



***Leptoseris hawaiiensis***  
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**Roe, P.**

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# Maldives National Red List Assessment: *Leptoseris hawaiiensis*

## A. Background Information

### 1. Assessment Information:

Assessor Name(s)	Philippa Roe
Date of Assessment	17 February 2022
Contributors	Hana Amir, Simone Montano, Ilham Mohamed
Institutional contributors	Ministry of Environment, Climate Change and Technology; Maldives Marine Research Institute; IUCN Project REGENERATE; Maldives Allen Coral Atlas; Noo Raajje; Six Senses Laamu
Facilitators	James Tallant
Reviewers	Janice Chanson, Maldives Marine Research Institute

### 2. Taxonomic Information:

Scientific Name	<i>Leptoseris hawaiiensis</i> (Vaughan 2907)	
Common Name (English)	Leptoseris hawaiiensis	
Common Name (Dhivehi)	-	
Taxonomy	Order	Scleractinia
	Sub-order	-
	Family	Agariciidae
Taxonomic Notes	-	

### 3. Geographic Range:

#### 3.1 Summary of Global Distribution

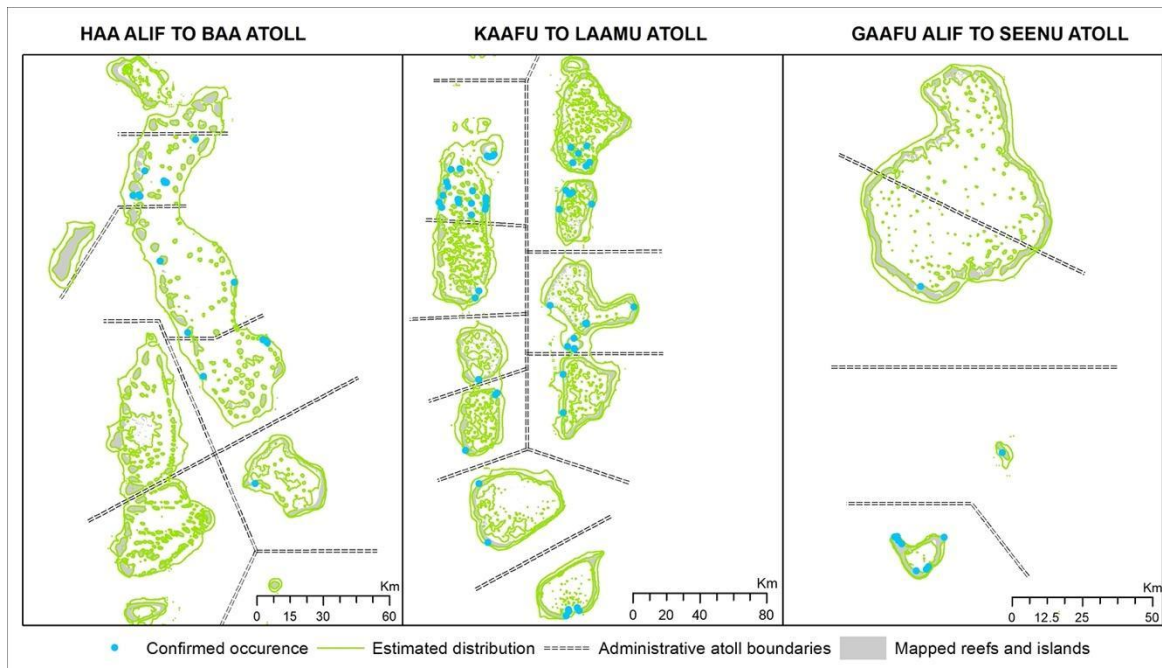
This species is widely distributed including the Red Sea and the Gulf of Aden, the southwest and central Indian Ocean, the central Indo-Pacific, tropical Australia, southern Japan and the South China Sea, the oceanic west Pacific, central Pacific, the Hawaiian Islands and Johnston Atoll, and the eastern Pacific. (IUCN RedList)

#### 3.2 Countries of Occurrence

American Samoa; Australia; British Indian Ocean Territory; Cambodia; Colombia; Comoros; Cook Islands; Costa Rica; Djibouti; Egypt; El Salvador; Eritrea; Fiji; French Polynesia; Guadeloupe; Guam; Honduras; India; Indonesia; Israel; Japan; Jordan; Kenya; Kiribati; Madagascar; Malaysia; Maldives; Mauritius; Mayotte; Mexico; Micronesia, Federated States of ; Mozambique; Myanmar; New Caledonia; Nicaragua; Niue; Norfolk Island; Northern Mariana Islands; Palau; Panama; 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

Although exact species distribution is unknown, the species is recorded on few occurrences within Maldives (Bigot & Amir, 2021; NooRaajje 2021) and genera throughout Maldives (Jimenez *et al.*2012) but is uncommon. Species estimates are based on species characteristics and genus data, estimates this species distributed from North to South of Maldives on deep reefs and steep slopes.



## 4. Population:

### 4.1 Summary

Species specific population information, including exact population size and trends, is not available. Population estimates and distribution are derived based upon best available for species and genus, and species characteristics and requirements.

### 4.2 Population Size

Species is recorded on few occurrences within Maldives (Bigot & Amir, 2021;) and genera throughout Maldives (Jimenez *et al.*2012) but is uncommon.

A ten-year generic mean, the mean percent cover of the genus over a ten year period of time, was calculated for each genus. This was used as a proxy for the potential species population size.

The ten-year generic percent cover mean derived from available data is  $1.48 \pm 0.25\%$  ( $\pm$  S.E). Recent estimates indicate genus cover is between 0.08 – 3.75% across most atolls with the highest percentage cover in Ari and Baa atolls (Noo Raajje 2021). Therefore, based on generic estimates the species population may vary between ~0.081 to ~3.75% cover assuming differing levels of dominance in a community.

### 4.3 Population Trend

The global population of this species is decreasing. The national past population trend is not known. The future population trend is likely to be decreasing.

This species may be resistant to temperature induced bleaching due to its deep habitat preference. This species is also less susceptible to sedimentation than other species as it is found on steep slopes (Berkelmans, Jones & Schaffelke, 2012), however water clarity following dredging may impact light availability.

### 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

Species is found on mesophotic coral reefs predominantly below 60 m (Luck *et al.*, 2013), and rarely found above 10 m (Turak & DeVantier, 2019), and has been recorded at 90 to 165 m depth (Pochon *et al.*, 2015; Maragos & Jokiel, 1986). This species is found mostly on steep reef slopes.

#### 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, but habitat is not directly removed for this species. Additional declines to the shallow reef ecosystem due to temperature induced bleaching events, in addition to further deterioration from structure breakdown and storms but are yet to be assessed for impacts on deeper reefs.

#### 5.4 A Migratory Species?

No.

### 6. Use and Trade:

#### 6.1 Is the species used or traded

No

#### 6.2 Summary

Highly unlikely due to depth preference

### 7. Threats:

#### 7.1 Summary

Species specific threats are unknown, and estimates are made based upon generic threats in addition to species characteristics and traits. Ecosystem threats include sedimentation, this species is not susceptible to smothering but lowering light levels from dredging and land reclamation. This genus is not particularly susceptible to coral bleaching due to depth preference.

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.

Other threats include further ecosystem breakdown, induced by fishing pressure and breakdown of the shallow reef- impacts are unknown for the deeper reef system.

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

### Residential & commercial development:

#### 2.3. Housing & urban areas

Timing: Ongoing

Stresses:

##### 2. Ecosystem/Community stresses

###### 2.3. 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:

##### 2. Ecosystem/Community stresses

###### 2.3. 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:

##### 2. Ecosystem/Community stresses

###### 2.3. 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:

##### 2. Ecosystem/Community stresses

###### 2.3. 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

### 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	1
Recovery from bleaching or disease	3
Resistance to disease	2
Susceptibility to predation	1
Recovery from sedimentation	2
Resistance to sedimentation	1
Susceptibility to sedimentation	1
<i>Average</i>	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 deterioration on deep reefs

### 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 (%)	20-30%
Meets Criteria Thresholds?	A1
	A2
	A3 NT (nearly meets VU A3)
	A4
Reduction Based on Which Sub-criteria?	a
	b
	c Habitat degradation associated with the impacts of climate change
	d
	e

**Assessment Under Criterion A** NT (nearly meets VU A3)

**Reasoning:** Our assessment of future population reduction is based on the projected date of onset of ASB. *L. hawaiiensis* is expected to experience ASB starting in 2041. However, the species ranges between 10 m - 400 m and therefore only a small



proportion of its population inhabits the 0-30 m depth range.

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. Corals found at greater depths are likely to be less impacted by bleaching.

This species is therefore less vulnerable to bleaching, based on literature review and scientific expertise. Therefore, total population decline is anticipated over approximately 5% of the species' depth range.

Furthermore, being found on steep slopes, and in deeper waters, this species is less vulnerable to impacts of sedimentation from dredging and land development.

Therefore, although this species is projected to experience a population reduction associated with the impacts of climate change, this reduction will be much less than that of corals found exclusively in shallow waters. We project a 20-30% reduction over the next three generations (2022-2052), nearly meeting the threshold for VU A3.

## 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		Unknown
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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 NT (nearly meets VU A3c)

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 NT (nearly meets VU A3c)

#### Narrative Justification for Assessment:

Although uncommon, *Leptoseris hawaiiensis* is found on deep reefs and steep slopes throughout the atolls of the Maldives, with a depth range of 10-400 m. Coral species found predominantly found at depths of greater than 30 m are less exposed to extreme and fluctuating water temperatures associated with the impacts of climate change.

Although the current population size and past rate of decline are not known, it is anticipated that the population will undergo a 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) will commence in the year 2041 over this species' distribution. However, only a small proportion of this species' depth range is likely to be seriously impacted by bleaching, and therefore the population reduction is expected to be much lower than that of species found in shallower waters.

Furthermore, being found on steep slopes and in deeper waters, this species is less vulnerable to impacts of sedimentation due to dredging and land development.

Therefore, although this species is projected to experience a population reduction associated with the impacts of climate change, this reduction will be much less than that of corals found exclusively in shallow waters. We project a 20-30% reduction over the next three generations (2022-2052), nearly meeting the threshold for VU A3c.

## REFERENCES

Biggot, L., & Amir, H. (2012). *Scleractinia corals of Baa Atoll (Maldives): First checklist and overview of stony corals community structure*.

Carpenter, K.E., Abrar, M., Aeby, G., Aronson, R.B., Banks, S., Bruckner, A., Chiriboga, A., Cortés, J., Delbeek, J.C., DeVantier, L., Edgar, G.J., Edwards, A.J., Fenner, D., Guzmán, H.M., Hoeksema, B.W., Hodgson, G., Johan, O., Licuanan, W.Y., Livingstone, S.R., Lovell, E.R., Moore, J.A., Obura, D.O., Ochavillo, D., Polidoro, B.A., Precht, W.F., Quibilan, M.C., Reboton, C., Richards, Z.T., Rogers, A.D., Sanciangco, J., Sheppard, A., Sheppard, C., Smith, J., Stuart, S., Turak, E., Veron, J.E.N., Wallace, C., Weil, E. and Wood, E. 2008. One-Third of Reef-Building Corals Face Elevated Extinction Risk from Climate Change and Local Impacts. *Science*. 25 July 2008: 560-563. DOI: 10.1126/science.1159196. Supporting online material: [www.sciencemag.org/cgi/content/full.1159196](http://www.sciencemag.org/cgi/content/full.1159196).

Jimenez, H., Bigot, L., Bourmaud, C., Chabanet, P., Gravier-Bonnet, N., Hamel, M. A., Payri, C., Mattio, L., Menou, J. L., Naeem, S., Rilwan, Y., Sattar, S., Scott, L., Shiham, A., Vigliola, L., & Andréfouët, S. (2012). Multi-taxa coral reef community structure in relation to habitats in the Baa Atoll Man and Biosphere UNESCO Reserve (Maldives), and implications for its conservation. *Journal of Sea Research*, 72, 77–86. <https://doi.org/10.1016/j.seares.2012.04.011>

Luck, D. G., Forsman, Z. H., Toonen, R. J., Leicht, S. J., and Kahng, S. E. (2013). Polyphyly and hidden species among Hawai'i's dominant mesophotic coral genera, *Leptoseris* and *Pavona* (Scleractinia: Agariciidae). *Peer J*. 1:e132. doi: 10.7717/peerj.132

Maragos, J.E. and Jokiel, P.L., 1986. Reef corals of Johnston Atoll: one of the world's most isolated reefs. *Coral Reefs*, 4(3), pp.141-150.

Pochon, X., Forsman, Z.H., Spalding, H.L., Padilla-Gamiño, J.L., Smith, C.M. and Gates, R.D., 2015. Depth specialization in mesophotic corals (*Leptoseris* spp.) and associated algal symbionts in Hawai'i. *Royal Society open science*, 2(2), p.140351.

Turak, E. and DeVantier, L., 2019. Reef-building corals of the upper mesophotic zone of the central Indo-west Pacific. In *Mesophotic coral ecosystems* (pp. 621-651). Springer, Cham.

UNEP 2017. *Coral Bleaching Futures - Downscaled projections of bleaching conditions for the world's coral reefs, implications of climate policy and management responses*. United Nations Environment Programme, Nairobi, Kenya

UNEP 2020. *Projections of future coral bleaching conditions using IPCC CMIP6 models: climate policy implications, management applications, and Regional Seas summaries*. United Nations Environment Programme, Nairobi, Kenya