NOAA Lists 20 New Corals as Threatened Under the Endangered Species Act.

In total, 22 species of coral are now protected under the Endangered Species Act, including the two corals (elkhorn and staghorn) listed as threatened in 2006. Fifteen of the newly listed species occur in the Indo-Pacific and five in the Caribbean (see table below). None are found in Hawaii.

Protecting and conserving biologically diverse coral reefs is essential. The Endangered Species Act gives us some important tools to conserve and recover those corals most in need of protection. The final decision to list these 20 corals is a result of the most extensive rulemaking ever undertaken by NOAA. The amount of scientific information sought, obtained, and analyzed was unprecedented. This information included general reef-building coral biology, habitat characteristics and threats, as well as species-specific spatial, demographic, and other information for the individual coral species in the final rule.

The final decision is a significant change from the proposed rule in November 2012, which proposed listing 66 species (a mix of threatened and endangered). We changed our determinations for many of the species for two general reasons:

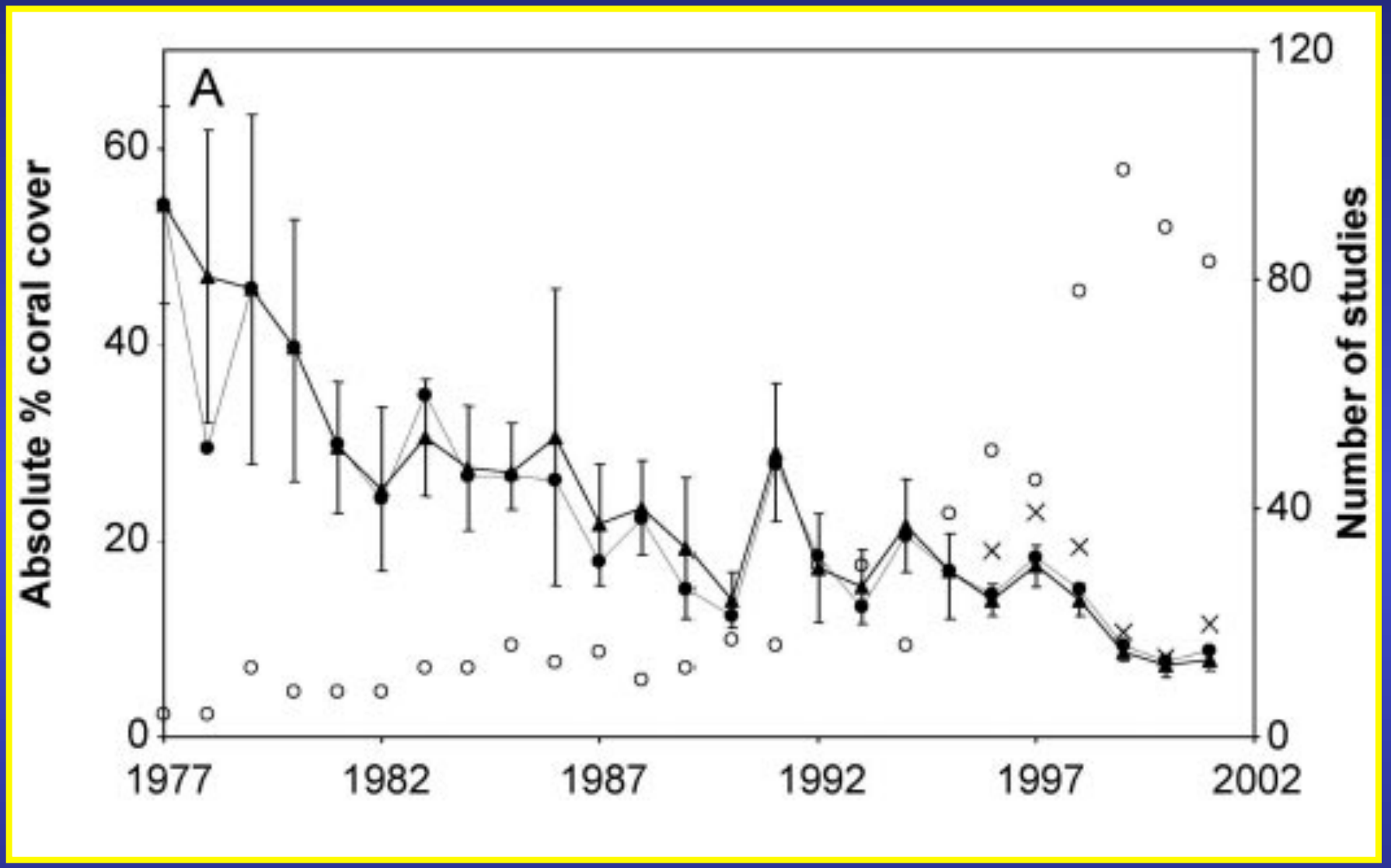
(1) We received and gathered new general and species specific information.
(2) Public comments helped us refine the way we apply all the available information to determine vulnerability to extinction of each species considered.

Corals listed under the Endangered Species Act
There are 22 coral species listed as "threatened" under the Endangered Species Act, grouped below by region where they are found.

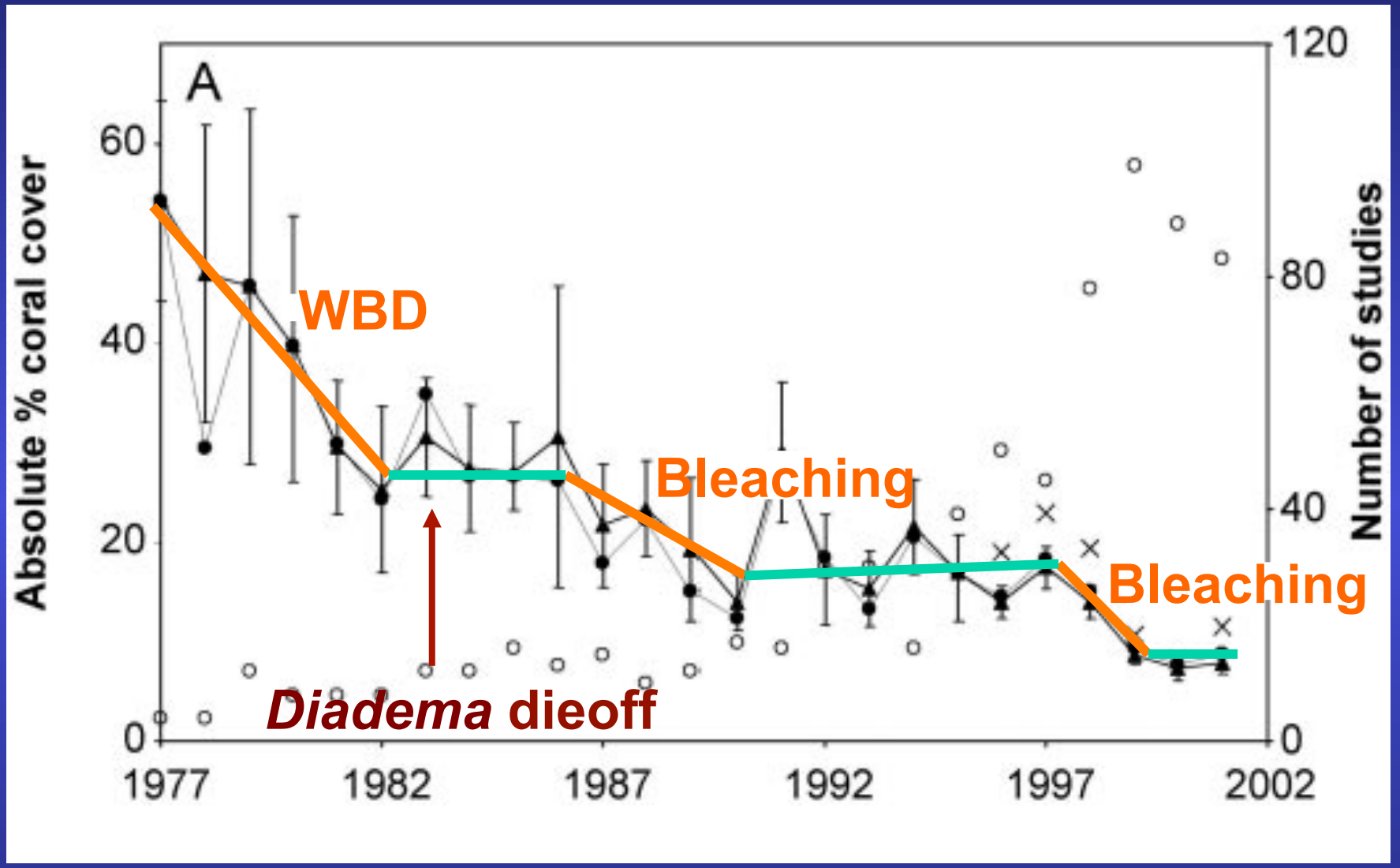
Caribbean coral species:

Acropora palmata - Elkhorn coral
Acropora cervicornis - Staghorn coral
Dendrogyra cylindrus - Pillar coral
Mycetophyllia ferox - Rough cactus coral
Orbicella annularis - Lobed star coral
Orbicella faveolata - Mountainous star coral
Orbicella franksi - Boulder star coral

In the recent historical past (pre-1980's), the Florida Reef Tract was dominated by acroporid corals.



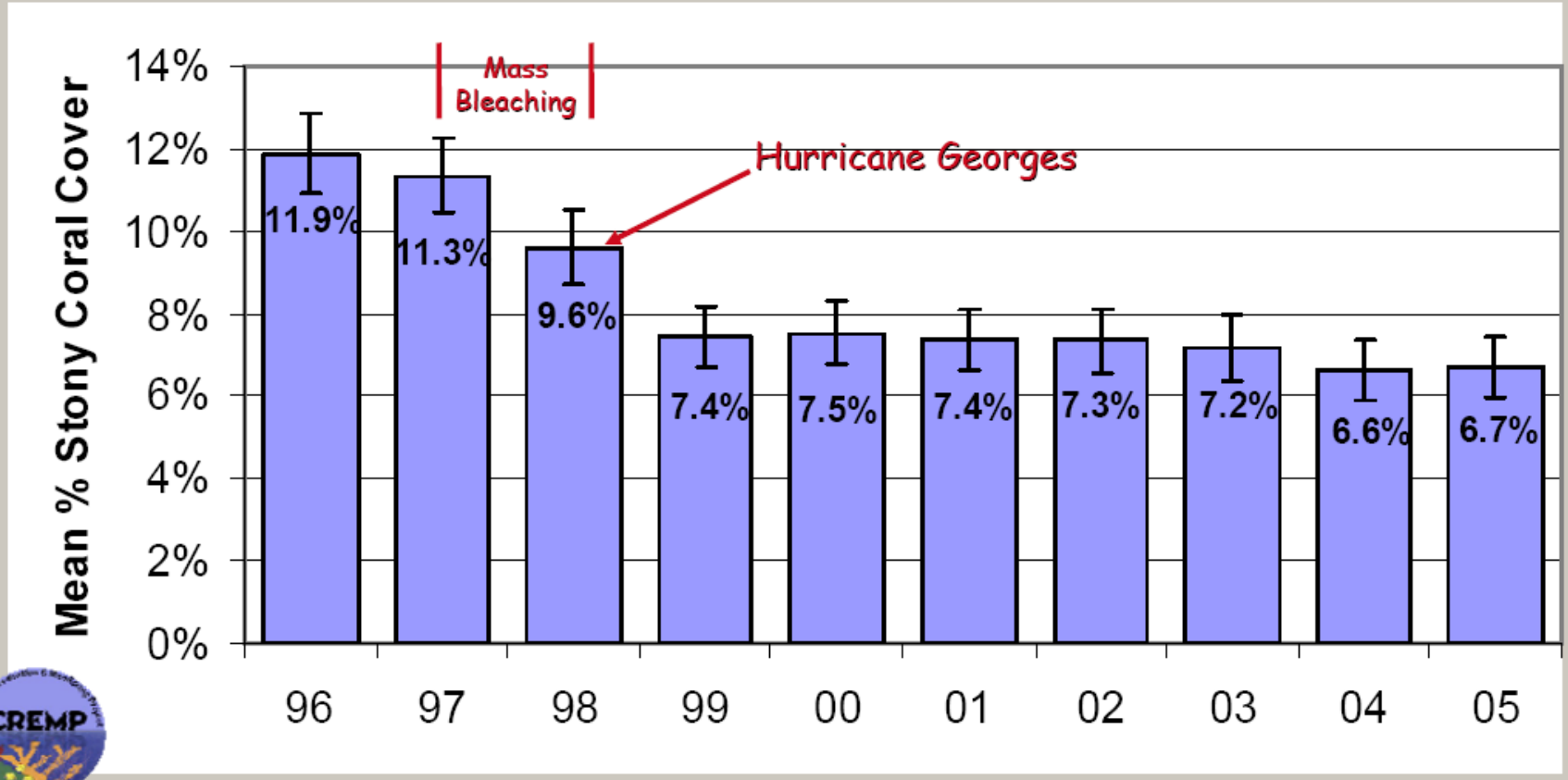
Gardner et al. 2003



Gardner et al. 2003

CREMP: Overall Coral Cover in the Florida Keys

http://www.floridamarine.org



Vol. 402: 115–122, 2010
doi: 10.3354/meps08438

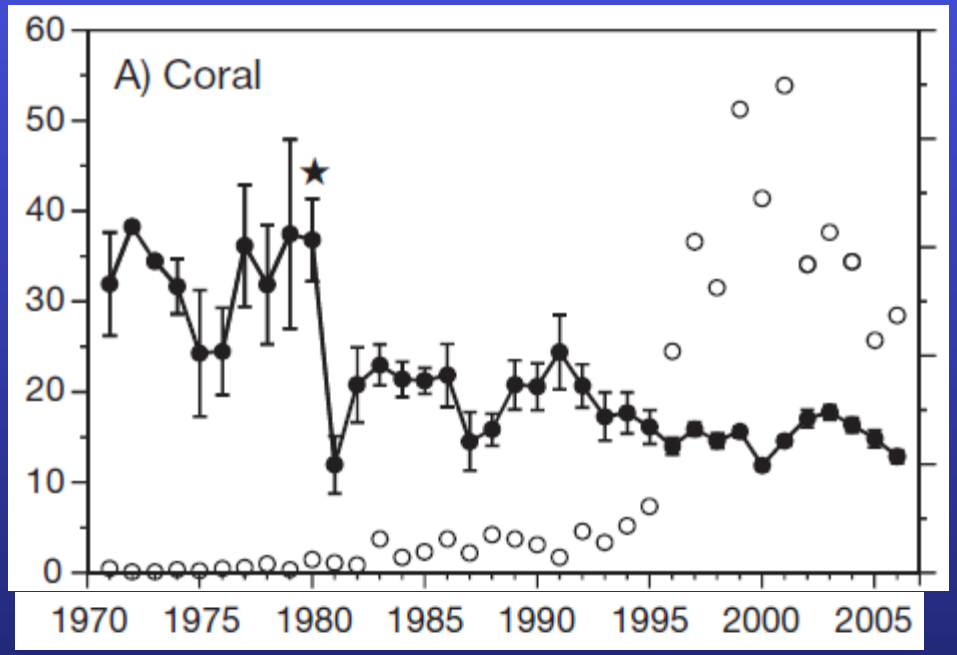
MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser

Published March 8

OPEN ACCESS

Regional spatio-temporal trends in Caribbean coral reef benthic communities

Virginia G. W. Schutte[1,3,*], Elizabeth R. Selig[1,2,4], John F. Bruno[1]



Why List?

In 2009, NOAA received a petition to list 83 species of reef-building corals under the ESA from the Center for Biological Diversity. On February 10, 2010, NOAA found that the Center presented substantial information indicating that listing under the ESA may be warranted for 82 of the 83 petitioned species.

Following the initial finding, NOAA convened a Biological Review Team to initiate a formal status review of the 82 species. The result was a Status Review Report, released in April 2012. The peer-reviewed report incorporated and summarized the best available scientific and commercial data to date.

The agency also conducted a public engagement process between April and July 2012 to gather additional scientific information, allow time for a public review of the Status Review and Draft Management Reports, and to further engage the public. All relevant information gathered was summarized in a new Supplemental Information Report.

Together, the Status Review, Supplemental Information, and Final Management reports form the basis of our proposed listing.

One-Third of Reef-Building Corals Face Elevated Extinction Risk from Climate Change and Local Impacts

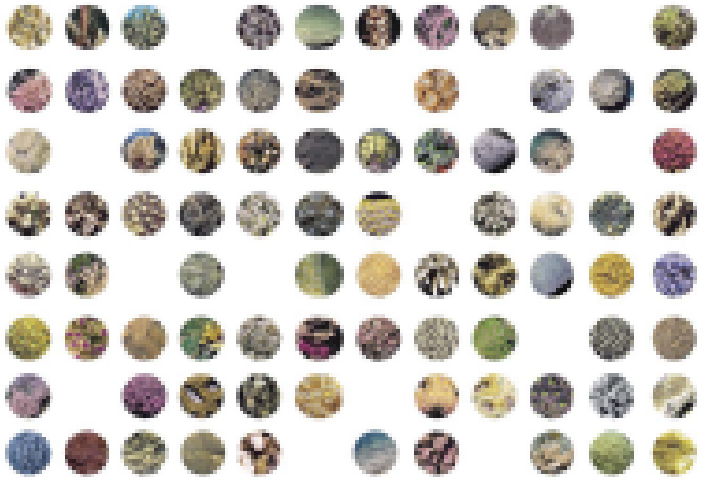
Kent E. Carpenter,[1]* Muhammad Abrar,[2] Greta Aeby,[3] Richard B. Aronson,[4] Stuart Banks,[5] Andrew Bruckner,[6] Angel Chiriboga,[7] Jorge Cortés,[8] J. Charles Delbeek,[9] Lyndon DeVantier,[10] Graham J. Edgar,[11,12] Alasdair J. Edwards,[13] Douglas Fenner,[14] Héctor M. Guzmán,[15] Bert W. Hoeksema,[16] Gregor Hodgson,[17] Ofri Johan,[18] Wilfredo Y. Licuanan,[19] Suzanne R. Livingstone,[1] Edward R. Lovell,[20] Jennifer A. Moore,[21] David O. Obura,[22] Domingo Ochavillo,[23] Beth A. Polidoro,[1] William F. Precht,[24] Miledel C. Quibilan,[25] Clarissa Reboton,[26] Zoe T. Richards,[27] Alex D. Rogers,[28] Jonnell Sanciangco,[1] Anne Sheppard,[29] Charles Sheppard,[29] Jennifer Smith,[1] Simon Stuart,[30] Emre Turak,[10] John E. N. Veron,[10] Carden Wallace,[31] Ernesto Weil,[32] Elizabeth Wood[33]

The conservation status of 845 zooxanthellate reef-building coral species was assessed by using International Union for Conservation of Nature Red List Criteria. Of the 704 species that could be assigned conservation status, 32.8% are in categories with elevated risk of extinction. Declines in abundance are associated with bleaching and diseases driven by elevated sea surface temperatures, with extinction risk further exacerbated by local-scale anthropogenic disturbances. The proportion of corals threatened with extinction has increased dramatically in recent decades and exceeds that of most terrestrial groups. The Caribbean has the largest proportion of corals in high extinction risk categories, whereas the Coral Triangle (western Pacific) has the highest proportion of species in all categories of elevated extinction risk. Our results emphasize the widespread plight of coral reefs and the urgent need to enact conservation measures.

NOAA Technical Memorandum NMFS-PIFSC-27

September 2011

Status Review Report of 82 Candidate Coral Species Petitioned Under the U.S. Endangered Species Act



Russell E. Brainard, Charles Birkeland, C. Mark Eakin, Paul McElhany, Margaret W. Miller, Matt Patterson, and Gregory A. Piniak

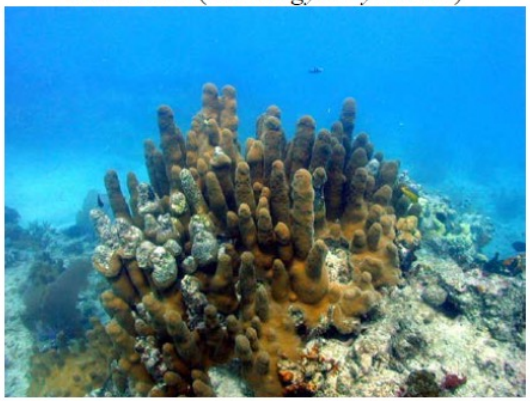
Pacific Islands Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Elkhorn coral (*Acropora palmata*)

Staghorn coral (*A. cervicornis*)

Lamarck's sheet coral (*Agaricia lamarcki*)

Pillar coral (*Dendrogyra cylindrus*)



Elliptical star coral (*Dichocoenia stokesi*)

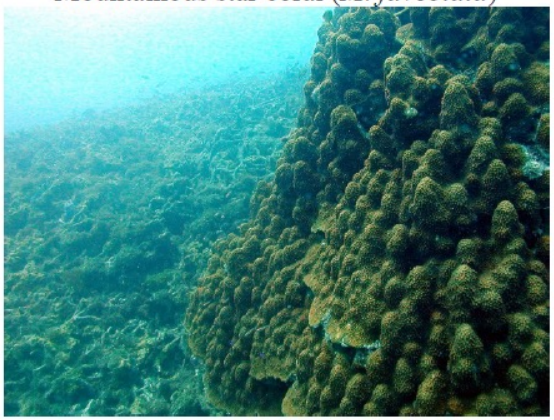
Rough cactus coral (*Mycetophyllia ferox*)

Boulder star coral (*Montastraea annularis*)

Boulder star coral (*M. annularis*)

Mountainous star coral (*M. faveolata*)

Mountainous star coral (*M. faveolata*)



Star coral (*M. franksi*)

Star coral (*M. franksi*)

The table below highlights the prosed seven coral species and their proposed status.

Coral Species	Proposed ESA Status	Present IUCN Red List Classification
Montastraea annularis	Endangered	Endangered
Montrastraea faveolata	Endangered	Endangered
Montastraea fransksi	Endangered	Vulnerable
Dendrogyra cylindrus	Endangered	Vulnerable
Mycetophyllia ferox	Endangered	Vulnerable
Dichocoenia stokesi	Threatened	Vulnerable
Agaricia lamarcki	Threatened	Vulnerable

Evaluation of Extinction Threats

Threat	Importance
Ocean warming	high
Disease	high
Ocean acidification	med-high
Fishing- trophic effects	medium
Sea-level rise	low-medium
Sedimentation	low-medium
Nutrients	low-medium
Changing circulation	low
Changing storms	low
Predation	low
Fishing - destructive practices	low
Physical damage - storms	low
Coastal construction	low
Aquarium and curio trade	low
Toxins*	not neglibile
Invasive species	neglible-low
Insolation*	probably negligible
Salinity	negligble
Dust	negligible
Physical damage - debris	negligible
Physical damage - tourism/divers	negligible
Physical damage - vessels	negligible

From Brainard et al. (2011)

Extinction Risk Analysis

- Likelihood of a species population falling below a Critical Risk Threshold by the year 2100,
  - a time frame where climate projections are readily available and sufficiently scientifically-vetted (IPCC AR4).
- Critical Risk Threshold was defined by the BRT as a condition where a species is of such low abundance, so spatially fragmented, or at such reduced genetic and genotypic diversity that extinction is extremely likely
  - Critical Risk Threshold is based on consideration of:
    - depensatory processes (e.g., declining reproductive output due to low population density of sessile broadcast spawners),
    - environmental stochasticity (non-deterministic), and
    - catastrophic events.

From Brainard et al. (2011)

Geographic Variability of Climate Change Threats

	Indo-Pacific	Eastern Pacific	Western Atlantic
Coral Genera	91	10	25
Coral species	~ 700	40	65
Concentration of Thermal Stress	Varied	Very High	Medium-High in Gulf & Caribbean
Bleaching Impact	Generally lowest	Very high, probable extinction (*Millepora boschmai*)	High
Rate of Acidification	Generally lowest	Slow change, pH already low	Highest
Impact of Disease	Low	Uncertain	High

From Brainard et al. (2011)

- Ocean warming is a clear and present threat to corals and coral reefs
- Ocean acidification is likely to be a major threat in coming decades
- Other climate threats are concerns, but have limited extinction risk
- The pervasive nature of climate threatens even the best managed and most remote reefs
- Climate change a major reason that most of the 82 candidate coral species are 'more likely than not' to fall below the Critical Risk Threshold by 2100.

From Brainard et al. (2011)

Summary

- Comprehensive synopses and extinction risk assessment of 82 species of corals
- Evaluation of a broad range of potential threats, the most important extinction risks were posed by the following global threats:
  - ocean warming,
  - coral disease,
  - ocean acidification, all directly or indirectly related to greenhouse gas emissions
- The mean estimated likelihood of falling below the Critical Risk Threshold by 2100 ranged from 78% ('likely') to 19% ('unlikely') among the 82 candidate coral species.
- The overall mean and the median estimated Critical Risk Threshold across all 82 candidate coral species both exceeded 50% likelihood, thereby falling into the 'more likely than not' category.
- The BRT concluded, with high uncertainty, that most of the 82 candidate coral species are 'more likely than not' to fall below the Critical Risk Threshold by 2100.

From Brainard et al. (2011)

Summary (con't)

- Caribbean species were estimated to have relatively high probabilities of falling below the Critical Risk Thresholds by 2100 with 5 of the top 7 candidate species from that region.
  - reflects the small geographic extent,
  - pervasive and demonstrated impacts of both local and global threats,
  - significant and well-documented declines of corals in the Caribbean region.
- Other high-risk species have highly restricted geographic ranges, demonstrated low population sizes, and/or extreme vulnerabilities to one or more threats.
- Lower risk species tended to have wide geographic and habitat distributions, tolerance to marginal environmental conditions, and/or known tolerance of important threats.
- The BRT identified increasing human population and the intensity of their collective consumption as the root drivers of almost all global and local threats to coral species.

From Brainard et al. (2011)

Key Species Restoration