An Updated Red List Assessment of Endemic Reef-Building Corals in the Caribbean

Evaluación actualizada de la Lista Roja de corales de arrecife endémicos en el Caribe

Évaluation mise à jour de la Liste rouge des coraux de récif endémiques dans les Caraïbes

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EXTENDED ABSTRACT

In 2008, all known species of reef-building corals were assessed by the International Union for the Conservation of Nature (IUCN). It was found that nearly one third of all hard corals were threatened or near threatened with extinction, with the Caribbean region having the highest proportion of at-risk species. The region is home to approximately 75 species of hard corals and has a high degree of endemism (~51 species). More than a decade later the region has seen extensive reef degradation and species decline. Continued efforts to reassess threatened species provide critical information on the rate of species decline for whole species assemblages. For species highly vulnerable to climate change and other anthropogenic threats, such as corals, periodical reassessments are critical in monitoring the status of species. To understand the current relative extinction risk of individual coral species, all known endemic corals to the Caribbean have been reassessed for extinction risk under the Categories and Criteria of the IUCN Red List of Threatened Species. The IUCN is the recognized global authority on the vulnerability of the natural world and defining the measures needed to safeguard species and ecosystems. Species that are considered threatened with extinction fall under one the following categories: Critically Endangered (CR), Endangered (EN), or Vulnerable (VU). Additional categories include Extinct (EX), Extinct in the Wild (EW), Near Threatened (NT), Least Concern (LC), and Data Deficient (DD). To be listed, species must meet specified quantitative thresholds of vulnerability as outlined by the IUCN's 5 criteria: Population size reduction (A), Geographic range (B), Small population size and reduction (C), Very small or restricted population (D), and Quantitative analysis (E). This is the first comprehensive review of the changing status of corals within the region since the previous Red List assessments in 2008. The process involved 22 collaborators and volunteer scientists from around the globe who contributed extensive amounts of input and research to assess all known reef-building corals within the region and included all new information pertaining to population, habitat and ecology, conservation efforts, and threats to corals. Estimates of individual species declines were ultimately calculated based on modeled live coral cover loss and the projected onset of annual severe bleaching (ASB) events. Coral cover loss and bleaching events are characterized by the decline in live coral and had been used as an estimate for population size reduction within 3 generation lengths (30 years). However, assessors/reviewers made cases for alternative categorization of select species based on one or more of the additional IUCN Red List of Threatened Species criterion. Estimates of coral cover loss used species distribution maps within GIS. Analysis of polygons estimated area of species range across the entire Caribbean as well as within five sub-regions designated by the Global Coral Reef Monitoring Network (GCRMN): Bahamas & Bermuda (1), Southern & Eastern Caribbean (2), Greater Antilles (3), Western & Southwestern Caribbean (4), and Gulf of Mexico & Florida (5) (Souter et al, 2020). Coral cover data from 1978 – 2019 as modelled by the GCRMN, acted as a proxy to estimate population decline for species in the past. Percent decline was calculated for the past 3 generations (1989 – 2019) for each sub-region of the Caribbean. To incorporate the likely impact of climate change on corals the assessment also included the onset of ASB events projected by the United Nations Environmental Programme (UNEP) under "business as usual" carbon emission into 2100 using IPCC CMIP6 global climate models. ASB is expected to occur when there are at least eight Degree Heating Weeks (DHW), characterized by SST being at minimum 1° C above the maximum monthly mean, over a three-month period. The number of DHWs had been calculated from 2015 – 2100 for reef habitat across the globe in 27 km x 27 km grids up to 30 m depths. An average, ASB is expected to occur in 2034 for all corals. However, declines were also informed by relative species' vulnerabilities and indicators of population resilience based on species traits. Species identified as being resistant to bleaching are categorized as having the ability to adapt to at least 1° C above the maximum monthly mean. Species categorized as having no adaptation to heat stress (0° C) are those highly/moderately susceptible to bleaching. Dominant depth range informed to what extent bleaching will occur at depths species are most abundant. Although these recently completed Red List assessments use different datasets to estimate decline than the original assessments conducted in 2008, the proportion of threatened coral species in the Caribbean has increased from approximately 25% to more than 50%. If the coral cover data were available to the 2008 assessment process, our results indicate that Caribbean corals would have qualified for higher extinction risk categories. As a result, nearly all the changes in status are non-genuine: the changes in status were not informed by observed population decline. Based on this, we infer that, though remaining dangerously high, the rate of Caribbean coral cover decline has slowed in recent decades. As for the IPCC CMIP6 models, they predict annual severe bleaching events will occur for all species by 2034 but have a high rate of delay when species adaptability to heat stress was incorporated. On average, a 1° C level of adaptation saw a nearly

30-year delay of the onset of ASB for all resistant species. With a generation length of 10 years, species that are resistant to bleaching do not meet the threshold for vulnerability within 3 generation lengths as set forth by Criteria A of the IUCN Red List of Threatened Species. For those species, coral cover loss data was used in place of bleaching projections. Modeled coral cover loss and bleaching events are insufficient to determine individual species decline as there remains a need for more species-specific information. Large scale models, such as those employed in this study, inform likely trends in populations of corals but remain challenging in determining the true changes status of species. Future coral assessment will require more research aimed at monitoring the populations of a vast array of coral species to determine genuine changes in extinction risk.

KEYWORDS: IUCN Red List, reef-building corals, climate change, coral cover, extinction risk

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