

**British Indian Ocean Territory Biodiversity Action Plan**  
**SOOTY TERN**



**SUMMARY**

**Taxonomy:** Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Charadriiformes, Family: Laridae, Subfamily: Sterninae, Genus: *Onychoprion*, Species: *Onychoprion fuscatus* (Linnaeus, 1766). Seven subspecies currently recognised [1]:

*O. f. fuscatus* (Linnaeus, 1766) – Gulf of Mexico, including West Indies and E Mexico, with sporadic isolated nesting attempts in E & S USA (Carolinas and Florida, more regularly in Louisiana and Texas); also islands in Gulf of Guinea and in S Atlantic. There is a tiny outpost population, one or two pairs, in the Azores.

*O. f. nubilosus* (Sparrman, 1788) – S Red Sea, Gulf of Aden and Indian Ocean E to W Pacific Ocean (Ryukyu Is and Philippines).

*O. f. serratus* (Wagler, 1830) – New Guinea and Australia, New Caledonia and S Pacific E to Easter I.

*O. f. kermadeci* Mathews, 1916 – Kermadec Is, Norfolk I and Lord Howe I.

*O. f. oahuensis* (Bloxam, 1827) – Bonin Is (S of Japan) E to Hawaii and S through tropical N Pacific to Line Is.

*O. f. crissalis* (Lawrence, 1872) – islands off W Mexico and Central America S to Galapagos.

*O. f. luctuosus* (R. A. Philippi [Krumwiede] & Landbeck, 1866) – Sala y Gómez and Desventuradas Is, off N Chile.

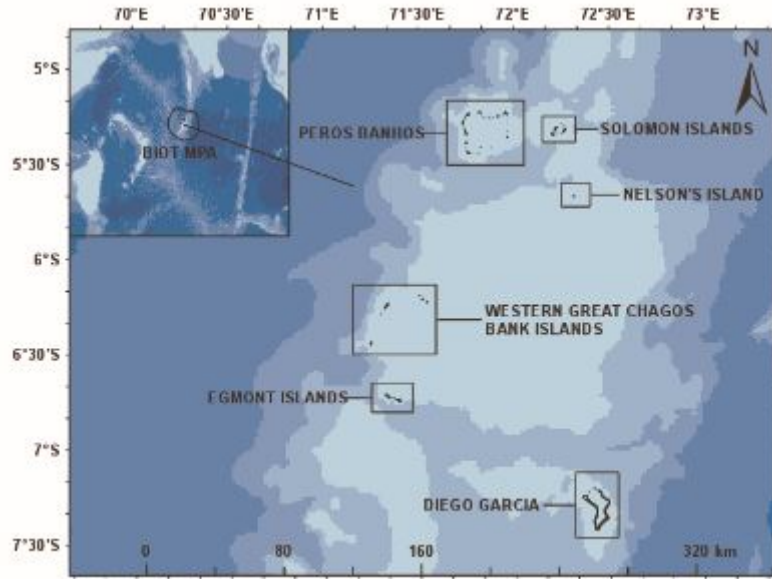
**Distribution:** Pantropical, in tropical and subtropical waters [1].

**Description:** Distinctive black-and-white tern with long wings and long tail. Very noisy, with yelping “wide-a-wake” call, especially around breeding colonies. One of the most numerous seabirds in the world with an estimated global population c. 21,000,000 – 22,000,000 pairs [2]. Nests, sometimes in immense colonies (> 1,000,000 pairs), on the ground, predominately on oceanic and barrier islands. Highly pelagic outside breeding season.

**IUCN Red List status:** Least Concern [3].

**Local trend:** Apparently stable but with large annual fluctuations. There is strong evidence of massive historical declines in the breeding population [4].

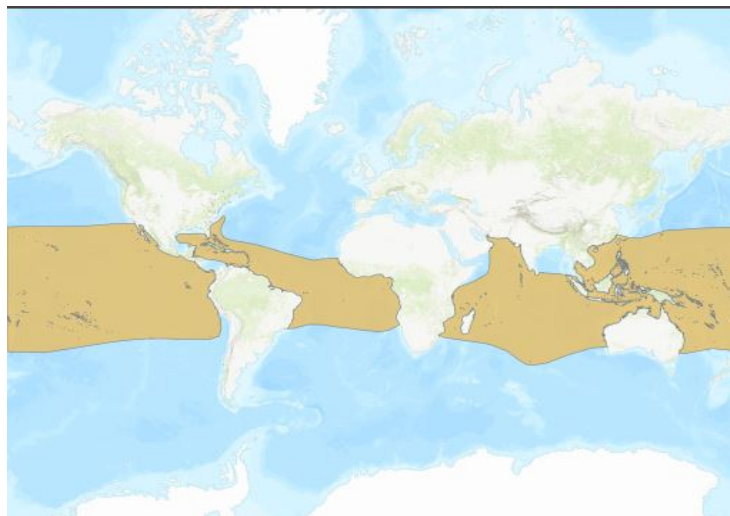
**Threats:** The principal, known and quantifiable threat to Sooty Tern in the Chagos Archipelago is the loss of suitable breeding habitat through invasive / non-native species. Secondary threats are likely to be from overfishing of sub-surface predators in the Indian Ocean and climate change-induced habitat alteration. A lack of understanding of the breeding phenology and a total lack of research into the feeding and foraging requirements and non-breeding distribution of the central Indian Ocean population *O. f. nubilosus* hinders conservation management for this species in the Chagos Archipelago.



**Figure 1.** The Chagos Archipelago (British Indian Ocean Territory - BIOT) showing its position in the central Indian Ocean and its atolls (MPA = Marine Protected Area).

## DISTRIBUTION

**Global:** Sooty Tern is a pantropical species found in tropical and subtropical waters (Fig. 2). It breeds, primarily on oceanic and barrier islands, in American Samoa; Anguilla; Australia; Bonaire, Sint Eustatius and Saba (Sint Eustatius); British Indian Ocean Territory; Cocos (Keeling) Islands; Cook Islands; Equatorial Guinea; French Polynesia; French Southern Territories; Guadeloupe; Jamaica; Kiribati; Maldives; Marshall Islands; Mauritius; Nauru; New Zealand; Norfolk Island; Northern Mariana Islands; Oman; Palau; Pitcairn; Réunion; Saint Helena, Ascension and Tristan da Cunha; Samoa; Sao Tomé and Príncipe; Seychelles; Tanzania, United Republic of; Tokelau; Tonga; Turks and Caicos Islands; Tuvalu; United States; United States Minor Outlying Islands; Vanuatu; Virgin Islands, British; Virgin Islands, U.S [3]. It is extant in several other countries. It tends towards vagrancy, especially after storms and has been recorded as far north as Iceland and inland, in amongst other areas, in Arizona [1].



**Figure 2.** Global breeding distribution of Sooty Tern *Onychoprion fuscatus* (Figure extracted from [3]).

**Local - Nesting:** In the Chagos Archipelago, since 2008, Sooty Tern has bred on eight rat-free islands (Figs. 3 and 4.): Parasol, Longue, Petite Bois Mangué, Grand and Petite Coquillage (Peros Banhos – Fig. 2); South, Middle and North Brother (Great Chagos Bank – Fig. 3) [8]. In 1884, a colony in excess of 100,000 pairs was present on Diego Garcia [5] but this no longer exists.



**Figure 3.** Distribution of breeding colonies of Sooty Tern *Onychoprion fuscatus* in the Chagos Archipelago – Peros Banhos atoll. 1 = Parasol, 2 = Longue, 3 = Petite Bois Mangué, 4 = Petite Coquillage, 5 = Grand Coquillage



**Figure 4.** Distribution of breeding colonies of Sooty Tern *Onychoprion fuscatus* in the Chagos Archipelago – western Great Chagos Bank atoll.

**Local - Foraging:** No research has been conducted into the foraging or, non-breeding distribution of Sooty Tern breeding in the Chagos Archipelago and, this is a critical gap for the conservation management of this species. A surface feeder and, elsewhere a near-obligate associate of sub-surface predators [1] that bring prey to the surface for their picking, anecdotally, it appears to forage beyond the Exclusive Economic Zone of the archipelago looking for tuna. In over ten years of sea voyages throughout the archipelago, this species was deemed uncommon at sea and no feeding flock was ever encountered [4]. Transient flocks have been encountered at night, attracted to ships lights. These were thought to have been foraging birds that were returning to breeding colonies.

## STATUS

**Status – Population estimate:** Sooty Tern is the most numerous bird in the Chagos Archipelago with a maximum annual breeding population of c. 200,000 pairs [8]. It is therefore a major driver of ecosystems through nutrient exchange both terrestrial and marine [10]. There are large variations in the annual breeding population due to periodic desertions of individual island colonies caused by infestations of the ixodid tick *Amblyomma loculosum* [9]. There are two epicentres of breeding [8], the north-eastern, rat-free islands of Peros Banhos (Fig. 3) and the rat-free Three Brothers islands on the western rim of the Great Chagos Bank (Fig. 4) (Table 1).

**Table 1.** Breeding islands and maximum number of breeding pairs of Sooty Tern in the Chagos Archipelago between 2008 – 2018.

ISLAND	YEAR	BREEDING PAIRS
SOUTH BROTHER	2009	10,000
MIDDLE BROTHER	2012	32,000
NORTH BROTHER	2009	10,000
PARASOL	2012	32,500
LONGUE	2012	48,000
PETITE BOIS MANGUE	2009	2,000
PETITE COQUILLAGE	2009	20,000
GRAND COQUILLAGE	2012	38,000

**Status – Population Trend:** The population dynamics of breeding Sooty Tern in the Chagos Archipelago is difficult to interpret due to the large annual variations in breeding numbers caused by desertions of breeding islands due to tick infestations, birds abandoning eggs and small chicks *en masse*. Bourne [5], recorded in 1884 a colony of > 100,000 pairs of breeding birds on Diego Garcia, a colony that ceased to exist soon after colonisation. It is not unreasonable to hypothesise that other such colonies existed throughout the archipelago but were exterminated upon human arrival [9]. Latterly, the annual breeding population is apparently stable at 50,000 – 150,000 pairs, with a capacity to reach c. 200,000 pairs under optimal breeding conditions [8].

**IUCN Red List status:** Least Concern (LC).

## ECOLOGY

**Ecology – Habitat and diet:** In the Chagos Archipelago, under optimum conditions, Sooty Tern nest in open areas with sparse or no ground cover with fringing trees or shrubs to provide shade. Under sub-optimal conditions, it attempts to nest in areas with extensive groundcover and occasionally, into the interior of coconut *Cocos nucifera* dominated forest. It only nests on rat-free islands [8 and 9]. In the non-breeding season, it is strictly pelagic and seldom seen in the archipelago [4]. The plumage of adults is not waterproof, and it is thought to sleep in flight when away from breeding colonies. Their diet consists of mainly fish and squid, occasionally taking crustaceans, insects and offal. Diet does vary globally and is dependent upon location, date of breeding and prey availability. They are pelagic surface feeders; adults strongly associate with sub-surface predators that drive baitfish to the surface [1], in the Chagos Archipelago this would predominantly be Skipjack *Katsuwonus pelamis* and Yellowfin Tuna *Thunnus albacares*. The numerical dominance of this species in all tropical waters of the world's oceans may be a reflection of its high phenotypic plasticity, expressed by differences in its food habits, breeding season and strategy [1].

**Ecology – Reproduction and life history:** The breeding phenology of Sooty Tern in the Chagos Archipelago is complicated and requires further research. It is known that when breeding it is highly synchronised within colonies and, all colonies throughout the Archipelago nest at the same time.

However, it breeds at unknown intervals and like elsewhere globally, it has bred subannually [8]. It is not island philopatric, having interannual variation in breeding island selection [8] caused by periodic desertions of breeding islands, usually at the egg-laying / newly hatched chick stage [9]. As found in the western Indian Ocean [11, 12] these periodic desertions are due to tick infestation [9].

**Ecology – Taxonomy and population structure:** The genus *Onychoprion* comprises four species, Sooty, Spectacled *O. lunatus*, Aleutian *O. aleuticus* and Bridled Tern *O. anaethetus* [1]. The latter breeds in very small numbers on rat-free islands in the Chagos Archipelago (< 100 pairs annually) [8].

## THREATS

**Terrestrial - Alien invasive Black (Ship) Rat *Rattus rattus*:** Black Rats were introduced to the Chagos Archipelago about 230 years ago and are still present on 26 of the 55 islands that make up 94% of the archipelago's terrestrial landmass [13]. Along with other human-introduced non-native species, principally pigs *Sus scrofa domesticus* and cats *Felis catus*, historically, these have had a catastrophic detrimental impact upon seabird breeding populations [6, 7 and 9]. In the northern atolls (Egmont Islands, Great Chagos Bank, Peros Banhos and the Solomon Islands – Fig. 1), rats dominate the breeding island selection of seabirds [8]. In the Chagos Archipelago, Sooty Tern only breed on rat-free islands with open areas in which to settle their breeding fares and, periodically desert these islands due to tick loads [8 and 9]. Due to the restricted breeding island requirements of this species in the archipelago, the opportunity for an expansion in breeding distribution appears limited. If rats invaded rat-free islands where seabird colonies exist, these colonies would very probably be exterminated. Due to the proximity of rat-infested islands to rat-free islands, this is a possibility. Eradicating rats would increase breeding island availability for this species and at least six others (Masked *Sula dactylara* and Brown Booby *S. leucogaster*, Bridled Tern, Wedge-tailed Shearwater *Ardenna pacifica*, Tropical Shearwater *Puffinua bailloni* and Brown Noddy *Anous stolidus* [8, 9 and 13]). It would also substantially reduce the possibility of rats invading rat-free islands and devastating the internationally important seabird colonies they hold [6 and 13]. **Impact – High.**

**Terrestrial – Native *Amblyomma loculosum*:** The ixodid tick *Amblyomma loculosum* occurs naturally in seabird colonies in the western and central Indian Ocean, with breeding Sooty Tern being a recognised host [12]. In the Chagos Archipelago it regularly causes the desertion of entire island colonies and total breeding failure [9]. The relationship between breeding Sooty Tern and *A. loculosum*, the overall impact upon population dynamics and the periodicity of the mass breeding failures are unknown. Research is required into the impact of *A. loculosum* on Sooty Tern populations in the Chagos Archipelago. **Impact – Unknown.**

**Terrestrial – Native land crabs:** Land crabs, primarily *Coenobita* ssp., *Grapsus* ssp. and Coconut Crab *Birgus latro* are native to the Chagos Archipelago and are ecosystem-drivers on all islands. All land crabs are likely to predate breeding colonies of Sooty Tern to an extent. The former two families are unlikely to impact adult birds but may predate small chicks and possibly eggs. Coconut Crab are capable of predated adults as well as eggs and chicks. Although a natural phenomenon, the impact of land crabs on breeding Sooty Tern is unknown and requires research. **Impact – Unknown.**

**Terrestrial - Alien (minor) invasive *Stachytarpheta jamaicensis*:** The non-native plant Jamaican Vervain (or Rat-tail) *Stachytarpheta jamaicensis* is present on at least 21 islands in the archipelago [14]. It is a dominant monoculture on disturbed soils where Sooty Tern prefer to nest, and these stands provide suboptimal breeding habitat. Generally, these overgrown stands are avoided but where birds do attempt to nest on them, chicks can become entangled in the foliage and die. *Stachytarpheta jamaicensis* should be classified as a minor invasive in the Chagos Archipelago and it should be eradicated or, if not feasible, its abundance and distribution controlled to improve the breeding habitat available for Sooty Tern and other terrestrial nesting seabirds. **Impact – Low.**

**Terrestrial - Alien invasive *Casuarina equisetifolia*:** The non-native Australian pine tree *Casuarina equisetifolia* was introduced to the Chagos Archipelago sometime after man's colonisation in the late 1700s and presently occurs on 16 islands. It is listed on the Global Invasive Species Database (GISD). Citation: Carr, P. 2020. British Indian Ocean Territory Biodiversity Action Plan: Sooty Tern Prepared by Bangor University for the BIOT Administration, FCO, King Charles Street, London. 5

In the Chagos Archipelago, as elsewhere [25], it alters natural habitat, reduces native biodiversity, inhibits the growth of other species and modifies successional patterns. Specific to arboreal nesting, globally significant populations of Red-footed Booby and Lesser Noddy, the tree's architecture does not provide nesting platforms. For terrestrial nesting species, it rapidly colonises disturbed areas, the preferred nesting habitat of Sooty Tern, forming monoculture stands that can prevent some species, especially Sulidae from breeding underneath. This species should be eradicated or, if not feasible, its abundance and distribution should be controlled. **Impact - Low**

**Terrestrial – Native invasive *Cassytha filiformis*:** The native [14], obligate parasitic vine *Cassytha filiformis* periodically renders some breeding habitat unsuitable through overgrowth of open areas, the preferred breeding locations of Sooty Tern in the Chagos Archipelago. These overgrown areas are generally avoided but, it appears in peak breeding years, birds do attempt to nest on top of the vine. This can lead to egg loss through the foliage and chicks becoming entangled in the vine and dying. The overall impact of *Cassytha filiformis* upon the breeding success of Sooty Tern colonies is unknown but, management of the distribution and extent of this plant could improve the reproductive output of the species. **Impact – Low.**

**Terrestrial – Native invasive Coconut *Cocos nucifera*:** Coconut is a naturally occurring tree in the Chagos Archipelago [14] that is essential to the stability of beach-crests. Historically, throughout the entire archipelago, native habitat was cleared to make way for coconut plantations [6 and 7] and it is assessed that > 75% of island cover is now coconut dominated [15]. It is probable that with the development of the plantations, much open Sooty Tern breeding habitat was lost. The coconut plantations have not been managed for over 50 years [7] and the resulting habitat has been termed “coconut chaos” holding minimal natural biodiversity [9]. To increase the availability of breeding habitat for Sooty Tern and other terrestrial nesting seabirds, former coconut plantations should be felled, and native habitat rehabilitated - this includes (re)establishing open areas for terrestrial nesting seabirds and rejuvenation of oceanic island rain forest for arboreal nesting seabirds such as Red-footed Booby *Sula sula* and Lesser Noddy *Anous tenuirostris*. **Impact – High.**

**Terrestrial – Global Mean Sea Level Rise (GMSLR):** Projected GMSLR for 1.5°C of global warming has an indicative range of 0.26 – 0.77m, relative to 1986–2005 [16], though a short series of sea level data from the Chagos indicates a rise currently of 5.5 mm per year [17]. All islands in the Chagos Archipelago are those of typical atolls, with a low elevation of generally < 2m (18). Based upon the above figures, with an even rise in global temperature of 1.5°C, most of the archipelago would be submerged in c. 360 years. Many models of global warming predict higher temperature rises in shorter timeframes that would bring forward the date the archipelago would disappear underwater. **Impact – High.**

**Marine – Commercial harvesting of near-obligate associate species:** Adult breeding birds are near-obligate associates with sub-surface predators [1] and in the eastern tropical Pacific associate with Skipjack *Katsuwonus pelamis* and Yellowfin Tuna *Thunnus albacares* [19], both of which regularly occur in the Indian Ocean. Indian Ocean stock assessments for the former are that it is not overfished but the latter is [20]. Two other species of tuna are commercially fished in the Indian Ocean, Albacore *T. alalunga* and Bigeye *T. obesus*, together they form < 10% of the commercial take, Yellowfin constitute ≈ 40% [20]. Removing sub-surface predators at unsustainable levels is likely to have negative impacts upon associated obligates, though for Sooty Tern in the central Indian Ocean this requires further research. Similarly, the incidence of bycatch on this species through commercial marine resource harvesting is unknown. **Impact – Unknown.**

**Marine – Illegal, Unregulated and Unreported (IUU) fishing in the Chagos Archipelago Marine Protected Area (MPA):** The Chagos Archipelago MPA was declared in 2010 as a Class 1 strict no-take MPA where harvesting of marine resources is illegal. Despite this designation, some IUU harvesting still occurs. The extent and impact of IUU harvesting in the Chagos Archipelago MPA is unknown and its impact upon breeding Sooty Tern is also unknown. As a near-obligate associate of sub-surface predators, Sooty tern will be impacted to some degree by IUU harvesting in its feeding, foraging and non-breeding areas. **Impact – Unknown.**

**Marine – Climate variation:** Research on the effect of climate variation on oceanic productivity and how this impacts Sooty Tern in the Indian Ocean is lacking, though off Australia variations in sea surface temperature have a negative influence on foraging success [21]. Any changes in oceanic productivity will have a positive/negative impact, species dependent, on seabirds, though what these are requires further research. **Impact – Unknown.**

**Marine – Plastic:** Sooty Tern as a surface feeder is susceptible to plastic ingestion, as other seabirds are known to be [22]. Although surface feeding Sterninae appear not as susceptible as other feeding guilds [23], the extent of plastic ingestion and its impact upon this species in the central Indian Ocean has not been researched and its impact unknown. **Impact – Unknown.**

**General – Lack of information required for conservation management of Sooty Tern in the Chagos Archipelago:** Despite Sooty Tern being the most numerous bird in the Chagos Archipelago [8], there remain several critical gaps in knowledge in order to make conservation management decisions regarding the species. Primary among these is its breeding phenology, feeding and foraging behaviour and range when breeding and, non-breeding distribution. **Impact – High.**

### RELEVANT POLICIES AND LEGISLATION

**International:** Six of the islands where this species presently breeds (Table 1) are designated as IUCN Important Bird and Biodiversity Areas (IBAs), the two Coquillages were proposed as IBAs in 2008 [24]. All eight islands are contained within a proposed reclassification of the Chagos Archipelago IBAs in to island clusters rather than individual islands [8].

**Local:** In BIOT Law, Sooty Tern is fully protected by The Protection and Preservation of Wildlife Ordinance 1970 and, all eight breeding islands fall under The Strict Nature Reserve Regulations 1998.

### MANAGEMENT NOTES

Global threats of unknown impact such as GMSLR, climate variation, marine plastic and commercial harvesting of marine resources are not immediately rectifiable in the Chagos Archipelago without international cooperation. Every effort should be made by the BIOT Administration and organisations working in the Archipelago to support research into these critical threats to Earth's oceans and by association, the planet.

All other threats to Sooty Tern, including all those deemed "High Impact" can be resolved with BIOTA support and funding. Resolving the terrestrial threats to Sooty Tern by *de facto*, will enhance the breeding prospects of all other 17 species of seabird breeding in the Archipelago and, enhance the natural biodiversity. Eradicating invasive rats from the entire archipelago (excluding inhabited Diego Garcia) is a viable option, as is the removal of former coconut plantations and the ecological rehabilitation of islands. The latter two have been recognised in the BIOT Interim Conservation Management as high priority.

## SPECIES ACTION PLAN

PROPOSED ACTION	OUTCOME(S)	TIMEFRAME	PROPOSED START	PRIORITY	LEAD
<b>POLICY &amp; LEGISLATION</b>					
Produce conservation management plans for all islands of the Chagos Archipelago, prioritising the management action required and establishing associated costs and logistic requirements.	Conservation management plans for all islands of the Chagos Archipelago, excluding Diego Garcia atoll.	1 year	June 2020	High	BIOTA with assistance from relevant experts from Bertarelli Programme of Marine Science, Royal Botanical Gardens Kew, Chagos Conservation Trust and associated experts
In the BIOT Interim Conservation Management Plan (BIOT ICMP), classify <i>Stachytarpheta jamaicensis</i> as an invasive	Update BIOT ICMP and include a list of invasive species, identifying these as a requirement for control or eradication	1 day	June 2020	Low	BIOT Administration Environmental Officer (BIOTA EO)
In the BIOT ICMP, classify <i>Casuarina equisetifolia</i> as an invasive	Update BIOT ICMP and include a list of invasive species, identifying these as a requirement for control or eradication	1 day	January 2020	Low	BIOTA EO
<b>MANAGEMENT</b>					
Using aerial baiting assisted by ground teams on islands where necessary, eradicate <i>Rattus rattus</i> from all islands of the Chagos Archipelago, except Diego Garcia, to assist island ecological restoration and Sooty Tern recovery	All rats eradicated from rat-infested islands in the Chagos Archipelago	3 years	June 2021	High	Chagos Conservation Trust (CCT) / Bertarelli Programme of Marine Science Chagos Seabird Ecology (BPMS ChaSE) team
As part of the same operation as the rat eradication programme, conduct vegetation management on islands	<ol style="list-style-type: none"> <li>1. Restore native habitat to areas of former coconut plantations, including open Sooty Tern fares</li> <li>2. Control/eradicate <i>Stachytarpheta</i></li> </ol>	3 years	January 2021	High	CCT / BPMS ChaSE Royal Botanical Gardens (RBG) Kew



except Diego Garcia, that were ecologically altered for coconut farming or, where alien invasive species are impacting natural ecosystems, to assist island ecological restoration and Sooty Tern recovery	<p><i>jamaicensis</i> on all islands</p> <p>3. Control/eradicate <i>Casuarina equisetifolia</i> on all islands</p> <p>4. Control <i>Cassytha filliformis</i> on islands where Sooty Tern breed</p>				
<b>RESEACH &amp; MONITORING</b>					
Islands to be monitored for rats biannually for 10 years after the eradication phase	To ensure success of eradication operation and provide a rapid response against any island that did not have rats eradicated	10 years	January 2024	High	BPMS ChaSE
As part of the biannual monitoring of rats, ongoing control/eradication of pest plant species to be conducted concurrently	To ensure control and eradication measures are successful or ongoing	10 years	January 2024	High	BPMS ChaSE
Using remote sensing technology, (audio and visual) establish breeding phenology of Sooty Tern on the Chagos Archipelago	Establish the breeding phenology of Sooty Tern	2 years	August 2020	High	BPMS ChaSE
Using telemetry (e.g. GPS and GLS), establish the feeding and foraging regimes and areas and non-breeding distribution of Sooty Tern breeding in the Chagos Archipelago	Map non-breeding distribution and feeding and foraging area and	2 years	August 2020	High	BPMS ChaSE
Conduct research into the impact of <i>Amblyomma loculosum</i> and land crabs on breeding Sooty Tern in the Chagos Archipelago	Establish impact of <i>Amblyomma loculosum</i> and land crabs on breeding Sooty Tern	2 years	August 2020	High	BPMS ChaSE
Prioritise, fund and implement effective control measures to deny Illegal, unregulated and unreported harvesting of marine resources in	Prevent IUU harvesting of marine resources in the Chagos Archipelago	25 years	August 2019	High	BIOTA

the Chagos Marine Protected Area.					
Research the impact of plastic in the Chagos Archipelago on breeding Sooty Tern.	Understanding the impact of plastic in the Indian Ocean on breeding Sooty Tern in the Chagos Archipelago	3 years	June 2020	Low	BPMS ChaSE
Research and model the possible timeframe and potential impact of GMSLR in the Chagos Archipelago	Understanding the impact of GMSLR in the in the Chagos Archipelago	3 years	June 2020	Low	BPMS and associated experts

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