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Catch and bycatch composition of illegal fishing in the British Indian Ocean Territory (BIOT)

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Introduction

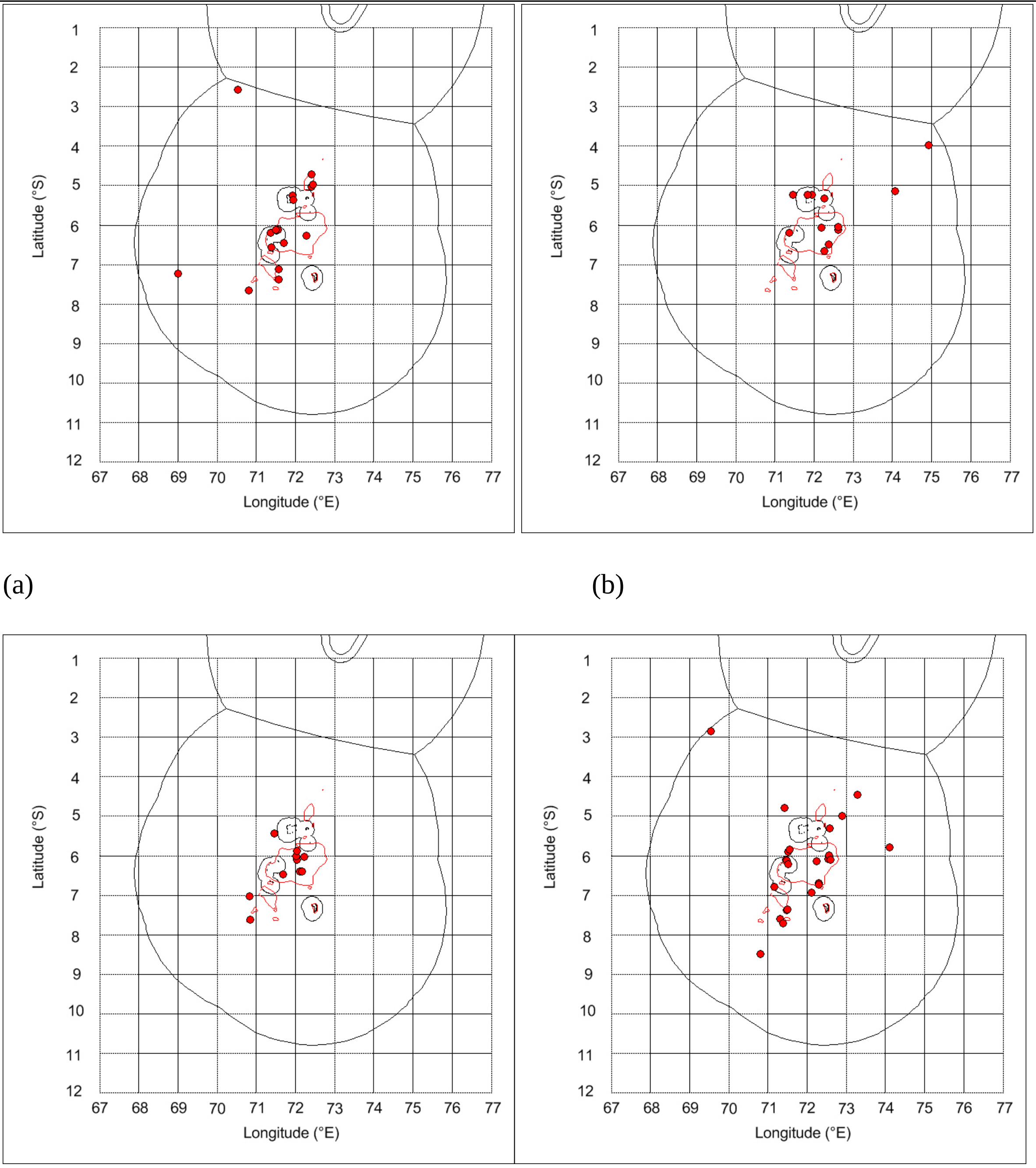
In April 2010, the UK government declared the BIOT (British Indian Ocean Territory) a no-take MPA to commercial fishing. The MPA covers an area over 544,000 km^2 and was created with aims of biodiversity conservation and creating a scientific reference site within the region (Mangi *et al*., 2010). Encompassing both coastal and pelagic areas, the MPA has doubled the area of ocean covered by MPAs worldwide and protects approximately half of the coral reefs in the Indian Ocean that are still classed as ‘high quality’. There are about 10 Important Bird Areas, with some of the Indian Ocean’s most dense populations of several seabird species. The area also includes undisturbed and recovering populations of Hawksbill and Green Turtles. Although commercial fishing within 200 nautical miles of the islands ceased in November 2010, recreational fishing for pelagic and demersal species with hook and lines is still permitted in an MPA exclusion zone covering the territorial waters around the island of Diego Garcia. Some tuna and tuna-like species are caught as part of this fishery, but sharks must be released alive. Catches of this fishery have been falling in recent years with landings of 42t, 31t and 21t recorded in 2010, 2011 and 2012 respectively. Recreational fishing for personal consumption by visiting yachts is also permitted outside the exclusion zone within the MPA. Angling from the shore remains difficult to quantify with no recent data available, however previous surveys suggests is approximately 10-15t annually.

There has also been illegal fishing operating for a number of years and Illegal, Unregulated and Unreported (IUU) fishing is considered as a significant threat to the ecosystem. The area is monitored by the BIOT Patrol vessel, the surveillance strategy of which is based on a combination of ecological risk assessment, historical fisheries data and intelligence on IUU activities. Beyond the blanket protection of all species through the declaration of the MPA, there are no separate national plans of action in place for individual species or species groups.

While the primary purpose of the Senior Fisheries Protection Officer (SFPO) is the enforcement of BIOT regulations, this position has also provided an opportunity to collect biological information on the catch onboard vessels fishing illegally in the area. While information collected was very basic at first, this has become increasingly more detailed through the development of more comprehensive monitoring forms. In this paper, catch data collected by the BIOT patrol vessel from 2007-2013 are analysed, with formal interview records with the arrested individual (the captain), comprising 37 arrests in total.

Location of arrests

The majority of arrests have been made in inshore areas with fewer taking place outside the island archipelago (Figure 1). Nevertheless, this is not necessarily a direct reflection of where the majority of illegal fishing is taking place as the location of arrests is based on a combination of both where the most illegal fishing is taking place and the location of the surveillance operations. Patrols routes have varied based on a number of factors including reported threats of piracy and IUU fishing intelligence. .



(a) (b)

(c) (d)

Figure 1. Map showing location of arrests in the BIOT Fisheries Conservation and Management Zone / MPA from (a) 2001-2003, (b) 2004-2006, (c) 2007-2009 and (d) 2010-2013.

Numbers of arrested vessels

Between 1 and 12 arrests have taken place annually since 1996 (Figure 2). There was a marked peak in arrests in the year the MPA was designated (2010), but this has decreased again in more recent years to roughly the same level as previously. Nevertheless, this is set against a background of variable offshore patrol time. In addition to fisheries patrols, the vessel is also used for conducting periodic sovereignty patrols of the outer islands, scientific surveys and other BIOT Administration tasks.

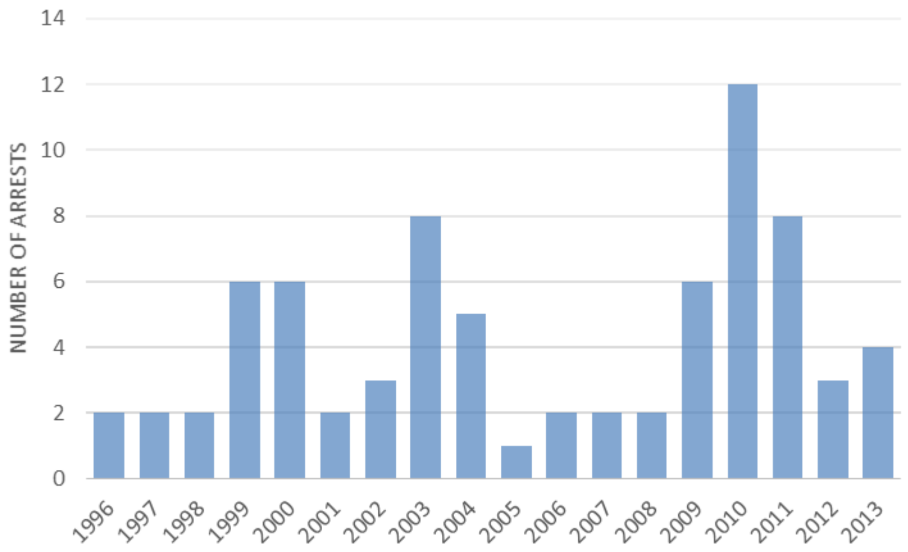


Figure 2. Number of arrested vessels in BIOT by year.

Gear

Fishing gear observed on board arrested vessels were predominantly longlines and drift nets, but troll lines, hand lines and harpoons were also recorded. Wire trace[2] was present on 89% of boats using longlines, indicating they were targeting sharks. Two types of fishing methods have been reported by the SFPO as being used for different target fisheries:

1) The first method uses a lightweight monofilament nylon driftnet a few hundred metres long which is predominantly used to fish to catch small pelagics such as flying fish (Exocoetidae) which are used to bait long line hooks. Vessels fishing using this method will generally then target tuna with their longline gear and rarely possess wire trace (unless stowed). This type of vessel will normally also carry a larger multifilament drift net, approximately 2.5km in length to fish for large pelagic species.

2) The second type of gear configuration is found on vessels which target shark species. These tend to only use the larger, multifilament drift nets to fish for pelagic species which are then

[2] Wire traces are used to prevent sharks biting off the hook so they can be taken onboard the vessel.

processed and used as bait on hooks with wire trace to target sharks. The current SFPO has reported consistently finding wire trace on vessels that do not possess the smaller monofilament nets.

Information on the type of gear types and species observed on board arrested vessels suggests that sharks are being targeted by many of those conducting illegal fishing. During the arrest interviews, fishers were questioned about the species groups they were targeting. Of the 6 responses3 provided, one captain reported that the vessel was targeting tuna, while the other five stated that sharks were the target catch.

Catch composition

Catch data available for analysis were limited, based on what had been recorded at the time. Data from 2007-2013 are analysed below. The mean total catch onboard (where catches were present as two boats had no catches onboard) was 2,030kg and 207 individuals. Sharks were present on 91% of vessels which had catch onboard, of which two vessels had finned sharks. On vessels where sharks were present, there was an average of 156 specimens weighing 1,961kg. This formed 61% of the total catch numbers and 78% of the total weight. The remaining species comprised predominantly tuna and reef fish.

Figure 3 provides a summary of the number of identified shark species observed on arrested vessels between 2007 and 2013. These data should be interpreted cautiously, however, as many specimens were not identified to species level. This may have been because the SFPO did not have sufficient time in addition to patrol activities or because catches were already partially decomposed or part-processed. Species which have more distinguishing features and so are more easily identifiable are also likely to show higher relative abundance. Nevertheless the data provide an indication of the main species caught. The most dominant species were the reef sharks; black tip (*Carcharhinus limbatus)*, grey reef (*C. amblyrhynchos*) and white tip reef (*Triaenodon obesus*), followed by the pelagic oceanic white tip (*C. longimanus*), blue (*Prionace glauca*) and hammerhead (Sphyrnidae) shark species.

The relatively high landings of reef species is not unexpected as many of the vessels were arrested in inshore areas, although due to the multi-day nature of the trips the exact locations of the arrests are not necessarily indicative of where the catch was taken. While the reef shark species dominated in terms of catch numbers, in terms of total biomass, the pelagic species would be expected to be higher than as represented by numbers, however, these data were not available.

The non-shark species were dominated by tuna; yellowfin (*Thunnus albacares*) and skipjack (*Katsuwonus pelamis*), snappers (Crimson jobfish (Sacré chien blanc) *Pristipomoides filamentosus* and Green jobfish (*Vacoas) Aprion virescens*), mackerel tuna (*Euthynnus affinis*), barracudas (*Sphyraena)*, trevally (Carangidae) and a variety of billfish (Xiphiidae and Istiophorus).

[3] Many respondents did not answer

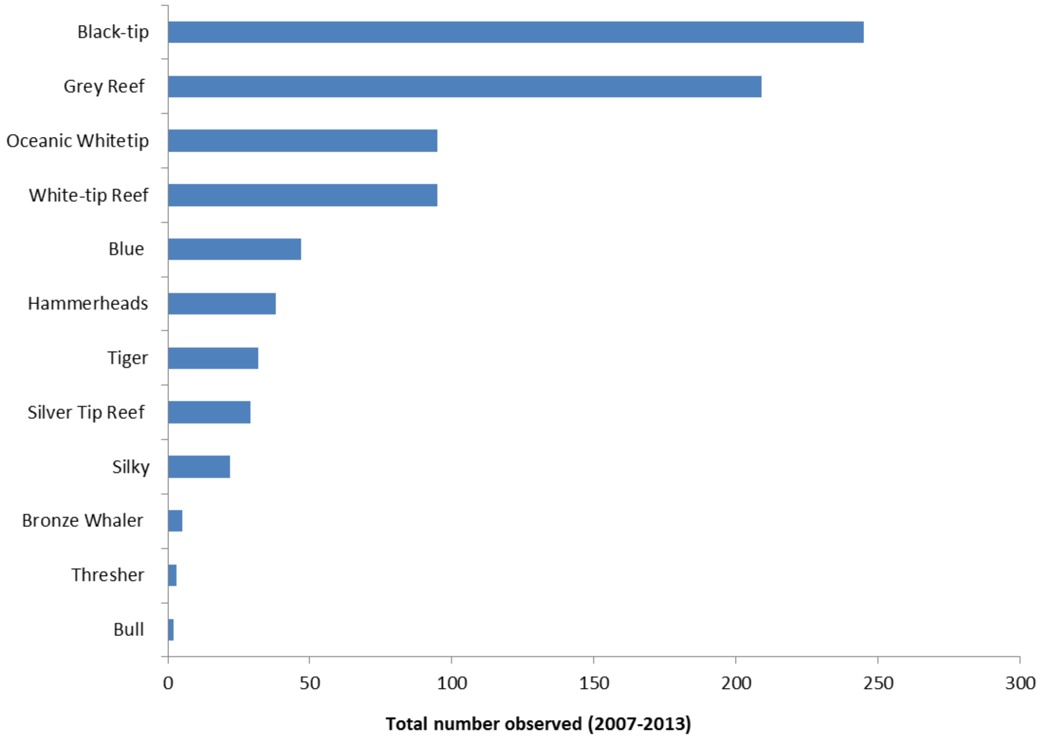


Figure 3. Numbers of identified sharks observed onboard arrested vessel between 2007 and 2013 (based on records from 11 vessels).

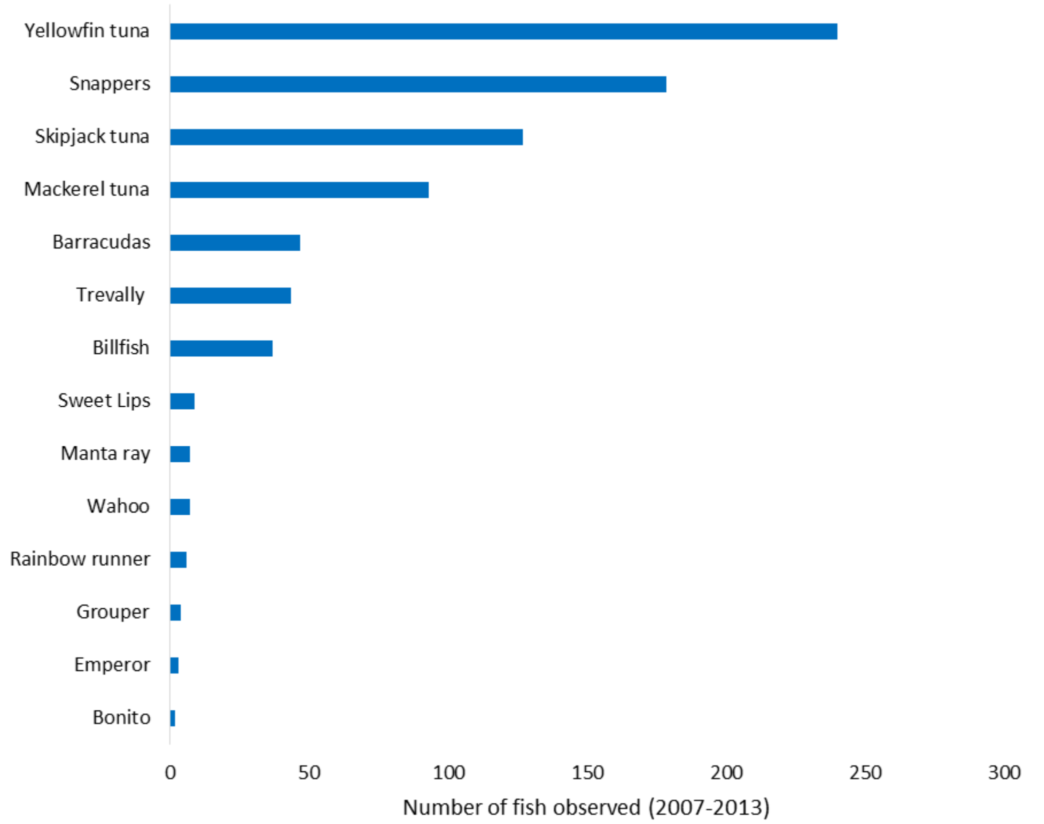


Figure 4. Numbers of identified non-shark species observed onboard arrested vessel between 2007 and 2013 (based on records from 14 vessels).

The nature of illegal fishing makes it impossible to calculate accurately how many fishing boats are operating within the EEZ illegally, but it has been attempted. Price et al. (2010) estimated the potential number of vessels operating legally in BIOT using sea cucumber landings data which resulted in a range from 30-60 up to 100-200. They estimate 20-50 boats per year based on anecdotal evidence from yacht owners anchored in BIOT waters. While these ranges are unlikely to be accurate given such high uncertainty and anecdotal methods of estimation, they nevertheless provide a starting point for exploratory catch predictions. The total annual catch can therefore be estimated from the mean total catch for all vessels for which catch information is available (including vessels which had no catch on board) multiplied by these estimates (Table 1). Based on these figures, total catch could be in the region of 50-360 t or 5,000-36,000 specimens while total shark catches might range from 40-280 t or 4,000 – 25,000 specimens. These estimates are not considered to be robust, but introduce the possible avenues for further work when more and better catch data and better surveillance estimates are available.

Table 1. Predicted total catches based on estimates of vessel numbers (Price et al., 2010)

Number of vessels	Total catch		Shark catch	
	Weight (t)	Number	Weight (t)	Number
200	355	36,163	283	25,215
100	178	18,081	142	12,608
60	107	10,849	85	7,565
30	53	5,424	42	3,782

Size composition of catches

The mean length of specimens (Table 2) and length frequencies were investigated for species with the highest representation of measured individuals (Figure 5). The mean total length of blue sharks was 243cm. Compared with the length at maturity (170-221cm[4]), this suggests the majority caught are mature species. The total mean length of Oceanic Whitetips is 152cm[5], however, suggesting the majority are juveniles (length at maturity ranges from 180-200cm). This was also true for the majority of Silky sharks which mature at a length of 228cm, but averaged 183cm[6] TL in the BIOT catch records. Again, due to the low sample sizes, these figures should be interpreted cautiously, but will be increasingly useful to monitor as the number of records increase.

Table 2. Mean length of the species with the highest frequency of records

Shark	Mean length, cm (±1 s.e.)	Measurement[7]
Bigeye thresher	305 (12)	TL
Blacktip	175 (9)	TL
Blacktip reef	104 (9)	TL
Blue shark	243 (3)	TL
Grey reef	119 (2)	TL
Lemon	244 (7)	TL
Silvertip	126 (4)	TL
Tiger	133 (10)	TL
Whitetip Reef	98 (3)	TL
Bronze whaler	176 (10)	FL
Oceanic whitetip	123 (6)	FL
Scalloped hammerhead	168 (8)	FL
Silky	151 (5)	FL

[4] www.fishbase.org
[5] Converted from fork length based on the relationship in Ariz et al., (2007)
[6] Converted from fork length based on the relationship in Ariz et al., (2007)
[7] TL= total length, FL = fork length

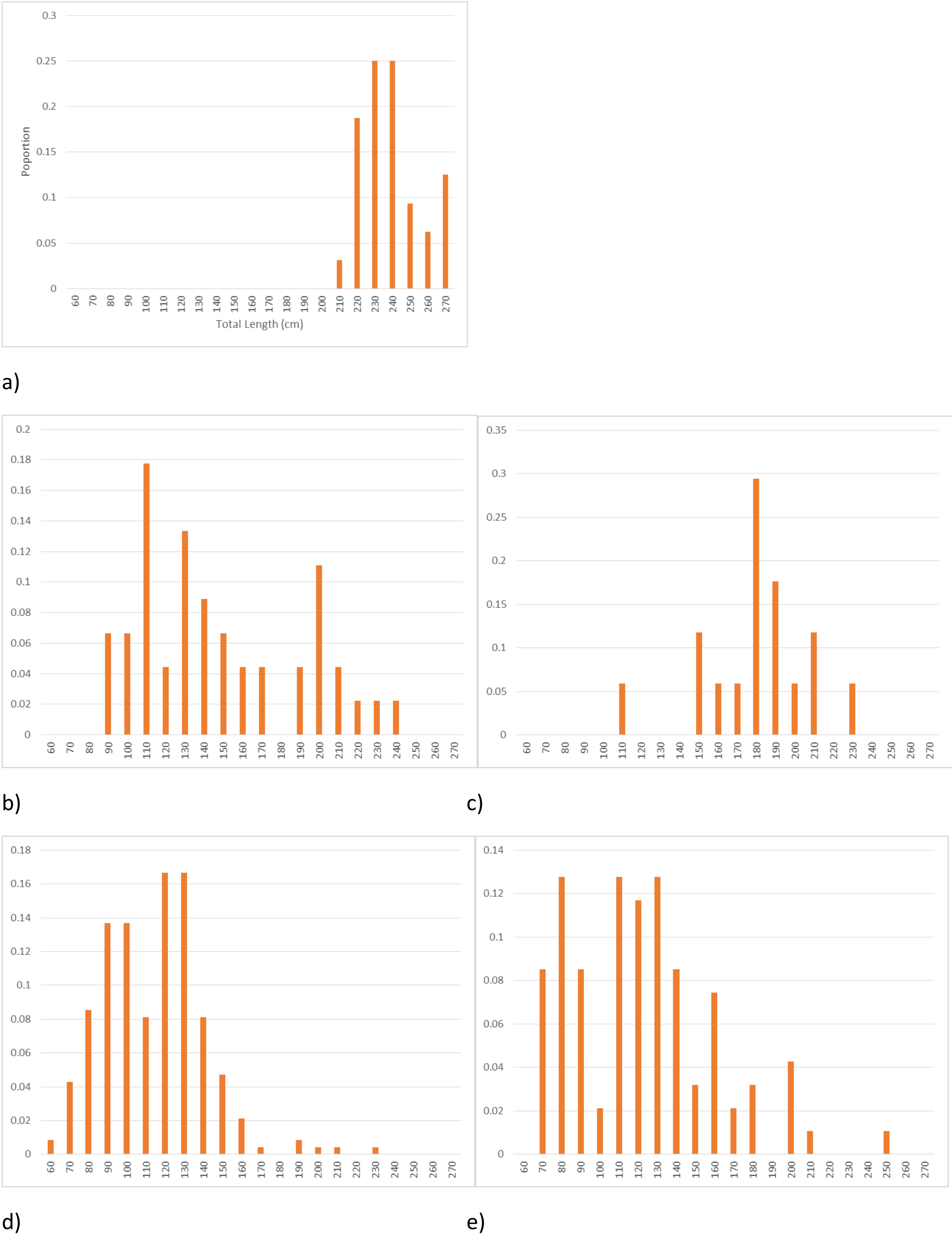


Figure 5. Length-frequency distributions based on total length (cm) for (a) blue sharks (n=32), (b) Oceanic whitetip sharks (n=45), (c) Silky sharks (n=(17), (d) Grey reef shark (n=234) and (e) Silvertip sharks (n=94). NB Total lengths for Oceanic whitetip and Silky sharks were calculated from fork lengths based on the species-specific relationships in Ariz et al., (2007) (TL=aFL+b, where a=1.339 and b=12.8071 for Oceanic whitetips and a=1.206, b=1.574 for silky sharks) .

Conclusions

This paper provides a short summary of the information obtained from the illegal fishery operating in BIOT. The majority of arrests have taken place in inshore areas and the majority of species recorded have been reef fish. Sharks are the prime target species for these vessels, present on 91% of vessels with landings onboard and comprising 78% of the catch when present.

While the analysis is currently fairly limited due to the many issues with obtaining the data which have been discussed, the improvements in data collection forms and training of the SFPOs has allowed much more information to be collected in recent years. Continued use of these more detailed recording forms are likely to provide an increasingly large and more comprehensive biological dataset through which the effect of these particular fisheries can be explored.

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