

The Maldives National Red List of Threatened Species

Scope: National Language: English

Chelonia mydas

Green sea turtle

Köhnk, S. and Stelfox, M.

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Maldives National Red List Assessment: Green Sea Turtle

A. Background Information

1. Assessment Information:

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28.02.2022

Date of Assessment

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2. Taxonomic Information:

Scientific Name Chelonia mydas
Common Name (English) Green sea turtle

كُورً Common Name (Dhivehi) Velaa, وُورً

Order Testudines

Taxonomy Sub-order Cryptodira

Family Cheloniidae

Taxonomic Notes Synonym(s): Testudo mydas Linnaeus, 1758

3. Geographic Range

3.1 Summary of Global Distribution

Green Turtles occur predominantly in tropical, occasionally in subtropical waters of all major ocean basins. They are highly migratory and can move between geographically disparate habitats. Green Turtle nesting has been documented in over 80 countries around the globe (Hirth 1997). It is currently estimated that Green Turtles inhabit coastal waters of over 140 countries (Groombridge and Luxmoore 1989).

3.2 Countries of Occurrence

Native: American Samoa (American Samoa); Angola (Angola); Anguilla; Antigua and Barbuda; Australia (Ashmore-Cartier Is., Coral Sea Is. Territory, Northern Territory, Queensland, Western Australia); Bahrain; Bangladesh; Barbados; Belize; Bonaire, Sint Eustatius and Saba (Saba, Sint Eustatius); Brazil; British Indian Ocean Territory; China; Christmas Island; Cocos (Keeling) Islands; Colombia; Comoros; Cook Islands; Costa Rica; Cuba; Curaçao; Cyprus; Dominica; Dominican Republic; Ecuador (Galápagos); Egypt; Equatorial Guinea (Bioko); Eritrea; Fiji; French Guiana; French Polynesia; French Southern Territories (Mozambique Channel Is.); Grenada; Guam; Guinea; Guinea-Bissau; Guyana;

Haiti; India (Andaman Is., Gujarat, Laccadive Is., Nicobar Is.); Indonesia (Bali, Jawa, Kalimantan, Lesser Sunda Is., Maluku, Papua, Sulawesi, Sumatera); Iran, Islamic Republic of; Jamaica; Japan (Honshu, Nansei-shoto, Ogasawarashoto); Kenya; Kiribati; Kuwait; Madagascar; Malaysia (Peninsular Malaysia, Sabah, Sarawak); Maldives; Marshall Islands; Martinique; Mauritania; Mayotte; Mexico (Baja California, Campeche, Michoacán, Quintana Roo, Revillagigedo Is., Sinaloa, Sonora, Tabasco, Tamaulipas, Veracruz, Yucatán); Micronesia, Federated States of; Mozambique; Myanmar; New Caledonia; New Zealand (Kermadec Is., North Is., South Is.); Nicaragua; Niue; Northern Mariana Islands; Oman; Pakistan; Palau; Panama; Papua New Guinea; Peru; Philippines; Puerto Rico; Saint Helena, Ascension and Tristan da Cunha (Ascension); Saint Kitts and Nevis; Saint Lucia; Saint Martin (French part); Saint Vincent and the Grenadines; Sao Tomé and Principe; Saudi Arabia; Senegal; Seychelles; Sierra Leone; Sint Maarten (Dutch part); Solomon Islands; Somalia; Sri Lanka; Suriname; Tanzania, United Republic of; Thailand; Timor-Leste; Tokelau; Tonga; Trinidad and Tobago; Turkey; Turks and Caicos Islands; Tuvalu; United Arab Emirates; United States (Florida, Hawaiian Is.); United States Minor Outlying Islands (Midway Is., US Line Is.); Vanuatu; Venezuela, Bolivarian Republic of (Aves I., Venezuelan Antilles); Viet Nam; Virgin Islands, British; Virgin Islands, U.S.; Yemen

Possibly extinct: Israel

Regionally extinct: Cayman Islands; Mauritius (Rodrigues - Native)

Reintroduced: Bermuda

3.3 National Distribution

Green turtles can be found in all atolls throughout the Maldives according to anecdotal reports and systematic surveys (Frazier et al. 1984). Recent sea turtle monitoring based on the photo identification method identified significant numbers of green turtles (>100) in Baa, Laamu and Lhaviyani atoll.

Green turtle nesting has been recorded in nine atolls, with significant nesting beaches (>20 nest per year) in Baa, Kaafu, Laamu and Thaa (Ahmed et al. 2020).

4. Population:

4.1 Summary

Green turtle populations in the Maldives have experienced a severe historic decline. The current known green turtles in the country are predominantly rather young, which could be reflective of these historic declines. Predictions based on capture-mark-recapture methods project a potential positive trend for the species (Hudgins, personal communication).

Historical records focus on nesting beaches. Different studies have recorded the number of observed nests on a selected number of beaches and provided a subsequent estimate of nesting females per year. In 1984, Frazier et al. reported an estimate of 515 nesting females per year based on surveys on 18 islands in five atolls (Ari, Baa, Laamu, and North and South Malé) in the 1980s. Unfortunately, the study did not clearly distinguish between nests from green and hawksbill turtles and on one of the surveyed islands (B.Kundunadhoo) both species are known to nest.

Zahir (2000) compiled reports on nesting of green turtles in the entire country, listing between 794 and 2048 turtles nesting yearly (see Zahir 2000 Table 1). The study mentions that olive ridley turtles are often mistaken for green turtles, but since proven incidences of olive ridleys nesting in the country are very rare, the total number is most likely negligible.

In 2016, Ali and Shimal published a summary of surveys carried out on eight islands in five atolls (Baa, Laamu, Noonu, North Male and Thaa), estimating a total of 103 green turtle females nesting per year.

4.2 Population size

Since data collection methods and survey effort varied greatly between the studies mentioned above, it is possible to consider only specific index sites for the evaluation of turtle nesting activity and thus the inferred population size. One such potential nesting site is Gaadhoo, a well-known green turtle nesting beach in Laamu atoll. It was listed by Frazier et al. (1984) to have an estimated number of 240 green turtle nests per year. Targeted monitoring efforts since May

2018 show a range of 52-72 documented nests per year (Goodfellow et al. 2020; Olive Ridley Project nesting database, internal communication). Surveys from 2020 and 2021 found even smaller numbers of nests (18 and 22 respectively, Afeef et al. 2021; Afeef, personal communication) but have to be evaluated with caution due to a distinctly smaller number of nesting surveys resulting from pandemic related travel restrictions.

As of November 23rd, 2021, 1170 individual green turtles have been identified during surveys and opportunistic data collection carried out in approximately 46 % of the country, based on the photo identification method (Olive Ridley Project photo-ID database, internal communication). Of these 221 individuals could be identified as adult females and 58 as males. The majority, 846 individuals, are considered juveniles (460) or could not be assigned clearly by the observer (431).

4.3 Population trend

Based on the historical and recent reports and estimates of nesting female green turtles, a clear population trend cannot be inferred due to the vastly different scales of data collection efforts (Frazier et al. 1984, Zahir 2000, Ali and Shimal 2016).

Reliable data from one green turtle index site, L.Gaadhoo, indicates a clear decrease in nesting activity of 70-78.3% (Frazier et al. 1984; Goodfellow et al. 2020; Olive Ridley Project nesting database, internal communication).

Current abundance estimates and models based on photo-ID data from 2016-2019 and capture-mark-recapture predict growing but only partially stable populations of green turtles based in the two atolls Lhaviyani and Laamu, which host the highest number of identified individual green turtles in the country (Hudgins, personal communication). These numbers must be considered with caution since they cover only a fraction of a generation length for this long-lived species.

4.4 Continuing decline in mature individuals?

Unknown – past decline in nesting females documented, future direction unclear

4.5 Extreme fluctuations?

No

4.6 Severely fragmented?

No – this is a migratory species which is known to easily cover distances greater than the distance between islands and atolls (see for example Marine Savers 2015, Christiansen et al. 2017, Hays et al. 2020).

5. Habitat and Ecology:

5.1 Summary

Green turtles spend most of their lives in the ocean, mainly in neritic areas for feeding and resting (seagrass beds, coral reefs (see for example Goatley et al. 2012; Lamont and Iverson 2018). Occasional journeys through pelagic areas occur during nesting migrations. Terrestrial areas, specifically beach areas, are used for nesting activity.

5.2 Systems (Terrestrial/Freshwater/Marine)

9. Marine Neritic -> 9.1 Pelagic, 9.8 Coral Reef, 9.9 Seagrass (Submerged); 12. Marine intertidal -> 12.2 Sand Shoreline and/or Beaches, Sand Bars, Spits, etc.; 13. Marine Coastal/Supratidal -> 13.3. Sand Dunes

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
9. Marine Neritic -> 9.1. Pelagic	Neonates and Juveniles	Suitable	-
9. Marine Neritic -> 9.8. Coral Reef	Resident	Suitable	-
9. Marine Neritic -> 9.9. Seagrass (Submerged)	Resident	Suitable	Yes
12. Marine Intertidal -> 12.2. Marine Intertidal - Sandy Shoreline and /or Beaches, Sand Bars, Spits, Etc	Resident	Suitable	-
13. Marine Coastal/Supratidal -> 13.3. Marine Coastal/Supratidal - Sand Dunes	Breeding Season	Suitable	Yes

5.3 Continuing Decline in Area, Extent, and/or Quality of Habitat?

- Decline in foraging habitat due to a loss of seagrass area (MUI 2019)
- Decline in resting habitat due to repeated decrease in coral reef quality through coral bleaching over multiple bleaching events in the past with uncertain potential of recovery (Ibrahim et al. 2016, Noo Raajje 2020)
- Decline in nesting habitat due to continuing coastal development

5.4 A Migratory Species?

Yes (see for example Marine Savers 2015, Christiansen et al. 2017, Hays et al. 2020)

6. Use and Trade:

Although it is illegal, this species is used locally as a delicacy and in pet trade. Green turtles are taken for personal consumption as food (Ali and Shimal 2016) and are also hunted in organized poaching trips (Petros and Riyaz, unpublished internal communication). Additionally, the practice of taking hatchlings from nests and keeping them as pets is still not uncommon in the country (Ahmed et al., 2019 and 2020). There are no records of international trade (import or export) of this species in the CITES trade database (CITES 2021)

7. Threats:

Green turtles face a variety of threats in the Maldives in the ocean as well as on land. Documented cases have identified bycatch, marine pollution and debris, and habitat loss (e.g., through seagrass removal) as threats for green turtles in the ocean. On land, threats include habitat loss due to development, improper waste disposal, beach degradation, light pollution and beach erosion, as well as a high incidence of poaching (nests and adults) and the use in pet trade (Ahmed et al. 2019, MUI 2019, Ahmed et al. 2020, Goodfellow et al. 2020, Afeef et al. 2021).

It is currently unclear which of the above listed threats is the most important risk factor influencing green turtle populations in the Maldives. Most likely, habitat loss and poaching have a severe impact, while bycatch is of lesser

importance since local fishing methods rely on targeted fishing practices and gear with no documented sea turtle bycatch (see e.g., Miller et al. 2017).

Under the IUCN – CMP Unified Classification of direct threats 2012 (Version 3.2), the following threats are applicable to this species.

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score	Stress
Residential & commercial development -> 1.1. Housing & urban areas	ongoing	Minority (<50%)	Unknown	Unknown	Species Disturbance
Residential & commercial development -> 1.2. Commercial & Industrial areas	ongoing	Majority (50- 90%)	Unknown	Unknown	Species Disturbance
Residential & commercial development -> 1.3. Tourism & recreation areas	ongoing	Majority (50- 90%)	Unknown	Unknown	Species Disturbance
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.1. Intentional use: (subsistence/small scale)	ongoing	Majority (50- 90%)	Causing/coul d cause fluctuations	Unknown	Species Mortality or Reduced Reproductive Success
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.4. Unintentional effects (large scale)	ongoing	Minority (<50%)	Unknown	Unknown	Species Mortality
6. Human intrusions & disturbance -> 6.1 Recreational activities	ongoing	Minority (<50%)	Causing/coul d cause fluctuations	Unknown	Species Mortality or Species Disturbance
11. Climate change & severe weather -> 11.5. Other impacts	ongoing	Whole (>90%)	Causing/coul d cause fluctuations	Unknown	Species Disturbance

8. Conservation and Research:

Limited information is available about the biology of green turtles in the Maldives in general, but initiatives focusing on biogeography, population ecology, reproductive biology and conservation are in place and continuously being extended (internal communication Environmental Protection Agency Maldives, documents available directly upon request; also see for example Olive Ridley Project 2021). The species has been protected under national legislature since 2016. It is listed under the CITES Convention Appendix I. The Maldives is also a signatory to the CITES convention since 2012, as well as to the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA Marine Turtle MOU).

8.1 Conservation actions in place

The conservation efforts for Green Turtles can be categorized into three categories namely; (1) global efforts, (2) Regional and (3) National efforts

(1) Global Efforts: Maldives is a party to three conventions with conservation efforts and recommendations to conserve the green turtle. These includes CITES, Convention on the Conservation of Migratory Species of Wild Animals (CMS) and Convention on Biological Diversity (CBD).

All the turtle under the family Cheloniidae including Green turtle is listed in the Appendix I of the CITES, which is considered as species that need highest level of protection. Hence, CITES prohibits international trade in specimens of these species except when the purpose of the import is not commercial, for instance for scientific research. In these exceptional cases, trade may take place provided it is authorized by the granting of both an import permit and an export permit (or re-export certificate).

The instrument for conservation of all sea turtles under the CMS in covered in the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA Marine Turtle MOU) Moreover, CMS has listed Green turtles under the Appendix I, where parties that are a Range State to a migratory species listed in Appendix I shall endeavour to strictly protect them by: prohibiting the taking of such species, with very restricted scope for exceptions; conserving and where appropriate restoring their habitats; preventing, removing or mitigating obstacles to their migration and controlling other factors that might endanger them

(2) Regional efforts: Indian Ocean Tuna Commission - IOTC Resolution 12/04 (Resolution 12/04 On the conservation of marine turtles | IOTC)

(3) National efforts, all species of marine turtles are protected under the Environment Protection and Preservation (4/93). According to the Turtle Protection Decree dated 4 April 2016, the following activities are prohibited:

- Capturing, harming, disturbing turtles
- Extraction of turtle eggs and harming/disturbing nests or any other habitats of turtles
- Keeping turtles as pets
- Trade of live animals and by products of turtles
- Research and rehabilitation without permit from EPA

Additionally, key habitats of green turtles such as L. Gaadhoo turtle nesting beach and surrounding sea grass area, B. Olhugiri island, B. Mendhoo island and Lh. Kuredhoo express are listed as marine protected areas under the Protected Areas Regulation (R-78/2018). In this regard, the Environmental Impact Assessment Regulation (R-27/2012) and Waste Management Regulation (R-58/2013) are also expected to play a role in mitigating and shielding from the impact of coastal zone development, as well as marine pollution.

At present there are at least 5 registered operational sea turtle rescue and rehabilitation centers, with 3 facilities providing veterinary services specializing in sea turtles. The different NGOs are actively engaged in sea turtle conservation awareness, especially in promoting best practices in sea turtle-human interactions.

8.2 Research in place

Various research efforts are in place including population monitoring and biogeography, nest monitoring and population health, social surveys for the perception and attitude towards sea turtle consumption and conservation in Maldives.

8.3 Conservation needs

The following conservation needs have been identified for the Maldives: Identification and protection of nesting and foraging hotspots for the species (e.g., inclusion in IOSEA-MoU site network), enforcement of existing legislation (e.g., harvest ban) and upcoming management plans (currently under development), improved conservation literacy for the public, increased cultural sensitivity in the implementation of conservation actions considering the social and cultural implications of the ban on harvesting a long-term food source and incorporation of any new research findings on e.g., distribution and nesting areas.

8.4 Research needs

Overall limited information is available, but specific research needs have been identified in the area of population genetics and migratory patterns (Ahmed et al. 2020), in depth analyses of the characteristics of green turtle habitats, and the impact of coastal development on foraging grounds and nesting sites, as well as understanding the socio-economic and cultural implications of conservation.

B. Assessment

9. CRITERION A

Criterion A

Generation Length 42.8 years (Seminoff 2004)

3 Generations 128.4 years

Reduction in population size? Yes
Start Date of Reduction 1980s
End Date of Reduction 2019

Rate of Reduction (%) 70-78.3% reduction in registered yearly nesting activity on

an index nesting beach

A1 -

Meets Criteria Thresholds? A2 Endangered

A3 -A4 -

a -

Reduction Based on Which Sub-

criteria?

b yesc yesd yes

e

Assessment Under Criterion A EN A2bcd

Narrative Justification for the Criterion A

Criterion A is based on observed, estimated, inferred or suspected reduction of the population size (i.e., number of mature individuals) (IUCN 2019). In the case of marine turtles, the annual reproductive effort (i.e., counts of nesting activities, nesting females and/or nests) is normally used to monitor population status and trends (NRC 2010). This method accounts only for a small percentage of the population, excluding males and non-nesting females, as well as juveniles even though these are not directly relevant for the current assessment. To include all sea turtles in the population, photo identification (photo-ID) data can be used to achieve an estimate closer to the actual population

size. Additionally, photo-ID data can provide an insight into population trends, reidentifying individual turtles over a great time span (Carpentier et al. 2016).

Criterion A requires estimating changes in population size over three generations (or a minimum of 10 years, according to whichever is longer). In the case of Green Turtles, generation length was estimated to be around 42.8 years (see Seminoff 2004), therefore data from roughly 128.4 years would be required to apply criterion A. Since Green Turtles are a very long-lived species, abundance data is not available for the entire required time frame. Therefore, it was assumed that the population abundance three generations ago was similar to the first observed abundance. This approach has been used for other assessments of other long-lived species such as the African Elephant *Loxondonta africana* (Blanc 2008), the Leatherback Turtle *Dermochelys coriacea* (Wallace et al. 2013), and the Loggerhead Turtle *Caretta caretta* (Casale and Tucker 2015), as well as for the Green Turtle *Chelonia mydas* regional assessment in the North Indian Ocean (Mancini et al. 2019).

From the available data two potential scenarios regarding the development of green turtle populations in the Maldives can be inferred:

Scenario 1: Including only estimates and total numbers of observed nests on an index beach into the calculations (Frazier et al. 1984, Goodfellow et al 2020, ORP Olive Ridley Project nesting data base, *internal communication*). In this case the population would be classified as Endangered under criterion A2 due to an estimated decline of 70-78.3%.

Scenario 2: Including only photo-ID data, which covers both sexes regardless of current reproductive activity and therefore provide a more complete representation of the resident turtle population but is only available for a short monitoring period of 3.5 years. In this case the population is projected to slowly increase and would be classified as Least Concern under criterion A.

Since green turtles are a species with a very long generation time, and Scenario 2 is based on a comparatively short data collection timeframe of less than a tenth of a generation, we have decided to apply scenario 1 so as not to underestimate the current threat level.

10. CRITERION B

Criterion B

Continuing

AOO Estimated 156 km² (Detail maps attached in the

Appendix)

EOO 90.000 km² (area of the EEZ Maldives)

B1 no

Meets Criteria Thresholds?

B2 Yes – Endangered

Severely Fragmented? No – migratory species

No. Locations 1

Threat used to calculate locations Habitat loss

(i) EOO -

(ii) AOO Yes (iii) Habitat Yes

Decline? (iv) Locations /

Subpopulations

(v) Mature Individuals

Extreme (i) EOO -Fluctuations? (ii) AOO --

(iii) Locations /
Subpopulations
(iv) Mature Individuals

Assessment Under Criterion B

EN B2ab(ii,iii)

Narrative Justification for the Criterion B

The subpopulation occupies the marine area of the Maldives from Ihavandhippolhu Atoll in the north to Addu Atoll in the south, spanning an area of roughly 90,000 km² equal to the countries Exclusive Economic Zone (EEZ). This distinctly exceeds the threshold of <20,000 km² for criterion B1.

When looking at the area of occupancy required for criterion B2, the smallest habitat for a critical stage in the life of the species is the available nesting habitat. Here it is estimated that this area is 156 km² as green turtles have been reported to nest on only a limited number of the country's islands, which meets the threshold of Endangered under criterion B2.

The green turtle population of the Maldives has undergone a severe decline in the past. Since a multitude of factors such as climate change, beach erosion and coastal development are negatively impacting the species' most important habitats throughout the entire country (nesting and foraging), we consider the species to be considered Endangered under criterion B2 specifically with a projected decline in area of occupancy and quality of habitat.

11. CRITERION C

Criterion C

Observed 280-700 mature individuals, estimated 560-No. Mature Individuals Unknown – past decline in nesting females Continuing Decline in Population Size? documented, future direction unclear Is Rate of Decline Known? Past decline documented (70-78.3 %) **Generation Length** 42.8 years Meets Thresholds for Rate of Yes Decline? C1 Rate of Decline (%) 70-78.3% in 1 generation Time Period of Decline 47 years (a) (i) No. Mature Individuals in **Each Subpopulation** (a) (ii) % Mature Individuals in one C2 Sub-population (b) Extreme Fluctuations in No. Mature Individuals?

Assessment Under Criterion C

NT C1

Narrative Justification for the Criterion C

For criterion *C*, the total number of adult females and males in the population is needed. We currently know of <300 mature individuals identified in the country with a sex ratio of 3.8:1 female to male. Additionally, over 430 individuals have been identified, but their life stage is currently unknown. Since these numbers were collected from surveys covering roughly 46% of the country, we estimate the total number of adult green turtles in the Maldives to be 560-1400.

This is below the threshold of <2,500 mature individuals for the Endangered category. The estimated past decline detailed in Criterion A markedly exceeds the threshold of 20 % within two generations for the Endangered category, but it is currently unclear whether that decline is currently still ongoing or projected to continue in the future. Therefore, the Maldivian Green Turtle population can be considered as Near Threatened under criterion C1.

12. CRITERION D

Criterion D

Assessment Under Criterion D VU D1

Narrative Justification for the Criterion D

The number of mature individuals is currently estimated to be 560-1400. The midpoint of this estimate meets the criteria threshold for the Vulnerable category under criterion D1.

13. CRITERION D

	Criterion E
Has a Quantitative Analysis Been Conducted?	No
Type of Quantitative Analysis	NA
Generation Length	NA
Probability of Extinction within 100 Years	NA
Probability of Extinction within 20 Years / 5 Generations (whichever is longer)	NA
Probability of Extinction within 10 Years / 3 Generations (whichever is longer)	NA
Assessment Under Crite	rion E DD

Narrative Justification for the Criterion E

No quantitative analysis was available at the time of the assessment.

14. PRELIMINARY ASSESSMENT

Preliminary Assessment EN A2bcd B2ab(ii,iii)

Up-list, Down-list, or No

Change?

No Change

Regional

Adjustment Justification for Regional

Adjustment

Not enough data is available to evaluate the potential rescue effects and interactions with other populations in the ocean basin, therefore no regional adjustment is

made.

Final Assessment EN A2bcd; B2ab(ii,iii)

Narrative Justification for Assessment

The current data on green turtles in the Maldives is still limited in various aspects, but specifically observations on the number of nests recorded annually on an index nesting beach indicate a decline in population size of 70-78.3% since at least the 1980s. This decline is on the upwards end of the Endangered category. Historical data is very limited, and estimates based on local knowledge point towards an even longer declining population trend. While more recent surveys give insight into total population size, clear trends for a long-lived species such as the green sea turtle cannot be stated with certainty. Additionally, the current estimate of available nesting habitat (AOO) for green turtles in the country is 156 km² which meets the threshold for the Endangered category under B2 and is potentially going to decline in the future due to coastal development and climate change. Since a multitude of threats including the major threats habitat loss and poaching are not projected to decline significantly or cease completely in the foreseeable future, green turtles were classified as Endangered under criteria A2bcd and B2ab(ii,iii) for the country

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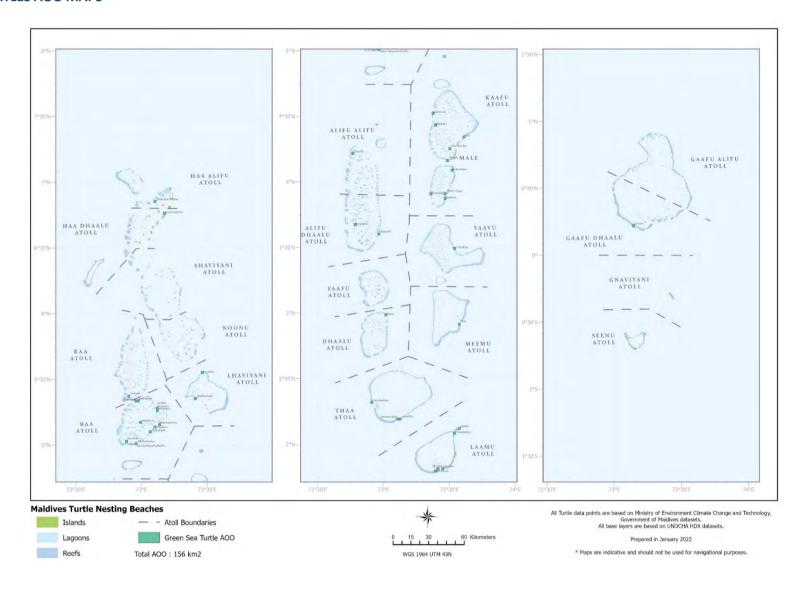
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Appendix

GREEN SEA TURTLES AOO MAPS



GREEN SEA TURTLES NESTING POINTS

