Review of St Helena tuna fishery status and management advice

St Helena

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Executive Summary

This is scientific advice prepared for St Helena Government to allow them to inform development of management and policy.

The objective of the report is to advise on the status of the local tuna resources (yellowfin tuna, bigeye tuna, skipjack and albacore) and provide advice on their sustainable management.

Tuna stocks are managed internationally by ICCAT. St Helena fisheries management measures, set out within its Exclusive Economic Zone (EEZ), ensure both compliance with ICCAT regulations and its required data submissions, whilst at the same time ensuring a regular resource supply by minimising risks of short-term local depletion and considering the wider ecosystem effects. Data were collated from historic local landings and at sea observer data from biological sampling and targeted tagging. Noting that this advice focuses on data collected from the commercial fishery and does not consider data collected from recreational fishery.

General advice for tuna fisheries in St Helena's EEZ:

- To date, the total quantity of tuna caught in St Helena waters, for all species, is considered to have been sustainable, at the local and international scale.
- Where sufficient information has been available, for yellowfin tuna, advice is provided on catch limits that are established to ensure sustainable exploitation of the local biomass.
- For the other tuna species, where information is limited, precautionary advice is provided. It is recommended that any expansion to the current fishery is implemented gradually, as a feedback process, in line with improvements in understanding.
- As part of the MPA management St Helena Government and fisheries stakeholders have agreed to fishing using only pole and line methods. Pole and line fishing is widely recognised as the most environmentally-friendly method of catching tuna, with minimal impact on non-target species.

Advice for yellowfin tuna fisheries in St Helena's EEZ:

- ICCAT considers that the international stock of yellowfin tuna is not overfished and is not undergoing overfishing;
- The international (Atlantic) TAC set by ICCAT is 110,000 t. There is no current allocation table with individual member (CPC) catch limits;

- Most inshore yellowfin tuna are caught between 60 cm and 90 cm (SFL), Bonaparte between 75 cm and 100 cm, and Cardno between 95 cm and 120 cm, with an indication that fish migrate out of the EEZ above this size;
- Tagging recoveries and analysis of catch length distributions indicates that there is movement between key fishing areas, which has implications for management as over-exploitation in one area could affect catches in the next;
- Biomass estimates from tagging recoveries between 2016 and 2019 indicate that an average of 1,916 t of yellowfin tuna biomass is available across the three key fishing grounds surveyed;
- In 2018, ICCAT estimate the biomass was 729,400 t for the total stock; suggesting 0.3% of the yellowfin stock is available within the St Helena EEZ;
- The ICCAT, F_{MSY} based, target exploitation rate for yellowfin is 13%, thus the same local target exploitation rate is advised, which would indicate average annual catches of around 254 t;
- At present, maintaining minimum landing sizes (MLS) at 5 kg is consistent with advice from ICCAT to minimise landings of small yellowfin tuna. ICCAT requires an MLS of 3.2 kg (REC 72-1).

Advice for bigeye tuna fisheries in St Helena's EEZ:

- ICCAT considers that the international stock of bigeye tuna is overfished and is undergoing overfishing;
- Consequently, ICCAT has agreed to reduce the international landings of bigeye tuna, particularly juveniles;
- The international (Atlantic) TAC set by ICCAT is 62,500 t;
- The UKOTs (including St Helena) have presented a submission to ICCAT indicating an intention to limit their bigeye fishing opportunities to catches < 1000 t.
- Within St Helena waters, bigeye tuna are predominantly caught at the eastern Cardno Seamount where catches comprise mainly large adult fish;
- As yet there are insufficient tagging returns to provide advice on the dynamics of the local biomass;
- It is advised that any expansion to the current fishery is implemented gradually, as a precautionary feedback process, including full observer coverage and/or electronic monitoring, and comprehensive data collection.
- At present, maintaining the St Helena MLS at 5 kg is consistent with advice from ICCAT to minimise landings of small bigeye tuna. ICCAT requires an MLS of 3.2 kg (REC 79-1).

Advice for skipjack tuna fisheries in St Helena EEZ:

- ICCAT considers that the international stock of skipjack tuna stock is not overfished and is not undergoing overfishing;

- There is no ICCAT international TAC for this species;
- Life-history characteristics of this species are indicative of highly fecund and short-lived species;
- ICCAT have not set an MLS for this species.

Advice for albacore tuna fisheries in St Helena EEZ:

- ICCAT considers that the international stock of (southern) albacore tuna is not overfished and is not undergoing overfishing;
- The international (Atlantic) TAC set by ICCAT is 25,901 t. The local TAC set by ICCAT for St Helena is 100 t (REC 16-07);
- There have been no significant landings of albacore in St Helena's EEZ since 2013;
- The limited time that this species spends within St Helena's EEZ indicates that dedicated monitoring or management approaches are not required at present for this species.

General management recommendations are made for further collection of information required to improve the provision of management advice; as will be available from the new logbooks due to be implemented as part of the Fisheries Legislations updates in 2020. Continuing the yellowfin tagging and introducing an annual tagging programme for bigeye is recommended.

A summary of current International and local management advice is detailed in Table A.

Table A. Species-specific stock status and UKOT limit defined by ICCAT. Management measures currently enforced and annual average landings and biomass and target exploitation estimates including minimum landing sizes (MLS).

	International				**Local status**		**Local management**	
Species	**Stock status**	**ICCAT (UKOT) limit (t)**	**ICCAT regional limit (t)**	**Relevant conservation and management measures in effect (2019)**	**Annual average landed[#] (t)**	**Biomass estimate (t)**	**Catch advice (2020)**	**MLS (whole weight, kg)**
Yellowfin	Not overfished & overfishing not occurring	No limit	110,000 (Rec 11-01)	REC 72-1: MLS of 3.2 kg. REC 16-01*	125	1916	254	5
Bigeye	Overfished & overfishing occurring	Maintain catches at recent levels	62,500 (Rec 19-02)	REC 79-1: MLS of 3.2 kg. REC 16-01*	32	-	-	5
Skipjack	Not overfished & overfishing not occurring	No limit	-	REC 16-01*	123	-	-	-
Albacore	Not overfished & overfishing not occurring	100[†]	25,901	REC 16-07	25	-	-	-

* REC 16-01: (1) authorisation required for vessels >20 m. (2) limits on the number of longline and purse seine boats. (3) limits on fish aggregating devices (FAD)s.

[#] Years – between 1998 and 2018

[†] St Helena only

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Abbreviations

B	Stock biomass
B_{MSY}	The long-term population biomass that would be expected to produce MSY
F	Fishing mortality (roughly equivalent to that rate of exploitation)
FAD	Fish Aggregating Device
F_{MSY}	The fishing mortality that would be expected to produce MSY over the long-term
ICCAT	International Commission for the Conservation of Atlantic Tuna
IUU	Illegal, unreported and unregulated
Landings	Catch reduced by any discards or tagged and released fish
LPUE	Landings Per Unit Effort
MLS	Minimum landing size
MSY	Maximum Sustainable Yield: the average maximum catch that can be taken from a population over the long-term
SCRS	Standing Committee on Research and Statistics
SFL	Straight fork length (cm)
STH	St Helena
t	Metric tonnes
TAC	Total Allowable Catch
UKOT	United Kingdom Overseas Territory
W_c	Weight at first capture
Yield	Catch in weight (landings + discards)
YPR	Yield (landings) Per Recruit

1 Objectives

The Blue Belt Programme supports the delivery of the UK Government's commitment to enhance marine protection of over 4 million km^2 of marine environment across UK Overseas Territories (UKOTs). The programme currently includes the Pitcairn Islands, British Indian Ocean Territory, British Antarctic Territory, South Georgia and the South Sandwich Islands, and the Territory of Ascension, St Helena and Tristan da Cunha. The programme aims to assist and support the UKOTs with the protection of their marine environment and sustainable management of their marine resources and human activities.

This report has been produced as part of the Blue Belt Overseas Territory Work Plan: St Helena, which, among other tasks, aims to provide advice on sustainable fisheries strategies and management plans. The aim of this report is to summarise information on key tuna species in St Helena waters and to provide advice on:

1. Historic exploitation of tuna;
2. The distribution of tuna biomass and external linkages;
3. The dynamics of biomass available, and a precautionary catch limit based on a target exploitation rate of the entire Atlantic stock.

The focus of this report is primarily yellowfin tuna, with preliminary results provided for bigeye tuna and summaries of historic landings for skipjack and albacore.

2 Background

St Helena is a remote island in the south Atlantic located at 15.96°S, 5.70°W. The island is situated approximately 1,290 km from the nearest island (Ascension) and 1,870 km from the nearest mainland, near the Angolan-Namibian border. St Helena has an IUCN Category VI Marine Protected Area that encompasses the entire 200 nm maritime zone. The primary objective of an IUCN Category VI MPA is "*to protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial*" (IUCN, 2020), which includes sustainable fisheries strategies and management.

St Helena has a long history of fishing, with the principal fishery targeting tuna. Four species of tuna are caught within St Helena's EEZ, yellowfin tuna (*Thunnus albacares*, YFT), bigeye tuna (*Thunnus obesus,* BET), skipjack (*Katsuwonus pelamis,* SKJ) and albacore/longfin tuna (*Thunnus alalunga*, LFT). All tuna species move across vast oceanic regions; the local biomass of all tuna species fished around St Helena comprise part of Atlantic stocks of these species. The St Helena EEZ can be divided into separate fisheries areas to clarify description, inshore and offshore (Figure 1). The inshore area includes the seas within 30 nm of the island. The offshore area encompasses the remainder of the EEZ, between 30 and 200nm.

There are three key fishing grounds within St Helena waters (Figure 1): the inshore waters, and two seamounts, Bonaparte (to the west of the island) and Cardno (to the north of the island). Yellowfin tuna and skipjack tuna are caught at all three grounds. Bigeye tuna are caught predominantly at Cardno Seamount (particularly the deeper eastern area) but are also caught inshore and occasionally at Bonaparte Seamount. Albacore are intermittently caught in the deeper waters surrounding St Helena and the seamounts.

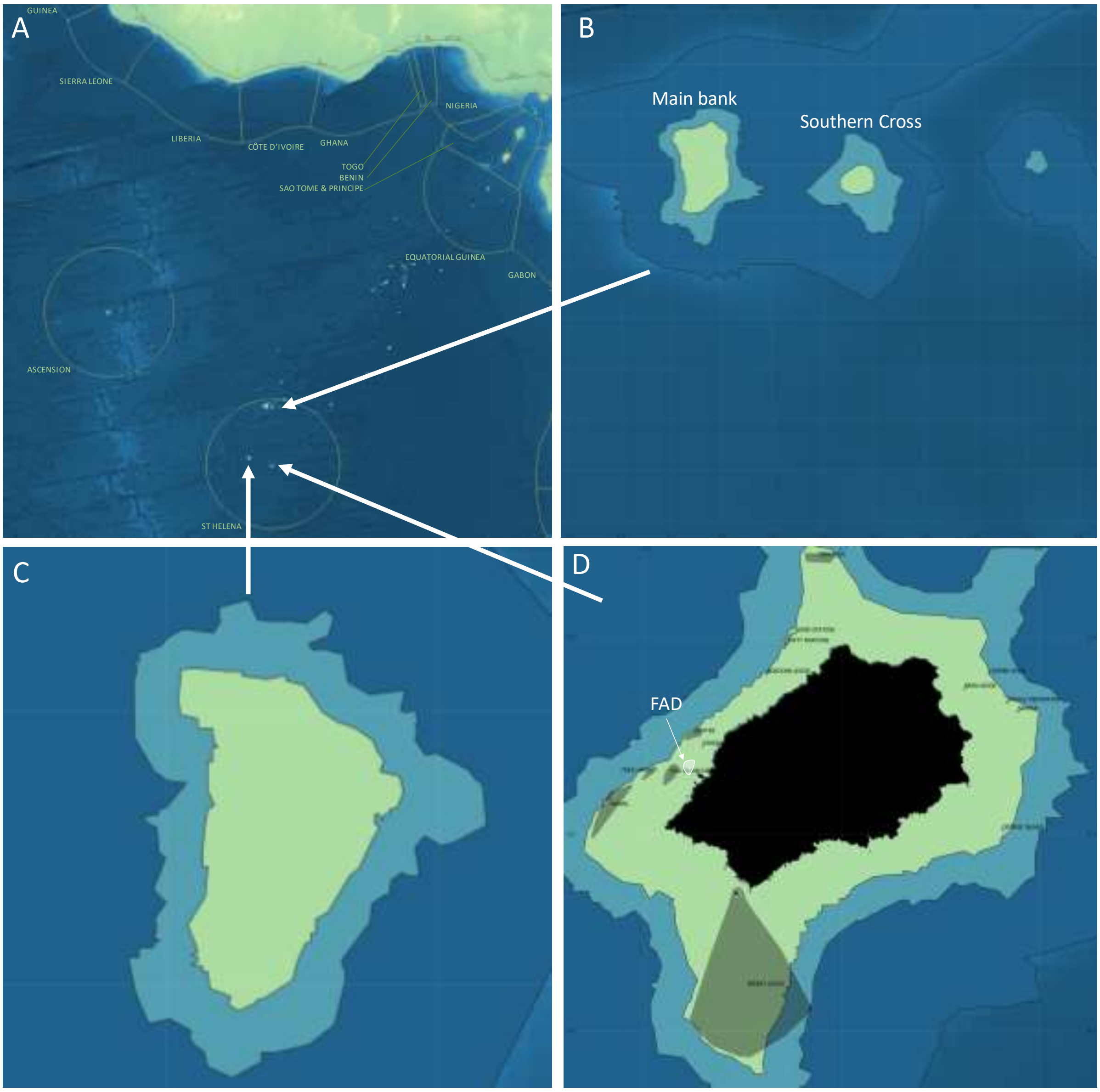

Figure 1. (A) St Helena's Exclusive Economic Zone (EEZ) and location in the South Atlantic, (B) Cardno Seamount including the location of the main bank and Southern Cross mounts, (C) Bonaparte Seamount and (D) inshore including the location of the Fish Aggregating Device (FAD).

3 Tuna Fishery Historic Overview

St Helena has a long history of fishing (Edwards, 1990), with fish providing an important source of protein for the island's population. A history of fishing within St Helena's waters is provided in the Fisheries Profile (Blue Belt, 2018), report on Longlining in the St Helena EEZ (Blue Belt, 2019) and the St Helena Fisheries Sector – Review and Strategy (Collins, 2017). The pole and line fishing method adopted by St Helena Government highlights the pro-active track record of prohibiting unsustainable fishing methods to conserve biodiversity in the EEZ (Blue Belt, 2019). Pole and line fishing employs baited hooks or lures cast from a stationary vessel to target tuna feeding at the surface. Bait fish are typically used to "chum" the area around the vessel to send the fish into a feeding frenzy, encouraging the tuna to feed. Schooling fish are targeted during feeding frenzies and removed one by one. This method is considered a relatively low-impact form of fishing because it has very limited by-catch; by comparison, longline trials in St Helena's EEZ between 1985 and 2016 reported high catches of swordfish (target species, managed by ICCAT) and shark species (by-catch) (Blue Belt, 2019).

Historically, most fishing took place inshore on small fishing vessels within 12 nm of the island with the inshore fleet modernised in the 1980's and 1990's. Since 1985, the seamounts to the west and north of the island (Bonaparte and Cardno, Figure 1) have also been fished by a number of vessels (Figure 2). The *Westerdam* survey (1985-1986) undertook pole and line fishing at Bonaparte and Cardno seamounts for yellowfin and purse seining for skipjack. Since then, the seamounts (Bonaparte and Cardno) have been fished intermittently since 2003 by local (*Portzic, Atlantic Rose*, *John Melliss, Extractor* and *Amalia*) and foreign *(Southern Cross*) flagged vessels.

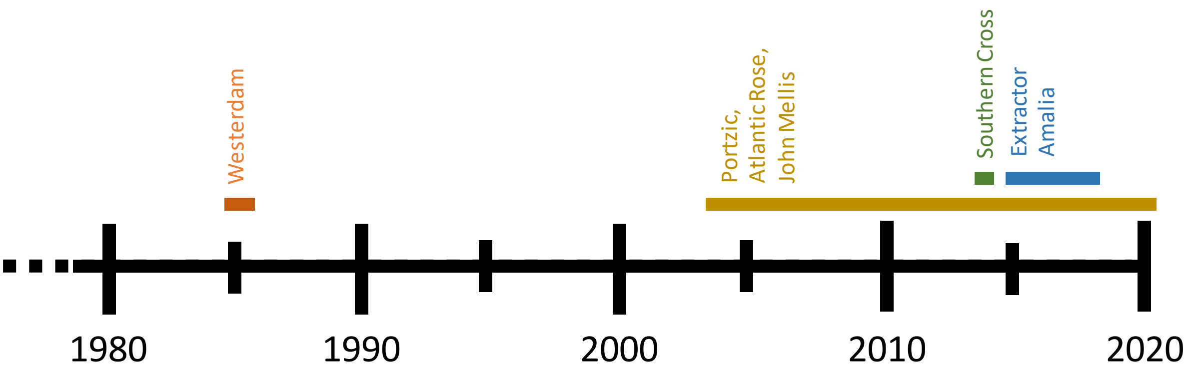

Figure 2. Timeline of seamount fishing within St Helena's EEZ.

Tuna are landed by both commercial and recreational fishers, with both playing an important part in local culture. Landings data from the commercial fishery have been collected at the St Helena Fisheries Corporation (SHFC) plant since 1977; recreational landings are not recorded. Note that reporting recreational and sports fishing landings is required by ICCAT regulations.

The average number of vessels landing tuna at the SHFC plant each year is 18 (between 1998 and 2018), ranging from 25 in 2000 to 13 in 2013 (Table 1). Quantities of bigeye, yellowfin, skipjack and albacore tuna landed since 1998 are summarised in Section 4, including annual and seasonal changes in landings, respectively.

4 Local Tuna fishery

When reviewing historic catch and effort trends, the fleet has been divided into inshore and seamount associated fishing, with seamount fishing carried out by both large and medium sized vessels. Fishing effort was not recorded at the point of landings, so the following assumptions were made about the fleets' behaviour. Any vessels which landed tuna (yellowfin, bigeye, skipjack or albacore) at the cold store on a given day were assigned the following effort:

1. All inshore vessels fished for 1 day;
2. All medium sized offshore vessels fished for 1 day;
3. All large offshore vessels fished for 8 days;

Thus, effort estimates are likely to be underestimated (and LPUE overestimated) as days when fish were not caught were not reported.

The *Southern Cross*, a South African flagged pole and line fishing vessel (LOA 31 m) with a hold capacity of 141.6 m^3, targeted yellowfin and bigeye tuna within St Helena's EEZ in 2013 (MRAG, 2013).

4.1 Annual variability in landings

Between 1998 and 2018, tuna landings in St Helena waters averaged 261 t per annum, in comparison to an average of 420,000 t of the major tuna species per annum across the Atlantic (Table 1); St Helena has never taken more than 0.2% of tuna landings within the region.

For the local fleet, in years where over 500 t of tuna have been caught (2004, 2005, 2006 and 2011), the increased landings are mostly comprised of yellowfin and skipjack caught by the inshore fleet (>56% of the total catch in these years, Table 1). Yellowfin and bigeye are the only species that are landed annually (with yellowfin the only species consistently landed inshore). Skipjack and albacore are not caught each year, but, as in 2011, can be caught in significant numbers in some years (Figure 3). There has been a declining trend in the number of days fished by the inshore fleet (Figure 3) throughout the time series, with stabilisation since 2014 to around 562 days per year.

Landings per unit effort (LPUE) for tuna species were estimated from 1998 to 2018 (Table 1). LPUE was higher offshore than inshore, with average (± SD) LPUE for the inshore fishery as 0.270 ± 0.117 t d^{-1} per vessel and for seamount regions as 0.454 ± 0.341 t d^{-1} per vessel (Table 1, Figure 3).

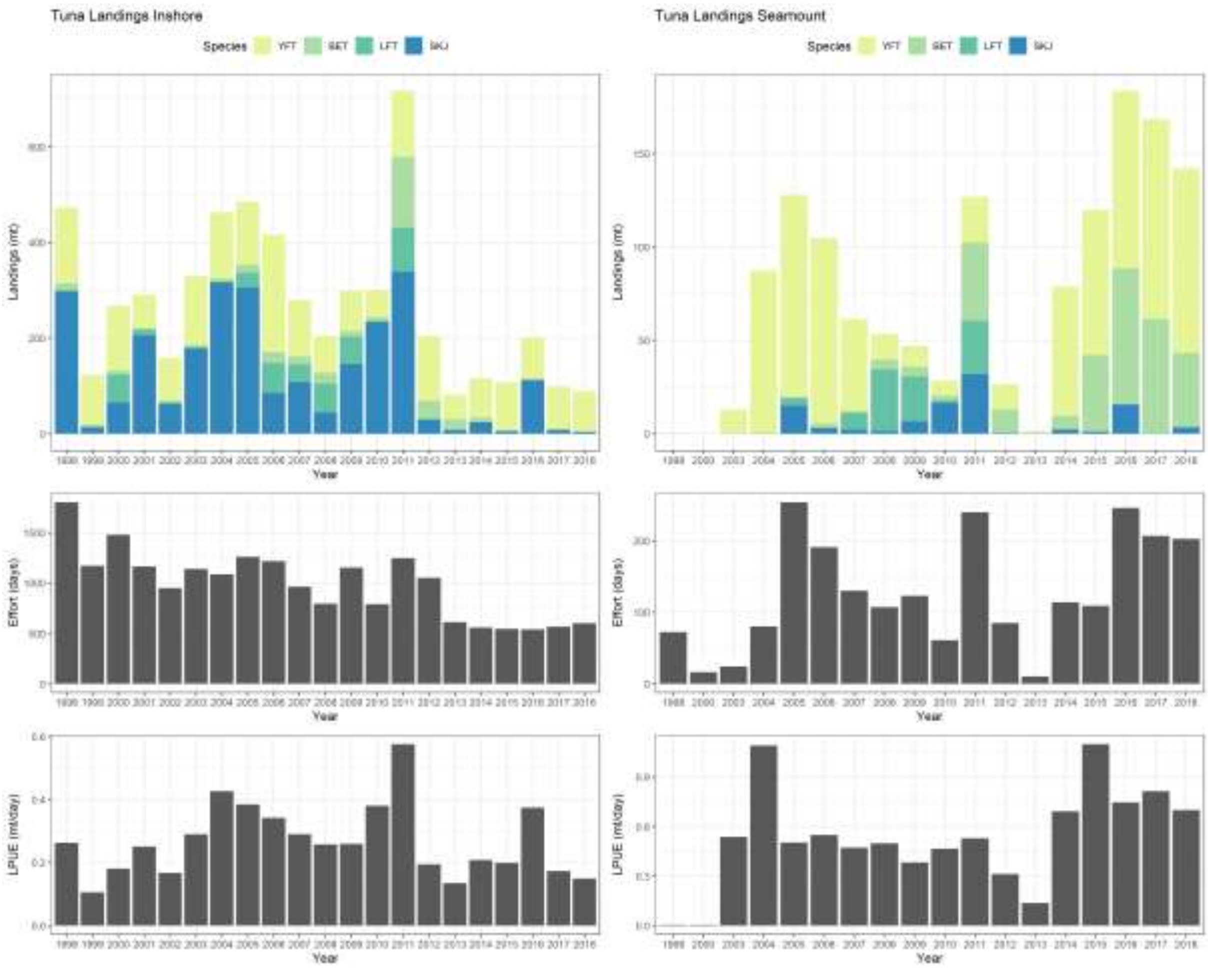

Figure 3. Tuna landings, fishing effort in days fished and landings per unit effort between 1998 and 2018 for the inshore and seamount targeting fisheries of St Helena.

Table 1. Landings of yellowfin (YFT), bigeye (BET), albacore/longfin (LFT) and skipjack (SKJ) tuna on St Helena seamounts and inshore including the effort in days, total when all species landings are combined (YFT, BET, LFT and SKJ) and landings per unit effort based on total tuna landed per days fished (Total LPUE). A summary of the total tuna landed within St Helena's EEZ and the effort in number of vessels commercially landing tuna is also noted. Combined landings of YFT, BET, LFT and SKJ from bait boats (BB), longlines (LL) and purse seines (PS) are also shown for the SE Atlantic stocks reported by ICCAT. The final column indicates the proportion of tuna landed by the St Helena fishery (PROP STH) compared to the SE Stock as a whole.

Year	Seamount							Inshore							St Helena EEZ Combined		SE Stock (ICCAT)			PROP STH (%)
	Effort (d)	Total (t)	YFT (t)	BET (t)	LFT (t)	SKJ (t)	Total LPUE ($t\ d^{-1}$ per boat)	Effort (d)	Total (t)	YFT (t)	BET (t)	LFT (t)	SKJ (t)	Total LPUE ($t\ d^{-1}$ per boat)	Total (t)	Effort (N vessels)	BB (t)	LL (t)	PS (t)	
1998	72	<1	<1	<1	0	0	0.004	1803	473	159	15	1	298	0.262	474	21	128363	122017	198483	0.11
1999	0	0	0	0	0	0	0	1172	123	105	5	1	13	0.105	123	19	128622	132576	213240	0.03
2000	16	<1	<1	0	0	0	0.004	1480	268	136	9	58	65	0.181	269	25	106725	134128	193104	0.06
2001	0	0	0	0	0	0	0	1164	291	70	4	12	205	0.250	291	19	132256	117445	202810	0.06
2002	0	0	0	0	0	0	0	951	159	90	5	2	63	0.167	159	17	91950	97144	185256	0.04
2003	24	13	13	0	0	0	0.537	1140	330	145	4	3	178	0.290	343	17	96710	107584	203257	0.08
2004	80	87	87	0	0	0	1.092	1086	463	139	6	1	317	0.426	550	19	134619	101263	186736	0.13
2005	254	128	108	1	4	15	0.504	1261	485	131	17	31	306	0.385	613	19	116954	81790	172180	0.17
2006	191	105	99	2	0	3	0.548	1217	416	246	23	62	85	0.342	521	25	114450	82149	140422	0.15
2007	130	61	49	1	9	2	0.473	965	279	118	17	37	108	0.290	340	18	100748	96138	137853	0.10
2008	107	53	14	5	33	1	0.499	795	204	77	23	61	44	0.257	257	14	82253	81629	180084	0.07
2009	123	47	11	5	24	7	0.383	1154	299	85	12	57	146	0.259	346	16	92675	79979	202477	0.09
2010	61	28	8	3	1	17	0.466	790	301	57	9	1	234	0.380	329	15	89736	82438	231390	0.08
2011	240	127	25	42	28	32	0.529	1246	717	138	148	92	339	0.576	844	21	106013	77713	248223	0.20
2012	85	27	14	13	0	0	0.313	1052	205	136	39	2	29	0.195	232	20	111732	77263	273196	0.05
2013*	10	1	1	0	0	0	0.137	610	82	52	21	2	7	0.134	83	13	90470	72937	280228	0.02
2014	114	79	69	7	0	2	0.692	558	116	82	10	0	24	0.208	195	18	81481	65483	276875	0.05
2015	109	120	78	41	0	1	1.100	544	108	101	3	0	5	0.199	228	15	73736	70162	311523	0.05
2016	246	184	95	73	0	16	0.746	540	202	86	4	0	112	0.374	386	13	81286	74823	336244	0.08
2017	207	169	107	61	0	0	0.814	566	98	89	1	0	8	0.173	267	18	72394	68839	334458	0.06
2018	203	142	99	40	0	3	0.700	601	89	85	0	0	4	0.149	231	17	128363	122017	198483	0.05
MEAN	108	72	46	15	5	5	0.454	985	272	111	18	20	123	0.270	337	18	102930	92644	224120	0.08

*Exploratory fishing by the foreign-flagged vessel Southern Cross resulted in an additional 34 days of fishing effort, 30 t yellowfin tuna and 111 t bigeye tuna from the seamounts in 2013.

Time series of LPUE provide an index of changes in local biomass. Monitoring LPUE trends allows the impact of the fishery on the local resource to be evaluated, while more detailed assessment processes are developed. The underlying rationale to LPUE analysis is that as the amount of effort exerted and catch increase, the removals from the local biomass will reach a rate at which a resource is fully exploited. The maximum sustainable yield (MSY) is the highest catches that the local biomass can sustain in the long-term. Further increases in catch cannot be supported by the local biomass and replacement by annual immigration/recruitment, and result in overfishing (over-exploitation). Monitoring LPUE rates as catches are increased provides an approximation of the region of sustainability, where catch levels are supported by the local biomass productivity.

The LPUE time series within Figure 3 exhibit variation around a relatively stable mean level. This is an indication that the historic effort exerted, and catch taken, by the fishery throughout the years for which data are available have not reduced the local biomass of tuna species below the maximum productivity. Some variation across time is recorded but that is likely to be a result of natural variation in the data and also spatial changes in the position of the fishery which have not been included in the analysis.

Figures 4 and 5 illustrate the relationship between landings and effort by the mixed tuna fishery, separated into the inshore fleet and the Cardno seamount; the latter derived from the two offshore fishing vessels operational there in recent years, as their effort has been targeted at Cardno Seamount.

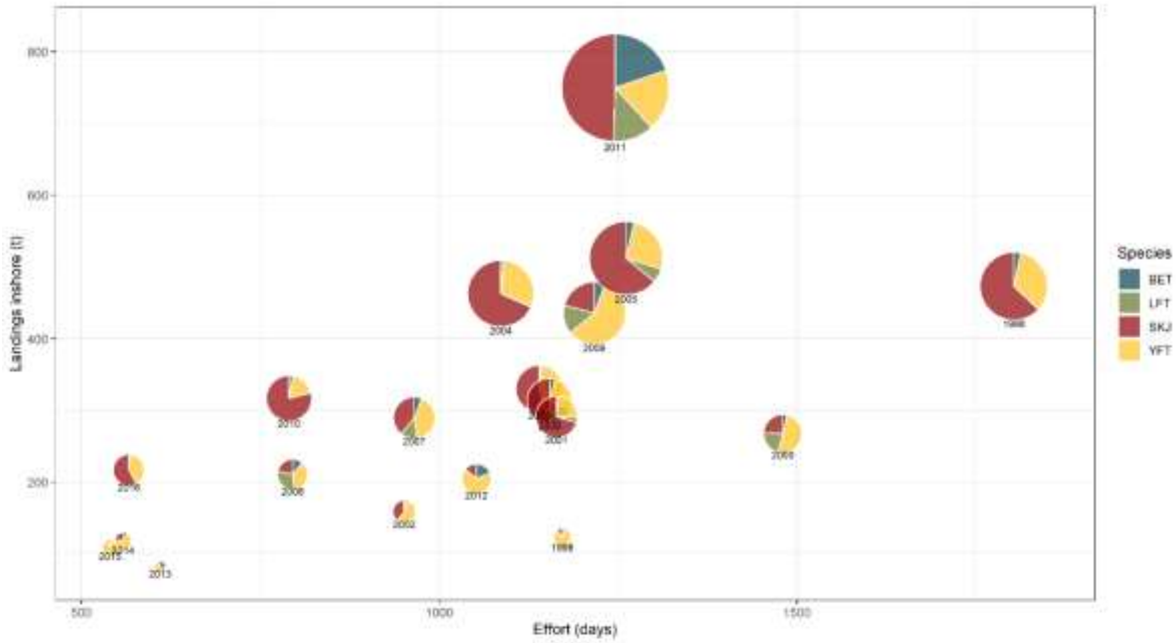

Figure 4. Landings of all tuna species (BET: bigeye, LFT: albacore, SKJ: skipjack and YFT: yellowfin) landed inshore plotted against the deployed effort in days, illustrating the increase in landings with increased effort.

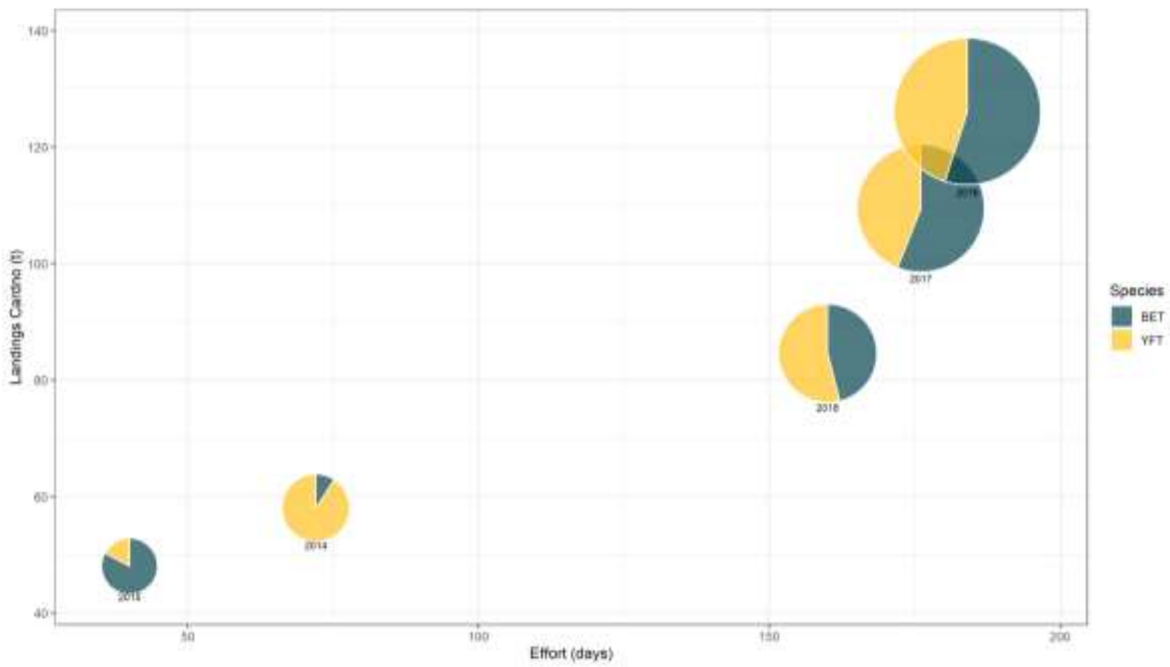

Figure 5. Landings of bigeye tuna (BET) and yellowfin tuna (YFT) by two offshore vessels from Cardno Seamount plotted against the deployed effort in days, illustrating the increase in landings with increased effort.

Landings by the inshore fleet have increased linearly with the effort deployed. There is no point at which mixed tuna landings have started to plateau or decline at the highest effort values. This indicates that the local mixed tuna biomass productivity has been able to support historic catches – a sustainable mixed tuna species fishery. It is noteworthy that the relationship has often been dependent on the availability of the highly migratory and seasonal tuna species skipjack and albacore. The highest landings of tuna are in years where there has been a high abundance of skipjack and albacore in the catches (Figure 4). The total quantity of tuna landed by the offshore vessels from Cardno seamount has also increased linearly to the effort deployed, with no upper threshold (Figure 5), again indicating that the annual biomass productivity is likely to be able to support increased catches there.

In addition to fishing operations by local vessels, the foreign-licensed vessel the *Southern Cross* can also be used to indicate the potential productivity within the St Helena EEZ. The observer report from the *Southern Cross* exploratory fishing within St Helena's EEZ in 2013 (MRAG, 2013) indicated that a total of 141 t of tuna were caught (111 t of bigeye tuna and 30 t of yellowfin tuna) during 34 days fishing at Bonaparte and Cardno seamounts. CPUE for BET for this trip was 3.258 t per day and for yellowfin tuna was 0.877 t per day. Differences in CPUE between this vessel and the local fleet may be attributed to a number of factors including:

1. Larger vessel size and number of crew. *Southern Cross* had around 12 fishermen compared to a maximum of 6 fishermen on local vessels;

2. Differences in methods to attract tuna. *Southern Cross* used a combination of frozen bait (Sardinella – *Sardinops sagax*), live bait and water spray. Bait is often a limiting factor when fishing at Cardno Seamount.

Overall, the total quantity of tuna landed from the inshore fleet and representative fishing vessels at Cardno Seamount have increased linearly to the effort deployed, with no upper threshold, indicating that the total quantity of tuna caught in St Helena waters to date is considered to have been sustainable at the local scale. However, the relationship may not hold for large tonnages, where catches deplete the local biomass and reduce catch rates, requiring increased effort, or where vessels interact in restricted areas (like seamounts) and reduce each other's efficiency.

Additionally, recruitment of tropical tuna to the fishery within St Helena's EEZ may be influenced by International landings in the South Atlantic. In 1990 there was an increase in landings of juvenile yellowfin, bigeye and skipjack tuna from the expansion of the purse seine fisheries fishing on FAD's within the region. This has affected recruitment for the fisheries Internationally (ICCAT, 2018, 2019a).

4.2 Seasonal variability in landings

Seasonal changes in landings can be explored by comparing the mean monthly effort (average number of days) and landings of tuna inshore (<20 nm from St Helena island) and at the seamounts (Bonaparte and Cardno seamounts) (Table 2 and Figure 6).

Table 2. Landings between 1998 and 2018 of yellowfin (YFT), bigeye (BET), albacore/longfin (LFT) and skipjack (SKJ) tuna on St Helena seamounts and inshore including the average effort in days and average total when all species landings are combined.

Month	Inshore						Seamount					
	Effort (d)	Total (kg)	YFT (kg)	BET (kg)	LFT (kg)	SKJ (kg)	Effort (d)	Total (kg)	YFT (kg)	BET (kg)	LFT (kg)	SKJ (kg)
JAN	80	18036	9845	1592	181	9537	11	6082	4847	1204	0	1185
FEB	83	18958	8030	1133	168	14955	10	5559	4590	943	12	576
MAR	105	31826	7976	1349	104	31338	14	5437	4655	757	3	1394
APR	117	33190	9670	2230	553	29700	14	7096	5306	1711	77	892
MAY	124	30521	13736	2586	1936	16103	19	11156	8394	1995	767	1122
JUN	97	17319	10630	1494	882	6374	12	6170	5630	476	64	301
JUL	81	14892	10070	919	3115	1413	15	8987	6326	711	1923	224
AUG	58	18035	5838	2221	9253	964	12	9046	4900	1374	2772	25
SEP	56	14289	10485	651	2946	2642	13	6390	3905	1185	1142	78
OCT	55	8801	7081	143	229	1388	15	7157	3954	2492	0	62
NOV	68	12657	10349	866	350	2122	12	7485	5188	2186	0	12
DEC	60	15448	7002	2703	367	6730	13	10585	3546	7021	5	1089

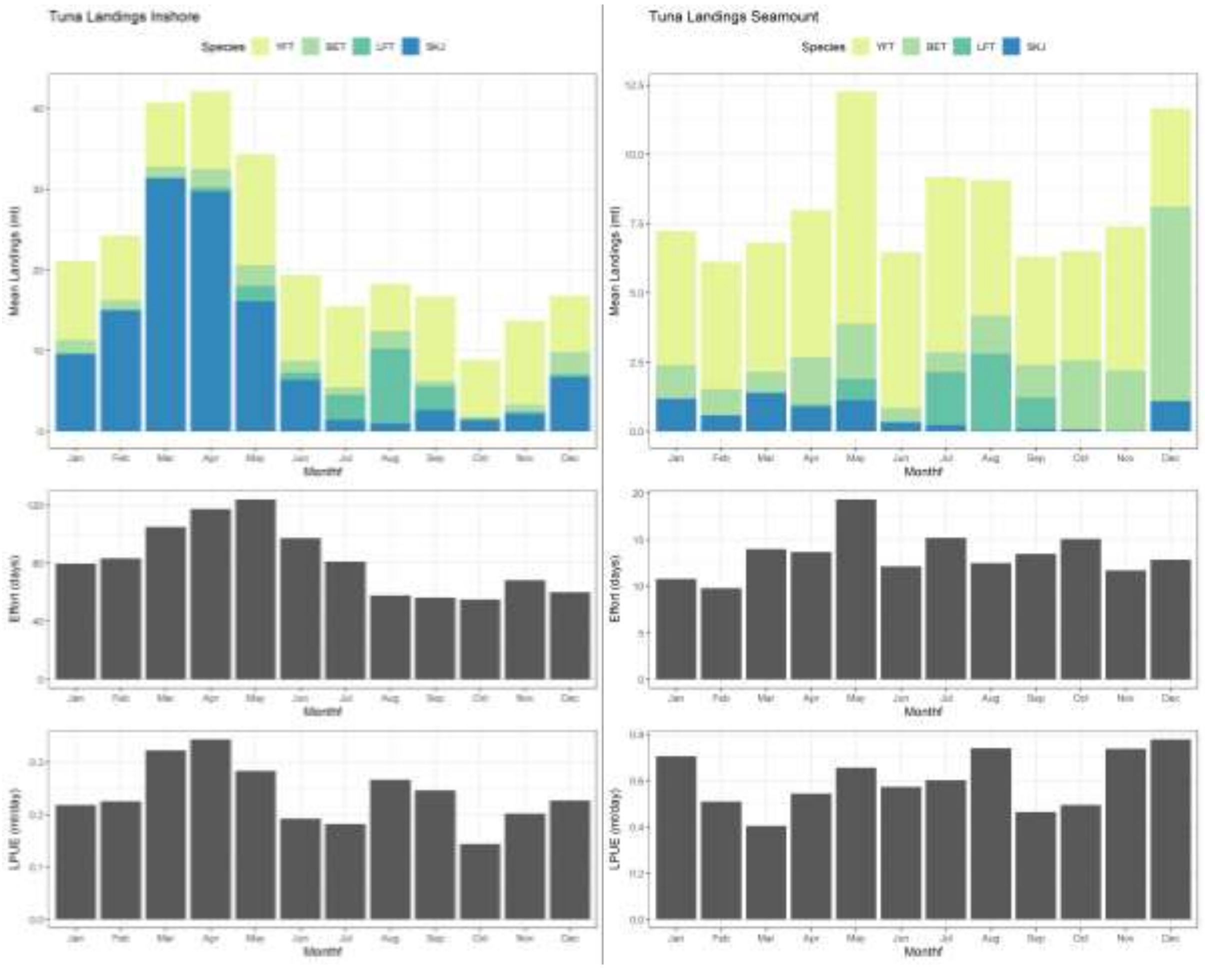

Figure 6. Mean monthly tuna landings, fishing effort in days fished and landings per unit effort (of all tuna) between 1998 and 2018 for the inshore and seamount fisheries of St Helena

Yellowfin are the dominant species landed both inshore and at the seamounts, with no real seasonality to the landings when all years are combined (Figure 6). Skipjack and albacore are only present for a proportion of the year, with a higher likelihood of albacore tuna landings from July to September and higher likelihood of skipjack landings from December to June. Inshore, there are consistent, yet low levels of bigeye tuna landed throughout the year. At the seamounts bigeye can be caught throughout the year if there are fishers operating there (Figure 6), however, there is a higher likelihood of landing bigeye at Cardno Seamount between September and December. Bigeye landings representing between 30 and 70% of tuna landings from the seamounts in these months.

5 Scientific Monitoring and Management

A number of factors may affect the sustainability of St Helena's tuna fisheries either directly, e.g. expansion of the fishery, IUU fishing and increasing fishing effort, or indirectly such as impacts from changes in oceanographic conditions, particularly surface temperatures, affecting species distribution and abundance/availability to the fishery. The following section outlines both International and local scientific monitoring and management, including methods used to assess local stock status.

5.1 International

Defining sustainable harvest limits is fundamental to any long-term fishing strategy. For species which cover wide areas with life stages separated by region, sustainability needs to be considered at the whole stock level (as managed by ICCAT) and the local level (managed by St Helena).

At the total stock scale, ICCAT establishes long-term catch limits (targeting *MSY*) based on life-history parameters including growth rates, natural mortality, size at maturity and recruitment rates per unit of spawning biomass, as well as the fishery characteristics such as the size of fish being caught. ICCAT stock assessments use a range of methods to determine the status of the stock in relation to the virgin biomass (B_0) and in relation to the average biomass that provides the maximum sustainable yield (B_{MSY}). Stock assessments also consider the level of fishing mortality (*F*, approximately the exploitation proportion) in relation to the level that would maintain the stock at or above B_{MSY} (i.e. $F <= F_{MSY}$). If *B* is at or greater than B_{MSY} and *F* is at or less than F_{MSY} the stock is considered healthy (see ICCAT, 2019b). If either $B < B_{MSY}$ (overexploited) or $F > F_{MSY}$ (overfished) the stock is considered at risk. Full details of the most up to date ICCAT stock assessments can be downloaded from the ICCAT website (https://www.iccat.int/en/).

5.2 Local

At the local scale, whilst tuna species remain within St Helena's EEZ, management needs to consider the overall catches compared to international allocations as well as local sustainability. A number of factors may affect the sustainability of St Helena's tuna fisheries either directly, e.g. expansion of the fishery increasing fishing effort, or indirectly such as impacts from changes in oceanographic conditions, particularly surface temperatures. For local management, a number of tools can be used to explore stock and exploitation status and to estimate local biomass. The migratory nature of tuna makes it difficult to apply appropriate statistical analysis to the local population (as the fish within St Helena's EEZ do not form a self-contained population). Nevertheless, to help inform domestic management of St Helena's tuna, a number of tagging and catch structure analyses have been applied to estimate biomass (Chapman) and optimal size at first capture (yield-per-recruit). Key assumptions for the assessments are further explored in the specific methods sections of this report (Appendix 14.1).

5.3 Scientific monitoring

To implement the tagging and catch analyses detailed, data were collated from local landings (recorded at the cold store), at-sea observer data from biological sampling and targeted tagging from a number of projects. The type of data collected and their use in the assessments is detailed in Table 3. Key information provided from logbooks includes the number of days or hours fished, the quantity of landings and discards (dead or alive) by species and the amount of bait species used. In the absence of logbooks, the cold store has been an invaluable resource for monitoring lengths and weights of tuna commercially landed since 2015.

Table 3. Sources of data used for tuna stock status and assessment analysis

Source	Duration	Use
DPLUS039: Sustainable development and management of St Helena's fisheries and marine tourism	April 2015 to June 2017	Biological sampling and tagging data.
Blue Belt	April 2016 to March 2020	Biological sampling and tagging data.
AOTTP: St Helena tuna tagging programme	March 2018 to June 2020	Biological sampling and tagging data.

5.3.1 Tagging studies in St Helena waters

Tagging provides a range of information that is used for the provision of management advice for fish stocks: growth rates, spatial and seasonal movement, rates of exchange between areas, behaviour and also estimates of biomass for the assessment of stock dynamics and exploitation rates; how big the stock is and how much can be taken.

Growth, spatial movement and behavioural studies can be completed with relatively short-term, ad-hoc tagging programmes. Assessment of local biomass dynamics and exploitation require sustained, structured programmes of tagging and analysis.

5.3.1.1 Assessing local biomass

Management of the tuna stocks is conducted through ICCAT and the tagging data will provide information on the links between the biomass within St Helena waters and the wider stock area.

Within St Helena waters, an assessment of the local biomass and its dynamics will allow the provision of advice on:

- The amount of local biomass and its rate of turnover: its productivity;
- TAC consistent with sustainable and economic management objectives;
- Advice on catch rates that allow for a robust (stable) fishery between years.

These components allow managers to know that they are not over-exploiting their local biomass (independent of the overall international fishery). It also informs TAC negotiations with external bodies and internal stakeholders.

5.3.1.2 Strengths and weaknesses of tagging assessments

The main assumption for tag based assessments is that fish have some degree of residency and that released and recaptured fish reflect the underlying stock behaviour and dynamics.

Where fish migrate away from the assessed areas, or, where both tagged and untagged fish are landed without being recorded, bias can introduce uncertainty to the assessment and advice. The migration can be allowed for within analyses but the assumption that the majority of catch has been scanned for tags is key. To be successful, tag based assessments require sufficient tagged fish to be released to achieve return (recapture) rates of around 5-10%.

Tag based assessments reflect generally where tags are released and recaptured, they are conditional on good areal coverage. For example, if only the inshore biomass is sampled by the fishery the total biomass can be underestimated (Bonaparte and Cardno are omitted as there is limited return migration).

The contrast between the ability of the local yellowfin tagging programme and that for the bigeye is an example where these strengths and weaknesses are apparent. For yellowfin, frequent catches across the EEZ have permitted release of sufficient tags to generate an estimation of the local abundance. Short-term residency of the fish has meant a good level of tag recapture.

For bigeye, smaller and more temporally fragmented fishing effort has meant fewer tags have been released. Emigration, or transitory migration, may move tagged fish away from the region more rapidly, although preliminary satellite tag results do indicate a degree of residency. The lack of returns to date has therefore resulted in, as yet, an inability to determine the local abundance.

5.3.1.3 Long-term objectives of tagging programmes

The optimum would be to set up a mandatory programme of releases and reporting with industry and stakeholder buy-in, which tracks changes in the local biomass to provide regular scientific input to ICCAT on the local biomass and extent of exploitation within St Helena waters. A long term programme would allow variation in the biomass across time to be monitored and advice on the variation that would be expected from year to year. This is readily achievable by observers and industry. Costs would be tags, payment of recoveries, time for working up the results and any review process. The advantage of this approach is that where current tagging returns to date have been low, as the time series increases, more information will be available to formulate advice.

Alternatively, a reduced option would be to continue the tagging programme for around 5 years of releases, with monitoring of returns for two more. This would provide a seven year series of local biomass estimates from which a constant TAC could be set for future catches. Long-term costs are lower but the input to e.g. the ICCAT management process would be reduced and local changes and variation would not be followed (e.g. as might result from climate change or increased fishing pressure).

6 Yellowfin Tuna, *Thunnus albacares*

6.1 Distribution

Yellowfin tuna are distributed throughout the tropical and sub-tropical waters of oceans. In the Atlantic, juvenile yellowfin form mixed schools with skipjack and juvenile bigeye. The equatorial zone of the Gulf of Guinea is the main spawning ground for yellowfin, which primarily occurs from December to April. There are other spawning regions across the Atlantic, including Cabo Verde and the Gulf of Mexico, though the importance of each ground is not understood yet. Even with numerous spawning grounds, the yellowfin tuna in the Atlantic are considered one stock based on their transatlantic movements (ICCAT, 2019a). In terms of landings, the highest catches are in the Gulf of Guinea around the equator. St Helena lies to the south of the region with highest catches, with yellowfin in the surrounding waters mostly caught by longline and purse seine vessels (Figure 7).

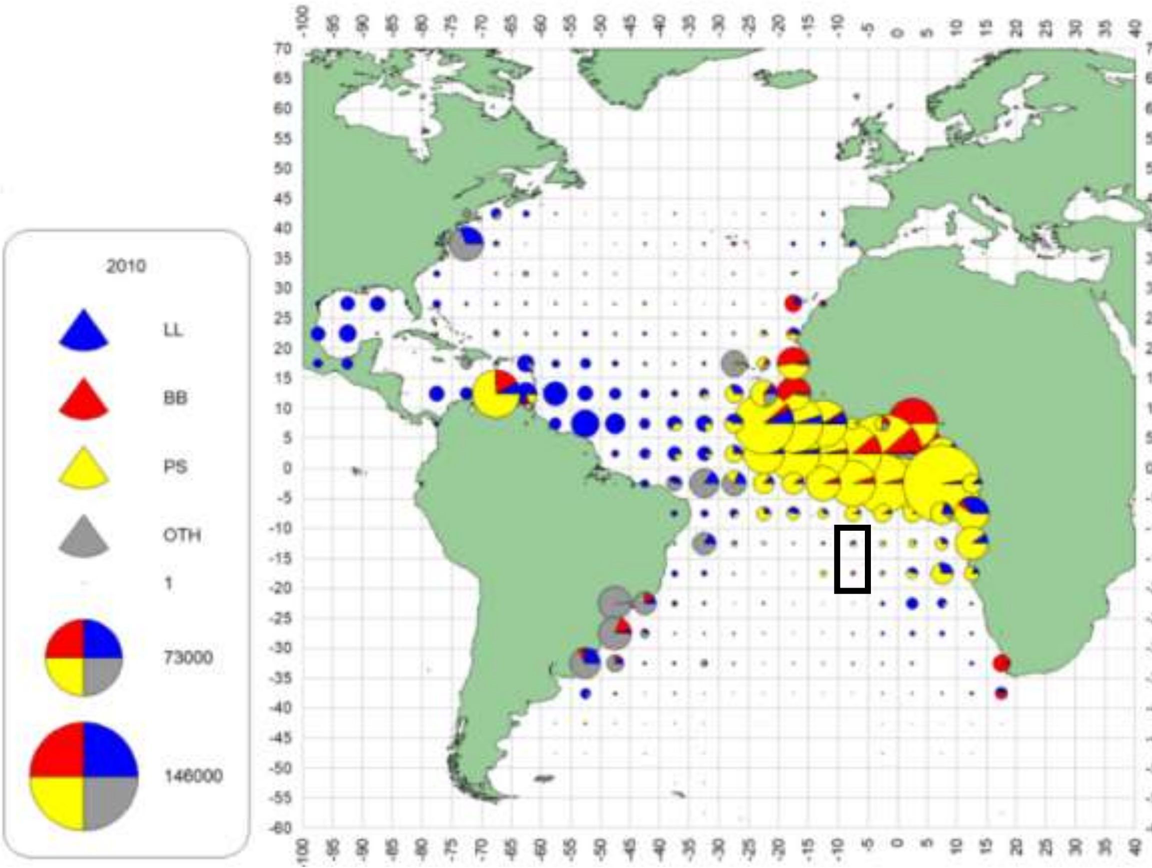

Figure 7. Yellowfin tuna total catches by gear type between 2010 and 2017 in the Atlantic from ICCAT data (source: ICCAT Assessment Summary). The quadrant for St Helena is highlighted as the black box at -10 longitude and -20 to -15 latitude.

Within St Helena's EEZ, yellowfin are widely distributed from inshore regions out to the 200 nm limit of the EEZ. The size-frequency of yellowfin tuna landed or tagged at the three fishing grounds highlights the connectivity between the regions (Figure 8). Each year class (cohort) is clearly identifiable in the landings data for each month and year at all fishing grounds (Figure 8). The average size (interquartile range, SFL) of yellowfin is 63 to 87 cm inshore, 77 to 101 cm at Bonaparte Seamount and 96 to 120 cm at Cardno Seamount. Yellowfin are recruited to the fishery at around 50 cm between February and March each year, at around 75 cm (SFL) they begin to occur at Bonaparte Seamount in March/April the following year, followed by Cardno Seamount in May/June of the same year. Noting that timings vary between years and are affected by region-specific fishing effort. This mixing between fishing grounds is also evident from recent tagging studies (Figure 9, Figure 10, and Blue Belt, 2018). The tuna tagging programme on St Helena has been underway since 2015, initially as part of a Darwin Plus Project (DPLUS039), but with additional funding in recent years from the Blue Belt Programme and ICCAT. The tagging results show that there is movement between fishing grounds within the EEZ (Table 4).

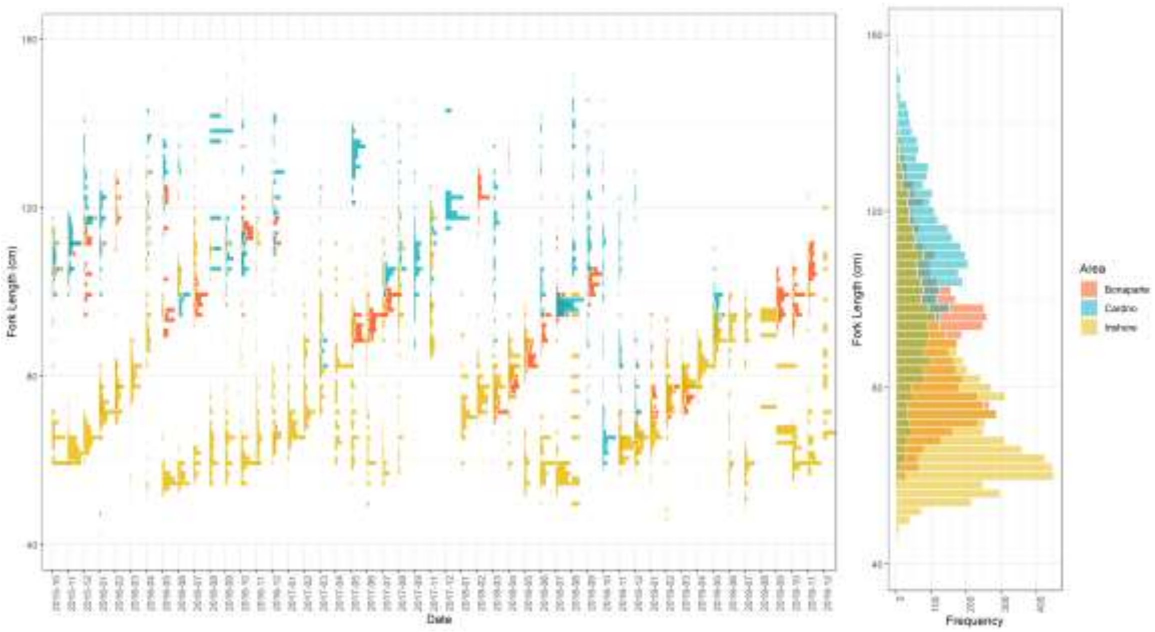

Figure 8. Length – frequency distribution from biological sampling or tagged yellowfin tuna at Bonaparte and Cardno seamounts and from inshore areas around St Helena island

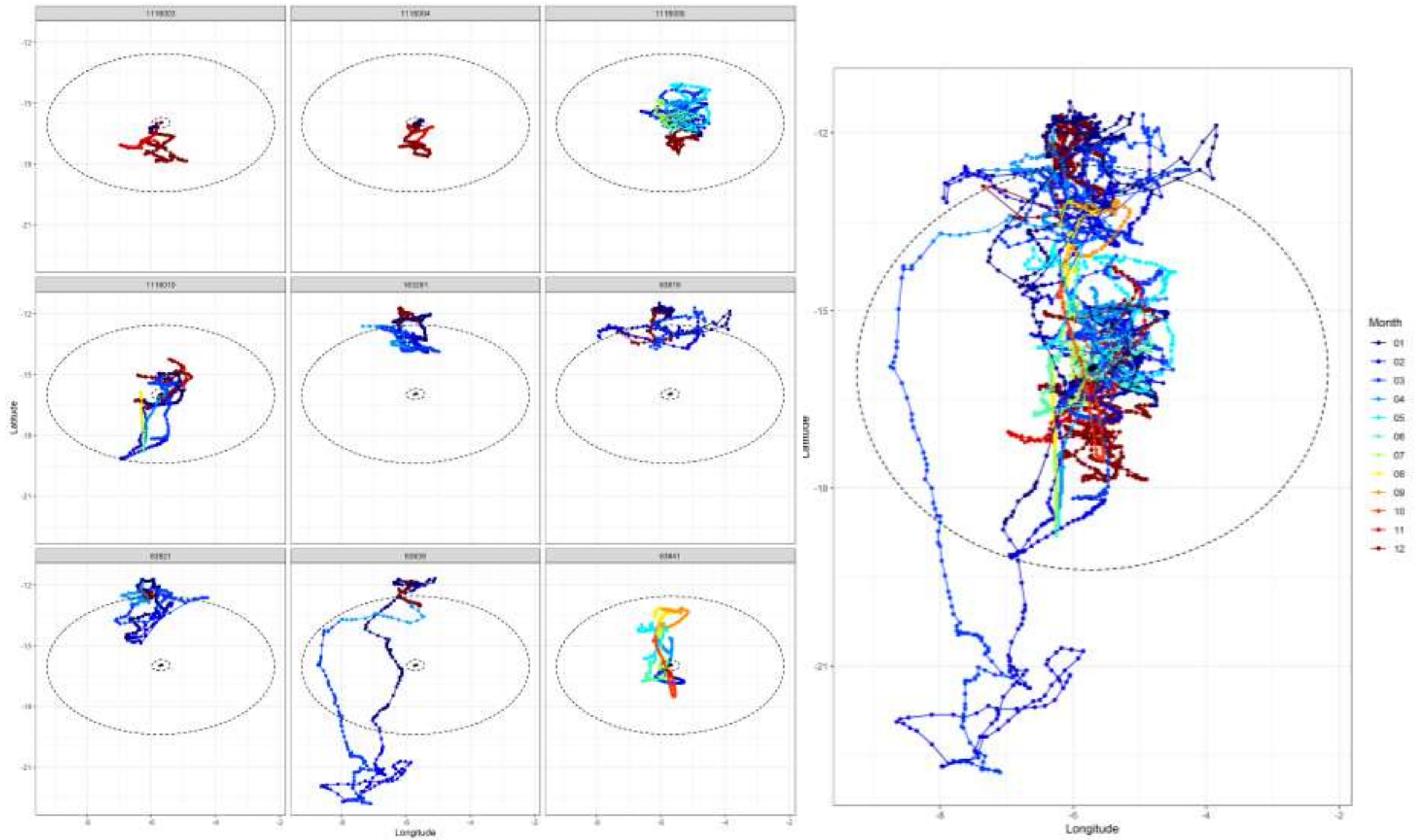

Figure 9. State space model daily position estimates (SSM) for satellite tagged yellowfin tuna highlighting all individuals at liberty by month (N = 9) with colour as month at liberty. (Wright et al. in prep)

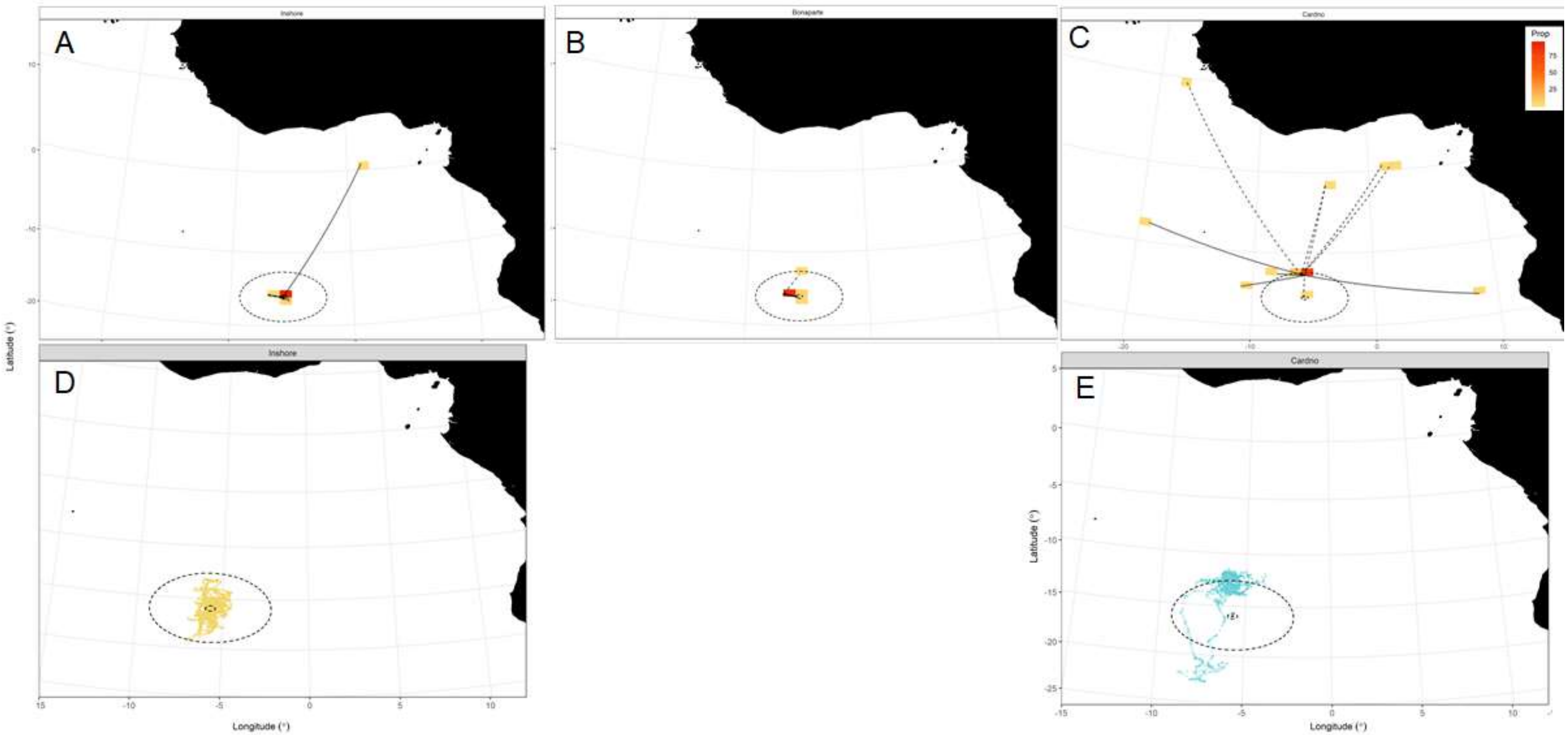

Figure 10. A-C. Release and recapture locations for conventionally tagged yellowfin tuna released inshore (A), at Bonaparte Seamount (B) and Cardno Seamount (C), showing whether fish were recaught at sizes < 86cm FL (solid line) and > 86cm FL (dashed line). Grid colour reflects the proportion (%) of individuals recaught within this cell. D & E. State space model daily position estimates (SSM) for satellite tagged yellowfin tuna released inshore (D: yellow) and at Cardno Seamount (E: blue). (Wright et al. in prep)

Table 4. Proportion of yellowfin tuna (YFT) tagged in the St Helena EEZ, South Atlantic Ocean, recaptured by region (waters around St Helena, "Inshore; Bonaparte Seamount; Cardno Seamount) and recapture size. Numbers recaught are shown in parentheses*.

Release area	Recapture Size	Recapture Number	Recapture area			
			Inshore	Bonaparte	Cardno	Outside EEZ
Inshore	<L50	319	99% (317)	<1% (1)	0% (0)	<1% (1)
	>L50	44	95% (42)	5% (2)	0% (0)	0% (0)
Bonaparte	<L50	8	38% (3)	62% (5)	0% (0)	0% (0)
	>L50	33	0% (0)	97% (32)	3% (1)	0% (0)
Cardno	<L50	26	0% (0)	0% (0)	85% (22)	15% (4)
	>L50	66	1% (1)	0% (0)	91% (60)	8% (6)
Outside	>L50	1	100% (1)	0% (0)	0% (0)	-

*Note, releases and recoveries were included from November 2015 until June 2019, and only include where the recapture location was known.

6.2 Landings

International Atlantic yellowfin catches, which are taken by a mixture of purse seine, longline and pole and line boats peaked at 193,000 t in 1990 but have stabilised at around 100,000 t in recent years (Figure 11). The most recent ICCAT yellowfin assessment (ICCAT, 2019a) indicates that the stock has a high probability of not being overfished (24% probability of overfished status) and of overfishing not occurring (43% probability of overfishing taking place). The maximum sustainable yield estimated by the assessment was 121,300 t and current relative fishing rate F_{2018}/F_{MSY} was 0.96. ICCAT notes that increased harvests on small yellowfin has had negative consequences to both long-term sustainable yield and stock status, with a recommendation that effective measures be found to reduce fishing mortality on small tuna. On average, St Helena lands 0.10% of the Atlantic yellowfin stock within the EEZ (ranging from 0.03% to 0.33% since 1977, Table 5).

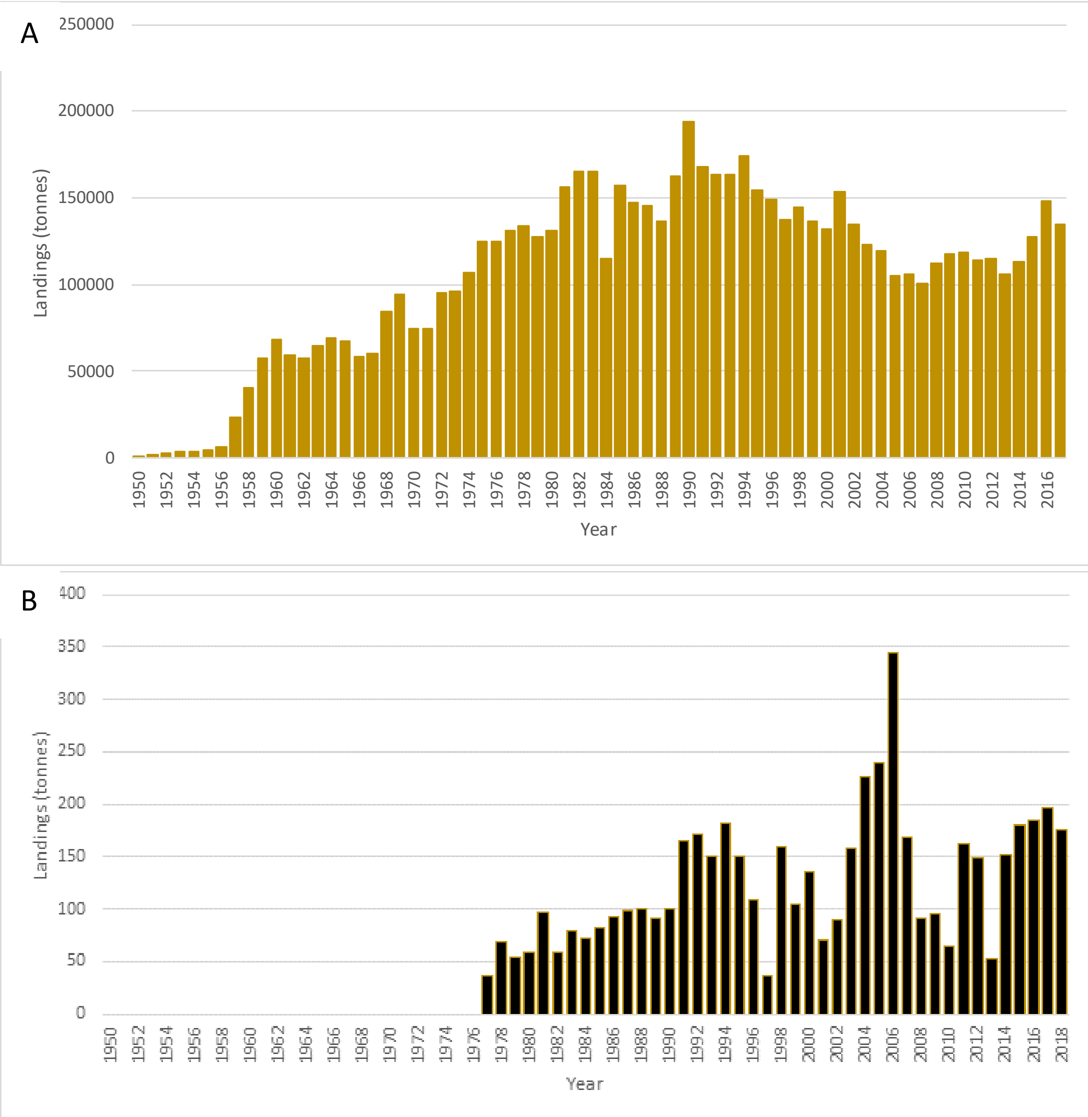

Figure 11. Annual Atlantic yellowfin tuna landings for the Atlantic stock (A) and for St Helena only (B).

The recent average weight of yellowfin in European purse seine catches, which represents the majority of Atlantic yellowfin landings, has declined to about half of the average weight recorded in 1990. The decline has been linked to a change in selectivity associated with the fleet fishing on FADs since the 1990’s, which has resulted in increased catches of small yellowfin tuna (Figure 12).

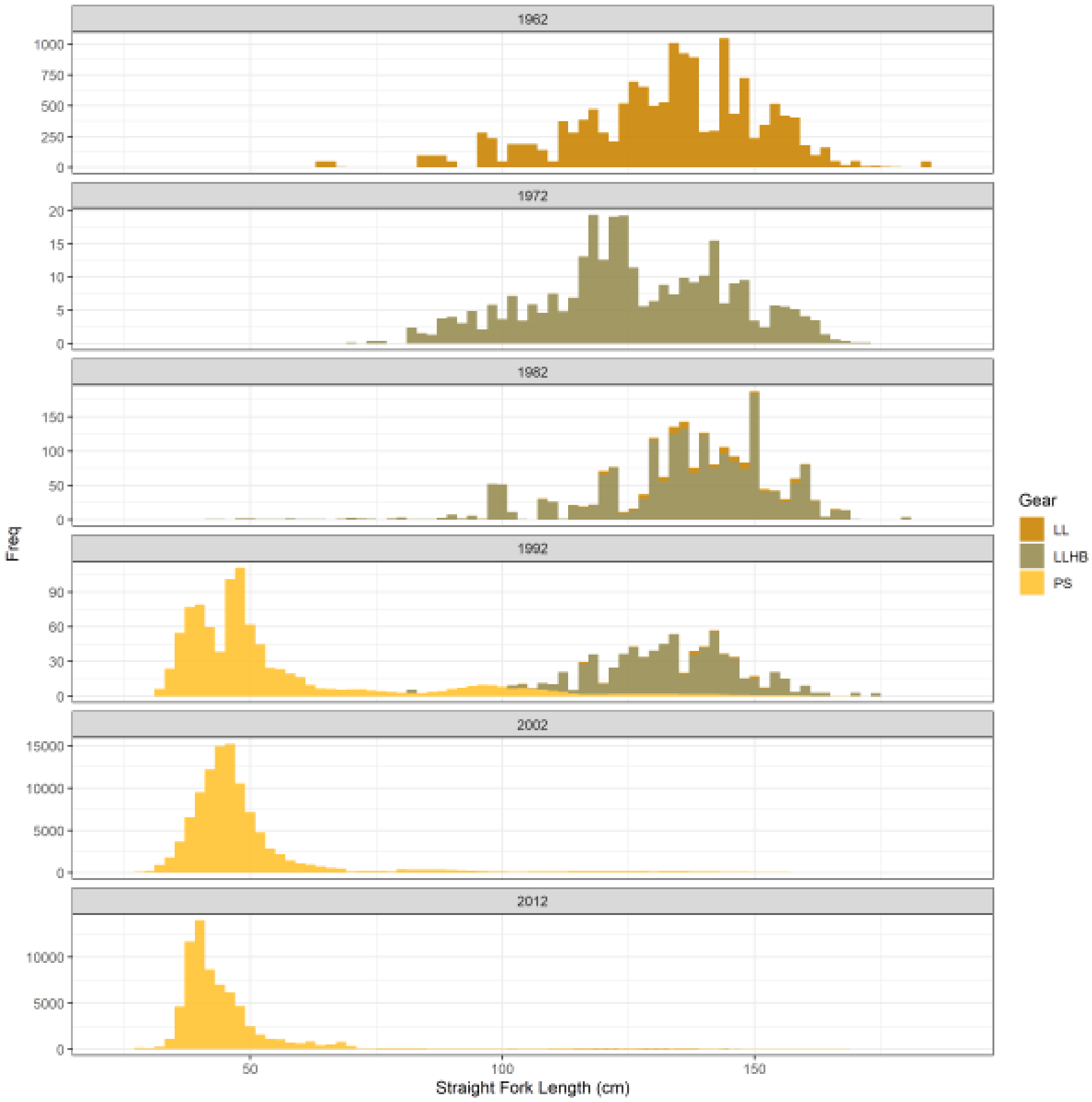

Figure 12. Decadal yellowfin tuna size frequency recorded between -20 and -5 latitude, and -10 and 0 longitude by the International fleet since 1962. Gears are longline (LL), longline home based (LLHB) and purse seine (PS).

Landings by the local commercial fishery since 1977, were collected by St Helena Fisheries Corporation plant (Table 5). Between 1977 and 2018 the average yellowfin catch in St Helena has been 125 t (minimum = 37 t, maximum = 344 t), with increases between 2004 and 2006, associated with more fishing effort at the seamounts (Figure 3, Table 1).

Table 5. St Helena yellowfin tuna monthly landings (kg) by year and percent of International Atlantic yellowfin tuna landings (% INT).

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL (KG)	% INT
1977													37000	0.03
1978													69000	0.05
1979													55000	0.04
1980													59000	0.05
1981													97000	0.06
1982													59000	0.04
1983													80000	0.05
1984													72000	0.06
1985													82000	0.05
1986													93000	0.06
1987													98000	0.07
1988													100000	0.07
1989													92000	0.06
1990													100000	0.05
1991													166000	0.10
1992													171000	0.10
1993													150000	0.09
1994													181000	0.10
1995													151000	0.10
1996													109000	0.07
1997													37000	0.03
1998	9238	12946	10650	24139	24063	18317	13834	8735	9072	7093	8376	12440	158903	0.11
1999	9758	7661	9538	23718	17584	11891	8062	3355	1655	4024	3612	3922	104780	0.08
2000	9248	9506	9684	7664	12822	10185	19921	8055	25126	7870	8692	6978	135751	0.10
2001	8817	4426	9219	7073	9600	7396	3829	2917	3241	3886	4389	5255	70048	0.05
2002	11585	5719	3331	6060	14209	4675	6267	1740	8228	17636	8211	2133	89794	0.07
2003	7087	7573	6943	9776	12253	15904	30326	19347	16977	13240	13243	4971	157640	0.13
2004	9606	13763	11477	15245	25641	19069	18033	15622	44618	22275	20911	9650	225910	0.19
2005	17877	15602	7456	14208	34975	15368	32823	25056	25933	53	33725	16534	239610	0.23
2006	28322	23387	29616	32991	32206	25135	24946	16319	23101	43385	46991	18556	344955	0.33
2007	13557	10446	25413	12379	21244	37034	20051	13055	8521	311	3660	2077	167748	0.17
2008	1293	290	1529	14338	31319	13727	15200	3841	2518	1499	3902	1246	90702	0.08
2009	9028	4147	4839	3071	6847	20069	15453	8248	9797	2453	9813	2082	95847	0.08
2010	1816	3739	7424	7246	14180	6981	4512	3364	1672	971	4336	8483	64724	0.05
2011	29926	20988	15804	12814	17728	14708	11439	14347	10074	1473	7902	5899	163102	0.14
2012	16398	10784	11088	15154	26625	4044	6197	6800	14260	17894	14905	5020	149169	0.13
2013	8234	1401	4748	7430	7845	2482	3606	2327	1879	2933	3855	6010	52750	0.05
2014	5750	4490	6632	5708	26623	21032	12506	9392	16438	13429	20320	9443	151763	0.13
2015	12720	23780	10495	22911	28073	8004	9049	10120	9821	12850	15353	16673	179847	0.14
2016	19173	18224	7366	9620	12831	31029	15726	4747	14354	12909	15091	24158	185226	0.13
2017	28110	10874	21526	16623	22411	13247	20198	15310	12600	3487	15850	16248	196481	0.15
2018	12568	23221	22980	13938	21998	15395	14264	3703	11152	6393	16501	13720	175829	0.13

6.3 Length-weight

The lengths and weights of landed tuna have been collected at the local processing facility since 2015. From this information the relationship between length and weight can be estimated:

$$W = 1.087 \cdot 10^{-5}(L)^{2.97} \qquad r^2 = 0.9054, P<0.0001$$

where, L = straight fork length (cm), and W = gilled and gutted weight (kg). Corresponding length-weight conversions using this growth equation are shown in Appendix 14.2.

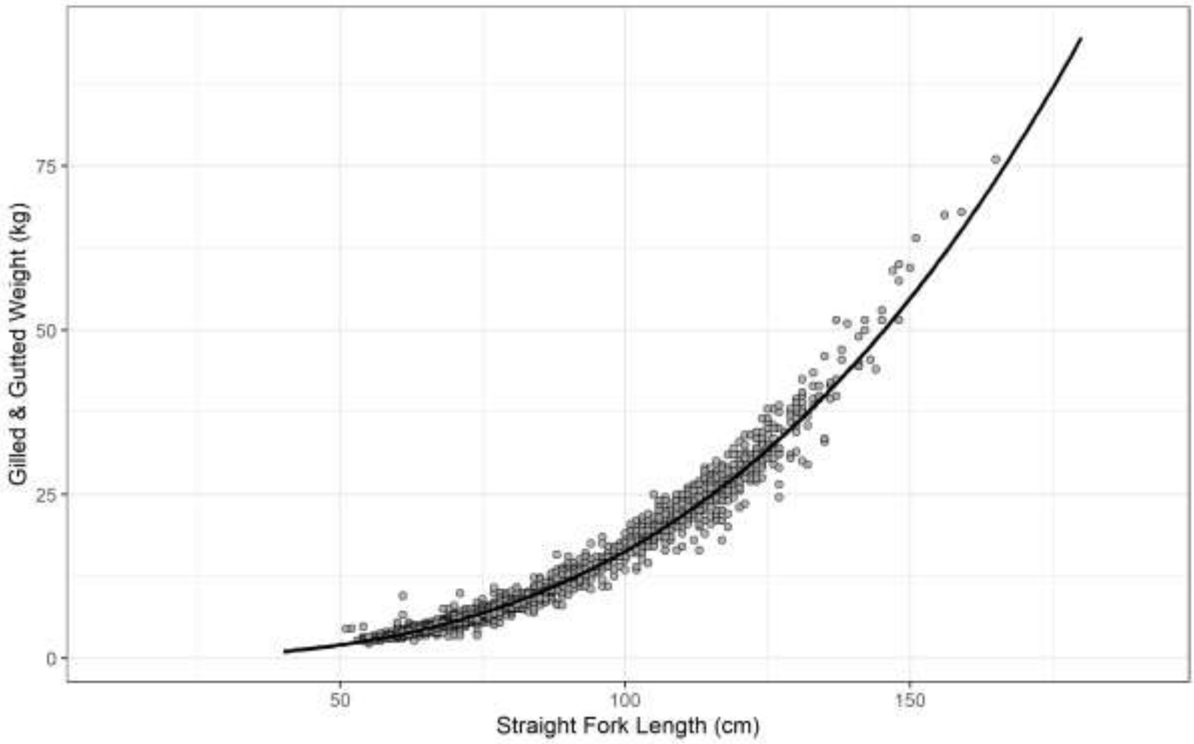

Figure 13. Length-weight relationship for yellowfin tuna (*Thunnus albacares*) landed in St Helena

6.4 Estimation of local biomass status

6.4.1 Biomass assessment

Tagging data were used to provide annual estimates of the local yellowfin biomass available within St Helena's EEZ. The methods and parameters used in the yellowfin Chapman assessment are detailed in Appendix 14.1. The ratio of fish tagged to fish landed within the EEZ is shown in Table 6. For the initial biomass estimates, no mortality from tagging was assumed. Tag failure rate was estimated from double tagged fish, where the square of the proportion of fish recovered with 1 tag was derived from St Helena tagged yellowfin between November 2015 and December 2019 (failure rate of $0.25^2 = 0.065$). Natural mortality (*M*) of 0.35 was based on the value used in the most recent Atlantic yellowfin tuna stock assessment (ICCAT, 2019). The mean weight of fish landed was based on a subset of individual fish which were weighed at the point of landing at the St Helena cold store (St Helena Fisheries Corporation). The numbers of yellowfin released and recovered by year is shown in Table 6. The weight and number of tuna within the catch was used to convert from numbers to biomass (

Table **7**). Noting that in 2016 and 2017 individual lengths and weights were collected, and in 2018 and 2019 only individual lengths were collected (with weights sampled for the whole catch rather than individually).

Table 6. Numbers of yellowfin tuna tagged and released each year between 2015 and 2019. Noting, that the Chapman considers all releases and recoveries within the EEZ and is not assessed by region.

Year	Released	Recapture				Recovered	Quantity landed (t)	Ratio of tagged to landed
		2016	2017	2018	2019			
2015	30	9	0	0	0	30%	180	1 every 6 t
2016	537	33	41	1	0	14%	185	1 every 0.345 t
2017	371	0	23	22	0	12%	196	1 every 0.528 t
2018	1858	0	0	197	128	17%	176	1 every 0.095 t
2019	1253	0	0	0	311	25%	268	1 every 0.214 t
Total	**4049**	**42**	**64**	**220**	**439**	**17%***		

*mean excluding 2015.

Table 7. Numbers of yellowfin tuna sampled and weighed.

Year	Weight (kg)	N
2016	38,111	2785
2017	20,371	1102
2018	4,350	352
2019	6,044	127

Annual biomass assessments are available for the years 2017 to 2019, based on one to three years of tag returns from each release. The biomass estimates range from 1,370 to 2,935 t (Table 8 and Figure 14). As the time series of tag releases and recaptures is short, a robust geometric mean of all of the estimates, 1,916 t, has been used as the provisional precautionary biomass estimate; this compares to the 2018 ICCAT estimate of 729,400 t for the total stock; 0.3% of the yellowfin stock within the St Helena EEZ.

Table 8. Chapman biomass assessment results for yellowfin excluding within year recaptures (2017 until 2019).

		Number of years used in estimation				Landed (t)
		0	1	2	3	
	2017		1,370			196
	2018		1,597	2,935		176
Year	2019		1,744	1,991	2,219	232
Geometric mean			1,916 t			200 t

The ICCAT, F_{MSY} based, target exploitation rate for the Atlantic yellowfin tuna stock is 13%, (see Appendix 14.1.1 for the derivation). The current ICCAT estimate of the exploitation rate of the stock in 2018 is above the target F_{MSY}, at 14% (with an estimated range from 9% to 22%). St Helena's estimated biomass of 1,916 t between 2017 and 2019 indicates a target catch of 254 t of yellowfin tuna per year. The recent average catch of yellowfin tuna from 2017 to 2019 is 200 t representing an average exploitation rate of 10%. This rate is below the ICCAT F_{MSY} target rate of 13%.

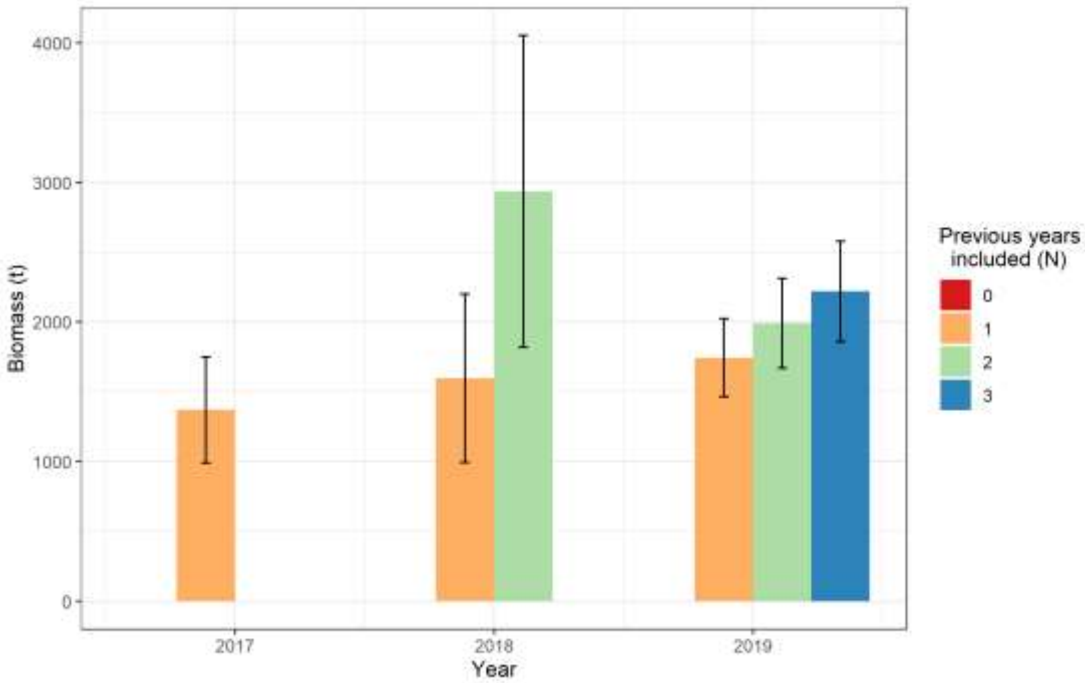

Figure 14. A. Biomass estimates without within year recoveries. The coloured bars indicate how many years of released tags were included in the analysis.

The biomass estimates are precautionary in that they are conditioned on the area in which tags have been released and recaptured. If seamounts have not been fished and tagged fish released there, then the biomass estimated by the tagging model may be an underestimate if there is limited mixing (see section 5.3.1.2 for further discussion).

The assumption that tagged fish mix randomly and are equally vulnerable to capture is reasonable, as tagged individuals are frequently caught mixed with untagged fish and with conspecifics (others of the same species). However, the assumption that the population is closed to migration may result in an over-estimate of biomass. It is known that there is migration of adult fish away from St Helena to the Gulf of Guinea and central Atlantic. The 2019 estimates in Figure 14 and Table 8, likely illustrates this effect as increasing the number of years of tag releases (adding older tagged fish) increases the estimate (see section 5.3.1.2). Some improvements to the Chapman assessment could include updating the estimate of migration rate out of the EEZ using satellite tagged fish or to estimate survival after tagging and release.

6.4.2 St Helena length distribution of catches

The stock was split into inshore and seamount recorded landings to provide an indication of the structure of the fishery in each area. The length distribution of the catch in each area ranges between 42 cm and 190 cm straight fork length. The interquartile range of yellowfin tuna caught in the different regions was 63 to 87 cm inshore, 77 to 101 cm at Bonaparte Seamount and 96 to 120 cm at Cardno Seamount (Figure 15). The results reflect fish entering the region inshore as juveniles, growing and moving between areas, as described within Section 6.1.

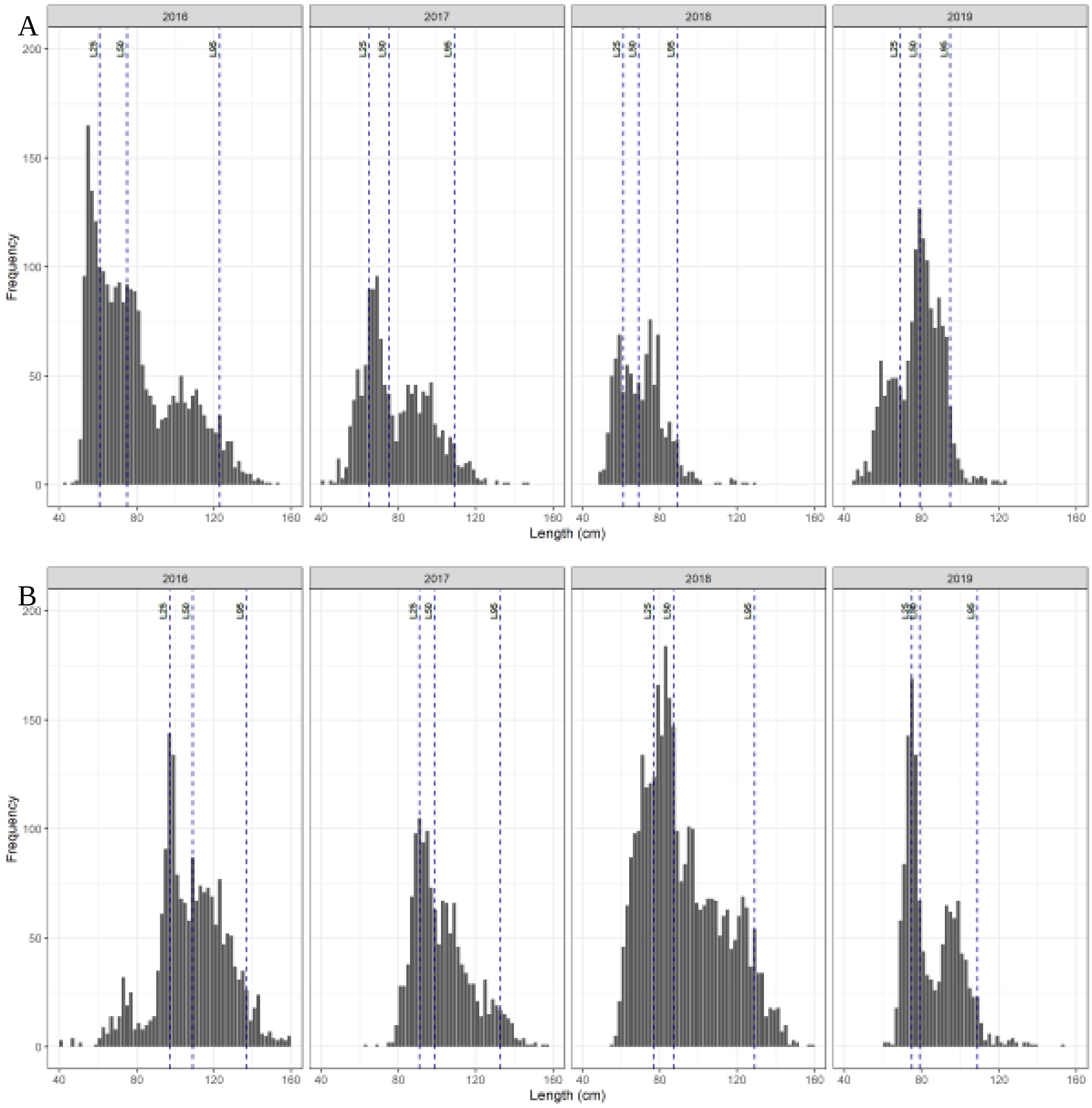

Figure 15. Annual length-frequency distributions of yellowfin tuna caught inshore (A) and at the Bonaparte and Cardno seamounts (B) showing indicators.

To add context to operations outside of St Helena's EEZ. In 2018, 8,198 t (6%) was landed by bait boats, 15,132 t (11%) was landed by longliners, 19,090 t (14%) was landed by other surface gears and 91,651 t (68%) was landed by purse seiners (ICCAT, 2019a). A summary of the size frequency of International yellowfin tuna landings in the surrounding waters of St Helena (between -20 and -5 latitude, and -10 and 0 longitude) and for the full stock are compared to local size-frequency distributions in Figure 16. The average size of fish caught by the purse seine fleet is less than 50 cm (2.34 kg whole weight) with a decline in average weight landed since 1990 when fishing on FADs commenced (ICCAT, 2019a).

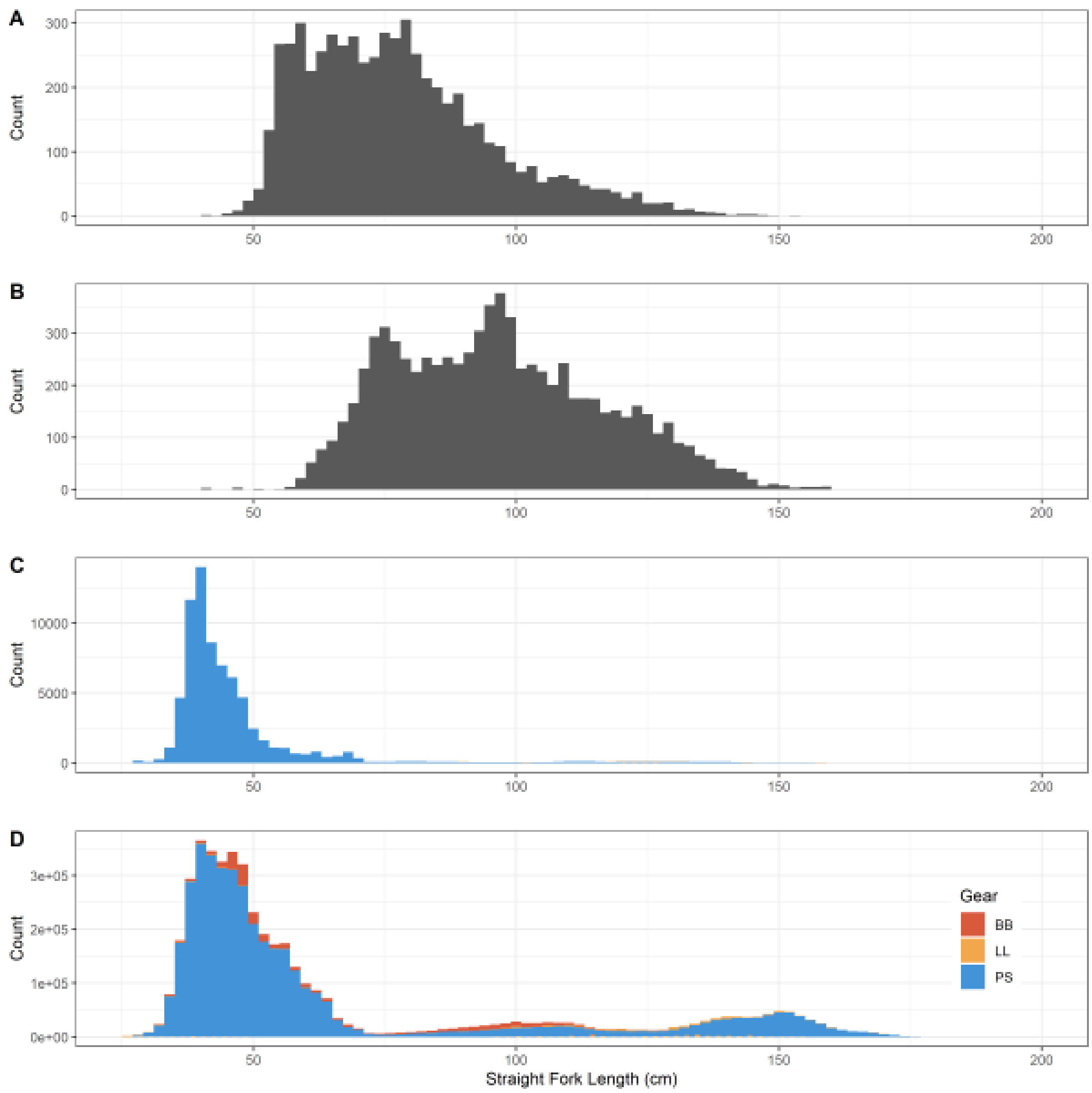

Figure 16. Yellowfin tuna size frequency recorded (A) within St Helena's EEZ by the inshore bait boat fleet between 2015 and 2019 (B) within St Helena's EEZ by the seamount fleet between 2015 and 2019, (C) between -20 and -5 latitude, and -10 and 0 longitude by the International fleet in 2012 and (D) for the full Atlantic stock by the International fleet in 2012. Gears used by the International fleet are bait boat (BB), longline (LL) and purse seine (PS).

6.4.3 Optimising landings

Yield-per-recruit (YPR) models were used to assess the trade-off between leaving fish to grow and catching them before migration. A model was created to mimic the local tuna biomass, with the model set up to assume migration out of the region once yellowfin reached 120 cm. In practice, this was done by increasing natural mortality to remove fish from the cohort once they reach 120 cm. A detailed summary of the yield-per-recruit analysis is provided in Appendix 14.1.2.

The YPR model can be used to mimic the behaviour and life-history characteristics from the local yellowfin tuna biomass. The analysis is carried out by constructing a model of the development of a cohort through time considering the growth and mortality of individuals. The analysis is conducted for a range of fishing mortalities and selection patterns (here varying the weight at first capture) and the theoretical yield derived from each is scaled to the initial recruitment. An example of a single model run with fishing pressure at 0.17 (F_{MSY}) and weight at first catch at 5 kg is shown in Figure 17. The model assumes full selection (all fish are "available" to the fishery) after the point of first capture (5 kg), with zero selection (no fish are "available" to the fishery) prior to this (Figure 17A). The quantity of catch is visualised in Figure 17B, indicating an increase in catch up to ~ 2.6 years, followed by a decrease as the numbers in the population are reduced due to mortality. The migration of fish above 3 years results in them no-longer being available to the fishery showing zero catch above this age (Figure 17B).

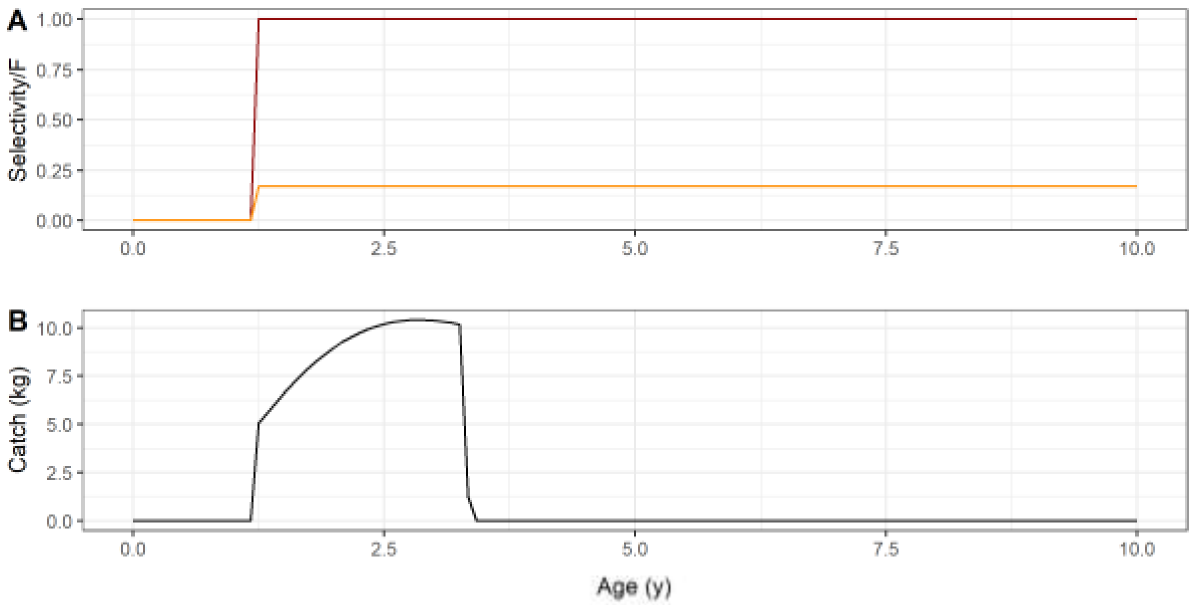

Figure 17. YPR model indicating yellowfin tuna age in relation to selectivity (red) and fishing mortality (*F*) (orange) [A] and catch (kg) [B].

The response of YPR to different fishing mortality and age at first capture (W_c) is shown in Figure 18. The model indicates that at F_{MSY} (0.17), to maximise yield-per-recruit a minimum landings size of 2.75 kg (52 cm) is suggested. Lower W_c allows St Helena to benefit from catches before the tuna migrate away.

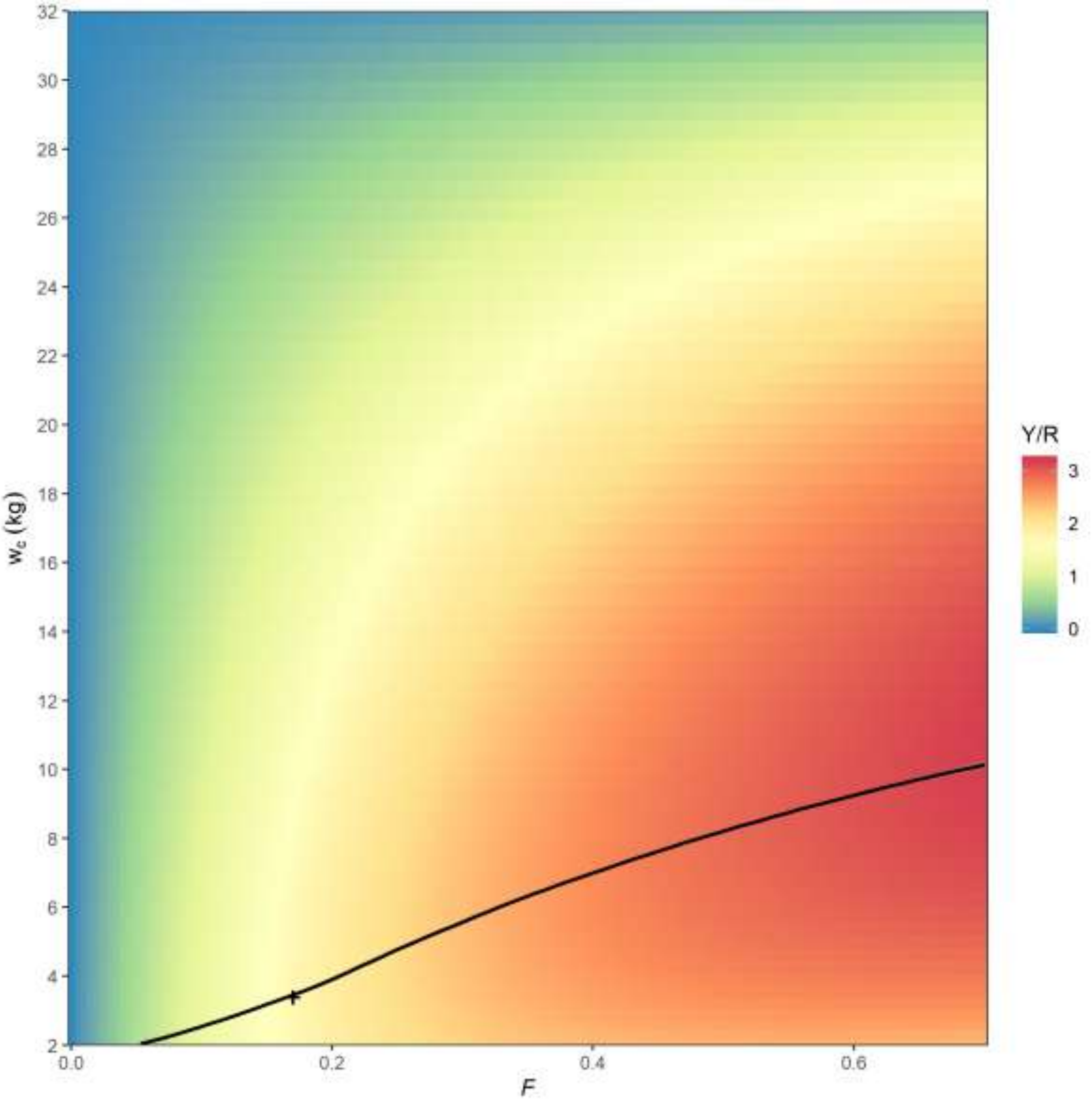

Figure 18. YPR for combinations of fishing mortality (*F*) and weight at first capture (w_c). The black line represents the W_c leading to maximum YPR for yellowfin tuna at each level of *F*. The black cross indicates F_{MSY}.

YPR analyses model a single cohort of fish and inherently assume that recruitment and the resulting age structure of the population is constant. Therefore, YPR analyses do not consider the issue of whether the fishing rate and weight at first capture predicted to produce maximum YPR is sustainable. For that reason, predicted yields are used for guidance for the weight at first capture only. The YPR analysis indicates that there is a trade-off between letting fish grow and catching them before migration and indicates that it may not be possible to find a completely optimal solution for this fishery.

6.5 Advice

The most recent ICCAT yellowfin assessment (ICCAT, 2019a) indicates that the stock has a high probability of not being overfished and of overfishing not occurring.

Locally, the average landings of yellowfin tuna between 1977 and 2018 was 125 t. For yellowfin tuna, caught throughout the EEZ, provisional tagging returns indicate a precautionary average local biomass estimate of around 1,916 t (based on tag releases from 2016 to 2018). Noting that this does not take into consideration other biomass that may be available within the EEZ, at other fishing grounds, and therefore is advised as a precautionary estimate. Following the ICCAT optimum exploitation rate of 13% this would imply yellowfin catches of 254 t.

Yield-per-recruit analysis was used to explore the effect of changing fishing effort and minimum landing sizes on theoretical maximum yields within St Helena's EEZ, with results indicating that there is a trade-off between letting fish grow and catching them before migration out of the EEZ. ICCAT's advice to reduce landings of small juveniles requires an MLS of 3.2 kg (56 cm SFL). With average St Helena catch weights of yellowfin tuna generally above this minimum, and in particular well above those caught by the international fleet, setting an MLS is considered a market objective rather than being required to optimise management of the local biomass. Therefore, maintaining the current market MLS at 5 kg is consistent with advice from ICCAT to minimise landings of small yellowfin tuna.

Scientific monitoring of the yellowfin should continue and include:

- Use of logbooks for all vessels
- Continuation of the current tagging programme across all tuna fishing grounds
- Biological sampling of gonads and length measurements to assess seasonal changes in sex and maturity by region

7 Bigeye tuna, *Thunnus obesus*

7.1 Distribution

Bigeye tuna are distributed throughout the tropical and sub-tropical waters of the Atlantic Ocean (between 50°N and 45°S) but are not caught in the Mediterranean Sea. It is currently considered that there is an Atlantic-wide single stock, though more complex scenarios of stock structure are possible. Adults spawn in tropical waters where the nursery areas are also located, juveniles diffuse into temperate waters as they grow. The Gulf of Guinea is defined as a major nursery ground for this species. Thus, St Helena waters are likely a feeding area for the species to the south of the key bigeye tuna fishing grounds in the Gulf of Guinea (Figure 19). The waters surrounding St Helena have relatively high landings from longlining vessels at the edge of the fishery range.

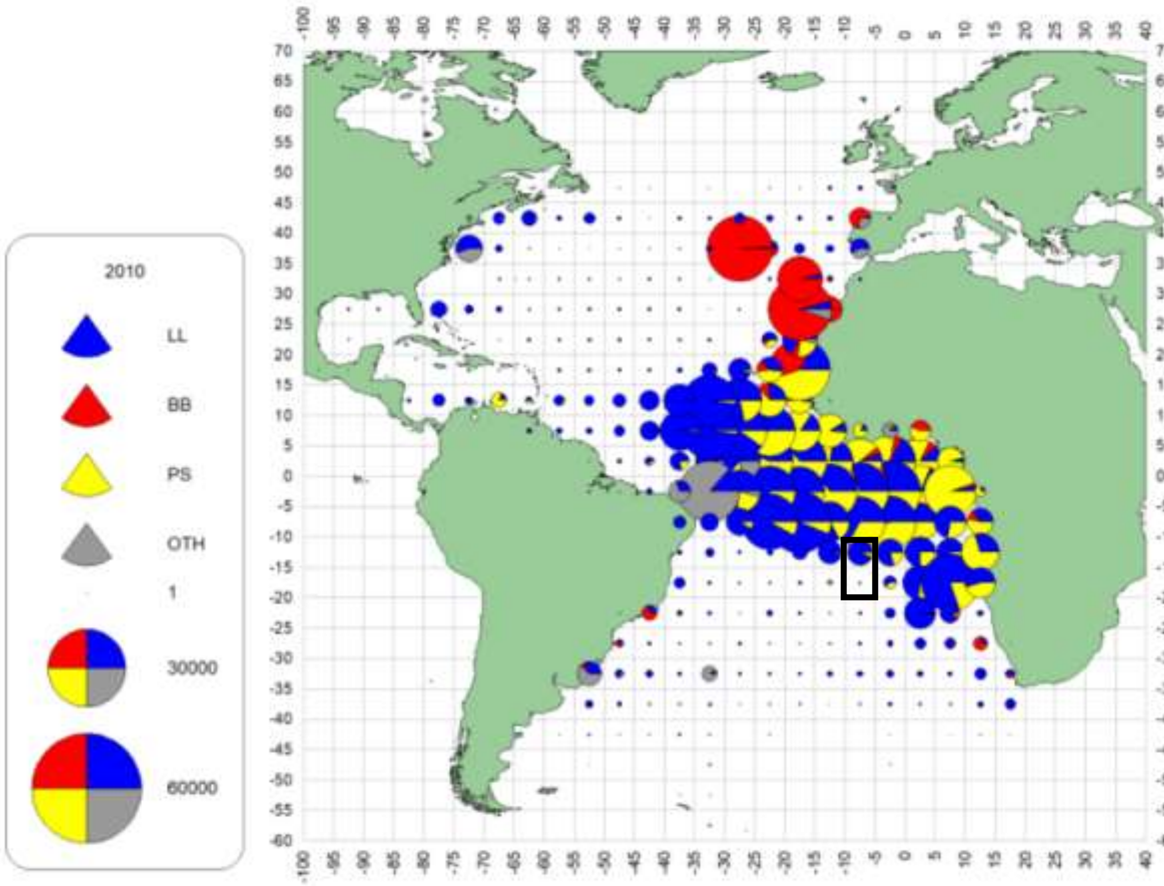

Figure 19. Bigeye tuna total catches between 2010 and 2017 in the Atlantic from ICCAT data (source: ICCAT Assessment Summary). The quadrant for St Helena is highlighted as the black box at -10 longitude and -20 to -15 latitude.

Within St Helena's EEZ, bigeye tuna are distributed from inshore regions out to the 200 nm limit of the EEZ, with bigeye caught predominantly at Cardno Seamount (particularly the eastern fishing ground known as the Southern Cross Seamount, as shown in Figure 1B). The size-frequency of bigeye tuna landed or tagged at Cardno Seamount and inshore is shown in Figure 20. There is no distinct and clear year class (cohort) identifiable in the frequencies for each month and year. However, there is a size gradient with the largest individuals caught at Cardno Seamount and a mixture of juveniles and adults caught inshore (Figure 20). The fish size in catches varies between 45 cm and 194 cm SFL with the interquartile range of bigeye tuna caught as 104 to 135 cm (Figure 20).

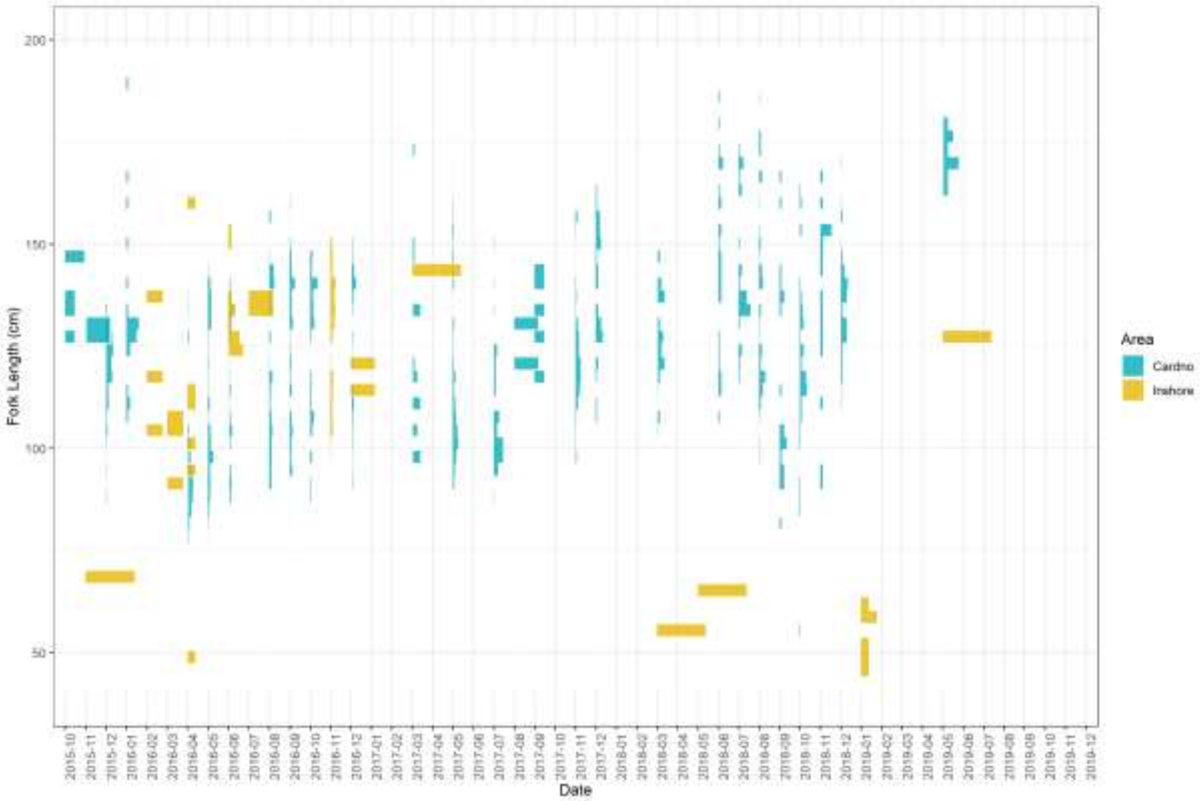

Figure 20. Length – frequency distribution of biological samples and tagged bigeye tuna at Cardno Seamount and from inshore areas around St Helena island.

The limited amount of tag recoveries to date and lack of clear cohorts in the length-frequency data make it difficult to assess the migratory potential and linkages of the St Helena bigeye tuna to other key grounds. However, daily position estimated for five satellite tagged bigeye released at Cardno Seamount, indicates that bigeye tuna can remain resident for up to nine months after release (Figure 21). The distribution is consistent with the distribution of the fishery, shown in Figure 19 which lies to the north of St Helena. The time over which the fish are resident in St Helena waters indicates that tagging conducted throughout the year would be likely to provide a means of estimating the annual local bigeye tuna biomass, as has been applied to provide provisional estimates of the yellowfin tuna.

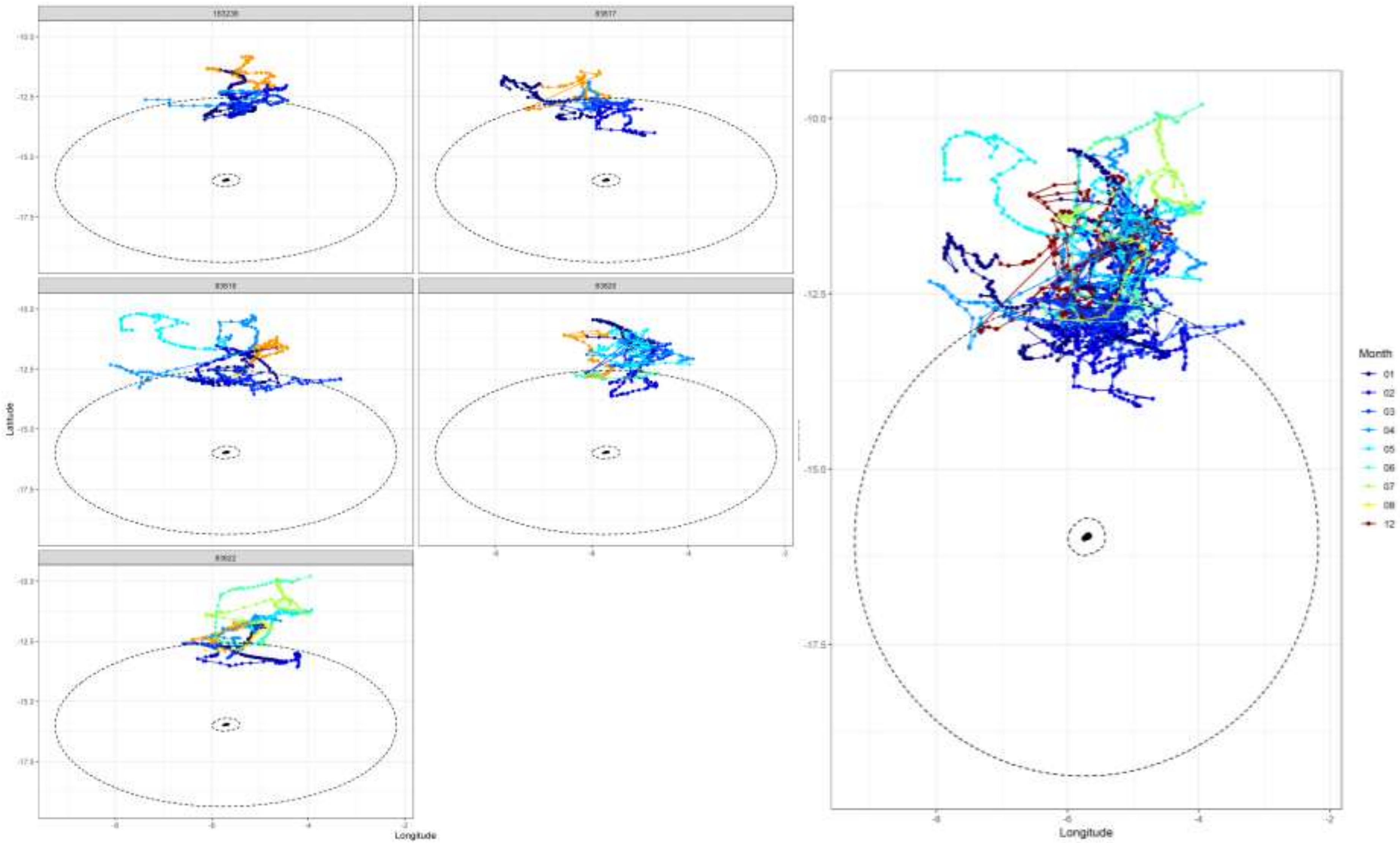

Figure 21. State space model daily position estimates (SSM) for satellite tagged bigeye tuna highlighting all individuals at liberty by month (N = 5) with colour as month at liberty. (Wright et al. in prep).

7.2 Landings

International bigeye tuna catches, which are taken by a mixture of purse seine, longline and pole and line boats peaked at 134,000 t in 1994 but has stabilised at around 75,000 t in recent years (Figure 22). The most recent ICCAT bigeye assessment (ICCAT, 2018) indicates that the stock has a high probability of being overfished and that overfishing is occurring. The maximum sustainable yield from the assessment was 76,200 t and the current relative fishing rate, F_{2017}/F_{MSY}, was 1.63, or 63% above the optimum. Maintaining the catches at recent levels in the future, is estimated to further reduce the probability of achieving the agreed sustainability targets of biomass at or above B_{MSY}, and fishing mortality at or below F_{MSY} by 2033 to around 1%. Thus, ICCAT's Scientific Committee advised that the Commission should ensure that catches are appropriately reduced to end overfishing and allow stocks to rebuild. On average, St Helena lands 0.03% of the Atlantic bigeye stock within the EEZ (ranging from 0% to 0.25% since 1977, Table 9).

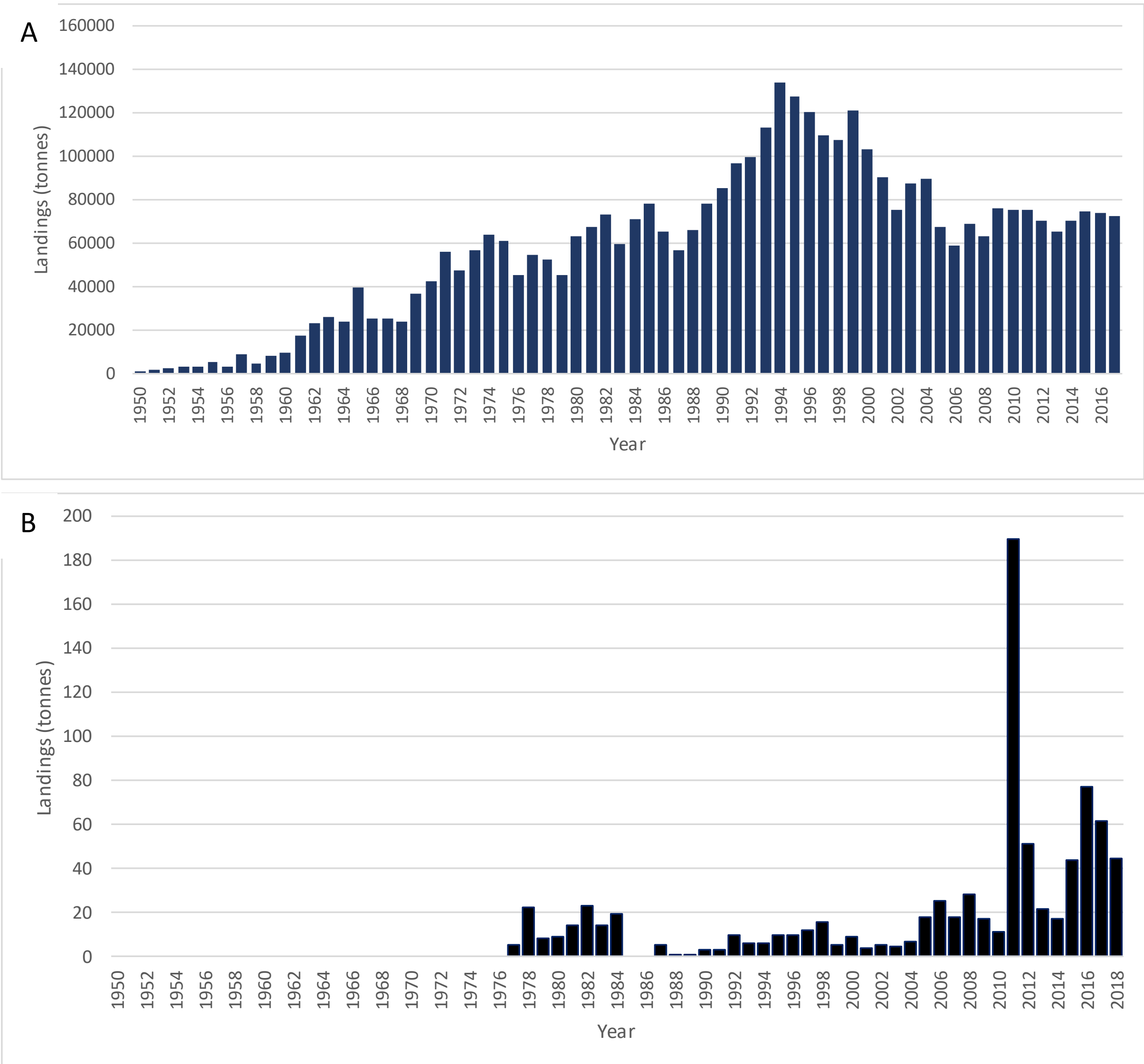

Figure 22. Annual bigeye tuna landings in the Atlantic (A) and for St Helena only (B).

In September 2019, ICCAT agreed a management plan for bigeye such that CPC's[1] with a recent average catch less than 1,000 t are encouraged to maintain their catch and effort at recent levels. ICCAT also agreed that for tropical tuna species any CPCs with recent average catches of less than 1,000 t that have planned an expansion of capacity in 2020, will have to provide a declaration to the Secretariat by 31 January 2020. The UKOTs have presented a submission to ICCAT indicating an intention to limit their bigeye fishing opportunities to combined bigeye catches < 1000 t.

Since the early 1990's selectivity of the fleets has changed towards smaller fish due to fishing around FADs by purse seiners in the South Atlantic (Figure 23).

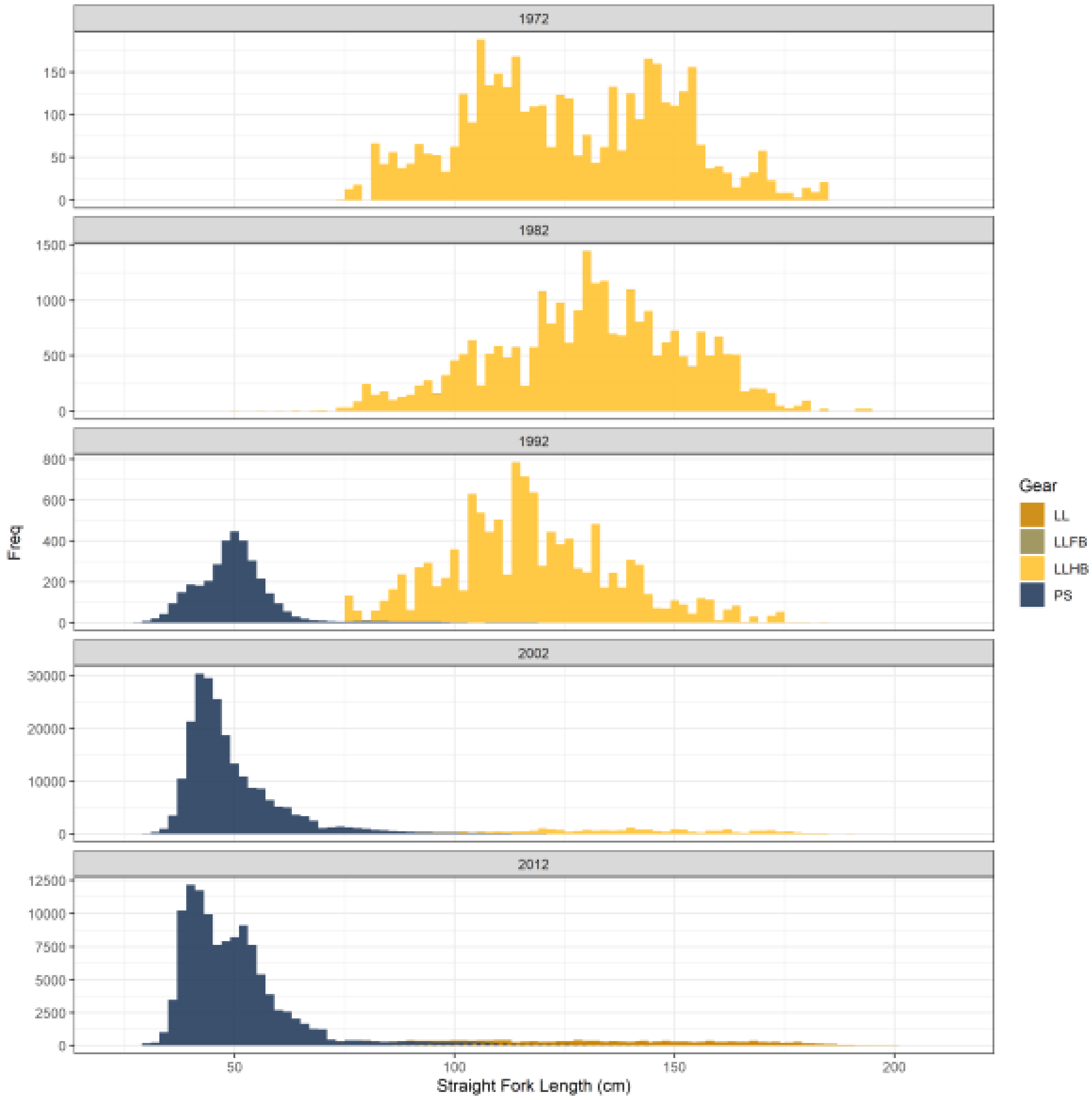

Figure 23. Decadal bigeye tuna size frequency recorded between -20 and -5 latitude, and -10 and 0 longitude by the International fleet since 1972.

[1] Contracting Parties and Cooperating Non-Contracting Parties to the Commission

Landings by the local commercial fishery since 1977 (Table 9), are collected by St Helena Fisheries Corporation plant. Between 1977 and 2018 the average bigeye catch in St Helena has been 32 t (minimum 0, maximum 190 t), with increases associated with more fishing effort at the seamounts (Section 4.1, Table 1). The maximum quantity landed inshore was in 2011 when 148 t of bigeye tuna was landed (42 t was also landed at the seamounts in 2011), and at the seamounts where 108 t was landed in 2005.

Table 9. St Helena bigeye tuna monthly landings (kg) by year and percent of International Atlantic bigeye tuna landings (% INT).

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL (KG)	% INT
1977													5000	0.01
1978													22000	0.04
1979													8000	0.02
1980													9000	0.01
1981													14000	0.02
1982													23000	0.03
1983													14000	0.02
1984													19000	0.03
1985													0	0.00
1986													0	0.00
1987													5000	0.01
1988													1000	0.00
1989													1000	0.00
1990													3000	0.00
1991													3000	0.00
1992													10000	0.01
1993													6000	0.01
1994													6000	0.00
1995													10000	0.01
1996													10000	0.01
1997													12000	0.01
1998	76	0	20	1503	2633	4576	4771	388	15	0	292	1174	15447	0.01
1999	354	160	508	2126	1204	417	199	14	0	64	0	0	5045	0.00
2000	366	0	443	734	1342	441	94	28	1761	0	1828	1795	8832	0.01
2001	759	0	255	39	251	747	800	11	88	19	181	936	4085	0.00
2002	91	340	0	231	945	835	250	0	0	673	980	748	5093	0.01
2003	76	0	215	526	1023	637	266	0	65	227	659	790	4482	0.01
2004	24	449	1064	675	1770	742	829	61	149	252	304	159	6474	0.01
2005	57	195	664	4065	4793	2142	333	2860	153	0	1241	1365	17864	0.03
2006	554	116	567	4575	1608	740	3806	5748	0	264	163	7348	25487	0.04
2007	94	0	1935	529	2238	6136	4913	433	1487	0	0	123	17886	0.03
2008	47	7	49	1842	4582	3238	1796	794	0	640	6944	8064	27999	0.04
2009	1533	66	266	667	6863	3614	1034	1359	285	49	1251	141	17127	0.02
2010	46	0	658	2026	3914	1004	659	2836	0	0	0	39	11179	0.01
2011	12	6512	19461	35397	28057	5772	41	43337	9531	42	978	40752	189889	0.25
2012	21060	19946	2688	974	1728	395	234	24	261	430	2626	931	51295	0.07
2013	12573	722	677	364	1299	202	0	0	0	135	527	4977	21475	0.03
2014	546	1338	3417	857	1951	336	43	1100	2708	1587	2579	922	17383	0.02
2015	113	41	1008	656	398	263	162	568	297	338	362	39857	44061	0.06
2016	3588	661	228	6300	13400	5486	1461	4858	8994	13251	8882	10249	77354.5	0.10
2017	128	4236	847	3602	4743	20	3370	1255	541	10943	11169	20368	61218	0.08
2018	6996	2223	4949	5055	7017	1157	5033	387	2003	3997	5126	294	44234.5	0.06

7.3 Length-weight

The lengths and weights of landed tuna have been collected at the local processing facility since 2015. From this information the relationship between length and weight for locally landed bigeye tuna is:

$$W = 1.165 \cdot 10^{-5}(L)^{3.168} \qquad r^2 = 0.9542, P<0.0001$$

where, L = straight fork length (cm), and W = gilled and gutted weight (kg).

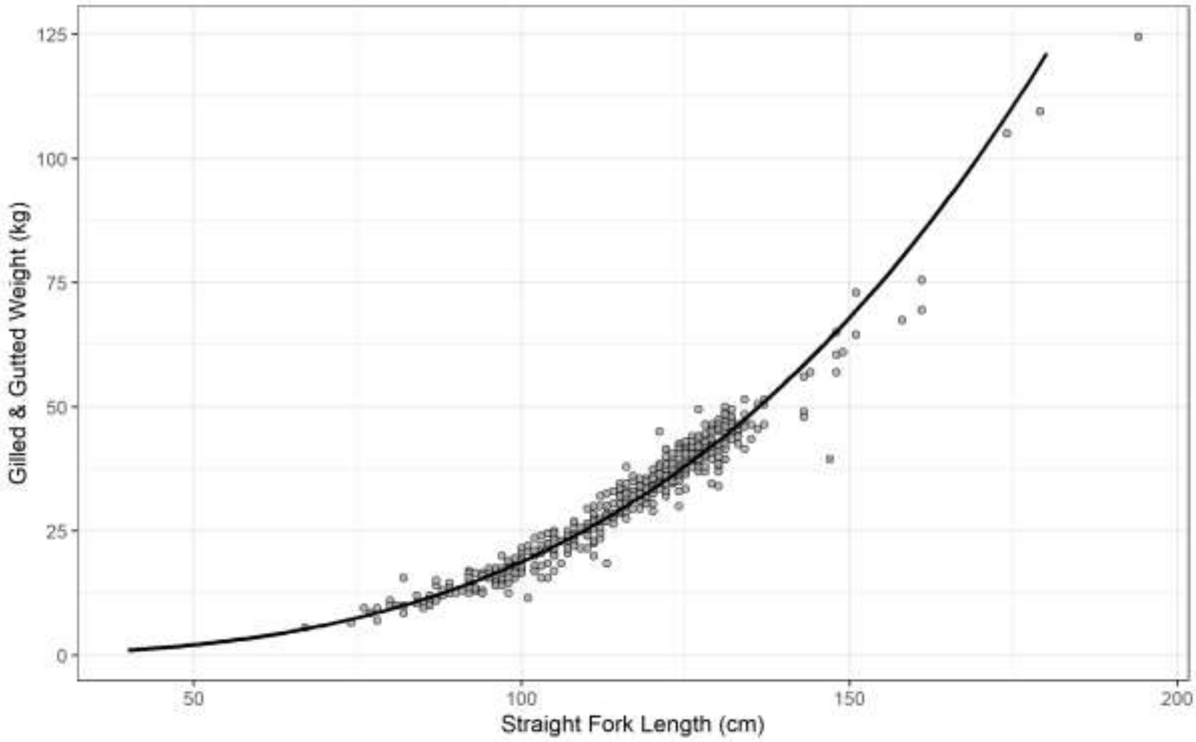

Figure 24. Length-weight relationship for bigeye tuna (*Thunnus obesus*)

Corresponding length-weight conversions using this growth equation are shown in Appendix 14.2.

7.4 Estimation of local biomass status

7.4.1 Biomass assessment

There have been insufficient releases and recoveries of tagged bigeye tuna within St Helena's EEZ to assess the local biomass. The numbers of bigeye released and recovered by year is shown in Table 10. All recoveries to date were from the grounds which they were released (Cardno Seamount).The recaptures from the increased number of tags released in 2018 and the retention of bigeye tuna within the EEZ established by the satellite tagging (Section 7.1) indicate that tagging should be able to provide estimates of the local biomass of this species in St Helena waters.

Table 10. Numbers of bigeye tuna tagged and released each year

		Recapture				Recovered
Year	Released	2016	2017	2018	2019	
2016	1	0	0	0	0	0%
2017	0	0	0	0	0	0%
2018	115	0	0	7	0	6%
2019	6	0	0	0	0	0%
Total	**122**	**0**	**0**	**7**	**0**	

For bigeye tuna, the smaller and more temporally fragmented fishing effort deployed, releasing fewer tags, has resulted in very few returns. There is also likely to be emigration with tags moving out from the region, although the satellite tag results do show a degree of residency. More directed tagging effort at Cardno would help determine the dynamics of the local stock and external linkages.

7.4.2 St Helena length distribution of catches

Bigeye catches were aggregated for all fish caught within St Helena's EEZ to provide a length distribution for each year for which data were available. The fish size in catches varied between 45 cm and 194 cm SFL. The interquartile range of bigeye tuna caught in the different regions was 112 to 138 cm inshore and 103 to 135 cm at Cardno Seamount (Figure 25). A 103 cm bigeye tuna is approximately 20.5 kg gilled and gutted weight. Mean average weight of bigeye tuna landed by the fishery Internationally has remained stable since around 2004 at around 10 kg, with variability in average size depending on the gear used to fish, with an average of 55 kg for longliners, 10 kg for bait boats and 6 kg for purse seiners (ICCAT, 2018).

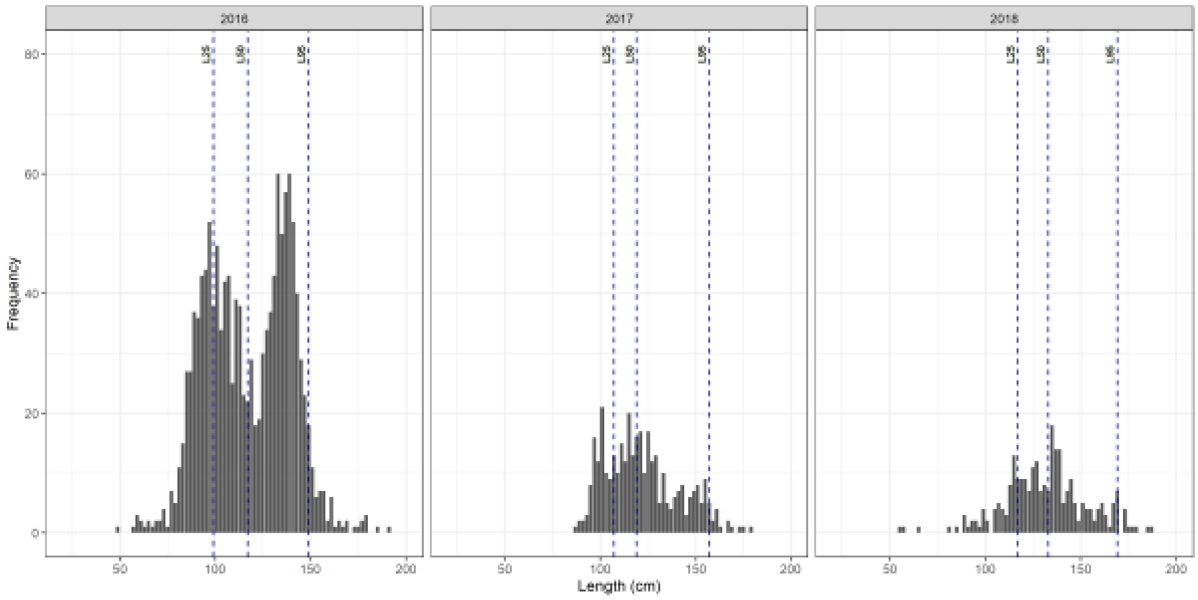

Figure 25. Length-frequency distribution of bigeye tuna caught within St Helena's.

To add the context for operations outside of St Helena's EEZ. The purse seine and longline fleets catch the majority of bigeye tuna in the Atlantic (ICCAT, 2018). For example, in 2018, 7,940 t (11%) was landed by bait boats, 32,032 t (44%) was landed by longliners, 4,567 t (6%) was landed by other surface gears and 27,749 t (38%) was landed by purse seiners. A summary of the size frequency of International bigeye tuna landings in the surrounding waters of St Helena (between -20 and -5 latitude, and -10 and 0 longitude) and the wider stock is compared to local size-frequency distributions in Figure 26. Compared to International landings, the size frequency reported by the longline fleet is relatively similar to landings by the bait boat fleet within St Helena's EEZ, whilst the purse seine fleet lands fish which are mostly <75 cm SFL. Fish less than 75 cm are mostly absent from landings by the St Helena's fishery for bigeye (Figure 26).

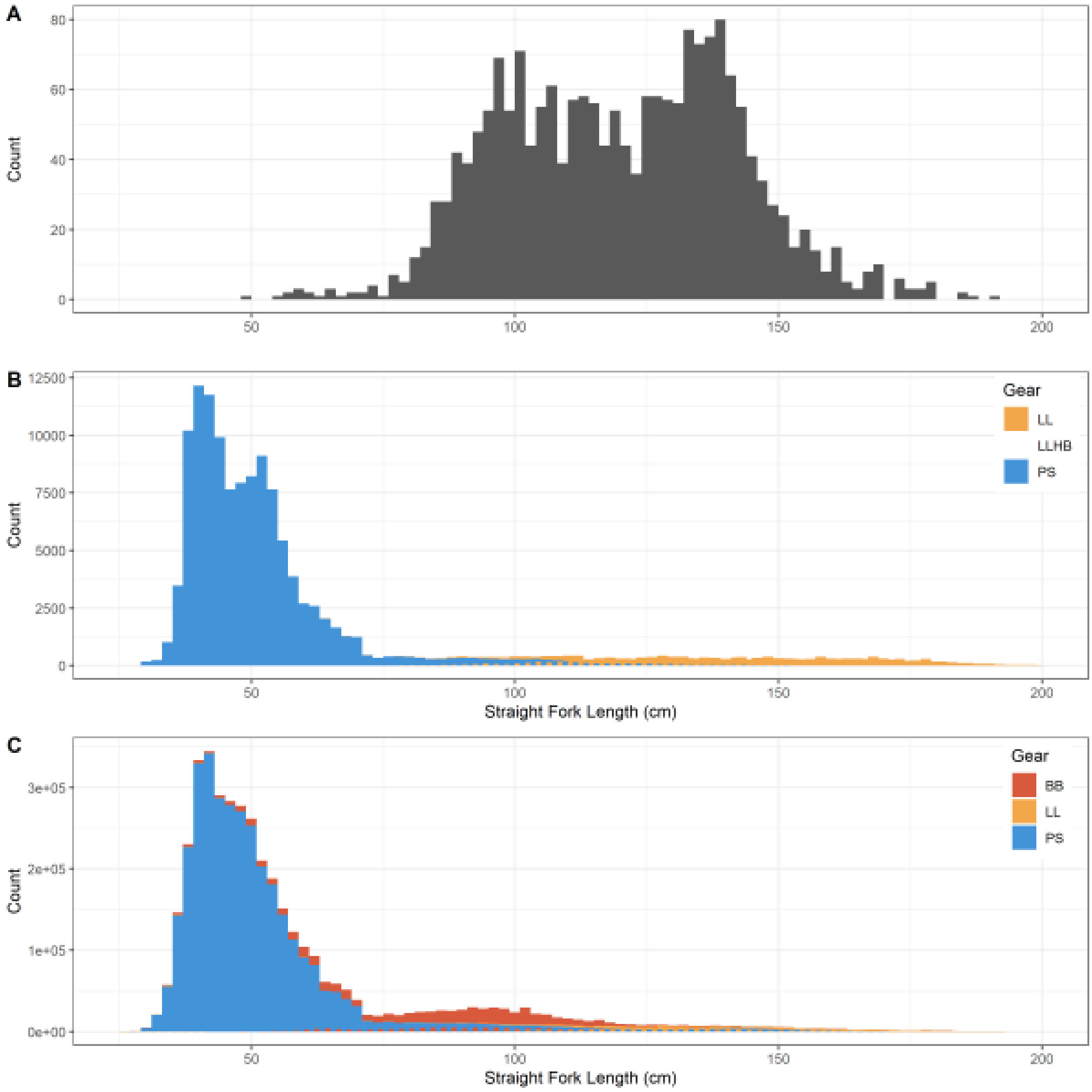

Figure 26. Bigeye tuna size frequency recorded (A) within St Helena's EEZ by the inshore bait boat fleet between 2015 and 2019, (B) between -20 and -5 latitude, and -10 and 0 longitude by the International fleet in 2012 and (C) for the full stock by the International fleet in 2012. Gears used by the International fleet are bait boat (BB), longline (LL) and purse seine (PS).

7.5 Advice

The most recent ICCAT bigeye assessment (ICCAT, 2018) indicates that the stock has a high probability of being overfished and of overfishing occurring. Thus, ICCAT's Scientific Committee advised that in the short-term the Commission should ensure that catches are appropriately reduced to end overfishing and allow stocks to rebuild.

In September 2019, ICCAT agreed a management plan for bigeye such that CPC's with a recent average catch less than 1,000 t are encouraged to maintain their catch and effort at recent levels. ICCAT also agreed that for tropical tuna species any CPCs with recent average catches of less than 1,000 t that have planned an expansion of capacity in 2020, will have to provide a declaration to the Secretariat by 31 January 2020. The UKOTs (including St Helena) presented a submission to ICCAT indicating an intention to limit their bigeye fishing opportunities to catches < 1000 t (previously 1,545 t). To minimise risk from local depletion, it is recommended that any expansion to the current fishery is exploratory with associated management measures; including that expansions are implemented gradually, as a precautionary feedback process, including full observer coverage and comprehensive data collection.

ICCAT also noted that over the long-term, recent increased international catches of small fishes could have had negative consequences for the productivity of bigeye tuna fisheries (e.g. reduced maximum yield and increased spawning stock biomass required to produce MSY). Current exploitation patterns assessed from length data from the St Helena fishery indicates that fish are taken at a good size indicating sustainable fishing (large mature individuals). The St Helena catch structure would not be considered to be impacting the stock in the same way.

Preliminary electronic tag recoveries at Cardno Seamount indicate that there is a degree of site fidelity up to nine months after release, which suggests that it may be possible to estimate biomass for this population in the future. However, as yet there are insufficient tagging returns to provide advice on the abundance of the local biomass. Additional conventional tagging of this population will help to assess connectivity and sustainability of targeting this population.

Scientific monitoring of the bigeye should continue and include:

- Use of logbooks for all vessels
- Increased conventional tagging across all bigeye fishing grounds
- Biological sampling of gonads and length measurements to assess seasonal changes in sex and maturity by region

8 Skipjack tuna, *Katsuwonus pelamis*

8.1 Distribution

Skipjack tuna are distributed throughout the tropical and sub-tropical waters of the three oceans. Skipjack is the predominant species found associating with FADs where it is caught with other juvenile tropical tunas (yellowfin and bigeye tuna). Atlantic tag recoveries of skipjack indicate average distances travelled of < 500 miles between tagging and recovery positions (ICCAT, 2014). The high regional attachment of skipjack suggests low probability of mixing between populations in the North and South Atlantic. Though, further tagging research is recommended to better understand stock structure.

In the Atlantic, skipjack tuna are caught by a mixture of bait-boat and purse seine boats (Figure 27), with highest catches in the Gulf of Guinea around the equator. St Helena lies to the south of the region with highest catches, with skipjack in the surrounding waters mostly caught by purse seine vessels (Figure 27).

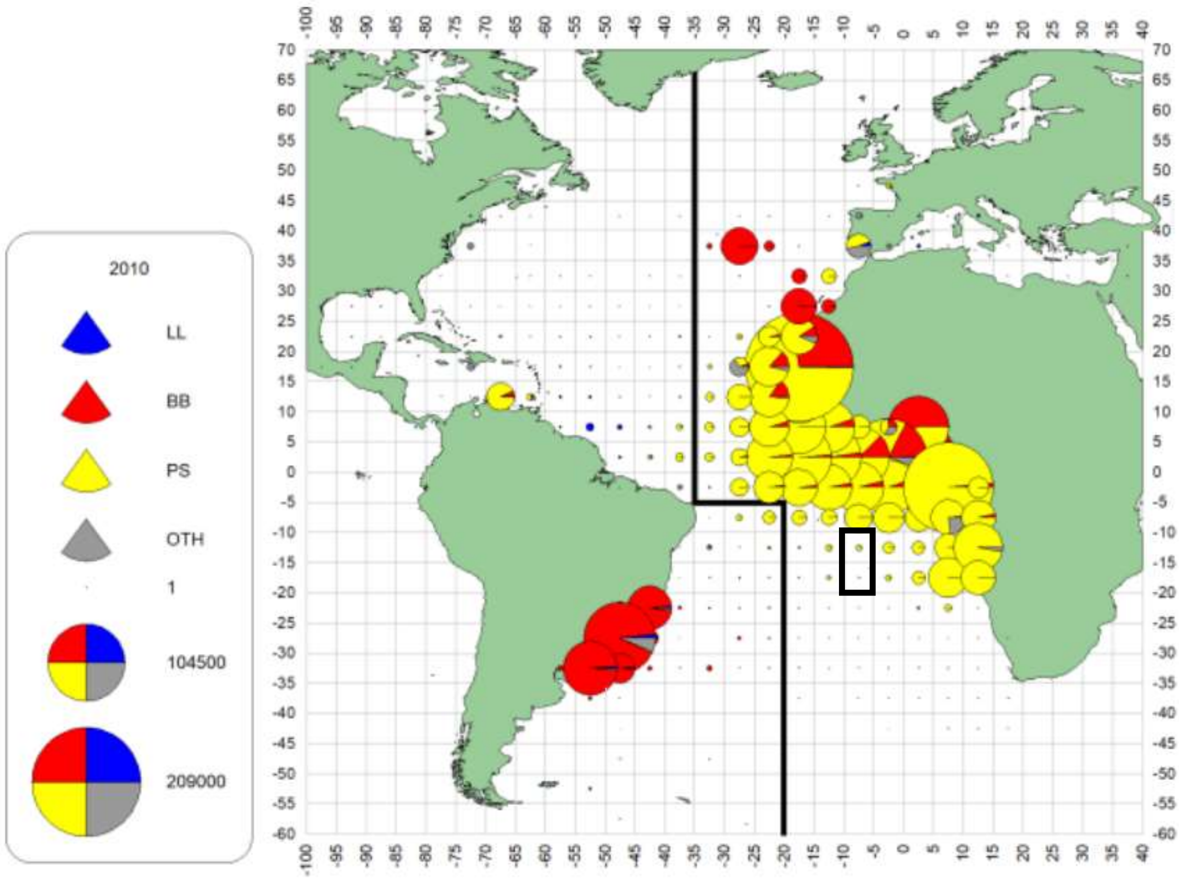

Figure 27. Skipjack tuna total catches between 2010 and 2017 in the Atlantic from ICCAT data (source: ICCAT Assessment Summary). The quadrant for St Helena is highlighted as the black box at -10 longitude and -20 to -15 latitude.

Within St Helena’s EEZ, skipjack are widely distributed from inshore regions out to the 200 nm limit of the EEZ, though there is a strong seasonal dynamic to the fishery, with increased landings between December and June (the warm months) (Figure 6).

The size-frequency of skipjack tuna landed or tagged within St Helena’s EEZ is shown in Figure 28. There is no distinct and clear year class (cohort) identifiable in the frequencies for each month and year. The fish size in catches varies between 24 cm and 75 cm SFL with the interquartile range of skipjack tuna caught as 45 to 53 cm (Figure 28).

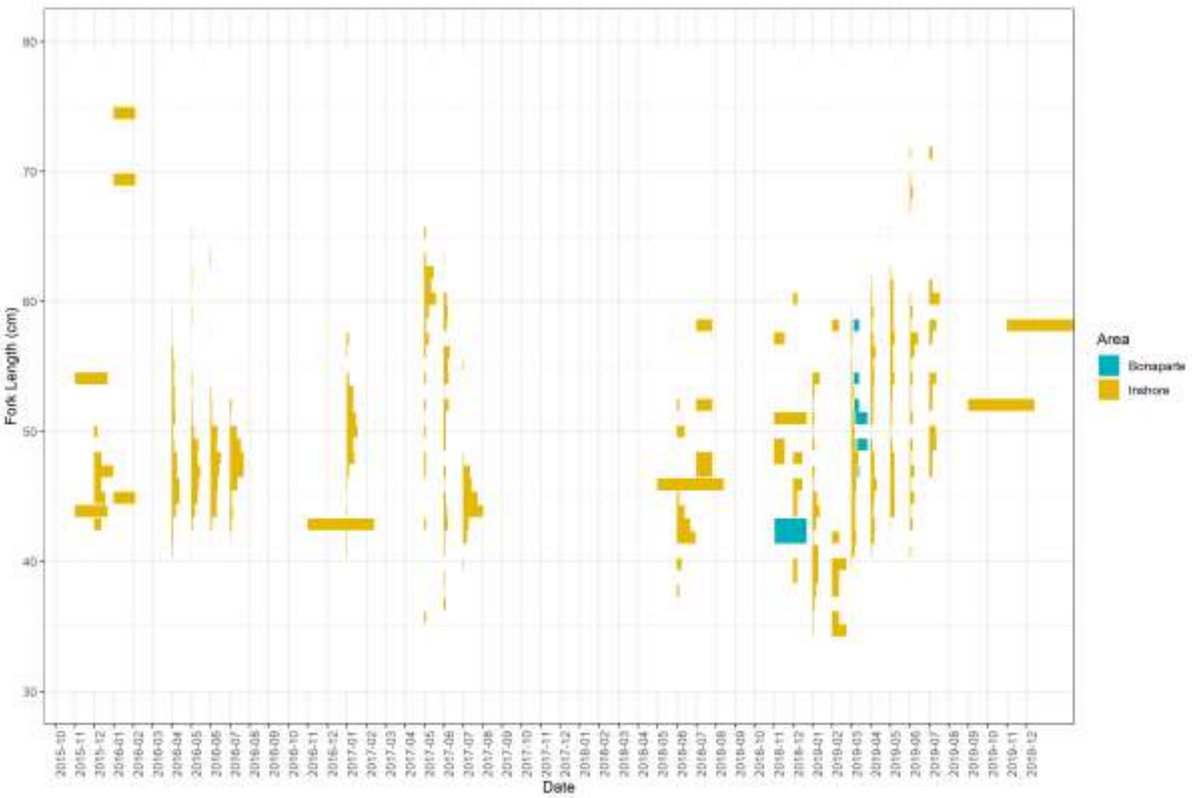

Figure 28. Length – frequency distribution from biological sampling or tagged skipjack tuna at Bonaparte Seamount and from inshore areas around St Helena island.

To add context to operations outside of St Helena’s EEZ. A summary of the size frequency of International skipjack tuna landings in the surrounding waters of St Helena (between -20 and -5 latitude, and -10 and 0 longitude) and for the stock as a whole is compared to local size-frequency distributions in Figure 29. Compared to International landings, the size frequency reported by the purse seine and bait boat fleets are relatively similar to landings by the bait boat fleet within St Helena’s EEZ, though there is a higher proportion of fish landed below 40 cm for the purse seine fleet Internationally (Figure 29).

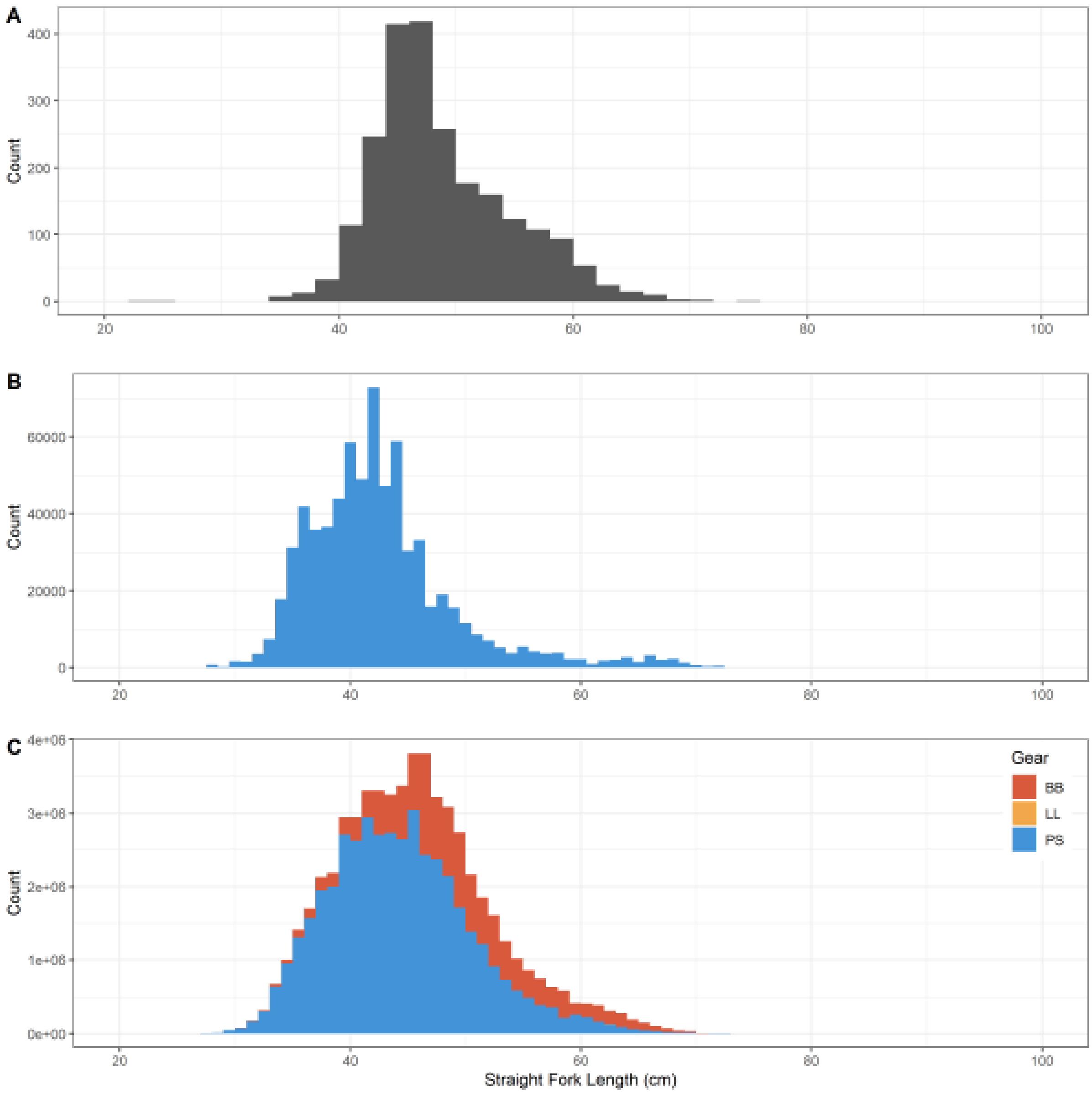

Figure 29. Skipjack tuna size frequency recorded (A) within St Helena's EEZ by the inshore bait boat fleet between 2015 and 2019 and (B) between -20 and -5 latitude, and -10 and 0 longitude by the International fleet in 2012. Gears used by the International fleet are bait boat (BB), and purse seine (PS).

8.2 Landings

International skipjack tuna catches, which are taken by mostly purse seine and bait boats have an increasing trend with highest landings in 2017 with around 250,000 t landed (Figure 30). Skipjack are currently split into eastern and western assessment components. The most recent ICCAT skipjack assessment (ICCAT, 2014) indicates that the eastern stock is not likely to be overfished and is not likely to be undergoing overfishing. The maximum sustainable yield from the assessment could not be calculated for the eastern stock, but even if caution is exercised when diagnosing the state of the stock, there is no evidence of a fall in yield or in average weight of individuals captured (ICCAT, 2014). The current relative fishing rate F_{2013}/F_{MSY} was likely < 1 for the eastern stock, though some caution was suggested as catch rates could be at or potentially above the MSY. On average, St Helena lands 0.42% of the East Atlantic skipjack stock within the EEZ (ranging from 0% to 0.42% since 1977, Table 11).

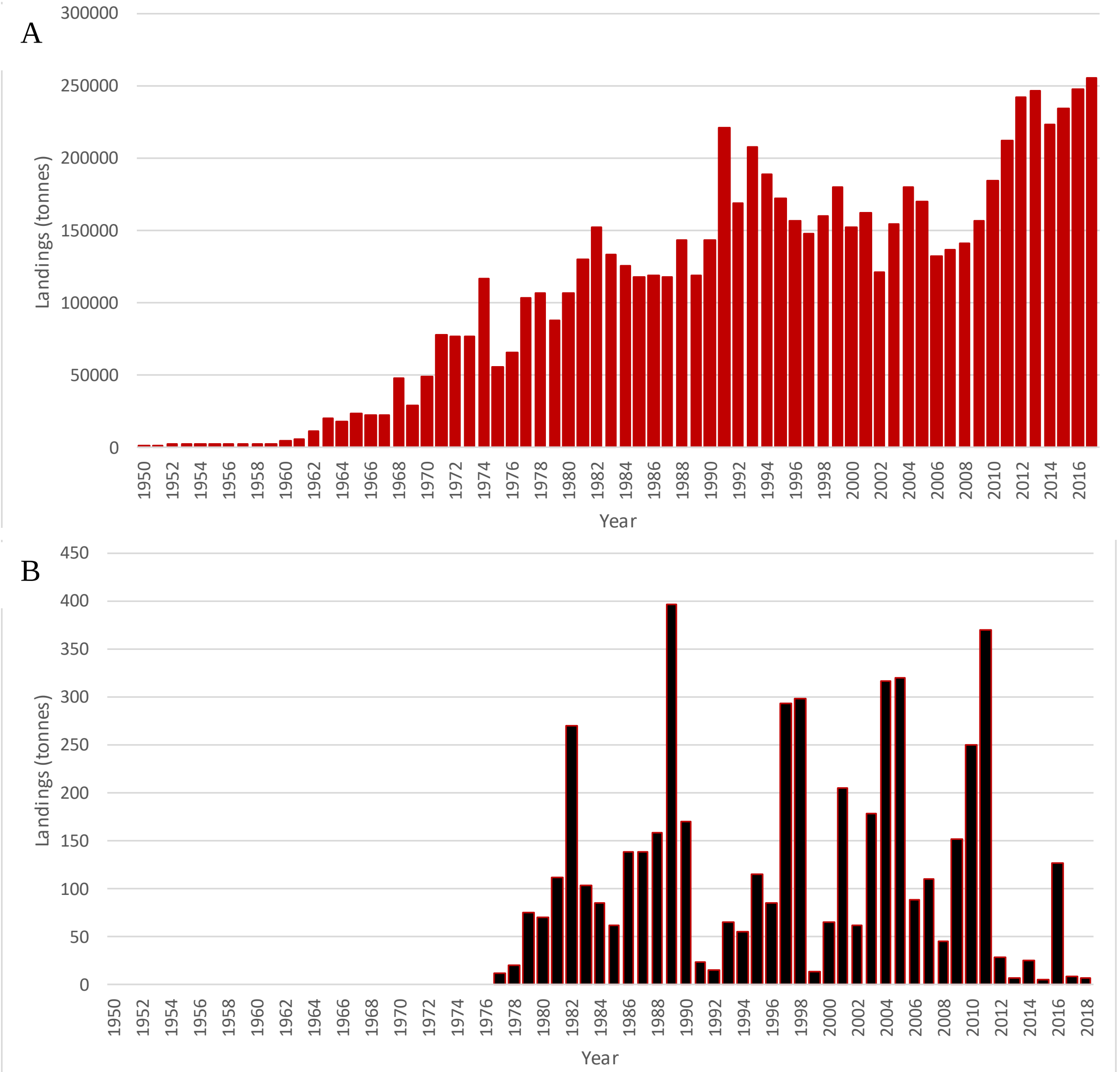

Figure 30. Annual skipjack tuna landings for the East Atlantic (A) and for St Helena only (B).

Skipjack in the East Atlantic are mostly caught by purse seine vessels, with a similar size at landing since 1992 (Figure 31).

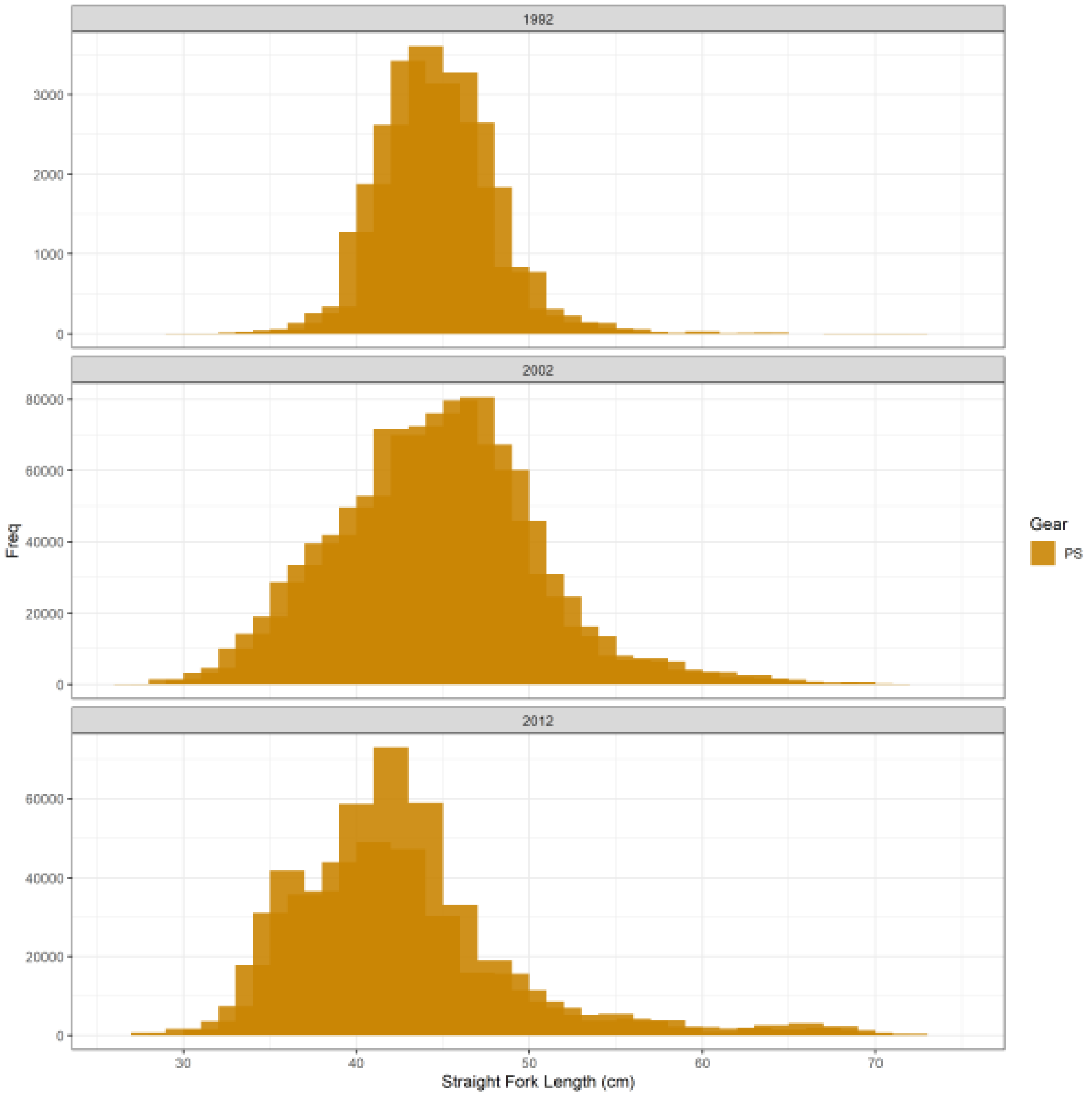

Figure 31. Decadal skipjack tuna size frequency recorded between -20 and -5 latitude, and -10 and 0 longitude by the International fleet since 1992.

Landings by the local commercial fishery since 1977 (Table 11), are collected by St Helena Fisheries Corporation plant. Between 1977 and 2018 the average skipjack catch in St Helena has been 123 t (minimum 6 t and maximum = 400 t).

Table 11. St Helena skipjack tuna monthly landings (kg) by year and percent of International East Atlantic skipjack tuna landings (% INT).

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL (KG)	% INT
1977													12000	0.01
1978	0	110	2970	9040	3930	1430	1390	2030	0	0	0	0	21000	0.02
1979	0	1280	6220	24480	39280	3980	640	0	0	0	0	0	76000	0.09
1980	0	830	9430	33400	20640	5100	150	0	0	0	0	0	70000	0.07
1981	0	2030	19300	55880	28450	5080	2030	860	0	0	0	0	112000	0.10
1982	1830	10770	132780	37790	42870	45210	1620	1210	0	0	0	0	271000	0.22
1983	5320	30580	37910	7350	9040	6800	760	0	0	0	0	0	103000	0.10
1984	110	10880	46270	2730	21810	1710	50	0	890	0	0	0	85000	0.09
1985	0	10	4990	32430	23180	1360	70	20	0	0	0	0	62000	0.08
1986	9760	300	17960	60270	25620	14760	7130	2010	930	0	0	0	139000	0.15
1987	1327	14473	57965	49197	12783	2523	0	255	0	0	0	0	139000	0.15
1988	2936	55299	42955	30410	14241	9499	2389	0	0	0	0	0	158000	0.13
1989	6040	57966	143754	116165	54195	18058	872	0	0	0	0	0	397000	0.42
1990	6923	3087	7817	70743	80246	351	27	1723	0	0	0	0	171000	0.14
1991	1102	14644	504	1875	2385	935	2180	0	0	0	0	68	24000	0.01
1992	0	502	2478	6209	2715	866	67	350	2775	269	0	0	16000	0.01
1993	0	4791	8341	20832	16746	4119	1551	81	4177	3984	32	10	65000	0.04
1994	0	19754	28781	3915	1954	207	101	54	11	0	0	0	55000	0.03
1995	6407	40459	37388	23554	4652	0	1016	270	158	612	58	131	115000	0.08
1996	11078	20231	53084	204	0	0	1486	96	54	43	0	0	86000	0.07
1997	614	7354	13603	57936	5453	767	3082	102	2576	110693	84768	6585	294000	0.25
1998	28192	74231	96919	60798	23842	13900	496	102	3	0	0	0	298483	0.23
1999	0	18	554	10038	1303	0	570	0	0	0	0	543	13025	0.01
2000	2046	6452	5620	7147	12493	16205	987	44	12397	1556	7	0	64953	0.05
2001	2952	34889	65789	69750	17302	14383	313	100	0	0	0	0	205478	0.16
2002	2647	3349	4581	29716	13498	885	0	6060	1206	545	93	0	62580	0.06
2003	6	4740	43594	54220	57555	13119	4632	11	84	0	0	0	177960	0.14
2004	9783	26274	127357	32842	41427	7123	17	1273	30541	18091	15849	6058	316632	0.20
2005	7236	37205	160533	97127	12333	1561	976	137	3167	446	26	0	320744	0.22
2006	167	383	24685	23336	27913	5966	1338	115	1661	2128	494	135	88320	0.08
2007	483	0	6530	58376	27489	3751	1137	10	1802	5111	3758	1252	109696	0.09
2008	500	166	18518	22096	1286	2699	70	0	0	0	0	0	45335	0.04
2009	0	874	33455	64336	18519	14990	8640	8667	2554	125	0	0	152159	0.11
2010	0	1908	24637	31438	11102	9847	33	1278	1390	735	22934	145148	250446	0.15
2011	168483	118097	65526	10298	2266	1050	4261	331	95	0	65	581	371050	0.20
2012	479	100	125	13426	882	13681	355	54	89	22	32	0	29242	0.01
2013	333	0	0	6086	82	259	15	64	0	2	3	0	6842	0.00
2014	0	0	334	16005	5697	354	22	783	1375	1097	228	17	25909	0.01
2015	128	3300	118	1433	662	0	46	0	0	0	5.5	142.5	6000	0.00
2016	195	0	36	27354.5	78761	14296.5	5837	0	78.5	15.5	35	204.5	126813.5	0.05
2017	1818.5	109	26	202	498	2263.5	629	1591	38	14	1122.5	188	8499.5	0.00
2018	166	223	61.5	281	1240	2328.5	2658	0	20	0	60.5	149.5	7188	0.00

8.3 Length-weight

The lengths and weights of landed skipjack tuna have been collected at the local processing facility since 2015. From this information the relationship between length and weight for locally landed skipjack tuna is:

$W = 1.1928 \cdot 10^{-5}(L)^{3.289}$ $r^2 = 0.9059$, $P<0.0001$

where, L = straight fork length (cm), and W = whole weight (kg).

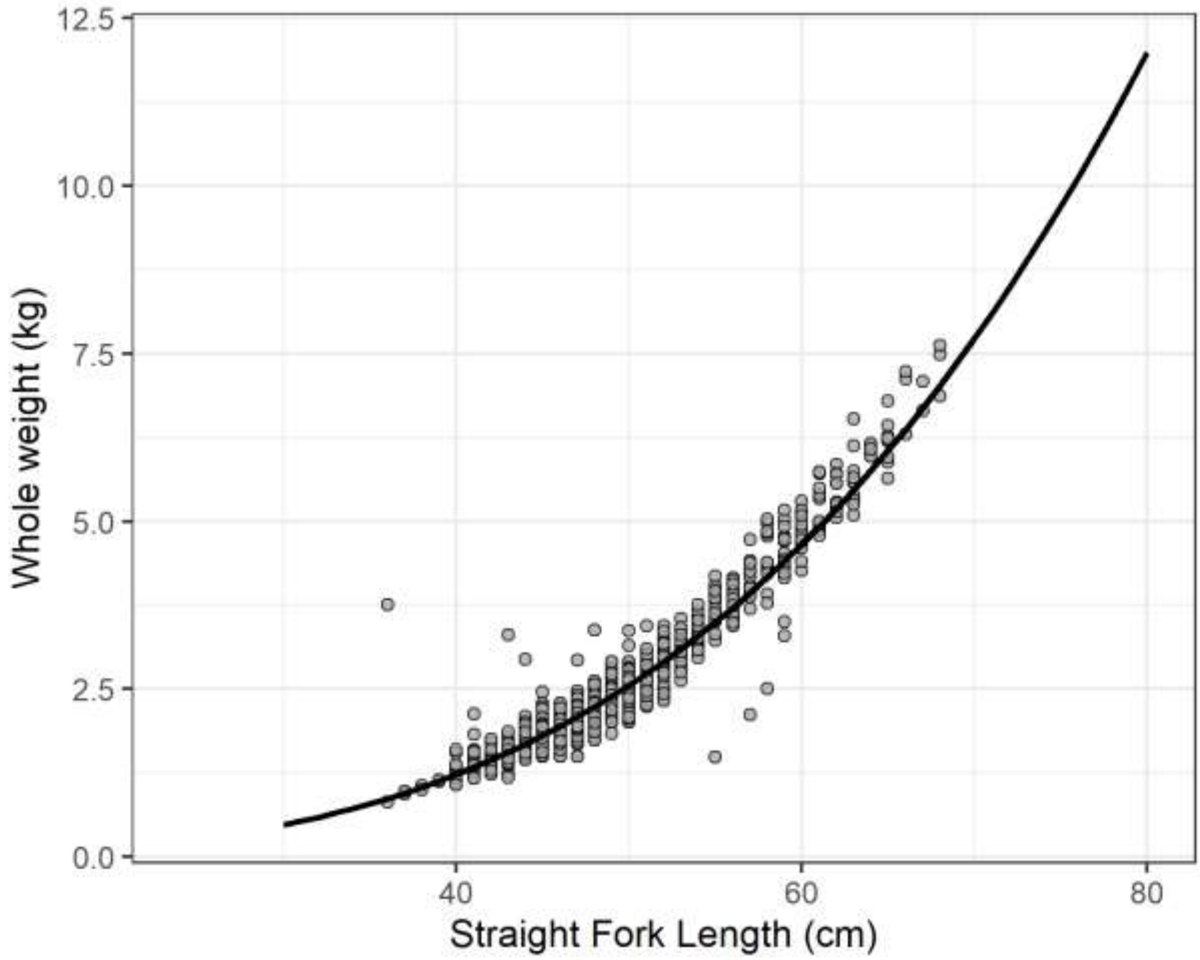

Figure 32. Length-weight relationship for skipjack tuna (*Katsuwonus pelamis*)

Corresponding length-weight conversions using this growth equation are shown in Appendix 14.2.

8.4 Estimation of local biomass status

8.4.1 Biomass assessment

Until 2019, there were insufficient releases and recoveries of skipjack tuna within St Helena's EEZ to assess the local biomass. The numbers of skipjack tuna released and recovered by year is shown in (Table 12). In 2019 the tag releases were increased, and good return rates achieved. This indicates that continuation of the programme to establish a time series of releases of several hundred tagged fish per year is likely to provide estimates of abundance and movement within the St Helena EEZ if required.

Table 12. Numbers of skipjack tagged and released each year

		Recapture				Recovered
Year	Released	2016	2017	2018	2019	
2015	7	0	0	0	0	0%
2016	65	0	1	0	0	2%
2017	21	0	0	0	0	0%
2018	44	0	0	0	2	5%
2019	758	0	0	0	40	5%
Total	**122**	**0**	**1**	**0**	**42**	

8.5 Advice

The most recent ICCAT skipjack assessment (ICCAT, 2014) indicates that the eastern stock is not likely to be overfished and is not likely to be undergoing overfishing. No TAC or MLS is recommended. Locally, the average landings of skipjack tuna between 1977 and 2018 was 123 t. Life-history characteristics of this species are indicative of highly fecund, opportunistic spawning and short lived species (Cayre and Farrugio, 1986), which makes skipjack a relatively sustainable species to commercially target.

Scientific monitoring of the skipjack should continue and include:

- Use of logbooks for all vessels
- Biological sampling of gonads and length measurements to assess seasonal changes in sex and maturity by region

9 Albacore tuna, *Thunnus alalunga*

9.1 Distribution

Albacore are temperate tuna distributed throughout the Atlantic Ocean and split into three stocks (northern Atlantic, southern Atlantic and Mediterranean). Some studies support the hypothesis that there are various sub-populations linking the North Atlantic and Mediterranean, and South Atlantic and Indian Ocean; ICCAT considers the three areas as separate for stock assessment and advice (ICCAT, 2016).

In the South Atlantic, albacore tuna are caught by a mixture of longline and bait boats (Figure 33), with the highest catches between 15°S and 45°S. Landings for the South Atlantic albacore are largely attributed to surface bait boat fleets of South Africa and Namibia, and longline fleets of Brazil and Chinese Taipei. These surface fleets are albacore directed and target sub-adult fish seasonally when albacore are available in coastal waters (October to May). In the South Atlantic, St Helena lies to the north of the region with highest catches, with albacore in the surrounding waters mostly caught by longline vessels (Figure 33). Albacore have not been landed in significant numbers in St Helena's EEZ since 2011, and to date there has been no local tagging programme focused on albacore tuna.

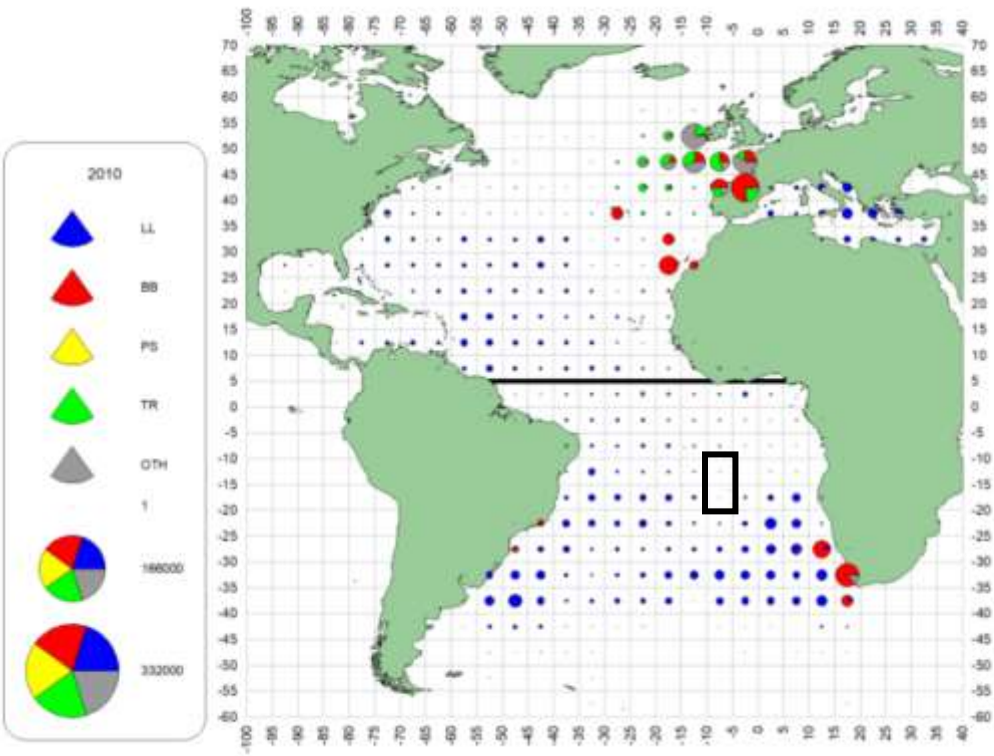

Figure 33. Albacore tuna total catches between 2010 and 2017 in the Atlantic from ICCAT data (source: ICCAT Assessment Summary). The quadrant for St Helena is highlighted as the black box at -10 longitude and -20 to -15 latitude.

9.2 Landings

International South Atlantic albacore tuna catches are taken by a mixture of longline and bait boats. Albacore landings peaked at over 70,000 t in 1986. Landings in the last decade have oscillated at around 20,000 t (Figure 34). The most recent ICCAT South Atlantic albacore assessment (ICCAT, 2016) indicates that historically the catches were too high (overfishing was occurring) and consequently the stock had been reduced below the target biomass (overfished). However, in recent years, fishing pressure has declined with a subsequent increase in stock biomass. Thus, there is a high probability that the stock is currently not overfished and not undergoing overfishing. The maximum sustainable yield was 25,900 t and the current relative fishing rate F_{2014}/F_{MSY} was 0.54. On average, St Helena lands 0.11% of the South Atlantic albacore stock within the EEZ (ranging from 0% to 0.5% since 1998, Table 13).

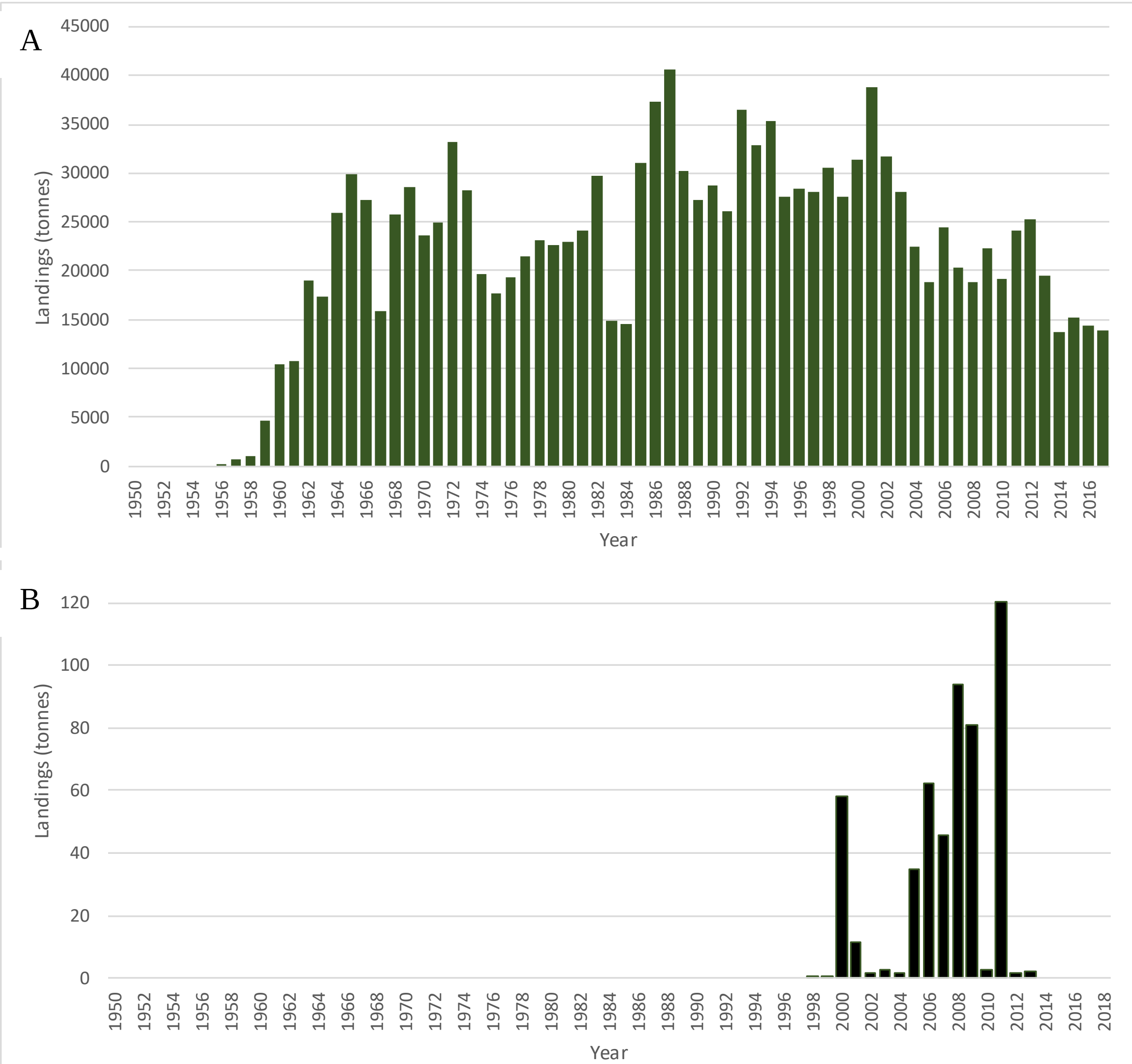

Figure 34. Annual South Atlantic albacore tuna landings (A) and for St Helena only (B).

Landings by the local commercial fishery (Table 13), have been recorded by St Helena Fisheries Corporation plant since 1977. Between 1998 and 2018 the average albacore catch in St Helena has been 25 t (minimum 0 and maximum 120), with an increasing trend in landings from 2005 to 2011 (Figure 34).

Table 13. St Helena albacore tuna monthly landings (kg) by year and percent of International South Atlantic albacore tuna landings (% INT).

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL (kg)	% INT
1998	0	0	24	101	0	181	307	131	13	0	0	0	757.1	0.00
1999	0	0	56	400	25	52	46	0	0	0	0	0	578.1	0.00
2000	0	21	107	1765	1665	5569	1426	10691	18065	4446	6906	7713	58372.6	0.19
2001	3617	3351	1234	978	727	635	169	404	171	250	177	0	11712.34	0.03
2002	175	0	0	385	496	371	0	103	0	102	39	0	1670.05	0.01
2003	0	0	132	1092	933	615	75	0	56	0	0	0	2902.5	0.01
2004	0	0	66	611	529	50	0	0	0	0	204	0	1459	0.01
2005	0	214	255	330	228	695	1306	31369	491	0	0	0	34885	0.18
2006	0	0	0	0	190	0	22196	39908	0	0	0	0	62293	0.25
2007	0	0	28	0	54	291	57	9811	35307	0	0	0	45546	0.22
2008	0	0	0	0	111	74	64778	28683	0	0	14	58	93715.5	0.50
2009	0	0	203	246	61	1710	177	78717	0	0	17	0	81129.5	0.36
2010	0	0	24	85	136	233	29	1373	733	0	0	0	2611.5	0.01
2011	0	113	0	6768	47533	8005	1921	34289	21738	0	0	0	120366.5	0.50
2012	0	0	35	0	111	419	785	208	24	15	0	0	1596	0.01
2013	0	0	52	0	122	653	1002	198	121	0	0	0	2147	0.01
2014	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00

9.3 Length-weight

The length-weight relationship for albacore tuna (estimated from South Africa albacore) is:

$$W = 1.3718 \cdot 10^{-5}(L)^{3.0973}$$

where, L = straight fork length (cm), and W = whole weight (kg).

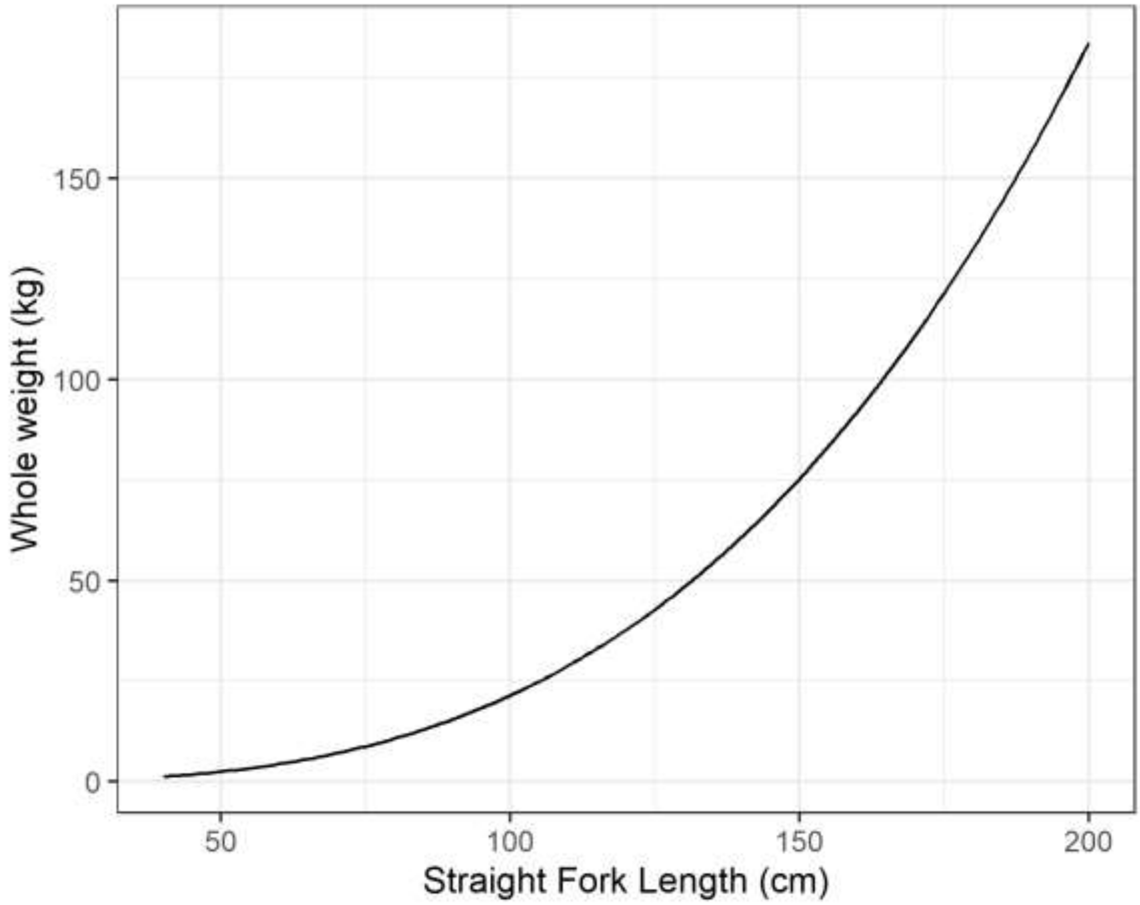

Figure 35. Length-weight relationship for South Atlantic albacore tuna (*Thunnus alalunga*).

Corresponding length-weight conversions using this growth equation are shown in Appendix 14.2.

9.4 Advice

The most recent ICCAT albacore assessment (ICCAT, 2016) indicates that the stock has been undergoing overfishing and had been overfished. However, in recent years, fishing pressure has declined with a subsequent increase in stock biomass. Thus, there is a high probability that the stock is not overfished and not undergoing overfishing.

Locally, the average landings of albacore tuna between 1998 and 2018 has been 25 t, though no significant landings of albacore have occurred since 2013. The lack of albacore landings within St Helena's EEZ since 2013 means that the catches of this species are not sufficient to warrant a dedicated monitoring or management approach for this species at present. Though, increased monitoring and assessment is recommended if catches increase in the future. Noting that at present St Helena has a TAC of 100 t for this species (ICCAT, REC 16-07).

10 Bait

In addition to the importance of sustainably managing fisheries that target commercial species like tuna for human consumption, there is also a need to consider the species targeted to support the tuna fishing. The quantity, size and species of bait caught can have a major impact on the success of tuna fishing trips. The sustainability of inshore bait fishing is assessed in Blue Belt report CR083 (Blue Belt, 2020a), though there is little information on the sustainability of bait at the seamounts. The quantity of bait required to sustain each fishery is difficult to quantify, but any increase in fishing pressure would also need to have an increase in monitoring of small pelagic species used as bait on these grounds to ensure that these populations are fished sustainably. Recent analysis of tuna stomachs collected by St Helena fishing vessels inshore and at the seamounts has been explored in Blue Belt report CR100 (Blue Belt, 2020b). Analysis of yellowfin tuna stomachs indicates that species used as bait (chub mackerel and *Decapterus* species) did not represent dominant or key contributing diet components for yellowfin tuna inshore or at the seamounts, with tuna mostly foraging on less agile fish, as well as squid and crustaceans (Blue Belt, 2020b).

11 Bycatch

The pole and line fishery is considered to have very low associated bycatch of other non-target species relative to other tuna fishing methods (purse seine and longline), as shown in a study comparing bycatch in the Maldivian skipjack fishery (Miller *et al.*, 2017). Bycatch was lowest for pole and line gear compared to longline and purse seine fishers, with dead discards at 0.02% of tuna landings. However, any increase in effort may increase the number of non-target individuals caught as by-catch. Therefore, updates to the permitted species in the new licensing framework, observer coverage and initial precautionary bycatch limits should be considered for any new fishing grounds or fishing vessels operating in St Helena's EEZ.

12 Acknowledgements

This work was funded by the UK Government through the Blue Belt Programme (https://www.gov.uk/government/publications/the-blue-belt-programme). Additional data was also provided from historic Darwin projects and the Atlantic Ocean Tropical Tuna Tagging Programme as detailed in Section 5.3. Authors sincerely thank the St Helena Government team (Darren Duncan, Gerald Benjamin, Elizabeth Clingham, Rhys Hobbs, Joachim Naulaerts, Martin Cranfield, Leeann Henry), the Stanford University team, Martin Collins, St Helena Fisheries Corporation, St Helena Fishers and St Helena Commercial Fishermen's Association for their fundamental role in sample collection, tagging release and recapture and continued discussions throughout the programme.

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14 Appendix

14.1 Local Biomass Assessments

For local management a number of tools can be used to explore stock and exploitation status and to estimate local biomass. A number of tagging and catch structure analyses have been applied to estimate biomass (Chapman assessment) and optimal size at first capture (yield-per-recruit). Key assumptions for the assessments are further explored in Table S1.

Table S1. Summary of fishery data analyses, outputs, data required to fit them and key assumptions.

Analysis	Output	Data inputs	Brief description of how it works	Key assumptions
Chapman	Biomass estimates	Tag release and recoveries by year, catches	Estimates size of the population based on the assumption that the proportion of tags caught is the same as the proportion of tags in the population.	The population is closed to migrations. Tagged fish mix randomly with untagged fish and are equally vulnerable to capture.
Yield-per-recruit	Theoretical optimal yield sizes, target age/size at first capture	Life-history traits (growth rates, length-weight, natural mortality), fishing mortality and selection	Simulates the abundance and yield of one cohort of recruits under different assumed fishing mortalities and selection patterns.	Fish population is assumed to have reached equilibrium with respect to the mortality imposed on it. Recruitment and consequent age structure are constant.

The life-history characteristics used in the stock assessments are detailed in Table S2. These values are taken from the latest stock assessment for yellowfin, bigeye, skipjack and albacore tuna (ICCAT, 2014, 2016, 2018, 2019a).

Table S2. Life-history characteristics and parameters used in stock status tools

Parameter	Parameter description	YFT	BET	SKJ	LFT	Ref
L_{inf}	Asymptotic length	155.7	179.9	112.34	147.5	(Gaertner *et al.*, 2008; ICCAT, 2014, 2016, 2018, 2019a)
L_{50} / L_{mat}	Length at 50% maturity	103.9*	110	42	90	(ICCAT, 2014, 2018, 2019a)
K		0.443	0.281	0.14	0.209	(Gaertner *et al.*, 2008; ICCAT, 2014, 2016, 2018, 2019a)
M	Natural mortality	0.35	0.2794	1.27	0.3	(ICCAT, 2014, 2016, 2018, 2019a)
M/K	M/K Ratio	0.79	0.99	9.07	1.44	Estimates from M & K values
F_{MSY}	Fishing mortality expected to give Maximum Sustainable Yield in the long term	0.17	0.207	1.02	0.202	(ICCAT, 2014, 2016, 2018, 2019a)

* Noting that for yellowfin tuna the length at 50% maturity has previously been defined as values between 92 cm (Schaefer, 1998) and 115cm SFL (ICCAT, 2019a). With the latest SCRS meeting suggesting the size at maturity of the Atlantic stock to be 115 cm SFL (ICCAT, 2019a). Though, the study which defines the 115 cm SFL for the latest ICCAT report suggests a L_{50} of 99 cm FL or 125 cm FL, depending on whether the threshold is set using cortical alveoli or advanced vitellogenic staging, respectively (Diaha *et al.*, 2016). Additionally it is suggested that there is likely a regional difference in size a maturity, as noted for the Pacific stock (Zhu *et al.*, 2008).

14.1.1Chapman

Chapman tag based assessments are a useful method for estimating the amount of biomass available within a local area (Chapman, 1951). For this analysis we considered two scenarios with regards to the behaviour of tuna following tagging: (1) tuna do not disperse following tagging and hence within year recoveries are considered biased and removed from the data and (2) tuna have enough time to disperse following tagging and are therefore distributed evenly within the biomass such that within year recoveries can be included in the analysis. The results of the first case (removal of within year recoveries) were decided to be more robust for initial advice and are presented in Section 6.4.1.

The Chapman method estimates the size of a population based on a single release and recapture event, under the assumption that the ratio of tagged to total fish in the recapture event is proportional to the ratio of tagged to total fish in the population. Here the Chapman estimator was modified to produce estimates of biomass in year *y* ($\hat{B}_{y,j}$) based on the number of tags estimated to be available in year *y* from tags released over *j* prior years (and including those released in year *y* when considering within year recaptures) ($n_{y,j}$). The Chapman estimator is calculated as (Walker *et al*., 2015):

$$\hat{B}_{y,j} = \left(\frac{(n_{y,j} + 1)(c_y + \bar{w})}{m_{y,j} + 1}\right) - \bar{w}$$

With an approximately unbiased estimate of its variance given by:

$$var(\hat{B}_{y,j}) = \frac{(n_{y,j} + 1)(c_y + \bar{w})(n_{y,j} - m_y)(c_y - m_{y,j})}{(m_{y,j} + 1)^2(m_{y,j} + 2)}$$

Where c_y is the total catch in tonnes in year *y*, $m_{y,j}$ is the number of tagged fish caught in year *y* that were released over *j* prior years (and including those released in year *y* when considering within year recaptures) and $\bar{w}$ is the mean weight of a fish estimated as 14.8 kg.

The number of tags estimated to be available for recapture in year *y* from those released over *j* prior years is determined from the number of tags released in those prior years corrected for tag failure (*f*) and natural mortality (*M*). When excluding within year recaptures, this is calculated as follows:

$$n_{y,j} = \sum_{i=y-j}^{y-1} \left[n_i e^{-(f+M)(y-i)} - \sum\nolimits_{k=i}^{y} m_{i,k} e^{-(f+M)(y-i)}\right]$$

Where *i* refers to release year and *k* to year of recapture. When including within year recaptures the first summation extends to year *y* and tag removals are subtracted the year after recapture. Natural mortality was assumed to be 0.35 and loss of both tags, estimated from single tag loss, 0.065.

Once biomass was estimated using the Chapman assessment, the standard catch equation (Baranov catch equation) was used to estimate a precautionary total allowable catch (Baranov, 1918):

$$C = \frac{F}{F + M}\left(1 - e^{-(F+M)}\right) B$$

where, F = is F_{MSY} for the Atlantic yellowfin tuna stock, M = natural mortality and B = biomass estimated from the Chapman assessment.

14.1.2 Exploitation Pattern

Exploitation patterns can be assessed by modelling different scenarios with yield per recruit analysis. By identifying current exploitation patterns (Section 3.2.1) measures can be recommended which can help to optimise exploitation with an aim to improve sustainability. This is strengthened with yield per recruit analysis, which provides an indication of the target age/size at first capture to maximise theoretical yield (Section 3.2.2).

14.1.2.1 Yield-per-recruit

Yield-per-recruit analysis is used to assess theoretical yield based on life-history traits and fishing pressure.

In monitoring the stock status of fishery resources, the main concern is “overfishing” which can be divided into “growth overfishing” or “recruitment overfishing”. Growth overfishing can occur when fishing effort is too high, and fish are caught before they can grow. Recruitment overfishing occurs when fishing impacts subsequent recruitment.

YPR analyses deal with growth overfishing. The analysis is carried out by constructing a model of the development of a cohort through time considering the growth and mortality of individuals. The analysis is conducted for a range of fishing mortalities and selection patterns (here varying the weight at first capture) and the theoretical yield derived from each is scaled to the initial recruitment. Because recruitment is assumed constant, YPR analyses do not consider the issue of whether the fishing rate predicted to produce maximum YPR is sustainable and hence predicted yields should be considered theoretical.

The analysis was conducted on a monthly time scale with the corresponding length- and weights-at-age derived using the von Bertalanffy and allometric relationships respectively. YPR is calculated:

$$\frac{Y}{R} = \sum_{w=w_c}^{a=a_{max}} w_a N_{a,ct}$$

Where Y is yield, R is the initial number of individuals in the cohort (recruitment), w_c is weight at first capture, a_{max} is the highest age modelled, w is weight, N_{ct} is the number of individuals caught and the a subscript denotes age.

The number of individuals in the cohort declines exponentially due to both natural (*M*) and fishing (*F*) mortality following the usual equation:

$$N_{a+1} = N_a e^{-(M+F_a)}$$
$$F_a = s_a F$$

Where S_a is selectivity-at-age and *F* is the fishing mortality on fully selected ages. Here we considered two selection patterns:

1) Knife edge selectivity at w_c. In this case a_{max} is taken as 120 months corresponding to 10 years.

2) Knife edge selectivity at w_c but with an assumed migration out of the population once reaching 120 cm. In practice, this was done by increasing *M* to remove fish from the cohort once they reach 120 cm but is equivalent to an a_{max} of 39 months.

The number of individuals caught was extracted from the cohort using the standard catch equation:

$$N_{a,ct} = \left(\frac{F_a}{F_a + M}\right) N_a \left(1 - e^{-(M+F_a)}\right)$$

The analysis was conducted over a range of fishing mortalities (*F*) and weights-at-first capture (w_c).

Within the models the maximum age ($a_{\max}$) was based on the point at which YPR stabilised, with 10 years defined as $a_{\max}$ for both models (Figure S1).

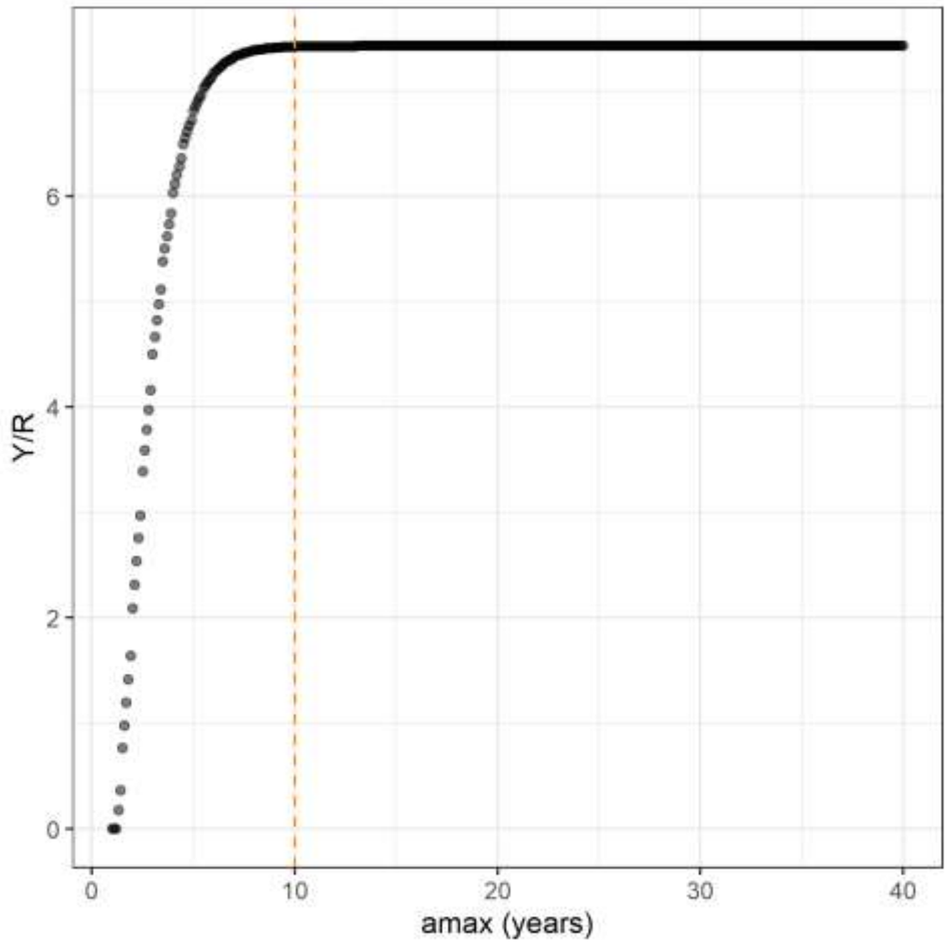

Figure S1. Maximum age (a_{max}) versus yield per recruit (YPR). The a_{max} used for the models is shown as the dashed orange line (10).

14.2 Length-weight key for yellowfin tuna, bigeye tuna, skipjack tuna, albacore tuna, dolphinfish and wahoo.

Table S3. Length-weight relationship for locally biologically sampled yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*), skipjack tuna (*Katsuwonus pelamis*), dolphinfish (*Corphaena hippurus*) and wahoo (*Acanthocybium solandri*).

SFL (cm)	YFT		BET		ALB	SKJ	COE	WAH
	Whole (kg)	GG (kg)	Whole (kg)	GG (kg)	Whole (kg)	Whole (kg)	Whole (kg)	GG (kg)
30						0.48		
31						0.53		
32						0.59		
33						0.65		
34						0.72		
35						0.79		
36						0.87		
37						0.95		
38						1.04		
39						1.13		
40	1.20	1.06	1.17	1.03	1.26	1.23	0.62	
41	1.29	1.14	1.26	1.12	1.36	1.33	0.66	
42	1.39	1.23	1.36	1.21	1.46	1.44	0.71	
43	1.49	1.32	1.47	1.30	1.57	1.56	0.75	
44	1.59	1.41	1.58	1.40	1.69	1.68	0.80	
45	1.71	1.51	1.69	1.50	1.81	1.81	0.86	
46	1.82	1.61	1.82	1.61	1.94	1.94	0.91	
47	1.94	1.72	1.95	1.72	2.07	2.09	0.97	
48	2.07	1.83	2.08	1.84	2.21	2.24	1.03	
49	2.20	1.95	2.22	1.96	2.36	2.39	1.09	
50	2.34	2.07	2.37	2.09	2.51	2.56	1.15	0.42
51	2.48	2.19	2.52	2.23	2.67	2.73	1.22	0.45
52	2.63	2.32	2.68	2.37	2.83	2.91	1.28	0.49
53	2.78	2.46	2.85	2.52	3.01	3.10	1.35	0.52
54	2.94	2.60	3.02	2.67	3.18	3.29	1.43	0.56
55	3.10	2.75	3.20	2.83	3.37	3.50	1.50	0.59
56	3.28	2.90	3.39	3.00	3.56	3.71	1.58	0.63
57	3.45	3.06	3.58	3.17	3.76	3.93	1.66	0.68
58	3.64	3.22	3.79	3.35	3.97	4.17	1.74	0.72
59	3.83	3.39	4.00	3.54	4.19	4.41	1.83	0.76
60	4.03	3.56	4.22	3.73	4.41	4.66	1.92	0.81
61	4.23	3.74	4.44	3.93	4.65	4.92	2.01	0.86
62	4.44	3.93	4.68	4.14	4.89	5.19	2.10	0.91
63	4.66	4.12	4.92	4.35	5.13	5.47	2.20	0.97
64	4.88	4.32	5.17	4.58	5.39	5.76	2.30	1.02
65	5.11	4.52	5.43	4.81	5.65	6.06	2.40	1.08
66	5.35	4.74	5.70	5.05	5.93	6.37	2.50	1.14
67	5.60	4.95	5.98	5.29	6.21	6.69	2.61	1.20
68	5.85	5.18	6.27	5.55	6.50	7.03	2.72	1.27
69	6.11	5.41	6.56	5.81	6.80	7.37	2.83	1.34
70	6.38	5.64	6.87	6.08	7.11	7.73	2.95	1.41
71	6.65	5.89	7.19	6.36	7.43	8.10	3.07	1.48
72	6.94	6.14	7.51	6.65	7.76	8.48	3.19	1.56
73	7.23	6.40	7.85	6.95	8.10	8.88	3.32	1.64
74	7.53	6.66	8.19	7.25	8.45	9.28	3.45	1.72
75	7.84	6.94	8.55	7.57	8.81	9.70	3.58	1.80
76	8.15	7.21	8.92	7.89	9.18	10.13	3.71	1.89
77	8.48	7.50	9.29	8.22	9.56	10.58	3.85	1.98
78	8.81	7.80	9.68	8.57	9.95	11.04	3.99	2.07
79	9.15	8.10	10.08	8.92	10.35	11.51	4.14	2.17
80	9.50	8.41	10.49	9.28	10.76	12.00	4.29	2.27
81	9.86	8.73	10.91	9.66	11.18		4.44	2.37
82	10.23	9.05	11.34	10.04	11.61		4.59	2.48
83	10.61	9.39	11.79	10.43	12.06		4.75	2.59
84	10.99	9.73	12.24	10.83	12.51		4.91	2.70
85	11.39	10.08	12.71	11.25	12.98		5.08	2.82
86	11.79	10.43	13.19	11.67	13.46		5.25	2.94

87	12.21	10.80	13.68	12.11	13.95		5.42	3.06
88	12.63	11.18	14.19	12.55	14.45		5.60	3.19
89	13.06	11.56	14.70	13.01	14.97		5.78	3.32
90	13.50	11.95	15.23	13.48	15.49		5.96	3.46
91	13.96	12.35	15.78	13.96	16.03		6.15	3.60
92	14.42	12.76	16.33	14.45	16.59		6.34	3.74
93	14.89	13.18	16.90	14.96	17.15		6.53	3.89
94	15.38	13.61	17.48	15.47	17.73		6.73	4.04
95	15.87	14.04	18.08	16.00	18.32		6.93	4.19
96	16.37	14.49	18.69	16.54	18.92		7.14	4.35
97	16.89	14.95	19.31	17.09	19.54		7.35	4.52
98	17.41	15.41	19.95	17.66	20.17		7.56	4.69
99	17.95	15.88	20.60	18.23	20.81		7.78	4.86
100	18.50	16.37	21.27	18.82	21.47		8.00	5.04
101	19.05	16.86	21.95	19.43	22.14		8.23	5.22
102	19.62	17.37	22.65	20.04	22.83		8.46	5.41
103	20.20	17.88	23.36	20.67	23.53		8.70	5.60
104	20.79	18.40	24.08	21.31	24.25		8.93	5.79
105	21.40	18.93	24.82	21.97	24.98		9.18	6.00
106	22.01	19.48	25.58	22.64	25.72		9.42	6.20
107	22.64	20.03	26.35	23.32	26.48		9.67	6.41
108	23.27	20.60	27.14	24.02	27.25		9.93	6.63
109	23.92	21.17	27.95	24.73	28.04		10.19	6.85
110	24.58	21.76	28.77	25.46	28.85		10.45	7.08
111	25.26	22.35	29.60	26.20	29.67		10.72	7.31
112	25.94	22.96	30.46	26.95	30.50		10.99	7.55
113	26.64	23.57	31.33	27.72	31.35		11.27	7.80
114	27.35	24.20	32.21	28.51	32.22		11.55	8.05
115	28.07	24.84	33.12	29.31	33.10		11.84	8.30
116	28.81	25.49	34.04	30.12	34.00		12.13	8.56
117	29.55	26.15	34.98	30.95	34.92		12.42	8.83
118	30.32	26.83	35.93	31.80	35.85		12.72	9.10
119	31.09	27.51	36.91	32.66	36.80		13.03	9.38
120	31.87	28.21	37.90	33.54	37.77		13.33	9.66
121	32.67	28.92	38.91	34.43	38.75		13.65	9.95
122	33.49	29.63	39.93	35.34	39.75		13.97	10.25
123	34.31	30.37	40.98	36.27	40.77		14.29	10.56
124	35.15	31.11	42.05	37.21	41.81		14.62	10.87
125	36.01	31.86	43.13	38.17	42.86		14.95	11.18
126	36.87	32.63	44.23	39.14	43.93		15.29	11.50
127	37.75	33.41	45.35	40.14	45.02		15.63	11.83
128	38.65	34.20	46.50	41.15	46.13		15.97	12.17
129	39.56	35.00	47.66	42.17	47.25		16.33	12.51
130	40.48	35.82	48.84	43.22	48.40		16.68	12.86
131	41.41	36.65	50.04	44.28	49.56		17.04	13.22
132	42.37	37.49	51.26	45.36	50.74		17.41	13.59
133	43.33	38.35	52.50	46.46	51.94		17.78	13.96
134	44.31	39.21	53.76	47.57	53.16		18.16	14.34
135	45.30	40.09	55.04	48.71	54.40		18.54	14.72
136	46.31	40.99	56.34	49.86	55.65		18.93	15.12
137	47.34	41.89	57.66	51.03	56.93		19.32	15.52
138	48.38	42.81	59.01	52.22	58.23		19.72	15.92
139	49.43	43.74	60.37	53.43	59.55		20.12	16.34
140	50.50	44.69	61.76	54.65	60.88		20.53	16.76
141	51.58	45.65	63.17	55.90	62.24		20.94	17.20
142	52.68	46.62	64.60	57.17	63.62		21.36	17.64
143	53.80	47.61	66.05	58.45	65.01		21.78	18.08
144	54.93	48.61	67.52	59.76	66.43		22.21	18.54
145	56.08	49.63	69.02	61.08	67.87		22.65	19.01
146	57.24	50.65	70.54	62.43	69.33		23.09	19.48
147	58.42	51.70	72.08	63.79	70.81		23.53	19.96
148	59.61	52.75	73.65	65.18	72.32		23.98	20.45
149	60.82	53.82	75.24	66.58	73.84		24.44	20.95
150	62.05	54.91	76.85	68.01	75.39		24.90	21.45
151	63.29	56.01	78.48	69.45	76.95		25.37	21.97
152	64.55	57.12	80.14	70.92	78.54		25.84	22.49
153	65.83	58.25	81.82	72.41	80.16		26.32	23.03
154	67.12	59.40	83.53	73.92	81.79		26.81	23.57
155	68.43	60.56	85.26	75.45	83.45		27.30	24.12
156	69.76	61.73	87.01	77.00	85.12		27.79	24.68
157	71.10	62.92	88.79	78.58	86.83		28.29	25.25

158	72.46	64.12	90.60	80.18	88.55		28.80	25.83
159	73.84	65.34	92.43	81.79	90.30		29.31	26.42
160	75.23	66.58	94.28	83.43	92.07		29.83	27.02
161	76.64	67.83	96.16	85.10	93.86		30.36	27.63
162	78.07	69.09	98.07	86.78	95.68		30.89	28.24
163	79.52	70.37	100.00	88.49	97.52		31.42	28.87
164	80.99	71.67	101.95	90.22	99.39		31.97	29.51
165	82.47	72.98	103.94	91.98	101.28		32.52	30.16
166	83.97	74.31	105.94	93.76	103.19		33.07	30.82
167	85.49	75.65	107.98	95.56	105.13		33.63	31.49
168	87.03	77.01	110.04	97.38	107.09		34.20	32.17
169	88.58	78.39	112.13	99.23	109.07		34.77	32.85
170	90.16	79.78	114.25	101.10	111.09		35.35	33.55
171	91.75	81.19	116.39	103.00	113.12			34.27
172	93.36	82.62	118.56	104.92	115.18			34.99
173	94.99	84.06	120.76	106.86	117.27			35.72
174	96.64	85.52	122.98	108.83	119.38			36.46
175	98.30	87.00	125.23	110.83	121.52			37.22
176	99.99	88.49	127.52	112.85	123.69			37.98
177	101.70	90.00	129.82	114.89	125.87			38.76
178	103.42	91.52	132.16	116.96	128.09			39.55
179	105.17	93.07	134.53	119.05	130.33			40.35
180	106.93	94.63	136.92	121.17	132.60			41.16

Review of St Helena tuna fishery status and management advice (CR087) Report – Stakeholder comments 10/07/2020

SHCFA – St Helena Commercial Fisherman's Association
SHNT – St Helena National Trust
IPNLF – International Pole and Line Foundation

Statements which do not need a response are highlighted in grey, comments responded to by Cefas in blue, and by St Helena Government in green

General Overview			
Topic	***Contributor***	***Comment***	***Notes***
General	SHCFA	SHCFA are pleased with the outcome of the report and the advice contained within. The 'boom and bust' approach is certainly not being advocated and we hope that most of our decision makers will put this advice to the forefront when the time comes to make a final TAC decision regarding YFT and BET	
General	SHCFA	In essence, the report provides a good advice from which the island can start making environmentally responsible decisions in respect of future fishery aspirations and we look forward to the socio-economic discussions which it and other documents will inform.	
General	SHNT	We are pleased to see a precautionary approach being taken throughout the document	
General	SHNT	We commend the explicit advice on a *gradual* implementation of any fishery expansion or TAC increase etc – again this follows the sustainable and non-industrial scope of works stipulated by IUCN under a Cat VI MPA	
General	SHNT	***"Defining sustainable harvest limits is fundamental to any long-term fishing strategy"*** Again we commend this statement and the recommendation for continued tagging work and stock analysis to fill data gaps – we do hope that future work will focus more heavily on data deficient species such as BET, not just focus on furthering the studies of YFT.	

Data Accuracy			
Southern Cross	SHCFA	It is noted that the Southern Cross has been added to the report and this is only right. However: • The exploratory exercise was actually 2 separate trips and not a trip as indicated in the report. Reasons for different CPUE to local vessels could include: • The number of crew needs to be reflected correctly (18) • The inclusion of superior electronic fish finding equipment needs to be added ('spotlight' sonar). • It might also be worth mentioning that the vessel was aware of a 'pinnacle' over the actual seamount which no local fisher knew about. The MRAG report will undoubtedly show that significant BET catches were made over/close proximity to a certain set of co-ordinates The reason I think these points could be added is because the Southern Cross has been used to help demonstrate /potential harvest rates in the past and /I have often witnessed 'finer' details being left out.	Cefas has noted that the first science report would bring out data and information that had not previously been provided. Additional data will be discussed with stakeholders when made available and subsequent analysis and advice outlined in the annual reports.
Conclusions/Recommendations			
Species movements	SHFCA	The movement/mixing of YFT tuna between the 3 primary fishing areas within the EFZ is important and reflects the findings of the Westerdam survey in 84'. Further tagging work on a more consistent basis over the seamounts will enhance understanding of this as I think the notion that juvenile fish entering exclusively the inshore region, growing and then moving between areas is not entirely true. I think the relationship between the island and Bonaparte is a close one as it is the experience of local fishermen that at times, Bonaparte experiences influxes of thousands of small YFT exactly the same size as those which occur around the island. Historical catches will very rarely reflect this because it is simple not viable for 4.5 – 5kg to be caught at Bonaparte and so skippers will simply not catch them. The point is that we need to avoid the possible confusion that St Helena's new cohorts of YFT make a beeline for the island only.	The Cefas report presents all tagging information collated to date. As the time series develops then less frequent events, such as temporal pattern and spatial distribution of recruitment will become apparent.

Species movements	IPNLF	The main caution from my side, having managed various large conventional and satellite tagging programs for pelagic species myself, is that the relatively high recapture rates might also reflect a relatively small biomass being available within the St Helena EEZ. The current suggestion of relative residency could make sense (not many alternative sea mount options nearby anyway), but I do want to mention that potential alternative explanation. Again a precautionary approach will be best, no rush, and I personally think harvest increases sticking to one-by-one methods are a feasible and good idea	The assessment method calculates biomass from all available return / recapture data. The relative stability of the biomass estimates between years, provides some confidence in the robustness of the method.
Yellowfin Tuna	SHNT	We believe the proposed advice for a YFT tonnage of (254T) was, again, in line with what we had anticipated for the MPA, based on historic data and ICCAT guidelines. We are pleased that this figure (derived from years of stock assessments) will now inform future management measures and enable SHG to make evidence based decisions	
Bigeye Tuna	SHNT	*"…The lack of returns to date, has therefore resulted in, an inability to determine the local abundance"* - we commend the inclusion of this statement as a clear reason behind the lack of any proposed TAC for BET. Due to BET being data deficient, again we welcome the recommendation for further tagging work and stock assessment analysis – only once this is complete can we ascertain a sustainable TAC for this species as part of St Helena's long term fishing strategy	
Bigeye Tuna	SHNT	We hope that SHG will take the above into account, and use the science based tonnages for YFT (254T) to propose a lower, sustainable (precautionary) tonnage for BET that takes into account the species' vulnerability. Such precautionary tonnages can then of course, be updated once science is available to evidence any potential increases.	Catch limits and advice for YFT cannot be used to provide limits and advice for another species. The life history, degree of residency, and tag recovery rates for other species cannot be predicted based on the YFT population.

Further work/programmes			
Continued tagging	SHCFA	We fully support the idea of continuing the YFT tagging and the introduction of an annual tagging programme for BET. Science led decision making is a must if we are to be recognised as a reputable MPA and will only do wonders to enhance the marketing of our seafood products. It is simply unethical to eventually achieve authentic sustainability, but use unsustainable strategies to get there.	
Continued tagging	IPNLF	I support suggestions of continuing the tagging program and refining the approach accordingly each year, for which IPNLF suggested data improvements could also assist. I believe that a precautionary approach of slowly increasing harvest rates in small increments, with data feedback loops, to promote cost effectiveness of the fleet and facility, should be encouraged in the meantime	
Observers	SHNT	We commend the recommendations that full observer coverage is required for any exploratory exercise in order to not only ensure best practice is taking place, but to obtain vital biometric data – particularly for data deficient species such as BET	
Observers	SHNT	We hope that a full scope of works will be developed for any proposed observer coverage, to ensure that it can be realised/is actually viable i.e. noting previous capacity constraints which have limited observer potential. Indeed, the Trust can also offer capacity assistance if we know how and where help is required.	SHG is shortly to consult on its compliance and enforcement strategy which will provide further details in relation to observers, and proposed coverage. The offer of further assistance is greatly appreciated, and we would ask that this is fed back as part of the consultation
Exploratory fishing	SHNT	We would like to see further definitions of what Cefas and SHG consider as '*exploratory*' i.e. what gears will be utilised? How will this be monitored? This should of course follow IUCN Cat VI guidelines and fall under the precautionary approach advised.	'Exploratory' is used in the context of a staged, monitored, increase from a baseline of limited data. SHG have agreed to use pole and line and this was the only gear considered in advice.

Further data collection/analysis - CPUE	IPNLF	I mention the stock-wide perspective above to ensure a clear separation, which was less apparent during this week's meeting, between stock wide sustainability and the potential for too much local fishing pressure to cause local depletions that could hurt the local fleet's operational consistency and profitability. I would expect short term drops in CPUE to result from too much local fishing pressure, which could potentially hamstring fishing seasons if they occur. The surprisingly clear offshore progression of tuna cohorts as they grow in your data, might also prove helpful if your CPUE monitoring of the nearshore fleet is then used as a metric for future TACs on the offshore seamounts. Tracking cohort progressions based on their natural, and additional fishing, mortality could represent an ideal future scenario for annually adaptive and scientifically informed future TACs per species	The tuna fished at St Helena are a small part of the Atlantic stocks, they are not a separate stock that could be overfished by the St Helena fishery. Overfishing will impact local supply in the short term. Monitoring of local area dynamics using observers and logbooks will help to understand local depletion rates by area (and cohort) and how that can be factored into advice.
Further data collection/analysis - Logbooks	SHNT	It would be beneficial to understand how the logbooks will be further refined under SHG/Blue Belt programme to ensure effectiveness of data capture • Again this links to previous discussions on possibly digitising the log sheets, to enable streamlined data collection and analysis? • Links with our App and the aspirations of Blue Belt to fund/develop a similar App with data capture abilities	This is something that Cefas would be interested in developing. Within the UK this approach is being trialled for small vessel data as well as around the world and BB funding may be available to support this.
ICCAT Quotas	SHNT	We noted the following comment made during the workshop: ***"The commitment for BET catch limits for all OTs (which includes St Helena) is <1000T – this is a very small proportion of the overall international TAC for BET, therefore St Helena should not have a big impact on the overall figures… if stock assessments take 2-7 years to complete, ICCAT could further reduce TACs to say 500T for all OTs – we do not want to see St Helena 'lose out' on what they are 'owed'."*** • This statement was concerning for a number of reasons but for clarity, we are sure that SHG would not push for TACs for data deficient, vulnerable species (such as BET), that would be higher than the well-	SHG has been developing a scientific monitoring and research programme for Bigeye tuna which has been submitted to the St Helena Research Institute (SHRI). The document sets out the aims of the research and monitoring, how it will be conducted and control measures that will be in place to ensure that fishing does not take place in an unsustainable manner.

		studied YFT (254T) just to secure *potential* tonnages under the ICCAT recommendations for all OTs. • ***Gradual*** expansion does not rule out future increases in TACs over time, nor does it prevent future submissions to ICCAT proposing increased tonnages for St Helena as an OT – ***if*** of course, these requests are evidence based • We note that in the discussion with Elected Members, held after the workshop, three members again reiterated this concern and stated that they too felt, the evidence (through further tagging work) was required prior to any requests to ICCAT for increases in TACs - and prior to setting TACs for BET or other data deficient species	
ICCAT Quotas	IPNLF	From a stock-wide sustainability perspective, ICCAT providing more quota to St Helena would actually represent a precautionary approach and provide stock-wide benefits against the massive growth overfishing occurring under FADs off West Africa. St Helena's fleet is certainly not the problem with regards to stock health, I don't think we could significantly harm the overall stock using one-by-one methods within your EEZ if we tried, and I hope that SHG will enable IPNLF to support you on the ICCAT engagement front. We are the experts there, were instrumental in getting the bigeye tuna rebuilding program endorsed, now aim to minimize the conservation burden upon smaller scale fleets, and I would happily collaborate with Blue Belt experts on that front if enabled to do so in our third year plan.	We agree with the comment regards the ability for St Helena to be able to harm the international stock on its own and the importance of our current conservations measures (one-by-one etc.). However, we still need to understand more about the BET that are within St Helena's waters. The YFT have been shown to have a period of temporary residency which needs to be considered when managing the resource locally. If a similar situation were to occur for BET (though potentially less likely), we need to make sure that we better

			understand this behaviour and how it may impact on the fishery.
Future investment	IPNLF	With scientific evidence now available to support precautionary and incremental increases in harvest volume, the key next step will be to formulate a plan that ensures that local fishery stakeholders see equitable benefits from the harvest increases. It's only logical that foreign investors will negotiate to receive the largest quota proportion they can get away with, but I encourage SHG to firmly ensure that their local fishers are not disenfranchised through the process. Local fishers are of course most deserving to glean benefits from your valuable resources, they already help St Helena present itself as a responsible fishing nation, and I am keen to help SHG collaboratively walk the current tightrope together with the local fishers. Even if the investors were to retract, I also genuinely believe the previously submitted business case could still be actioned with your support. I'm always available to discuss these critical considerations at your convenience.	We agree with this and want to ensure that local fishers are able to receive the benefits of the islands resources. The current investment process is a cooperative arrangement which means that all local fishers are able to join and benefit in a profit sharing arrangement.