



## ***Plerogyra sinuosa***

**Bubble coral**

**Basheer, A.**

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# Maldives National Red List Assessment: *Plerogyra sinuosa*

## A. Background Information

### 1. Assessment Information

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Date of Assessment	18 February 2022
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### 2. Taxonomic Information

Scientific Name	<i>Plerogyra sinuosa</i> (Dana, 1846)	
Common Name (English)	Bubble coral	
Common Name (Dhivehi)	No species name	
Taxonomy	Order	Scleractinia
	Sub-order	-
	Family	Euphyllidae
Taxonomic Notes	-	

### 3. Geographic Range

#### 3.1 Summary of Global Distribution

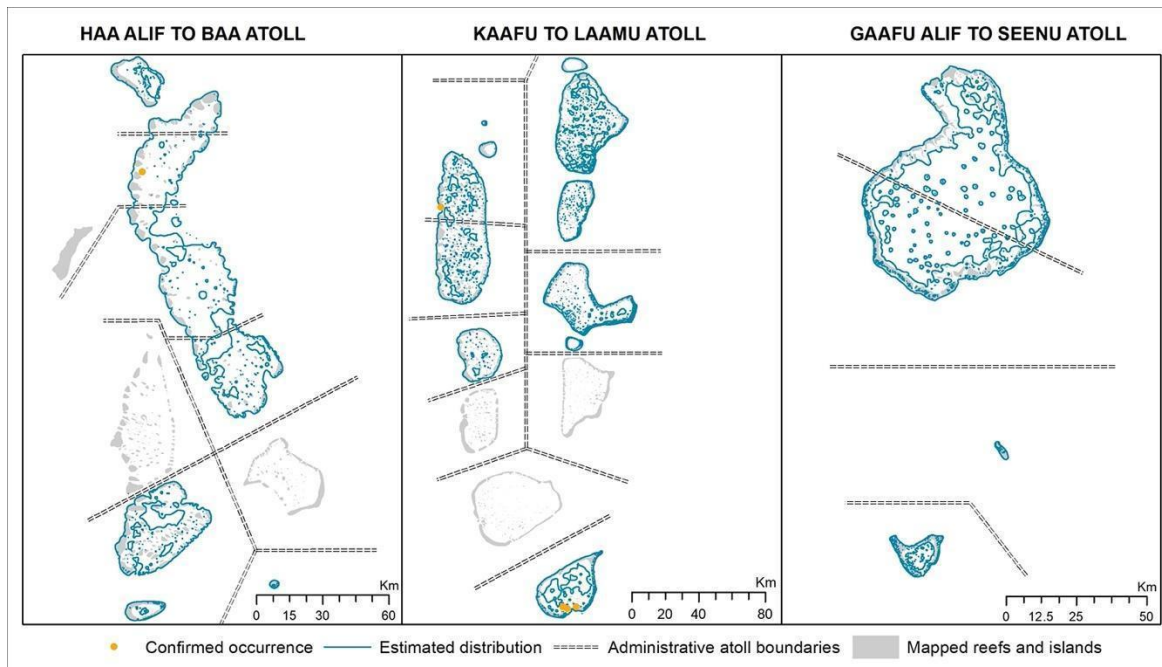
In the Indo-West Pacific, this species is found in the Red Sea and the Gulf of Aden, the southwest and northern Indian Ocean, the central Indo-Pacific, Australia, South-east Asia, Japan and the East China Sea, the oceanic West Pacific, and the central Pacific.

#### 3.2 Countries of Occurrence

American Samoa; Australia; British Indian Ocean Territory; Cambodia; Comoros; Cook Islands; Djibouti; Egypt; Eritrea; Fiji; French Polynesia; Guam; India; Indonesia; Israel; Japan; Jordan; Kenya; Kiribati; Madagascar; Malaysia; Maldives; Marshall Islands; Mauritius; Mayotte; Micronesia, Federated States of; Mozambique; Myanmar; Nauru; New Caledonia; Niue; 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

### 3.3 National distribution

Although exact species distribution is unknown. It has only been recorded in 2 atolls in Maldives. However, it is estimated it can be found in most of the atolls in Maldives.



## 4. Population

### 4.1 Summary

Species-specific population information, including exact population size, is not available. Population estimates and distribution are derived based on best available generic information.

### 4.2 Population Size

The global population size is generalized as “common” (Devantier, Turak and Szava-Kovats 2020). National population size is unknown.

### 4.3 Population Trend

Global and national past population trends are unknown. Future population trend is likely to be decreasing.

### 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. Population assumed to be cohesive based on generic distribution although degree of connectivity between atolls is unknown.

### 5. Habitat and Ecology:

#### 5.1 Summary

These species are especially found in protected habitats such as crevices and overhangs and can also be found in turbid areas (Veron and Pichon 1980); (Veron et, al;2000).

#### Systems (terrestrial / freshwater / marine)

Marine

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

Yes. There is continuous loss of area, extent and habitat quality stemming from coastal development projects and increase in frequency and magnitude of climate change impacts including extreme temperature fluctuations.

#### A Migratory Species?

No

### 6. Use and Trade:

#### Is the species used or traded?

Yes

#### Summary

The species is harvested for use in coral nurseries and illegally harvested for aquarium trade. This harvesting may represent a threat to the species.

### 7. Threats:

#### Summary

This species is known to be vulnerable to bleaching and diseases. The species is also affected by overall declines in ecosystem and habitat quality. Therefore, as the species is found in shallow reef habitats (<15 m), it is expected that the species is particularly vulnerable to the impacts of coastal development projects and of climate change.

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, *P. sinuosa* is expected to undergo ASB starting in 2039.

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

### 1. 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*

5. Biological resource use:

5.4. Fishing & harvesting aquatic resource

5.4.3. Unintentional effects: subsistence/small scale

*Timing: Ongoing*

*Stresses:*

1. *Ecosystem/Community stresses*

1.2. *Ecosystem degradation*

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*

8. Invasive & other problematic species, genes & disease:

8.2. Problematic native species/diseases

## 8.2.1. Unspecified species/disease

### 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*

## 9. Pollution:

### 9.1. Domestic & urban wastewater

#### 9.1.1. Sewage

*Timing: Ongoing*

*Stresses:*

#### 1. *Ecosystem/Community stresses*

##### 1.2. *Ecosystem degradation*

#### 9.1.2. Run-off

*Timing: Ongoing*

*Stresses:*

#### 1. *Ecosystem/Community stresses*

##### 1.2. *Ecosystem degradation*

### 9.4. Garbage and solid waste

*Timing: Ongoing*

*Stresses:*

#### 1. *Ecosystem/Community stresses*

##### 1.2. *Ecosystem degradation*

## 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

## 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	3
Susceptibility to predation	2
Recovery from sedimentation	1



Resistance to sedimentation	1
Susceptibility to sedimentation	1
<i>Average</i>	2

## 8. Conservation and Research:

### Summary

The species is globally listed as “Near Threatened” on the IUCN Red List of Threatened Species and is included within CITES Appendix II. Collection, killing and export of live and dead scleractinian corals is illegal under Maldivian fisheries law. Distribution of the species falls under multiple national MPAs, though not all the MPAs are properly managed.

Species distribution and population information would be required to better manage and protect the species especially as it is a popular target for propagation products and for aquaria. Further species-specific research for threats would

### Conservation Actions/Research in Place

Globally, as a coral the species is included within CITES Appendix II. It is listed as “Vulnerable” within the IUCN Red List of Threatened Species.

Nationally, collection, killing, and export of both live and dead scleractinian corals (under phylum Cnidaria) are illegal in the Maldives under the Maldives Fisheries Law 2020/R-75. The distribution of the genus, and likely the species, overlaps multiple MPAs including Baa atoll biosphere reserve SAMPA.

### 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

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 reduction in population size of 80-90% over the next three 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). *Pterogyra sinuosa* is expected to experience ASB starting in 2039.

The species ranges between 5 m and 20 m. 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.

Therefore, total population decline is anticipated over 100% of the species' depth range. In addition, this species is considered to have low resistance to bleaching, with high susceptibility to the same threat based on literature review and scientific expertise. Similarly, it is susceptible to diseases and predation.

Therefore, this species is projected to undergo a population reduction of 80-90% over the next three generations (2022-2052).

## 10. CRITERION B

### Criterion B

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

Although *Plerogyra sinuosa* is known from only two atolls in the Maldives, it is likely more widespread, with a depth range of 5-20 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. This species is known to be susceptible to threats including bleaching and disease.

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), it is estimated that Annual Severe Bleaching (ASB) is likely to commence in 2039 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.

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