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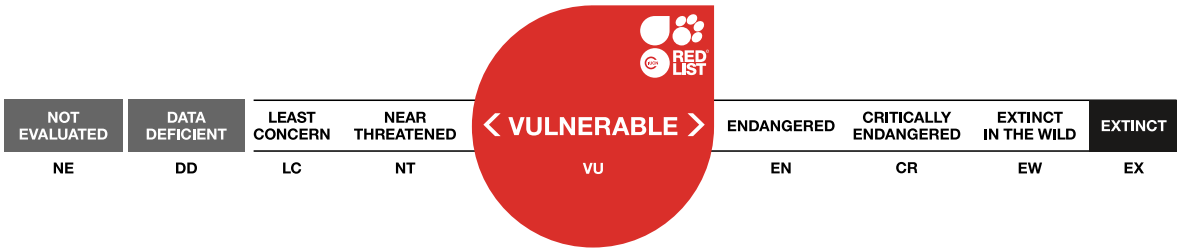
Ramalina fragilis, Fragile Ramalina

Assessment by: Bungartz, F. & Parrinello, C.



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Taxonomy

Kingdom	Phylum	Class	Order	Family
Fungi	Ascomycota	Lecanoromycetes	Lecanorales	Ramalinaceae

Scientific Name: *Ramalina fragilis* Aptroot & Bungartz

Common Name(s):

- English: Fragile Ramalina
- Spanish; Castilian: Ramalina Frágil

Taxonomic Source(s):

Index Fungorum Partnership. 2016. Index Fungorum. Available at: http://www.indexfungorum.org. (Accessed: 09 May 2016).

Assessment Information

Red List Category & Criteria: Vulnerable A3c ver 3.1

Year Published: 2021

Date Assessed: February 10, 2021

Justification:

Ramalina fragilis is the rarest one of four endemic Galapagos species in the genus *Ramalina*. In the Galapagos this genus is unusually species diverse and extremely abundant on shrubs and trees from the coastal zone into the transition zone. Trees and shrubs from afar often have a greenish-yellow colour because they are abundantly draped by usnic-acid coloured *Ramalina* species. *Ramalina fragilis* is, however, one of the few rock-dwelling Galapagos *Ramalina*. It is in many respects unusual: a pale species that easily breaks apart (thus its name). Growing on rock, particularly the coastal sites are susceptible to flash floods during El Niño years and the fragile thalli offer little resistance against erosion. Some sites at very low altitude, in the immediate vicinity of the sea and may also be subject to exceptionally high tides, and these habitats may be affected by sea-level rise. Future declines in the population size, area of occupancy, and habitat quality of up to 40% over the next 45 years (three generations) are suspected due to extreme El Niño events, thus the species is assessed as Vulnerable (A3c).

Geographic Range

Range Description:

This species is one of four endemic *Ramalina* species in the Galapagos (see Aptroot and Bungartz 2007). Presently, it is known from the coastal, dry, and transition zones on 6 different islands [Española (incl. Gardner), Floreana, Pinzón, San Cristóbal, Santa Fé, Isabela (Volcán Sierra Negra)], at a total of 20 localities (among those several Galapagos lichen diversity hotspots: Isla Santa Fé, Isla Pinzón, lava cliff above Post Office Bay on Floreana).

Country Occurrence:

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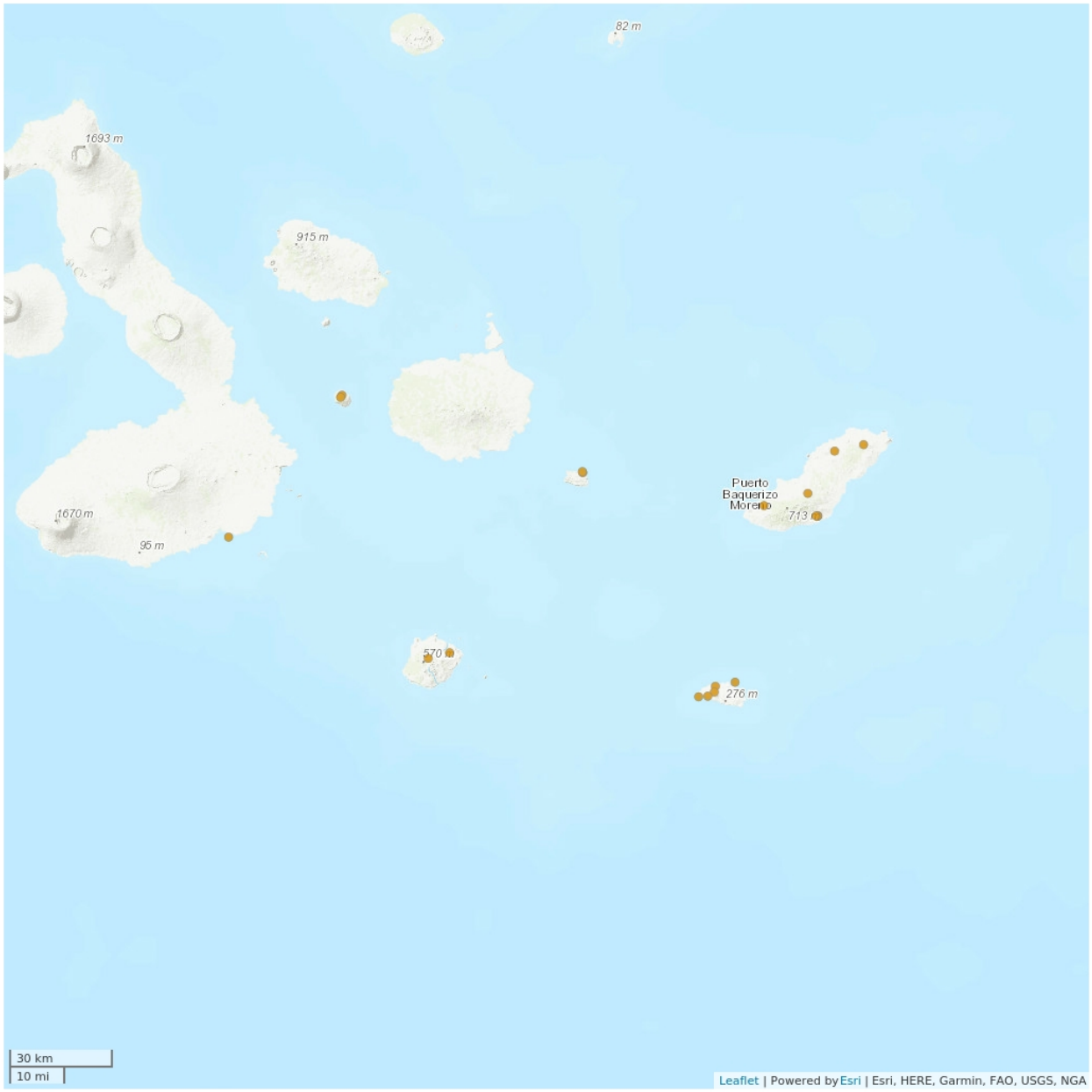
Native, Extant (resident): Ecuador (Galápagos)

Distribution Map



Legend

EXTANT (RESIDENT)

Compiled by:

IUCN 2021

The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.

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Population

Ramalina fragilis is the rarest of endemic Galapagos *Ramalina* species. There exist very few known collection sites (20 sites = "de facto individuals"); none of these sites are currently affected by humans directly as they are well protected inside the Galapagos National Park, but Weber and Beck (1985) documents that *Ramalina* species are very drastically affected by El Niño events. Flash floods and erosion can easily wipe out entire populations of the saxicolous species (like *R. fragilis*). Although these species are naturally adapted to these irregularly occurring events, El Niños are projected to occur more frequently and much more drastically in the future due to climate change (d'Ozouville *et al.* 2011, Oña and Di Carlo 2011a,b, Trueman *et al*. 2011, Cai *et al*. 2014, Salinas-de-León *et al*. 2020). *Ramalina fragilis* is predominantly a coastal species growing on rock substrates and may, therefore, also inadvertently be affected by sea level rise. Ali and Aitchison (2014) documented that the Galapagos map has drastically changed at various times over the past 10,000 years due to sea level fluctuations. It can be assumed that *R. fragilis* is capable of migrating inland and thus avoiding these effects because some of the collection sites lie further inland. However, due to the small size of the populations and the more drastic projected climate fluctuations, recovery times may not be sufficient to re-establish stable populations.

Historic weather data document that El Niño events, although unpredictable, have occurred on average between 1-3 times every 50 years. Climate change scenarios predict that these events will be more drastic and more frequent in the future. With a generation time estimate of ca. 15 years for *R. fragilis*, a severe impact from irregularly, unpredictable El Niño events will almost certainly drastically impact the few small existing subpopulations of the species scattered throughout the archipelago within the next three generations of this species, and a population reduction of c.40% is suspected over that timeframe.
Current Population Trend: Stable

Habitat and Ecology **(see Appendix for additional information)**

Ramalina fragilis is a coastal saxicolous species which has also been found further inland, but typically in dry habitats: three collection sites are in the coastal zone (in immediate proximity to the sea), nine collections are in the dry zone (mostly close to the sea, but not in the immediate vicinity), and seven collections in the lower transition zone (all bordering the dry zone, further inland, but not among humid vegetation at higher altitudes). All specimens were collected on rock, in more or less sheltered to exposed rock surfaces (on basalt lava). Several collection sites have been identified during the species inventory as local Galapagos lichen diversity "hot spots" (collection sites, where at least 50 different species have been recorded in close proximity), and one of these sites [trail going to Post Office Bay off the dirt road between highlands and Puerto Velasco Ibarra, cliff at NE-side of trail (mirador)] has been identified as a lichen refugium (i.e., a hot spot with an unusual amount of species records only reported from this locality).

Among the four known Galapagos endemic *Ramalina* species, three are saxicolous (*R. fragilis*, *R. furcellangulida*, *R. polyforma*). *Ramalina fragilis* and *R. polyforma* grow in similar habitats (steep fronts of large rocks, boulders and cliffs; most common at the coast, but also in the dry and the transition zone); the two species occasionally have also been found growing together at the same locality. *Ramalina furcellangulida* is much less specific, also growing as an epiphyte in open dry wood- and scrubland, in typically sunny and exposed areas. All of these endemic *Ramalina* species are typical elements of habitats along the coast and the dry Galapagos lowlands. They are naturally adapted to

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survive extended periods of drought, but they cannot cope with prolonged periods of inundation caused by flooding or excessive rainfall.

Systems: Terrestrial

Threats (see Appendix for additional information)

The localities from which the species is known do not appear immediately threatened. This small, fragile species must, however, be considered particularly susceptible to inundation and erosion from flash floods that occur during torrential rains, which are particularly severe in El Niño years. These drastic effects of El Niño, "wreaking havoc" among Galapagos lichens, have been witnessed and vividly been described by Weber and Beck (1985). General predictions suggest that El Niño events will occur more regularly and more pronounced as a result of climate change (d'Ozouville *et al.* 2011, Oña and Di Carlo 2011a,b, Trueman *et al*. 2011, Cai *et al*. 2014, Salinas-de-León *et al*. 2020).

Today, the Galapagos lichen populations have mostly recovered from the most drastic El Niño witnessed by Weber and Beck (1985), with annual rainfall of up to 2,500 mm, more than five times than during normal years. If predictions about increased frequency and intensity are correct, recovery periods may no longer be sufficient for the species most susceptible to such changes, like *Ramalina fragilis*. Unfortunately, at the regional scale of the Galapagos the effects of climate change on weather patterns remains difficult to predict. Typical projections suggest a scenario with more prolonged periods of excessive rainfall. Ironically, the most recent 2016/17 El Niño was instead characterized by an extended period of drought (up to 6 months without any rainfall). For months the cloud forests in the humid highlands remained without precipitation; the cloud forests not even shrouded in fog. Lichens of the humid highlands that rely on near permanent humidity in the air for their water supply, were thus drastically affected. This contrasts with the species in the dry lowlands, like *R. fragilis*, which are naturally adapted to survive extended periods of drought. Their population thus remained largely intact during the most recent 2016/17 El Niño. Long-term impact of climate change on the archipelago thus remains unpredictable; weather patterns already appear more extreme with both scenarios, extreme rainfall and extreme drought, equally possible. Rainfall statistics are available from Charles Darwin Foundation (2020).

Sea-level rise resulting from climate change will further aggravate these threats from drastically changing weather patterns. With reduced recovery periods as a result of more excessive and erratic El Niños, coastal lichen populations will have less resources and opportunity to migrate further upwards and inland to escape inundation of their coastal habitat cause by sea level rise. Several of the habitat sites where *R. fragilis* occurs are in close proximity to the sea and thus the species will likely be directly impacted also by sea level rise.

Conservation Actions (see Appendix for additional information)

All known sites where *Ramalina fragilis* grows are currently well protected within the Galapagos National Park. At present, the impact from tourism must be considered negligible; most of the coastal sites are not in close proximity to tourist landing spots; one site on the island of San Cristóbal even is located within an area fenced-off from grazing (to protect the rare island endemic *Calandrinia galapagosa*; a vascular plant).

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There are talks to further develop a trail from the highlands on Floreana towards Post Office Bay; this concept proposes to open up the trail for hiking, so that tourist guides can offer day-tours from the coast to the highlands, and vice versa. Along the trail lies one particularly rich lichen diversity hot spot. The site is also a refuge for several unique species; *R. fragilis* is one of the lichens that occur at this hot spot. The area must be protected from development; the impact of constructing any trail should be minimal, the trail should be restricted to hikers only, and the impacts of horse-back riding or mountain biking should be avoided (erosion of sensitive rock surfaces can potentially have drastic consequences); and climbing any rock surfaces must be also prohibited. The current system requires all local guides to be certified by the National Park Directorate; training certified guides is a good opportunity to raise awareness about the unique lichen biota of the archipelago. These training events should emphasize and explain why it is important that tourists stay on the trails, especially at regularly visited sites (like the site near Post Office Bay). Particularly during and after El Niño years the known habitat sites of *R. fragilis* should be monitored to better assess how the populations are affected.

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Credits

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External Resources

For Supplementary Material, and for Images and External Links to Additional Information, please see the Red List website.

Appendix

Habitats

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

Habitat	Season	Suitability	Major Importance?
3. Shrubland -> 3.5. Shrubland - Subtropical/Tropical Dry	Resident	Suitable	-
12. Marine Intertidal -> 12.1. Marine Intertidal - Rocky Shoreline	Resident	Suitable	-
13. Marine Coastal/Supratidal -> 13.1. Marine Coastal/Supratidal - Sea Cliffs and Rocky Offshore Islands	Resident	Suitable	-

Plant Growth Forms

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

Plant Growth Form
LC. Lichen

Threats

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

Threat	Timing	Scope	Severity	Impact Score
11. Climate change & severe weather -> 11.1. Habitat shifting & alteration	Ongoing	Whole (>90%)	Slow, significant declines	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 2. Species Stresses -> 2.1. Species mortality		
11. Climate change & severe weather -> 11.4. Storms & flooding	Ongoing	Whole (>90%)	Rapid declines	High impact: 8
	Stresses:	2. Species Stresses -> 2.1. Species mortality		

Conservation Actions in Place

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

Conservation Action in Place
In-place research and monitoring
Action Recovery Plan: No
Systematic monitoring scheme: No
In-place land/water protection
Conservation sites identified: Yes, over entire range
Percentage of population protected by PAs: 91-100

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Conservation Action in Place
Occurs in at least one protected area: Yes

Conservation Actions Needed

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

Conservation Action Needed
1. Land/water protection -> 1.2. Resource & habitat protection
4. Education & awareness -> 4.3. Awareness & communications

Research Needed

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

Research Needed
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.5. Threats
3. Monitoring -> 3.1. Population trends
3. Monitoring -> 3.4. Habitat trends

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km²): 198
Continuing decline in area of occupancy (AOO): No
Extreme fluctuations in area of occupancy (AOO): Unknown
Estimated extent of occurrence (EOO) (km²): 1700
Continuing decline in extent of occurrence (EOO): Unknown
Extreme fluctuations in extent of occurrence (EOO): Unknown
Continuing decline in number of locations: Unknown
Extreme fluctuations in the number of locations: Unknown
Population
Continuing decline of mature individuals: Unknown
Extreme fluctuations: Unknown
Population severely fragmented: No
Continuing decline in subpopulations: Unknown

Population
Extreme fluctuations in subpopulations: Unknown
All individuals in one subpopulation: No
Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: No
Generation Length (years): 15

The IUCN Red List Partnership

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