British Indian Ocean Territory Biodiversity Action Plan

SEA TURTLES: HAWKSBILL AND GREEN TURTLE

Summary

Taxonomy: Kingdom: Animalia; Phylum: Chordata; Class: Reptilia; Order: Testudines; Family: Cheloniidae

Species: *Eretmochelys imbricata* (hawksbill)

Nativeness: Native, breeding, foraging

Description: Large, migratory marine reptile up to 1.2 metres in length and 150 kg in weight. Migrates from feeding grounds on shallow coral reefs in BIOT and the West Indian Ocean region to nest on 235 km of oceanic beach coastline of 65 islands in BIOT. Diego Garcia and Peros Banhos atolls account for 90% of hawksbill nesting. Adult diet is predominantly demosponges and anthozoans in shallow reef habitat. Key foraging grounds in BIOT have been identified in the Great Chagos Bank.

IUCN Red List Global Assessment (2008) status: Critically endangered

Local trend: Increasing

Threats: Principal threats are climate change and fisheries bycatch (particularly coastal feeding areas and during migration), with secondary threats from ghost fishing gear and nesting habitat degradation (accumulated marine debris, dense palm roots in plantation areas, light pollution, erosion, invasive

Species: *Chelonia mydas* (green turtle)

Nativeness: Native, breeding, foraging

Description: Large, highly migratory marine reptile up to 1.4 metres in length and 300 kg in weight. Migrates from coastal foraging grounds within BIOT (Great Chagos Bank) and across the Western Indian Ocean (including Somalia, Kenya, Mozambique, Madagascar, Seychelles, Maldives, mid oceanic atolls) to nest on 235 km of oceanic beach coastline of 65 islands in BIOT. Diego Garcia and Peros Banhos atolls accounts for 70% of green turtle nesting. Adults are predominantly herbivorous with a diet composed largely of seagrass and macroalgae. Foraging grounds in BIOT have been identified on the Great Chagos Bank (south Danger Island, South East sector).

IUCN Red List Global Assessment (2004) status: Endangered

Local trend: Increasing

Threats: Principal threats are climate change and fisheries bycatch (particularly coastal feeding areas and during migration), with secondary threats from ghost fishing gear and nesting habitat degradation (accumulated marine debris, dense palm roots in plantation areas, light pollution, erosion, invasive

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Hawksbill and green turtles

1. Distribution

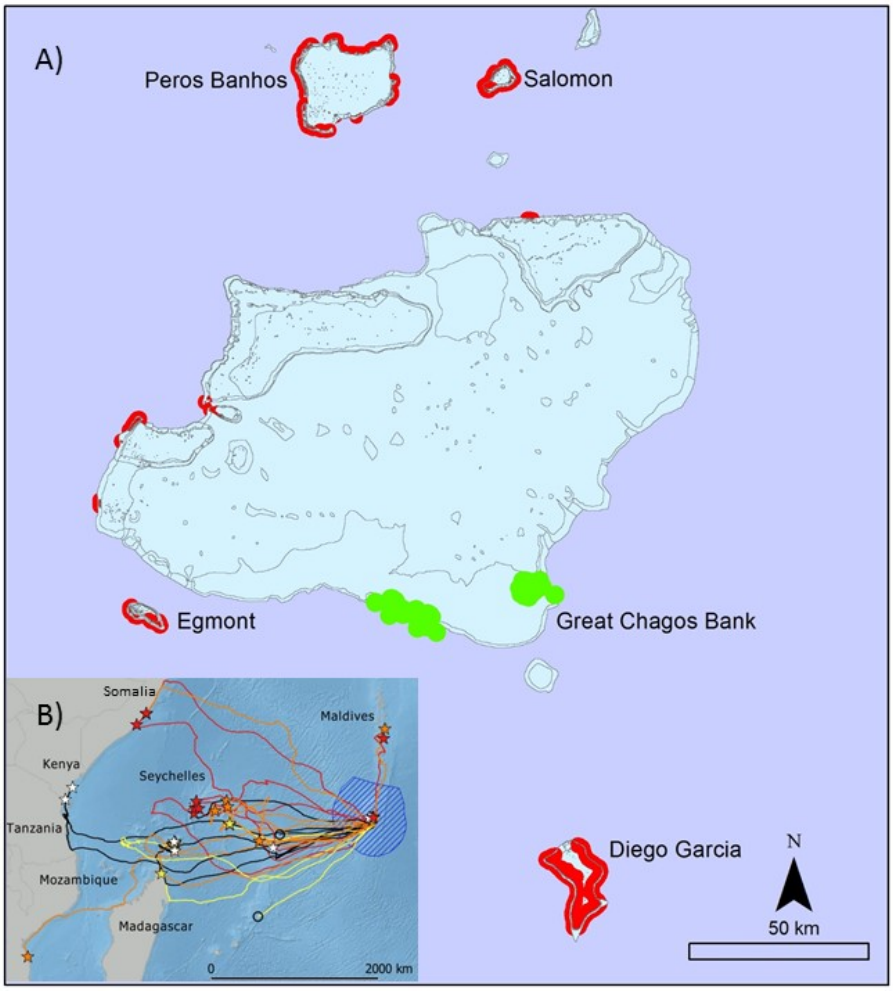

Figure 1: A) Distribution of sea turtle breeding and foraging sites in the British Indian Ocean Territory as of January 2020 (Hays et al. 2014; Esteban et al. 2018; Mortimer and Esteban et al. 2020). All five islanded atolls provide nesting habitat for hawksbill and green turtles as well as foraging habitat for hawksbill turtles. Nesting sites are found on oceanside sandy beaches of all islanded atolls in BIOT (shown in red). Foraging sites of hawksbill turtles occur around coral reefs (grey lines represent reefs as taken from aerial photographs and satellite imagery) whilst green turtles forage predominantly on seagrass. To date, only Great Chagos Bank has been identified as an important foraging habitat for green turtles (sites at 23–29m depth shown in green). Blue shading represents depths greater than 20 m from Admiralty Chart). B) Foraging distribution of 35 green turtles (nesting on Diego Garcia between 2012–2018) using satellite telemetry devices (Hays and Esteban, unpublished data). Of 33 turtles that reached foraging sites: 40% migrated to Seychelles, 18% to mainland Africa and 20% remained within BIOT. Of the remaining, two migrated to the Maldives and one to Madagascar (circles indicate incomplete tracks). The boundary of BIOT's 200 nm exclusive economic zone (EEZ) is shown (blue stipples).

Global

Hawksbill and green turtles are both migrants and resident in BIOT. Hawksbill turtles breed and forage in BIOT whilst green turtles breed and migrate to foraging sites around the Western Indian

Ocean (70–5000 km distant; Fig. 1B). BIOT is a nesting refuge for a significant portion of the region's hawksbill and green turtles, accounting for 39–51% of estimated hawksbill and 14–20% of estimated green turtle clutches laid in the southwestern Indian Ocean (Mortimer and Esteban et al. 2020).

Local

Nesting:

All islanded atolls of BIOT provide sandy nesting beaches for both hawksbill and green turtles (Fig. 1) and suitable turtle nesting habitat occurs along 56% (132 km) of the 235 km of oceanic coastline. Diego Garcia (41 km) and Peros Banhos (41 km) are the most important atolls for both hawksbill (50% and 42% respectively) and green turtle (32% and 39% respectively) nesting activities (Table 1).

Nesting seasonality documented for BIOT hawksbills indicated 86% occurred October-February, with a peak of 28% in December. Green turtle nesting is more variable and occurs year-round with a peak between June-October (64% of nesting activities) and 3–7% of annual nesting emergences in each of the other months. Inter-annual variability recorded in Diego Garcia (two-weekly surveys) typifies nesting populations worldwide and within the region; remigration intervals are driven by varying environmental conditions at foraging grounds that modulate the time taken for females to reach breeding fitness.

Table 1. Sea turtle nesting in the British Indian Ocean Territory varies with available sandy beaches on the five islanded atolls (see Mortimer and Esteban et al. 2020 for more detail).

Atoll	Oceanic coastline suitable for nesting			Relative Levels Hawksbill Nesting		Relative Levels Green Turtle Nesting	
	# Islands	km	%	% of Total	Est. mean clutches laid (p.a.)	% of Total	Est. mean clutches laid (p.a.)
Peros Banhos	36	41	51	41.6	2627	38.8	7941
Salomon	11	14	53	2.5	158	3.4	696
Great Chagos Bank	8	19	57	2.0	126	16.1	3295
Egmont	8	17	76	5.0	316	10.2	2088
Diego Garcia	4	41	56	48.8	3081	31.6	6467
Total	67	132	56	100	6308	100	20,487

Foraging:

All of the coral atolls in BIOT provide suitable foraging habitat for immature and adult hawksbill turtles. Satellite tracking studies of hawksbill turtles are currently demonstrating the importance of the Great Chagos Bank for hawksbills nesting on Diego Garcia. Hawksbills also forage on deeper (>10 m depth) submerged banks, such as Pitt Bank and Centurion Bank.

Green turtles have a diet of seagrass and satellite tracking results (n=35; unpublished data) have shown that approximately 20% of the green turtles nesting on Diego Garcia use the Great Chagos Bank as foraging habitat. These green turtles potentially remain in BIOT during their entire adult life cycle which demonstrates the high value of the Chagos MPA for full protection of a proportion of the green turtle population. Vast seagrass meadows across the SE Great Chagos Bank and South of Danger Island have now been identified (Hays et al. 2018, Esteban et al. 2018) as foraging habitat for

green turtles. Seagrass has also been reported on Speaker's Bank and Colvocoresses Reef (Spalding, pers. comm.). Much of the Great Chagos Bank remains unexplored and it is possible that green turtle foraging distribution in BIOT is much greater than currently known.

Many of the shallower lagoons provide suitable developmental habitat for immature hawksbill and green turtles due to reduced risk from predation. An important developmental foraging habitat was discovered at Turtle Cove in the southern lagoon of Diego Garcia atoll in 1996 (Mortimer, 1999) and several hundred hawksbill and green turtles have been recorded foraging at this site using long-term flipper tag monitoring and drone surveys (unpublished data; see Schofield et al. 2019 for method).

2. Status

Global	**Population estimate:**	**IUCN Global Assessment status:**
Hawksbill	Decreasing	Critically endangered (Mortimer & Donnelly 2008)
Green	Decreasing	Endangered (Seminoff 2004)

Local	**Nesting population estimate:**	**Local trend: Increased nesting**
Hawksbill	6300 egg clutches laid p.a.	Increased by 2–5 times since 1996
Green	20,500 egg clutches laid p.a.	Increased by 4–9 times since 1996

It is worth noting that the Global Assessments for hawksbill and green turtles are currently being updated for the South Western Indian Ocean sub-populations.

After almost two centuries of permanent human settlement and associated exploitation and trade in hawksbill shell, green turtle meat, turtle oil and eggs (Wenban-Smith & Carter, 2016), BIOT has been uninhabited since 1973 (except Diego Garcia). Since 1968 and 1970, green turtles and hawksbills (respectively) have been protected by conservation legislation. Since 1973, turtle protection was reinforced by several Special Nature Reserves without human habitation or artificial lighting. Nesting beaches have been fully protected for over 50 years.

In 1970, after a survey of a few islands, it was concluded that only a few hundred hawksbill and green turtles remained (<1000 clutches laid annually by each species) (Frazier, 1975). In 1996, the first systematic survey of turtle nesting in BIOT was conducted (49 islands) (Mortimer & Day, 1999), estimating 300–700 nesting hawksbills (1200–2800 clutches) annually and 400-800 green turtles (2200–4400 clutches) by using seasonality data from Seychelles (Mortimer & Bresson, 1999; Mortimer 1988).

Current nesting densities may reflect a combination of ecological factors and historical human exploitation, with higher nesting densities now reported on atolls with relatively less accessible islands. The Chagos Archipelago was inhabited by ~650–1200 coconut plantation labourers who collected wood and caught fish and turtles, beginning in the years 1776 at Diego Garcia, 1808 at Egmont, and 1813 at Peros Banhos, Salomon and Great Chagos Bank, and ending in 1935 at Egmont and Great Chagos Bank, and in 1971–1973 at Diego Garcia, Salomon and Peros Banhos (Wenban-Smith & Carter 2016).

Peros Banhos and Diego Garcia host most of the nesting habitat and the largest populations of nesting turtles in BIOT. At Peros Banhos, topography provides protection with abundant habitat on

36 small islands scattered along the rim of the vast (34 km diameter) lagoon. At both Peros Banhos and Great Chagos Bank, rough seas and primitive sail and oar-driven boats would limit efficiency of historic turtle hunts (Wenban-Smith & Carter, 2016). Furthermore, at many Great Chagos Bank islands, high energy beaches offering ideal habitat for green turtles while restricting human access, may explain abundant green turtle nesting. In contrast, Salomon atoll (11% total nesting habitat) today hosts <5% of turtle populations despite reports of abundant turtles in 1786 (Horsburgh 1809, in Mortimer & Day, 1999) and 1813 (Wenban-Smith & Carter, 2016). Salomon atoll comprises a nearly closed island-ring enabling human access to all nesting beaches regardless of weather. Egmont atoll also has islands easily accessible year-round, but its human population was relatively smaller and habitation ended 37 years earlier. Today its beaches (13% of total) host 16% of BIOT green turtles and 5% of hawksbills.

3. Ecology

Habitat and diet

Different life stages of sea turtles utilise different habitats. Hatchlings and small juveniles are epipelagic omnivores that are thought to associate with floating debris and vegetation such as Sargassum in ocean currents (Witherington et al. 2012). Immature and adult turtles forage in the neritic zone and breeding adults undertake long-distance migrations between foraging and breeding habitats. Adults show fidelity to both breeding grounds (Miller 1997) and foraging grounds (Shimada et al. 2019). For example, a green turtle that was flipper tagged at foraging grounds in Kenya in 2003 was observed breeding in Diego Garcia in 2015 and then satellite tracked back to the same foraging grounds in Kenya (Shimada et al. 2019).

Hawksbill foraging habitat and diet in BIOT is unstudied. Hawksbill turtles forage in a variety of soft and hard bottomed habitats throughout the tropics and sponges dominate their diet in the Pacific and Atlantic (Meylan 1988). In the only study of hawksbill diet in the Western Indian Ocean, the most important species contributing to their diet were sponges and anthozoans (Seychelles; von Brandis et al. 2014).

Green turtle diet in the Western Indian Ocean is dominated by seagrass (Seychelles; Stokes et al. 2019); but Green turtle diet in BIOT is largely unstudied. Seagrass habitat is relatively limited in the Chagos Archipelago. Small numbers of juvenile green turtles forage at Turtle Cove inside Diego Garcia lagoon (Mortimer 2000). Satellite tracking studies have now shown that approximately 20% of green turtles breeding on Diego Garcia migrate to relatively deep foraging grounds on the SE Great Chagos Bank (Hays et al. 2014; Dujon et al. 2017, see Fig. 1) where they forage in small home ranges (Christiansen et al. 2017) on deepwater (24–30 m depth) monospecific seagrass meadows of *Thalassodendron ciliatum* (Esteban et al. 2018). Observations of adult green turtles foraging on seagrass meadows (8–12 m depth) reported by Sheppard et al. (2012) south of Danger Island in the SW Great Chagos Bank (Esteban, pers. comm.) indicate that green turtle foraging habitat in BIOT is potentially much more extensive than currently identified. Further satellite tracking of green turtles nesting in BIOT can play a critical role in the future mapping of previously unknown seagrass habitat in BIOT and further afield (Hays et al. 2018).

Reproduction and life history

Sea turtles mature very slowly. In the Indo-Pacific, age to maturity of hawksbills is a minimum of 30–35 years (Limpus and Miller 2000) and nesting may continue for over 17–20 years (Mortimer and

Bresson 1999). Green turtles exhibit the slowest growth rates of sea turtles with age to maturity of up to 40 years and estimates of reproductive longevity of 17–23 years (Fitzsimmons et al. 1995).

Hawksbill and green turtles nest on sandy marine beaches, largely on the oceanside of atolls with no significant nesting recorded inside the Diego Garcia lagoon (Mortimer and Esteban et al. 2020). In general, female hawksbill turtles lay an average of 3–5 clutches per season (Mortimer & Donnelly 2008) in contrast to 6 clutches per season for green turtles (Esteban et al. 2017). Internesting interval between clutches of approximately 100-150 eggs is about 12 and 14 days (green and hawksbills respectively, Miller 2007). Hatchlings emerge 60–70 days after nesting after sunset and disperse rapidly once in the ocean. Remigration intervals are around 3 years (Miller 2007). These values are derived from global studies as nesting ecology is largely unstudied in BIOT.

The sex of sea turtle hatchlings is determined by incubation temperature. In compared to other turtle rookeries, sand temperatures during nesting seasons for both species in BIOT are relatively cool due to presence of dense coastal vegetation shading nests. Beaches on BIOT produce a fairly balanced hatchling sex ratio of 53% and 63% male hatchlings, respectively, for hawksbill and green turtles so that BIOT may act as one of the only sources of male turtles in the Indian Ocean (Esteban and Laloë et al. 2016).

Taxonomy and population structure

Hawksbill and green turtles generally breed at their natal nesting sites resulting in reproductive isolation among breeding populations. Preliminary genetic studies of both nesting and foraging hawksbills (Mortimer & Broderick, 1999; Vargas et al., 2016) and nesting green turtles (Bourjea et al., 2015) demonstrate linkages between BIOT and elsewhere in the southwestern Indian Ocean, especially the Seychelles. The taxonomy and population structure in BIOT is largely unstudied.

4. Threats to hawksbill and green turtles [threats are classified and scored according to IUCN Threats Classification Scheme https://www.iucnredlist.org/resources/threat-classification-scheme]

Climate change and severe weather: habitat shifting and alteration *Impact: High*

The continued loss of favourable nesting beaches as a result of sea level rise poses a significant threat to sea turtles, particularly in regions with narrow beach platforms and low lying islands, such as BIOT. Sea level rise may reach 30–60 cm by 2100 (Oppenheimer et al. 2019) and the trend is projected to accelerate. Threats of sea level rise were apparent after extreme high tides in BIOT during October 2019. Tide-driven waves flooded across coastal vegetation to reach lagoon-side overwashing turtle nests and creating a 60–100 cm high sand barrier that prevented turtles from successful nest excavation along much of the oceanside beach (Esteban, pers. comment).

Garbage and solid waste *Impact: Medium*

Many types of Anthropogenic Marine Debris (AMD) have been accumulating within the marine environment. In the open ocean, sea turtles become entangled in drifting debris, such as ghost nets, and drown (Stelfox et al. 2019). On the beach, larger items blocking access for nesting females and impeding hatchling emergence and access to the sea. Large fragments easily fragment into small pieces and become incorporated into beach sand leading to ingestion, contamination and the

potential to alter the physical properties of beach sand including grain size, permeability and temperature. Changes in sand temperature and permeability could lead to unfavourable incubation conditions for sea turtle eggs such as egg desiccation or consequences for hatchling sex-ratios (Nelms et al. 2016).

Fishing and harvesting aquatic resources *Impact: Medium*

Incidental fishing capture is a major cause of mortality for sea turtles and may affect BIOT green turtles in their coastal foraging habitats (across the Western Indian Ocean) and during migrations. By-catch rates of green turtles are substantial (e.g., 140 turtles by the European purse-seine tuna fishery in the Indian Ocean 2008–2017; Ruiz et al. 2018) and likely underreported, especially gillnet, driftnet and longline fisheries that are responsible for most of the bycatch mortality. Fishery bycatch may impact both adult and juvenile stages of turtles originating from BIOT.

Climate change and severe weather: temperature extremes *Impact: Low*

Increasing temperatures on turtle nesting beaches are predicted to pose a major threat to sea turtles in the 21st century causing sex ratios to become female-biased and reducing hatching success. In the medium term, BIOT may provide a refuge for male hatchling emergence providing that the coastal vegetation remains intact and continues to shade egg clutches (Esteban and Laloë et al. 2016). In the long-term, incubation temperatures will continue to increase so that the primary sex ratio of turtles in BIOT becomes female biased.

Invasive non-native/alien species/diseases (named species) *Impact: Medium*

Invasive brown rats (*Rattus rattus*) are abundant on many islands of BIOT and in particular on Diego Garcia where the majority of turtle nesting activities occur. Rats predate on eggs and turtle hatchlings (Esteban, pers. comm.). Dense growths of coconut palm (*Cocos nucifera*) form root balls that impede nest excavation in many former plantation areas of BIOT.

Excess energy: light pollution *Impact: Low*

Artificial lighting disrupts sea turtle nesting and disorientates hatchlings so that they head towards the light rather than the open sea. Light pollution has been responsible for adult and hatchling mortality close to nesting beaches on Diego Garcia. Vessels moored or anchored in the lagoon may be intermittent sources of light pollution that can attract hatchlings and may expose them to increased predation by large pelagic fish.

Industrial & military effluents (e.g., oil spills) *Impact: Low*

Systems are in place on Diego Garcia to manage sources of potential pollution and, although unlikely, a major oil spill in the lagoon could have disastrous impacts for the resident population of hawksbills and green turtles foraging in the lagoon, especially at Turtle Cove. Nesting beaches would become contaminated affecting nesting success.

Residential & commercial development *Impact: Negligible*

In Diego Garcia, development is currently limited around oceanside beaches although past dredging and construction of pipelines have encroached on marginal nesting habitat. All construction is subject to EIA and permits so impact is controlled. Conflict between coastal development and turtle nesting habitat may increase in future with predicted sea level increase.

Recreational activities *Impact: Negligible*

Viewing foraging turtles at Turtle Cove is a popular experience for the community on Diego Garcia with information available on signboards and regulation signage alerting visitors about prosecution if caught entering the water and disturbing turtles. Many residents visit the oceanside beaches for exercise so some unintentional disturbance of nesting females may occur.

5. Relevant policies and legislation for sea turtles

International:

The east of Diego Garcia is protected as a Ramsar Site with full protection for hawksbill and green turtles nesting on the oceanside coast and for adult hawksbills and immature hawksbill and green turtles foraging on the oceanside and within Turtle Cove (Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 (RAMSAR)).

Hawksbill and green turtles are listed under Appendix 1 of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora 1973) that commits signatory states to conserving and restoring the habitats of listed species (Article III paragraph 4a), minimising activities that impede their migration (Article III, paragraph 4b) and prohibiting the taking of those species (Article III, paragraph 5).

The UK is signatory state to the Bonn Convention on Migratory Species (1979) and related Memorandum of Understanding for the Management of Sea Turtles within the Indian Ocean and South East Asian Region (IOSEA). This commits parties to conserving and restoring the habitats of listed species (Article III, para. 4a, minimising activities that impede their migration (Article III, paragraph 4b) and prohibiting the taking of those species (Article III, paragraph 5).

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter 1972 (The London Convention) protects sea turtle nesting habitat from oil pollution.

Local:

Since 1968 and 1970, green turtles and hawksbills (respectively) have been protected by specific species conservation legislation in BIOT. In 1988, turtle protection was reinforced by several Strict Nature Reserves (e.g., eastern islands of Peros Banhos, Danger Island, Nelson Island) without human habitation or artificial lighting. Turtle protection was enhanced on Diego Garcia by the restricted nature reserve that requires visitors to have entry permits (The Diego Garcia Conservation (Restricted Area) Ordinance 1994.

6. Management notes

Nesting and foraging habitats of hawksbill and green turtles in BIOT are already well-protected locally. The major threats to the population remain largely beyond local control, including climate

change, fisheries by-catch and oceanic debris in the Indian Ocean foraging grounds. Nevertheless, there may be steps that can be taken by BIOT to address these threats via international organisations such as IOTC and IOSEA to improve population resilience. In BIOT, anthropogenic factors such as beach debris (sourced from outside BIOT), light pollution and human disturbance on Diego Garcia currently affect nesting beaches and may have a negative effect on nesting habitat quality. The increasing rat population on the majority of BIOT islands is of concern and, if left unmanaged, may significantly lower hawksbill and green turtle nesting productivity as a result of predation on eggs and hatchlings. Rat eradication should be implemented at key nesting beaches, especially Diego Garcia, along with improved monitoring to assess the efficacy of control measures. Formal management plans for nesting beaches are needed to assign responsibilities and ensure continuity of action, particularly with regards to debris accumulation, light pollution, human disturbance and invasive species control.

The reported increasing trend in BIOT green turtle populations is encouraging, although continued monitoring is needed for hawksbills to determine whether the apparent upward trend is significant or simply reflects inter-annual variability. Annual monitoring of turtle nesting activity should continue over the short to medium term, particularly given the importance of BIOT as a nesting refuge for green turtles from across the Western Indian Ocean. Currently, nesting activity on the index beach (representative section of 2.8 km beach at the boundary of the Nature Reserve in Diego Garcia) main beaches is monitored 2-4 weeks with some gaps in records so efforts to ensure continuity of surveys every 2 weeks are encouraged. Although the surveys are time- and labour-intensive, the continuation will hopefully ensure that an accurate estimate of nesting population can made. The need for long-time series to confirm statistical significance of apparent trends in abundance was highlighted by Mazaris et al. (2017) who reported that, worldwide, many time-series documenting sea turtle abundance remains non-significant because they are too short-term. Estimates of nesting numbers can be further improved. For example, the population estimates assumed 55% of total turtle tracks resulted in egg-laying and these assumed values were based on data from Seychelles. Population estimates could be improved by collecting data on rates of egg-laying success across BIOT. The size of the immature foraging population has not yet been estimated and is a priority for research. Rising global temperatures and sea levels present the greatest long-term threat to the survival of sea turtles in BIOT and are impossible to manage locally. Given the potential threats from climate change, regular monitoring of hatching success and nest temperatures would be valuable to increase understanding of the impacts of climate change on the population and hopefully provide insights into possible conservation mitigation actions.

SPECIES ACTION PLAN

PROPOSED ACTION	OUTCOME(S)	TIMEFRAME	PROPOSED START	PRIORITY	LEAD*
Policy & Legislation					
Adopt the IOSEA recommended EIA guidelines for sea turtles	1 guidelines adopted	1 year	June 2020	HIGH	Environmental Officer / BIOTA
Adopt the IOSEA recommended guidelines for light pollution.	1 guidelines adopted	1 year	June 2020	HIGH	Environmental Officer / BIOTA
Adopt the IOSEA recommended policy on Effects of Noise Pollution on Marine Species, particularly for areas such as military firing ranges adjacent to nesting beaches.	1 guidelines adopted	1 year	June 2020	HIGH	Environmental Officer / BIOTA
Extend Ramsar Site on Diego Garcia to turtle nesting and foraging grounds in BIOT following the recent Ramsar resolution to encourage extension of Ramsar sites to include critical turtle habitats (COP13, 2018)	Ramsar site extended	1 year	June 2020	MEDIUM	BIOTA
Review existing petrochemical spill response plans associated with ship-to-shore refuelling activities and petroleum storage, ensuring that responsibilities are clearly defined.	1 operational document	2 months	June 2020	MEDIUM	Environmental Officer/ BIOTA
Contribute to draft Hawksbill Assessment for IOSEA MoU of CMS as BIOT data are absent	CMS MoU compliant	3 months	June 2020	HIGH	Deakin University / Swansea University
Adopt IOSEA MoU of CMS action to encourage signatory states to propose an IOSEA network site in their state: propose Turtle Cove development site as IOSEA network site	CMS network site in Diego Garcia	1 year	June 2020	HIGH	Environmental Officer / BIOTA
Implement IOSEA work plan in BIOT	CMS MoU compliant	2 years	June 2020	HIGH	Environmental Officer / BIOTA Swansea University
Management					
Produce a management plan for BIOT Marine Reserve, or locally for each nature reserve, and integrate the Sea Turtle BAP actions within plans.	Management plan(s) produced	1 year	2020	HIGH	BIOTA
Attend periodic Western Indian Ocean sea turtle task force meetings as UK-DEFRA nominated representative and feedback to relevant organisations; implement actions.	Report produced for BIOTA and DEFRA	5 days	2020	MEDIUM	UK nominated representative Swansea University

PROPOSED ACTION	OUTCOME(S)	TIMEFRAME	PROPOSED START	PRIORITY	LEAD*
Research & monitoring					
Work with CMS to include BIOT turtle data in their database of sea turtle nesting sites and movement patterns: provide data to Dr Colin Limpus (CMS technical advisor for sea turtles)	Comply with CMS requirements	2 months	June 2020	HIGH	Deakin University / Swansea University
Monitor the incubation temperature and hatching success of green and hawksbill turtle clutches in each nesting season	50 nests monitored, 1 academic paper produced	2 years	October 2020	MEDIUM	Deakin University / Swansea University
Estimate annual hawksbill and green turtle nesting activity on Diego Garcia index beach through routine counts of tracks year round	1 report produced	1 year	June 2020	MEDIUM	PWD / Environment Officer Deakin University / Swansea University
Monitor the population of foraging immature turtles in Diego Garcia lagoon via (a) flipper tagging and (b) drone surveys	2 academic papers produced	1 year	June 2020	MEDIUM	Deakin University / Swansea University
Conduct lighting survey on Diego Garcia with recommendations for variation in lighting.	1 report produced	3 months	June 2020	HIGH	PWD / Environment Officer
Assess the important foraging grounds for hawksbills in Diego Garcia; determine diet components	1 academic paper produced/thesis	3 years	December 2018	MEDIUM	Deakin University / Swansea University
Maintain remote camera traps installed along beaches in Diego Garcia, Peros Benhos and Nelson's Island to turtle nesting activity monitoring in remote locations of BIOT	1 academic paper produced	1 year	June 2020	MEDIUM	Deakin University / Swansea University SFPO / BIOTA
Survey green turtle foraging grounds in Great Chagos Bank to assess seagrass health and importance for associated fish assemblage by using BRUVS and opportunistic surveys	1 academic paper produced	2 years	March 2019	MEDIUM	SFPO / Deakin University / Swansea University
Initiate routine indexing of rat abundance at Diego Garcia index beach during peak of hawksbill and green turtle hatchling emergence	30 stations set up; 4 survey completed	4 x 1 week	October 2020	MEDIUM	Deakin University / Swansea University PhD student
Assess preferred vegetation for sea turtle nesting; map coastal vegetation of Diego Garcia and assess distribution of invasive Casuarina tree which leads to beach erosion	50 nests monitored, 1 academic paper/thesis	3 months	October 2020	MEDIUM	Deakin University / Swansea University PhD student

PROPOSED ACTION	OUTCOME(S)	TIMEFRAME	PROPOSED START	PRIORITY	LEAD*
	produced				
Produce elevation maps at key nesting areas along oceanside beaches of Diego Garcia and model potential losses from predicted sea level rise, producing recommendations for potential mitigation strategies	1 academic paper	1 year	October 2020	MEDIUM	Deakin University / Swansea University
Assess the accumulation of anthropogenic debris on sea turtles nesting on beaches of BIOT; provide recommendations for beach clean prioritisation	1 academic paper/thesis	1 year	June 2020	MEDIUM	Swansea University / ZSL
Assess the effect of microplastics on sea turtle hatching success	1 academic paper	1 year	June 2020	MEDIUM	Swansea University
Assess the movements of immature turtles in Diego Garcia lagoon via satellite tracking; assess drives of movement and preferred foraging locations and diet	1-2 academic papers/thesis	2 years	June 2020	MEDIUM	Deakin University / Swansea University
Communication & awareness-raising					
Erect visitor information board at nesting beach access points and update Turtle Cove information board to increase awareness about sea turtle conservation on Diego Garcia	4 signs installed	1 year	June 2020	MEDIUM	BIOTA / PWD / Deakin University / Swansea University
Celebrate World Ocean's Day to increase awareness of the BIOT marine environment	1 event organised	1 day	June 2020	LOW	BIOTA / PWD
Produce an updated visitor information leaflet on the biology and conservation of sea turtles in BIOT	Leaflet printed	2 months	June 2020	LOW	BIOTA / Deakin University / Swansea University
Produce and publicise guidelines for nesting beach debris clean ups via the Adopt a Beach programme	Guidelines printed	3 months	June 2020	HIGH	BIOTA / ZSL / Swansea University
Organise regular beach clean ups via the Adopt a Beach programme	2 month cleans: 10 beach zones	2 months	June 2020	HIGH	Environment Officer
Initiate education campaign of importance of reducing use of single-use plastic bottles and not discarding plastics and fishing gear at sea	Promotion film at cinema	Ongoing	June 2020	HIGH	BIOTA / ZSL / Swansea University

7. References

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