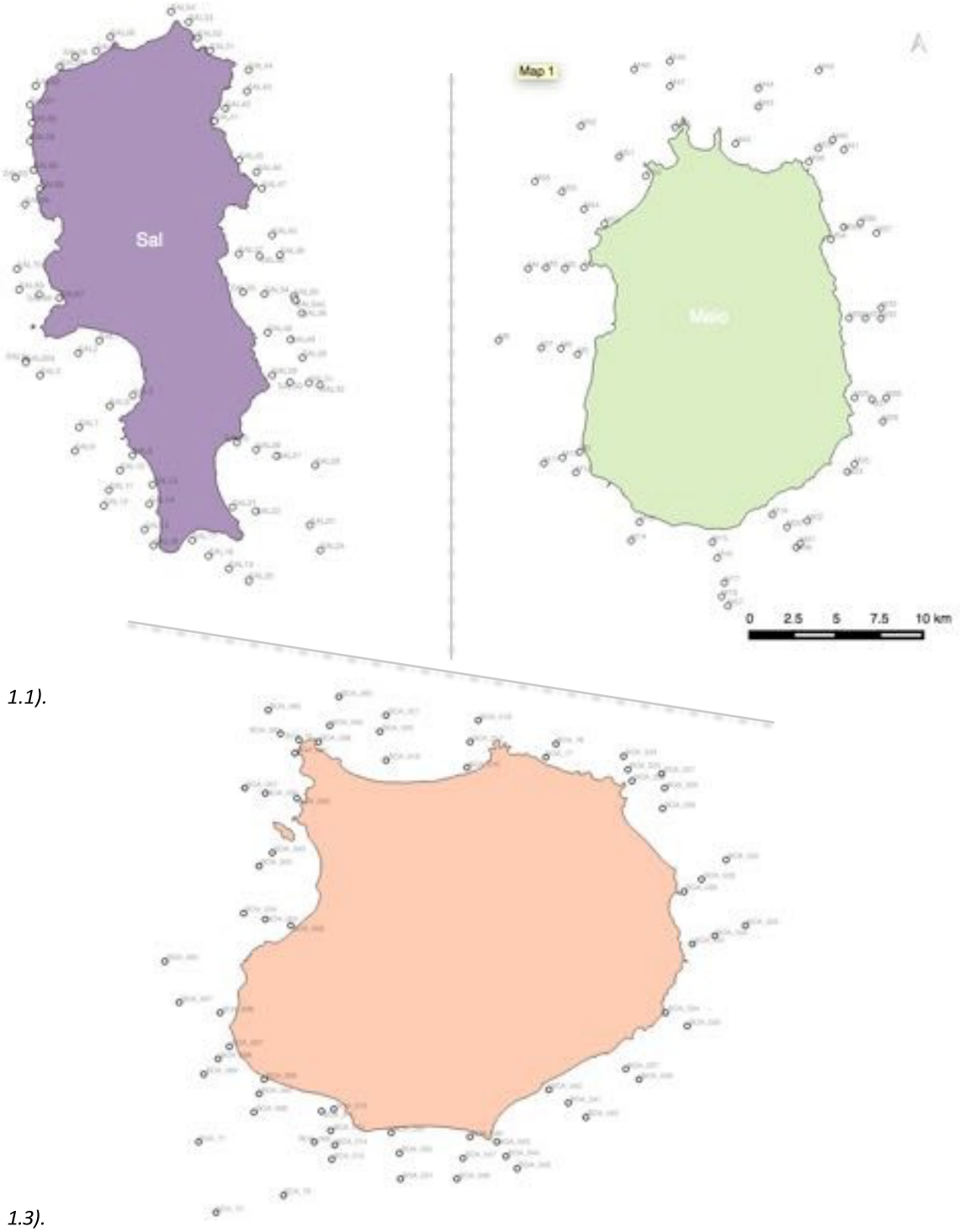
2.1.4 Mega-planktivore surveys

Monitoring of mega-planktivores (whale sharks and manta rays) was conducted monthly between March and October when conditions were more favourable. Initially a simple and standardised route was taken from Sal Rei 20nm to a location south of Boa Vista. Invariably when animals were observed the route changed. All observations were recorded and where possible at least 2 people entered the water to get photo identification, record the sex of the animal and note any discerning characteristics about it and its behaviour. These data were compiled to form the basis of a photo ID guide and foundation for a visiting population estimate based on all observed animals.

2.2 RESULTS

2.2.1 Baseline surveys with BRUVs

In 2016 we conducted 128 successful BRUV replicas around the islands of Maio (n=57) and Sal (n=65), as well as increased the coverage around Boa Vista (n=6). Together with data collected in 2015 (n=63) this has generated a dataset of 191 replicas spanning the three Eastern islands of the archipelago.



1.1).

1.3).

Fig. 1. - Maps illustrating the BRUV deployments conducted around Sal (1.1.), and Maio (1.2), during 2016 as well as the development of the survey in Boa Vista (1.3) during 2015 and 2016.

We are constructing a comprehensive fisheries independent assessment of species utilising these three islands using broad, standardised monitoring that allows us to investigate relative abundance and diversity as well as distribution of elasmobranchs between islands, sites and years.

This approach enables the identification of critical sites for the development and survival of focal shark and ray species.

Table 1 . – Shows the frequency species were observed on BRUV recordings across the three islands Sal, Boa Vista and Maio. In some cases where analysis did permit species to be fully described they were identified to the furthest taxonomic level possible.

	Scientific name	Common name	Sal	Boa Vista	Maio	Total
Sharks	*Paralageus pectoralis*	Atlantic weasel shark	-	18	18	*36*
	Lepdocheles smithii	Barbeled houndshark	-	1	-	*1*
	Mustelus mustelus	Smoothhound	18	10	38	*66*
	Ginglymostoma cirratum	Nurse shark	3	6	12	*21*
	Rhizoprionodon acutus	Milk shark	1	7	3	*11*
	Carcharhinus brevipinna	Spinner shark	25	4	2	*31*
	Carcharhinus limbatus	Black tip shark	4	5	2	*11*
	Carcharhinus obscurus	Dusky shark	-	2	-	*2*
	Negaprion brevirostris	Lemon shark	5	2	1	*8*
	Sphyrna lewini	Scalloped hammerhead	1	1	-	*2*
	Sphyrna zygaena	Smooth hammerhead	-	1	-	*1*
	Galeocerdo cuvier	Tiger shark	4	-	1	*5*
Rays	*Taeniurops grabata*	Round stingray	17	10	5	*32*
	Dasyatis centroura	Roughtailed stingray	1	2	-	*3*
	Mobula tarapacana	Sicklefin mobula ray	1	-	3	*4*
	Manta birostris	Oceanic manta ray	1	-	-	*1*
	Carcharhinidae	Requiem sharks	1	4	2	*7*
	Triakidae / Hemigaleidae	Hound / Weasel sharks	-	2	-	*2*
		Total no.	*82*	*75*	*87*	*244*

Table 2 . – Illustrates the number of deployments conducted (No. R.); whether elasmobranchs were observed on the deployment (P.) and how many (A). The total number of species recorded for each island (No. of Species) and the Catch Per Unit of Effort. 1). Where 'Effort' is based on 'one hour' of BRUV deployment = No. R. / A. and 2). CPUE Presence P. / No. R.

Island	*No. Replicas (No. R)*	*Presence (P.)*	*Abundance (A.)*	*No. of Species (No. S.)*	*CPUE-hour*	*CPUE Presence*
Sal	65	34	82	12	1.262	0.523
Boa Vista	69	41	75	13	1.087	0.594
Maio	57	33	87	10	1.526	0.579

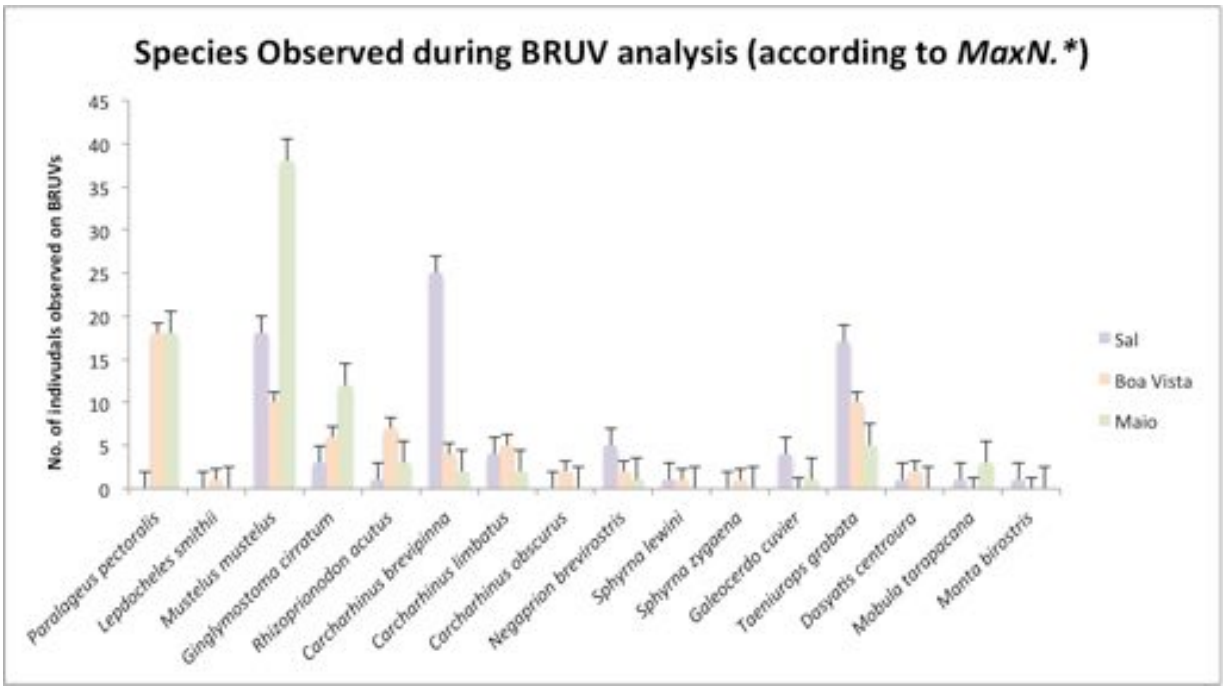


Fig. 2. – Species diversity and relative abundance according to BRUV observations across all islands.

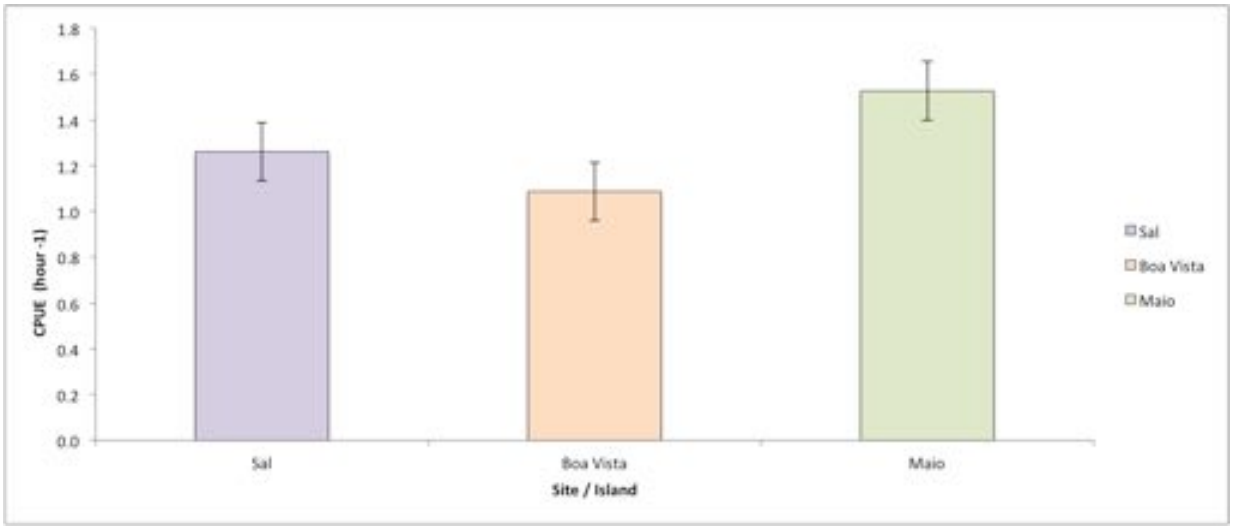


Fig. 3. Catch Per Unit of Effort (CPUE) according to BRUV observations across islands

2.2.2. Fisher interviews and traditional knowledge

On the island of Maio fisher interviews were conducted (n=52) throughout the various communities across the island. Perception interviews were also realized in the capital Porto Ingles due to the significantly higher population density found there as well as in the second largest fishing community, Barreiro. In Sal fisher interviews were conducted in Espargos, Palmeiras, Santa Maria and Pedra Lume (n=60).

Both interviews are standardized versions developed by MarAlliance in Belize. They were translated to Portuguese and adapted in order maintain relevance to the local ecology and society. Interviews were often conducted in *kriolo* as in many cases fishers do not speak

fluent Portuguese. Nonetheless, in all cases the interviewer was a trained local; Edvaldo Lopes and Edgar Gazim Lima respectively. Avoiding foreign NGO direct association helped to reduce the level of misinformation. Results are still to be fully analysed.

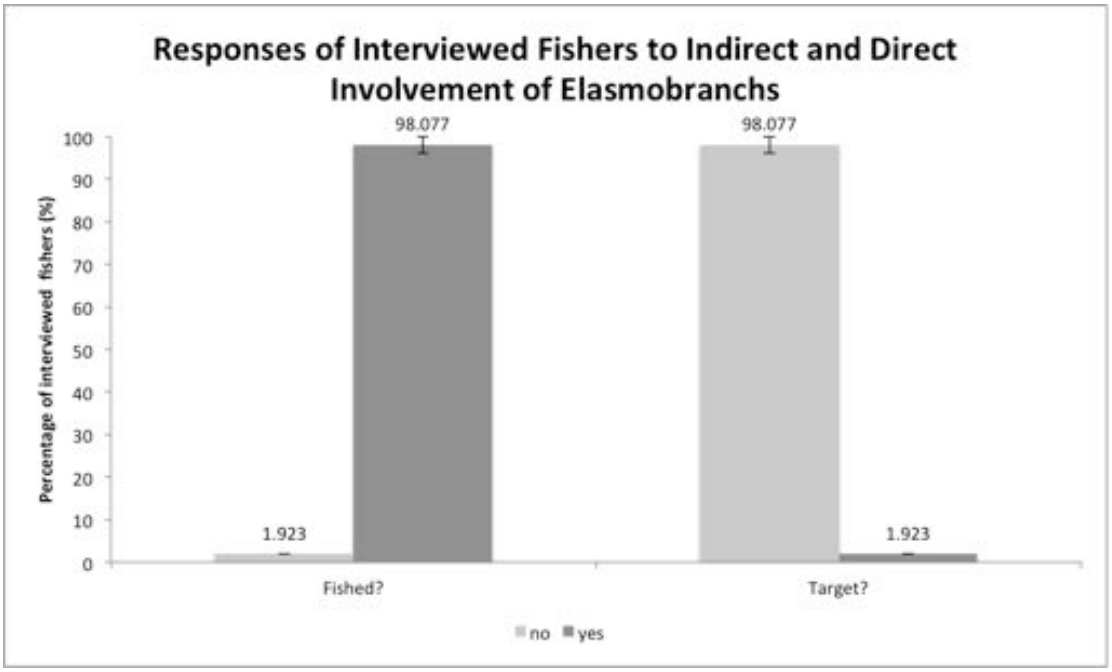


Fig. 4 . Graph illustrating the responses of fishers in Maio (n=52) to two questions. 1). Whether they had ever accidentally or intentionally fished sharks or rays; & 2). Whether sharks or rays where the target species of any of their fishing effort.

Results from preliminary interviews have indicated that these islands do not possess a formal artisanal shark fishery.[2] However, in the Eastern Islands when sharks are encountered they are often taken opportunistically, either for bait for more lucrative finfish (of particular local value are *Thunnus albacares* and *Acanthocybium solandri*) or, salted and dried to be sold as *cação*, particularly during *Cinza* (Ash Wednesday) and *Natal* (Christmas).

It is worth mentioning that artisanal shark fisheries were significantly more abundant in the late 1990s and early 2000s when the use of artisanal longline was driven by access to the fin trade. This in conjunction with large-scale exploitation are responsible for the reduced numbers of sharks currently found in many areas.

The term *cação* is the local name for smoothhound (*Mustelus mustelus*), and is the only species actively pursued (primarily with gill nets and hook and line); however, in part due to the lack of selectivity of the technique in question, the name has also come to broadly encompass a variety of other species. The term is synonymous with species usually encountered at neonate or juvenile stages; this includes *Sphyrna lewini, Carcharhinus limbatus, Rhizoprionodon acutus, Paragaleus pectoralis* and potentially others.

Additionally, initial landings surveys in Santiago revealed the development of a burgeoning deep-sea fishery. The appearance of species such as gulper sharks (*Centrophorus granulosus*)

2 On the main island of Santiago deep water species are being fished with increasing frequency and intention and merits investigation.

and bluntnose sixgill sharks (*Hexanchus griseus*) are indicative that artisanal and semi-industrial fishing is now utilising depths between 500-1000m+. Presumably driven by downward trends in many of the near shore fisheries it reveals an increasing trend of consumption of shark, which has also been documented in hotels and restaurants in Sal and Boa Vista. Ironically, there is some evidence to suggest that our misperception of sharks as man-eaters was a one of the main reasons why culturally it was not eaten on a wide scale.

Legislation banning the act of finning and the remote location of the Eastern islands largely has precluded further expansion of the fin trade within the artisanal fishery. There are reports of Senegalese traders purchasing fins. And mandibles (jaws) are frequently purchased to be sold as curios to foreign tourists in Sal and somewhat in Boa Vista. Reportedly many of these jaws come from São Vicente though this market invariably drives local exploitation as well. However, in Praia and São Vicente fins are reportedly still being shipped out of Cabo Verde and the monopolisation of Chinese commerce on throughout the islands could provide additional routes.

Rays are more seldom involved in artisanal fisheries. When *Mylobatidae* (stingrays) are caught using hook and line, similarly to sharks, they are taken opportunistically, *Taeniurops grabata* being the most frequently encountered. Fishers often see several species of *Mobulidae* (Mobula and manta rays) though for the most part are not considered a target. This may be in part due to the large size the oceanic manta ray can achieve and the obvious difficulties associated with its transport. However, there was a *Mobula* believed to be *M. hypostoma* (pictured), which was killed in Boa Vista in March 2016.

Nonetheless this was reportedly bycatch in a hook and line fishery.

Fig. 5. Photo of M. hypostoma reportedly caught as bycatch by an artisanal tuna fisher (Photo by Angelito Monteiro)

On the other hand, 2 whale sharks (*Rhincodon typus*) were killed in Sal at the end of 2015 early 2016. Reportedly, using a *fisga* (spear / harpoon). Manta rays are curious animals and often interact with fishers/ boats; consequently, without protection, they are risk.

2.2.3 Scientific longlines

In 2015 we identified the protected bay near Sal Rei, the capital of Boa Vista, as being used as a nursery for a variety of different species, most significantly the endangered scalloped hammerhead (*Sphyrna lewini* with the possibility for sympatry with *S. zygaena*). We also confirmed blacktip sharks (*Carcharhinus limbatus)* and milk sharks (*Rhizoprionodon acutus)* as using the bay although areas are portioned between species.

The bay's shallow waters and abundant sand ensure visibility is often minimal and consequently the use of BRUVs is severely limited. As a result, in 2016 we initiated a scientific

longline study that could confirm the bay's importance as a nursery area through a capture, mark, recapture study. With these data we aim to improve knowledge of the population and its survival in relation to artisanal fisheries as well as better quantify their status in Boa Vista.

We initially used a bottom-set longline (at a depth between 1-5m) with 10-18 hooks and soak time of 30 minutes. We caught 32 individuals of three different species (*Rhizoprionodon acutus, Sphyrna lewini* and *Carcharhinus limbatus*) and began to identify species-level zoning occurring in the bay. In September, we decided to use individual hand lines to avoid mortality due to an abundance of neonate sharks.

In August and September 2016, we conducted bottom-set scientific longlines sets (n=19) in the Baía de Sal Rei. Longlines measured approximately 100-200m and had between 1-18 hooks: producing a total of 247 hooks with a cumulative soak time of 589 minutes. In September, we began to use handlines (HL, n=12) to avoid any mortality due to the increased abundance at that time of year.

The objective was to identify which species were present in the bay, which zones they were utilizing and establish any potential partitioning between habitats and / or species, as well as investigate the impact artisanal fisheries have upon these individuals in this site. Unfortunately, most of the tagging programme was delayed due to the arrival of the incorrect equipment from the supplier and only 2 neonate sharks were deemed large enough to tag (Hallprint 'spaghetti' tags) we hope to fully develop this in the summer of 2017

Fig. 6. – Map showing the position of the longline stations in the Baía de Sal Rei.

In the 259 hooks deployed we caught 29 individual sharks from 3 species: milk shark (*Rhizoprionodon acutus),* blacktip shark *(Carcharhinus limbatus)* and scalloped hammerhead (*Sphyrna lewini).* All sharks were neonate stage development and measured between 42-75cm Total Length (TL). Many of which had open umbilici a sign of having be born less than a

month before being caught and scientifically confirming the bay as being used as a nursery for these 3 species (and possibly others).

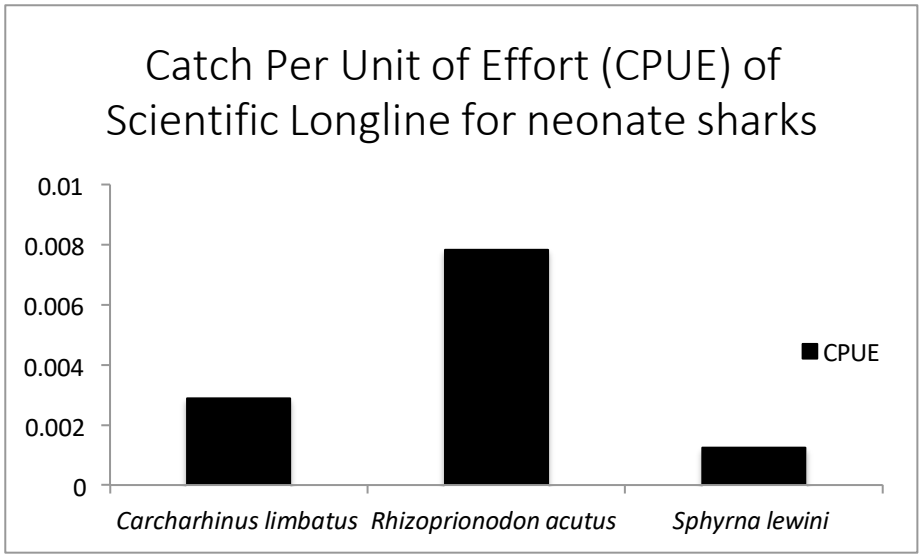


Fig. 7. – Graph illustrating the CPUE for 3 species caught during longline sets in the baía de Sal Rei. CPUE was calculated for 'effort' as 1 hook / hour.

We also conducted several drumlines (DL) and surface longline (SLL) sets outside of the bay to investigate connectivity of adult sharks. We caught 4 tiger sharks (*Galeocerdo cuvier*) in excess of 250cm, on which we deployed fin-mounted SPOT (Smart position only tracking) tags to assess their utilization of the coastal area around Boa Vista. Since these important large-bodied apex predators can be highly migratory between coastal and pelagic sites we hope to provide valuable data on their movements in Cabo Verde. The data is on-going and will be reported in 2018.

2.2.4 Mega-planktivore surveys

During the initial study in Boa Vista we were able to highlight an area that contained higher levels of mega-planktivore abundance (namely whale shark, *Rhincodon typus* and Oceanic Manta ray, *Manta birostris;* as well as sickle-fin mobulas, *Mobula tarapacana)*, cetacean species (pilot whales, rough toothed dolphin, pan tropical spotted dolphin and seasonal aggregations of humpback whales amongst others).

In 2016 we conducted monthly monitoring trips to the site to assess seasonality and begin to establish a photographic ID catalogue of whale sharks and manta rays; something previously limited in the Eastern Tropical Atlantic. We conducted 14 trips to the area between March and October. During these trips we observed 26 manta rays and 8 whale sharks. When possible, we collected ventral / side photo ID shots and began compiling a catalogue of individuals. Together with those collected during the initial study we now have - *M. birostris* (n=21) and *R. typus* (n=14) for subsequent analysis.

The sightings area is approximately 25km from the island's capital Sal Rei. The 'site' itself is not a specific location or benthic feature but an area of approximately 60km^2 sitting between 3km and 12km SW of the island (see figure 1). It ranges from a depth of 20m near Santa

Monica to greater than 70m before a drop off that extends relatively quickly to over 1000m to the South and East.

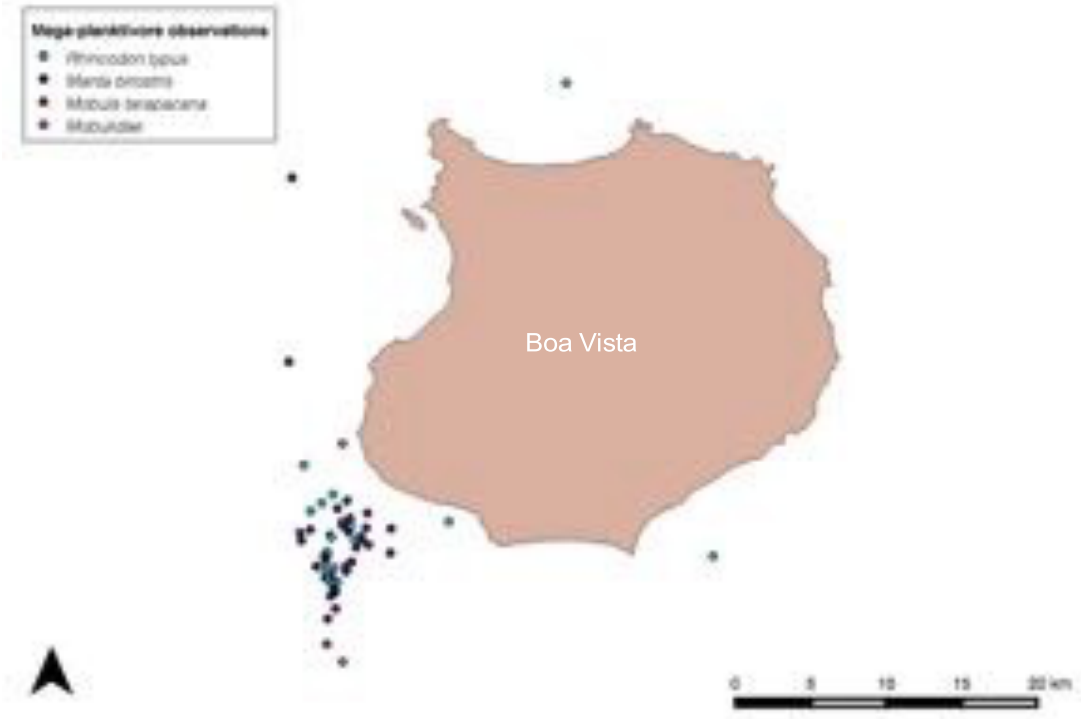


Fig 8. Observations of mega-planktivores; whale sharks (turquoise); manta rays (purple).

In the early 2000s people were known to have conducted tours to view these animals, however, anecdotal evidence also suggests populations have fallen drastically since then. Furthermore, given the size of the area combined with the limited relative abundance, this seasonal visitation of mega-planktivores does not currently pose a viable option for any form of eco-tourism. Instead, we recommend that the area be limited to artisanal fisheries.

2.3 DISCUSSION

2.3.1. BRUV surveys

BRUV surveys were undertaken in April / May (2015) in Boa Vista, May / June (2016) in Maio and July (2016) in Sal. Consequently, there may be a distinction between season particularly for Boa Vista since higher water temperature between June and October may have an impact on shark abundance, particularly for certain species. Additionally, these seasonal distinctions impact sea state and consequently visibility. This is especially pertinent with methods such as BRUV (and UVC) in which the ability to observe animals underwater directly affects frequency of observations. In Boa Vista most replicas were carried out in April 2015; interestingly Boa Vista registered higher Species Richness than the other two islands but less relative abundance.

The estimated Total Length (TL) of sharks was found to be significantly lower in Maio when compared to Sal. In part this is because of the composition of species found in the two islands with smaller *Triakidae* and *Hemigaleidae* being more locally abundant in Maio than elsewhere. However, to what extent this is due to natural ecological distinctions or because the larger individuals have already been fished out remains to be seen.

2.3.2 Artisanal fisheries

Although artisanal fishers do not commonly target sharks, given the frequency of their involvement in certain fisheries, particularly those fishing the bottom (for example moray), added to the difficulty of removing swallowed hooks without the proper equipment, there is strong probability many sharks caught, are taken. Furthermore, as with fishermen worldwide, there is a pervading sense of a decline across most fisheries. As target species become harder the catch the likelihood of taking sharks will only increase.

As mentioned, anecdotal evidence from fishers indicates the fin trade was significantly more widespread in the early 2000s. However, thanks in part to legislation this has been drastically reduced. However, it is also likely that decreases in their populations rendered these activities less economically viable. Nonetheless, semi-industrial boats are still known to operate in pursuit of sharks. This is of particularly concern regarding several boats coming from Santiago to Maio and increasingly Boa Vista and areas such as *João Valente* represent important areas for research.

2.3.3. Shark nurseries

Our monitoring suggests that Boa Vista may be an important site for reproduction of several species including the endangered scalloped hammerhead (*Sphyrna lewini*), Data Deficient species such as the Atlantic weasel shark (*Paragaleus pectoralis*), nurse shark (*Ginglymostoma cirratum*), black tip sharks (*Carcharhinus limbatus*), milk sharks (*Rhizoprionodon acutus*) and potentially taxa of the *Mobulidae*. Adults of these species are all known to use the waters around these 3 islands suggesting populations exhibit a certain degree of site fidelity and that these sites may have significance for local populations. On the other hand, some species, notably *Sphyrnidae,* can be highly migratory and therefore these nurseries may also carry out recruitment into wider populations in the region.

The bay's proximity to the capital ensures that the human impact on the marine resources is constantly high particularly through fishing effort and coastal development. The use of artisanal gillnets and recreational fishing have a high-incidence of bycatch (and intentional) of neonate sharks; particularly during the summer months (July-October), and specimens are frequently encountered washed up on the beach.

Managing nursery areas does not by itself represent a solution to the problem of declining shark populations (Heupel *et al.,* 2007) but instead can be an essential part. If used in conjunction with other measures notably protection of other life stages this could increase the likelihood of neonates and sub-adults developing and mature sharks reproducing. This may represent a viable option in reversing global trends for species of conservation concern and which already have existing legislation (namely *Sphyrnidae*).

Furthermore, blacktip sharks (*C. limbatus*) are particularly appealing to the dive industry and recreational (catch and release) fishing industry. Consequently, unselective fishing with gill nets, which does not differentiate between species, should be avoided in nursery areas; particularly during pupping areas and the night when these species are invariably encountered.

Although higher water temperatures may benefit the reproduction of some species, this may not be homogenous across species. Consequently, there is need to investigate key sites during the winter when the composition of species can be distinct an example of this are lemon sharks (*Negaprion brevirostris*), which may be pupping in bays in Boa Vista during the winter.

2.3.4. Mega-planktivores

Using ID images, we have begun to research returning individuals and to identify site fidelity as well as seasonality. Furthermore, in August this year we began to deploy Smart Position Only Satellite Tags (SPOT, n =10). Using a pole spear whilst free diving we were able to tag 5 manta rays and 5 whale sharks. At the moment of writing the tags are still on sending data. We aim to evaluate potential connectivity with West Africa, the Caribbean or other known populations in the Atlantic (notably Ascension and the Azores) as well as better understand their movements and utilization in this area.

Although these animals may well be migrating seasonally to / through the waters around Boa Vista, anecdotal evidence suggests there is at least some year-round presence. However, as surveys themselves are considerably affected by seasonality through wind and sea-state conditions, we are not yet able to discern to what extent individuals are more frequently observed in the summer months primarily since it is easier to spot them. At this point this should not be misconstrued to mean that mega-planktivores are not utilising these same waters during the winter, but rather, that they are much less likely to be encountered given the same unit of effort.

Equally the lack of data from other areas of the island does not signify that these individuals are not utilising these waters around the island, or that there is not another area of higher abundance located elsewhere. Initial investigations on this site were based on reports from fishermen of repeated encounters, and subsequent research suggests the area is of importance to these species.

3. COMMUNITY OUTREACH AND EDUCATION

Equally as important as the collection of scientific data is the dispersal of information and raising awareness at a community level. Given the negative stigma often associated with sharks and their role in the trophic levels this is of even more importance. In Cabo Verde, as in many insular communities, despite the diversity of species found in the waters around the archipelago, most people remain unaware of their presence or similarly of their importance to the wider ecosystem. Consequently, communicating results and raising awareness is essential and remains a fundamental part of the project.

On one hand, educating local communities about the benefits of maintaining a healthy marine environment has consequences for public health and sanitation, as well as ecosystem services ranging from maintaining productive fisheries to carbon dioxide storage and oxygen replenishment. On the other hand, it can also be a source to generate income. Eco-tourism and wildlife-encounter-tourism are direct example of the economic pull healthy populations

of marine fauna (notably sharks and rays) can attract. Conversely, this is also a factor in the wider tourism market which too is influenced by the appeal of healthy marine ecosystems in this case clean beaches and unpolluted seas cater to the growing marine-based activities / sports (kite surfing, wind surfing etc.,). Added to which fisheries have a strong cultural significance and are an important part of identity in Cabo Verde.

3.1 METHODS

We have been working with two principal groups to achieve long-term results:

1). Primary school children and,
2). Traditional fishers.

Local Schools

We work with school children at primary school level (predominantly 10-12 year olds from local communities). Our work in schools prioritises interactive learning and participation. It encompasses marine biology and sea life with the overarching objective of changing heavily ingrained public perceptions of sharks and rays. Due to scheduling it is focused in the spring (March to June) and autumn (October-December).

We hope to be able to significantly expand our reach and our activities this year through the inclusion of a local education officer. This will allow us to develop these relationships with local schools as well as conduct field trips.

Traditional Fishers

The other core group are traditional fishers. We are able to focus more on raising awareness with fishers during the summer surveying months as it can be linked to practical field experience during monitoring. Providing field experience allows us to begin to train fishers in scientific monitoring techniques and eco-tourism activities to diversify livelihoods. It also provides a more tangible environment in which to communicate and illustrate these principles.

The ecological knowledge of many fishers is astounding yet this is normally overlooked by many stakeholders due to their lack of formal education. By providing fishers with materials they might otherwise not have access to we are able not only train them in different potential future livelihoods thus reducing fishing pressure, but also more importantly, to explain to them elements of marine biology and fisheries management they have never been taught, greatly strengthening their intrinsic ecological knowledge. How maintaining viable shark populations benefits healthy fish populations is obviously and important message for us.

3.2 RESULTS

In 2016 we visited the schools of Riba D'Olte, Sal Rei (*Escola nova*), Rabil and Povoação Velha and reached over 500 kids and 10 teachers. Supplementing activities in 2015 where we communicated with over 900 children and 9 teachers. Using a combination of informative presentations and interactive activities.

When possible, we use pre- and post-questionnaires to measure potential shifts in children's perceptions regarding how sharks (and rays) make them feel. Although rudimentary, at the very least they encourage the child to consider these perceptions and at the best they illustrate changes in perceptions when shown facts and simplified-scientific data concerning these animals.

We reached over 150 fishers during interview and communicated with a further 60 fishers in workshops in Calheta, Vila do Maio, Pedra Lume and Sal Rei. These workshops focused on raising awareness of the links between elasmobranchs and healthy fish populations.

3.3 DISCUSSION

BRUVs have the additional advantage of being able to connect communities and marine fauna through the collection of scientific data. Since videos can be quickly analysed and clips and educational videos created. Such videos not only serve to raise awareness but also instill pride through the connection of local species to nearby communities. Fishermen are particularly fond of BRUVs since it gives them the ability to see the benthos and the species they know so well, in their natural state that they might otherwise not get the chance to see.[3] This pride is an important building block for establishing a conservation ethos and ensures the data can continue to be used long after it is collected.

In the next five years we aim to continue to expand standardised surveying methodologies to the remaining islands in the archipelago while focusing on specific areas of management-driven research, capacity building and education. Amongst these is characterizing the connectivity of these populations with other islands and sites in the Atlantic, promoting the sustainable management of large marine species, building the capacities of fishers, students and partners in research and monitoring techniques, and developing a comprehensive education and outreach program for marine management and conservation. The data collected are expected to feed into management decisions for the sustainability of large fish populations and small-scale fisheries.

In 2017 we hope to able to recruit a local officer to manage education. This inclusion will allow us to significantly expand our Outreach and Education Programme to include more school visits, field trips, workshops and fairs in collaboration with the *Comité Ambiental* of the *Câmara Municipal de Boa Vista.* In doing so we aim to drastically improve marine environmental education in Boa Vista as well as provide extra-curricular activities for local children that encourage sustainable use of marine resources and give fishers a voice through monthly discussions.

3 Obviously, care needs to be taken in order not to catalyse the exploitation or highlight specific sites and potentially resident species.

4. CAPACITY-BUILDING

Cultivating skills and increasing capacities goes hand in hand with education and is central to MarAlliance's mission. Through training in marine biology, scientific monitoring, sustainability and eco-tourism we aim to increase knowledge and capacities of traditional fishers, teachers and students. This has the overall objective of allowing local communities to benefit sustainably in conjunction with threatened marine wildlife instead of through its removal.

Fisher Training

Collaboration with local fishers is a core part of our work. Not only does it allow us to train fishers in marine ecology, elasmobranchs and sustainability but it also allows us to learn about survey sites, fishing effort and the local situation. This horizontal transfer of knowledge promotes trust and understanding and enhances our ability to understand the situation.

By working *with* fishers in a participatory approach we encourage positive interaction with the marine environment, expand skills and raise capacities for sustainable resource management. We recognise that reprimanding fishers is not going to achieve long-lasting success; instead through participatory training and raising skillsets, we aim to allow fishers to be the beneficiaries for sustainably managing marine resources. By empowering fishers and cultivating pride in these species, we are creating alliances between fishers and the local marine wildlife. Whilst the diversification of skills and livelihoods expands existing knowledge into other related areas (scientific monitoring, eco-tourism and resource management).

In 2016 we trained 10 fishers in scientific monitoring for all the methodologies employed. Furthermore, we conducted school visits with our core group of fishers giving them the opportunity to speak to students about the importance of elasmobranchs in maintaining healthy fish populations. Not only does this approach provide a more tangible alternative to typical environmental presentations for the children but it also empowers fishers and encourages them to continue to develop their knowledge and skills in these areas.

We will continue to collaborate with fishers in all aspects of our monitoring work and aim to significantly expand the number of fishers trained in 2017. Furthermore, we hope to increasingly connect with the fishing community in Boa Vista through monthly discussions and help in the development of a fisher cooperative (association).

Eco-tourism

In all these islands tourism is a mainstay of the economy and shark-encounter eco-tourism already occurs on a small-scale. The two main examples of this are through the dive industry and terrestrial viewing of aggregations (notably in Sal). Encounter tourism is likely to expand as tourist numbers increase and it is fundamental that this be closely monitored. Implementing Guidelines for all activities observing elasmobranchs is essential for the safety of sharks and tourists alike as is evaluating any effects that such activities might have upon these populations.

Eco-tourism may represent an alternative source of revenue to small-scale extractive shark fishing (Topelko & Dearden, 2005), however, it is essential that local fishers are involved in order that the direct economic benefits for conserving sharks be transferred to those directly responsible. With out this linkage, those incentives not to fish sharks are lost and eco-tourism will fail to function sustainably. On the other hand, without local involvement at all levels, it too can become an extractive venture instead of a self-sustaining industry. To these ends research and careful consideration are imperative before undertaking any such development.

Sustainable Fisheries

The other principal objective of our fisher programme is to encourage sustainable fisheries. By educating and training fishers in ecology and scientific monitoring we are increasing their capacity to manage local resources in a sustainable way and shifting dependence from a handful of fisheries. In the fisher community in Boa Vista there is a lack of cohesion amongst fishers since many migrated from other islands. Currently demonstrated by the lack of a fishers cooperative. Such disintegration is a significant impediment to successful management.

We aim to unite fishers and highlight the importance of data, communication and managing resources. Through monthly discussions we are providing a forum for fishers to discuss their concerns and voice their questions - be it regarding ecology, legislation or safety. By unifying fishers we aim to pave the way to help establish a fisher cooperative which can benefit fisheries and biodiversity alike.

Advocating the protection of sharks has potential benefits for many other species, some of which represent sustainable and viable economic alternatives to exploiting sharks. Furthermore, conserving sharks and maintaining healthy marine systems, have potential benefits for food security and fish populations. By encouraging the move away from unselective techniques, which lead to high levels of bycatch of sharks. An example of this is reducing gill-net use in critical nursery areas during pupping.

5. POLICY SUPPORT

We wish to commend the Direcção Nacional da Ambiente (DNA), Instituto Nacional de Desenvolvimento das Pescas (INDP) and The United Nations Food and Agriculture Organisation (FAO) for undertaking the process of drafting the National Plan of Action for Sharks (NPOA-sharks) and for supporting the protection of CITES listed highly migratory species *Spyhrindae*, *Lamna nasus, Rhincodon typus, Carcharodon carcharias, Carcharhinus longimanus and Cetorhinus maximus.*

MarAlliance is grateful for being included in the drafting of the national NPOA-sharks to ensure the sustainable management and conservation of the countries' shark populations. We would like to offer our continued support in this process as well and happily provide data in future decision making for the improved management of sharks and rays in in coastal waters.

In continuation from the development of NPOA- sharks, we wish to propose the idea of the formation of a National Advisory Group for sharks. This would include all members involved including fishers, community associations, INDP, DNA, NGOs, tour operators and other relevant stakeholders. The objective being improved communication, available data and decision- making regarding the sustainable conservation and management of sharks within the Cabo Verdean EEZ.

6. CONCLUSIONS AND RECOMMENDATIONS

We completed Cabo Verde's first fisheries-independent shark and ray baseline study and have demonstrated that techniques are appropriate for replication to the country's 7 remaining islands. Establishing broad-scale monitoring will allow critical habitats to be identified and monitored and changes in relative abundance and diversity of species to be assessed in the long-term. This is especially pertinent given the global situation and recent historical trends outlined with in the archipelago.

Shark populations have been significantly reduced from historical levels in all the islands surveyed. Although taking sharks for their fins has been largely controlled in these artisanal fisheries, it remains more prevalent where links to foreign markets are easily accessible (in São Vicente and Praia). Additionally, the growing exploitation by artisanal fisheries for shark meat cannot be disregarded, especially whilst foreign industrial fisheries continue to target sharks at an unsustainable rate.

On one hand, establishing local marine monitoring provides a vehicle through which to communicate with communities, educate and raise awareness. On the other hand, it can be a method to promote sustainable resource management. Maintaining healthy marine ecosystems is vital for food security and increasingly important for tourism. Given the importance of these industries to the island's economies, the conservation of marine wildlife has increasingly significant socio-economic, cultural and ecological implications.

The development of an action plan for the sustainable management and conservation of sharks is an incredibly important step, nonetheless, it needs to be complimented by other management measures (For example, well managed Marine Protected Areas (MPAs), without which these measures species will be ineffectively protected and populations will likely continue to decrease. Elasmobranchs are an integral part of Cabo Verdean nature and culture; only by continually improving our understanding, are we able to see their survival as an increasingly valuable economic asset as well.

Additional we wish to achieve in 2017:

1. Expansion of baseline monitoring throughout Cabo Verde.
2. Capacity building in techniques with DNA staff.
3. Consultations with fishers to assess methods and mechanisms in small-scale sustainable fisheries of sharks and rays.
4. Support the formation of a National Advisory Group for sharks that integrates representatives from all sectors (public, private, fishing,

academia etc.,) and supports the government in work with sharks and rays.

5. Support the completion of Cabo Verde's NPOA-sharks.
6. The development of a national Code of Conduct with respect to any activities conducted with the intention of observing / interacting with elasmobranchs.
7. Expansion of extra-curricular education and activities in Boa Vista.

"Pamodi ki tiburón é Kabu Verdi!"

(Because sharks are Cabo Verde!)

Traditional fisher, Vila do Maio, 2016

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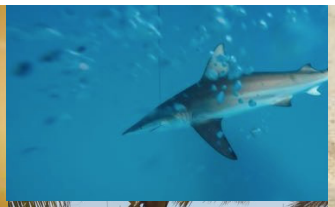



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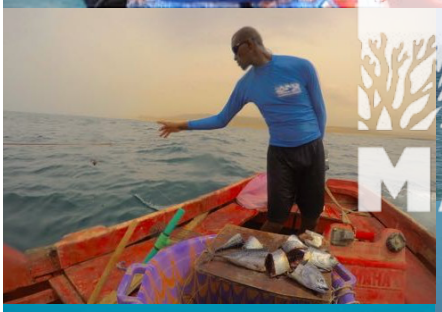







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