

Endangered Species Act Draft Proposed Rule for Pillar Coral (*Dendrogyra cylindrus*): ID 432

Peer Review Report

We solicited review of the draft Proposed Rule to change the status of pillar coral (*Dendrogyra cylindrus*) from threatened to endangered on the Federal List of Threatened and Endangered Species. Three people agreed to review the draft proposed rule. Reviewer comments are compiled in this report. Reviewers are listed alphabetically, and comments are not associated with the order of the reviewers as listed.

Reviewers

Dr. Margaret W. Miller
SECORE, International
Miami, Florida

Dr. Karen Neely
Nova Southeastern University
Dania Beach, Florida

Dr. Tyler Smith
University of the Virgin Islands
St. Thomas, US Virgin Islands

Charge Statement Questions

Responses are not associated with the order of names as they appear above.

1. Does the proposed rule include and cite the best scientific and commercial information available on the species and its biology, habitat and distribution, population structure, abundance trends, threats, and conservation measures?

Reviewer 1: In my opinion, the proposed rule has many good sources of information, but could benefit from a more comprehensive review of available literature. I have sent many references on this for additional consideration.

Reviewer 2: Yes. The proposed rule includes the best scientific and commercial information available.

Reviewer 3: To my knowledge, the best available scientific and commercial info has been incorporated into this proposed rule.

2. Are specific conclusions factually supported, sound, and logical?

Reviewer 1: Yes. As noted above, there is additional information on the species that is not included, and would strengthen the conclusions, but in general they are supported.

Reviewer 2: Yes, the specific conclusions that the species is in precipitous declines, with increased risk of extinction from local and global stressors, compensatory processes, environmental stochasticity, or catastrophic events is well supported, sound, and logical.

Reviewer 3: Yes, the species has undergone drastic declines, to the point of extirpation in some locations at the edge of the range, since the previous listing was published. The multiple threats described, but particularly high susceptibility to thermally-induced bleaching, lethal disease, and overall reproductive failure support the proposed rule.

3. Where available and relevant, are opposing scientific studies or theories acknowledged and discussed?

Reviewer 1: There are no known opposing studies/theories that I am aware of.

Reviewer 2: I am not aware of any opposing scientific studies or theories that would bear on the rule change.

Reviewer 3: I am not aware of any 'opposing' studies or theories. Because *D. cylindrus* has always been a rare species, there was little quantitative data available at the time of the original listing. There is now much more quantitative data on population status based on the previous listing, and the large effort to quantify SCTL D effects. All of it shows bad news.

4. Are uncertainties assessed and clearly stated?

Reviewer 1: There do not seem to be many assessed/stated, but I am not sure there are many/any warranted, so I don't see this as a particular problem.

Reviewer 2: There was no mention of uncertainties regarding the status of the species. The largest might be the extrapolation of studies in certain geographic regions to areas outside the regions. However, I believe that sufficient studies across the species range were included to extrapolate similar dynamics (decline) to other areas, particularly those that have already been subjected to stony coral tissue loss disease.

Reviewer 3: I did not notice explicit discussion of uncertainties in the proposed rule document, except as relates to the minority portion of the range from which quantitative population status/trend info is available. I have made some suggestion in my markup regarding potential uncertainty that could be highlighted (e.g., that SCTL D has not affected all of the range, yet).

Summary of Reviewer Comments

Major comments are addressed below. All non-substantive edits were incorporated within the document when and where appropriate and are not repeated here.

Overall Comments

1. In general, I think this looks pretty good, although there is some literature which isn't incorporated which may be useful.

RESPONSE: Incorporated provided literature where appropriate.

2. There is a preprint on DCYL populations out of Venezuela which may be of interest

RESPONSE: Reference was incorporated in the Abundance, Trends, and Distribution section.

3. Cindy Lewis's dissertation has some good info on propensity of DCYL to bleaching, and also on white plague.

RESPONSE: Added reference.

4. Lewis et al manuscript on black band in DCYL may be relevant to reference.

RESPONSE: Added reference.

5. Some of the info on the rescue is incorrect. I've corrected where I can, and would also recommend using the Neely et al publication on this topic.

RESPONSE: Accepted revised text and added reference.

6. We actually did a lot of work on DCYL spawning and larval propagation of DCYL in Florida which isn't mentioned. I'll attach the reports on this topic.

RESPONSE: Added information relevant to settlement from larval propagation, but did not incorporate references documenting fertilization with no subsequent settlement or where there was no information about settlement.

7. I am including a photo for your consideration (a juvenile raised from larval propagation efforts in a field nursery by FUNDEMAR in the Dominican Republic - they have had a lot more success with their 2020 cohort!).



RESPONSE: Contacted reviewer to obtain 2020 settlement information and added it to the Conservation Measures section.

Abundance, Trends, and Distribution

8. Text: It has a relatively low annual egg production and low sexual recruitment.

Comment: Low to non-existent ... is there evidence from the broader range of any known larval recruitment for this species?

RESPONSE: Added that there have been no reports of observed sexual recruitment in the wild.

9. Text: New studies published since the listing provide some population trend information.

Comment: You may also want to consider the preprint out of Venezuela.

RESPONSE: Incorporated information from the study.

10. Text: Estimates of percentage of sites with *D. cylindrus* present ranged from one percent in Florida to a high of 30 percent in the US Virgin Islands.

Comment: Ref? Or I guess you are just referencing the Status Review for this whole paragraph? (Could cite it). I assume this is from the NCRMP data – of so, should probably acknowledge this information was only available from US territories and could note that these ‘occurrences’ were most often a single colony (I presume).

*RESPONSE: This paragraph is referencing information from the final listing rule, so the citation for the rule was added. Reports of number of sites where *D. cylindrus* was found were not limited to the US but came from published reports documenting this information; the intention here is to provide a quick summary from the listing rule citing the locations with the highest and lowest site prevalence to show the range in values.*

11. Text: In 2002, there were 70 fragments compared to 585 fragments observed in 2012, and almost 97 percent of the fragments observed in 2012 were produced as a result of partial colony mortality.

Comment: May be worth explicitly explaining that these authors use ‘fragments’ (at least as best as I understand from the paper) as tissue remnants on standing colonies (not just broken, disconnected skeletal fragments). I think this is why the results sound moderately not bad

RESPONSE: Added that fragments were tissue remnants on standing colonies.

12. Text: Assuming two stress events per decade until 2042 when thermal stress events are predicted to become annual, local extinction of *D. cylindrus* in Florida was modeled to occur in 2066 for the 80 percent survival scenario, and in 2046 and 2039 for 50 percent survival and 20 percent survival scenarios, respectively (Chan et al. 2019).

Comment: These estimates seem extremely optimistic in light of the estimated 93% extirpation for Keys and 100% extirpation for SE Florida that has already occurred. Consider omitting this modeling result or else adding an additional sentence along the lines of “These model predictions have, unfortunately proven unduly optimistic, being outstripped by recent observed declines in Florida (REFS)’

RESPONSE: Added a sentence to relay that the modeling results were based on thermal stress events and did not account for disease which ultimately caused near extirpation from Florida much sooner.

13. Text: During baseline surveys in 2013-2014 (542 colonies, 533 alive), average live tissue was 70 percent (including the dead colonies), and 22 percent of the colonies exhibited low (2.2 percent) recent mortality.

Comment: Not clear what this means. Consider phrasing as average (partial) tissue mortality was 30%.

RESPONSE: Accepted suggested text.

14. Text: However, acute stressors, including the 2014/2015 bleaching event and following outbreak of disease, later identified as a new distinct disease termed stony coral tissue loss disease (SCTLD), resulted in extremely high mortality.

Comment: add “ongoing outbreaks of white plague, black band disease”

Citations: Neely et al 2021.

Also Lewis C. 2018. Florida’s pillar coral (*Dendrogyra cylindrus*): the roles of the holobiont partners in bleaching, recovery, and disease processes. Doctoral dissertation, Florida International University.

Lewis, C.L.; Neely, K.L.; Richardson, L.L.; Rodriguez-Lanetty, M. Temporal dynamics of black band disease affecting pillar coral (*Dendrogyra cylindrus*) following two consecutive hyperthermal events on the Florida Reef Tract. *Coral Reefs*. 36:427-431; 2017

RESPONSE: Added suggested text and citations.

15. Text: Based on the extreme loss of colonies and live tissue, *D. cylindrus* is now considered functionally extinct along the Florida reef tract (Jones et al. 2021; Neely et al. 2021).

Comment: In spirit of discussing uncertainties, could add a sentence that such quantitative trend data is only available from these two regions (however, no evidence of increases, and much more widespread evidence of severe disease impacts described below).

RESPONSE: Added a sentence at the end of the section stating that we believe the species is in decline throughout much of its range based on the quantitative studies of declines in the northern and south western portions of its range and the more widespread severe disease impacts described in the Threats section.

Threats

16. Text: The disease appears to be both water-born and transmissible through direct contact (Neely 2018).

Comment: Reference should be: Aeby, G.; Ushijima, B.; Campbell, J.E.; Jones, S.; Williams, G.; Meyer, J.L.; Hase, C.; Paul, V. Pathogenesis of a tissue loss disease affecting multiple species of corals along the Florida Reef Tract. *Frontiers in Marine Science*. 6; 2019

RESPONSE: Changed the reference.

17. Text: SCTLD does not appear to be seasonal like many other coral diseases that will ramp up during higher temperatures but then decrease as water temperatures cool.

Comment: In the spirit of ‘acknowledging uncertainty’, you could include a sentence here articulating where SCTLD has not affected (yet, but also that there is no known reason that its spread would not be expected to continue).

RESPONSE: I added information here and in the Risk of Extinction section stating that we expect SCTLD to continue to spread throughout the species’ range based on the previous spread and the fact that SCTLD is waterborne.

18. Text: In 54 sites surveyed in 2020 around St. Thomas, US Virgin Islands, 67 percent of the *D. cylindrus* colonies were infected with SCTLD, and *D. cylindrus* was the species with the highest prevalence of SCTLD within the epidemic zone (Costa et al. 2021).

Comment: Above, it gives n's for these prevalence numbers. Should include here if available.

RESPONSE: Added sample sizes.

Conservation Measures

19. Text: Initial ex situ treatment trials on *D. cylindrus* consisted of amputation of diseased tissue and dipping the colonies in a Lugol's iodide solution commonly used in the aquarium industry; this method was effective about 53 percent of the time (O'Neil et al. 2018).

Comment: Need to define 'effectiveness' in this paragraph. Was this the increment of replicates with arrested tissue loss over and above controls (untreated) replicates? This control info needs to be specified to make this number meaningful.

RESPONSE: Added text to indicate effective meant disease progression was arrested after repeated medicated dips and amputations. There was no control treatment, so the word "trials" was removed since it implied an experimental design. Added the number of colonies and fragments treated.

20. Text: Antibiotics pastes have been successfully applied in situ to coral species infected with SCTLD in Florida (67 to 95 percent effectiveness), though no reports of effectiveness on in situ *D. cylindrus* colonies have been published (Neely et al. 2020b; Shilling et al. 2021; Walker et al. 2021).

Comment: Also: Neely, K.L.; Shea, C.P.; Macaulay, K.A.; Hower, E.K.; Dobler, M.A. Short- and Long-Term Effectiveness of Coral Disease Treatments. *Frontiers in Marine Science*. 8; 2021

RESPONSE: Added citation.

21. Text: From May 2016 to December 2018, fragments were collected from all remaining *D. cylindrus* genotypes left following the 2014/2015 bleaching event and subsequent disease outbreak (Kabay 2016; O'Neil et al. 2021).

Comment: This isn't really true. We didn't have huge losses from the bleaching events, but were worried about the next one. And we were trying to collect ahead of the SCTLD line, so it wasn't really the "survivors". Would recommend deleting this second half of the sentence. The main reference for this story is: Neely, K.L.; Lewis, C.L.; O'Neil, K.; Woodley, C.M.; Moore, J.; Ransom, Z.; Moura, A.; Nedimyer, K.; Vaughan, D. Saving the last unicorns: the genetic rescue of Florida's pillar corals. *Frontiers in Marine Science*. 8:876; 2021

RESPONSE: Revised as suggested and added reference.

22. Text: The first report of successful larval propagation resulted from collection and fertilization of gametes in Curaçao (Marhaver et al. 2015).

Comment: We actually did this in 2013 in Florida. Margaret Miller's Quicklook spawning report documents this. They were first settled in Florida at Mote from wild spawn in 2016. See Mote report. We also settled from wild spawn in 2017, 2018, and attempted in 2019. We fertilized from

onshore tanks at Mote and KML in 2018 and 2019. Keri took the reins with her spawning systems in 2020. Reports are all attached to this email.

RESPONSE: Revised text to indicate the cited reference was the first report of successful larval settlement from assisted fertilization. Added successful settlement information from the 2016 and 2018 Florida cohorts that was available in the provided 2019 report. No information about settlement was provided in the reports for the 2017 cohort, and the 2013 cohort achieved fertilization but not settlement.

23. Text: An estimated 380 corals were transferred to the nursery, and one year after they were transferred, one surviving coral was observed (Villalpando et al. 2021).

Comment: The group in DR (FUNDEMAR) had a much more successful cohort in 2020 with a decent number of sexual recruits surviving in a field nursery that look beautiful. I can provide photo if that would be helpful, and/or try to get current survivor count from them.

RESPONSE: Added surviving recruit information to the text after obtaining it from the reviewer.

24. Text: Conservation actions include treatment of individual colonies for SCTLD and ex situ holding and propagation of *D. cylindrus* for future restoration.

Comment: No need to limit propagation to ex situ, is there?

RESPONSE: Revised text to indicate disease treatment, ex situ banking, and propagation.

Risk of Extinction

25. Text: The final listing rule (79 FR 53852, September 10, 2014) also described the rationale for why *D. cylindrus* was not in danger of extinction at the time and did not warrant listing as endangered because: (1) there was little evidence of population declines, (2) *D. cylindrus* showed evidence of resistance to bleaching from warmer temperatures in some portions of its range under some circumstances (e.g., Roatan, Honduras),...

Comment: But we found they are quite susceptible (to bleaching). See Lewis dissertation for more info.

RESPONSE: The information provided in this paragraph is from the final listing rule describing why the species was not originally listed as endangered, so no changes were made.

Additional References provided by Reviewers

Cavada-Blanco, F., J. Cappelletto, E. Agudo-Adriani, S. Martinez, J. P. Rodriguez, and A. Croquer. 2020. Status of the pillar coral *Dendrogyra cylindrus* in Los Roques National Park, Southern Caribbean. bioRxiv doi: 10.1101/2020.09.15.297770. <https://doi.org/10.1101/2020.09.15.297770>.

Lewis, C. L., K. L. Neely, L. L. Richardson, and M. Rodriguez-Lanetty. 2017. Temporal dynamics of black band disease affecting pillar coral (*Dendrogyra cylindrus*) following two consecutive hyperthermal events on the Florida Reef Tract. Coral Reefs 36(2):427-431.

Lewis, C. F. 2018. Florida's Pillar Coral (*Dendrogyra cylindrus*): The Roles of the Holobiont Partners in Bleaching, Recovery, and Disease Processes. Ph.D. dissertation. Florida International University, FIU Electronic Theses and Dissertations. 3952.

https://digitalcommons.fiu.edu/etd/3952?utm_source=digitalcommons.fiu.edu%2Fetd%2F3952&utm_medium=PDF&utm_campaign=PDFCoverPages.

Miller, M. W. 2013. Quicklook Report: Coral spawning in the upper Florida Keys, Aug 2013. National Marine Fisheries Service, Southeast Fisheries Science Center.

Neely, K. L. 2017. Quicklook Report: *Dendrogyra cylindrus* spawning in the Looe Key region, August 2017. Florida Keys Community College. 5 pp.

Neely, K. L. 2018. Quick Look Report: *Dendrogyra cylindrus* spawning research – July 2018. Nova Southeastern University. 10 pp.

Neely, K. L. 2019. Quick Look Report: *Dendrogyra cylindrus* spawning– August 2019. Nova Southeastern University. 8pp.

Neely, K. L., C. L. Lewis, K. O'Neil, C. M. Woodley, J. Moore, Z. Ransom, A. Moura, K. Nedimyer, and D. Vaughan. 2021. Saving the Last Unicorns: The Genetic Rescue of Florida's Pillar Corals. *Frontiers in Marine Science* 8:657429. doi: 10.3389/fmars.2021.657429.

Page, C., and D. Vaughan. 2016. Refining Techniques for the Settlement and Outplant of Coral Recruits to Enhance Survival Back into the Field: 6 Month Report. Mote Marine Laboratory, Protect Our Reefs - POR-2015-6.