The Maldives National Red List of Threatened Species
Scope: National
Language: English

Diploastrea heliopora

Honeycomb coral

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Maldives National Red List Assessment: *Diploastrea heliopora*

A. Background Information

1. Assessment Information:

Assessor Name(s)	Philippa Roe / Maeesha Mohamed
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2. Taxonomic Information:

Scientific Name		*Diploastrea heliopora* (Lamarck, 1816)
Common Name (English)		Honeycomb coral
Common Name (Dhivehi)		
Taxonomy	Order	Scleractinia
	Sub-order	
	Family	Diploastrea
Taxonomic Notes		Only species within this genus

3. Geographic Range:

3.1 Summary of Global Distribution

Western and eastern Indian Ocean, northwest, western and central pacific (IUCN RedList)

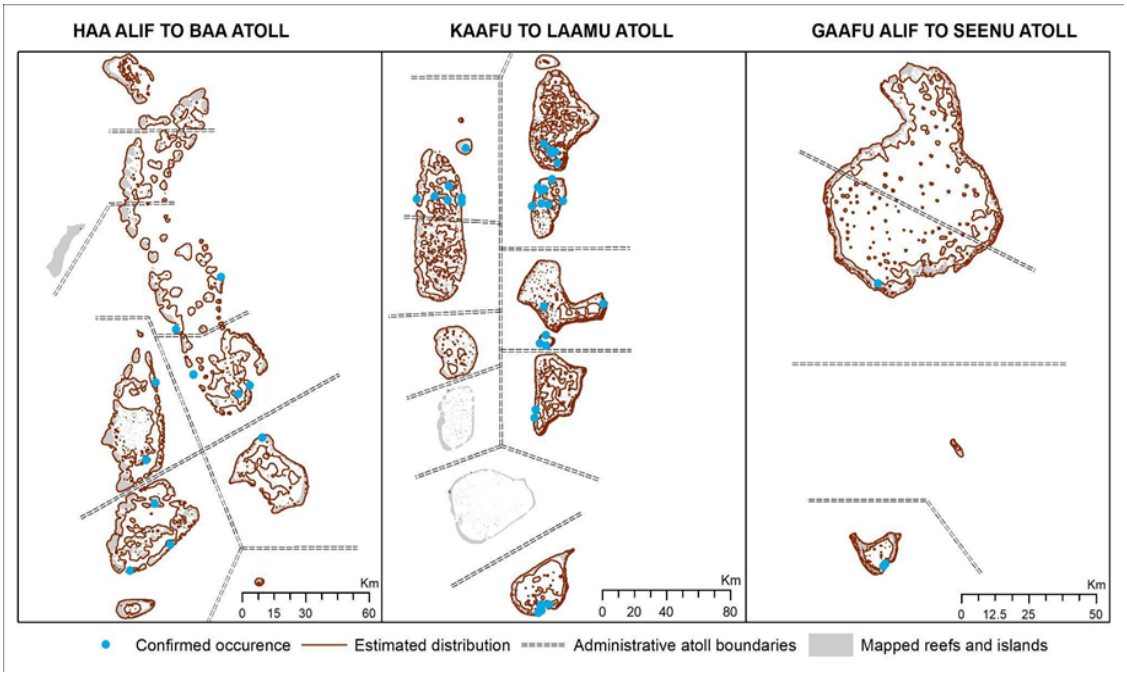
3.2 Countries of Occurrence

American Samoa; Australia; British Indian Ocean Territory; Cambodia; China; Comoros; Djibouti; Egypt; Eritrea; Fiji; Guam; India; Indonesia; Israel; Japan; Jordan; Kenya; Kiribati; Madagascar; Malaysia; Maldives; Marshall Islands; Mauritius; Mayotte; Micronesia, Federated States of ; Mozambique; Myanmar; Nauru; New Caledonia; Northern Mariana Islands; Palau; Papua New Guinea; Philippines; Réunion; Samoa; Saudi Arabia; Seychelles; Singapore; Solomon

Islands; Somalia; Sri Lanka; Sudan; Taiwan, Province of China; Tanzania, United Republic of; Thailand; Tokelau; Tonga; Tuvalu; United States Minor Outlying Islands; Vanuatu; Viet Nam; Wallis and Futuna; Yemen (IUCN RedList).

3.3 National Distribution

Exact species distribution is unknown but recorded in multiple and numerous occurrences within Maldives. Species estimates are based on available data, species characteristics and genus data, estimates of this species distributed from North to South of Maldives on the upper to mid reef slope.



4. Population:

4.1 Summary

Species specific population information is not available. Population estimates and distribution are based upon best available generic information and species characteristics and requirements.

4.2 Population Size

Species is widely recorded throughout Maldives with the exception of a few Atolls.

4.3 Population Trend

The national population trend for this genus is not known, but is likely to be decreasing. Short-term trends are highly variable due to impact and recovery from bleaching events.

4.4 Generation length

Estimates for coral generation lengths are based on Carpenter *et al.* 2008, as follows. The coral colony is considered to be the mature individual, as it typically lives, is injured, or dies as a unit. The average age of natural survival of a coral colony was defined as the average age of a mature individual, or one generation length. Based on available knowledge of coral species' biology and life history, this was determined to be 10 years. Therefore, population reductions are estimated over 30 years, representing three generation lengths.

4.5 Continuing Decline in Number of Mature Individuals?

Unknown.

4.6 Extreme Fluctuations?

No

4.7 Severely Fragmented?

No

5. Habitat and Ecology:

5.1 Summary

Rages from 0 - 30 m depth, and can inhabit high wave energy and sheltered environments, however, described as needing clear waters.

5.2 Systems (terrestrial / freshwater / marine)

Marine

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

Declines in habitat with disturbance of shallow reefs via dredging and land reclamation affect water clarity and remove habitat for this species. Additional declines to the reef ecosystem due to temperature induced bleaching events, in addition to further deterioration from structure breakdown and storms.

5.4 A Migratory Species?

No.

6. Use and Trade:

6.1 Is the species used or traded?

Unknown

6.2 Summary

Unknown

7. Threats:

7.1 Summary

The understanding of threats to this species are predominantly based on genus-level threats. Ecosystem threats include sedimentation and lowering light levels from dredging and land reclamation. This species is susceptible to sedimentation, and this form of threat is distributed throughout this species's distribution.

This species is known to be susceptible to coral bleaching. The projected date of onset of Annual Severe Bleaching (ASB) is the date after which the capacity of coral reefs to recover from repeated bleaching events is expected to significantly reduce - resulting in fundamental, permanent population changes (UNEP 2017). The calculation of ASB by UNEP (2020) is restricted to a 30 m depth, due to the dataset used for the spatial analysis.

We calculated the mean year of ASB onset, assuming 0° coral adaptation (UNEP 2020) to climate change, for areas occupied by the genus. A 0° adaptation (i.e. no adaptation) to climate change was applied as a precautionary approach:

- as the capacity of coral to adapt to climate change is not yet well understood
- as there are other climate change impacts that may compound population decline and affect population refuges, and

- to account for impacts from coastal development that could potentially exacerbate the effect of bleaching prompted by climate change.

Based on this analysis, *D. heliopora* is expected to undergo ASB starting in 2040.

Other threats include further ecosystem breakdown, induced by fishing pressure and breakdown of the shallow reef-impacts unknown. In shallow reefs reef breakdown causes further damage with storms damaging surviving corals with rubble.

7.2 Major Threats to the Species (using IUCN Threat Classification Scheme)

Residential & commercial development:

1.1. Housing & urban areas
Timing: Ongoing
Stresses:
1. Ecosystem/Community stresses
1.1. Ecosystem conversion
1.2. Ecosystem degradation
1.3. Indirect ecosystem effects
2. Species stresses
2.2. Species disturbance
2.3. Indirect species effects
2.3.7. Reduced reproductive success

1.2. Commercial & industrial areas
Timing: Ongoing
Stresses:
1. Ecosystem/Community stresses
1.1. Ecosystem conversion
1.2. Ecosystem degradation
1.3. Indirect ecosystem effects
2. Species stresses
2.2. Species disturbance
2.3. Indirect species effects
2.3.7. Reduced reproductive success

1.3. Tourism & recreational areas
Timing: Ongoing
Stresses:
1. Ecosystem/Community stresses
1.1. Ecosystem conversion
1.2. Ecosystem degradation
1.3. Indirect ecosystem effects
2. Species stresses
2.2. Species disturbance
2.3. Indirect species effects
2.3.7. Reduced reproductive success

7. Natural system modifications:

7.3. Other ecosystem modifications
Timing: Ongoing
Stresses:
1. Ecosystem/Community stresses
1.1. Ecosystem conversion
1.2. Ecosystem degradation
1.3. Indirect ecosystem effects
2. Species stresses
2.2. Species disturbance
2.3. Indirect species effects
2.3.7. Reduced reproductive success

11. Climate change & severe weather:

11.1. Habitat shifting & alteration
Timing: Ongoing

Stresses:
1. Ecosystem/Community stresses
1.2. Ecosystem degradation
2. Species stresses
2.1. Species mortality
2.2. Species disturbance
2.3. Indirect species effects
2.3.2. Competition
2.3.7. Reduced reproductive success

11.2. Temperature extremes
Timing: Ongoing
Stresses:
1. Ecosystem/Community stresses
1.2. Ecosystem degradation
2. Species stresses
2.1. Species mortality
2.2. Species disturbance
2.3. Indirect species effects
2.3.2. Competition
2.3.7. Reduced reproductive success

11.4. Storms & flooding
Timing: Ongoing
Stresses:
1. Ecosystem/Community stresses
1.2. Ecosystem degradation

7.3 Species vulnerability modifiers

Coral abundance and distribution data is only available at the genus level. Species characteristics were used to evaluate how susceptible each species is to treats. This data was gathered from the IUCN SSC Coral Working Group's Global Traits Database, and available literature. Each species was assigned a vulnerability score for each trait (3 = high vulnerability; 2 = medium vulnerability; 1 = low vulnerability). This species was scored as follows.

Trait	**Vulnerability score**
Susceptibility to bleaching	3
Resistance to bleaching	3
Recovery from bleaching or disease	3
Resistance to disease	2
Susceptibility to predation	2
Recovery from sedimentation	2
Resistance to sedimentation	2
Susceptibility to sedimentation	2
Average	*2*

8. Conservation and Research:

8.1 Summary

This species is listed as 'Least Concern' on the IUCN RedList of Threatened species. Collection, killing and export of live and dead Scleractinia corals is illegal under Maldivian fisheries law. Distribution of the species falls under multiple national MPAs though these do not have effective management.

Species specific surveys would be needed to better manage and protect this species, including understanding distribution and impact of shallow-reef threats to the outer reef.

8.2 Conservation Actions/Research in Place

Globally, as a coral the species is included within CITES Appendix II. It is listed as "Least concern" within the IUCN Red List of Threatened Species.
Nationally, collection, killing, and export of both live and dead Scleractinia corals (under phylum Cnidaria) are illegal in the Maldives under the Maldives Fisheries Law 2020/R-75. Marine protected areas are established throughout Maldives; however, they do not have effective management plans or procedures, therefore conservation of the species and genera cannot be assumed.

8.3 Conservation Actions Needed

Despite laws and regulations protecting coral species within the country, implementation of such laws and regulations are a challenge. There is a need to create infrastructure and capacity that would enable relevant laws and regulations to be enforced whilst educating the general public that they exist. Educational and training needs extend to more educational opportunities in the marine field as well as skill training opportunities that can support research, further education, institutional development, awareness and communication efforts. Moreover, with the spatial distribution of maldivian reefs and the corals that are found within them, there is an urgent need to foster intra-governmental as well as inter-agency and inter-organizational cooperation and partnerships to mediate limitations related to capacity and resources. Areas of high abundance of specific species along with areas of high coral cover and resilience need to be identified and managed if not fully protected to ensure sustainable use and longevity. Management includes mitigating impacts from coastal development and resolving conflict of multi-use resources. Further, with increasing interest in restoration of reefs, there is a need to properly manage species harvest for projects to ensure that wild stocks are not decimated and species are able to recover.

1. Land/water protection
   1.1. Site/area protection
   1.2. Resource & habitat protection
2. Land/water management
   2.1. Site/area management
   2.3. Habitat & natural process restoration
3. Species management
   3.1. Species management
      3.1.1. Harvest management
   3.2. Species recovery
4. Education & awareness
   4.1. Formal education
   4.2. Training
   4.3. Awareness & communications
5. Law & policy
   5.3. Private sector standards & codes
   5.4. Compliance & enforcement
      5.4.1. Scale unspecified
7. External capacity building
   7.1. Institutional & civil society development
   7.2. Alliance & partnership development
   7.3. Conservation finance

8.4 Research Needed

1. Research
   1.2. Population size, distribution and past trends
   1.3. Life history and ecology

1.5. Threats
1.6. Conservation actions
3. Monitoring
3.1. Population trends
3.4. Habitat trends

B. Assessment

9. CRITERION A

Criterion A

Generation Length		10 years
3 Generations		30 years
Reduction in population size?		Yes
Start Date of Reduction		2022
End Date of Reduction		2052
Rate of Reduction (%)		80-90%
Meets Criteria Thresholds?	A1	-
	A2	-
	A3	Projected 80-90% decline over the next 3 generations (CR A3)
	A4	-
Reduction Based on Which Sub-criteria?	a	-
	b	-
	c	Decline in habitat quality associated with impacts of climate change
	d	-
	e	Mortality due to repeated bleaching
Assessment Under Criterion A		**CR A3ce**

Reasoning:

Our assessment of future population reduction is based on the projected date of onset of ASB. *D. heliopora* is expected to undergo ASB starting in 2040 (less than three generations from the present). The species ranges between 0-30 m, meaning 100% of its population is impacted.

Depth and depth range is considered in our assessment, as populations at depths shallower than 30 m are expected to experience greater temperature fluctuations and extreme temperatures (Riegl and Piller 2003), and therefore decline more quickly.

The species is highly vulnerable to bleaching, with high susceptibility and low resistance based on literature review and scientific expertise. Therefore, total population decline is anticipated over 100% of the species' depth range.

Therefore, this species is projected to experience a reduction of 80-90% between 2022 and 2052 (three generations in the future).

10. CRITERION B

Criterion B

AOO		-
EOO		-
Meets Criteria Thresholds?	B1	-
	B2	-
Severely Fragmented?		-
No. Locations		-
Threat used to calculate locations		-
Continuing Decline?	(i) EOO	-
	(ii) AOO	-
	(iii) Habitat	-
	(iv) Locations / Subpopulations	-
	(v) Mature Individuals	-

Extreme Fluctuations?	(i) EOO	-
	(ii) AOO	-
	(iii) Locations / Subpopulations	-
	(iv)Mature Individuals	-

Assessment Under Criterion B DD

11. CRITERION C

Criterion C

No. Mature Individuals	Unknown
Continuing Decline in Population Size?	-
Is Rate of Decline Known?	-
Generation Length	-

C1	Meets Thresholds for Rate of Decline?	-
	Rate of Decline (%)	-
	Time Period of Decline	-
C2	(a) (i) No. Mature Individuals in Each Subpopulation	-
	(a) (ii) % Mature Individuals in one Sub-population	-
	(b) Extreme Fluctuations in No. Mature Individuals?	-

Assessment Under Criterion C DD

12. CRITERION D

Criterion D

No. Mature Individuals		-
Meets Criteria Thresholds?		-
VUD2	AOO	-

No. Locations	-
Plausible Future Threat That Would Quickly Drive Taxon to CR or EX	-
Plausible Future Threat That Would Quickly Drive Taxon to VU or EN	-

Assessment Under Criterion D DD

13. CRITERION E

Criterion E

Has a Quantitative Analysis Been Conducted?	No
Type of Quantitative Analysis	-
Generation Length	-
Probability of Extinction within 100 Years	-
Probability of Extinction within 20 Years / 5 Generations (whichever is longer)	-
Probability of Extinction within 10 Years / 3 Generations (whichever is longer)	-

Assessment Under Criterion E DD

14. Preliminary and Final Assessment

Preliminary Assessment		**CR A3ce**
Regional Adjustment	Up-list, Down-list, or No Change?	No change
	Justification for Regional Adjustment	No likely interaction with individuals outside the region
Final Assessment		**CR A3ce**

Narrative Justification for Assessment:

Diploastrea heliopora is known from almost all the atolls of the Maldives, with a depth range of 0-30 m. Coral species found at depths of less than 30 m are more exposed to extreme and fluctuating water temperatures associated with the impacts of climate change, which can lead to population reductions.

We anticipate that this species will undergo a severe decline in the future based on the impacts of climate change on its local range. Based on published climate model-based bleaching assessments published by UNEP (2017, 2020), Annual Severe Bleaching (ASB) is likely to commence in 2040 over this species' distribution, affecting 100% of its depth range. ASB reduces corals' ability to recover from repeated bleaching events, resulting in fundamental, permanent population changes (UNEP 2017). ASB is expected to constitute at least a 80-90% reduction in population size. Therefore, we project a 80-90% population reduction over the next three generations (2022-2052), resulting from degradation in habitat quality associated with the impacts of climate change. This meets the threshold for CR A3c.

C. References

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