The Old Man and the Sea: Reconstructing the History of Ocean Life around Ascension Island

Polly Rose Burns

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Abstract

In 2016, the UK government announced plans for a large-scale Marine Protected Area (MPA) around Ascension Island, a UK Overseas Territory in the South Atlantic. Legal designation is expected in 2019 and research is underway to inform its management. To establish accurate baselines of marine life and assess change over time, extensive historical sources were examined. One hundred and thirty-nine interviews were also conducted to identify perceptions of change in the marine environment by past and present Ascension Island inhabitants. Historical sources indicate seabird and turtle populations declined substantially following human settlement, and despite recent population recoveries, pre-settlement abundance has not been reached. Reported fish abundance was high and remained relatively consistent throughout the historical references, but residents have noticed recent changes, notably in fishing effort, declines in yellowfin tuna (*Thunnus albacares*), and increases of Galapagos sharks (*Carcharhinus galapagensis*). Two shark attacks occurred in 2017, with their increased aggression completely new to most interviewees. However, previous periods of high shark abundance with threatening behaviour were noted, including a likely shark attack in 1879. Overall, Ascension appears to have largely avoided depletion of fish stocks from commercial fishing pressure, but recent changes highlight the need for precautionary management with strong protection to safeguard the island's extraordinary assets.

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Dedicated to Prof. Laurence Mee (1951-2014) - without whom I would not be the historical-ecologist-in-training I am today.

Declaration

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References.

Introduction

The Value of Historical Baselines and Informal Knowledge: A Review

Throughout history, humans have exploited marine environments for living resources (Lotze, 2004; Lotze & Worm, 2009). Thereby ecosystems have been progressively altered, often over century-long timescales (Jackson et al., 2001; Roberts, 2007). However, where change occurs slowly, it can be hard to establish the extent to which a place has been modified by human activity (Lotze & Milewski, 2004), particularly as altered systems are often confused with natural states (Jackson *et al*. 2001) and sources of change can be difficult to identify (Dayton *et al*., 1998). In 1995 the concept of "shifting baselines" was introduced to describe people's gradual change in perception over time and across generations of what a natural ecosystem looks like (Pauly, 1995). Integral to this is that people tend to consider their first experience of an environment as "natural" and therefore the point from which future change has occurred (Jackson, 1997; Folke *et al*., 2004). But if only modern evaluations exist then ecosystems will be viewed from points after when degradation has already occurred and sometimes massively so (Pauly, 1995). Consequently, progressive decline in condition of an ecosystem can occur with little recognition (Pinnegar & Engelhard, 2008).

As recently as 1883 it was claimed the world's fisheries were 'inexhaustible' (Huxley, 1884). However, this out-dated view of the ocean as safe from the threats faced by terrestrial environments is now largely dispelled (Roberts, 2003). To help counteract shifting baselines, historical data and perspectives can be used to develop more appropriate ecological baselines from which to define management aims (Lotze & Worm, 2009). There is a wealth of sources to provide information on historical ecosystems, many of which are not used by modern marine scientists (Carlton, 1998, Sáenz-Arroyo et al., 2006). Sources for these beyond historical literature could include Traditional Ecological Knowledge (TEK), historic biological surveys or fishery statistics (Silvano & Valbo-Jørgensen, 2008; Lotze & Worm, 2009).

We know marine ecosystems have changed due to early explorers' accounts that to the modern-day observer would seem impossible (Roberts, 2003). Previously unchartered places across the world seemed to have an infinite abundance of marine life (Lotze, 2004). Examination of historical fishing logbooks can put modern stock estimations into perspective. For example, a study by Baum & Myers (2004) that compared catch data from the Gulf of Mexico between the 1950s to 1990s showed that some shark species have declined by up to 99%. Similarly, a study by Rosenberg *et al*. (2005) considered 148 years of data for cod biomass on the Scotian shelf showed this was 1.26 million MT in 1852 compared with a modern 'peak' biomass in the 1980s estimated at just 300,000 MT. Similarly, a modelling study by Rose (2004) showed that by the mid-1800s, there had already been significant biomass declines in Newfoundland cod (*Gadus morhua*) when compared to even earlier historical records (Figure 1).

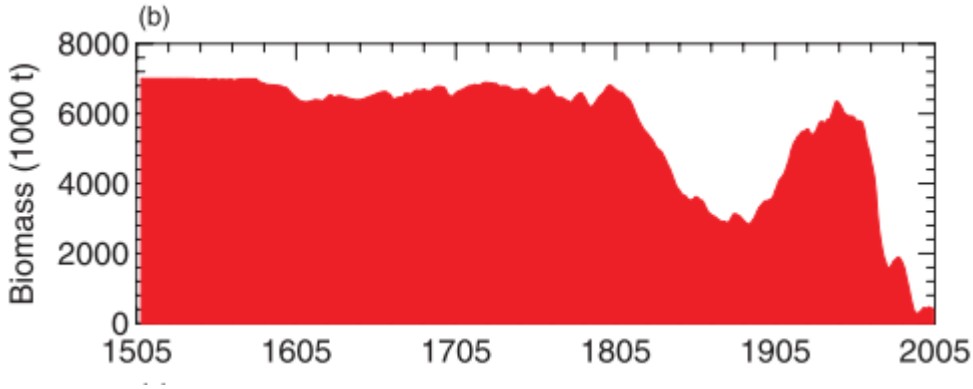


Figure 1: Adapted from Fig. 1 in Rose (2004): modelled biomass of Newfoundland and Labrador waters cod (Gadus morhua) between 1500 to 2003.

Since Pauly's (1995) landmark paper on 'shifting baselines' historical information has increasingly become acknowledged and integrated into marine science and management (Engelhard et al., 2015). Alongside this multi-disciplinary research has shown that appropriate historical sources can be relied upon to give reliable baselines from which to measure environmental change over time (Lotze & Milewski, 2004). For example, historical information has been used to make cases for MPAs (Bunce *et al*., 2008; Zapelini *et al*., 2017) and to select areas best suited for restoration

efforts (Braje *et al*., 2015). Another approach has been to reconstruct the history of fishing impacts, and identify means to counteract negative changes (Pitcher, 2001). For example, historical data has been used to convey the degree of change in coral reef status since pre-human times and this information has since been recognised as key in recovery (Pandolfi *et al*., 2003). Focussing on Jamaican coral reefs Jackson (1997), conducted a study that used historical records from as early as the 15th century to try to put current perceptions of 'healthy' Caribbean coral reefs into perspective. This work was built upon by Hardt (2008), who studied exploitation of Jamaican coral reefs from 600AD onwards then used the historical accounts to give modern day fisheries decline a context and emphasise the inclusion of historical ecology in modern management regimes.

In work by Sáenz-Arroyo *et al*., (2006) the authors used narratives of early visitors to the Gulf of California to generate a picture of marine life in this area in the 16-19th centuries and concluded that some of the identified references should be used to set baselines for current management goals to work towards. Similarly, Lotze & Milewski (2004) used historical data to reset baselines for food-webs in the Quoddy region of the Bay of Fundy and felt this type of approach should be applied where possible to marine ecosystems in general. Areas for which it has been done include the Wadden Sea by Lotze *et al*., (2005) who revealed ecosystem transformation dating back over 2,500 years and around the UK, Thurstan *et al*. (2010) used fishery statistics from 1889 over 118 years to quantify changes, where previously only 40-year-old data had been used. The findings from Thurstan *et al*'s study revealed that trawl fisheries productivity in British waters had reduced by 94% over 118 years. These examples and others like them such as Lotze & Worm (2009), McClenachan (2009) and Palomares & Heymans (2006) illustrate how historical research can help improve marine ecosystem understanding and if modelling and genetic techniques are also added to the picture then findings can be strengthened further still (Christensen *et al*., 2003; Roman and Palumbi, 2003; Jennings and Blanchard, 2004).

Local Ecological Knowledge ((LEK) hereby defined as information based on observations and experiences of the local environment, to provide largely qualitative measures of its condition) and Traditional Ecological Knowledge ((TEK), here defined as a wide picture of the environment as shared between generations) (Turvey *et al*., 2014) are increasingly being used to help inform marine ecosystem management (Wilson *et al*., 2006; Ruddle & Hickey, 2008; Lima *et al*., 2017). For example, baseline data provided by local people has provided important evidence in support of management plans (Zapelini *et al*., 2017). LEK and TEK acquired via questionnaires and interviews (e.g. Beaudreau and Levin, 2014; Sáenz-Arroyo & Revollo-Fernández, 2016) have been used to generate information about fisheries and target species (Neis *et al*., 1999), and to obtain detailed testimonies from people about places they have known well over extended periods (Johannes, 1998; Thurstan *et al*., 2016; Zapelini et al., 2017). For locations where scientific information about marine ecosystems is sparse then LEK, TEK and historical literature can be particularly important (Neis & Felt, 2000; Ainsworth *et al*., 2008; Zapelini *et al*., 2017; Lima *et al*., 2017). For example, Sáenz-Arroyo *et al*. (2005b) used a combination of interviews with fishermen and historical accounts to create a more comprehensive picture of Gulf Grouper (*Mycteroperca jordani*) fisheries than quantitative surveys alone could show. In this study Sáenz-Arroyo *et al*. (2005a) specifically addressed the concept of shifting baselines amongst generations when results of their interviews were interpreted, as did Turvey *et al*., (2010) in their investigation of Yangtze fishing communities. Papworth *et al*. (2009) went further to say that as well as generational differences, 'personal amnesia' can exist where an individual fails to recognise change in their own memory.

Previous studies on Ascension Island and its Relevance

Ascension Island is a "young" volcanic island about 1 million years old (Daly, 1925; Jicha *et al*., 2013). The Portuguese explorer João da Nova discovered it in 1501, but its lack of fresh water (Ritsema, 2010) kept it uninhabited until 1815 when the British used it as a strategic base after they exiled Napoleon

to St Helena (Irving, 2015). Along with its isolation, it has maintained low population numbers and has been relatively undisturbed such that it warrants consideration for designation as an "ocean wilderness". Such areas provide good measures for "natural baselines" and are considered worthy of strong protection (Graham & McClanahan, 2013; D'agata *et al*., 2016). In Ascension's case, its great isolation and young geological age have resulted in relatively low species diversity but high levels of endemism (Floeter *et al*., 2008; Barnes *et al*., 2015). Lower numbers of species also offer the chance for species to adopt new, singular functions and behaviours (Morais *et al*., 2017). Features such as these make Ascension and places like it of high conservation priority, particularly as human impacts are notably problematic (Kier *et al*., 2009).

In 2010, under the UN's Convention on Biological Diversity (CBD), governments pledged to protect 10% of the world's marine environments, with a focus on areas of economic and ecological importance (Secretariat CBD, 2010). As a step towards this the UK Government committed to designate a 'blue belt' of protection for UK overseas territories which included making Ascension's 200 nautical mile (nm) Exclusive Economic Zone (EEZ) a large-scale Marine Protected Area (MPA) (Conservatives, 2015). This led to an 'Our Ocean' commitment in 2016 (http://ourocean2016.org/commitments/#commitments-main), announced by the UK government to confirm it would provide a budget to close at least half of Ascension's EEZ to commercial fishing by 2019 (Foreign & Commonwealth Office, 2016).

Few scientific studies have examined Ascension's marine life, primarily due to its extreme isolation (O'Leary *et al*. in prep). In 2017 when the Marine Biological Association of the United Kingdom reviewed what has been done it concluded the island's marine biodiversity to be of outstanding biological interest (Brickle *et al*., 2017), citing studies that included: Chace & Manning, 1972; Rosewater, 1975; Pawson, 1978; Price & John, 1980; Manning & Chace, 1990; Irving, 2013; De Grave *et al*., 2014; Weber *et al*., 2014; Brewin

et al., 2016). While the 2017 study is undoubtedly valuable it does not provide "baseline information" in an historical context (Plumeridge & Roberts, 2017). To do this properly environmental records for Ascension would need to be considered since its discovery in 1501 then assessed against how things currently stand (Luiz & Edwards, 2011), whereby LEK could form a part of that process (Zapelini *et al*., 2017). As Ascension is situated on a major historical trade route between Europe and the Cape of Good Hope for vessels bound for Asia (Mitchell, 2010; Ritsema, 2010) a good supply of documentation about the island exists, written by sailors and boat passengers who passed by (Manning & Chace, 1990; Ritsema, 2010), or who stopped there to obtain turtle meat for food (Weber *et al*., 2014). As the first 300 years of Ascension's visitors were only temporary, these accounts are expected to reflect short-term experiences. After the British claimed possession of Ascension, narratives also became available from people who lived there and thus extended time frames were covered. As such they provide excellent material for recreating historical marine ecology (Pinnegar & Engelhard, 2008) and allow for comparisons between past and present (Zapelini *et al*., 2017).

Aims

With the future designation of an MPA for Ascension in mind, this study aims to create a baseline picture of the island's marine life based on all of the information looked at, with particular reference to megafauna (particularly sharks, turtles and seabirds) and fish species. The information used to compile these results will come from the review of extensive historical records from numerous sources. To supplement this LEK will be obtained from questionnaire interviews to examine whether people's perception of marine life in Ascension has changed over their lifetimes and if so how and to what extent. It is hoped the results here will provide accurate ecosystem baselines from which management goals can be set.

Methods

Study Site

Ascension lies south of the equator in the tropics at 7 56'S, 14 22'W and covers 88 km^2 (Figure 2). The nearest land is the highly isolated island of St Helena which lies 1300 km southeast. Around 800 people inhabit Ascension (McLeod, 2016) and the island is a UK Overseas Territory, governed jointly with Tristan da Cuhna and St Helena (Irving, 2015). Ascension provides a military base for UK and US Air Forces and alongside Ascension Island Government (AIG) there only 2 other major employers (Irving, 2015). Sea-sports are very popular with local people particularly fishing, paddle boarding, swimming, snorkelling and SCUBA diving (pers. obs.). However, in July 2017 the Government temporarily banned people from entering the sea in response to two shark attacks earlier that year (Telegraph, 2017; BBC News, 2017). The attacks had followed increased reports of aggressive behaviour from Galapagos sharks (*Carcharhinus galapagensis*) towards people over the previous year (Pers. Comm. Multiple Ascension residents).

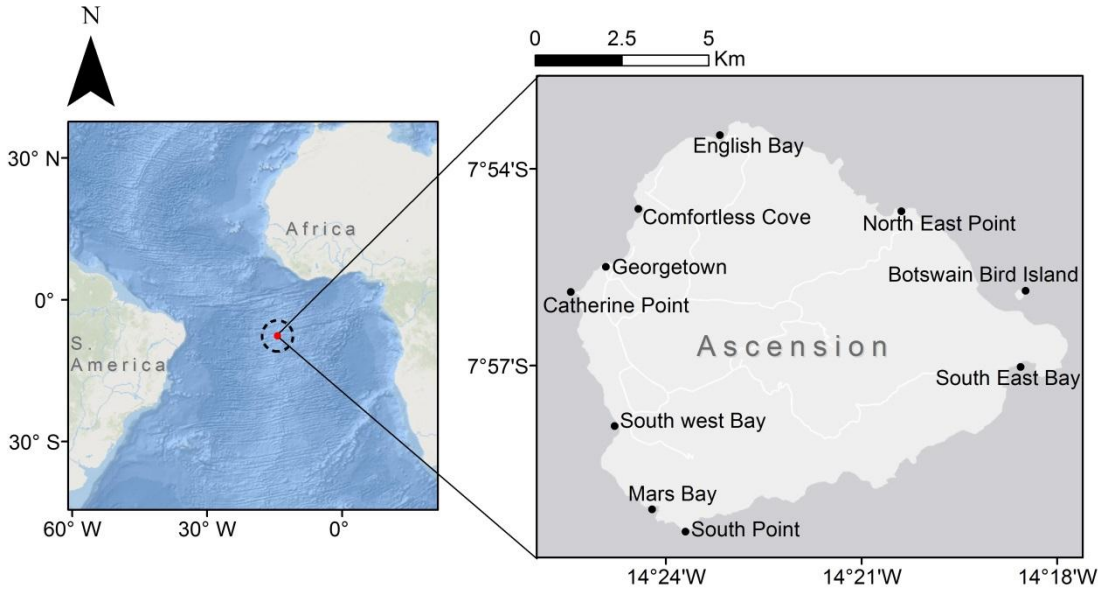


Figure 2: Global location of Ascension Island with EEZ shown by dashed line and zoomed in view to show key locations on the island.

Literature and Archival Research

To develop a historical picture of marine life on and around Ascension, I searched the literature and archival sources for accounts dated from when the island was discovered to the present day. For this the phrase 'Ascension Island' was put into Google, Google Scholar, and in online catalogues belonging to The National Archives of the United Kingdom, National Scottish Archives, Bodleian Library Archives, Caird Library and the British Library Archives and Manuscripts. On recommendation from the Museum of St Helena and Ascension Island Heritage Society Museum I also examined archives from the Cable & Wireless Archive (Porthcurno, UK), Ascension Island Heritage Archive (Ascension Island), 'The Islander' newspaper archives (Ascension Island) and St Helena Government Archive (St Helena).

For the sources identified by my Internet search I used criteria described in Table 1 to select those to examine. From those I looked at there were 627 quotes about Ascension's marine environment that I reduced to 272 after I discarded all that did not specifically mention abundance of marine life, except for anything related to sharks. I also removed one that was plagiarised, one I felt had been based on other peoples' accounts rather than personal experience and all that authors only *thought* early explorers may have seen. The remaining quotes were then ordered chronologically and evaluated for credibility by considering why they were written and for what audience. I also questioned credibility of accounts that seemed in total contrast to other observations made around a similar time. Throughout the research I collected photographs that provided insight into Ascension's marine life.

Table 1: Criteria used to select and reject items related to Ascension Island in online search results based on their titles and description.

Item selected if 1-4, or has 5-11:	**Item rejected if:**
1. Sailor's logbooks/personal accounts	Already seen item elsewhere
2. Personal letters	Item available online

3. Island Commander's logbooks/personal accounts	Item is form of financial report
4. Naturalist's account	Item is video recording (due to lack of equipment to play)
5. Specific references to marine life, fishing, turtles or seabirds	Topic of item clearly defined and irrelevant (e.g. 'Postal' 'Green Mountain farm')
6. Early date of publication	
7. 'Miscellaneous' in title	
8. 'Communications' in title	
9. Photographs	
10. Guides to safe navigation of island	
11. No online description	

Local Ecological Knowledge (LEK) from Interviews

To obtain information on how past and present residents of Ascension perceive its marine life, I created a semi-structured questionnaire to probe people's knowledge and perceptions of marine life during a field trip to St. Helena and Ascension Island between July and September 2017. In total, one hundred and thirty-nine people were interviewed for this study. Ninety-two of these were current residents of Ascension (equating to over 10% of the population). Forty-four interviews were done on St Helena because there is no right of abode on Ascension after employment there ends, such that many ex-Ascension workers either re-locate or retire to St Helena (AIG, no date a). These 136 interviews were performed face to face during the fieldwork in either interviewee's homes, workplaces or in public spaces or aboard the 'Royal Mail Ship St Helena' during its passage to or from Ascension via Cape Town and St Helena. I later performed the questionnaire

by Skype in November 2017 on 3 past residents of Ascension who no longer lived on either island but were recommended to me by people I met on both.

Potential interviewees were identified through both purposive and snowball sampling. The former is based around a researcher's judgement of the community and his or her research aims (Babbie, 2012) and as my questionnaire required respondents to have experienced the marine environment in prescribed ways as either an amateur or professional fisher or conservationist/naturalist, or as a recreational user of the sea (i.e. someone who liked to swim, dive, snorkel or visit the coastline). I actively approached people I saw fishing, operating a boat or gathered at a dive club meeting to introduce myself and the aim of my project. If following this someone agreed to take my questionnaire I either interviewed them on the spot or arranged to do so later. From this "Snowballing" then ensued, whereby I received recommendations from people I interviewed of others to approach (Babbie, 2012).

The questionnaire (Appendix 1) contained a mixture of short answer and open-ended questions which avoided leading questions, technical jargon, and ambiguous terms such as 'many' or 'few' (Oppenhiem, 1992, Houtkoop-Stenstra, 2000). In closed questions, only one piece of information at a time was requested (Fink, 2017) and where appropriate, multiple choice options included a 'don't know' response (Converse & Presser, 1986). In the section about fishing I followed Fink's (2017) suggestion that questions should flow from most to least familiar to help respondents relax and feel confident about retrieving memories. Hence for this I began with simple questions about how people fished, and their biggest fish caught. After early interview experiences revealed some questions could have been better phrased I amended these as shown in Table 2, to help with clarification. The point at which the changes are made are also shown in the table.

To be suitable for an interview someone needed to live/ have lived on Ascension ***or*** have visited Ascension more than once ***and either;***

fished/dived/swam/coastal walked/worked in conservation/worked in tourism **either** regularly for over a year ***or*** at one point in time and again at least a year later. The first question asked was, "Could you describe your personal history of involvement with Ascension Island? For example dates you have been here, how long for, and what you do here?" which was used to place interviewees in one category: either fishing (N=93), conservation (N=7) or recreational user of the sea (i.e. someone who liked to swim, dive, snorkel or visit the coastline) (N=39). If any uncertainty over the best fitting category between "fisher" and one of the others existed, "fisher" was used as the default option and nobody objected to this.

Prior to interviews respondents were asked to sign a consent form which also provided information about the project that I would expand on verbally if required (Appendix 2). This followed University of York ethics procedures as did all other aspects of the study (https://www.york.ac.uk/environment/ethics/#tab-4). A Zoom H1 device was used to record all interviews and later transcribed, except for three cases where permission for this was declined and so respondents' answers were noted at source. Interviews varied in length from 10 minutes to an hour. All but four were conducted individually, with exceptions of three groups of two and one group of three where interviewees were all asked questions separately. To help interviewees relate their memories to dates, they were prompted with a timeline of key events in Ascension's history (Appendix 3). For example, the Falklands War was used to help orientate fishers' memories of catches they experienced around this time. This is in line with the concept of aiding the reconstruction of memories by giving memories context (Fisher & Geiselman, 1992). To help people identify the marine life they remembered and to standardize the names used, participants worked from a photographic ID sheet I gave them. Similarly, fishers were given a map to help them recall and identify places they fished.

Table 2: Minor changes made to the questionnaire to make meanings of questions clearer to interviewees.

Original Questions:	Changed to, with new wording in bold:	Reason:
Q2. How would you describe your interest in the sea? (e.g. hobby/interest/professional)	After 2nd interview: Q2. How would you describe your interest in the sea **when on Ascension**? (e.g. hobby/interest/professional) **How frequently would you say you're on or by the sea?**	Adding 'Ascension' directed people to talk specifically about the island rather than the sea in general and requesting a figure for how frequently someone spent time on or by the sea would allow for a better assessment of the timescale of their observations.
Section A: Q10. Could you describe an example of an exceptional day's catch in the last year? – i.e. how many/much fish did you catch, where was this and when did you catch it?	After 5th interview: Section A: Q10. Could you describe an example of **a memorable day's fishing in your last year of fishing?** – i.e. how many/much	It was soon established that fishing on Ascension does not involve catching as much as possible, given lack of demand for fish and opportunity to sell it, hence substituting 'memorable' for 'exceptional' felt more appropriate as it directed people

	fish did you catch, where was this and when did you catch it?	towards a fishing related memory that stood out for any broad reason.
Section A: Q14. Do you remember what your best day's catch was then? What did you catch and where?	After 5th interview: Section A: Q14. Do you remember **a memorable day's** fishing back then? What did you catch and where?	As above.
Question on sharks in 'Round up' section after questions on increased/decreased species	After 5th interview: Question on sharks in 'Changes over time' section **moved to be before** questions on increased/decreased species	I was concerned that since there had been the perceived increase in shark numbers, interviewees frequently gave sharks as an increased species, and nothing else. By allowing people to talk about the sharks first, when they got to the 'increased species' question they had already expressed shark views and could explore

		other possibilities of species which may have also increased.
Are there any species you see today that are more common now than they used to be?'	After 6th interview: Are there any species you **know of that have increased in numbers during your stay on Ascension**?	The phrasing of the question was confusing and interviewees often required clarification.
Are there any species you know of that were more common in the past than they are now?	After 6th interview: Are there any species you **know of that have decreased in numbers during your stay on Ascension**?	As above.
	After 6th interview: Added in: Would you say the amount of effort you have to put in order to catch fish has changed during your stay on Ascension?	This question was added to allow respondents a second tack on perceiving changes in fish abundance.

Analysis of Results

Recorded interviews were transcribed into Word documents then imported into NVivo (http://www.qsrinternational.com/nvivo/what-is-nvivo), where they were grouped by classifications for: sex, age group, occupation (fisher, conservationist or recreational user of the sea), when someone first came to Ascension and their length of time on Ascension. Within the 'fisher' occupation category participants were further grouped for 'type' and 'area fished'. For people who had lived on Ascension since birth, I calculated their length of time there to start from age 13 to reduce the chance of giving credit for time on the island to a period in life when memory can be unreliable (Odegard *et al*., 2009).

Responses to each question were then systematically categorised, or coded, in NVivo. Coded responses facilitate analysis by assigning categories (named 'nodes' in NVivo) for allocating units of meaning to the descriptive information provided by respondents. Coding therefore enabled similar responses to be identified amongst interviewees, and the total number of people who answered in that way tallied (Figure 3). The use of NVivo to code responses also enables rapid and comprehensive data searches. Furthermore, it enables analysis across interviewee responses linked to respondent characteristics (e.g. age, gender, date of arrival on Ascension). From coded data, a series of summary tables were produced that show numbers of interviewee answers for each question independently compared with respondent characteristics. All result tables were exported into Excel for analysis. SPSS Statistics 24 and Excel were used to run statistical tests. Non-parametric binomial tests were used to test for statistically significant results from interview questions, and Pearson Chi-squared tests were used to test for a significant relationship between respondent characteristics and their answers. Results were classed as significant with probability values (P) <0.05.

Figure 3: Example of coding in NVivo; in this case whether the respondent noticed an increase in fishing effort around Ascension. Responses are categorised as 'No', 'Yes' and 'Yes (due to sharks)' on the left with the corresponding number of interviewees on the right.

Results

History of Exploitation

Fishing

The earliest account found of fishing on Ascension was from Peter Mundy in 1656 who remarked “Here is plenty of good fish to bee had with a little paines taken in fishing… The best fishing is near the shore in a boate, or from the rocks on the land, from whence you may see mulltitudes of divers sortts close to the shoare.” By contrast the next from 1678 described things much more modestly “Caught several fish with teeth and mouth like a monkey” (Bevan, 1678). In the early eighteenth century descriptions returned to more profuse with “We sent our long boat to fish with 5 hands and they brought more on board in a very little time that what from the whole ships company and going again that night they brought aboard 700 large fish..." (Pyke, 1705) and "We spent two or three hours in the Pinnace near the Rocks, where we caught a prodigious number of various Fish; which were so plenty, that in one Hour there were more caught than was sufficient for forty Men to eat in a day” (Beeckman, 1718). One early traveller appreciated Ascension’s ample supply of fish as they could be caught with ease when waves “pour water upon the bank” (Osbeck, 1765) and praised the taste of what we now call Queen Triggerfish (*Balistes vetula),* Blackfish (*Melichthys niger),* Rock Grouper (*Epinephelus adscensionis*) (Osbeck & Forster, 1771). Another record of seafood eaten at the same time noted “a species of conger eel [likely *Gymnothorax moringa*], a species of bream [likely *Diplodus adscensionis*], Caravlhoes [likely *Caranx hippos*], mullet [likely *Mugil curvidens*], some crayfish and oysters” and said these “frequented the numerous creeks and islets” (Cowell and Read, 1765). However good catches could not always be guaranteed as noted by Davis in 1798 "Upon returning to the ship we found people on board had been more fortunate [in their search for provisions] for they had procured a good quantity of fish”. In 1815 Ascension was claimed as British territory and one of the ships which did this, the H.M.S Peruvian, logged 110 fish caught averaging 3lbs, as well

as enough caught using a seine from the shore to feed the two crews (Stonehouse, 1960). When Ascension's first British Royal Marines commander, Lieutenant Nicholls, arrived in 1823 he introduced the production of dried and salted eel to sell to visiting ships (Stonehouse, 1960). In the logbook of Nicholls' successor, it was noted that fishing was part of the daily activities of the garrison (Bate, 1835a) and in 1880, the activity was said to regularly occur (Roe & Parsons, 1885). In letters to the admiralty in the mid-nineteenth century less meat was requested "as there is a good supply of fish" (Hutton, 1847a). Frequent references to fishing and the type of fish caught around Ascension occurred throughout the 19th century (Table 3); with notes sometimes made of how the weather affected this. For example, a new resident to the island was told by her cook that readily available fish became not so "when the rollers are in"[1] (Gill, 1878) and a resident also commented "Shellfish picked off rocks for eating - unable to fish due to rollers" (Haggard, 1878b).

By the early twentieth century reports of fishing on Ascension began to reveal problems, for example, "Fishing - the amount of fish in Inland [supposed to mean inshore] waters has been very small this year and many blank days have occurred, especially of late" (Holroyd-Doveton & Burke., 1918). Nevertheless, throughout the first half of the 20th century articles such as in the National Geographic Magazine (Simmons, 1927) and the Cable & Wireless' magazine 'Zodiac' and personal reports from residents made reference to fishing as part of recreational life on Ascension (e.g. Anon., 1923; Gunther, 1925; Simmons, 1927; Diels et al., 1927; Marx, 1983).

[1] The 'rollers' are sudden, large swells that occur at certain times of year on Ascension (Mortimer & Carr, 1987)

Table 3: References for specific mentions to fish around Ascension during 19th century, with years of the observations in chronological order for each species

Species	Year of Observation	Reference
Conger eel (Moray eel – *Gymnothorax moringa)*	1829, 1834, 1878	Webster, 1834a; Webster, 1834b; Brandreth & Power, 1835; Gill, 1878
Rock-cod (Grouper – *Epinephelus adscensionis*)	1834, 1878	Brandreth & Power, 1835; Gill, 1878
Cavalha/cavalhoe (*Caranx hippos*)	1834, 1895, 1878	Studley, 1898; Webster, 1934a; Brandreth & Power, 1835
Soldier (either *Myripristis jacobus* or *Holocentrus adscensionis*)	1834	Brandreth & Power, 1835
Tuna/bonito (*Thunnus albacares* or *Katsuwonus pelamis)*	1895	Studley, 1898
S. capensis (Old Wife *Diplodus ascensionis*)	1875	Mellis, 1875
L. glauca (Silverfish *Trachinotus ovatus*)	1875	Mellis, 1875
Shellfish/oysters (Possibly *Saccostrea cucullate)*	1834, 1878	Webster, 1834a; Webster, 1834b; Brandreth & Power, 1834; Haggard, 1878b
Five-fingers (*Abudefduf saxatillis*)	1878	Gill, 1878
General abundance/variety of fish to eat	1816, 1826, 1829, 1834, 1843, 1858, 1878, 1895	Campbell, 1816; Pickup, 1985; D'Urville & Rosenman, 1987; Brandreth & Power, 1835; Webster, 1834a; Webster, 1834b; Martin, 1843; Burnett, 1858b; Haggard, 1878a; Thomson,

	1878; Gill, 1878; Studley, 1898

In 1930, the Empire Canning Council's[2] expression of interest in a fish cannery on Ascension was met with opposition that the type of fish caught there would not be suited to British tastes alongside the difficulties of intensive fishing in the island's challenging sea conditions (Willmott, 1930a). Nevertheless, a concession was granted to an Argentine company in 1938 which permitted their vessels to fish Ascension's waters (Jarrett, 1938), but because the Second World War interrupted the venture it failed to achieve commercial success (Wills, 1955). In the short time operations occurred, via boats fishing with handlines, only 3 tons of fish over 4 weeks were landed, with 60% of this taken between Clarence Bay and Portland Point, and the remainder between Clarence Bay and English Bay (Mason, 1939a) (Table 4). Six vessels were involved, with shark, mackerel and cavalley (*Caranx hippos*) used as bait whereby shark was reported as best (Bunker, 1939).

[2] Set up to rival America's canning industry (Jones, 1930).

Table 4: Catch statistics from Argentine fishing vessel S.S. Sentinel include species and amounts caught around Ascension in 4-week period of 1938, adapted from Mason, 1939b.

Species	Number of fish	Total weight (lbs)
Albicore [*sic*] [Albacore tuna, *Thunnus alalunga*]	947	41,076
Barracuda [*Sphyraena barracuda*]	80	2000
Cavalli [Cavalley jack, *Caranx hippos*] (Quantity in cold storage – significantly more caught and used for bait)	350	1,400

After the war, interest in Ascension as a commercial fishing enterprise picked up again. A 1947 survey designed to investigate the fishing prospects gave an optimistic view of Ascension's tuna fishing (Oelrichs, 1948a). Despite this, a later one in 1953, undertaken to satisfy South African interests in establishing a commercial fishery on the island, concluded low plankton counts and a limited shelf meant there was a limit on how much biomass the area could support and thus how productive the area could be for fisheries (Wills, 1955). Additionally, the logistical challenges of Ascension's remoteness and associated expenses were also restrictive (Anon., 1948). Sharks were abundant around Ascension and could have been a valuable source of income, but when shark prices fell the final decision to not go ahead was made (Wills, 1955). Commercial fishing none-the-less occurred around Ascension, though based on the evidence I found not frequently or on a large scale. In 1975, a report of the vessels listed as having visited the island included one trawler (Anon. 1975b).

During the 20th century, commercial fishing pressure within Ascension's EEZ was considered high with Japanese and Taiwanese fleets used mainly longlines to target assorted tuna species, namely Yellowfin (*Thunnus albacares*) Bigeye, (*Thunnus obsesus*) & Skipjack (*Katsuwonus pelamis*) (RSPB, 2017). According to Scullion (1990), Spanish and Venezuelan fleets also tried to purse-seine for tuna with little success. An interviewee told me the fishing ships could be seen with "shark fins and shark tails hanging across the decks" in the 1980s (Interview SH 030). This fishery was unmonitored, so a licensing system was introduced in 1988 (RSPB, 2017). In the 1990s the number of licensed fishing vessels peaked at 80 (RSPB, 2017), with the number of permitted fishing days around the island peaking in 2011 at 4,231 (Figure 4). A report found in the St Helena archives (Anon., 2001) gives no details but states that a commercial fishing operation was looking at establishing a processing plant on Ascension in 1995 – though this appears not to have happened. No licensed fishing was allowed in Ascension's water between 2005 and 2009 due to a change in administration of the island from the St Helena government to Ascension Island Government. Licensed fishing was reintroduced in 2010. In 2012, the Bigeye tuna catch from Ascension's EEZ was 1,543 tonnes and yellowfin tuna was 65 tonnes representing 2.2% and 0.06% of the total Atlantic catch respectively (Irving, 2015), the majority caught likely by Taiwanese fleets (Reeves & Laptikhovsky, 2014). Commercial fishers were again prohibited in 2014/15 whilst options for future fisheries management were considered (Reeves & Laptivosky, 2014; Armstrong & Reeves, 2015). When the tuna fishery re-opened in 2015, an area of 50 nm around the island and the whole of the southern half of Ascension's EEZ was closed to commercial fishing as a provisional measure whilst seeking formal protection, with licenses available for pelagic longlining in the northern half (RSPB, 2017). However, uptake of these licenses was low, with just two sold for the 2015/2016 season (Pers. Comm. J. Brown, previous Head of Conservation for AIG, 2017), where a license lasted from August to the following July. In 2004 evidence of illegal fishing activity was found in the form of longlines around the island (AIG, 2004).

Formally, Ascension Island has been considered to be at high risk from Illegal, Unregulated and Unreported (IUU) fishing (Pearce, 2009). Further evidence of IUU activities exist in the form of fishing patrol encounters (MRAG & Argos Froyanes Ltd., 2010) and from anecdotal reports of fishing vessels, often seen around the island at night.

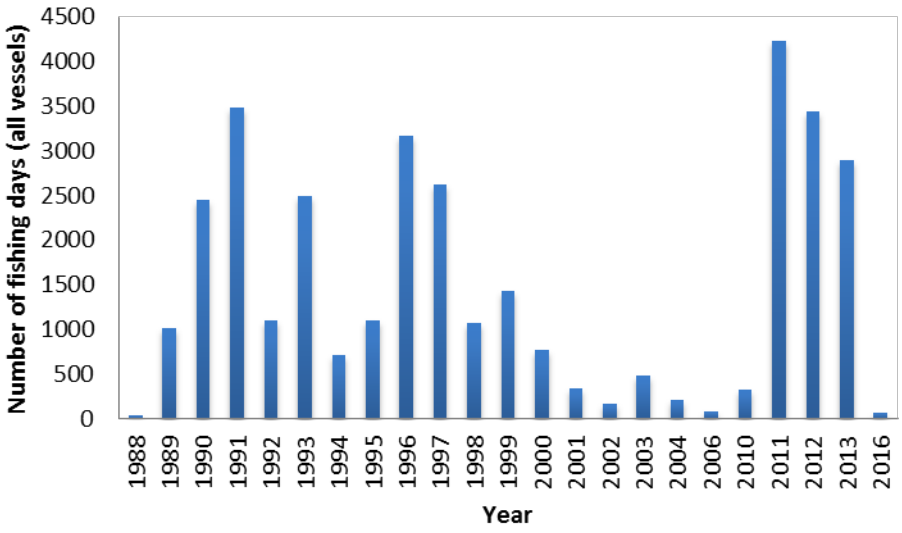


Figure 4: Licensed commercial fishing days within Ascension Island's Exclusive Economic Zone (source: Ascension Island Government Conservation department).

Although Ascension has no domestic commercial fishery today, residents commonly fish inshore for recreation and personal consumption (Armstrong & Reeves, 2015). This popularity makes fishing feature highly in Ascension's local newspaper, 'The Islander', whereby between 1971 and 2016 there were 253 related articles of which only 4 were about commercial fishing and all after 2001 (Figure 5). Additionally, features in the Africa Pilot on fishing indicate the acclaim of fishing around Ascension (GB Hydrographic Dept., 1930; 1963; 1977; 2002; 2004; 2007). Catch records from the Islander convey firstly the number of headline-making-fish and the significant increase in sizes of marlin and tuna reported (Figure 6). Around 2005 there appears to be a drop off in the number of fish related articles. Although the reasons are unclear it is not likely to be related to the administration of the paper, given there is always more than one editor working on the paper on a rotational basis. So even if one left, it would be unlikely to have a major

effect on content. Additionally, there were multiple correspondents reporting on the fishing, for example, one from the US base, one from Georgetown. Many of the articles were unrelated to correspondents, and standalone news pieces. Therefore, the apparent reduction in fish catches could potentially be attributed to changes in the fishing and numbers of fish caught. The ease of fishing was conveyed to me during my time on Ascension in August to September 2017– six interviewees commented they used to be able to catch fish with cloth as bait, a phenomenon also reported in 1895 (Studley, 1898) and in Bartlett's account from 1934 (Bartlett, 1972a). The US Air Force installed fishing equipment on its rescue boat with a suggestion to do the same for the British, which conveys the popularity of fishing (Wainwright, 1964a). Although the majority of fishing by residents was on a recreational basis, the UK and US air force personnel mess halls were provided with fish by local people, which often amounted to significant numbers, demonstrated by:

> "Because like I say in 1987 when I got here, the American's they had a boat here, a Peaboat, and at that time their employees used to go fishing for the mess hall and every week, twice a week they used to get grouper, two tonnes of it." Interview AI 063.

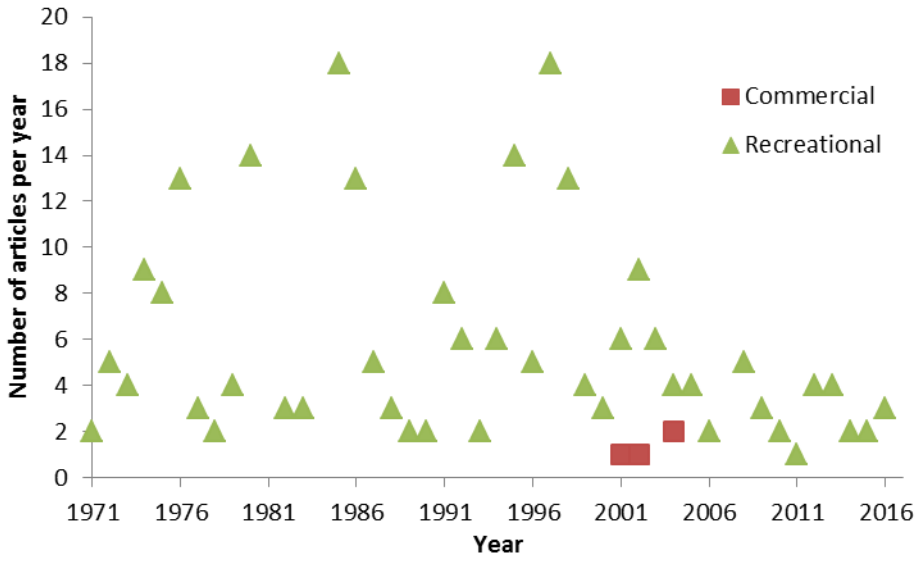


Figure 5: Number of articles on recreational (R^2=0.06, t=-1.57, P=0.12) and commercial fishing around Ascension appearing in the 'Islander' newspaper 1971 – 2017.

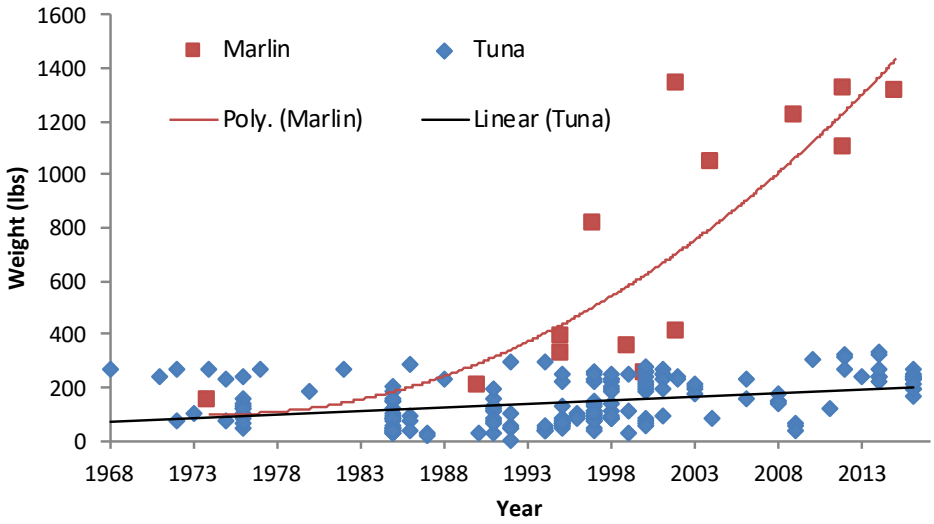


Figure 6: Reported catches of yellowfin tuna (Thunnus albacares) (R^2 =0.13, t =5.35, P=2.55E^-07) and marlin (likely Makaira nigricans) (R^2=0.61, t=4.3, P=0.001) from around Ascension in the 'Islander' newspaper 1968 – 2017 (Data pre-dating 1971 when 'The Islander' started was reported in a later edition of the paper).

In 2002, the first sport fishing company was established on Ascension and by 2016 there were three, with trolling, hand line, rod fishing, chumming, and spearfishing offered (Pers. Comm. M. Hennigsen; B. Chester; E. Cuylaerts, 2017, who each run or ran the fishing companies on the island). Sport fishing in Ascension has produced World Records in the past for

assorted species and currently two stand with the International Game Fishing Association for Horse-eye jack *(Caranx latus)* and Rainbow runner (*Elagatis bipinnulata*) (Stewart *et al*. in prep). From photographic evidence and communication with residents, marlin, yellowfin tuna and other game fish are regularly caught using spearfishing and trolling amongst other methods (Armstrong & Reeves, 2015). Marlin over 1000lbs ('Granders') only started to be caught off Ascension when the sport fishing boats arrived on the island (Figure 6). Presently, there are no government limits on the amount of fish caught recreationally or by the sport fishing operations around Ascension, apart from a 10 kg per person rule on exports (Armstrong & Reeves, 2015).

In April 2016, all Ascension's sport fishing companies ceased operations after the island's airport closed for long-term repairs such that offshore fishing today requires access to a privately-owned boat or an invite to fish on the United States Air Force (USAF) vessel (Pers. comm. P. Yannulis, operator of USAF boat, 2017). Shore fishing has been unaffected by the airport closure (Armstrong & Reeves, 2015) with grouper (*Epinephelus adscensionis*) and moray eel ('Congers' *Gymnothorax moringa*) the main target species and the majority of fishing is done from sites of easy access which means the area directly off Georgetown and the west coast (Figure 2) get the most shore fishing, with the north-east side the second most popular (Pers. Comm. Multiple Ascension Island residents, 2017). Similarly, due to the size of boats, and relative ease of catching fish, boat fishing tends to occur within five miles of the shore and to the 'front' (west) of the island (Figure 2), but other areas are fished depending on the weather conditions. Large game fish have been frequently caught, including sharks (Figure 7) and at certain times it is possible to catch tuna from the shore.

Figure 7: Selection of fish caught around Ascension Island: a) 1337 lb marlin caught 2002; b) 102 lb wahoo caught 1992; c) Hooked shark, no date (between 1988-2002)

Turtles

Green turtle (*Chelonia mydas*) meat was considered a delicacy, and Ascension Island gained a reputation as a place at which to stop and capture turtles in the 1600s. It can be supposed that visitors to Ascension in the first 100 years exploited the turtles but the earliest account of hunting turtle I found was in Ashmole and Ashmole (2000), who refer to a statement from

1644 relating to the ship Mary “she has gone to Ascension to turtell”. Twenty-two years later in 1666, Rennefort, secretary for the French East India Company and a brief visitor to the island (Cawley, 2015) also commented on hunting for turtle. As early as 1678 it was noted from a traveller’s diary that on Ascension he had “famous turtle soup for dinner” (Bevan, 1678). Following colonisation of Ascension in 1815, turtle captures became an intensive and organised hunting operation, where turtle capturing parties were sent out to collect turtle, with half a crown paid to hunters for each one caught (Ellis, 1885). This was to not only supply residents with food but as a commodity to sell to visiting ships (Ashmole & Ashmole, 2000). The turtles were easy targets whilst onshore; after they’d laid their eggs they were turned on their backs by hunting parties which rendered them immobile until later collected. So turtles could be kept alive until required for longer, a turtle pond was built shortly after 1815, subsequently enlarged and a second pond added in 1829 (Ashmole & Ashmole, 2000) (Figure 8). As word of the turtles’ availability on Ascension spread, provisioning visits to the island increased (Ashmole & Ashmole, 2000). They were sought after as their meat was considered to improve sailors’ health, particularly for prevention and treatment of scurvy and was a welcome change from the ship diet (Keber, 2002).

Figure 8: Picture shows 'turned' turtles in turtle ponds on Ascension. No date. (Source: Chatham, no date.)

As a conservation measure, turtles had to be allowed to lay their eggs before capture (Hart-Davis, 1972a). Despite this, the accounts increasingly referred to the numbers of turtles decreasing. In 1892, the H.M.S Wye returned from Ascension with the news there was a 'great scarcity of turtles' (Anon., 1892). Additionally, in 1901, the average at the time was 250 which was considered to show a decline as 800 turtles were captured in the past (Aiton, 1901) (no specific year given in the source when, but likely 1847 when records show 829 were turned (Huxley, 1999). In fact, from official records I found, catches of turtle peaked at 1506 turtles a year in 1829 (Figure 9a). However, Brandreth (Brandreth & Power, 1835) comments that in one, unspecified, year (but before 1829), 2500 were taken. The latest data suggests 3,950 turtles nest at Ascension per year (Weber *et al*., 2014), giving a catch of 2500 some context. Though there is a gap in catch records between 1875 and 1899, I did find a reference to 270 turtles taken for the ponds between January and May in 1881 (not included in Figure 9a as not necessarily the full season's catch), which was described as 'fair' (Richards, 1881).

The reduction in the turtle population led to speculation of the reasons. In 1906, it was reported the average for the last 7 years of 138 animals per year would have been higher if it weren't for the noise caused by guns and boat traffic; an annual limit of 200 turtles caught was imposed (Anon, 1906b). By 1922 though, the average catch of turtle for the previous three years was just 38. Protection was called for but opposed due to their importance as food for island residents, so instead, a limit on capture was maintained set at 400 turtles (Anon., 1922c). It is unclear from the records I consulted why this limit was increased at a time of concern over population size. The statistics report for 1926 stated "The turtles seemingly no longer land in the vicinity of the town. The more remote beaches at NE and SW, formerly resorted to by the turtles in hundreds now only land in tens." (Lander, 1927a). The concerns did not see an end to turtle hunting - between 1924 and 1934 the Eastern Telegraph Company continued to receive permission to take turtles as a supplement to residents' diet and to send back to Great Britain where they were a feature on Royal banquet tables (Simmons *et al*., 1927; Ashmole & Ashmole, 2000). Eventually in 1935, the license wasn't renewed as the hunt had become uneconomical (Bartlett, 1935a), demonstrating the general trend of decline. It seems that despite this, turtle were still captured for local use as reported in 1935 when 'over a score' were in the ponds (Bartlett, 1935b). Weights of the turtle captured were also often remarked upon (Figure 9b) since to manually turn them on their backs meant those involved experienced their weights first-hand, and observers could closely observe the turtle's size in the ponds or on the beaches.

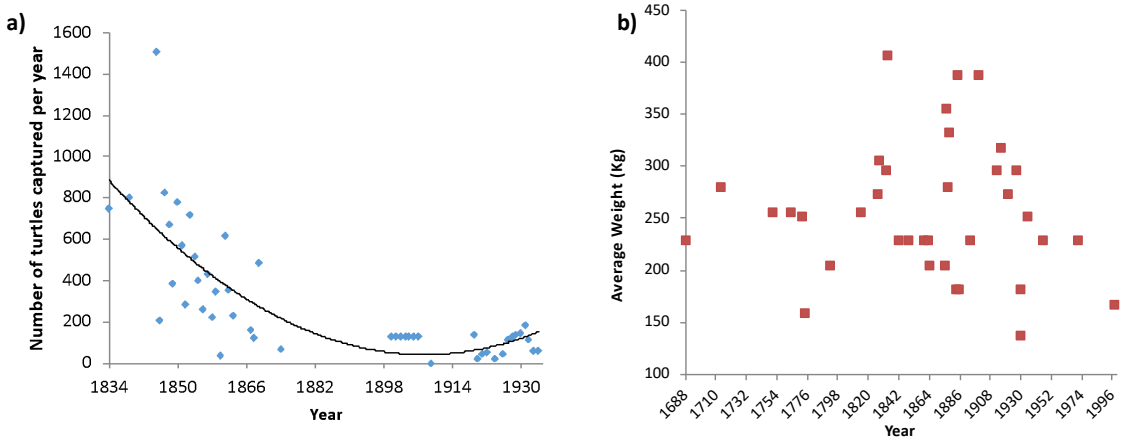


Figure 9:a) Annual Turtle catches on Ascension Island from 1834 to 1934 when concessions for their capture ended (R^2=0.48, t=-6.47, P=6.28E^-8).

Years missing: *1835-1838, 1840-1844, 1864-1866, 1870-1873, 1875-1899, 1910-1918, 1923, 1925*

Data sources: *Anon., 1928b; Huxley, 1997; Anon., 1864; Kerby, 1871; GB Hydrographic Office, 1963; Anon., 1906; Dumas, 1910; Anon. 1922a; Anon., 1922b; Lander, 1925; Lander, 1927b; Wood, 1928; Wood, 1929; Willmott, 1930b; Anon., 1931b; Willmott, 1932; Anon., 1933; Willmott, 1933; Bartlett, 1934.*

b) Average weight of turtles caught by year on Ascension between 1688 and 1996 (R^2 = 0.003, t=-0.34, P=0.74)

Data sources: *Ovington, 1689; Beeckman, 1718; Osbeck, 1752; Cowell & Read, 1765; Purdy, 1816; Forster, 1777; Avis, 2000; Campbell, 1816; Anon., 1923b; Holman, 1834; Anon., 1928; Brandreth & Power, 1835; Anon., 1931; Brandreth & Power, 1835; Webster, 1834a; Allen, 1835; Martin, 1843; Cree, 1850; Anon., 1861; Anon., 1864; Daines, 1867; Matkin & Rehbock, 1992; Spry, 1877; Gill, 1878; Aiton, 1901; MacCormick & Franklin, 1884; Ellis, 1885; Anon., 1886; Studley, 1895; Huxley, 1997; Bennett, 1914; Drew, 1989; Anon., 1928; Pollock, 1998; Hart-Davis, 1972b; Hays et al., 2002*

Several years later the arrival of the US Airforce to establish a base saw an increase in the human population on Ascension and a renewed demand for food. In 1942 the US took 18 turtles out of a possible 50 they were permitted to take by the St Helena Government (Huxley, 1999). It was quickly

discovered that the taste of turtle meat wasn't popular despite its reputation previously, so they were only occasionally caught for food in 1943, 1946, 1947 and 1949 (Cardwell 1943; 1944; Clark, 1947; Oelrichs, 1948b; 1950). In 1944 they became a protected species under the WildLife (Protection) (Ascension) Ordinance (Chapter 129) (Huxley, 1997). This was strengthened by the Ascension Land Ordinance in 1967, which gave the administrator of Ascension power to control access to sites of importance for turtles during their breeding season (Huxley, 1997). In 1968, a turtle egg hatchery operation was established by Mariculture Ltd. This involved 20,000 Ascension eggs taken per year to supply a hatchery in the Cayman Isles which reared hatchlings to adults then released them into the wild as a conservation measure, or sold their meat and leather (Anon., 1972c). A further 5,000 eggs were removed from Ascension nests by Mariculture Ltd, to be hatched out in Ascension's turtle ponds, later tagged and released beyond the reach of inshore predators (Huxley, 1997). In 1972 it was reported by the "Islander" that two bull turtles were captured and sent to the Cayman Isles as part of this operation (Anon., 1972b).

Seabirds

Before 1815, the frequent temporary visitors often commented on the lack of fear shown by the seabirds towards humans. Linschoten's first account from 1589 depicts seabirds "leaping or sitting on our shoulders and arms, not once fearing us", and something very similar was also described a hundred years later, "and never stir from their Nests for fear, of any passengers approach, but sit billing and pecking as such as pass by" (Ovington, 1696). In 1715, it was said that the seabirds "…suffr'd themselves to be taken off from their eggs…" (Beeckman, 1718) and by the end of the eighteenth century remarked that birds were "in numbers considerable and are so passive as to allow themselves to be caught by hand or knocked down by sticks or stones in broad daylight" (Davis, 1798).

The first few mentions of seabirds as food referred to their poor flavour; assessments include "morish" (Linschoten, 1596), which means strong

tasting or fishy, and “very unpalatable, and so distasteful to sailors, they rarely touch them” (Ovington, 1696). Despite this, seabirds were killed, for what could be considered as sport, with Peter Mundy reflecting in 1656 “we strucke them downe with sticks” (Mundy, 1936), and Osbeck in 1752 “Also Ascension, where the birds and fishes are so easily caught: the former on the heap of stones…” (Osbeck, 1765), implying that birds were killed while sitting on their nest sites. The men-of-war birds (*Fregata Aquila*) and boobies were consumed by Dampier and his crew whilst shipwrecked on Ascension in 1700 (Dampier & Masefield, 1906a) but these species did not feature heavily in other accounts. The first record that describes the seabird eggs as “good for eating”, came in 1765, for Wideawake terns (*Onychoprion fuscatus)* (Cowell & Read, 1765). By 1829, it was reported that 120,000 Wideawake eggs had been collected in one week, with the same figure also mentioned in1834 (Brandreth & Power, 1935).

Although early distaste was shown towards seabirds, an account in 1843, wherein sea birds are grouped together with fish, “Abundance of fish and marine birds are obtainable” (Martin, 1843) indicates they are possibly consumed for food though whether the birds are collected for their eggs or the adults is unclear. In 1843, Fraser (1843) was more specific and commented “Of this permission [to take eggs] all on the island eagerly avail themselves; and, though vast numbers of eggs are carried away, up to the last there seems but little diminution of the stock." By 1868, Collingwood (1868) reported that the birds flew away in alarm at a human approach, in contrast to their behaviour a hundred years earlier. In the same year it was also reported that to ensure the eggs they ate were fresh, marines garrisoned on Ascension would rope off an area, smash all the eggs within it, and return some days later to collect the new eggs (Studley, 1868). By 1870, a decline in seabird numbers was noted: “Very many years ago, sea fowl must have covered the island, and deposited plenty of guano, as is evident from the marks upon the clinker, but for many years they (with the exception of the "wide-awake" [fair]) have been confined to Botswain Bird

Island, the Gillar rocks, and other small islets round the coast, and to the parts of the island which are almost and quite inaccessible" (Kerby, 1871). In 1927, the apparent decline in seabirds raised the question of what used to be there "These sea birds once lived in great cities and left their guano in countless tons, to be scattered by wind and weakened by rain. Perhaps these colonies were of boobies, man-of-war birds, and terns; but a careful search for bones in the deposits may show that here once lived an extinct species of penguin or perhaps rare sea birds akin to petrel and albatross" (Simmons, 1927). Further evidence of the seabirds' decline is a map from 1838 (Bedford, 1838) which shows booby nesting grounds that are no longer used (Hughes et al., 2008).

These indications of a decrease in the seabird population could not only be as a result of the egg collections but also predatory species introduced to Ascension. Rats probably arrived on Ascension before Dampier's ship ran aground there in 1700[3] due to his observations of them there (Duffey, 1964) with later reference to their presence in 1756, when Henry Cowell, Captain of the HMS York, commented "…no other creature except Ratts (*sic*) and Birds" (Cowell & Read, 1765). Around 1815 cats were introduced to control the rats (Ratcliffe et al., 2009) but by Darwin's visit in 1836 he described the cats as a "great plague" (Hughes et al., 2008).

The decrease in seabird population continued to be observed alongside an increase in threats to their survival in the 20th century. In 1942 it was estimated the population of Sooty terns (locally known as Wideawakes) contained a million birds (Chapin, 1954). During WW2, concerns of bird strikes were raised due to the Wideawakes' close proximity to aircraft landing on and taking off the new runway on Ascension. As a result, an ornithologist smashed Wideawake eggs in a failed attempt to relocate their nesting ground (Cant, 1973) – later, the ornithologist confessed his regret at these actions (Chapin, 1960). The Sooty (wideawake) terns were still

[3] Other sources list Dampier's leak off Ascension as 1701 but from what I saw it was 1700

described as 'recovering' in 1948 from the "unavoidable decimation" caused by use of the runway during WW2 (Anon., 1948). Despite this, 12,500 eggs were collected in 1948 (Anon., 1948), and a license that allowed Cable & Wireless to collect Wideawake eggs as a food supplement for residents remained until 1957 (Avis, 2000). Informally, it seems egg consumption continued into the 1980s as I was told "We used to eat the Wideawake eggs, rich and tasty, just go once and take what you need." (Interview SH 025 – on island 1979-1989). When the British Ornithologist's Union surveyed seabirds on Ascension in 1957-59, they estimated the population of sooty terns was 750,000 (Hart-Davis, 1972a), indicating a decline of 250,000 since Chapin's estimate 15 years previously. The cats' impact on the population is still evident towards the end of the 20th century, for in 1964 the seabird population was described by the administrator on Ascension as "decimated by feral cats" and "corpses lying every where in hundreds" on the nesting sites (Wainwright, 1964b; c). In 2000, an Ascension law was passed which meant all domestic cats were to be neutered and identified as such with reflective collars (Ratcliffe *et al*., 2009). Extensive poisoning and trapping was employed to kill feral cats, with the programme successfully ceasing in 2006, and a positive recovery of seabirds seen since (Ratcliffe *et al*., 2009). Rat eradication is still on going on the island, with the population appearing to be increasing (AIG, 2015d). Birds and eggs are now fully protected on Ascension under the Ascension Island Wildlife Ordinance implemented in 2013 (AIG, 2013).

Other wildlife exploitation

Alongside the more frequent and detailed observations of exploiting the fish, turtles and seabirds, there were some references to exploitation of other marine life around Ascension but to a lesser degree. It would seem Ascension had a population of whales in close enough proximity for whaling operations to be considered. In 1828, Captain William Bate (commander of the island at the time) expressed his desire to use the island as a whaling station (Stonehouse, 1960) though I found no evidence that one was ever

established. Records show that whalers from elsewhere did visit the island. Townsend's (1935) study of American whaling activity clearly shows there are 60+ records of Sperm whales caught around Ascension between 1761 and 1920. Other evidence includes a letter written by Captain Bate that describes swapping turtle for whaling boats from visiting whalers (Bate, 1835b), a comment made in 1903, when an American whaler 'President' visited the island (Anon., 1904), and a log entry of whalers passing in 1906 (Anon., 1906a).

One of Ascension's only native animals is the land crab (*Johngarthia lagostoma*), which was commented on by Dampier as part of the diet supporting the shipwrecked crew in 1700: "the Goats, Land-crabs, Men of War Birds, and Boobies, good Food" (Dampier & Masefield, 1906a). Following the establishment of a permanent population it is conveyed regular killing of land crabs occurred. Roe (1882) commented that land crabs were regularly killed in large numbers which is confirmed in a British Admiral's journal entry for the 15th January 1887 that reported 1350 land crabs were killed (Anon., 1890). In fact, Hart-Davis (1972a) reported that between 1879 and 1887, 335,535 were killed, by which point "Land crabs are still a large item, but the men have to go very far afield to get many". The crabs were killed because of their appetite for crops (Hartnoll et al., 2009; Anon., 1972d). An account from 1876 (Drew, 1876) confirms that payment was received for each crab killed, which is why numbers killed was recorded though they were rarely eaten. This appears to have had an impact on the population by 1904, when it was reported that a Mr Bruce caught a land crab "which does not seem to be a common animal on the island" (Bruce *et al*., 1907). References to the land crabs were not found from this point onwards, until more recent analyses of their populations (Hartnoll *et al*., 2009; Hartnoll *et al*., 2010) wherein the structure suggests an ageing population. Additionally, an estimate from surveys in 2013 suggested a population size of 80,000 adult females (AIG, 2015b).

Historical Timeline

From the results of my historical literature search, I have constructed the following timeline of references to the marine environment, alongside key events in the island's history. The full table of quotes can be found in the supplementary information.

The Forgotten Island: Post-discovery years of Ascension Island 1501-1814

The majority of the early visitors to the island remarked on the large number of birds (Table 5), for example they "came by thousands flying about our ships" (Linschoten, 1596), and were in "infinite swarms" (More, 1600 in Teale, 1978) and "numberlesse number" (Mundy, 1936). They were still referred to as 'numberless' in 1775 (Forster, 1777). The castaway Hasenbosch, whose diary was found next to his skeleton on Ascension, commented there were so many birds in 1725 they "deprived me of some of its [the sun's] light" (Ritsema, 2010), a sentiment echoed by visiting surgeon William Davis in 1778 (Davis, 1778). Turtles and fish attracted fewer comments but were still plentiful (Welch, 1950 in Teale, 1978; Mundy et al., 1907; Mundy, 1936; Pyke, 1705; Cowell & Read, 1765; Avis, 2000). The earliest reference to turtles I found was from Father John dos Santos in 1600 (Welch 1950 in Teale 1978), who wrote "there were tortoises, but no trace of grass or trees anywhere" and many people noted their value for food (Ovington, 1698; Osbeck, 1752; Read, 1765; Dampier & Masefield, 1906a; Cowell & Avis, 2000). For fish, it was said in 1656 "little paines taken in fishing" in 1656 (Mundy, 1936) and "in one Hour there were more caught than was sufficient for forty Men to eat in a day" (Beeckman, 1718). Conger eels (Spotted Moray; *Gymnothorax morninga*) were specifically mentioned three times (Beeckman, 1718; Davis, 1798; Mundy, 1936) and blackfish (*Melichthys niger*) twice (Osbeck & Forster, 1771; Avis, 2000)

Table 5: Timeline of key quotes or events from Ascension's history and observations of the marine environment from 1501-1814 (References from Osbeck, 1765 translated from German). Additions I added to quotes for clarity are included in square brackets.

Quote or Key event	Date	Author	Source	Page Number
Ascension Island discovered by João da Nova Castella but initially named 'Conception Island'. Discovery was not formally recorded.	1501		Weaver, 2011	
Island rediscovered on Ascension Day and named 'Ascension Island' by Alfonso de Albuquerque.	1503		Glover, 2010	
King John III of Portugal made a deed officially declaring Ascension as part of the Portuguese empire.	1539		Ashmole & Ashmole, 2000	
"It hath certain faire and white Sandes about it, and great store of Fish, wherein it surpasseth S. Helena, but in it there are no beastes at all, onely by reason of the great quantitie of Fishes ther are so many birds in it yt. it is strange, and they are of the bignesse of young Geese, & came by thousands	1589	Jan Huygen van Linschoten	Linschoten, 1596	261

flying about our ships, crying and making great noyse, and ranue up and downe in the shippe, some leaping and sitting on our shoulders and armes, not once fearing us, so that we tooke many of them, and wrung of their neckes, but they are not good to eate, because they taste morish [*strong-tasted or fishy*]."				
"About the Iland and the Iland of Saint Helena, unto the Equinoctiall line, there are flying Fishes, as great as Herings, which flie by great flockes together, two or three Fadome above the water…"	1589	Jan Huygen van Linschoten	Linschoten, 1596	261
"About this Iland are many birds, because of the great number of fishes that are about it, specially small flying fishes, which in Portingall are called Pisce Bolodor."	1589	Jan Huygen van Linschoten	Linschoten, 1596	265
"They are all unhabited and desert, and have upon them infinite swarmes of a kinde of fowles of the bignes of duckes."	1600	John Leoa More	More, 1600 in Teale, 1978	87
"Fish was abundant: there were tortoises, but no trace of grass or trees anywhere."	1600	Father John dos Santos	Welch, 1950 in Teale, 1978	88
"…there is not soe much as fresh water upon it, verie bare and nothinge to bee had there but Sea Fowle and fish, of which there is aboundance."	1634	Peter Mundy	Mundy et al., 1907	333

"A multitude of rarreg, craggy, sharpe pointed hard rocks for miles along the shoare and up toward the land, appearing white with the dung of sea foule, of which there were innumerable of severall kinds."	1656	Peter Mundy	Mundy, 1936	10
"Of sea fowle, as I said before, are a numberlesse number; some of them would be hoevering over our heads, seeking to lightt on us, [come] soe near thatt wee strucke them downe with sticks..."	1656	Peter Mundy	Mundy, 1936	84
"Here is plenty of good fish to bee had with a little paines taken in fishing, as cavallas, rocke-fish, conny-fish [possibly coney fish, a type of grouper], conger, etts. ... The best fishing is near the shore in a boate, or from the rocks on the land, from whence you may see mulltitudes of divers sortts close to the shoare."	1656	Peter Mundy	Mundy, 1936	84-85
"He said that after hunting for turtles, his landing party was bombarded by flocks of screaming birds…"	1666	Rennefort	Cawley, 2015	298
"The whole island is white with the dung of mews, cormorant and a sort of wild geese that come thither to breed and also to prey upon the dead fish which lie in heaps upon the shore."	1673	Struys	In Green, 1962	129
"Caught several fish with teeth and mouth like a monkey. They called them Parrot fish."	1678	Jacob Bevan	Bevan, 1678	

"And at the time when the turtle resort to these places to lay their eggs, they are accompanied with abundance of Fish, especially sharks; the places which the Turtle then leave being at that time destitute of Fish, which follow the turtle."	1684	William Dampier	Dampier & Masefield, 1906b	133
"The most inviting stay for Ships here, are the store of Turtle with which the Island abounds, some of which are grown to four or five hundred weight, but others are of less dimensions…"	1689	John Ovington	Ovington, 1696	513
"Besides these, here are birds in great quantity, but very unpalatable, and so distasteful to the Sailers, that they rarely touch them; by which usage they are kept in gentle tameness and familiarity, and never stir from their Nests for fear, of any Passengers approach, but sit billing and pecking as such as pass by. Among these the Boobies are most numerous, a Fowl so stupidly tame that it freely endures to be touched and handled, without any timorousness or fear."	1689	John Ovington	Ovington, 1696	514
"…So that now we were, by God's Providence, in a Condition of subsisting some Time; having plenty of very good Turtle by our Tents, and Water for the fetching."	1700	William Dampier	Dampier & Masefield, 1906a	572

“Here are a vast plenty of fish so every man without any means of learning may catch as many as he pleases with a line and hook. We sent our long boat to fish with 5 hands and they brought more on board in a very little time that what from the whole ships company and going again that night they brought aboard 700 large fish..."	1705	James Pyke	Pyke, 1705	
"When our men landed, they were surpriz'd to see the vast number of large Sea-fowl on the Rocks; such as Boobees, nodees, Men of War, Tropick Birds, &c. that suffr'd themselves to be taken off from their eggs…"	1715	Daniel Beeckman	Beeckman, 1718	201
"We spent two or three hours in the Pinnace near the Rocks, where we caught a prodigious number of various Fish; which were so plenty, that in one Hour there were more caught than was sufficient for forty Men to eat in a day…”	1715	Daniel Beeckman	Beeckman, 1718	201
"Some of our Men that were on the Shore fish'd among the Rocks on the Sea-side, and caught a great Number of Conger Eels."	1715	Daniel Beeckman	Beeckman, 1718	201
"Here is also great plenty of Oysters, Limpets, and other Shell-fish."	1715	Daniel Beeckman	Beeckman, 1718	201
"There is no place more stor'd with Sea-Tortoise."	1715	Daniel Beeckman	Beeckman, 1718	201

"During the time of this noise I never in my life saw so many fowls together, they looking like a cloud, and intercepting between me and the sky, deprived me of some of its light." (Wideawake or sooty terns).	1725	Leendert Hasenbosch	Ritsema, 2010	64
"The largest turtles, or sea-tortoises, have their residence on it, and are sometimes caught by hundreds in one night."	1752	Pehr Osbeck	Osbeck & Forster, 1771	78
"Sea birds are numerous here, and, what is remarkable, they were so bold, that they would let any one come up and take them with his hands."	1752	Pehr Osbeck	Osbeck & Forster, 1771	85
"*Balistes ringens* Linn. *Nigra* Osbeck. This fish may be frequently be caught, with the hands, namely, when the water throws its waves a great way on the land, and you throw some bread to the fish; for here both birds and fishes are as it were tame."	1752	Pehr Osbeck	Osbeck & Forster, 1771	93-94
"Trachinus ascensionis [*Epinephelus adscensionis]*. This fish tastes exceedingly well…"	1755	Pehr Osbeck	Osbeck & Forster, 1771	96
Saint Helena, an English island, we also have a comfortable place of rest; Also Ascension, where the birds and fishes are so easily caught: the former on the heap of stones, and the latter, when they pour the water upon the bank."	1752	Pehr Osbeck	Osbeck, 1765	426
"Flying fish were seen so much today as yesterday in large quantities."	1752	Pehr Osbeck	Osbeck, 1765	374

“It is completely uninhabited and without a forest. The largest turtles have set up their main camp on the same ground, so that they can be caught in hundreds at night.”	1752	Pehr Osbeck	Osbeck, 1765	374
“Sea-birds are here in great numbers, and, which are so bold and brave that one can walk past them, and can touch them with their bare hands.”	1752	Pehr Osbeck	Osbeck, 1765	380
"Here is great plenty of large turtle, and fish in abundance, but no other kind of refreshment to be got. The turtles come on shore in the night to lay eggs in the sandy bays, and by being watered are turned in great plenty: here we got upward of 90 turtles some upwards of 5 cwt."	1765	Henry Cowell	Cowell & Read, 1765	
"Following the road to the right over shingles and boulders a rough journey of a couple of miles takes you to Wideawake Fairr, a plateau near the sea shore monopolized by birds who lay their eggs here, they assemble in great numbers about June which is their breeding time & then foresake the island altogether. "	1765	Henry Cowell	Cowell & Read, 1765	
"The rocky black lava was the residence of numberless men of war birds and boobies, which sat on their eggs, and suffered us to come close to them."	1775	Georg Forster	Forster, 1777	
"The bay abounds with fish, particularly a small cod, but they have a black appearance..."	1793	George Maxwell	Avis, 2000	

"Vessels calling at Ascension for turtle often turn 50 in a night, from 3cwt to 5cwt each, and may be found in great abundance 8 months out of 12, say June, July, August and September excepted, when the season is too cold."	1793	George Maxwell	Avis, 2000	
"- of aquatic birds there are great numbers and variety called by the seamen man of war birds, boobies, noddies, gulls etc. These birds roost upon the hillocks of burnt lava before mentioned in numbers considerable and are so passive as to allow themselves to be caught by hand or knocked down by sticks or stones in broad daylight."	1798	William Davis	Davis, 1798	179
"Upon returning to the ship we found people on board had been more fortunate for they had procured a good quantity of fish which were very acceptable such as rock cod, a kind of mullet and the conger eel which is reckoned by some a great delicacy and I am told is much esteemed by the people of St Helena."	1798	William Davis	Davis, 1798	180

The H.M.S. Ascension: 1815 – 1922

From 1815, the island becomes inhabited when appointed as H.M.S. Ascension and classified as a "Stone Sloop of War of the Smaller Class" (AIG, no date b). The references to marine life are increasingly on the quantities of resources taken (Table 6). In 1829 the supply of turtle is 'reliable' and forms part of rations in 1829 and 1847 (Brandreth & Power, 1835; Hutton, 1847a). The British commander of the island commented on turtle supply for three years in a row, noting that in 1833 this was poor compared to that previously (Bate 1831; 1832b; 1833a). In 1868 Ascension was referred to as the best place in the world for supplies of turtle meat, but despite this, signs of depletion were already apparent at this time with Georgetown beach visited by 'but a few' turtles (Collingwood, 1868). Ascension was still considered very good for turtles in 1876 (Matkin & Rehbock, 1992), but it is unclear how long for as this was the last reference to turtles I found before 1923.

Observations of birds were still frequent during this time, though in comparison to pre-habitation references, 'numberless' or similar is not used to describe the birds in general. The exception is "innumerable", used to describe Botswain Bird Island's population; in contrast the same author's description of the mainland is "incredible numbers" (Allen, 1835). Though it is apparent from the quotes the birds exist in quantity, (Holman, 1834; Brandreth & Power, 1835; Martin, 1843; Daines, 1867; Collingwood, 1868) the descriptions perhaps convey to a lesser degree than in previous years. Specifically, in 1878 and 1879 "millions" (Haggard, 1878b; Thomson, 1878; Moseley, 1879) is used to describe the population size whereas in 1843, 1868, 1877 and in 1885 "thousands" is used (Fraser, 1843; Sperling, 1868; Spry, 1877; Haggard, 1878b; Thomson, 1878; Moseley, 1879; Ellis, 1885). In 1870 it is observed there has been an apparent decline in the birds (Kirby, 1971).

The quantities and variety of fish are regularly commented on which portrays the fishing remains good (Campbell, 1816; Brandreth & Power, 1835; Webster, 1834a; Martin, 1843; Porter, 1843; Burnett, 1858b; Haggard, 1878a; Thomson, 1878; Gill, 1878; Studley, 1898; Twigg, 1919). The exception is an observation that indicates low levels of fish were available in 1918 (Holroyd-Doveton & Burke, 1918). The conger eel's (*Gymnothorax moringa*) prevalence around Ascension and desirability as a food is frequently commented on (Webster, 1834a; Brandreth & Power, 1835; Gill, 1878).

Table 6: Timeline of key quotes or events from Ascension's history and observations of the marine environment from 1815 - 1922. Additions I added to quotes for clarity are included in square brackets.

Quote or key event	Date	Author	Source	Page Number
Napoleon exiled to St Helena and British Navy claimed Ascension to prevent French rescue attempts. HMS Zenobia and Peruvian arrived to claim island.	1815		Irving, 2015; Pickup, 1985.	
"They have plenty of fine turtle and fish of various kinds."	1816	Captain Colin Campbell	Campbell, 1816	
Napoleon's death – Ascension camp kept on for health services and stores.	1821		Ashmole & Ashmole, 2000	
Command passed to Marines.	1822		Thomson, 1878	
Yellow fever brought to Ascension and kills 50 people, 24 of them residents. Comfortless Cove (originally 'Comfort Cove') created as quarantine for future ships with sick crew members.	1823		Glover, 2010; Thomson, 1878	
"The Wide-awakes, or Kitty-wakes as the sailors call them [sooty terns], are also very numerous, both on the rocks and plains, in the laying and	1828	James Holman	Holman, 1834	447

breeding season: and consequently, an immense number of eggs are deposited, which are much used by the persons on the island."				
‘Regent Square’ camp renamed Georgetown after King George IV.	1829		Ashmole & Ashmole, 2000	
“At Ascension the crew spent most of their time fishing and made huge catches."	1829	Jules-Sébastien-César Dumont D'Urville	D'Urville & Rosenman, 1987	269
"The island for a long time was chiefly celebrated in the 'Almanac de Gourmands' and owed its distinction to the abundance of turtle found on it. The number of these amphibious creatures that have been caught year after year, and their enormous size, have frequently staggered belief. I have already stated, that in one year upwards of 2500 were turned on the beaches, among which were several that weighed from six hundred to eight hundred pounds each. The supply in general is so abundant as to be issued to the ships and troops and fresh meat..."	1829	Captain H.R. Brandreth	Brandreth & Power, 1835	249
"The coast of Ascension abounds with a variety of fish, and almost all are of excellent quality; perhaps the conger-eel may be considered the most approved.”	1829	Captain H.R. Brandreth	Brandreth & Power, 1835	250

"It is said in one week the garrison collected from the "Wide-awake Fair" (the name given to their retreat) 120,000 eggs."	1829	Captain H.R. Brandreth	Brandreth & Power, 1835	250
"Considerable rewards have been offered to divers to go down to the boat, but the sharks being very numerous round her nose, none could be prevailed upon to attempt it."	1830	H.M.S Median's Captain	Hart-Davis, 1972a	59
"The turtle are returning in numbers to the different Bays, and shall take every opportunity of sending some to their Lordships during the season."	1831	Commander William Bate	Bate, 1831	63
"The turtle this year are in great abundance in one of the Bays about a week since we turned Fifty, and might have had double that number."	1832	Commander William Bate	Bate, 1832b	93
"The turtle season has been bad, and the only bad one we have had since I have been here…"	1833	Commander William Bate	Bate, 1833a	199
"Although the average weight of the turtle is about eight hundred pounds, it often amounts to nine…"	1834	William Webster	Webster, 1834a	394
"The shores of Ascension abound with fish, among which the congers hold a respectable station, not only supplying the tables, but leaving a surplus for exportation."	1834	William Webster	Webster, 1834a	399

"The fishes are cavalloe, bonita, and the small mackerel called the scombus glaucus vel Ascensionis, from its abundance here in some seasons…It were almost superfluous to say there are many sharks."	1834	William Webster	Webster, 1834b	324
"Great numbers of the bird called man-of-war bird, or sea eagle, came off from the rocks and hovered about the masts and rigging of the vessel, but without alighting."	1834	Caroline Power	Brandreth & Power, 1835	257
"[Turtle] are generally from four hundred to eight hundred pounds weight when taking in the season; and are kept in two ponds. About four or five hundred is the number generally taken."	1834	Caroline Power	Brandreth & Power, 1835	262
"Amongst the articles of food, the eggs of the wide-awake furnish an important item, ten thousand dozen being often taken in one week during the season…"	1834	Caroline Power	Brandreth & Power, 1835	262
"The fish for food here are the rock-cod, the cavalha (rather coarse when large, but good eating when small), the conger-eel - their best fish; the snipper or soldier (a beautiful fish, quite red and golden when first caught), and a quantity of a fish with dark skin and beautiful purple streaks abound, but are not good eating; oysters also abound, but are	1834	Caroline Power	Brandreth & Power, 1835	262

rather coarse and not much eaten. They have mullet, but I have not seen it. "				
"Ascension has, from the period of its cooling, been the peculiar home of numerous sea-birds and turtles, which come annually to deposit their eggs. The former are in incredible numbers."	1835	William Allen.	Allen, 1835	
"Fifteen hundred [turtle] have been taken in a season, and put in ponds walled in from the sea. They are of very fine quality, and all large, some weighing 8 cwt."	1835	William Allen.	Allen, 1835	
"It [Botswain Bird Island] is covered with innumerable birds, and great numbers of sharks are constantly about its base."	1835	William Allen.	Allen, 1835	
"Whilst passing this end of the island at sea, I could not imagine what the white patches were with which the whole plain was mottled; I now found that they were sea fowl."	1836	Charles Darwin	Stonehouse, 1960	
“arrival of the Bonneta from the coast”	1838	Richard Dundas	Dundas, 1838	
"Sea fowl are very numerous…"	1843	Robert Martin	Martin, 1843	524
"Abundance of fish and marine birds are obtainable."	1843	Robert Martin	Martin, 1843	524

"Considerable numbers of poultry are reared, and turtle and various kinds of fish abound on the coast."	1843	G.R. Porter	Porter, 1843	390
"Thousands of birds congregate on this spot, three times in two year." (On Wideawake fair)	1843	Fraser	Fraser, 1843	
"Of this permission [to gather tern eggs] all on the island eagerly avail themselves; and, though vast numbers of eggs are carried away, up to the last there seems but little diminution of the stock."	1843	Fraser	Fraser, 1843	
"The pond was generally swarming with young turtle, about the size of large walnuts, and these were taken a mile out to sea and set free, to escape the small sharks and black fish."	1843	Fraser	Fraser, 1843	
"However valuable the turtle to this establishment, as well as to vessels arriving from the coast the meat soon satiates [sic], and the men become indifferent to it, requiring an occasional change, and as there is a good supply of fish, and vegetables twice a week: I consider under these circumstances two days issue of fresh beef or mutton in the week quite ample."	1847	Capt. Frederick Hutton	Hutton, 1847a	16
"The turtle season promises to be very abundant, and have now 200 in the ponds."	1847	Capt. Frederick Hutton	Hutton, 1847b	20

"The turtle season finished on the 22nd May, the season having proved abundant, ships of war have been supplied with 109 during the quarter always providing them as well as the Tortoise and those on shore with 2 days fresh turtle and vegetables in the week, and 2 days on their departure, and have now 421 in the ponds which will be sufficient for every supply I can anticipate until next season."	1847	Capt. Frederick Hutton	Hutton, 1847c	47
"The good points about Ascension as far as I can see are, a fair, healthy though hot climate, as much fish of fair quality as you like to pull out the sea, and plenty of occupation."	1858	Captain William Burnett	Burnett, 1858b	6
"The great peak was then distinctively seen towering above the white clouds that round it and overshadowed the lower hills, the barren, treeless sides of which sloped, grey and destitute of vegetation, down to the precipices that overhung the sea, some dark with the native colour of the rocks, and others white with the deposit of sea-birds, large flocks of which were seen around them. Sea-swallows, gannets, and brown-plumaged man-of-war birds hovered about our vessel; while the Botswain-birds, with the long white feathers in their tails, compared by sailors to marline-spikes, floated between our masts apparently without	1865	T. Daines	Daines, 1867	683

an effort. Shoals of flying-fish occasionally rose before our bows; and porpoises, keeping way with us, gave every opportunity of watching their gambols as, with their sharp noses, they seemed to bore through the translucent waves, or rolled their arching backs and sharp dorsal fins above the surface, or sometimes, in their eagerness leapt completely out."				
"From fifteen to thirty [turtles] are thus turned in a night, and in one season that is mentioned six hundred were captured."	1865	T. Daines	Daines, 1867	685
"Their numbers [hatchling turtles] are greatly thinned by voracious birds and fishes, and even when well grown they are not secure; for the head of a large turtle was found in a shark fourteen feet long, captured by the 'Thalia' in Clarence Bay. This fact and the numbers of females, from six hundred to a thousand, turned in the course of a year, Sir James apprehends may in time diminish the supply; and he suggests that measures should be adopted, such, perhaps, as the securing of a female in each of the open bays, for the capture of the males also."	1865	T. Daines	Daines, 1867	685
"From this elevation the view was most striking: a deep and broad rocky valley in the fore ground, covered with screaming sea-fowl…"	1868	Cuthbert Collingwood	Collingwood, 1868	422

"The birds themselves are immense numbers, hovering over the valley, screaming and making various discordant noises, which, heard at a distance, sound like the murmur of a vast crowd."	1868	Cuthbert Collingwood	Collingwood, 1868	424
"…for Ascension, barren and desolate as it is, has yet one product in which it is not exceeded by any part of the world, viz. turtle."	1868	Cuthbert Collingwood	Collingwood, 1868	426
"The sandy bays of the island are visited by great numbers of these unwieldly and valuable reptiles…"	1868	Cuthbert Collingwood	Collingwood, 1868	426
"The sandy shore adjoining George Town, I was informed, is no longer so rich and profitable a beach as it once was, the reason probably being that turtle, like birds of passage, return again and again to the same spot to deposit their eggs; and on this beach, as being the most accessible, the greatest number have been turned, so that but few visit it at present."	1868	Cuthbert Collingwood	Collingwood, 1868	426
"Numerous small fishes and crabs swam about them [the turtles] unmolested; but on inquiry I learned that they are never fed, although they are not unfrequently kept in the reservoirs for a year or more after capture."	1868	Cuthbert Collingwood	Collingwood, 1868	427

"On the lava rock adjacent, where the waves break with great violence, numbers of beautifully coloured crabs (Grapsi, n.s.) ran actively about; the pools abounded with large purple-spined Echini, ensconced in round hollows, and beautiful azure and banded rock fish; but the only seaweed I observed was the cosmopolitan peacock's-tail (Padina pavonia).	1868	Cuthbert Collingwood	Collingwood, 1868	428
"A gradual incline of a quarter of a mile terminated in a plain of ten or fifteen acres in extent, literally covered with the birds."	1868	Rowland M. Sperling	Sperling, 1868	287
"No description can give an adequate idea of the effect produced by the thousands upon thousands of these wild sea-birds floating and screaming over this arid cinder-bed, the eggs and young scattered so thickly on the ground that in some instances it was impossible to avoid crushing them, and the bleached bones of dead birds distributed in all directions."	1868	Rowland M. Sperling	Sperling, 1868	287
Letter from McDowell (commander at the time) requested that ships arriving at Ascension don't fire guns during turtle season (July – December), as the noise was thought to be partly the reason behind a reducing yield in turtles.	1868	Cmdr. McDowell	McDowell, 1868	

"Very many years ago, sea fowl must have covered the island, and deposited plenty of guano, as is evident from the marks upon the clinker, but for many years they (with the exception of the "wide-awake") have been confined to Botswain Bird Island, the Gillar rocks, and other small islet[s] round the coast, and to the parts of the island which are almost and quite inaccessible."	1870	Edward Kerby	Kerby, 1871	
"A few flying fish seen."	1876	Thomas Henry Tizard	Tizard, 1876	
"Turtle are more plentiful here than at any other place in the world: they land at certain seasons to lay their eggs in the sand, and are then caught and placed in ponds for consumption or export."	1876	Joseph Matkin	Matkin & Rehbock, 1992	326
"On one part of the island the sea bird called "Wide-Awakes" have their rookery; it covers several acres of ground, over which it is impossible to walk without treading on the eggs or young; the place is called "Wide Awake Fair" and is one of the sights of Ascension."	1876	Joseph Matkin	Matkin & Rehbock, 1992	326
"…and quite near at hand is "Wide-awake Fair," a rough stony plateau, where thousands of sea-birds land for breeding during the season."	1877	W.J.J. Spry	Spry, 1877	377-378

"The sea is teeming with good fish and two men were told off to do nothing but fish for the island."	1878	John Haggard.	Haggard, 1878a	3
"There are millions of them [terns] and when you go into the fair they will peck at you and light on your hat."	1878	John Haggard.	Haggard, 1878a	10
"When the birds rise, as they did as we passed between the rock [Botswain Bird Island] and the shore, the sky is black with them."	1878	John Haggard.	Haggard, 1878b	10
"This is the breeding place of the *Sterna fuliginosa*, called there the Wide-awake. The birds are in millions, darkening the air, when they are disturbed, like smoke; the eggs are excellent… Ten thousand dozen are sometimes gathered in the breeding season in a single week… "	1878	Charles Wyville Thomson	Thomson, 1878	227
"Fish are abundant around the island - and of many kinds - mullet, rock-cod, cavallas and others."	1878	Charles Wyville Thomson	Thomson, 1878	228
"…'But surely there is plenty of fish?' 'Generally, ma'am, but not when the rollers are in.'"	1878	Isobel Gill	Gill, 1878	54
"…for the fish here was as good as and plentiful as it had been in St Helena. And then there was the turtle!"	1878	Isobel Gill	Gill, 1878	67

"Besides this horrid conger - which strange to say, is considered quite a delicacy in Ascension - our little bay swarmed with fish of every shape and size, from the monster shark, that cost us much in the way of lost lines and hooks, to a lovely nimble wee fish, vulgarly called 'five-fingers' striped with changeful green, and glistening like a rainbow with every restless motion. The white-fleshed cavalhoe and the savoury rock-cod were the staple food of our breakfast and dinner-table; but numerous as they were, it required no small skill to catch them, owing to the larger number and greater greed of the hideous black "old maids" with their double row of dog-like teeth. If the rock cod did not look sharp, these ravenous creatures got hooked in their stead, much to our disgust for they were unfit for table use."	1878	Isobel Gill	Gill, 1878	125
"Millions of shell-fish covered the lower rocks, among which lurked lucid pools, lined with the wonderfully-constructed homes of their inhabitants."	1878	Isobel Gill	Gill, 1878	140
"A single "Wideawake" the name given to the Tern, (*Sterna fuliginosa*), which breeds in millions gregariously at "Wideawake Fair" on the main island, was found on the plateau [Botswain bird Island]."	1879	Henry Nottidge Moseley	Moseley, 1879	563

"At this season the island is visited by several species in vast numbers, which come from all sides to breed; and even when the migrants have departed, the surrounding seas never seem to be quite deserted, owing to the number of resident Gannets, Tropic-birds, and Frigate-birds."	1879	F.G. Penrose	Penrose, 1879	274
"The island 'Bird fairs' (upper and lower at the mountain) have been occupied by the Wideawakes for some time, but not the Blue-stone one. These fairs appear to be rapidly on the increase each year."	1881	Anon.	The National Archives ADM 1/6591	
"A flock of about a score of frigate pelicans flew off to the ship, and when hovering over the main-truck, I shot two, but had the vexation to lose both by their falling overboard…"	1884	Robert MacCormick	MacCormick & Franklin, 1884	367
"These birds breed in such numbers on one part of the island, as to gain for it the name of "Wide-awake Fair"."	1884	Robert MacCormick	MacCormick & Franklin, 1884	368
"To the south of Riding School Crater is a broken and rocky tract called Wide-Awake Fair, because the Wide-awakes, or Terns, which visit Ascension in thousands every seven or eight months to breed, there deposit their eggs."	1885	A.B. Ellis	Ellis, 1885	48
"Never have I seen anything like the sea-fishing to be obtained here! They catch 'cavallhoes' albicore, and bonito; and when it is stated that	1895	J. Tatchell Studley	Studley, 1898	669

we caught ninety four of the former (many of them weighing 15 or 16 lbs each and some more) the nature of the sport may be imagined."				
"It will be sad news, moreover, to lovers of turtle soup to know that the cost of this delicacy is more likely to increase than decrease, as the number of turtles captured each successive season appears to be getting smaller. Time was when as many as 800 were caught in a single year at Ascension."	1901	Alexander Aiton	Aiton, 1901	441
"Several gannets and tailor birds seen flying and diving about the ship; three young gannets caught."	1904	Bruce et al.	Bruce et al. 1907	80
"In the afternoon a party of us went to Wide-awake valley. There were no live birds at the place, though plenty of dead terns (*Sterna fuliginosa*) were scattered over the valley."	1904	Bruce et al.	Bruce et al. 1907	80
"On the way Mr Bruce caught a land crab, which does not appear to be a common animal on the island."	1904	Bruce et al.	Bruce et al. 1907	80
"About a dozen species of fish were caught during the day; four large sharks besides other fish were in the trammel net which was badly torn by the former. A trumpet-fish was caught in the large trap and some others were found in the small traps."	1904	Bruce et al.	Bruce et al. 1907	81

Several albacores (Thynns albicora [*Thunnus albacares*]) or a kind of tunny were caught by means of a line; the largest one weighed 105lbs. Some other fish were caught on the line, but many hooks were carried away by the large tunnies."	1904	Bruce et al.	Bruce et al. 1907	81
"Weighed anchor early in the morning and trawled in 40 fathoms off Pyramid Point before breakfast. Secured a very rich haul - about 130 fish altogether, of which about 100 were flat-fish."	1904	Bruce et al.	Bruce et al. 1907	81
"During the voyage between (St Helena and Ascension), the tropical seas were devoid of bird-life, except for a few gannets seen as Ascension was neared (the first were observed between one and two hundred miles from the island)."	1904	Bruce et al.	Bruce et al. 1907	299
"One of the sights of the island is the "Wideawake Fair," or breeding ground of the "Wideawakes" (*Sterna fuliginosa)* millions of which are said to nest there. The birds were absent at this time (although some were seen during the first day's sail after the *Scotia* left the island), but great numbers of their corpses strewed the ground."	1904	Bruce et al.	Bruce et al. 1907	299
"The trawling in 40 fathoms off Pyramid Point, Ascension, on June 9th, 1904, revealed the presence of a large number of flat-fish. These were	1904	Bruce et al.	Bruce et al. 1907	384

chiefly *Rhomboidichthys podas,* though *Hemirhombus solaeformis* and *Arnoglossus capensis* were tolerably abundant."				
"Here also I was interested in the extraordinary numbers of *Balistes* which swarmed around the ship to feed on orange-peel, pieces of bread, and other refuse thrown overboard."	1910	J.T. Cunningham	Cunningham, 1910	87
"Flying-fish of course were seen in large numbers; they first appeared after we had passed Cape Verde, and continued to be abundant till we were approaching St. Helena, but during my stay at that island I never saw one."	1910	J.T. Cunningham	Cunningham, 1910	87
"In the bay there was nothing to do but keep watch and fish. 'There were plenty of good-sized cod' remembers Ernest Smith, one of the Marine infantrymen. 'We'd fillet enough to make a nice parcel to take back to the camp at San, feeding the carcases to the monstrous sharks, which abounded...'"	1915	Ernest Smith	Hart-Davis, 1972a	163
"Fishing - the amount of fish in Inland waters has been very small this year and many blank days have occurred, especially of late. Mullet has been netted in quantities up to 4 dozen by Messrs. Brown and Padday.	1918	Anon.	Holroyd-Doveton & Burke, 1918	38

Cod and Cavalhoes are occasionally in evidence, while Mr Banister has secured several fine crayfish."				
"Whilst making fast under the lee of the island, any doubts of a sufficiency of fresh fish for lunch were speedily dispelled. Swimming round the boat in the deep through wonderfully clear water, came numbers of deep-sea cavalle, and several were speedily speared and lay flapping on deck."	1918	Cyril F. Willey	Willey, 1918	42
"Birds everywhere. The ground is nearly level, dazzlingly white, and covered with colonies of Gannets, Female Frigate and Booby Birds. Eggs everywhere, and half and full-grown birds in glorious confusion squatting or standing on the bare floor just out of pecking range of one another."	1918	Cyril F. Willey	Willey, 1918	43
"There is a good quantity of edible fish to be caught from the rocks, or in the open sea from a boat and this sport affords good food for anybody."	1919	Francis Twigg	Twigg, 1919	

Ascension, the Island of Communication: 1923 – 1983

The exceptional fishing around the island was the main source of references to the abundance of fish (Table 7), with a variety of species caught and in remarkable numbers with little effort. For example, in 1925, 300 cavalle (*Caranx hippos*) were caught in about 45 minutes with merely rag as bait (Marx, 1983) and fish could even be grabbed from a boat (Simmons, 1927). The number of turtles captured fell to practically zero early in the 1920s (Figure 9a) and there are no references to the numbers of turtle on Ascension between 1923 and 1983. Birds were apparently still present in millions to the point they darken the sky (Simmons, 1927). This sentiment was echoed in 1929 (Keilor, 1997) and 1936 (Watts, 1936). The manager of Cable & Wireless on the island had only been on the island a year when he remarked the birds were "as numerous as ever" but he did notice a decrease in nesting sites (Cardwell, 1941). From 1945 onwards, references to the birds indicate they are significantly less abundant than in the past. From a fish perspective, there are multiple references to the blackfish's prevalence (Gunther, 1925; Simmons, 1927; Stonehouse, 1960; Green, 1962; Bartlett, 1972a; Hart-Davis, 1972a; Cross, 1980; Packer, 1983; Keilor, 1997; Pollock, 1998), but the conger eel (*Gymnothorax moringa*) was regularly unavailable for consumption in 1929 and is only mentioned once (Keilor, 1970).

Table 7: Timeline of key quotes or events from Ascension's history and observations of the marine environment from 1923 - 1983 (References from Diels et al., 1927 translated from German). Additions I added to quotes for clarity are included in square brackets.

Quote or key event	Date	Author	Source	Page Number
H.M.S Ascension decommissioned and became dependency of St Helena. Eastern Telegraph Company took over management whilst using it as a station for the Eastern Network of telegraph cables.	1922		Seddon, 2005; AIG no date b	
"Fishing is good. A stout sea rod is essential for rock cod, congers, soldiers, and cavalli - with plenty of line on your reel as you may get something on larger than you expect. Fine sport may be had with a fly rod with silvers and steam brass. Mullet are caught in the large rock pools."	1923	Anon.	Anon., 1923	146
"Masses of coralline Lithothamnin came up, and with it, many small tropical fish brightly coloured, and the usual fauna that thrives sheltered in the cracks and crevices."	1925	ER Gunther	Gunther, 1925	
"…in the pure blue waters we saw scores of black fish gloriously striped with azure on each side of the dorsal fin; several of these were caught on lines for they will eat anything."	1925	ER Gunther	Gunther, 1925	

"Our pools swarmed with fish. I caught a caranx [member of Jack family] and many small fish brilliantly yellow or blue, gobies and blennies: many were impossible to capture by an ordinary net owing to crevices in the rock: moreover spinous sea urchins were so littered over the rock, that it was not easy to find a foothold underwater: above the water line there was a cupidala like mollusc which tore the skin much more severely than barnacles, and which grew much more thickly than limpets. In other respects life was poor: very little weed, a few shells, brittle stars, and worms - crabs of course were numerous. Black fish abounded as they did around the ship. They were so thick in the surf that a long Atlantic roller advancing towards the beach mounting, curling, translucent was seen to be speckled by them. These fish often measure one foot long and six inches high, so that there could not be room for many of them in the thinness of the a wave: even so they were innumerable and were washed up on the beach right up to the limits of the foam: sometimes they lay on the sand stranded and I picked up one in my hands."	1925	ER Gunther	Gunther, 1925	
"One time I caught 300 cavalle [crevalle] in 1/2 to 3/4 of an hour, with bamboo rod unbarbed hook and red rag tied to it. Silver fish we caught with a fly rod and spinner on in the Butcher's pool with blood. Crawfish we used our own	1925	Fred Marx	Marx, 1983	195

special line to which we attached about 10 hooks with squid attached to the hook, drop it over the side of the rocks and if you felt a pull you drew the line up as soon as the feelers came out you grabbed them with a gloved hand and flung it on the rocks behind you, result a nice crawfish supper."				
"At Ascension there were especially many terns"	1927	Diels et al.	Diels et al. 1927	102
"On the 14th of September the appearance of many terns and single slender frigate birds showed the proximity of the Ascension Island."	1927	Diels et al.	Diels et al. 1927	103
"On the bank, basalt and tuffe, gray and reddish, light trachyte appear, in some places one can see steep drops and basalt columns standing in the surf, some of which are whitened by the guano of the many terns, gannets and frigate birds round the island."	1927	Diels et al.	Diels et al. 1927	103
"There is such an abundance of fish on the anchorage that the unfortunate, black and blue striped fish can be grasped by hand from the boat."	1927	Diels et al.	Diels et al. 1927	103
"Occasional seaward faces of the vertical cliffs [of Botswain Bird Island] are broken with ledges and terrible slides, and with the glasses, on nearer approach, we could see that these were covered with birds, most of them blue-faced boobies (*Sula dactylathra*), first described from the islet a century ago."	1927	G.F. Simmons	Simmons, 1927	44

"Along the shore reefs we gathered oysters and crabs, spiny lobsters and tiny shore fishes. With the boats we sought porpoises courting and mating in the lee of the island; the giant tuna swinging offshore in schools, in pursuit of flying fishes and turbots; and the myriad of fish of many colors which lure the island fishermen out on to the giant swells of the mid-Atlantic."	1927	G.F. Simmons	Simmons, 1927	53
"At the present time there is a wonderful city of birds at Wide-awake Fair on the western corner of the clinker plains. We of the *Blossom* went to the Fair on numerous occasions during the breeding season and found the birds assembled by the millions on flattened areas between the ragged cones. The eggs were in such formation on the ground that it was difficult to step without treading on one or more."	1927	G.F. Simmons	Simmons, 1927	55-56
"Upon our approach the birds rose in deafening chorus and hung over our heads in a threatening blanket of wings and sharp bills that darkened the sun."	1927	G.F. Simmons	Simmons, 1927	56
"As soon as we dropped anchor at Ascension the black turbot, or trigger-fish (*Melichthys piceus* [niger]), swarmed about the hull."	1927	G.F. Simmons	Simmons, 1927	57, 58
"Fresh fish is caught in abundance daily."	1927	Lee Lander	Lander, 1927a	262

"In the months of November and December, game fish - Albacore (Tunny fish) - up to 230lbs or more can be caught."	1927	Lee Lander	Lander, 1927a	263
"Fish are abundant including Albacore, Barracouta, Cod, Cavalhoe, Crayfish, Mullett and Gurnard. The waters also swarm with sharks. There is some idea of erecting a fish curing factory here toward which the present population are particularly averse."	1928	Anon.	Anon., 1928a	
"The advent of tropical waters was heralded by the flying fish. Hundreds skimmed the water in all directions, their scales glistening like silver in the bright sunlight."	1929	John Keilor	Keilor, 1997	2
"To realise the vast numbers of the Wideawakes it was a good scheme to take a shot-gun out to the Plain, and fire a blank cartridge in the air, when the thousands of startled birds would almost darken the sky."	1929	John Keilor	Keilor, 1997	33
"The waters round the coast were stocked with many kinds of excellent fish including albacore, conger eel, 'soldiers' and 'silvers'…Conger was considered a particular delicacy, but did not often figure on the Mess menu. Whether this was due to the difficulties in securing the eels, or whether they were less abundant than the other fish I cannot say."	1929	John Keilor	Keilor, 1997	35

"Besides the sharks, the waters around Ascension abounded with a voracious scavenger fish known locally as Black fish, which, needless to say, were quite unfit for food."	1929	John Keilor	Keilor, 1997	35
"There is an abundance of excellent fish to be caught among the rocks throughout the year, such as rock-cod, mullet, conger eel, cavalhoes, etc.; and they are so plentiful that a boat's crew may sometimes catch sufficient to supply the crew of a cruiser… Oysters are abundant, but are not good."	1930	GB Hydrographic Department	GB Hydrographic Department, 1930	
"The principal fish which frequent the waters of Ascension are Albacore, Snook, Rock cod, Yellowtail and Cavalhoe…Cavalhoe running from 3 to 12 lbs frequent the Island waters in large shoals at irregular times of the year, and are caught with handlines and gaffs, when sea and rollers permit. Rock Cod running up to 4 lbs are caught from the rocks, also when sea and rollers permit."	1930	E.A. Willmott	Willmott, 1930a	
Eastern Telegraph Company renamed to Cable & Wireless.	1934		AIG, no date b	
"In the clear waters, the sandy bottom can be seen teeming with fish; from the shark, the albacore and the tiger conger to the dainty five finger, the waters abound with their natural inhabitants."	1934	L.S Bartlett	Bartlett., 1972a	

"Thousands of eggs are taken every year, yet the number of birds does not appear to decrease."	1934	L.S Bartlett	Bartlett., 1972c	
"[Blackfish] are far too numerous and are rightly considered a pest."	1934	L.S Bartlett	Bartlett., 1972a	
"One virtue which may be claimed for these blackfish is their diligence in cleaning ship's anchors, these scavengers set to work on her, removing any weed in an incredibly short space of time."	1934	L.S Bartlett	Bartlett., 1972b	
"Every eight months millions of wide-awake gulls arrive to lay their eggs in two desolate valleys. Each bird lays one egg, and it is hard to walk without breaking some."	1936	C.C. Watts	Watts, 1936	52
"As regards the sea-birds - I notice the Admiralty Chart bears a note beginning "The Wideawakes, tropical swallows deposit their eggs in countless numbers etc. etc." This note on the Admiralty Chart is given in the area lying northward of Dark Slope Crater. The locality indicated on the chart may have been the locality used by the birds some years ago but this is no longer the case. It is now the height of the season and the birds are as numerous as ever."	1941	S. Cardwell	Cardwell, 1941	
U.S Government in collaboration with UK builds airstrip 'Wideawake'.	1942		Seddon, 2005	

“There were plenty of fish in the sea around Ascension...The principal catch included tuna, albacore and wahoo, weighing from sixty to eighty pounds each. There would be a few jacks weighing about twenty pounds each. On a good day a boat would bring in six or seven hundred pounds of fish.”	1942	Clarke	Clarke, 1942	
“Two days of fishing provided enough for a fish meal for the 1500 men of the task force - a welcome relief from an all canned diet.”	1942	Clarke	Clarke, 1942	
“The jacks, weighing about twenty pounds each, were so thick they were practically touching each other in their frenzied attacks on the sardines. The men in the garbage squad noticed the jacks. They borrowed some large gaff hooks on poles from the fishing crews, waded hip deep into the water, and as the jacks swam about them and between their legs gaffed the fish and threw them on shore. In five minutes four men had twenty or more jacks, which ended up as a delicious evening meal.”	1942	Clarke	Clarke, 1942	
"Well known before 1870, it was a huge nesting colony of sooty terns, often said to number millions."	1946	James P. Chapin	Chapin, 1946	314
"…the sea was alive with flat fish with large gaping mouths which we learned were 'black fish'."	1947	Leonora Pollock	Pollock, 1998	

"For the sum of 7s. 6d. Per month every household could have a daily supply of fish - rock cod, silver fish, mullet, cavalhoes, wahoo, crayfish, soldiers - unless the rollers were up and no fishermen could go out."	1947	Leonora Pollock	Pollock, 1998	
"Various species of the tuna family have been located in satisfactory schools. Albacore, yellowfin, skipjack, wahoo, cavally [crevalle] and sharks have also been found to abound."	1948	V. W. Oelrichs	Oelrichs, 1948a	
Decision made that fishing enterprise on Ascension shouldn't go ahead due to fall in price of shark.	1953	Frederick Wills	Wills, 1954	
"It is my belief that in 1942 there may have possibly been a million [Wideawake terns]."	1954	James P. Chapin	Chapin, 1954	3
"I don't think there are any creatures more cannibalistic than the fish round these shores. When the young 'fry' hatch out between January and March they drift inshore, forming large patches on the surface of the water and the sea literally boils with adult fish of all kinds gobbling them up as fast as they can. In addition they are being dive bombed the whole time by gannets, frigate birds, terns and all kinds of sea birds from the air."	1955	Malcolm Lockie	Lockie, 1955b	188

License issued to Ovenstone Industries Propercerdary Limited of P.O. Box 3 lasting 25 years from 31st March 1955. £50 p/a and one farthing on every crayfish exported & ten shillings on every 2,240lbs exported as royalties.	1955	Frederick Wills	Wills, 1955	
"A boy fishing from the boat deck not far from where I was standing pulled a wriggling black fish aboard. I glanced down and saw that the sea was alive with hundreds of them, struggling to reach some piece of floating rubbish with such vigour that the fish in the centre of the moving mass were lifted partially out of the water by the press from all sides. Overhead the various sea birds circled and wheeled away beyond the superstructure of the ship. However desolate the island might look, the sea and sky at any rate were filled with life."	1956	J.E. Packer	Packer, 1983	2
"'Ascension Black Fish,' said the officers. Hundreds of them, in shoals. If you fall over the side they'll have you - just like that'. "	1960	Bernard Stonehouse	Stonehouse, 1960	17
"In a moment twenty and more dolphins were sporting around the boat, leaping alongside and criss-crossing before us like acrobats heralding a circus."	1960	Bernard Stonehouse	Stonehouse, 1960	93-94

"Black fish nibbled imaginary algae from the mooring line, and a pair of lithe grey sharks, no bigger than dog-fish, sped from the shadows of the boat."	1960	Bernard Stonehouse	Stonehouse, 1960	96
"For two nights and a day we steamed over a calm tropical sea, seeing occasional shoals of flying-fish and porpoises, but no birds of any description."	1960	Bernard Stonehouse	Stonehouse, 1960	192
"Two large Manta Rays, like squares of black canvas, drifted lazily past the landing. Off the Western cliffs a shoal of porpoises played; as we watched two of them leapt from the water ten or a dozen times in quick succession, leaving a trail of rippling circles. The others swarm slowly towards the rough water, and one at least had a small calf alongside."	1960	Bernard Stonehouse	Stonehouse, 1960	175-6
"Now only the Wideawake Terns breed in any force on the main island; the remaining species can nest only on inaccessible cliffs or isolated stacks like the one we were watching."	1960	Bernard Stonehouse	Stonehouse, 1960	45-46
"Although we found evidence that there must have once been large colonies of sea-birds (including Boobies) on the main island (Ashmole, in prep.), no boobies now nest there, being confined to off-shore stacks and islets; records of a few	1962	D.F Dorward	Dorward, 1962	175

deserted eggs on the main island, however, show that re-colonization is occasionally attempted."				
"Millions of these mysterious sea-birds (*Wideawakes*) invade the plains of the island…"	1962	Lawrence G. Green	Green, 1962	145
"I believe that Ascension is their greatest nesting stronghold. Sometimes the curtain of [Wideawake] birds is dense enough to black out the sun."	1962	Lawrence G. Green	Green, 1962	145
"I said there were possibly two million Wideawakes, and by this time the people on Ascension must have eaten millions of their eggs."	1962	Lawrence G. Green	Green, 1962	147
"Fishing? I can imagine a keen angler revelling in the fishing. 'One afternoon ten of us fished from the pontoon near the jetty,' a cable man told me. 'We caught over one hundred fish, mainly the local rock-cod.' Tunny and wahoo are hooked easily enough from motor-boats offshore. Every year the 'fry' arrive in millions, fish of the horse mackerel family, and are chased right up on to the beach by the tunny. You can pick up stranded *marsbankers* [Bigeye scad] and cavally [Crevalle] on Long Beach by the dozen if you get there before the shrieking sea-birds. Cavally are often speared from the pontoon, smoked and sent to St. Helena. Crawfish are easily caught in nets, and you can find oysters and crabs	1962	Lawrence G. Green	Green, 1962	151-152

to vary the shellfish menu. Most plentiful of all the Ascension fish is the black turbot or trigger fish (just 'blackfish' on the island), a scavenger which loves seaweed and will clean the hull of any ship in the anchorage."				
"There is an abundance of excellent fish to be caught among the rocks throughout the year, such as rock-cod, mullet, conger eel, cavalhoes, etc.; and they are so plentiful that a boat's crew may sometimes catch sufficient to supply the crew of a cruiser"	1963	GB Hydrographic Department	GB Hydrographic Department, 1963	
UK Government administrator takes over management from Cable & Wireless. Building for BBC's World Service Atlantic Relay Station begins.	1964		Packer, 1983	
"Many thousands lived on the island…Nearly all the land crabs recorded were fairly large, measuring 15-17.5 cm across the carapace."	1964	Eric Duffey	Duffey, 1964	242

"The USAF have also found game fishing a very popular recreation using their air/sea rescue launch which has been fitted with two fishing chairs and equipped with four rods and it is recommended that the British launches should be similarly used so that they can be used when there are no ships in port. The game fishing is very good and there are many kinds of the very biggest fish about."	1964	M.E Wainwright	Wainwright, 1964a	P.6
Wideawake runway extended.	1965		Packer, 1983	
"There has just been an influx of "fry" on Long Beach, a remarkable and fascinating sight. The majority of predators, however, were frigate birds and I saw comparatively few boobies catching them."	1965	M.E Wainwright	Wainwright, 1965	
NASA facilities installed to assist Apollo programme.	1967		AIG, no date b	
"Fishing is good."	1967	Duff Hart Davis	Hart-Davis, 1967	5
Whales seen from pier head for first time in 10 years	1971	The Islander	Anon., 1971d	

"The sea round Ascension teems with life, and fishing has been the most profitable local sport ever since the beginning of the occupation. Rock cod and cavally [Crevalle] were (and still are) the kinds most easily taken from the rocks, but bonito, yellowtail, albacore and wahoo all abounded to say nothing of the sharks. Almost all Ascension's fish are edible, with the notable exception of the ubiquitous blackfish, which swarm in thousands round the coast."	1972	Duff Hart Davis	Hart-Davis, 1972a	167
The Islander newspaper reports mass death of fry – three years ago driven inshore in such large numbers people able to catch them in buckets	1973	The Islander	Anon., 1973	
"Every 10 months thousands of Sooty terns return to the island and breed close by the area used as an airstrip."	1973	Jeff Cant	Cant, 1973	6
First recorded catch of marlin off Ascension – 120-180lb and 6-8ft.	1974	The Islander	Anon., 1974c	
Whales seen from Ascension Island	1976	The Islander	Anon., 1976	
"There is an abundance of excellent fish to be caught among the rocks throughout the year, such as rock-cod, mullet, conger eel, cavalhoes, etc. The best place for fishing is on the reef near the anchorage. Crayfish are also caught	1977	GB Hydrographic	GB Hydrographic Department, 1977	

near the mouths of the caverns among the rocks towards English Bay. Oysters are abundant, but are small, they are of the rock type and are excellent eating."		Departme nt		
"The sub-fossil record indicates that the species (*Oceanodroma castro)* was once more generally distributed over the island."	1977	Storrs L. Olson	Olson, 1977	39
"In 1957-59 the B.O.U expedition found only about ten pairs of Red-Footed Boobies on Botswainbird Islet, one of which could be confirmed as breeding on a cliff ledge. Simmons (1968) saw single examples of at least two individuals on several occasions from 1962 to 1964. I failed to encounter the species on either of my visits in 1970 and 1971."	1977	Storrs L. Olson	Olson, 1977	40
"A crust of toast or a bad orange is tossed over the ship's side and in a moment the sea is seething with a boiling mass of [Black]fish."	1980	Tony Cross	Cross, 1980	149
"At one time Ascension was the breeding ground for millions of sea-birds, and the guano-splashed sides of rocks covering the low-lying parts are a clear indication that these now unvisited areas were covered with vast numbers of birds. Nowadays the southern tip of the island is covered in just the same way at certain times of the year."	1980	Tony Cross	Cross, 1980	151
Airstrip facilities renovated to be used as a staging post during Falklands War.	1982		Seddon, 2005	

Modern Ascension Island: 1984 – 2017

In recent years there is more quantitative data on the marine life as modern studies and observations occur (Table 8). The quality and quantity of fishing continues to be a feature of references. For example, in 1985 6 sailfish, 24 wahoo and 60 tuna could be caught in a morning's fishing in 1985 (Anon., 1985a) and early in the 21st century blackfish were noted for their abundance (Ashmole & Ashmole, 2000; Ghione, 2002).

Table 8: Timeline of key quotes or events from Ascension's history and observations of the marine environment from 1984 - 2017.

Quote	Date	Author	Source	Page Number
Ascension Island Services takes over running island.	1984		The Islander, 1984	
"…that they went out on Saturday morning with a group of fishermen and came home 'loaded'. When asked 'what with', this very same co-owner reported 'oh yes, well there were 6 sail, 24 wahoo, 60 tuna and for fun we nearly rammed the Wendy Rose!'"	1985	The Islander	Anon., 1985a	
"A week past Saturday Buffalo caught 18 tuna, in his own words "no big ones". On Sunday 9 tuna were caught. Then last Saturday they caught 21 and a quarter! The other 3/4s went to a hungry shark"	1985	The Islander	Anon., 1985b	
"Offshore, tuna, wahoo, grouper and eels are common catches and porpoises, sharks and very occasionally whales can be seen."	1997	Sue Edgar & Debbie Morris	Edgar & Morris, 1997	2
"Fishing goes on all around the island - grouper, silver fish, soldier fish and Moray eels (!) being the most common catches though small sharks are also frequently landed."	1997	Sue Edgar & Debbie Morris	Edgar & Morris, 1997	12

NASA observation post closed down. European Space Agency construct observatory station.	1990		Anon. no date a	
"Although the fish diversity is low, one species is extraordinarily abundant. This is the Blackfish *Melichthys niger*…"	2000	Philip & Myrtle Ashmole	Ashmole and Ashmole, 2000	241
Ascension Island Services succeeded by Ascension Island Government.	2001		The Islander, 2001	
"Two are standing at the prow, the others are sitting on the sides of the fishing smack, whose bottom is full of fish. I managed to make out sixteen big fish, either tuna fish or others which I don't recognise."	2002	Sergio Ghione	Ghione, 2002	53
"A second boat arrives with another twenty or so tuna fish and then a third with an enormous tuna: it has to be tied with a rope and it needs six men to haul it up the pier."	2002	Sergio Ghione	Ghione, 2002	54
"The tuna remains are thrown back into the sea, which immediately just swarms with blackfish, which are absolutely voracious but inedible."	2002	Sergio Ghione	Ghione, 2002	54
"A precipitous decline of 2 million birds occurred between 1965 and 1985."	2013	B. John Hughes	Hughes, 2013	70

"In 1985 this [the blue shark] was the most numerous shark species (*Blue shark*) seen close to the island by divers, particularly off the east side of the island around Botswain Bird Island (R. Irving, *pers. Obs.*). More recently, Tim Hook, a knowledgeable Ascension angler (as reported by Wirtz et al., 2014), states that large groups of dozens of differently sized individuals may be seen on occasion. The current sport-fishing world record for this species (at 140 kg) is from Ascension Island (Wirtz et al., 2014).	2015	Robert Irving	Irving, 2015	24
"Within Ascension's nearshore waters, bottlenose dolphins are considered 'resident' as they are present throughout the year and may be seen all around the coastline, though particularly off the island's east coast."	2015	Robert Irving	Irving, 2015	30
"The Galapagos shark is the most common shark species seen in the nearshore waters around Ascension. Anecdotal evidence suggests their numbers are thought to be increasing again."	2015	Robert Irving	Irving, 2015	58

History of sharks, shark attacks and details of other 'problematic' fish

Several species of sharks have been recorded around Ascension Island, including the Galapagos shark (*Carcharhinus galapagensis*), tiger shark (*Galeocerdo cuvier*) and Bluntnose sixgill shark (*Hexanchus griseus*) which are all classed as near-threatened on the IUCN Red List for Threatened Species (Irving, 2015). The Scalloped hammerhead (*Sphyrna lewini*), listed as endangered, has also been recorded (Irving, 2015). Due to the two recent shark attacks, which as far as anyone was aware were the first to occur around Ascension Island, I felt it was important to give a historical context of the current situation. The full collection of shark related accounts is in Table 9. The only historical documentation of a possible shark attack I uncovered was in a letter written in 1858 by John Haggard to his mother who said that after a boat was smashed against rocks, two crew members last seen clinging to a part of it, were never seen again so were probably eaten by sharks "of which several were near." Subsequently in the same letter, he recalled returning to the scene a week later to search for their bodies, but only a foot and a thigh were found (Haggard, 1879). Despite no records of shark attacks since then, an article in the Islander newspaper in May 1974, gave advice on the best way to provide first aid for shark bites and prevent them in the first place – although no premise for this article is provided (Mills, 1974a). A second article around the same time also notes that "A nosey shark will almost always leave you alone if you drop your fish and make a slow steady retreat" (Hubbard, 1974). A year later in a letter about sea safety around Ascension to the Islander newspaper the author felt the sharks were "too well fed" to attack although she also noted their unpredictability (Currington, 1975). Similarly, another letter that year said that Ascension's sharks were far less interested in people compared to those in the Red Sea (Mills, 1975). However, a few years later The Islander warned that sharks, amongst other factors made it unsafe to swim around Ascension (Anon., 1982).

In most historical comments about sharks in Ascension, the species involved were not identified, plus there is some debate about what species performed the recent attacks. The most likely culprit is the Galapagos shark (*Carcharhinus galapagensis*) because it is common, comes close to shore and has been aggressive towards people (Pers. Obs. Aug-Sept. 2017, Pers. Comm. Multiple residents of Ascension Island, Wetherbee *et al*., 1996 & see Figure 10). Galapagos sharks have been responsible for several attacks worldwide before including two fatal (Shark Research Institute, 2018). The Great White shark seems unlikely to have been responsible as it has never been recorded from Ascension while Tiger sharks which do occur there (Wirtz *et al*., 2014) are an easy shark to identify from their stripes.

Aside from this, accounts of other 'problematic' fish species were also found. In the medical records for Ascension, an attack by a barracuda was recorded in 1947 after a sailor fell into the sea and had an arm severed (Anon. 1947). Another warning article was written for Barracuda in the Islander newspaper (Mills, 1974a & b). The Blackfish (*Melichthys niger*) found around Ascension appear to have got a reputation as dangerous: the Africa Pilot, which is designed to give instructions to sailors for how to safely navigate, warned readers about the blackfish in 1977, 2002, 2004 and 2007 "Caution. Small fish about 15 cm long, known locally as "Black Fish", swim around an anchored vessel in large shoals, eating anything thrown into the water within seconds. They will only attack humans if these have an open cut or wound letting blood into the water. Caution should be exercised in these waters." Additionally, Stonehouse (1960) recalled being told of Blackfish "Hundreds of them, in shoals. If you fall over the side they'll have you - just like that".

The references to sharks collected through the course of this research reveal a great deal about the ecology and nature of sharks around Ascension. We gather that young sharks were often seen (Beeckman, 1718; Fraser, 1843; Edgar & Morris, 1997). A shark scientist visited Ascension in 1980-1 and reported that none of the sharks he had seen in the inshore environment

were mature (Castro, 1981). However, the use of ‘monster’ in both 1878 (Gill, 1878) and 1915 (Hart-Davis 1972a) conveys not only a large size but conveys the emotional response towards seeing sharks. Furthermore, many of the references were specific in the sizes seen: a 14ft shark was caught in Clarence Bay in 1865 (Daines, 1867), an 8ft in 1925 (Gunther, 1925), and sharks ran to 16ft in 1930 (Willmott, 1930a). References to the danger sharks pose is common (Burnett, 1858a; Anon., 1923; Faulkner, 1954; Anon., 1964; Hart-Davis, 1967; Bartlett, 1972b; Cant, 1973; Cross, 1980; Chapman, 1985; Edgar & Morris, 1997; Keilor, 1997), and the use of ‘Man-eaters’ (Green, 1962) sustains the implicit theme of ‘monster’ sharks. The accounts suggest sharks have targeted hooked fish (Beeckman, 1718; Gill, 1878) and at certain times it is rare for hooked fish to escape sharks (Clarke 1942; Stonehouse, 1960). The account of a tuna hooked on a line targeted from 1934 sounds very similar to multiple incidents I witnessed when on fishing boats in 2017 (Bartlett, 1972b).

Table 9: Historical references to the presence, behaviour and abundance of sharks around Ascension Island. Additions I added to quotes for clarity are included in square brackets.

Quote	Date	Author	Source	Page number
"And at the time when the turtle resort to these places to lay their eggs, they are accompanied with abundance of Fish, especially sharks…"	1684	William Dampier	Dampier & Masefield, 1906b	133
"But we were often plagu'd with young Sharks, that wou'd run away with our Hooks and Lines. The water was so clear that we cou'd see the Fish take the Bait; and when we saw a Shark coming towards it, we made what haste we cou'd to pull up our Lines; yet they were so quick that they wou'd catch the Bait sometimes on the very Surface of the Water."	1715	Daniel Beeckman	Beeckman, 1718	201
"The inedible onnes being shark and a flat purple coloured fish about the size of a plaice, commonly called Blackfish."	1765	Henry Cowell	Cowell & Read, 1765	
"Every possible means has been used for the past 4 days, by sweeping and creeping, but it has been found impossible to recover either the [lost] boat or the provisions. Considerable rewards have been offered to divers to go down to the boat, but the sharks being very numerous round her nose, none could be prevailed upon to attempt it."	1830	H.M.S Median's Captain	Hart-Davis, 1972a	59
"He was a beautiful Scotch terrier, and was brave as well as handsome, caring nothing for the small sharks round him in the water…"	1832	Lt-Col. Molesworth Philips	Philips, 1832	

"It were almost superfluous to say there are many sharks."	1834	William Webster	Webster, 1834b	324
"It [Botswain Bird Island] is covered with innumerable birds, and great numbers of sharks are constantly about its base."	1835	William Allen.	Allen, 1835	1835
"The pond was generally swarming with young turtle, about the size of large walnuts, and these were taken a mile out to sea and set free, to escape the small sharks and black fish."	1843	Fraser	Fraser, 1843	1843
"Sharks are so numerous in these latitudes that it is only when very smooth (a rare occurrence) that one can venture with safety to plunge in to the sea under shade of a rock."	1858	Captain William Burnett	Burnett, 1858a	4
"Their numbers [turtle hatchlings] are greatly thinned by voracious birds and fishes, and even when well grown they are not secure; for the head of a large turtle was found in a shark fourteen feet long, captured by the 'Thalia' in Clarence Bay. "	1865	T. Daines	Daines, 1867	685
"Besides this horrid conger - which strange to say, is considered quite a delicacy in Ascension - our little bay swarmed with fish of every shape and size, from the monster shark, that cost us much in the way of lost lines and hooks, to a lovely nimble wee fish, vulgarly called 'five-fingers' striped with changeful green, and glistening like a rainbow with every restless motion.	1878	Isobel Gill	Gill, 1878	125
"Both [men] were probably pulled off by the sharks of which there were several near." Referring to Goring & Cook, men involved in boat wreck off Ascension.	1879	John Haggard.	Haggard, 1879	2
"We have since searched for bodies [close to Botswain Bird Island] but the sharks had forestalled and of course none were found."	1879	John Haggard.	Haggard, 1879	3

"There was a thigh and left foot of one body, and nearly a complete skeleton of another which had washed into a place where the sharks could not get at it." Return to scene of boat loss one week after incident.	1879	John Haggard.	Haggard, 1879	7
"About a dozen species of fish were caught during the day; four large sharks besides other fish were in the trammel net which was badly torn by the former."	1904	Bruce et al.	Bruce et al. 1907	81
'We'd fillet enough to make a nice parcel to take back to the camp at San, feeding the carcases to the monstrous sharks, which abounded...'"	1915	Ernest Smith	Hart-Davis, 1972a	163
"No-one was allowed to bathe in the sea then because of the sharks, except in Comfortless Cove."	1922	Dorees Drew	Drew, 1989	
"Owing to sharks, bathing in the open sea is prohibited…"	1923	Anon.	Anon., 1923	146
"As a matter of fact, the sharks appear to be timid. One fat fisherman some time ago, fell off a high rock on to a large shark; the shark apparently thought it couldn't really be true, or else he thought there was a "catch in it" for he made off as if he suddenly remembered that he mustn't miss that train!"	1923	Anon.	Anon., 1923	146
"We saw a shark's fin prowling among the waves about the ship: I judged it to be about 8 feet long."	1925	ER Gunther	Gunther, 1925	
"The waters also swarm with sharks."	1928	Anon.	Anon., 1928a	
"Sharks were plentiful all around the coast, and rendered bathing very dangerous except in the shallow coves like comfortless and South West Bay."	1929	John Keilor	Keilor, 1997	35
"Several sharks were caught while I was on the island. When one of them was cut open some thirty youngsters fell out and swam away, apparently none the worse for their experience!"	1929	John Keilor	Keilor, 1997	35

"…and this, together with the fact that out waters are infested with sharks running to 16 feet might not make trawling a success."	1930	E.A. Willmott	Willmott, 1930a	
"Sharks abound but there is no evidence of any exceeding 14 feet. The presence of these hungry monsters, added to the powerful backwash on the beaches, makes bathing quite unsafe, and for these reasons open sea bathing is quite prohibited."	1934	L.S Bartlett	Bartlett., 1972b	
“More often than not, triangular fins, cutting through the water mark the presence of sharks.”	1934	L.S Bartlett	Bartlett., 1972a	
"Mr Norman Bramble, a keen fisherman in these waters, related the following episode to me - it concerned an albacore and several sharks, the former a magnificent fighter, using every ounce of his weight to resist capture, the latter, cowards by nature, ever lurking near and ready to attack anything in difficulty…With this in mind, I, a very tired and sore angler made a desperate effort to bring the fish to gaff; almost achieved, he was in sight and not more than two foot away, when, to my mortification, he was seized by a school of sharks, and taken completely from the hook. The sea around us was in uproar – thirty sharks of all sizes were digging into a two hundred pound albacore, gallant but tired and defenceless."	1934	L.S Bartlett	Bartlett., 1972b	
"The Atlantic, on other occasions, proved to be less kind, large rollers appearing off Ascension and the preponderance of sharks soon put sea-bathing off limits. In any case attack was expected at any time and the beaches were put out of bounds from 1830 to 0730."	1942	Jeff Cant	Cant, 1973	4

"Sharks were plentiful also. It was not unusual to be hauling in a fighting tuna and have the line go slack as a shark hit a bleeding tuna. We would then haul in the remainder consisting of a head or a tuna with a large chunk removed"	1942	Clarke	Clarke, 1942	
"Competent swimmers, one or two per float, entered the water and began slacking off on the suspending lines to lower the line beginning at the shoreward end. They had some difficulty working with the new rope, but before the work could get under way the first of the sharks appeared. A small boat with riflemen could contend with one or two sharks, but when a dozen sharks moved close to the line there was no humane way to keep swimmers in the water."	1942	Clarke	Clarke, 1942	
"A shark guard with M-1 rifles was posted on a motor launch to protect the swimmers from the feared predators. Being an expert marksman, my job that memorable day was with the shark guard."	1942	W.A. Chapman	Chapman, 1985	7
"There was a salt water swimming pool - sea bathing, owing to the danger of sharks, was only allowed at Comfortless Cove (where the sea cables join land). A rope was stretched across the entrance and a watcher was supposed to keep a look out for any sharks."	1944-1954	John Barnard	Barnard, 1968	
"Despite my experience when I first landed, I made many shopping expeditions but I always gazed with slight fear on the long stretch of heaving water which had to be negotiated, particularly if there were sharks around."	1947	Leonora Pollock	Pollock, 1998	
"It was not safe to bathe in the sea because of the danger from sharks and rollers."	1947	Leonora Pollock	Pollock, 1998	
"Shark appear to exist in quantities at Ascension and both meat and livers were fetching a good price until recently."	1953	Frederick Wills	Wills, 1955	

"The beaches here are really beautiful...but the undertow is dangerous and there is also the danger of sharks. One beach is safe-Comfortless Cove...but we are supposed to post a watcher for sharks."	1954	Faulkner	Faulkner, 1954	
"'There's a pool,' they said rather doubtfully, 'one of the old turtle ponds. And you can swim in the sea, but only in Comfortless Cove. Costs you five pounds anywhere else. Sharks.' The sharks, it seemed were real ones, the five pounds a legal penalty for bathing in the sea or any arm thereof."	1960	Bernard Stonehouse	Stonehouse, 1960	16
"I mentioned the sharks. 'Sharks,' said my informant, 'you've never seen anything like it. Why if you catch a fish you're lucky to get it inboard; they'll just leave you the head.'	1960	Bernard Stonehouse	Stonehouse, 1960	17-18
"We were, however, on the look out for sharks. Off the landing at Boatswain Bird Island we had seen enough grey sharks to know the that the group was well represented in Ascension Waters…On the whole they seemed to prefer deep water; I did not see any at all during our bathing, and some of the Americans who swam occasionally off English Bay and other parts of the coast reported that only a very few small ones were ever to be found inshore."	1960	Bernard Stonehouse	Stonehouse, 1960	138
"In the dim depths below, the wall of Botswain Bird Island fell ten fathoms to a clean sea bottom, scoured by the continuous rush of current through the strait. Black fish nibbled imaginary algae from the mooring line, and a pair of lithe grey sharks, no bigger than dog-fish, sped from the shadows of the boat."	1960	Bernard Stonehouse	Stonehouse, 1960	96
"They fish for man-eating sharks from this jetty."	1962	Lawrence G. Green	Green, 1962	149

"Fishing is forbidden while bathers are in the water, because the bait attracts fierce barracoota [*sic*] and sharks. And all the time, someone has to watch the narrow entrance to the cove to see that the man-eaters do not enter."	1962	Lawrence G. Green	Green, 1962	151
"Plans have been approved for clubs to be built at Two Boats but it is recommended that more facilities should be provided for sport in the form of a second rough 9 hole golf course, squash court and sea swimming at English Bay where it may be possible to enclose a part of the bay to keep out shark."	1964	M.E Wainwright	Wainwright, 1964a	6
"3. Bathing. It is, at present, an offence to swim in the sea without a permit, due to the dangerous sea conditions and the presence of sharks. The law is not, however, enforced but everyone is warned that, other than at Comfortless Cove, it is dangerous to swim except for strong swimmers and anyone doing so swims at his own risk."	1964	Anon.	Anon., 1964	
"Swimming in the sea is made dangerous by the presence of sharks and the big Atlantic swell..."	1967	Duff Hart Davis	Hart-Davis, 1967	5
"As we all know there are sharks swimming around in the sea here. Last Sunday 12-year old Steven Morris landed a 7 feet 3 inch shark which weighed 200 pounds"	1971	The Islander	Anon., 1971c	
"Rock cod and cavally were (and still are) the kinds most easily taken from the rocks, but bonito, yellowtail, albacore and wahoo all abounded to say nothing of the sharks."	1972	Duff Hart Davis	Hart-Davis, 1972a	167
"As the wahoo came closer, we saw an ominous gray shadow behind him and every now and then a black triangular fin would appear above the water, like a small sail. There was a large mako shark following the hooked wahoo into the boat and he was getting closer and closer to the wahoo's tail…Old sawtooth must	1974	Roger Lee	Lee, 1974	

have finally got his stomach full. He did not come around again for the remainder of the afternoon."			
“At this time we also saw our first shark – identification is uncertain but I suspect it was a White tip oceanic shark…Along this section we surprised a Hammerhead shark, and got within a few feet before it realised we were there, and made off at high speed.”	1975	John Buchanan	Buchanan, 1975
"Without wishing to sound like a Job's Comforter, I'm also prompted to mention that small sharks are not an uncommon occurrence at Comfortless, and whilst I am a subscriber to the belief that the sharks in Ascension waters are too well fed to warrant unprecedented attention, one must remember that sharks are unpredictable scavengers: a pair of kicking legs on the surface of the water produces the same vibrations as an injured fish and could possibly attract a cruising shark, albeit a well-fed one."	1975	Anita Currington	Currington, 1975
"A half only of one of the wahoo was brought ashore, testimony to the truly sharp teeth of a passing shark."	1975	The Islander	Anon., 1975c
"There are few points where Ascension scores high, and that's the docility of the shark!"	1975	Allen Mills	Mills, 1975
"…all strikes ended in fish-less lines, as the Sharks took their Breakfasts as clean as the butchers knife, including one lure. Wahoo were seen to be jumping out of the water all around, and looking over the side of the boat, one could see layers of Sharks (like aircraft at London Airport, waiting to land), standing by for another tasty morsel from the Fishing club."	1977	The Islander	Anon., 1977
"P.M. - one small bonita and a large tuna head (the sharks got the rest!)”	1979	The Islander	Anon., 1979

Article in The Islander describes a cat jumping in to the sea off the pier, to be pursued by '4 or 5 largish' sharks until eventually it is washed ashore unharmed	1979	The Islander - John Shanks	Shanks, 1979	
"For the would-be swimmer the blackfish is harmless, but the blue shark (*Prionace glauca*) has a well-deserved reputation for vicious attacks on human beings, so swimming is limited to one or two areas where the tell-tale dorsal fin would be readily spotted. Less common in Ascension waters and less likely to cause problems are hammerhead sharks (Sphyrna spp.)"	1980	Tony Cross	Cross, 1980	150
"Also lots of sharks, some of whom managed to win a battle with Bill Keohane for what might have been the biggest wahoo of the day, from the size of the mouth that Bill finally pulled in!"	1980	The Islander - Vera Keohane	Keohane, 1980b	
"Almost all the sharks caught close to shore are sexually immature, usual for those under 8 ft. I have yet to see a fully mature shark at Ascension."	1981	Jose I. Castro	Castro, 1981	
"There is a standing instruction on the island for servicemen and that is simply that there is no swimming on the island with the sole exception of Comfortless Cove...If that isn't enough, the Queen's Harbour Master reported sharks in Georgetown Harbour on Monday."	1982	The Islander	Anon., 1982	
Talk given by Mac McDowell on sharks - residents asked how safe it was to swim on Ascension, to which the answer was if the sharks are left alone they'll leave swimmers alone. Hammerhead and 'grey' sharks are reported to be most common species around Ascension	1983	The Islander	Anon., 1983	

"There have been several reports of shark sightings around Ascension recently, most notably that of an eighteen foot specimen caught by a fisherman off the 'Maersk'…Smaller sharks have been seen off North East Bay, where they are quite commonly found, and one swimmer spotted a 2-3 footer in the water at English Bay...It is thought that the sharks have been attracted closer in to our shores than usual by a larger amount of offal going overboard from ships in the bay, since there have been up to five ships at anchor off Long Beach at once over the past few weeks."	1986	The Islander	Anon., 1986b	
280lb Big-eye thresher shark caught	1990	The Islander	Anon., 1990b	
11ft shortfin mako shark caught	1990	The Islander	Anon., 1990c	
"Offshore, tuna, wahoo, grouper and eels are common catches and porpoises, sharks and very occasionally whales can be seen."	1997	Sue Edgar & Debbie Morris	Edgar & Morris, 1997	2
"If they [turtle hatchlings] make it past the cats, landcrabs, the frigate birds, desiccation and their own dodgy sense of directions, their problems have only just begun: rocks and rollers, blackfish, groupers, morays and sharks all stand between them and the open sea."	1997	Sue Edgar & Debbie Morris	Edgar & Morris, 1997	9
"Unfortunately there are few places where swimming is possible due to strong currents and the danger of freak waves not to mention sharks!"	1997	Sue Edgar & Debbie Morris	Edgar & Morris, 1997	12
"Fishing goes on all around the island - grouper, silver fish, soldier fish and Moray eels (!) being the most common catches though small sharks are also frequently landed."	1997	Sue Edgar & Debbie Morris	Edgar & Morris, 1997	12

"Grouper, Silver Fish and Moray Eels are the most common catches but sharks are often landed. The Blue Shark is the commoner and ranges over the entire Atlantic Ocean, often swimming just below the surface with the dorsal fin showing. It is fast and voracious, sometimes taking hooked Tuna and leaving the fisherman to reel in only the severed head."	2003	Neil MacFall	MacFall, 2003	
"It is reported that at Ascension, groups of these sharks (*Scalloped hammerheads*) used to be seen at certain places close to the coast, though they are rarely seen at these sites any longer."	2015	Robert Irving	Irving, 2015	23
"At Ascension, they [Galapagos shark] are known to venture into inshore waters to feed on inshore fishes, such as the plentiful blackfish *Melichthys niger*."	2015	Robert Irving	Irving, 2015	24
"In 1985 this [Galapagos shark] was the most numerous shark species seen close to the island by divers, particularly off the east side of the island around Botswain Bird Island (R. Irving, pers. Obs.). More recently, Tim Hook, a knowledgeable Ascension angler (as reported by Wirtz et al., 2014), states that large groups of dozens of differently sized individuals may be seen on occasion."	2015	Robert Irving	Irving, 2015	24
"At Ascension, this species [Bluntnose sixgill shark] is only caught at night, frequently near the pipeline deepwater mooring off Georgetown. The current sport-fishing world record for this species from Ascension, at 586 kg (Wirtz et al., 2014)."	2015	Robert Irving	Irving, 2015	25
"The Galapagos shark is the most common shark species seen in the nearshore waters around Ascension. Anecdotal evidence suggests their numbers are thought to be increasing again."	2015	Robert Irving	Irving, 2015	58

"Although there are tales of sharks abounding, in the one hundred years of meticulous naval records there is no mention of any casualty from them."	J. Arthur Dixon	Dixon, no date

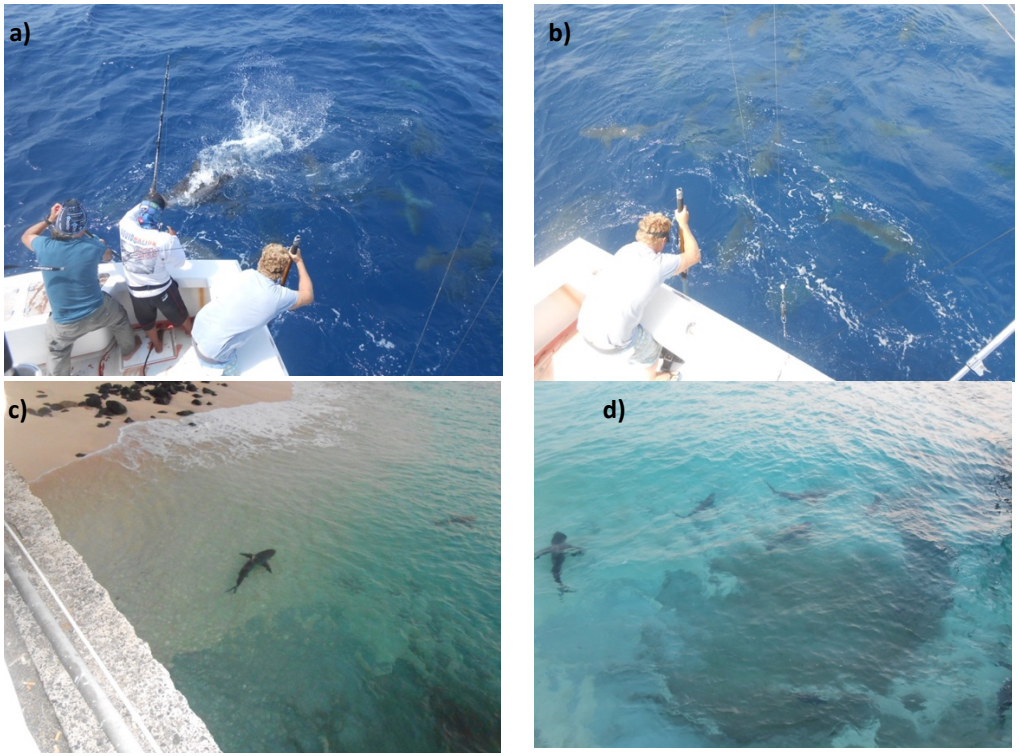


Figure 10: Author's own photos of Galapagos sharks around Ascension Island, July – September 2017 a) attacking hooked tuna, b) surrounding boat following fishing activity c), d) from the pier head in Georgetown in shallow water

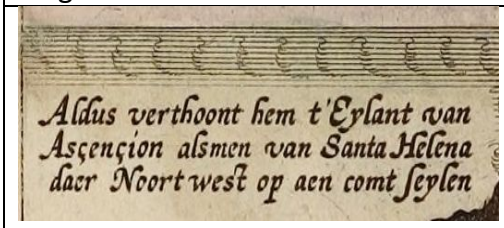
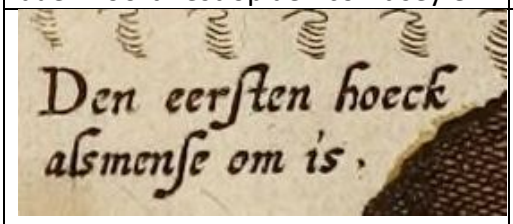
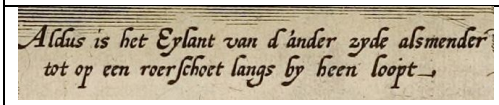
Historical photographic sources and images of Ascension's marine environment

Early views

The earliest confirmed drawing of Ascension Island I could trace is an engraving that accompanies Linschoten's account of the island in 1589 (Figure 11). The text, translated from Dutch is addressed in Table 10. I was able to examine several editions of the book containing Linschoten's impressions of Ascension with the accompanying print: three online (Linschoten, 1598; Linschoten, 1605; Linschoten et al., 1885) and two at the British Library (de Bry & Becker, 1601; de Bry & Gallern, 1617). The versions of the print did vary between editions. Furthermore, a copy of the print and the page it originates from also has a second illustration described as Ascension Island (Figure 12). The editions I examined in libraries did not contain this drawing and I could not therefore corroborate that it is definitely the case. However, the account given by Linschoten (row 5 in Table 5) appears to be a close match to what is depicted supporting the conclusion it is Ascension. Both images illustrate high numbers of birds and Figure 12 appears to depict general abundance of marine life, particularly flying fish.

Figure 11: Engraving of Ascension Island found in Linschoten's Itinerario (1605) by Theodore de Bry (1601). Image provided by Library Regionaal Archief Alkmaar, Netherlands (though earlier versions in English exist by William Rogers, as seen in Linschoten (1596)).

Table 10: Translated Dutch text from de Bry's engraving – kindly provided by Marijke Joustra of the Regionaal Archief Alkmaar.

Original text	Modern Dutch	English translation
 Aldus verthoont hem t'Eylant van Asçension als men van Santa Helena daer Noortwest op aen comt seylen	Zo ziet het Eiland Ascension eruit als men er vanuit Sint Helena naar het noordwesten naar toe zeilt.	This is how the island Ascension looks like when one is sailing from Saint Helena to the north west.
 Den eersten hoeck als men se om is	De eerste hoek wanneer men er omheen is	The first corner when one is around it
 Aldus is het Eylant van d'ander zyde als men der tot op een roerschoet langs by heen loopt	Zo ziet het eiland er uit van de andere kant als men er op de afstand van een	This is how the island looks like from the other side when one passes it at the distance of a gunshot.

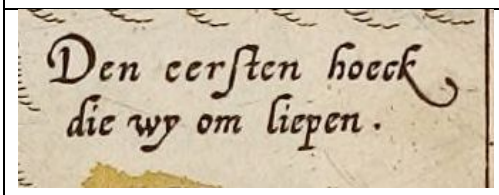
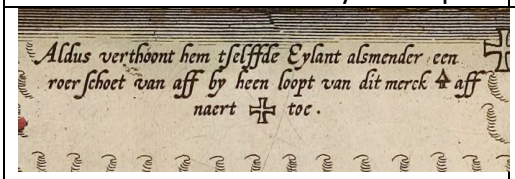
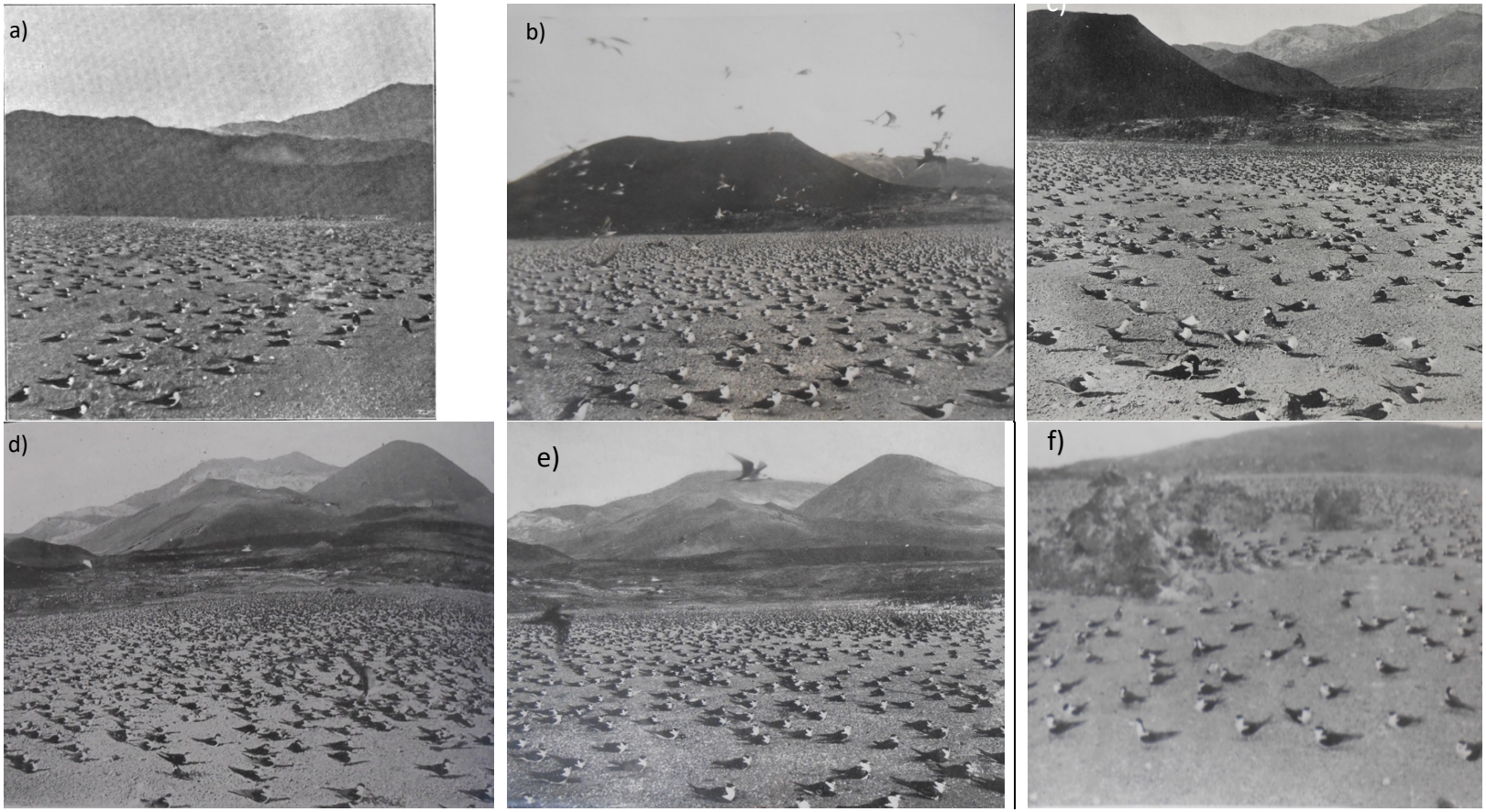
	geweerschot langs loopt	
 Den eersten hoeck die wy om liepen	De eerste hoek waar wij omheen liepen	The first corner we walked around
 Aldus verthoont hem t selffde Eylant als men der een roerschoet van aff by heen loopt van dit merck ^ aff naer t + toe	Zo ziet hetzelfde eiland er uit als men er op de afstand van een geweerschot omheen loopt vanaf dit merk ^naar het + toe	This is how the island looks like when one walks around it at the distance of a gunshot, from this sign ^ to the + [the signs are an arrow and a cross]
 Witte sant strant	Wit zandstrand	White sandy beach

Figure 12: Illustration from Linschoten's (1596) accounts of his travels. Although attributed to Ascension Island (sourced as for sale through Amazon (https://www.amazon.com/Antique-Print-ASCENSION-ISLAND-WHALE-FLYING-FISH-De-Bry-1601/dp/B01MY78S72)) I could not find the exact edition seen here to check the location of the scene. It is likely from the German version of the edition of the text with new engravings made by Johann Theodor and Johann Israel de Bry.

Seabirds

Photographs of the Wideawake Fair where many of the Sooty (wideawake) terns (*Onychoprion fuscatus*) nested were found from several periods in the records I examined. Viewed collectively, the photographs of the birds give an impression of population sizes over time. The earliest picture I found shows the nesting population in 1895 (Figure 13a). The later photos, although from slightly different angles, depict an unvarying Wideawake population size (Figure 13b, c, d, and e). However, the photo from around 1942 (Figure 13f) and 1974 (Figure 13g) are in contrast to the earlier years, showing comparatively fewer birds. A possible explanation for the lack of birds in 1942 is this would have coincided with the construction of the runway on Ascension which had significant consequences on the seabirds nesting close by (Chapin, 1964). A recent photo taken in March 2018 (Figure 13h) enables comparison with the present day and indicates modern populations are not as high as seen at the time the oldest photos were taken. An important consideration is that photos represent only a moment in time and may not accurately represent the abundance of birds. This could depend on the time of year the photos were taken as Wideawakes return to nest around every 10 months, leaving the nest sites largely empty (Chapin, 1964). Without precise dates this possibility is hard to rule out. Therefore, the interpretation of these photos should be treated with caution.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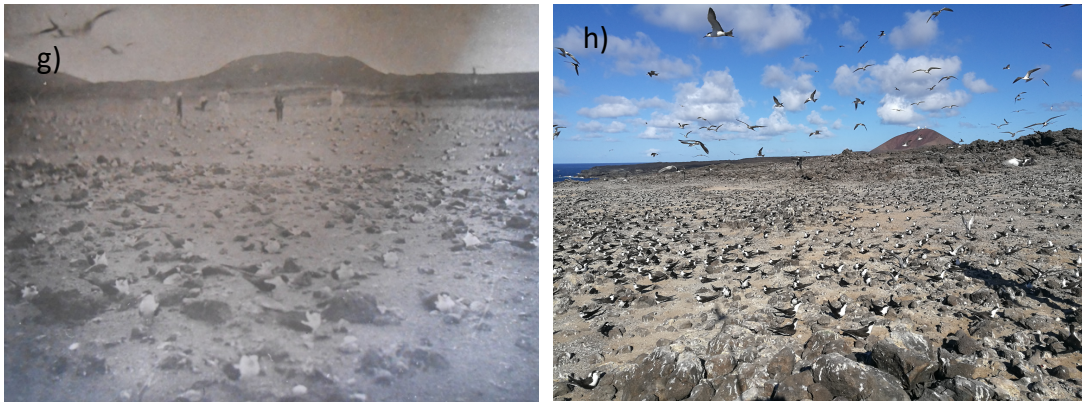


Figure 13: Historical photos of Wideawake fair on Ascension Island: a) Wideawake fair, 1895 (Studley, 1898); b) Wideawake Fair, circa 1912 (Anon., 1912 – Ascension Archives); c) Wide-a-Wake Fair, no date. (Chatham, no date); d) Wideawake fair, circa 1912 (Haywood in Anon., 1923); e) Wideawake Fair, 1929 (Keilor, 1997); f) Wideawake Fair, 1942 (Chapin, 1954); g) Wideawake Fair (Parry, 1974); h) Wideawake Fair, March 2018 (Sophie Tuppen, AIG).

Pollution on Ascension Island

Figure 14 shows photographic evidence of industrial waste dumped on Ascension from the late 1960s until early 1990s, including oil barrels, cars, and other scrap metal. A report from 1993 gave details of the clean-up operation that followed (Raytheon Service Company Environmental Engineering Services, 1993). Within this report there was no information on the impacts on marine life of this pollution. I saw no modern evidence to suggest such pollution still exists. Figure 15 depicts an algal bloom which occurred in Ascension's marine environment between 1999 and 2000. Although undated, a photo of what appears to have been a mass fish die off was found (Figure 16)

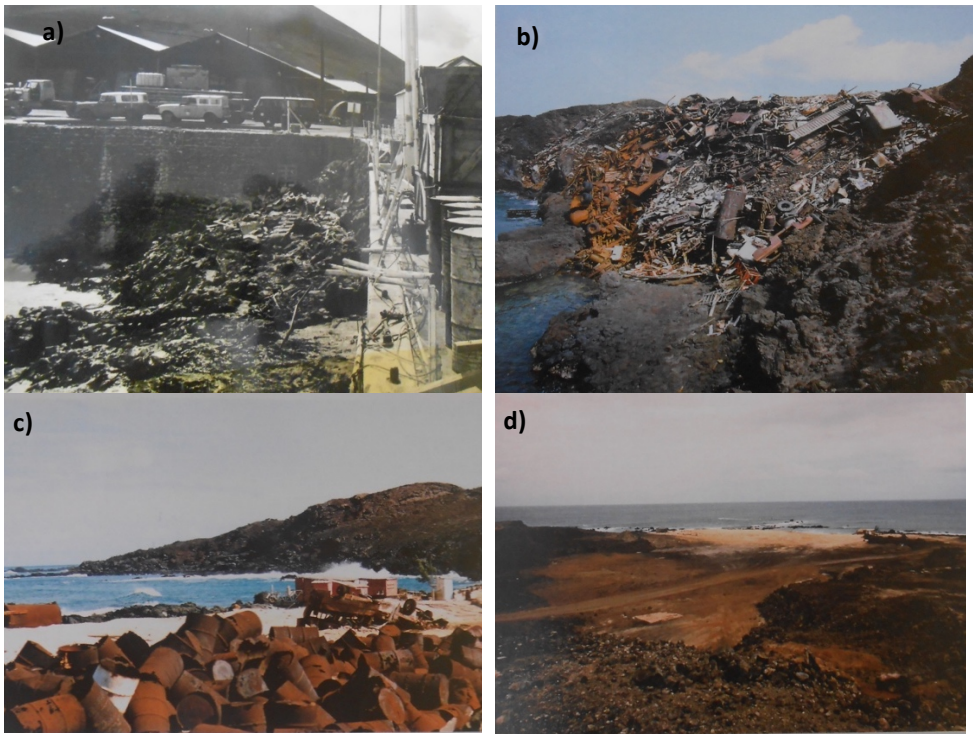


Figure 14: Historical photos of pollution on Ascension: a) Photograph shows east-side of Georgetown pier head (Source: Anon., 1967); b) Photo shows a site on Ascension used for disposal of waste material (Source: Raytheon Service Company Environmental Engineering Services, 1993); c) Payne point disposal site (Raytheon Service Company Environmental Engineering Services, 1993); d) The same Payne point disposal site shown in image (c) following a clean-up operation (Raytheon Service Company Environmental Engineering Services, 1993).

Figure 15: Evidence of an algal bloom in Ascension's inshore environment (specific location unclear; date between 1999 and 2000). Sources: Anon, no date d; Ascension Island archives, C16).

Figure 16: An undated photograph apparently showing masses of fish washed up on Ascension's shore (Source: Ascension archives; Anon., no date b).

Questionnaire Results

Respondent characteristics

114 (82%) of respondents were male and 25 (18%) female and a profile of ages is shown in Figure 17. The answer to the first question ("Could you describe your personal history of involvement with Ascension Island? For example dates you have been here, how long for, and what you do here?") was used to identify the year the interviewee first visited Ascension and their length of time on the island. As many have not remained consistently on Ascension due to 'no right to abode' information on both the first year of visiting Ascension and the total length of time spent there was therefore gathered (Table 11).

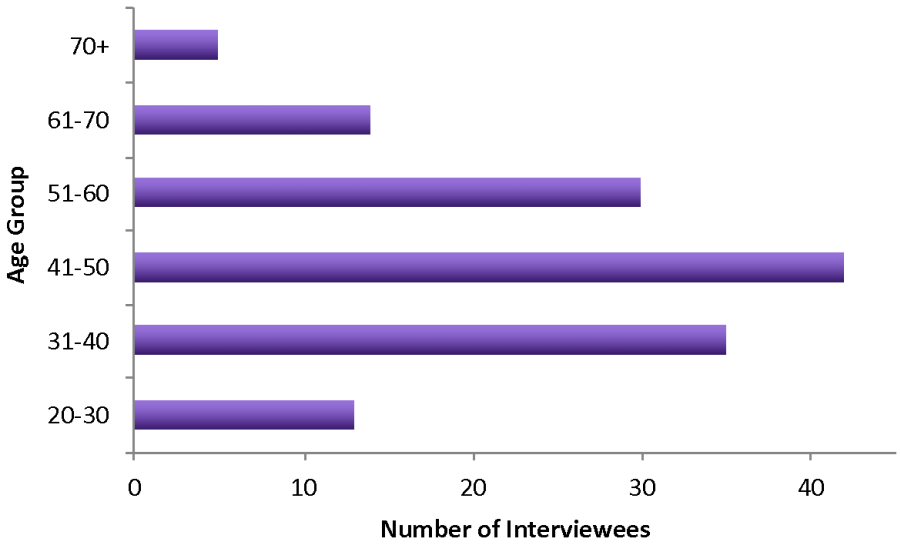


Figure 17: Age distribution of those interviewed about Ascensions's marine environment (N=139).

Fishing effort

87 respondents out of 93 in the fishing category answered, "Would you say the amount of effort you have to put in in order to catch fish has changed during your stay on Ascension?" All respondents who said 'yes' (N=37) clearly stated the change was a *reduced* catch per unit of fishing effort. Fifteen additional respondents noted that catch per unit effort had only reduced because of the sharks. All categories are exclusive of each other. A

binomial test was used to test for significance between the number of respondents who said yes (either due to sharks or other factors N=52) and those who answered 'no' (N=35) which gave a non-significant two tailed p-value of 0.09, though if one more person had said 'yes' this would have been a significant result of a P value of 0.05. It was noted by one interviewee that the number of boats used for fishing has increased since the 1990s and early 2000s (Interview SH 027). One of the respondents commented:

> "*All I can say is that it's not as easy to catch them like it used to be, it's not uncommon to go fishing one afternoon and not catch anything. I remember before days you could never say you'd go fishing and not come back with a fish*." (Interview AI 008 – Arrived in 1987 and been on the island almost 30 years)

This impression that fishing has become harder was a general theme, whereby one respondent recalling an elder fisherman's experience said:

> "*One old guy told me they used to go round the beach, find a little metal stake in the sand and put your line out and then you come back later and check it and you've got tuna on there. But that don't work no more now."* (Interview AI 066 – Arrived in 1999 and been on the island 18 years)

Table 11: Matrix showing how long interviewees had lived on Ascension in relation to when they first arrived.

	First year on island = 2016	First year on island = 2010-2015	First year on island = 2000-2009	First year on island = 1990-1999	First year on island = 1980-1989	First year on island = 1970-1979	First year on island = 1960-1969	First year on island = 1950-1959	**Total for 'length of time on island' category**
Length of time on island = < 1 year	1	0	0	0	0	0	0	0	**1**
Length of time on island = 1-10 years	2	20	9	12	5	4	0	0	**52**
Length of time on island = 11-20 years	0	2	10	14	7	2	2	1	**38**
Length of time on island = 21-30 years	0	0	0	8	6	4	2	1	**21**
Length of time on island = 31-40 years	0	0	0	0	7	3	5	1	**16**
Length of time on island = 41-50 years	0	0	0	0	0	3	7	0	**10**
Length of time on island = 51-60 years	0	0	0	0	0	0	1	0	**1**
Total for 'First year on island' category:	**3**	**22**	**19**	**34**	**25**	**16**	**16**	**3**	

Figure 18 shows responses to the question: "Would you say the amount of effort you have to put in in order to catch fish has changed during your stay on Ascension?" separated by age of respondent. Perceptions of the impact of sharks differed between younger and older age groups, with older respondents less likely to attribute falling catch per unit of fishing effort to shark activity, or to have perceived any change.

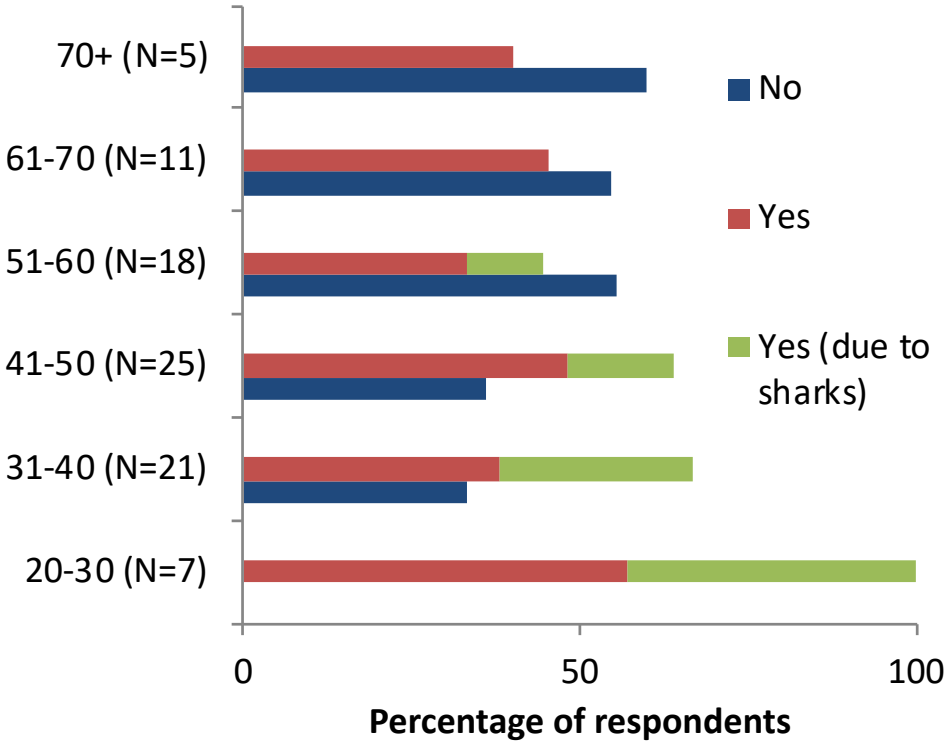


Figure 18: Respondents' views as percentages (N=87) on changes in catch per unit of fishing effort around Ascension separated by age. Numbers of respondents in each age category are shown on the y-axis labels.

Figure 19 shows respondents' views to the question "Would you say the amount of effort you have to put in in order to catch fish has changed during your stay on Ascension?" split by the length of time they had spent on the island. There is little difference ($x^2 > 22.7, P = 0.84$) between most of the categories, though no one who had been there longer than 41 years felt that sharks were responsible for a fall in catch per unit of effort.

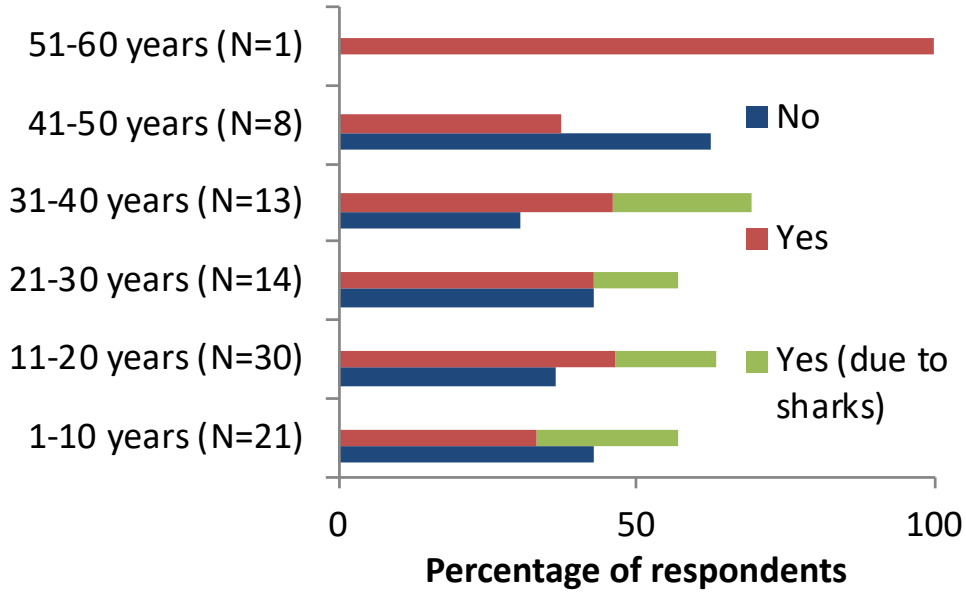


Figure 19: Respondents' views as percentages (N=87) on changes in catch per unit of fishing effort around Ascension split into categories of various lengths of time on Ascension ($x^2 > 22.7, P = 0.84$). Numbers of respondents in each category are shown on the y-axis labels.

Figure 20 shows there was no clear temporal pattern in perceptions of change from respondents who had arrived at different times in catch per unit of fishing effort.

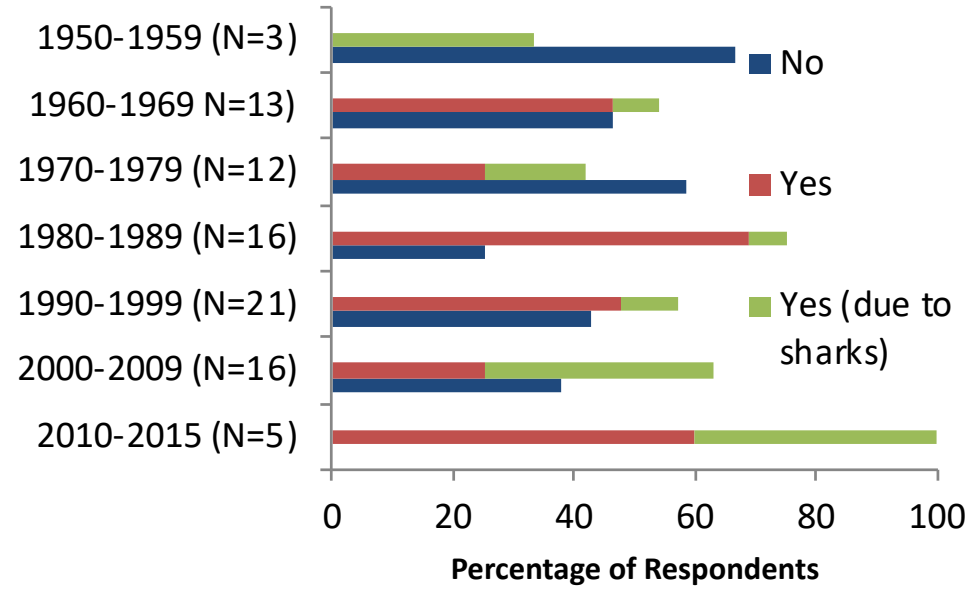


Figure 20: Respondents' views as percentages (N=87) on changes in catch per unit of fishing effort around Ascension separated by their first year on Ascension. Numbers of respondents in each category are shown on the y-axis labels.

Figure 21 shows respondents split into two categories for both the length of time and the first year on island. A higher percentage of those who arrived on the island from 1990 onwards felt that the catch per unit of fishing effort had decreased in comparison to pre-1990 arrivals (Figure 21a). Only slightly more of the shorter-term residents felt fish catch per unit of fishing effort had decreased due to sharks (Figure 21b). Other than these exceptions there are minimal differences between categories in Figure 21 a) and b). I used a chi-squared test to identify whether there was any significant difference between responses (i.e. CPUE had declined versus not declined). I looked at both length of stay and first year on the island categories and found neither was significant: first year of arrival, $x^2 > 2.156$, P = 0.340; time on the island, $x^2 > 0.484$, P= 0.785.

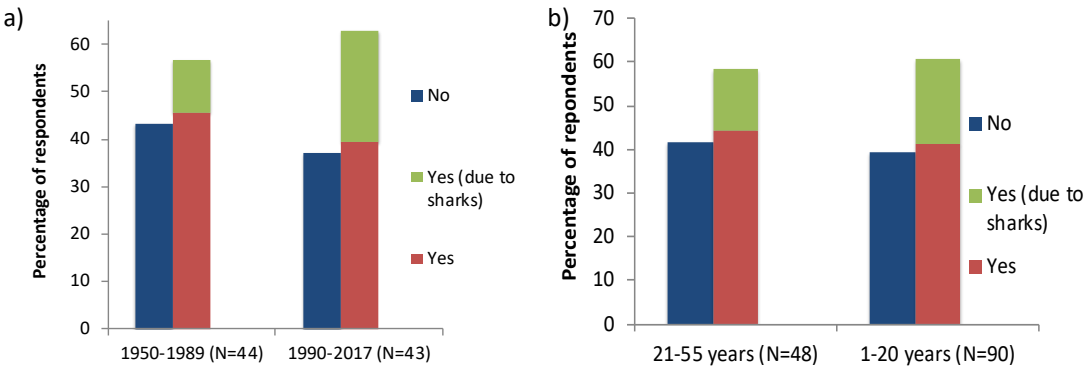


Figure 21: Answers given as percentages on whether catch per unit effort had changed around Ascension, in relation to first year on island (a) $x^2 > 2.156$, P = 0.340 and length of time on the island (b) $x^2 > 0.484$, P= 0.785.

Attitudes to Sharks

All 139 respondents gave answers to "What is your view on sharks in Ascension waters?" (Figure 22) (N=299, multiple answers per respondent). Seven respondents said they had had near misses with sharks during their time on the island, by which they meant they'd felt so threatened by sharks whilst in the water, they had had to exit the water and felt it would have been more serious if they hadn't. Several people commented that sharks were previously caught around the island – some were put back, others were kept but no part of the shark was wasted. One interviewee had recorded a

408 lb, 10 ft 6-inch shark caught in 1991. Photographic evidence of shark catches was provided and found (see Figure 7). There was very little fear of sharks in the past, one interviewee remarked:

> "*…when we come [in] from fishing and if you're bloody you could actually dive over the side by the pier to wash off, wash your clothes, there's no way right now you would do that*." Interview SH 003, arrived 1983 and on Ascension for 18 years.

Sharks were always recognised as having been present before, but their change in behaviour is exemplified by not only the attacks but observations such as:

> "*I see one shark grab the propeller on a little boat and shake it. Stuff I see in these two years I've never seen or heard of before*" Interview AI 066, been on Ascension since 1999.

> "*We were at one [island] point and the tidal pool was so shallow you could walk on it, and this one shark was so persistent because it could smell the tuna blood, it was really persistent at getting into that small pool. And I don't know what he was going to do when he get in there because there was no water but he was flipping, turning, it really wanted to get at what was in that pool at all costs*." Interview AI 021, been on Ascension since 1995.

> "*I've been in the water, not only me, with 12 sharks around. I've even tried to feed them, I had a short hand spear, shoot a blackfish and tried to give it to him, and watch him get excited when they fight one another and never had any experience of having to fight them off."* AI 036, been on Ascension since 1962.

Eight interviewees felt the present situation, wherein large sharks are being seen in abundance inshore, wasn't completely new, for example:

> *"Sometimes there were, twice a year, there were massive huge ones, they changed the colour of the water they were so close together you'd think you could get out the boat and walk."* SH 044, on Ascension 1998 – 2008.

The majority of those who also agreed sharks were frequently seen in high numbers arrived between 1960 and 1969 (6/8 respondents). For those forty-seven respondents who felt the presence of sharks in large numbers was completely new, 28 came to Ascension for the first time between 1990 and 2017, with 19 arriving before that. Two respondents spoke of their experiences seeing hammerheads swimming under the gangway of the ship they were disembarking from:

> *"The boat came here and I can see it now, I was only 10 years old, before I moved here, and I remember when they turned on those lights on to operate the derricks to offload the cargo, I can see it now, the pontoon came out against the ship and they turned the lights on and what do you see down there? Sharks, swimming around. And what sticks in my mind are the Hammerheads."* Interview AI 014, talking about 1970s.

> *"I came to Ascension 1968, I think it was 7th or 8th of April and the ship came in around 3 o'clock in the morning. I was walking down the gangway of the ship…I think it was the Good Hope Castle and I was walking down the gangway and the boys on the boat say, 'Don't look down', naturally I looked down. And under the gangway, there was a huge Hammerhead shark going underneath and I said, 'oh my god!'"* Interview AI 020, on Ascension since 1968.

Of those who felt the sharks had increased (N=71), 25 arrived between 1950 and 1989 with 46 arriving since 1990; 22 had been on the island 21-55 years and 49 between 1-20 years. I did a binomial test on both these results, which gave significant results for both year of arrival (P=0.02) and length of time on Ascension (P=0.002). Both these results convey those who first experienced Ascension earlier, and who have been on Ascension longer, are less likely to see the sharks as having increased.

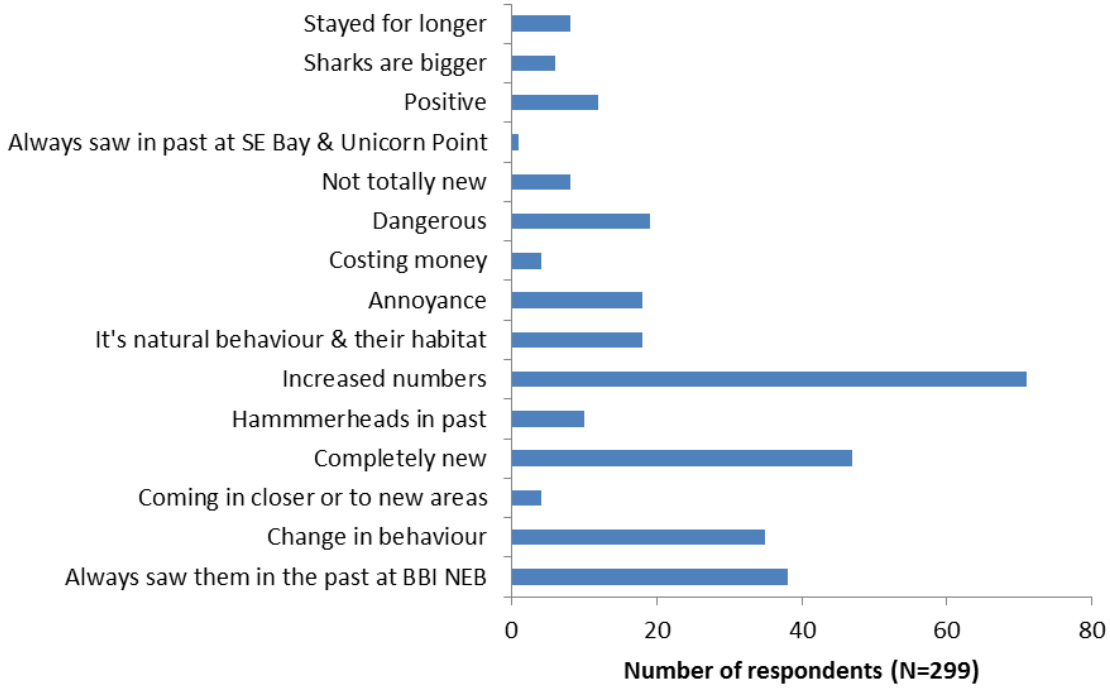


Figure 22: Responses to "What is your view on sharks in Ascension waters?" around Ascension (N=299). BBI – Botswain Bird Island; NEB = North East Bay; SE Bay = South-east Bay. 'Completely new' refers to the present state of shark abundance and proximity to the island as not seen previously by the respondent and 'not completely new' refers to the opposite.

There were 185 responses to "What should be done about the sharks?" (Figure 23). The responses were grouped into relevant categories: Conservation minded (N=93), Information focussed measures (N=35), Cutting shark numbers (N=34) and 'Don't Know' (N=22). The conservation minded category includes most common responses of 'Nothing can or should be done' (N=49).

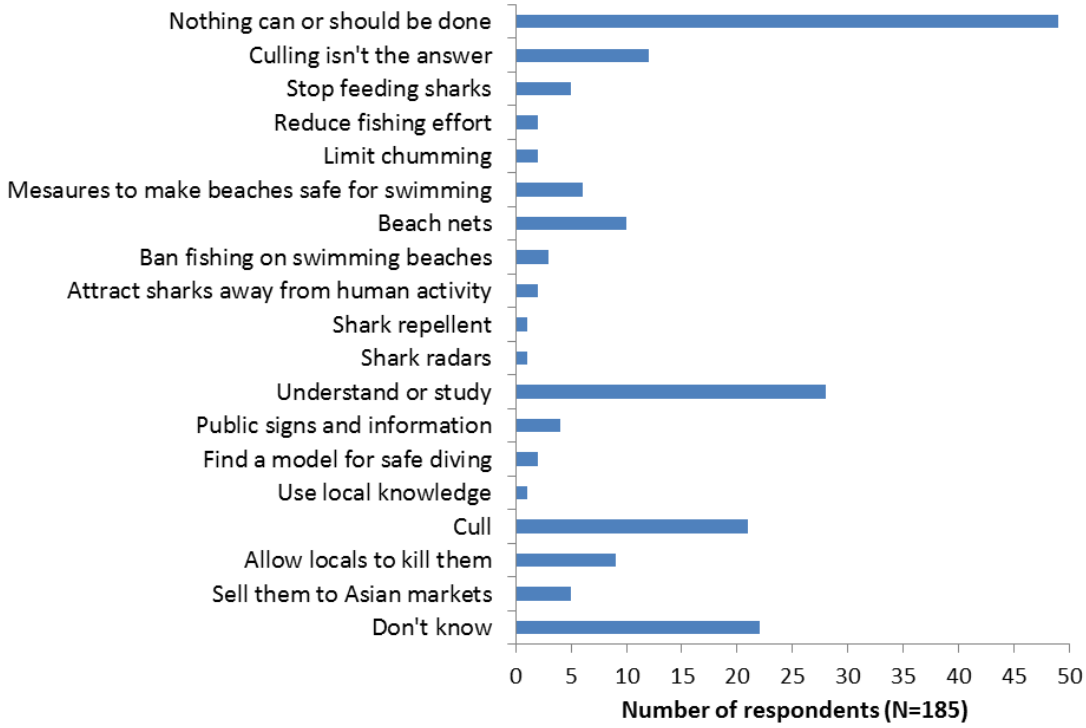


Figure 23: Respondents' views on what should be done about the present shark situation around Ascension.

Figure 24 compares views of the different user group on what should be done about the sharks. Conservation minded measures responses represented the majority of responses for all groups, while reducing shark numbers was most popular among people who were identified as fishers.

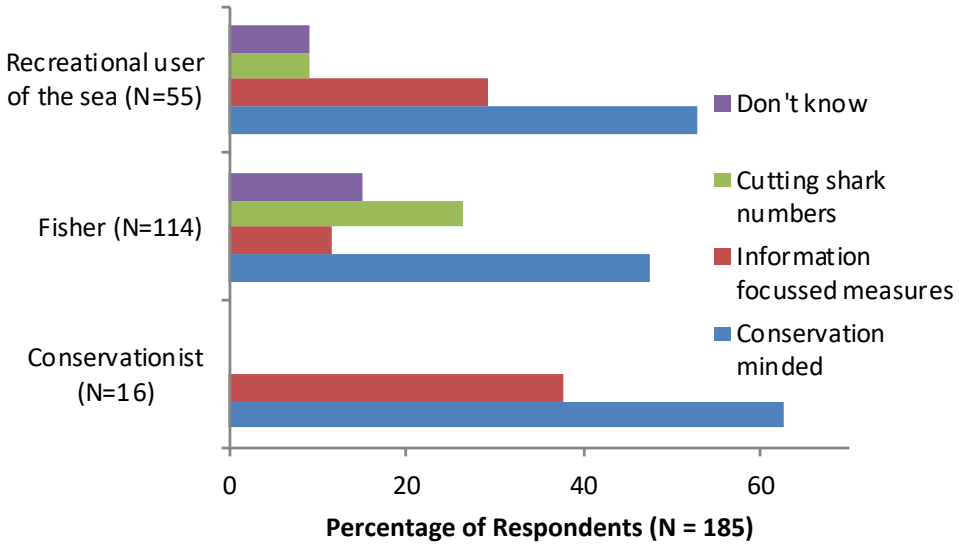


Figure 24: Views on "what should be done about the sharks" around Ascension split by type of user of Ascension's marine environment. Number of respondents in each category is shown in brackets on y-axis labels.

A slightly larger percentage of older respondents believe sharks should be culled, compared to a more conservation minded response among younger respondents (Figure 25). I used a chi-squared to test whether there was any difference in the proportion of those focussing on culling the sharks between respondents split by age group. The result was not significant ($x^2 > 1.256, p = 0.262$).

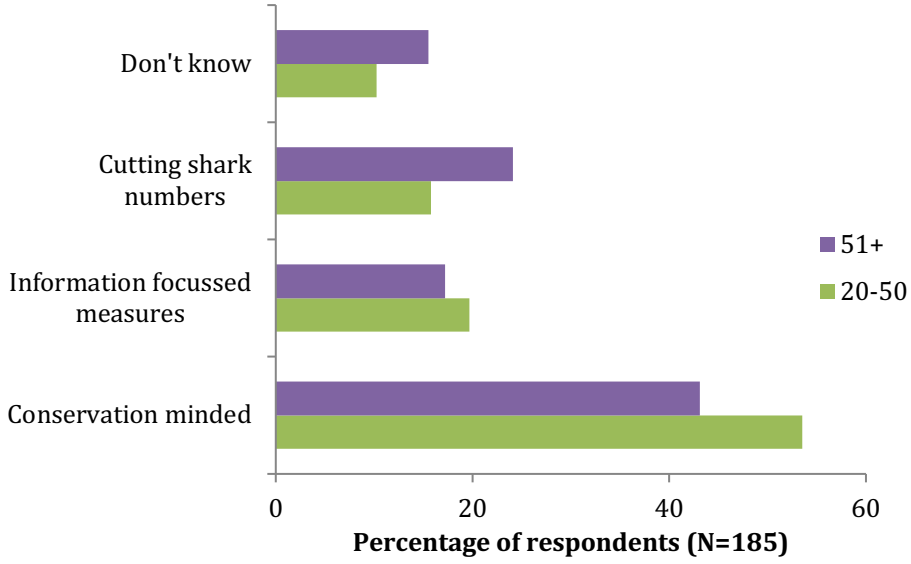


Figure 25: Percentages of 20-50-year olds (N=126) and 51+ (N=58) respondents' views on what should be done about the sharks around Ascension ($x^2 > 1.256, p = 0.262$).

While conservation minded answers were most popular more respondents felt *something* (N=90) should be done rather than not (N=49).

During the interview "Has this [your view of sharks] changed since the recent shark attack(s) on Ascension? was asked. Seventy respondents felt their attitudes to sharks hadn't changed, forty-six considered their views had changed and twenty-three stated 'don't know' or were unclear in their responses. Figure 26 groups responses by age categories but there does not appear to be a clear pattern associated with age group.

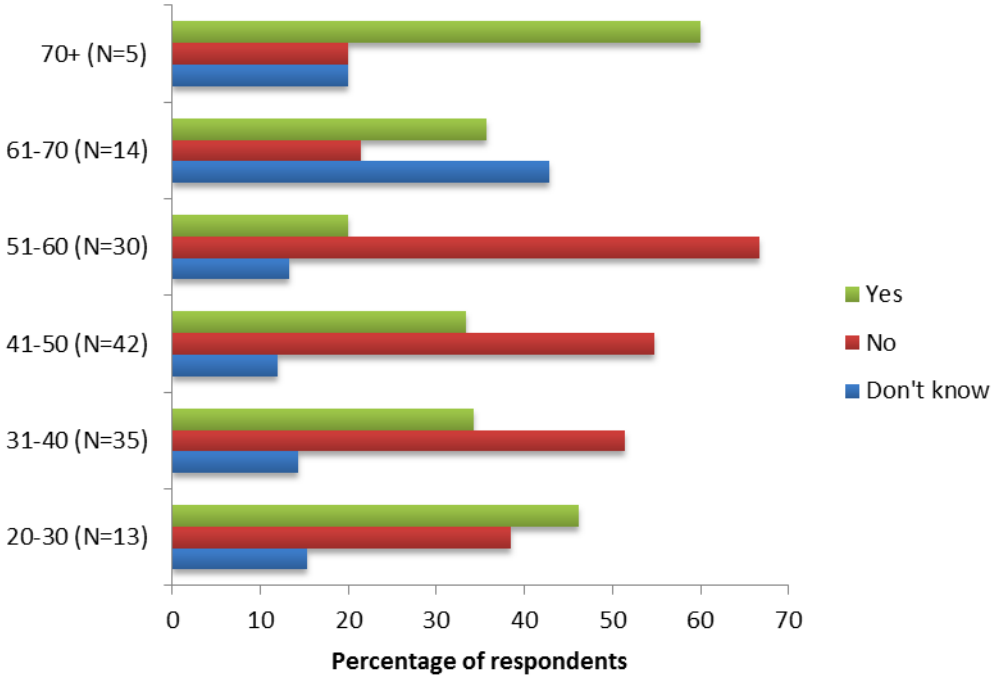


Figure 26: Respondents' answers on whether their view on sharks had changed since the shark attacks sorted by age group. Number of respondents in each category shown in brackets on y-axis labels.

Figure 27 presents the answers to "Has this [your view of sharks] changed since the recent shark attack(s) on Ascension?" versus the length of time on the island (Figure 27a) and first year on Ascension (Figure 27b) conveying no clear pattern. This shows there is no connection between experience of Ascension's marine environment and attitudes to sharks.

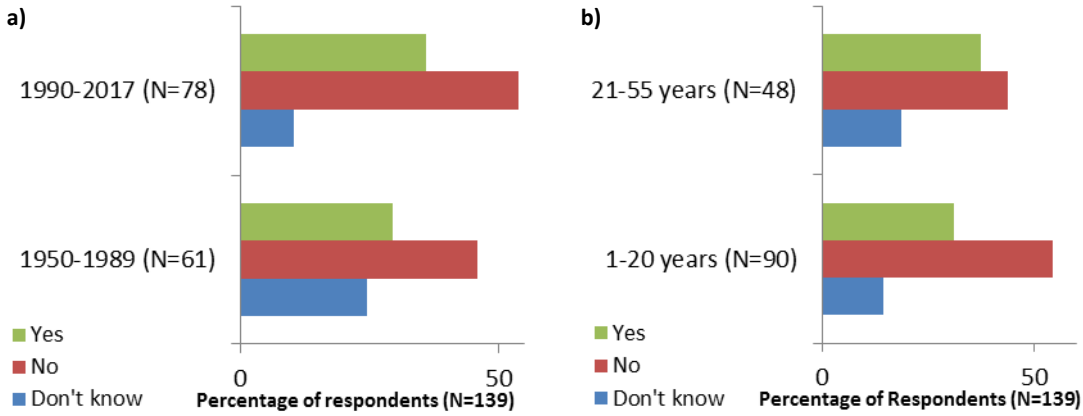


Figure 27: percentage of respondents' answers to whether their views on sharks had changed by categories: a) 'first year on island' condensed into just two categories, b) length of time on island condensed into two categories.

Figure 28 plots percentage of *only* those who felt shark numbers have increased (N=71) against the first year on Ascension. There was no clear association between time of first experience of the island and perceptions.

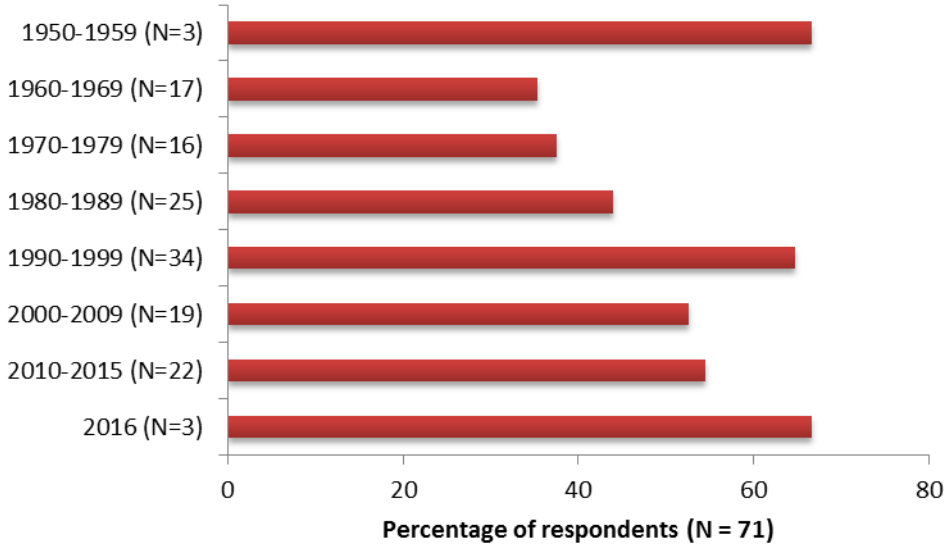


Figure 28: Percentage of respondents in each 'first year on Ascension Island' category who felt shark numbers had increased around Ascension. Number of respondents in each category shown in brackets on y-axis labels.

Figure 29 compares the percentage of respondents in each category of 'length of time on island' who answered there had been an increase in sharks. Again, there is no apparent association of length of experience with a perception on an increase in sharks.

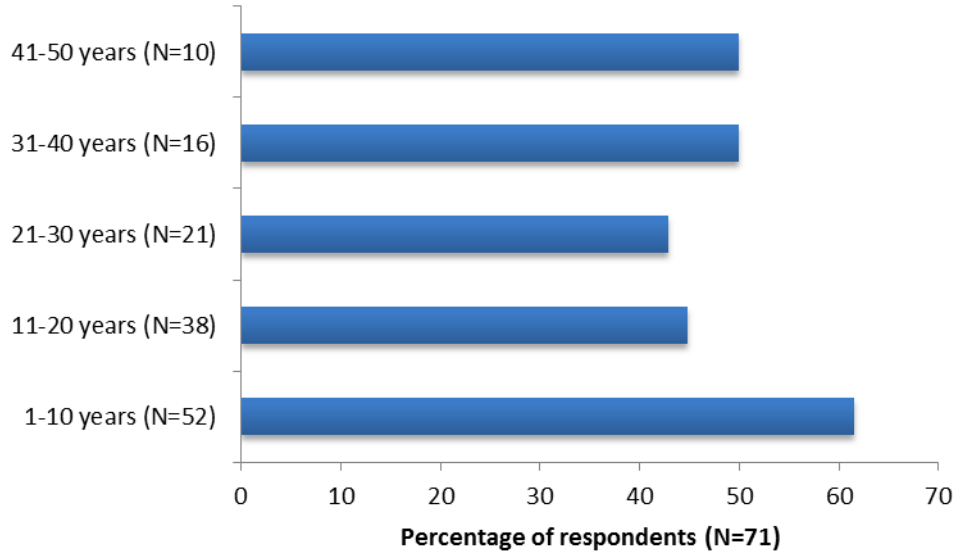


Figure 29: Percentage of respondents grouped by 'length of time on Ascension Island' who felt shark numbers had increased around Ascension. Number of respondents in each category shown in brackets on y-axis labels. There were no respondents in the 'less than one year' and 51-60 category noticing an increase in sharks so these categories were omitted from the graph.

Although a specific question was not asked about why there has been a perceived change in shark numbers and behaviour around Ascension Island, many respondents commented on what they considered to be the reason for this change (Figure 30). The two most popular reasons were the chumming of sardines around the island when fishing for tuna or other game fish (N=16), followed by the disposal into the sea of carcasses after cleaning and filleting fish (N=11).

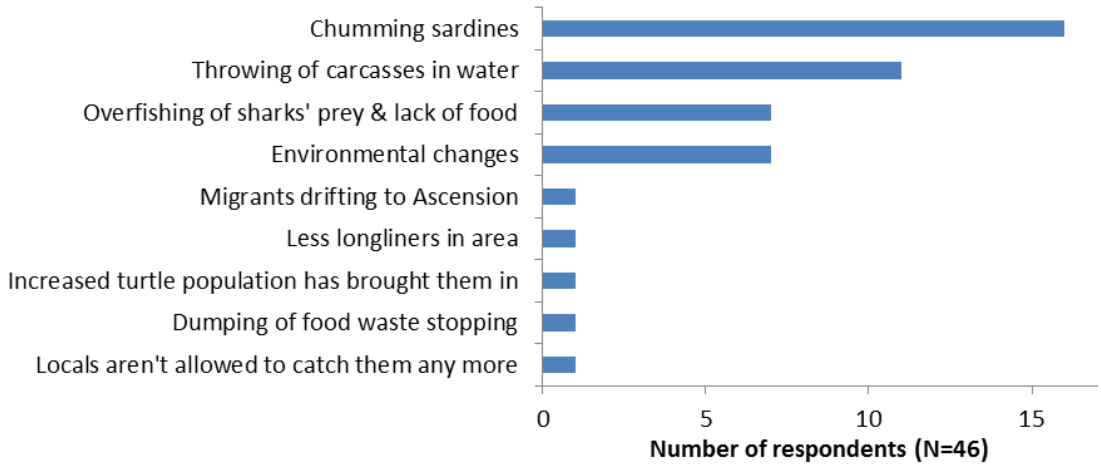


Figure 30: Views of respondents on why there have been changes in shark activity around Ascension Island.

Perceptions of fishing productivity

Respondents within the fisher category were asked "What is/was a typical day's catch?" (for your most recent fishing year on Ascension) and "Can you remember what a typical day's catch was then? (for your first fishing year on Ascension)". Responses are plotted in Figure 32. Figure (d) tuna (*Thunnus albacares*) shows a significant change in the productivity of the fishing over the timespan of interviewees' experience, with regression P values of 0.0006 (with outliers) and 2.6E^-6 (without outliers). Other species showed significant P values for either with or without outliers, but not both.

Perceived changes in fishing locations

Figure 31 displays respondents' answers to "Are there any places you used to fish that are no longer productive or vice versa? (Use map to get exact areas)". There was a widespread perception of site-specific declines in productivity, given the large number of fishing sites named. English Bay was the location most frequently mentioned to have declined in productivity. This is addition to the majority of locations listed down to Hummock Point are all near roads and access routes. Eleven respondents commented that easy access places had declined (Figure 33). One interviewee stated:

> "Round the back [east side (Figure 2)] of the island you'd be amazed at how much fish, same species as round here but it would be more plentiful because nobody goes those

places." Interview AI 078, First arrived 1990, total time on the island 22 years.

171 named sites were given as having decreased in fishing productivity compared to only 11 places said to have improved (Figure 33). Thirty-four respondents felt no fishing sites around the island had changed. The total number of responses is higher than the sample size as more than one answer given by some respondents.

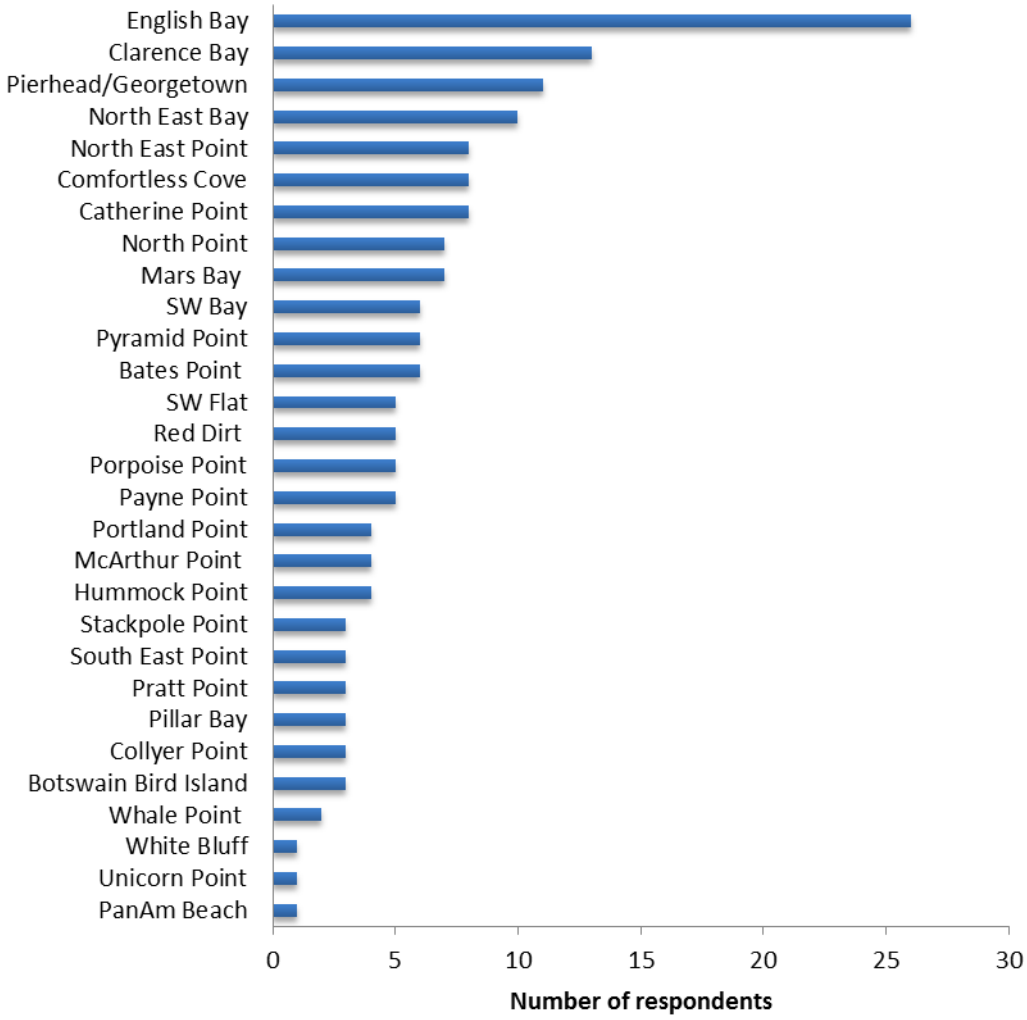
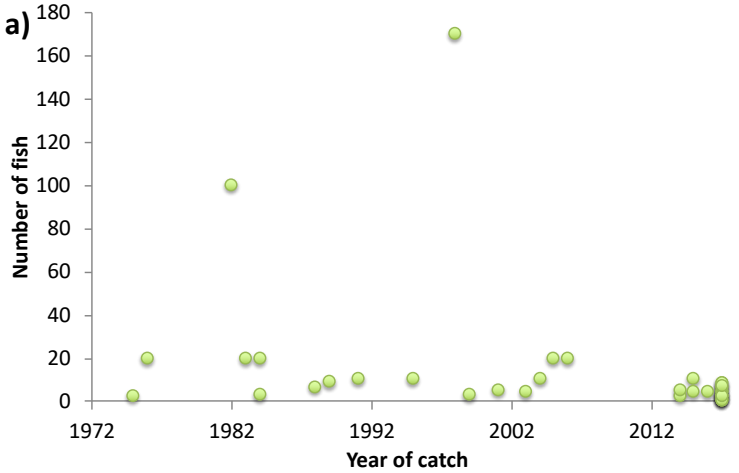
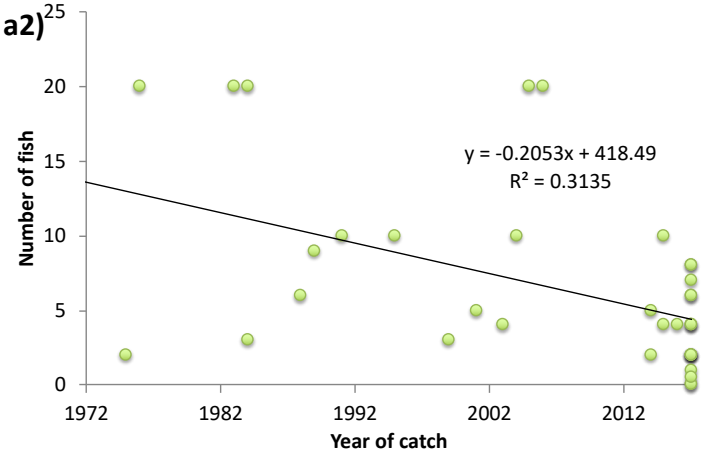
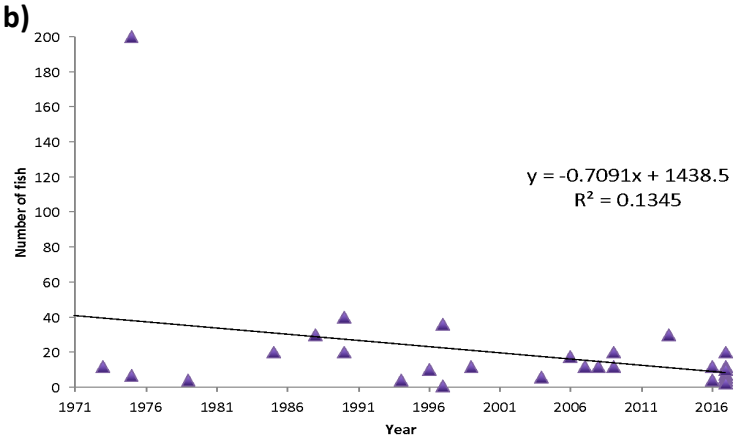


Figure 31: Locations named as having decreased in productivity for fishing around Ascension (N=171).


a)
Number of fish
Year of catch
0
20
40
60
80
100
120
140
160
180
1972
1982
1992
2002
2012


a2)
Number of fish
Year of catch
y = -0.2053x + 418.49
R² = 0.3135
0
5
10
15
20
25
1972
1982
1992
2002
2012


b)
Number of fish
Year
y = -0.7091x + 1438.5
R² = 0.1345
0
20
40
60
80
100
120
140
160
180
200
1971
1976
1981
1986
1991
1996
2001
2006
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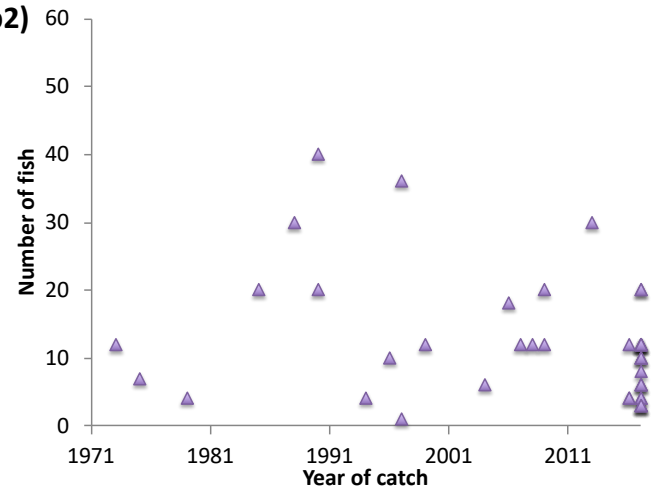
2016


b2)
Number of fish
Year of catch
0
10
20
30
40
50
60
1971
1981
1991
2001
2011

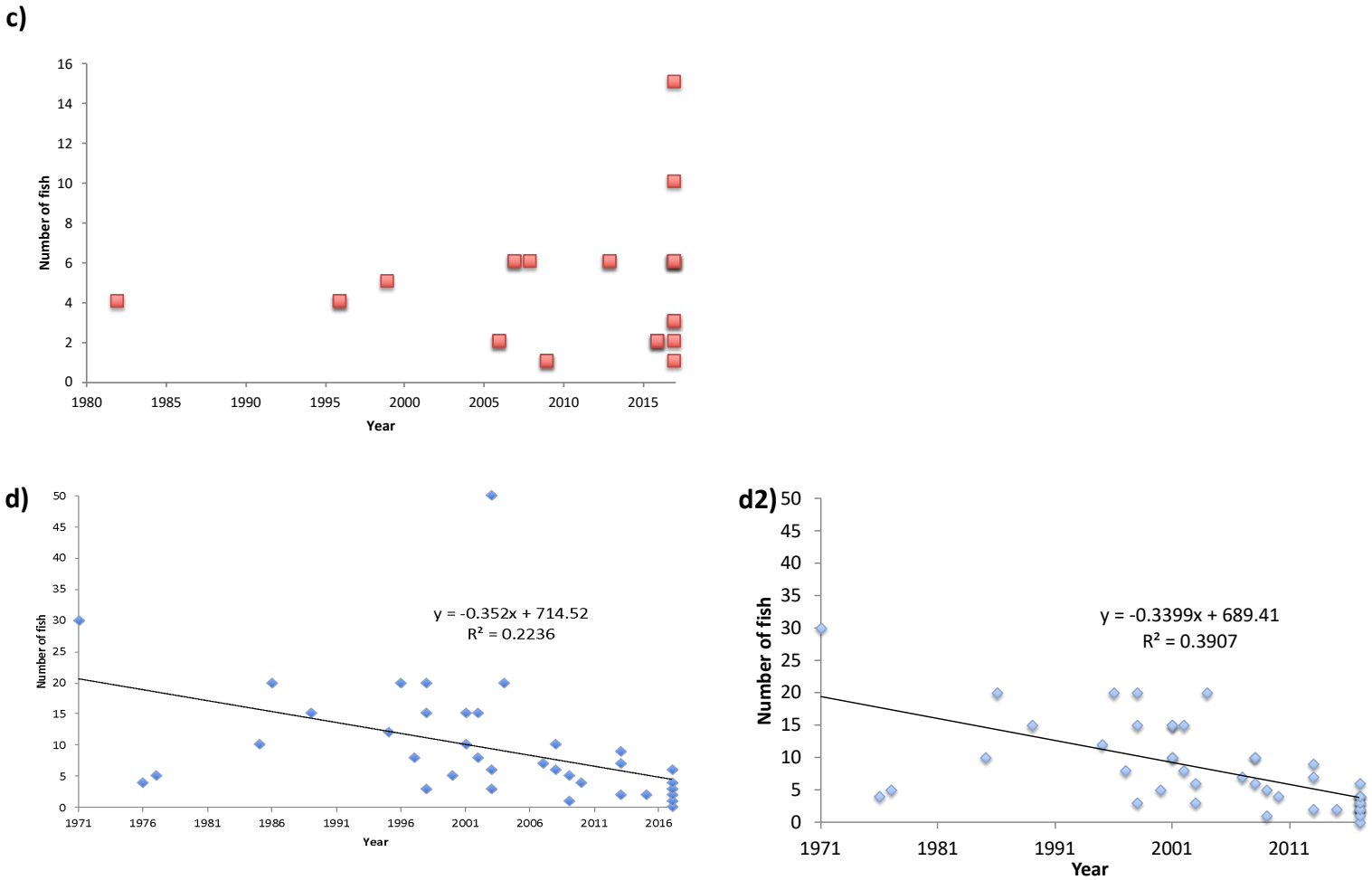


Figure 32: Responses for the number of fish caught in a 'typical day's fishing' around Ascension for the most commonly named species mentioned by respondents, with alternative statistics when outliers removed if appropriate. Linear regression lines are displayed with equation and R^2 values. a) 'Fish' – where non-specific species were referred to (N=42) R^2 =0.06, P-value = 0.1,

t=-1.63; a2) 'Fish' with outliers removed, N=40, P=0.0001, t=-4.15; b) 'Grouper' Epinephelus adscensionis (N=45), P-value = 0.01, t=-2.58; b2) Grouper with outliers removed, R^2 =0.06, N=44, P=0.1, t=-1.68; c) 'Eel' Gymnothorax moringa (N=30), R^2 =0.0001, P-value = 0.96, t=-0.06; d) 'Tuna' Thunnus albacares (N=51), P-value = 0.0006, t=-3.64; d2) 'Tuna' with outliers removed, N=47, P=2.6E^-6, t=-5.37.

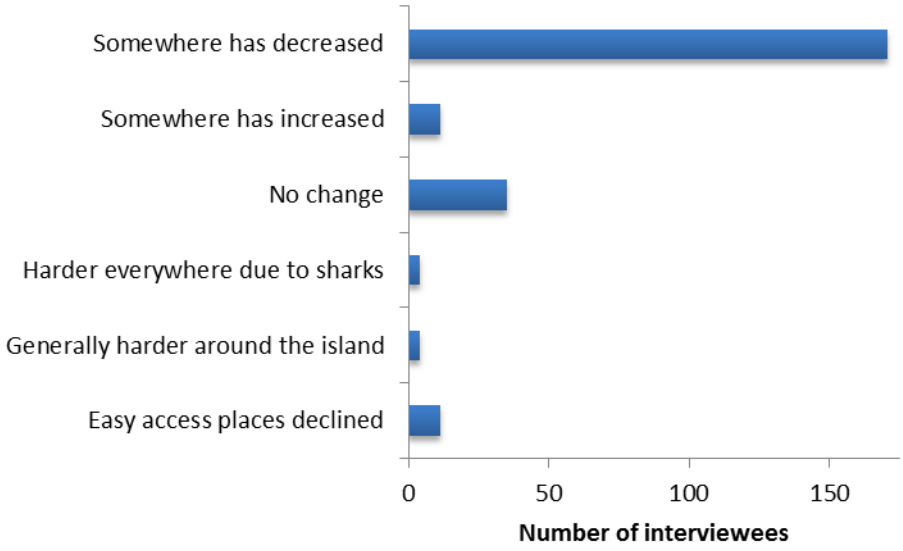


Figure 33: Summary of answers given to "Are there any places that you used to fish that are no longer productive or vice versa?" around Ascension (N=235). The categories of 'Somewhere has decreased' and 'Somewhere has increased' are grouped responses which named a specific location.

Figure 34a breaks down responses to the question "Are there any places that you used to fish that are no longer productive or vice versa?" by date of first arrival on Ascension and Figure 34b by length of experience. Chi-squared tests show there was no significant difference with (a): p = 0.4, x^2 < 11.4; (b): p = 0.1, x^2 < 17.1.

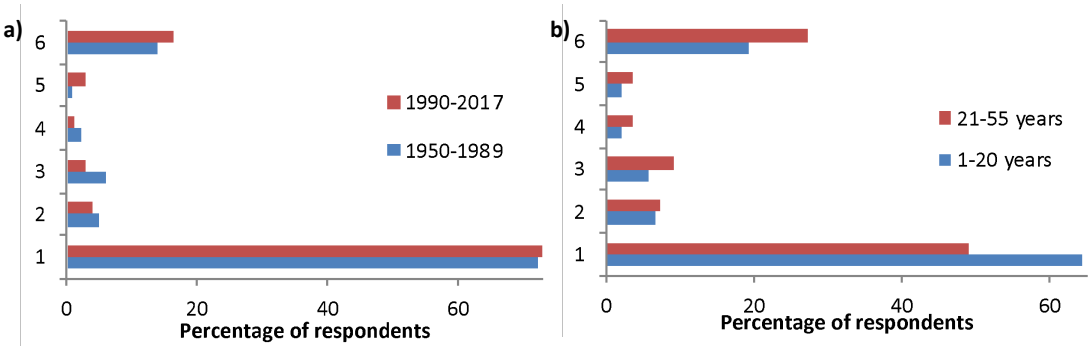


Figure 34: Responses to "Are there any places that you used to fish that are no longer productive or vice versa?" around Ascension sorted by a) first year on Ascension and b) length of time on Ascension Key: 1 = Somewhere has decreased, 2 = Somewhere has increased, 3 = Easy access places declined, 4 = Generally harder around the island, 5 = Harder everywhere due to sharks, 6 = No change.

Perceptions of species decline or increase

When asked "Are there any species you know of that have decreased in numbers during your stay on Ascension?", there were 146 named instances of decrease. Grouper (*Epinephelus adscensionis*) was most commonly named (N=21), closely followed by tuna (*Thunnus albacares*) (N=20) (consistent with Figure 32) and 'fry'[4] (N=20) (Figure 35). Fifty respondents believed nothing had declined in their experience.

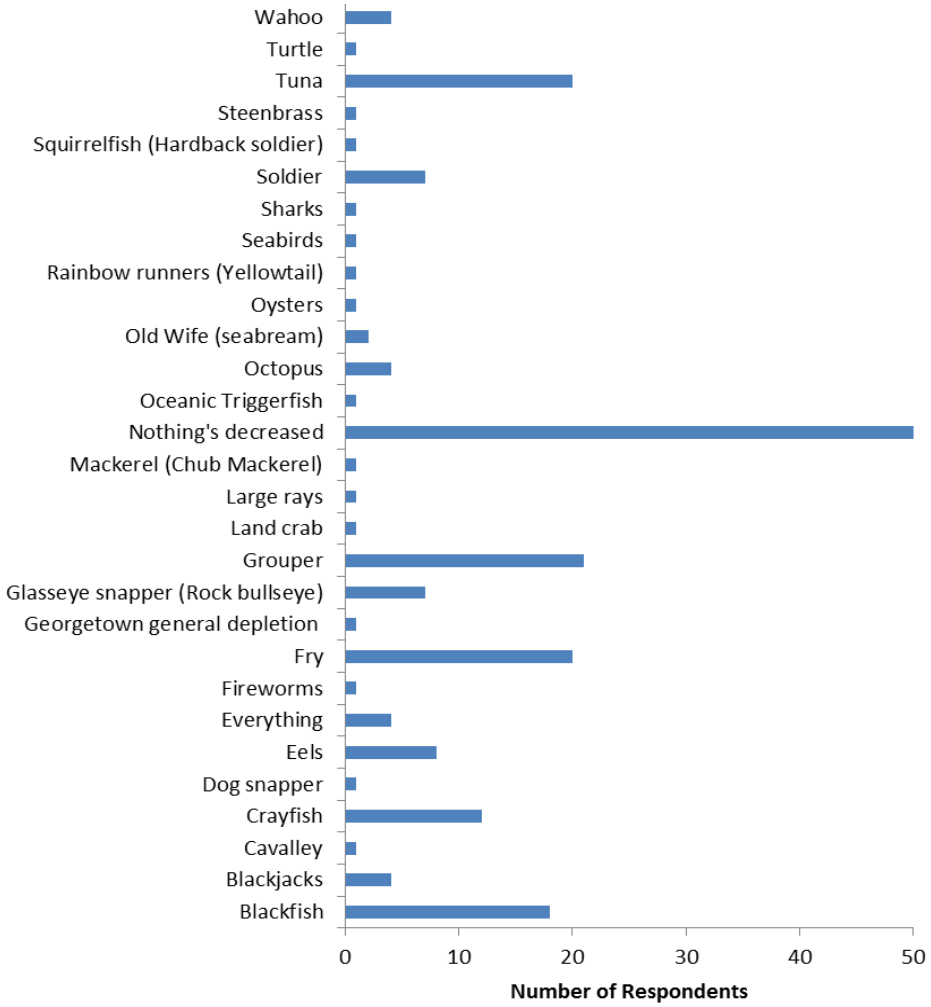


Figure 35: Answers given to "Are there any species you know of that have decreased in numbers during your stay on Ascension?" (N=196 responses).

[4] 'Fry' can refer to juveniles of a variety of fish species. In general, interviewees mentioning fry runs meant species such as Kingston (Mackerel Scad, *Decapterus macarellus* and other members of the *Decapterus* genus), Mackerel (Chub mackerel, *Scomber japonicus*) and Steenbrass (Bigeye Scad, *Selar crumenophthalmus*) which come inshore in large numbers, chased in by larger fish such as tuna species and Yellowtail (Rainbow runner, *Elegatis bipinnulata*) (Edwards, 1990; Pers. Comm. Andy Richardson, 2018). Other fry events can be juvenile grouper (*Epinephelus adscensionis*) and squirrelfish (*Holocentrus adscensionis*) accumulating inshore, depending on oceanographic conditions (Pers. Comm. Andy Richardson, 2018).

Comparing respondent's views based on their experience there was a high level of similarity in perceptions of decline (Figure 36a, chi-squared $x^2 < 0.007$, p=0.93) and with some minor differences in perception of trends in different species (Figure 36b) between the categories for year of first arrival on Ascension. Similarly, there was no statistically significant difference between categories for the length of time on Ascension (Figure 36c, chi-squared $x^2 < 1.57$, p=0.21). Again, some difference in perceptions of specific species' trends did exist (Figure 36d). One respondent who arrived in 2015 pointed out:

> *"Since I've been here, the number of tunas that I've seen and the numbers that have been brought back in, like in my time here, when I first came here there was a lot more, they were giving tuna away at the pier head, people were feeding dogs tuna because it was that common, but now when someone brings up a tuna it's 'oh wow we can get some fresh tuna!'"*
>
> Interview AI 006

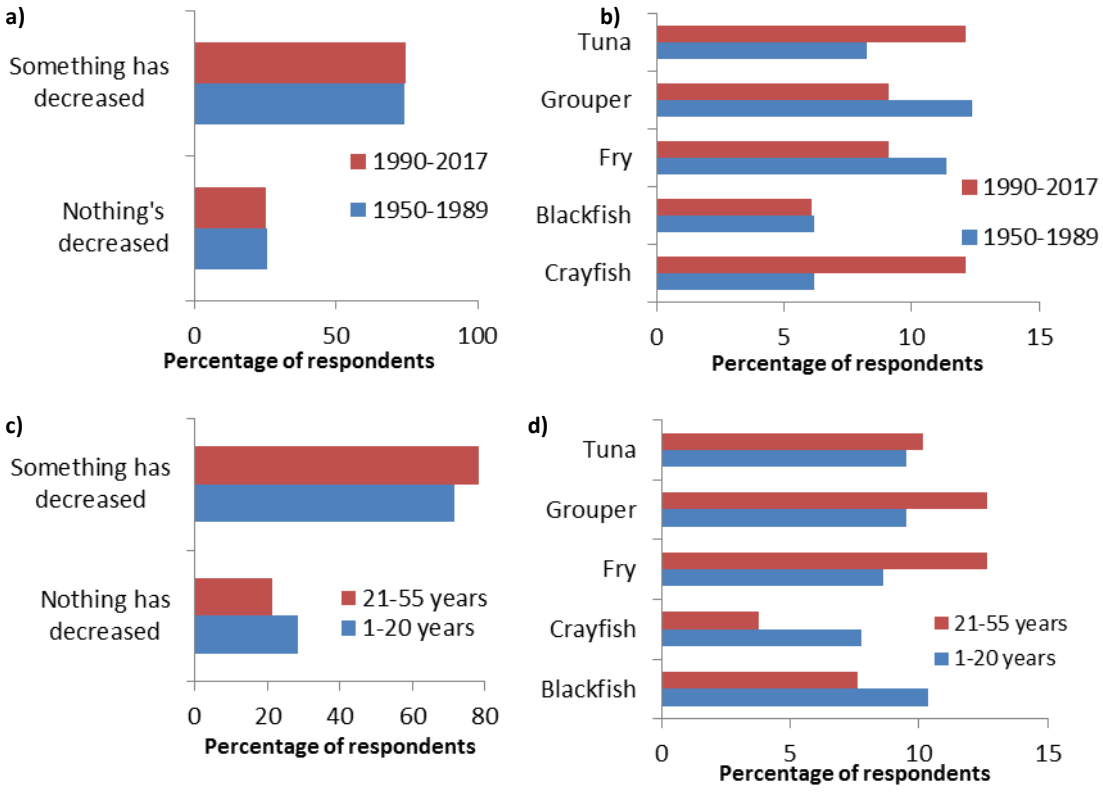


Figure 36: The percentage of respondents who answered "Are there any species you know of that have decreased in numbers during your stay on Ascension?" with something has decreased against nothing has decreased by first year on island (a) and length of time on island (c) and who answered with tuna, grouper, fry, blackfish or crayfish by first year on island (b) and length of time on island (d).

Of those asked, "Are there any species you know of that have increased in numbers during your stay on Ascension?" there was almost an even number of respondents who felt nothing had increased (Number of answers =62) and those who felt at least one species had increased (Number of answers =61). Grouper (*Epinephelus adscensionis*) was most commonly perceived to have increased (N=11) followed by turtle (*Chelonia mydas*) (N=9) (Figure 37). Twelve species were referred to as increasing by just one respondent.

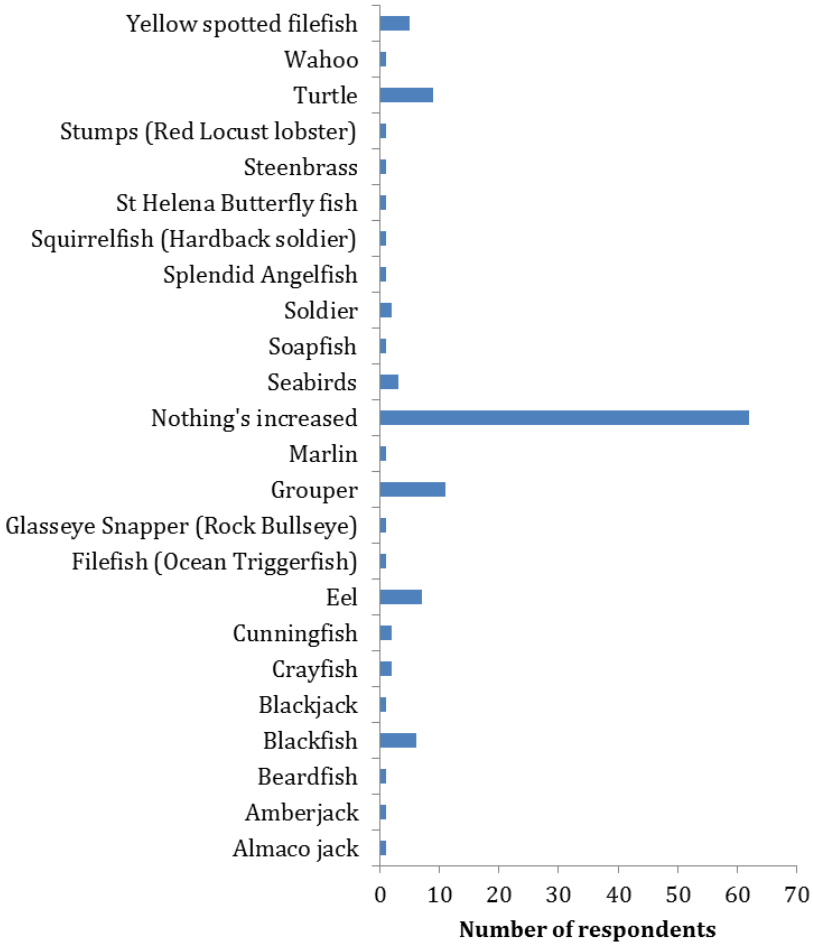


Figure 37: Answers given to "Are there any species you know of that have increased in numbers during your stay on Ascension?" (N=123).

General Observations

Figure 38 depicts respondents answers when asked "Apart from what I've already asked you about, is there anything else you feel is important to tell me in regards to the marine environment? Any significant events or observations?" (Number of responses = 179 as more than one answer given by some respondents). The most common answer was "nothing to add" (N=75), and after this an observation that the fry runs (see footnote 4) on the island had stopped (N=31)) or that mass fish die offs were part of the island's history (N=31). Such die offs were reported in the Islander newspaper in December 1974, January 2008 and according to interviewees in February 2011 and 2012. Seven respondents said they felt Ascension Island was better for fishing than St Helena. Eight people I interviewed were concerned about shore line rubbish on Ascension that included washed up fishing gear, beer cans or other flotsam that may pose a risk to wildlife or people. Three respondents commented on whales' presence in 2017; one felt they were less frequent when last seen in 2015, another said whales had not been seen since they had arrived in 2014, "so must be new", and the third said that whales were seen in the 1970s, but not during their stay on the island from 2011 to (July) 2017.

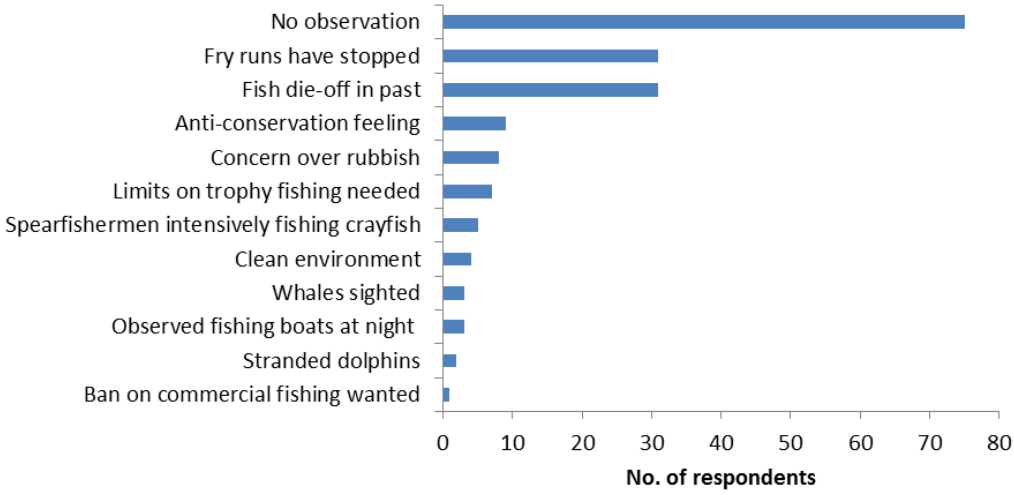


Figure 38: Observations of Ascension's marine environment not covered by other interview questions during respondents' (N=179) personal experience of the island.

Discussion

The results presented in this thesis appear to give a clear picture of Ascension's rich marine environment from the first observations found, particularly for seabirds, turtles and fish life. Many historical studies show that fishing and anthropogenic pressures have seriously damaged ecosystems (Jackson *et al.*, 2001; Roberts, 2007) and though changes are evident, Ascension Island seems to have escaped the level of harm seen elsewhere. When comparing the seabird and turtle populations to the present day however, they appear to be considerably smaller than in the past. Although the abundance of fish life appears to have been a constant, recent significant declines in tuna (*Thunnus albacares*) have been perceived by interviewees. Many interviewees also noted fishing grounds have declined and have experienced a decreased catch per unit effort. These recent changes highlight the need for precautionary and effective management to be developed for Ascension Island's marine environment.

Fish

One of the most striking consistencies among the historical accounts examined were comments on the great abundance of fish. From Linschoten's "great store of Fish" in 1589 (Linschoten, 1596) through to the 20th century, the ease of fishing and its productivity are apparent. Typical 20th century examples are, "In the clear waters, the sandy bottom can be seen teeming with fish; from the shark, the albacore and the tiger conger to the dainty five finger, the water abound with their natural inhabitants." from 1934 (Bartlett, 1972) or "The sea round Ascension teems with life, and fishing has been the most profitable local sport ever since the beginning of the occupation." (Hart-Davis, 1972b) The interviews sustain perceptions of high abundance into the 21st century. The apparent maintenance of high fish abundance over the course of centuries through to the present day makes Ascension unusual in a fast-changing world in which overexploitation and species declines are commonplace (Jackson *et al.*, 2001; Roberts 2007).

The sustained high abundance does not, however, indicate constancy of species composition. Historic examples also demonstrate changes, and the interview data points to more recent changes: many more interviewed felt *something* had decreased or increased rather than no changes having been observed.

Taking the historical examples first, in 1876, the comments made by Thomas Tizard aboard the Challenger, just “a few flying fish were seen”, seem in contrast to those made by Linschoten in 1589. Linschoten (1885) remarks “…there are flying Fishes, as great as Herings, which flie by great flockes together…”, with the corresponding engravings accompanying this text (Figure 11 & Figure 12) also conveying flying fish as a dominant feature of the fauna. In 1865, Baines (1867) reported “Shoals of flying-fish occasionally rose before our bows”, which is more in keeping with Tizard. Cunningham (1910) commented that "Flying-fish of course were seen in large numbers; they first appeared after we had passed Cape Verde, and continued to be abundant till we were approaching St. Helena, but during my stay at that island I never saw one." This seems more in line with early accounts, as does "The advent of tropical waters was heralded by the flying fish. Hundreds skimmed the water in all directions, their scales glistening like silver in the bright sunlight." from Keilor (1997) in 1929. Comments on the appearance of flying fish disappear from here on, the next and only mention, in 1971, being “flying fish constantly dance across the water” (Anon., 1971b).

Early accounts suggest flying fish to be as obvious as birds, but that impression fades as the years progress. Flying fish were not mentioned during any of the interviews and during six and half weeks in August – September 2017 I did not see any flying fish. Flying fish have been reported as an important food source for birds on Ascension, particularly frigate birds and boobies (Dorward, 1962; Stonehouse, 1962; Oppel *et al*., 2015), so if the flying fish have decreased in numbers this could have consequences for the rest of the food web.

Hughes (2013) documented a shift from small pelagic fish (including flying fish) to squid in the diet of sooty terns on Ascension between 2004 and 2012. He reported small fish were not as available to birds around Ascension due to decreases in larger fish pushing them close to the surface where they can be caught. Tuna were commented in by twenty interviewees as having declined, which would substantiate Hughes' (2013) view.

From my interview results, a higher proportion of people who arrived since 1990 said they noticed a decline in tuna, compared to people with longer experience, suggesting a recent decline. ICCAT catch data for yellowfin tuna in the South Atlantic show that 1990 was a peak year (ICCAT, 2014), as do catch statistics from Ascension's commercial fishery (RSPB, 2017). People arriving at that time could have been conscious of a higher baseline abundance of tuna, and therefore more likely to notice a decrease. However, the ICCAT data is regional and reflects the entire South Atlantic and will not be accurately representative of tuna populations specifically around Ascension. Comparisons between interviewees' perceptions of tuna populations and stock status may have value but are not necessarily credible. Additionally, there is no commercial fishery around Ascension so catch data will not be reflective of tuna catches within Ascension's EEZ.

The arrival of the fry (Footnote 4) has apparently been long been noted, with reference made to the "arrival of the Bonneta [Bonito and/or Skipjack, *Katsuwonus pelamis*], from the coast" in April 1838 (Dundas, 1838). Members of the tuna and mackerel families, including bonito, are associated with the fry runs described by residents of the island. Perceived declines in fry were of particular concern to respondents (20 people noted declines). There was a higher percentage of those who considered fry to have declined in the 1950-1989 category for first year on island and 21-55-year category for length of time, which suggests fry declines preceded tuna declines.

Blackfish are one of the dominant features of marine life on Ascension Island. Historical accounts give the impression of vast numbers: "This fish (Balistes ringens [misidentification of *Melichthys niger*, see 'Reliability of

early accounts' below] may be frequently be caught, with the hands, namely, when the water throws its waves a great way on the land" (Forster & Osbeck, 1771), and "even so they were innumerable and were washed up on the beach right up to the limits of the foam: sometimes they lay on the sand stranded and I picked up one in my hands." (Gunther, 1925). Personally, I had created an image of masses of Blackfish from the accounts I had read, channelling words used over time such as "swarmed" (Cunningham, 1910; Simmons, 1927; Hart-Davis, 1972a; Ghione, 2002), "alive with flat fish" (Pollock, 1998) and "boiling mass of fish" (Lockie, 1955b; Cross, 1980). However, I found myself disappointed on arrival in August 2017 to see fewer blackfish than expected, but as a first-time visitor I had nothing to make a comparison to. Eighteen people interviewed on the island felt Blackfish had decreased in their experience, with a higher percentage falling in the category of people who'd been on the island 1-20 years, suggesting the decline has been a recent one. Additionally, 8% (N=4) of those asked about changes in physical habitats said there was more algal growth underwater. Blackfish have long been observed to clean exposed surfaces of algae (Simmons, 1927; Bartlett, 1972b; Stonehouse, 1960; Green, 1962; Hart-Davis, 1972a; Ashmole & Ashmole, 2000) and only places inaccessible to the blackfish are able to support algal growth (Irving, 2013). The perceived increase in algae may be connected to the noted decrease in blackfish. Blackfish are not a target species or kept when caught accidentally so the apparent decrease is not as a result of overfishing. The Galapagos shark (*Carcharhinus galapagensis*) is known to feed on blackfish (Irving, 2015), so more abundant sharks inshore could have reduced blackfish by predation.

In historical accounts, conger eels (Spotted Moray *Gymnothorax moringa*) are often referred to as favoured for eating and abundant. However, a comment made in 1929, suggested that despite being preferred eating fish they were not frequently available (Keilor, 1997). The author asks himself whether this is due to scarcity caused by their popularity. After 1929, I found no further comments on the eels. A nearly equal number of interview

respondents felt that conger eels had decreased (N=8) and increased (N=7), and their catch recollections show no significant change.

Mass mortality events for fish appear to have happened for centuries, based on a combination of respondents' comments, newspaper reports (e.g. Anon., 1974b) and historical accounts. Blackfish (*Melichthys niger*) were often involved (Pinheiro *et al.,* 2010). The first reference was made by Struys in 1673: "also to prey upon the dead fish which lie in heaps upon the shore." Similarly, Figure 16 shows Ascension Island workers in the 19th century scooping up dead fish. There were newspaper reports of the newspaper also reported events in 1974 (Anon. 1974b), 1999 (Godley & Broderick, 1999) 2008 (Anon., 2008), 2011 (Anon., 2011a). There have been a number of theories as to why these occur – including offshore volcanism, algal blooms and low oxygen conditions (Pinheiro *et al*., 2010), with stress also put on the importance of increasing water temperatures (Godley & Broderick, 2011). A report in the Islander newspaper stated that testing of dead blackfish suggested a bacterial infection, which could have been brought on by environmental stress (Anon., 2011b). Evidence of algal blooms on Ascension were found, with one of the fish die off events preceded by dead algae washing ashore (Pinheiro et al., 2010), suggesting a connection. Additionally, six people that felt 'red tides' were the cause of fish die offs on the island. (Pinheiro *et al.,* 2010). These 'red tides' are known to have happened globally throughout history and may be exacerbated by nutrient pollution, such as sewage and agricultural runoff (Anderson, 1997; Heisler et al., 2008).

Seven respondents who had experienced the marine life on both Ascension and St Helena felt that Ascension was better, specifically for fishing. St Helena was discovered a year after Ascension, yet as an island with fresh water and more resources, it was inhabited earlier, with the first settlers arriving in 1518 (Brooke, 1808) and has since had a long history of commercial fishing (Edwards, 1990). In 1589, Linschoten (1596) commented of Ascension: "and great store of Fish, wherein it surpasseth S. Helena". Considering Linschoten gave the following glowing report of St Helena, it

seems Ascension has always been exceptional: "…besides this they have so great abundance of Fish, round about the Iland, that it seemeth a wonder wrought of God: for with crooked nayles, they may take as much Fish as they will, so that all the shippes does provide themselves of Fish of all sorts in that place, which is hanged up and dried, and is of as good a taste (and savor), as any Fish that ever I eate: and this every man that hath beene there, affirmeth to be true."

A recent survey found grouper to be three times more abundant around Ascension than St Helena; along with differences in size, age at maturity and number of large males, suggesting the impact of higher fishing pressure (Choat & Robertson, 2008). Although I did not compare St Helena, or investigate the history of fishing in St Helena, these observations suggest Ascension has retained greater marine life abundance due to less fishing. Sustaining this concept, in the Gulf of California, Mexico, exploitation of Gulf Grouper (*Mycteroperca jordani*) has led to population declines of up to 99%, as shown by historical records (Sáenz-Arroyo *et al*., 2005b).

Sharks

When interviewees were asked for their views on sharks, 71 of them (over 50% of the 139 interviewees) felt the sharks had increased in numbers, with 47 respondents stating they hadn't seen anything like the current situation before. The fact that there were significant differences between those who have seen an increase in sharks, when compared against length of time on Ascension and first year on Ascension, indicates those who first experienced Ascension earlier, and who have been on Ascension longer, are less likely to see the sharks as new and having increased.

Evidence from the historical literature indicates that sharks have been observed in varying numbers throughout history, but the large numbers recently are certainly not new. Most interviewees who felt higher shark abundance was unprecedented arrived in the last 30 years or less (32 of 47 respondents who noted higher abundance of sharks), while 6 of the 8 who felt the situation wasn't new arrived between 1960 and 1989.

One thing that did seem to be widely agreed among the interviewees was the change in shark behaviour. Prior to 2016-17, the sharks did not often come inshore, and were never aggressive or even seemed interested in human activity, whether diving or fishing. It was rare that fish would be taken off a fishing line. The noted increase in aggression by respondents is also highlighted by the general public's increased fear of sharks in the past compared to the present day (Simpfendorfer *et al*., 2011). There would be a period (usually around two weeks to a month in winter) that sharks came in to the pier. Historical data shows that sharks have acted aggressively before, with one account of a shark attack in 1879. Sharks were described as in 'abundance' in 1684 (Dampier & Masefield, 1906b) and caused similar problems to that experienced by fishermen in 2016-2017 in 1715 by 'plaguing' fishermen who had fish on their hooks (Beeckman, 1718). In 1858, it was considered too dangerous to swim unless the water was calm enough to spot a shark (Burnett, 1858a) (twenty years before the reported shark attack) and in 1942, the beaches were closed overnight due to a fear of an attack (Cant, 1973). In 1923, bathing around the island was reportedly banned due to sharks (Anon., 1923), which appeared to be enforced until 1964 with a £5 penalty for breaches, remaining law until at least 1973 when it was last mentioned (I can't find any evidence of the law having been removed). The feeling of danger from sharks around the island in 2016 and 2017, as expressed by 19 interviewees, seems to have been experienced by multiple visitors and residents throughout history.

A study around Hawaii, where Galapagos sharks are also common and feature in shark diving activities, showed despite an overall increase in numbers of sharks at diving sites between 2004 and 2008, there was no reported increase in shark attacks with five shark attacks in the 1990s and the same number in the 2000s after shark cage enterprises were established in 2001 (Meyer *et al*., 2009). The dive companies used chum to attract sharks to cages, somewhat contradicting the view of some on Ascension that

chumming by sport fishing boats has encouraged the sharks to act aggressively.

At St Paul's Rocks, 940km away from Ascension off the coast of Brazil, historical records indicate the onset of commercial fishing caused extinction of the local Galapagos Shark population (Luiz & Edwards, 2011). This example shows that remoteness doesn't always protect a place from anthropogenic pressures.

Globally, sharks are under intense exploitation pressure that has caused widespread declines (Davidson *et al*., 2016; Ward-Paige & Worm, 2017). For example, in the Northwest Atlantic, certain species of shark have declined by 75% over 15 years at the end of the 20th century (Baum et al., 2003), and on the Great Barrier Reef in Australia, reef shark numbers were markedly higher in areas closed to fishing than in those subject to fishing pressure (Robbins *et al.,* 2006). The abundance of sharks around Ascension represents a rare counterpoint to overexploitation, strengthening the case for strong protection from fishing around Ascension. Apex predators such as sharks are considered to be pivotal for the health of an ecosystem as a whole (Myers *et al.,* 2009) because of their impact on ecosystem capacity and top-down control on lower-trophic species both directly and indirectly (Bornatowski *et al*., 2014; Roff *et al*., 2016). However, the interactions of shark populations with the human community need to be carefully managed. Interview respondents who had anti-conservation feelings were angry that despite warnings to the Conservation department that attacks were likely, and that the behaviour of the sharks was dangerous, they felt ignored. Some felt that conservation of the sharks was put ahead of the community's concerns. The response on Ascension perhaps contrasts with places such as Western Australia, where setting drum lines to kill sharks has been used to try to reduce the number sharks following attacks, prioritising human concerns over the sharks (Neff, 2015).

Globally, incidences of shark attacks appear to be on the rise, leading to divisions in attitudes on the appropriate way forward (Gray & Gray, 2017). There is the conflict associated with protecting humans from attacks by sharks which are themselves often endangered and protected (Simpfendorfer *et al*., 2011). Shark attacks can have an adverse effect on the economy of a local area (Hazin *et al*., 2008). Seeking public perceptions surrounding shark attacks can be beneficial for conservation of sharks after attacks (Pepin-Neff & Wynter, 2017). Neff (2012) suggested that it is only when human, rather than shark, behaviour or attitude changes that action is called for.

More of my interviewees said their views of sharks hadn't changed (N=70) than those who said they had (N=46) following the Ascension attacks; similar to a survey undertaken in South Africa (Neff & Yang, 2013). 35 respondents felt that the sharks' behaviour had changed, but contrary to Neff's (2012) research, more people felt something should be done rather than nothing – even if what was done wasn't necessarily to reduce shark numbers. Twenty-eight respondents (15%) called for the sharks to be better understood or studied. Although 35 respondents felt the shark numbers should be reduced in some way, many more felt that non-lethal alternatives such as a study to look at the changes in sharks or taking no action were a better way forward.

Culling programmes to prevent shark attacks have been attempted in a number of places but have often been expensive with limited success in reducing attacks and can have large impacts on the ecosystem (Gibbs & Warren, 2015). An analysis of media reports following shark attacks in Australia suggested that there was a disconnect between the public and policy makers and concluded that future policies should take into account public views in a formal manner (McCagh *et al*, 2015), an approach which would also seem to be well founded on Ascension.

Two respondents remembered a shark net at Comfortless Cove, with one of those also remembering a net at English Bay (both aged 31-40). I was unable

to find any formal confirmation of this. In a non-interview setting, I was told anecdotally that other people had remembered shark nets in place. A photo of Comfortless Cove in 1951/2 shows a rope across the bay (Anon. 1952), but not a net, and this rope was still in place at the time of my visit in 2017, thought to be a safety precaution against currents sweeping swimmers out the bay. Ten respondents specifically called for beach nets to allow swimming to take place, with six more calling for unspecified 'measures to ensure safe swimming'.

There is a difference between exclusion nets, which can be small meshed and designed to keep sharks out of a swimming area, and gill-nets which are designed to capture sharks (Cliff & Dudley, 2011). However, the use of nets may not be the solution to protecting bathers and can have significant consequences on marine life. Exclusion nets are only suitable for beaches unaffected by strong currents and rough seas (Cliff & Dudley, 2011); something not feasible for Ascension Island. A report looking at the use of gill nets in New South Wales found that between 1950 and 2008, 16,064 animals were recorded trapped, with 259 of them marine mammals, reptiles or birds (Green et al., 2009). There was, however, no corresponding decrease in the rate of shark attacks in New South Wales, and during the last 35 years the rate increased by 28% (Green et al., 2009). Shark nets are often perceived as a non-destructive preventive measure. In reality, despite improvements, fatalities of non-target species in nets remain high (Gray & Gray, 2017). Measures to keep sharks away from swimming beaches have worked, but the resulting impact on marine life was large, including non-target species such as turtles (Simpfendorfer *et al*., 2011). With Ascension Island considered the second biggest site for Green Turtle breeding in the Atlantic Ocean (Weber *et al.,* 2014), the impact on turtles would have to be carefully considered before netting went ahead.

Seabirds

The seabirds on Ascension were a major theme of early accounts. Remarks such as "came by thousands" (1589) (Linschoten, 1885), "infinite swarms of

a kinde of fowles" (1600) (More, 1600), "Numberlesse" (1656) (Mundy, 1936) all indicate that birds were in vast numbers in the first 200 years following the island's discovery. Their extent on the island is also apparent from comments such as "The whole island is white with the dung of mews, cormorant and a sort of wild geese that come thither to breed" made in 1673 (Green, 1962). The use of 'numberless' to describe the birds was still used in 1775 (Forster, 1777). Although references to large numbers of birds continued, by 1870 it was said that "Very many years ago, sea fowl must have covered the island, and deposited plenty of guano, as is evident from the marks upon the clinker, but for many years they (with the exception of the "wide-awake") have been confined to Botswain Bird Island, the Gillar rocks, and other small islets round the coast, and to the parts of the island which are almost and quite inaccessible." (Kerby, 1871). There had clearly been a significant decline. As well as direct killing of the birds or eggs for food, which had occurred since the island was discovered, the other main agent of decline would have been the introduction of rats from passing ships, and later feral cats (Stonehouse, 1962; Ratcliffe *et al*., 2009). Kerby's observation that the strongholds for the birds were the inaccessible areas strongly points to rats and cats having impacted the populations. The theory is that rats made it ashore after Dampier's ship ran aground in 1700 (Duffey, 1964). We know rats were certainly there from 1765 when Cowell remarked "There is some wild goats we saw here but no other creature except Ratts *(sic)* and Birds" (Cowell & Read, 1765). Cats were introduced when the island was permanently settled upon (Ratcliffe et al., 2009), ironically as a means to control the rat population (Pain *et al*., 2000).

Only three respondents felt that the seabirds had decreased, and an equal number suggested an increase, which suggests little obvious change since the 1960s. Surveys showed that all species of terns on Ascension have declined in the second half of the 20th century, by as much as 73% in the case of Black Noddies (Ratcliffe *et al.,* 1999). However, the apparent discrepancies between the scientific surveys and peoples' observations

could be down to restricted access to the nesting sites implemented by the Conservation Department from 2001 onwards, so people were less likely to visit and notice population changes. Ashmole *et al*. (1994) considered the main impact of rats was on the Madeiran Storm Petrel (*Oceanodroma castro*), with no or low numbers of rats found in surveys of sooty tern nesting sites in 1992 and 1995 respectively (Merritt *et al*., 1992; Ashmole & Bell 1995). Cats, on the other hand, were reported to kill 3.5% of the sooty tern population each year (Ashmole, 1963). More recently, an eradication programme has been mounted to remove feral cats and rats – the latter still in progress – which could be responsible for indications of recolonization by four species of seabirds and reduction in sooty tern mortalities, though recovery is limited by the continued presence of rats (Ratcliffe *et al*., 2009).

A further factor to consider is evidence that some birds once present on the island have disappeared (Hughes, 2013). The terrestrial Ascension Rail *Mundia elpenor,* was seen alive for the first and only time by Peter Mundy in 1656 (Figure 39), whilst the Ascension night heron *Nycticorax olsoni* was identified from bones found on the island; both are considered to have been endemic (Hughes, 2013). Audubon's shearwater *Puffinus iherminieri* is still found elsewhere but no longer has a breeding population on Ascension (Hughes, 2013). For an island such as Ascension where initial visits were infrequent, but the threats from people came early on, there is the possibility that other species have been eliminated unbeknown to us.

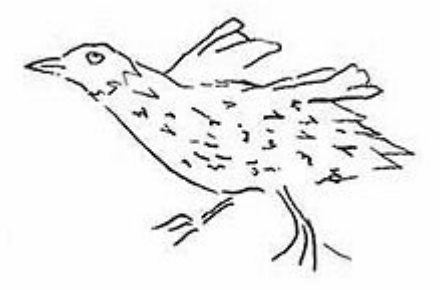


Figure 39: Mundy's drawing of the Ascension rail (Mundia elpenor) (Mundy, 1656).

Turtles

Turtles also featured prominently in early accounts of the island. The first reference to them as 'tortoise' came in 1600 (Teale, 1978), but gave no impression of their numbers. As turtle nesting on Ascension is seasonal, peaking in March and for three months either side (Godley *et al*., 2001) it is possible that those visiting at other times might not have seen many turtles. When William Dampier visited in 1684 however, he made reference to Ascension as "the most remarkable place for their breeding", alongside the Cayman Isles (Dampier & Masefield, 1906b), which are strong words from someone who was a pioneering explorer and naturalist who had travelled much of the world (Preston & Preston, 2005). As the popularity of turtles as food grew, numbers of turtles captured for consumption undoubtedly increased and the catches appear to have reached their peak in 1845, after which point they declined (Figure 9a).

The weight of captured turtles also appeared to decline (Figure 9b), suggesting a population structure change caused by the removal of large individuals (Allendorf *et al*., 2008). Weber *et al* (2014) found the carapace length of nesting turtles had decreased by 10% between 1973/4 to 2012. Simultaneously, since the enforcement of formal protection in the 1970s, turtles on Ascension have recovered well, with the number of nests increasing from 3,752 to 23,724 (Weber *et al*., 2014) and Broderick *et al*. (2006) estimated a 285% increase in the Ascension population. Broderick *et al*. (2006), also determined a pre-1822 historical population of 19-22,000 individuals. The evidence of turtle captures prior to that date presented here suggests that this baseline should be higher, particularly considering Osbeck's comment from 1752, that "hundreds are caught in one night" (Osbeck & Forster, 1771). In other places, for example the Caribbean, Green turtle populations are just 0.3% of what they once were (McClenachan *et al*., 2006).

Other marine life

American whalers operating around Ascension (Townsend, 1935) were likely based on St Helena where there was a whaling station (Edwards, 1990) operational in 1833, 1875 and 1910 (MacLeod & Bennett, 2007). Supporting this, the American whaling boat 'President' that visited Ascension in 1903 (Anon., 1904) was also a frequent visitor to St Helena (Edwards, 1990). From Townsend's study, it seems only Sperm Whales (*Physeter microcephalus)* were captured around Ascension. Islanders targeted dolphins and small cetaceans around St Helena until whaling was banned in 1979 (MacLeod & Bennett, 2007; Perrin, 1985). Linschoten's illustration (Figure 12) shows a cetacean like animal. In 1934, Bartlett (1972b) noted, "whales are frequently observed from the island", whereas "very occasionally whales can be seen." from 1997 (Edgar & Morris, 1997) suggests a decrease in the abundance of whales, though without more references to the whale population between those two points it would be speculation to suggest a decline.

From contemporary sources and Islander newspaper articles there is evidence of Humpback Whales (*Megaptera novaeangliae*) visiting the island (Irving, 2015), though the first Islander report on whales states they have not been seen for 10 years (Anon., 1971d). When I visited in August - September 2017, humpback whales were seen on an almost daily basis. Of the three people that commented on the whales, they all spoke of having not seen them for at least two years and one mentioned that fewer were seen in 2015. The waters of St Helena are regularly visited by Humpback whales (Perrin, 1985), and it is suggested they use these waters as breeding or calving grounds (MacLeod & Bennett, 2008). The presence of whales around Ascension, along with my own and other's personal observation of calves, along with anecdotal records from the Islander newspaper (Hardcastle, 1976; Morris, 1997, Anon., 2012), increasingly suggests a similar conclusion for Ascension.

There were also records in the Islander newspaper of toothed whales washing up on the shore, in 1980 (Peters *et al*., 1980), 1981 (Anon., 1981a),

2002 (Anon., 2002b) - all of which were identified as a Gervais beaked whales (*Mesoplodon europaeus*). Strandings of beaked whales are known to be triggered by anthropogenic noise, including from military sources (Cox *et al*., 2006). The strandings in the early 1980s coincided with warship activity in the area (Anon., 19891a). Apart from this evidence, I found no other observations of beaked whales around Ascension, which is not unexpected given they are considered 'data deficient' worldwide (Taylor *et al*., 2008). Though there were obviously numbers significant enough for whalers to target Sperm Whales around Ascension Island in the past, I found no modern references to them nor were they mentioned in any of my interviews, from which it could be inferred the population has decreased.

The intensive fishing of crayfish (*Panulirus echinatus*) around Ascension was commented on by five respondents and twelve interviewees considered crayfish to have decreased. Of those 12, most had been on the island less than 20 years and had arrived since 1990, suggesting the impact on crayfish stocks is recent. The human population rise between 1970 and 1990 is likely to have increased demand for crayfish and it was regularly exported until 2014, when exports were banned as a conservation measure (AIG, 2015a).

I did not find any further records of land crab (*Johngarthia lagostoma)* killing since the report of 335,535 land crabs killed between 1879 and 1887, but this does not mean to say it wasn't happening. Hartnoll *et al*. (2010) stated land crabs migrate to spawn on the coast between January and May. This could mean the capture rate of 1,350 in a single day in January 1887 was particularly high due to easy exploitation of the congregated crabs on their migration. However, an account from 1876 refers to crabs only migrating in February and March (Drew, 1876) so the high capture rate may not have been due to ease of capture during a migration but targeted killing. Supporting this view, Drew (1876) commented that there was a reward for killing them due to their destruction of crops (Hartnoll *et al*., 2009).

Only one respondent felt that land crabs had decreased, who had first arrived on the island between 1980-89. The Ascension Island Species Action Plan (SAP) reports there is insufficient data to judge local population trends (AIG, 2015b). However, the last major recruitment events were reportedly in 1963, 1973 and 1987 (Anon., 1974a; Anon., 1987; Hartnoll *et al*., 2009), with another migration not noticed till 2002 (Anon., 2002b). Furthermore, the population seems to be ageing and combined with the historical numbers killed in the past this implies a declining population (Hartnoll *et al*., 2009). If the respondent arriving in 1980-89 were seeing larger populations following recent, more frequent recruitments that occurred in the previous two decades, declines would seem more pronounced since then. When the total population estimate of 80,000 adult females in 2013 (AIG, 2015b) is considered in comparison to the 335,535 killed over 8 years, and 1350 killed in a single day, even when taking into account these figures will include males, it can be surmised that there has been a large reduction in the number of land crabs on Ascension.

Reliability of early accounts

Historical accounts from sailors, naturalists, residents and other passers-by are easy to criticise as anecdotal, non-quantitative, and with limited relevance to contemporary management (Pinnegar & Engelhard, 2008). That said, historical perspectives have improved understanding of a growing number of places (e.g. Dalzell, 1998; Jackson *et al*., 2001; McClenachan *et al*., 2006; Sáenz-Arroyo *et al*., 2006; Roberts, 2007; McClenachan *et al*., 2012). Historical accounts are also of increasing use when combined with one or other measures of change (Jackson *et al*., 2001).

We must remain sensitive to the possibility that explorers may embellish their accounts when caught up in the excitement of new places (Sáenz-Arroyo *et al*., 2006). However, such accounts could include valuable evidence of previous marine ecosystem states (Sáenz-Arroyo *et al*., 2006). William Dampier (1651-1715), for example, “was devoted to close observations of winds and tides, geography, plants and animal life” (Sáenz-

Arroyo *et al*., 2006). Studies of Dampier's work have shown his observations to be of high accuracy and impressive dedication (Preston & Preston, 2005).

The earliest accounts of Ascension I could trace came from Linschoten, whose account pre-dates Dutch colonialism (Saldanha, 2011). He was regarded as a 'humanist scholar', meaning his accounts could be widely applied and weren't perceived to focus on one area or have preconceptions (Saldanha, 2011). An example of where embellishment could have occurred within my references was "One time I caught 300 cavalle [crevalle, *Caranx hippos*] in 1/2 to 3/4 of an hour" (Marx, 1983), which would equate to over 6 fish per minute over 45 minutes. This seems relatively unfeasible particularly when considered they were caught with a hook but may have been possible if "I" referred to himself and companions. It is challenging to quantify if exaggeration has occurred in most cases, but caution should always be taken in interpretation.

There are stages of how early accounts can develop into more formal publications, from field notes or log books, through to scholarly editions of a book resulting from the early notes (MacLaren, 2011). The motives and perspectives for the publications evolve through the stages and it would be naive to consider the first stage comprising of logbooks, diaries and notes are unaffected by "cultural assumptions" or language constraints (MacLaren, 2011). The latter is certainly the case for some of the accounts I uncovered, for example, "They are all unhabited and deserr, and have upon them infinite swarmes of a kinde of fowles of the bignes of duckes." (p. 87; More, 1600). The use of terms such as 'duckes' is ambiguous and makes judging the type of bird referred to challenging, leaving scope for certainty in comparing this anecdote with the present. MacLaren (2011) considers most texts that are published as books using original material have been edited, often without the original author's consent, to suit target audiences. An example of a potential case for this would be the diary of Leendert Hasenbosch, the castaway whose diary was found a year after it was supposedly written in 1726. However, it has been suggested that the diary

is actually fake since no body was ever found, and additionally the translation made of the diary in order to sell it as a published book was embellished to improve sales prospects (Ritsema, 2010; Mitchell, 2010).

A further example of uncertainty of species is the description of a 'blue and black striped fish' which is so abundant it can be caught by hand (Diels *et al.,* 1927). This description is similar to other accounts of abundant Blackfish (*Melichthys niger*), but the physical description of the fish leads to doubt, the stripes making it possibly the old wife (*Diplodus ascensionis*). A further unclear species reference is Maxwell's (found in Avis, 2000) reference from 1793 "The bay abounds with fish, particularly a small cod, but they have a black appearance". Both the reference to "abounds" and "black appearance" leads me to believe he refers to Blackfish, but "cod" calls this into question. Given he doesn't mention Blackfish in a separate statement, and also later specifies "rock cod" as a different fish (probably *Epinephelus adscensionis*); I concluded he meant Blackfish.

Care must also be taken as early visitors may have based their accounts of Ascension Island on those of other people. A clear example was initially published in Cowell & Read (1765): "The fish frequenting the numerous creeks and islets comprise a species of conger eel, a species of bream, Carvalhoes, mullet, some crayfish and oysters all of which are edible the oysters however not being very [illegible word]. The inedible onnes being shark and a flat purple coloured fish about the size of a plaice, commonly called Blackfish" The account was repeated, with the exact same spelling of words in Stone (1874). Additionally, Mellis' (1875) account of Ascension Island's birds is thought to be based on readings of others' texts. Firstly, he primarily wrote about St Helena where he was born and lived and does not mention visiting Ascension. Secondly, he referred to the birds as "so tame and plentiful at a place called 'Wideawake-Fair', that they may be knocked down by hundreds with a walking-stick". Although in Ascension's earlier years this was the case, by 1868 they took to the air when people approached (Collingwood, 1868) and by 1870 there is noticeable shrinkage

of the area covered by nesting birds (Kerby, 1871). Although a diary entry from 1878 refers to the Wideawakes that will “peck at you and light on your hat", another account from the same year said birds were “darkening the air, when they are disturbed” (Thomson, 1878). The Africa Pilot uses the same or very similar references to the fish life, with only subtle changes made between the 1930 and 1963 versions, suggesting that after first publication the text was simply copied and pasted into subsequent editions and not based on up-to-date observations. Accounts from James Holman are to be considered carefully given that he was blind (Ashmole & Ashmole, 2000), and therefore must have been relayed to him by others and not what he witnessed first-hand. Although cases such as these may need to be disregarded, the number of other, obviously original, accounts still go a long way to building up the picture of Ascension’s marine life.

For turtles and birds on Ascension, which are not present in the same quantities throughout the year due to nesting seasons, the difference in numbers seen by visitors to the island could be explained by seasonal variations. In the case of both the turtles and birds, however, there was compelling evidence for decline, in the form of observations and data collected in the course of this research and modelling of turtle populations using similar historical data (Weber *et al*., 2014).

Reliability of respondent answers

Surveys of local ecological knowledge do have drawbacks. Respondents may not notice changes, especially if they are gradual. Quantitative data, for example, show the Green turtle (*Chelonia mydas*) population has increased by 285% since 1970 for Ascension (Broderick *et al*., 2006), but only nine respondents commented that they felt turtles had increased, and one felt they had decreased. This could be down to the fact that since 2014, regulations have been in place limiting activities on and access to turtle nesting beaches for conservation purposes (AIG, 2015e). There has also been the introduction of paid visits to see the nesting turtles which may have discouraged those who had previously been able to observe nesting turtles

freely. If there is less opportunity for people to have observed turtles, and similarly the seabirds, this could mean less people are noticing changes. A number of factors can influence interviewees' perceptions of their environment (Daw, 2010). Yli-Pelkonen & Kohl (2005) characterised five different levels of LEK: "less interested local residents, interested local residents, recreational nature enthusiasts, experienced nature enthusiasts, and ecological specialists" all of which were represented in my study. Using a group of interviewees with similar interest levels in the study's topic is also important (Anadón *et al*., 2009). Given the proximity of daily life to the sea on Ascension, and the role the sea plays in community life the majority of people interviewed are likely to have meaningful things to report about marine life and its possible changes, but things will undoubtedly have been missed.

Previous analyses looking to judge the effectiveness of LEK by comparing with quantitative data have had mixed results (O'Donnell *et al*., 2010). For example, Anadón *et al*. (2009) found that LEK produced large-scale, cost effective and reliable data on terrestrial tortoise abundance in South eastern Spain. On the other hand, Daw (2008) found discrepancies between official data and using local knowledge in the Seychelles and Western Indian Ocean. In Daw's study, rare events and memories relating to positive emotions were the easiest to recall. It has been shown that fishers participating in interviews tend to be more pessimistic in their responses when compared against quantitative stock assessments (Densen, 2001; Ainsworth & Pitcher, 2005). It is therefore conceivable that some of my respondents have overestimated declines or changes in marine life seen around on Ascension. On the other hand, low catch rates of Walleye (*Stizostedion vitreum*) were shown to be over-exaggerated by anglers in Alberta, Canada, which could mean reduced stock levels are missed by management (Sullivan, 2003).

Interviewee reliability can also be influenced by personal motives (Cook *et al*., 2014). For example, respondents may be unwilling to share information on species' declines if they are concerned this would result in stricter limits

on fishing on the island (Bergmann *et al*., 2004; Anadón *et al*., 2009). My sample also included interviewees involved in conservation, which may help mitigate the influence on overall responses (Anadón *et al*., 2009).

Interviewees may also answer questions unnaturally because they know they are participating in a study, known as the 'Hawthorne Effect' (Fink, 2017). 'Recall bias' can also exist during interviews, where respondents' answers become increasingly inaccurate the longer the gap since that memory was made (Tarrant *et al*., 1993), and tend towards what they feel they should be saying (Sullivan, 2003). Small numbers of interviews can lead to bias (Yli-Pelkonen & Kohl, 2005). This study aimed to reach out to as many people as possible, from a broad range of backgrounds, varying interests in the marine environment and on different time frames. Combined with the fact that the 88 interviews on Ascension represent over 10% of the current population (McLeod, 2016), with another 51 no longer on the island, I believe the interviews undertaken represent enough peoples' views coming from a range of motives, to generate a sound picture of the marine environment over the last 60 years.

Using an anonymous questionnaire to gather LEK has been suggested as a better way to gather accurate information than a face-to-face interview as interviewees may feel less accountable for their responses (Daw, 2010). I gave interviewees the chance to be completely anonymous, and not to use their quotes at all in this report. Although some people were initially shy or hesitant to take part, overall, I felt people relished the opportunity to talk about their views and share stories. Even those who were originally uncertain about taking part showed little reluctance to be very honest and open with me. There is little evidence to suggest embellishment or exaggeration, and the results show that similar stories were relayed to me by different people helped to corroborate individual accounts. The only cause for concern was that an incorrect rumour could spread quickly. For example, there was a rumour a film crew visiting the island at the time I was there had sighted a great white shark (*Carcharodon carcharias*), which

having spoken to the film crew involved I knew to be untrue. However, residents on Ascension relayed it to me as fact.

Length of experience also influences the degree to which respondents can perceive changes. The modal length of time interviewees had spent on the island was 1-10 years. 86 interviewees who had been there longer than 10 years, and 27 who had been there 30 years or more. My analyses separated more from less experienced respondents, where possible, to examine experience-related differences in perceptions in more depth.

Much of fishermen's knowledge is not written down, which can lead to misremembering and inaccuracies (Neis *et al*, 1999). By asking for photos and records during the interview process I tried to reduce such uncertainties. Archival research looking at 'The Islander' newspaper, which has been published weekly since 1971 was a further way of corroborating, as large or unusual (and therefore memorable) fish catches often made it into the newspaper. Densen (2001) also suggests encouragement of fishermen to keep their own records and provide training to give them the skills to interpret the data, which can then be fed back into management. I saw examples of where fishermen had kept their own records, but these data were not used for any purpose other than to supplement their own memory. In the absence of commercial fishing operations around Ascension Island these recreational fishing trip records could be the only form of catch and size data and could offer a cost-effective way of gathering large amounts of data. Future work designating the MPA could therefore be improved by an increase in involvement of local people and encouraging their experiences to become part of the process in a more formal way.

Importance of local people's opinions in designation of a marine protected area

Involving the local community will be key to successful implementation and enforcement of a new MPA designated in Ascension's EEZ. This is especially the case given that there are already some people opposed to the Ascension's Conservation Department's actions to date. Benefits of doing so

include better cooperation, less expensive implementation and improved outcomes (O'Leary *et al*., in prep). The engagement of stakeholders in all aspects of MPA designation can have multiple benefits for the process (Zapelini *et al*., 2017) and planning processes failing to include all stakeholders often lead to unsuccessful MPAs (Martín-García *et al*., 2015) and missed opportunities for conservation (Blyth *et al*., 2002; Aswani & Lauer, 2006). How well the MPA functions relies in part on the local community's compliance with the boundaries set so seeking views is crucial (Pita *et al*., 2013). In Brazil, development of an MPA network was unsuccessful due to the lack of inclusion of the local fishermen (Zapelini *et al*., 2017). The endorsement of the community has been considered critical to achieving success in the Lamlash Bay MPA (Howarth *et al*., 2015). Using LEK in the development of a network of MPAs in the Western Solomon Isles was vital to ensure residents' support for management (Cinner & Aswani, 2007). The value of local knowledge and other 'human dimensions' used in the design of MPAs are also recognised (Johannes & Neis, 2007; Charles & Wilson, 2009), and likely to be increasingly utilised for marine management applications (Thornton & Scheer, 2012). Knowledge on many aspects of marine science can be passed from local people to scientists (Silvano & Valbo-Jørgensen, 2008). Using local knowledge can also give more localised and specific information (Densen, 2001) which for Ascension could be particularly advantageous as species such as tuna are assessed on a much broader scale across the Atlantic. The data from local people can help to give specific targets and outcomes for the designation and monitoring of the MPA around Ascension. This is particularly true for long-term observers who may be more likely to provide accurate data based on more observations and picking up long-term trends (Densen, 2001).

Small-scale fishery impact

There is a perspective that artisanal and recreational fishing is less damaging than commercial-scale fisheries (Hawkins & Roberts, 2004; Cook & Cowx, 2006). However, artisanal and recreational fishing can be detrimental to

marine ecosystems (Jennings *et al*., 1995; Jennings & Polunin, 1996; Hawkins & Roberts, 2004; Cook & Cowx, 2006; Lewin *et al*., 2006; Pinnegar & Engelhard, 2008; Lloret & Font, 2013), and cumulative impacts of individual fishers can be underrated (Lewin *et al*., 2006). Ignoring recreational fisheries when discussing the impact of fishing will lead to an under estimation of the impacts on populations and marine ecosystems, and serious declines have been attributed to recreational fisheries (Cooke & Cowx, 2004). The perceptions from interviewees that popular and accessible fishing spots have declined suggest that the inshore recreational fishery on Ascension has had an impact. Therefore, it is key that careful management is applied to limit further declines and aid recovery.

As one of the dominant methods of fishing on Ascension, it is important that the impacts of spearfishing are quantified, however international studies are limited (Frisch *et al*., 2012). Many of those that exist have conveyed adverse ecological impacts (Pita & Friere, 2016). Seven respondents I spoke to felt that stricter limits should be enforced on spearfishing, with concerns about the current unregulated status and impacts of the fishery. Stricter measures for sport fishing were also suggested by Armstrong & Reeves (2015).

Returning to the past

Understanding what has happened in the past is considered essential to establishing more appropriate goals for protecting marine ecosystems (Plumeridge & Roberts, 2007). Other studies have used local knowledge and historical sources to infer more serious declines in marine life than previously understood from available modern data, and used the results to inform management (e.g. Jackson, 1997; Pandolfi *et al*., 2003; Lotze & Milewski, 2004; Sáenz-Arroyo *et al*. 2005a; Sáenz-Arroyo *et al*. 2005b; Lotze *et al*., 2005; Sáenz-Arroyo *et al*., 2006; Wilson *et al*., 2006; Ainsworth *et al*., 2008; Ruddle & Hickey, 2008; Thurstan *et al*. 2010; Turvey *et al*., 2010; Beaudreau and Levin, 2014; Sáenz-Arroyo & Revollo-Fernández, 2016; Zapelini *et al*., 2017; Lima *et al*., 2017; Lima *et al*., 2017). Revised

management ambitions must recognise that it may not be possible to return an ecosystem to a former state.

The world today is different in many ways to that of the past. Species that have been completely lost are impossible to recover (Pinnegar & Engelhard, 2008). As appealing as it is, seeing a complete recovery in marine ecosystems is unlikely (Pitcher, 2001). Weber *et al*. (2014) concluded that due to large-scale ecosystem changes, Ascension turtles may not be recoverable to pre-exploitation levels. However, apart from turtle and seabirds, the changes to Ascension's marine environment seem to have been relatively recent, making the possibility of reversing declines more likely. Even for turtles and seabirds, recent studies show indications of positive albeit still limited, recoveries (Ratcliffe *et al*., 2009; Weber *et al*., 2014).

Conclusion

The combination of historical research and a survey of local knowledge reveals Ascension to be a place whose marine life was considered exceptional from the time of discovery all the way to the present, although not unchanged. Seabirds and turtles were prominent in early accounts and have declined, although with some recent recovery. Fish were also early on noted to be prolific, and many species remain so, perhaps due to the relatively low levels of commercial fishing. Interviews with local people show few consistent changes in marine life, though the decline of tuna and fry were common themes, and several popular fishing spots were considered to have declined in productivity. The most noteworthy change commented on was the more aggressive behaviour and increasing abundance of Galapagos sharks inshore, which could be an indication of larger-scale changes in the Atlantic marine environment, particularly when taken in combination with the reduction in fry runs around the island.

Ascension's inhabitants have a generally positive and protective view of the marine life; it is special and unique to them and the prevailing attitude towards fishing was generally that they only took what they needed and didn't catch for the sake of it; there also isn't the heavy demand. Furthermore, their preference for a study of the sharks rather than a cull underlines their passion for the marine environment. Saying that, there have been occasions of large quantities of fish caught and the commercial sport fishing operations have increased the pressure on fish communities. With the closure of the runway shutting these operations down, a gradual reduction in commercial longline fishing and the new MPA being planned, Ascension Island has a real opportunity to set the gold standard in marine conservation, particularly by factoring in the historical information provided here into ambitious conservation goals.

Appendix 1

Questionnaire used during interviews

Introduction

I am undertaking a Masters' degree by research at the University of York in the UK. My aim is to understand how marine life around Ascension Island in the past compares with the present day. As part of this work, I am interviewing people who have first-hand knowledge of the island's waters to ask them about their experiences. The answers you provide will help me put together a more detailed picture of whether the seas around Ascension have changed over time, and if so, what the main changes were. I will share the final results with island residents and the Department of Conservation and Fisheries**.**

Please listen to the questions carefully and where multiple options are provided, choose the one which most accurately reflects your answer. For non-multiple choice questions please provide as much detail as you wish, and feel free to elaborate. If you want to name a specific species, please identify using the list of photos I have produced to ensure I can confirm which species you are referring to.

If you want to stop at any point, please just say. You are entitled to cease the interview, and I have no problem with it.

Interviewer Completion:

Interviewee Name: Date:

Location:

Interview Identification Code:

To be known as:

Respondent Completion:

1. Could you describe your personal history of involvement with Ascension Island? For example dates you have been here, how long for, and what you do here?
2. How would you describe your interest in the sea when on Ascension? (e.g. hobby/interest/professional) How frequently would you say you're on or by the sea?
3. Area of involvement with Ascension (select one):
    a. Fishing (Including sport, food and commercial) (GO TO SECTION A)
    b. Conservation (GO TO SECTION B)
    c. Tourism apart from any form that relates to fishing (GO TO SECTION C)
    d. Commercial Diver (GO TO SECTION D)
    e. Recreational diver (GO TO SECTION D)
    f. Boat/yacht operator (GO TO SECTION D)
    g. Boat crew (GO TO SECTION D)
    h. RAF/USAF staff (GO TO SECTION D)

i. Local resident (GO TO SECTION D)

j. Other (please specify) (GO TO SECTION D)

SECTION A

4. Type of fishing when on Ascension (More than one option can be chosen):

   a. Commercial (for profit)

   b. Mainly for food for family/friends

   c. Mainly recreational – i.e. not for food and including sport

5. Method(s) of fishing:

6. Area you fish:

   a. Coast from land

   b. Coastal area (within 12nm) (from boat)

   c. Offshore (within 200nm)

   d. Combination (please specify)

7. What was the biggest fish you have ever caught and what species was it? Where did you catch it? (Prompt for a date if not given).

At present (or during last year of fishing if no longer fishing):

8. When did you last fish in Ascension Island waters?

9. What 5 (max.) species do you most commonly catch at the moment/at the end of your fishing on Ascension?

10. Could you describe an example of a memorable day's fishing in your last year of fishing? – i.e. how many/much fish did you catch, where was this and when did you catch it?

11. What is/was a typical day's catch?

I'm now going to ask you the same questions again but this time I'd like you to answer them for your first of year of fishing:

12. Which year did you start fishing Ascension Island waters?

13. What species did you most commonly catch then?

14. Do you remember a memorable day's fishing back then? What did you catch and where?

15. Can you remember what was a typical day's catch then?

Changes over time:

16. What is your view on sharks in Ascension waters? Has this changed since the recent shark attack on Ascension? (Follow up with 'what should be done?')

17. Are there any species you know of that have increased in numbers during your stay on Ascension?

18. Are there any species you know of that have decreased in numbers during your stay on Ascension?

19. Would you say the amount of effort you have to put in in order to catch fish has changed during your stay on Ascension?

20. Are there any places you used to fish that are no longer productive, or vice versa? (Use map to get exact areas)

Round up

21. Apart from what I've already asked you about, is there anything else you feel is important to tell me in regards to the marine environment? Any significant events or observations? (Probe for a timeframe/other groups of marine animals)

22. Do you have any interesting logbooks/records/photos that you would be happy to let me see for my research? (Particularly to back up any specific catches mentioned)

23. Can you recommend anyone I should speak to?

24. Age of respondent (select one category)?

□ 20-30 □ 31-40 □ 41-50 □ 51-60 □ 61-70 □ 70+

SECTION B

4. Which area of Conservation research would you say is your focus?

a. Terrestrial

b. Marine

Please specify species/area:

5. What is your view on sharks in Ascension waters? Has this changed since the recent shark attack on Ascension? (Follow up with 'what should be done?'

6. In terms of the marine and coastal *habitats* around Ascension have you:

   a. Noticed any change between your first and most recent year of Ascension research, and if so what,

   b. When,

   c. And what do you think was the cause?

7. In terms of the *abundance* of marine and coastal species on and around *Ascension:*

   a. Have you noticed any change between your first and most recent year of Ascension research, and if so what,

   b. When,

   c. And what do you think was the cause?

8. In terms of the *diversity* of marine and coastal species *on Ascension*

   a. Have you noticed any change between your first and most recent year of Ascension research, and if so what,

b. When,

c. And what do you think was the cause?

Round up

9. Apart from what I've already asked you about, is there anything else you feel is important to tell me in regards to the marine environment? Any significant events or observations? (Probe for a timeframe/other marine animal groups)

10. Do you have any interesting records or photos that you would be happy to let me see for my research?

11. Can you recommend anyone else I should speak to?

12. Age of respondent (select one category)?

□ 20-30 □ 31-40 □ 41-50 □ 51-60 □ 61-70 □ 70+

SECTION C

4. In what capacity do you work in Ascension Island tourism?

Opinion:

5. What is your view on sharks in Ascension waters? Has this changed since the recent shark attack on Ascension? (Follow up with 'what should be done?')

6. In terms of the marine and coastal *habitats* around Ascension have you:

a) Noticed any change between your first and most recent year working on Ascension, and if so what,

b) When,

c) And what do you think was the cause?

7. In terms of the *abundance* of marine and coastal species around *Ascension:*

a) Have you noticed any change between your first and most recent year working on Ascension, and if so what,

b) When,

c) And what do you think was the cause?

Round up

7. Apart from what I've already asked you about, is there anything else you feel is important to tell me in regards to the marine environment? Any significant events or observations? (Probe for a timeframe/other marine animal groups)

8. Do you have any interesting records or photographs that you would be happy to let me see for my research?

9. Can you recommend anyone else I should speak to?

10. Age (select one category)?

□ 20-30 □ 31-40 □ 41-50 □ 51-60 □ 61-70 □ 70+

SECTION D

Changes over time:

4. What is your view on sharks in Ascension waters? Has this changed since the recent shark attack on Ascension? (Follow up with 'what should be done?')
5. Are there any marine and coastal species you know of that have increased in numbers during your stay on Ascension?
6. Are there any marine and coastal species you know of that you think have decreased in numbers during your stay on Ascension?
7. Have you noticed any changes to the underwater or coastal physical environment (e.g beaches) during your experience of Ascension's waters?

Round up

8. Apart from what I've already asked you about, is there anything else you feel is important to tell me about the marine environment? Any significant events or observations? (Probe for a timeframe/other marine animal groups)
9. Do you have any interesting photos/records that you would be happy to let me see for my research?
10. Can you recommend anyone else I should speak to?
11. Age (select one category)?

□ 20-30 □ 31-40 □ 41-50 □ 51-60 □ 61-70 □ 70+

Appendix 2

Consent form for interviewees:

The Old Man and the Sea: Unravelling historical changes in the marine environment of Ascension Island: Consent Form

Interview Identification Code (completed by interviewer):

Interviewer:

Name:

Date:

Location:

Contact details (for follow up questions and sending information):

I would like to interview you for my MSc project at the University of York that aims to create a picture of the marine environment around Ascension Island through history and compare with the present day. The work will be submitted to a scientific journal that has open access. If you agree to participate, everything you say can be anonymous and none of the answers you give will be attributable back to you if this is preferred. Your personal data will be fully confidential. If you want to stop at any point, please just say. You are entitled to cease the interview, and I have no problem with it. I expect the interview to take no more than 1 hour; if you are short of time or need to cut the interview short let me know and hopefully we can rearrange and continue at another convenient time.

Are you happy to participate?

Yes/No

I would like to record our interview today and this will be stored securely electronically. This will only be used to ensure accuracy in recording your answers. Do you agree to being recorded?

Yes/No

You can receive copies of your interview transcript and/or recording if you email me, Polly Burns at **prb509@york.ac.uk**.

Can I use your answers as quotes in my report?

Yes/No

If so, how would you like to be referenced? It doesn't have to be by name, if you would prefer me not to use that. E.g. "Ascension Island fisherman"

Would you like to receive a copy of my results?

Yes/No

Signed:

Date:

Signature of Interviewer:

Date:

Appendix 3

Timeline created using Packers (1983); St Helena Government, (2016); AIG, (2014); Dillon, (2013); Economist, (2010); Ritsema, (2010); Anon., (no date a).

1942 – U.S. Army build airstrip and first plane lands

1947 – reductions in army staff ends in removal of all servicemen; management returns to Cable & Wireless

1957 – The Duke of Edinburgh visits the island and British Ornothologist's Union Centenary Expedition arrives

1958 – wooden control tower for airfield burnt down. New mountain road via Command Hill and Hospital Hill tarred and opened to traffic

1960 – The 'Golfball' erected

1963 – Road built from N.E. Bay track to the Devil's Ashpit. Rainstorm which saw 3 years' worth of rain fall in a day flooded cemetery and caused landslides and road damage

1964 – Island's administration goes to designated Administrator. Building for BBC began at English Bay and Muriel Avenue

1965 – airstrip significantly extended

1966 – NASA facilities and BBC Atlantic Relay Station installed

1973 – Good Hope Castle caught fire 30 miles offshore and survivors rescued and brought to Ascension

1982 – Ascension used as a staging post during the Falkland's war

1990 – NASA observation post closed down. European Space Agency construct observatory station

2002 – First elected advisory council and formation of Government

2003 – Non-scheduled civilian aircraft allowed to land at Ascension

2014 – Current administrator Marc Holland sworn in

2016 - Current governor Lisa Philips appointed

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