

# **Towards an evidence-based Marine Protected Area at Ascension Island: ensuring scientifically robust marine spatial planning**

## **Background**

Ascension Island Government has spent the past 18 months considering in full the best way to manage its marine environment (throughout its Exclusive Fishing Zone: EFZ), taking into account the need to protect marine biodiversity alongside the economic driver to generate much-needed income for the Island. A licensed, foreign flagged, commercial longline fishery for tuna operated in the waters around Ascension Island from 1988-2004 and then again from 2010-2013, with license fees contributing a significant portion to annual Government revenue. In 2014, Ascension Island Government suspended the fishery whilst they reviewed and updated fisheries legislation and licensing criteria to provide a strong legal framework from which the fishery will operate, as well as considering options for the creation of large-scale marine reserves. As of December 2015 the commercial fishery re-opened in 50% of the 445,390km<sup>2</sup> EFZ, with the remaining 50% of the zone closed to commercial fishing. This forms part of the first step in the UK Government realising its manifesto commitment for a Marine Protected Area (MPA) around Ascension, and a 'Blue Belt' around its Overseas Territories more generally.

The current closed area covers over 220,000 km<sup>2</sup>, including the entire southern half of the EFZ and an inner ring of 50 nautical miles surrounding the Island, making it the largest no-take zone in the Atlantic Ocean. This area includes three shallow-water seamounts to protect potential aggregation areas of large pelagic species and the inner shelf area where many of the Island's endemic species are found. However, there are still significant knowledge gaps that need to be addressed in order to identify those areas that would benefit most from spatial or temporal protection measures. For this reason, AIG has deferred formal designation of an MPA while existing scientific data is compiled and analysed and new research can take place to enable informed decisions on the placement of a marine reserve.

## **A scientific roadmap**

*"Effective governance is based on sound science and the ability to monitor and assess the impacts of human activities on marine ecosystems"* Rogers et al. (2015).

The ultimate objective of the scientific programme will be to integrate all available fisheries and ecological data within a formal marine spatial planning framework to ensure that any future large-scale MPA is placed in the most appropriate location. Establishing baselines of abundance and monitoring protocols for pelagic megafauna will also be important in order to evaluate the effectiveness of marine protection. As a first step towards this goal, AIG is holding a stakeholder workshop in April 2016 with leading scientists from a wide range of partner organisations to begin drawing up a work plan and priority list of research needed to inform policy decisions. From these discussions, a 'scientific roadmap' will be developed to set out the marine research agenda on Ascension Island, both in the run up to designation of an MPA and in the years following. AIG will also be looking to establish a long-term coalition of academic institutions, NGOs and donors to support the delivery of priority research areas identified in the workshop.

## **Workshop aims**

The workshop has three major objectives:

1. To review current knowledge of Ascension Island's marine environment in the context of marine spatial planning and sufficiency for marine reserve designation.
2. To draw up a prioritised and costed list of research that still needs to be completed, including both pre-designation evidence gathering and subsequent monitoring.
3. To discuss practical aspects of delivering the science plan, including logistics and legacy planning

## **Species Summaries**

### **1. Marine turtles**

Ascension Island is home to the largest green turtle nesting aggregation in the South Atlantic, which has experienced a rapid population increase over the past 40 years as the stock recovers from historical exploitation. Green turtles are now protected under local legislation and the three principle nesting sites are designated as Nature Reserves. Significant satellite tracking work has been conducted since the mid-1990s which suggests that the entire adult population migrates from feeding grounds situated along the Brazilian coastal shelf. Juveniles are more widely dispersed, with population genetic data indicating the occurrence of Ascension-born individuals from northern Argentina to the Caribbean and potentially also West Africa. Threats to green turtles from pelagic long-lining during their oceanic migration to Ascension Island have not been reliably quantified but are believed to be comparatively low based on regional by-catch statistics. Long-term population trends certainly do not suggest cause for concern.

Two other species of marine turtles are also recorded from Ascension Island's waters: the hawksbill and the leatherback. A small, resident population of hawksbill turtles occurs in near-shore benthic habitats, with long-term tagging and genetic studies suggesting that the Island serves as a mid-Atlantic developmental habitat for juvenile animals before recruiting to their adult foraging grounds in Brazil or tropical West Africa. The limited satellite tracking that has been conducted suggests that individuals maintain restricted home ranges in shallow coastal habitats (<30m depth) over periods of several months, with residence times of 3 – 7 years recorded for some tagged individuals. Onward migration routes are yet to be elucidated, but threats from pelagic long-lining are believed to be limited. Leatherback turtles are rarely sighted in Ascension's coastal waters, but their presence within the EFZ is confirmed by satellite telemetry data of individuals tagged from West Africa. Ascension appears to lie on the migratory routes of adult leatherbacks migrating between the world's largest rookery in Gabon and feeding grounds in South America.

### **Knowledge gaps for discussion**

Although significant tracking of green turtles has already been undertaken, these data are currently widely scattered. To understand any risk area for green turtles we need to delineate their migratory corridor which requires compilation and synthesis of existing tracks. Representativeness tests of current data should determine the need for any further tracking of this species.

Further tracking work on hawksbills may elaborate on migratory pathways and establish links with regional nesting populations and adult foraging aggregations. However, this may be extremely difficult practically given the long coastal residence times and so is considered low priority.

Leatherback turtles are the more susceptible species to longline fishing, so further attention to their migrations through Ascension's waters may be warranted. Existing tracking data have generally been analysed in a whole ocean context with no specific focus on migration corridors within Ascension's EFZ. However only two per cent of tracking data locations occurred in the waters of Ascension Island and St Helena with 78 per cent of all leatherback turtle locations being received from the high seas.

Huang 2015 analysed by-catch of turtles in the Atlantic from the Taiwanese longline fishery (2002-2013) and data indicated leatherback, olive Ridley, loggerhead and green turtles were caught in the tropical Atlantic. If possible detailed re-analysis of this data plus any new data from observers and catch reports would allow a greater understanding of marine turtle by-catch within the Ascension EFZ allowing us to quantify risks, including any spatial and temporal variation in by-catch. Studies on post-release survival rates and variation among gear types (e.g. circle-hook versus J-hook, line depths, soak time) may also be informative depending on by-catch rates.

## **2. Seabirds**

Ascension Island is one of the most important tropical seabird nesting stations in the Atlantic Ocean, supporting almost 500,000 pairs of 11 breeding species. These include the endemic Ascension frigate bird and a distinct sub-species of band-rumped storm petrel, along with boobies, terns, tropic birds and noddies. Populations of some species appear to be increasing following the eradication of feral cats from the main island of Ascension between 2001 and 2004. National observer programmes suggest a very low rate of seabird by-catch in the tropical Atlantic tuna long-line fishery, although this requires verification.

The at-sea distribution of Ascension's seabirds has only recently been investigated. Significant satellite tracking of frigates and masked boobies was conducted between 2011 and 2014, showing that both species forage over a wide expanse of open ocean, incorporating much of the Territory's 200 nm EFZ. Frigate birds also make regular forays beyond the EFZ and into international waters, with juveniles and non-breeding adults being particularly wide-ranging. No well-defined foraging hotspots have yet been identified, which likely reflects the lack of persistently productive marine features. However, seasonal shifts in distribution suggest that birds may be tracking dynamic oceanographic features such as frontal zones. The extensive oceanic migrations of sooty terns between breeding seasons have also been mapped using geolocator tags, with most birds travelling far to the north of Ascension to exploit the productive waters of the equatorial Atlantic.

Limited dietary analysis has been conducted on Ascension's seabirds, but the available evidence suggests that flying fish (particularly *Exocoetus* sp.) form an important staple for frigates, boobies and sooty terns. These species are often reported to form feeding associations with surface-schooling tuna and billfish, which is supported by observations made within Ascension's EFZ.

### Knowledge gaps for discussion

Although significant tracking work has already been conducted, the spatial ecology of many seabird species remains unstudied, including non-breeding migrants that may utilise the EFZ during Atlantic crossings. Given the close feeding association between sooty terns and tuna, filling knowledge gaps on movements during the breeding season should be considered a priority. Work has begun on this in collaboration with AOS/University of Birmingham.

Even for those species for which tracking data exist, the environmental factors that determine foraging distribution are still not well understood. Given that foraging habitats exploited by tropical oceanic seabirds appear to be highly dynamic, the ability to predict utilisation areas from environmental variables across multiple years and seasons will likely be important for identifying any hotspots. In some cases (e.g. frigates) it has been difficult to separate foraging locations from other behaviours within tracking data and further studies using additional technologies (e.g. accelerometers or altimeters) may be needed to reliably map foraging habitats.

Crucially, at-sea distributions of seabirds inferred from tracking data must also be analysed in the context of risk, including overlap with commercial fisheries and a more detailed understanding of by-catch mortality rates using local observers. Historical vessel monitoring data is limited in resolution and reliability but may be sufficient to map general trends in the distribution of the fleet. Standards of vessel tracking have been substantially improved under the revised regime, although the closed area now curtails 'normal' vessel movements.

Assuming that low by-catch rates can be confirmed, principle threats to Ascension's seabirds from commercial fishing are likely to be through indirect food chain modification e.g. interruption of feeding associations with tunas. Further studies of ecological interactions between seabirds and tuna are needed to evaluate this threat, including diet/stable isotope analysis to quantify foraging niche overlap and visual assessments of the composition and location of multispecies feeding assemblages. Given that bigeye tuna typically forage in deep water below the thermocline, interactions with surface-feeding seabirds may be limited.

### **3. Tuna (yellowfin and bigeye)**

Currently there is limited data available on the tuna species from within Ascension's EFZ. Catch data is available since 1988, however the resolution is limited and variable. Bigeye tuna are the principle target of the commercial offshore fishery, accounting for approximately 77% of the total catch, whilst yellowfin tuna are the dominant species taken by inshore recreational vessels. Both of these species are currently managed as single stocks in the Atlantic, with catch quotas set regionally by ICCAT. Some demographic studies of yellowfin tuna have been completed by AIG Conservation & Fisheries Department which suggest that the inshore area is not used for spawning.

#### *Knowledge gaps for discussion*

Further research is urgently needed to study the migration and behaviour of tuna populations. Tuna are considered 'highly migratory species' and, with catch quotas currently set regionally, the benefits of marine protection will likely depend on the degree of residency within final closed areas. Current qualitative data indicates that there is an inshore semi resident population of yellowfin tuna though residency time is unknown and this needs further study. AIG Conservation & Fisheries Department have already gathered some short-term data on vertical movements of yellowfin tuna in the near shore environment; however, this needs to be expanded to examine annual migration cycles, regional connectivity and residence times both within the inshore area and the whole Ascension EFZ. Information on foraging behaviour combined with prey distribution and prey seasonal migrations may also help inform this.

There is currently no tracking data available for bigeye tuna in Ascension's waters, despite being the principle species exploited by commercial vessels, and this clearly needs addressing. The deep foraging depths of these species make tracking based on light geolocation difficult, although new methods incorporating temperature data have been developed. Satellite tracking, potentially combined with population genetic studies, will help to determine whether Ascension's tuna are part of a single regional stock or whether more complex management models are needed.

As part of the new management regime observers will be deployed on some of the offshore vessels. This will provide the opportunity to gather more biological data on the species including length-weight data (to assess any change in stock composition over time); tuna reproductive status and diet sampling.

Given that tuna are the target species of the offshore fishery, identifying key foraging habitats and hotspots of abundance may not be useful. However understanding dietary relationships and functional roles including any niche partitioning with key by-catch species may be insightful. Important trophic ecology information can be gathered through stable isotope work.

#### **4. Sharks and billfish**

Twelve species of elasmobranch have been recorded within Ascension's EFZ, with the Galapagos shark (*Carcharhinus galapagensis*) being the species most commonly observed in inshore waters. The Island is also renowned as a home to large billfish species such as marlin, sailfish and swordfish, including a number of record-breaking specimens. Despite making up a significant proportion of reported fisheries by-catch (in particular the blue shark), very little is known about the ecology of these species within Ascension's EFZ. Tagging studies of blue sharks have demonstrated extensive movements in the Atlantic with numerous trans-Atlantic migrations which are probably accomplished by swimming slowly and utilising the major prevailing current systems.

##### *Knowledge gaps for discussion*

Many oceanic sharks and billfish are highly migratory, with several species permitted to be retained on board for commercial sale under regional ICCAT quotas. The effectiveness of marine reserves as a conservation tool for these species will therefore likely depend on residence times within final closed areas. Satellite tracking studies are urgently needed to describe home ranges, migratory routes and residence times of these species within the Ascension EFZ, as well as identifying any potential aggregation areas or key foraging habitats that could help direct the most suitable location for closed areas. Ascension Island Government has been awarded a Darwin bid to track sharks and billfish, in particular Galapagos sharks, tiger sharks and blue marlin to improve knowledge of their spatial ecology. This work will commence this year in collaboration with ZSL & SAERI.

Part of the new licensing criteria for the offshore fishery includes improvements in catch record-keeping and better tracking of vessel movements. This improved data will give more detailed information on spatio-temporal patterns in catches and highlight any particular areas/seasons when there is increased by-catch of sharks and billfish, which will need to be integrated into plans for the MPA. Within the new licensing criteria vessels are not allowed to retain on board any bigeye thresher, hammerhead, shortfin mako or oceanic whitetip sharks and all attempts should be made to return them to the sea alive. To understand how effective this is as a conservation measure, studies of post-release survival rates may be useful and could be accomplished using PSAT tags.

Abundance studies of pelagic species are urgently needed to gather baseline data for comparison of population trends between the fishery and marine reserves over time. Gathering baseline data on abundances of pelagic species early in the process of reserve designation will obviously be important for evaluating its success, as well as potentially identifying important aggregation areas that can feed into the reserve design itself. For example, Ascension's three shallow water seamounts have been incorporated in the provisional closed area as potential aggregation areas for marine megafauna, but there is currently limited empirical data to support this. AIG is already in discussion with potential collaborators on the deployment of pelagic monitoring protocols using baited remote underwater video units (BRUVs) to help address such knowledge gaps. This methodology has been successfully used in other large marine reserves (e.g. Chagos, Pitcairn) and can generate standardised abundance indices for comparison.

Stable isotope analysis can be used to help identify dietary relationships and functional roles including any niche partitioning. Collection of opportunistic diet samples from shark/billfish caught as by-catch (species which are dead on hauling) would add to our understanding of the food web roles within the Ascension EFZ as well as detecting any trophic or functional shifts over time.

#### **5. Inshore marine communities**

Ascension Island has an active inshore recreational fishery and two commercial sportsfishing businesses operate full time on island. Currently limited catch data is returned by the fishermen but as part of the review of inshore fishing management it is proposed to make catch documentation compulsory as part of new licensing regulations.

A current two year Darwin funded Ascension Island Marine Sustainability (AIMS) project is being run through the AIG Conservation & Fisheries Department in partnership with SAERI and is collecting data on inshore marine biodiversity and fisheries. Research includes life history studies on grouper and moray eel to help inform potential size restrictions, closed seasons or other management measures. Dive surveys are establishing baselines of species abundance as well as looking at seasonal variations in species assemblage. Habitat mapping using side scan sonar is also underway and when combined with and underwater visual census data may help to identify key biodiversity areas.

### Knowledge gaps for discussion

Continual monitoring of established inshore species abundance and distribution baselines will allow early detection of any shift in baselines over time. It is proposed to have some trial closed areas within the inshore area and these will need to be monitored to identify their success on population numbers, in particular for grouper which is one of the more heavily fished inshore species.

One species for which concern is often noted and has been reported historically as frequently taken for food/sale is the spiny lobster. However there is no knowledge of abundance of the spiny lobster population around Ascension. It is thought to spawn all year round but no studies have been conducted to verify this and research into peaks in reproduction may help inform future management decisions.

Further abundance and life history studies on the other main species caught and taken locally for food should also be conducted including glass-eye snapper, squirrelfish, amberjack, dorado, wahoo and octopus.

## **6. Other species/data**

Migratory species including tuna, billfish and sharks have been recorded in other areas to aggregate in topographically complex areas and around frontal features with strong sea-surface height and temperature gradients. This highlights the need for a more comprehensive understanding of oceanographic data from around Ascension and analysis of links between oceanography and fish catches. High resolution remote sensing data is available and this could be ground-truthed with CTD data. There is a need for a longer term comparison of oceanography (including eg sea surface temperature, chlorophyll concentrations, location of frontal systems) with fine scale catch data to look at changes in distribution and migration routes of the target and by-catch species.

Initial plankton sampling has been conducted during the patrol period and continuation of this to examine for any spatiotemporal variability in productivity areas or areas or evidence of any eggs or larvae of tuna species is needed.

Flying fish are known to form the major prey species of several pelagic tropical seabirds, including masked boobies and frigate birds. No research has been carried out to date at Ascension on the flying fish populations, and whilst not a species under threat, knowledge of their distribution could help map the foraging locations of predators that are susceptible to longline fishing. During the last fisheries patrol, visual censuses of flying fish numbers throughout the EFZ were conducted with the aim of gathering information on distribution and identification of any key utilisation areas. Further opportunistic data can be collected during future research/patrol voyages. Initial plankton sampling has also been conducted during the patrol period and continuation of this to examine for any spatiotemporal variability may be useful as part of a 'food chain mapping' approach to identify key foraging areas for marine megafauna.

With licensed vessels comes the opportunity to conduct specific fishery-related research. This could include line observation camera trials (instead of observers) which would give a greater coverage of

lines hauled, however there may be issues retrieving the cameras from the vessels at the end of the season. There is also the potential for hook mitigation trials.

### **Lower priority areas**

There is relatively little known of the deepwater benthic fauna around Ascension or of the life found on the main seamounts. A recent three day study in partnership with BAS and SAERI, including use of cameras and deepwater trawls, of the shelf area identified areas with vulnerable marine ecosystems that had not previously been documented. There are two known hydrothermal vent fields (Turtle Pits / Wideawake (4°49'S, 12°22'W) and Red Lion (4°48'S, 12°23'W)) which are both located just outside the Ascension EFZ and further surveys may find such areas within the zone.

Whale sharks are seen around Ascension at certain times of year but little is known about them during their time in Ascension waters. Ad hoc sightings and photo ID's may permit identification of individuals and help understand any seasonality in timings around Ascension and potential migration routes. Tracking of individuals would help us understand the whale shark migration routes in the Atlantic.

Genetic research (which is currently underway) may identify the storm petrel population as an endemic to Ascension. Little is known of the foraging or migration routes of this species and further research would be advisable should this species prove to indeed be an endemic.

Since 2001 the conservation department on Ascension (and volunteers) have been recording sightings of cetaceans around the Island. Inshore sightings have been primarily of bottlenose dolphins. There is no further data on abundances, distributions or migration routes of any of the cetacean species around Ascension.

To date little climate change research has been conducted around Ascension and research in this area would help to understand the impacts of changing sea temperatures, shifts in current patterns or ocean acidification on the biodiversity around Ascension including the potential for increased number of invasive species.