

# Draft Proposed Rule to Remove *Siderastrea glynni* from the Federal List of Threatened and Endangered Species: ID423

## Peer Review Comments

We solicited review of the draft Proposed Rule to Remove *Siderastrea glynni* from the Federal List of Threatened and Endangered Species. Four people agreed to serve as peer reviewers. Reviewer comments are compiled below and are not associated with the order of the reviewers as listed. No editorial suggestions to the text were received.

Reviewers (listed alphabetically):

**Dr. Ann F. Budd**

Department of Earth and Environmental Sciences  
University of Iowa

**Dr. C. Mark Eakin**

Satellite Oceanography & Climate Division  
NOAA National Environmental Satellite, Data, and Information Service

**Dr. Danwei Huang**

Department of Biological Sciences  
National University of Singapore

**Dr. Todd C. Lajeunesse**

Department of Biology  
Pennsylvania State University

**Specific Responses to Charge Statement Questions** (not associated with order of names as they appear above):

**Reviewer 1:**

1. Does the proposed rule include and cite the best scientific and commercial information available on the taxonomy and identity of *S. glynni*?  
Yes.
2. Is the conclusion about the identity of *S. glynni* factually supported, sound, and logical?  
Yes.
3. Where available and relevant, are opposing scientific studies or theories acknowledged and discussed?  
Mostly, but see below.
4. Are uncertainties assessed and clearly stated?  
Mostly, but see below.

I don't disagree with this statement [referring to sentence on environmental conditions influencing morphology of *S. glynni*]. However, *S. glynni* was not distinguished by a multivariate analysis, but rather, it is 'distinguished by relatively small corallites (2.5-3.5

mm); numerous thin septa (40-48 per corallite); a porous columella; and a distinctive synapticular meshwork’.

Colin Garcia et al. (2017; Biological Bulletin) also notes this.

While a multivariate analysis (e.g. in Glynn et al. 2016) can tell generally if species are distinct across all traits (the inclusion of which can be subjective), species diagnoses often don’t require such evidence, nor do species always separate in morphological space. Fig. 3 in Glynn et al. (2016) illustrates this point, since *S. siderea* and *S. radians* are not distinguishable on the morphological space, and yet are genetically distinct (Forsman et al. 2005; Coral Reefs).

#### Reviewer 2:

1. Does the proposed rule include and cite the best scientific and commercial information available on the taxonomy and identity of *S. glynni*?

The proposed rule accurately reflects and clearly establishes the state of knowledge regarding our understanding of the true identity of *Siderastrea glynni* based on genetic, ecological, and paleontological evidence, including the personal admission, in the most recent paper published on this subject, that colonies of the Caribbean species *Siderastrea siderea* were indeed brought to the very location on the Pacific coast of Panama in the early 1980s where small colonies of the animal were discovered years later in the early 1990s. There exists no other relevant or opposing scientific studies of which I am aware.

2. Is the conclusion about the identity of *S. glynni* factually supported, sound, and logical?

To conclude, all of these lines of evidence point to only one logical parsimonious explanation: *Siderastrea glynni* is in fact *Siderastrea siderea* introduced from the Caribbean Sea.

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

There exists no other relevant or opposing scientific studies of which I am aware.

4. Are uncertainties assessed and clearly stated?

I confirm that the uncertainties were assessed and clearly stated either by you and/or in the papers you cited in the report.

#### Reviewer 3:

1. Does the proposed rule include and cite the best scientific and commercial information available on the taxonomy and identity of *S. glynni*?

As far as I am aware, the best scientific references are cited. However, I do have a comment about morphology (page 7). Yes, Glynn et al. (2016) found no statistically significant differences between *Siderastrea siderea*, *S. radians*, and *S. glynni*. However, the Glynn et al. (2016) morphometric analysis was based on a very small sample size (1 colony of *S. glynni*, 4 colonies of *S. siderea*, 7 colonies of *S. radians*), and it did not include the key diagnostic character of *S. glynni*, which is the structure of the corallite wall (Budd & Guzman 1994). The Glynn et al. (2016) morphometric analysis was based on only three measurements – corallite diameter, total number of septa per corallite,

and calical slope. It did not include the full suite of characters that distinguish species of *Siderastrea*. In fact, the results of the analysis of Glynn et al. (2016) indicate that even *S. siderea* and *S. radians* are not significantly different. The diagnostic character of *S. radians* is the development of the columella, which was also not included in the Glynn et al. (2016) morphometric analysis.

I would agree that the three “species” of *Siderastrea* overlap in corallite diameter and in total number of septa per corallite. However, *S. glynni* is unique in having thin septa that continue across the corallite wall between calices, causing the wall to have an unusual reticulate structure. Also colonies of *S. glynni* are unattached, forming coralliths, whereas colonies of *S. siderea* are usually attached.

In sum, I would conclude that *S. siderea* and *S. glynni* are morphologically similar, but they are not the same. There are morphological differences between the two “species”, which could be caused by differences in the environment.

2. Is the conclusion about the identity of *S. glynni* factually supported, sound, and logical?

Yes, the three most convincing arguments for synonymizing the *S. siderea* and *S. glynni* are the lack of difference in molecular data, the zooxanthellae affinities with the Caribbean, and the transplantation of *S. glynni* from the Caribbean to the Eastern Pacific. *S. glynni* is likely merely an extinct variety of *S. siderea*. As explained by Glynn et al. (2016), the morphological differences could be the result of elevated nutrients and differences in other environmental factors in the Eastern Pacific.

In sum, yes, I agree that *Siderastrea glynni* should be removed from the Federal List of Threatened and Endangered Species.

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

Yes, with regard to molecular data and zooxanthellae, but no, with regard to morphology. The morphological arguments rely too heavily on Glynn et al. (2016), and do not refer to the original morphological data in Budd & Guzman (1994), Table 1.

4. Are uncertainties assessed and clearly stated?

In general, the document does an excellent job providing rationale for removing *S. glynni* from the Threatened and Endangered Species. My only quibble is the morphology paragraph on page 7.

#### **Reviewer 4:**

1. Does the proposed rule include and cite the best scientific and commercial information available on the taxonomy and identity of *S. glynni*?

Yes. I believe all the information known on this species is cited in the text. However, the bibliography omits Kleemann 1990, which is cited in the text, and should be added to the bibliography.

2. Is the conclusion about the identity of *S. glynni* factually supported, sound, and logical?

Yes. There is very strong evidence to support the current conclusion that *S. glynni* is a junior synonym of *S. siderea*.

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

Yes. The opposing position was based on uncertainty at the time of the original listing. Conclusions at that time were based primarily on a lack of evidence indicating it was not a new species rather than evidence that it was. The evidence originally supporting *S. glynni* as a new species was morphological. Subsequent work in a wide range of corals indicates that morphology in corals, including this family, is sufficiently plastic that it is a far less valid method of distinguishing species than newer genetic analysis or analysis of symbionts.

4. Are uncertainties assessed and clearly stated?

Yes.

**General Comments** (not associated with order of names as they appear above):

**Reviewer 2:**

Minor comments about some of the text in the proposal:

The taxonomy of the genus *Symbiodinium* has changed dramatically over the past few years. *Symbiodinium trenchii* is now *Durusdinium trenchii* and *Symbiodinium goreau*, is now *Cladocopium goreau*. Both of these dinoflagellate genera are in the family Symbiodiniaceae. Also, the closely related *Symbiodinium* living in co-occurring eastern Pacific corals (specifically *Pocillopora*) has been formally described as *Durusdinium glynnii*.

I have attached a paper that definitively shows that the other closely related "D" symbiont found in native Pacific corals is indeed a different species than *D. trenchii* that that found in the introduced *S. siderea* in Panama.

**Additional References provided by Reviewers 1 and 2:**

Colín-García NA, Campos JE, Musi JLT, Forsman ZH, Muñoz JLM, Reyes AM, González JEA. 2017. Comparative Molecular and Morphological Variation Analysis of *Siderastrea* (Anthozoa, Scleractinia) Reveals the Presence of *Siderastrea stellata* in the Gulf of Mexico. *Biol Bull.* 232(1):58-70.

LaJeunesse TC, Parkinson JE, Gabrielson PW, Jeong HJ, Reimer JD, Voolstra CR, Santos SR. 2018. Systematic Revision of Symbiodiniaceae Highlights the Antiquity and Diversity of Coral Endosymbionts. *Current Biology* 28(16):2570-2580.

Wham DC, Ning G, LaJeunesse TC. 2017. *Symbiodinium glynnii* sp. nov., a species of stress-tolerant symbiotic dinoflagellates from pocilloporid and montiporid corals in the Pacific Ocean. *Phycologia* 56(4):369-409.