



**Western
Pacific
Regional
Fishery
Management
Council**

May 24, 2021

Mr. Michael D. Tosatto
Pacific Islands Regional Office
NOAA Inouye Regional Center
1845 Wasp Boulevard, Building 176
Honolulu, HI 96818

RE: Proposed Critical Habitat Designation for Seven Threatened Corals in U.S. Waters in the Indo-Pacific (NOAA-NMFS-2016-0131)

Dear Mike:

The Western Pacific Regional Fishery Management Council (Council) appreciates the opportunity to provide comments to the National Marine Fisheries Service (NMFS) on the proposed rule to designate critical habitat for the seven threatened corals in U.S. waters in the Indo-Pacific pursuant to section 4 of the Endangered Species Act (ESA)¹. The Council appreciates NMFS for responding to the requests for holding public hearings and extending the public comment period.

The Council believes that the proposed critical habitat designations in U.S. waters published by NMFS are overly broad, and not based upon the best available scientific or economic information. Furthermore, the Council concludes that existing federal and local mechanisms also provide adequate protections for corals and their habitat, and designation of critical habitat is not likely to provide additional conservation benefits.

By way of background, in 2018, the Supreme Court held that critical-habitat designations are limited to areas that are “also habitat for the species.” See *Weyerhaeuser Co. v. U.S. Fish & Wildlife Serv.*, 139 S. Ct. 361,368(2018) (emphasis in original). However, the Court left open the question of whether a currently-uninhabitable area would qualify as critical habitat.

In 2019, NMFS promulgated revisions to the ESA implementing regulations. The new regulations included revisions to critical habitat designation. The new regulations allow NMFS greater latitude to exclude certain areas from the critical-habitat designation, expanding the circumstances under which designation could be deemed “not prudent” beyond those where designation would risk harm to the species or would not benefit the species. See 50 CFR §424.12(a)(1). The regulations also provide that NMFS may only designate unoccupied habitat after determining that occupied areas “would be inadequate to ensure the conservation of the species.” 50 CFR §424.12(b)(2). Even then, such unoccupied areas can only be designated if

¹ See 85 Fed. Reg. 76262 (November 27, 2020)

NMFS determines there is a “reasonable certainty both that the area will contribute to the conservation of the species and that the area contains one or more of those physical or biological features essential to the conservation of the species.” 50 CFR § 424.12(b)(2).

Review of Proposed Designations by Dr. Veron

To assist in its review of the proposed critical habitat designations, the Council contacted Dr. John “Charlie” Veron and requested his review of the scientific information underpinning the proposed designations. Dr. Veron is a world-renowned expert on coral species, and has authored many books, monographs, and scientific articles regarding coral species. He is credited with discovering more than 20% of the world's coral species. Consequently, his expertise in these areas is unquestioned. Dr. Veron was not contacted by NMFS to solicit his input or peer review of NMFS’ proposed critical habitat designations. This is disturbing given both Dr. Veron’s breadth of knowledge in this area, and his access to key scientific information and studies regarding these species. Dr. Veron noted that he remains willing to provide an independent review of NMFS’ work if requested to do so.

Dr. Veron conducted an in-depth review of NMFS’ information report that provides the basis for the proposed designations. His review is attached to this comment letter. Dr. Veron’s general conclusions regarding the information report were as follows:

1. The report does not support the proposed designation of critical habitat for the 7 coral species considered. The report omits crucial scientific information about these species. Furthermore, the report fails to provide a global context, and does not consider the range-wide distribution of the 7 coral species, rendering the evaluation of habitat within American waters inaccurate and unreliable;
2. For the 7 species considered, American territories have a minor global importance for their conservation and recovery. Broad designations of ocean area in American territories are thus not warranted;
3. Of the 7 species considered for critical habitat designation, 6 are ‘least concern’ in terms of conservation status based on the Corals of the World information, while one species is considered data deficient. In general, the 7 species are broadly distributed, and are not at risk other than to mass bleaching, which affect all corals around the world;
4. All 7 species occur on reefs, and the corals need only small areas of reef habitat to settle and grow. The proposed critical habitat designations are overly broad because large areas of ocean around the reef areas are not essential for conservation or recovery of the species;
5. There are no habitat characteristics in American territories that distinguish these areas from comparable regions elsewhere in the world. American territories provide no unique habitat features that are not provided elsewhere in the world;
6. Any delineation or designation of coral critical habitat should be based on habitat maps that have been verified on the ground for accuracy of reef areas. Such maps were not used or considered in the report. Absent such verification, coral delineations are arbitrary because areas delineated may not be suitable to support coral species; and
7. Statements contained in the report indicate that there are multiple misidentifications of the 7 coral species in the analysis. This is not surprising because the 7 coral species at issue are commonly misidentified or require specialized expertise for identification. In general, over half of the scientific publications cited misidentify coral species.

In summary, Dr. Veron's review shows that the proposed designations of critical habitat by NMFS were overly-broad, and not supported by the best available scientific information. This review, along with the fact that Dr. Veron was not contacted by NMFS during the development of its proposal, strongly suggests that NMFS should reconsider its designations as outlined in this comment letter.

Review of Coral Species Information

All seven of the ESA-listed coral species that NMFS identifies as occurring in American Samoa, Guam and the Commonwealth of the Northern Mariana Islands (CNMI) have either a moderate or wide distribution based on information available in the Corals of the World (Table 1; Veron 2014²). Of these seven species, *Euphyllia paradivisa* has the narrowest distribution, with the species confirmed or strongly predicted to occur in 16 ecoregions (Figure 1). As indicated in NMFS' final listing rule, the core range of *E. paradivisa* is restricted to the Coral Triangle. *Acropora retusa* has a much broader distribution, occurring in 44 ecoregions from the Red Sea and the Indian Ocean to the central Pacific (Figure 1). In all seven species, occurrence in U.S. jurisdictions represents a small portion of the species range, and the core species range occurs outside of U.S. waters. In fact, NMFS states in the proposed rule that coral reef areas within U.S. jurisdiction provide no more than about 2% of each listed species' total range. In determining whether unoccupied areas should be designated as critical habitat, NMFS stated that it could not support the notion that such a small area of unoccupied area at the range margin is essential to the conservation of the species.³ It is perplexing then, that NMFS has determined the occupied portions of that same 2% of the species range to be essential to the species and has proposed critical habitat designation. Dr. Veron's review also states that U.S. jurisdictions only have a minor global importance for their conservation and recovery.

Documentation of the occurrence of ESA-listed coral species in U.S. waters are highly uncertain, and largely based on opportunistic survey observations, with some species (*A. jacquelineae*, *Seriatopora aculeate*) based solely on one or two reports from personal communication sources. Species identification uncertainty for ESA-listed coral species are moderate to high indicating that occurrence records are uncertain, and contain misidentifications (Fenner 2015⁴). Available information on these species in U.S. jurisdictions mostly provide presence or absence record at a point in time, and do not provide a basis for determining whether those areas are essential to the species' recovery. The available data also do not provide sufficient information to determine which portions of reef habitat in U.S. jurisdictions were occupied by the species at the time the species were listed under the ESA.

The opportunistic observations of rare coral colonies may simply represent the presence of "waif" species in U.S. waters. In marine biogeography, a "waif" is an unusual species that is alien to a location and is unsuccessful at maintaining a reproducing population due to very small

² Veron, J.E.N. 2014. Results of an update of the Corals of the World Information Base for the Listing Determination of 66 Coral Species under the Endangered Species Act. Report to the Western Pacific Regional Fishery Management Council. Honolulu: Western Pacific Regional Fishery Management Council. 11pp. + Appendices.

³ See proposed rule at 85 Fed. Reg. 76274.

⁴ Fenner 2015. Species identification uncertainty for the 15 ESA-listed Indo-Pacific coral species. Memorandum to file, NMFS Pacific Islands Regional Office, April 2015, 94 pages.

populations sizes (i.e., often only a single or a few colonies are observed). Due to the pelagic larval stage of coral species, a waif coral species may settle on a reef in U.S. waters that originated on reefs from other national jurisdictions. Such a coral does not become "naturalized" in the new reef area as it typically only persists a single generation and disappears. This mechanism may explain the opportunistic observations given the broad distributions of many of the ESA-listed coral species relative to the small overall proportion of their habitats in U.S. jurisdictions and suggests that U.S. coral reef areas identified for designation are not "critical" for the persistence of those species. NMFS should consider this concept in the context of the listed species' full geographic context.

In territorial waters, existing laws and regulations in American Samoa, Commonwealth of the Northern Mariana Islands (CNMI) and Guam protect corals and their habitat from various impacts. For example, in American Samoa, regulations prohibiting direct take of corals and protecting corals from water quality impacts are incorporated in the Department of Marine and Wildlife Resource and American Samoa Environmental Protection Agency regulations. In the CNMI, projects permitted through the Coastal Resource Management Program are prioritized for permitting based on a list of criteria that is favorable to the conservation of coral reefs, and take of corals for reasons other than scientific study is considered unacceptable. Guam similarly regulates harvest of corals in territorial waters through commercial permits and prioritizes coral reefs for protection in the Guam EPA regulations. In American Samoa and CNMI, a stoppage period during the annual coral spawning event is required for earthmoving or other activities that may affect coral reproduction. A comprehensive summary of existing protections under local and federal laws were included in Appendix 1 of NMFS' Management Report prepared during the listing process⁵.

The conservation value of any ESA-listed coral species habitat in the U.S. jurisdictions is likely to be negligible in the context of the species full range and existing local and federal protections for corals and coastal habitat. The Council requests NMFS to reevaluate the applicability of critical habitat in U.S. jurisdictions in accordance with 50 CFR 424.12(a)(1) and 50 CFR § 424.12(b)(2).

Table 1. Summary of distribution information for ESA-listed corals thought to occur in U.S. waters. Source: Veron 2014.

Species	Information from Veron (2014)	
	Number of ecoregions confirmed or strongly predicted	Distribution
<i>Euphyllia paradivisa</i>	16	moderate
<i>Acropora jacquelineae</i>	17	moderate
<i>Seriatopora aculeata</i>	26	wide
<i>Isopora crateriformis</i>	30	wide
<i>Acropora globiceps</i>	38	wide
<i>Acropora speciosa</i>	38	wide
<i>Acropora retusa</i>	44	wide

⁵ Available online at: <https://www.fisheries.noaa.gov/resource/document/management-report-82-corals-status-review-under-endangered-species-act-esa>

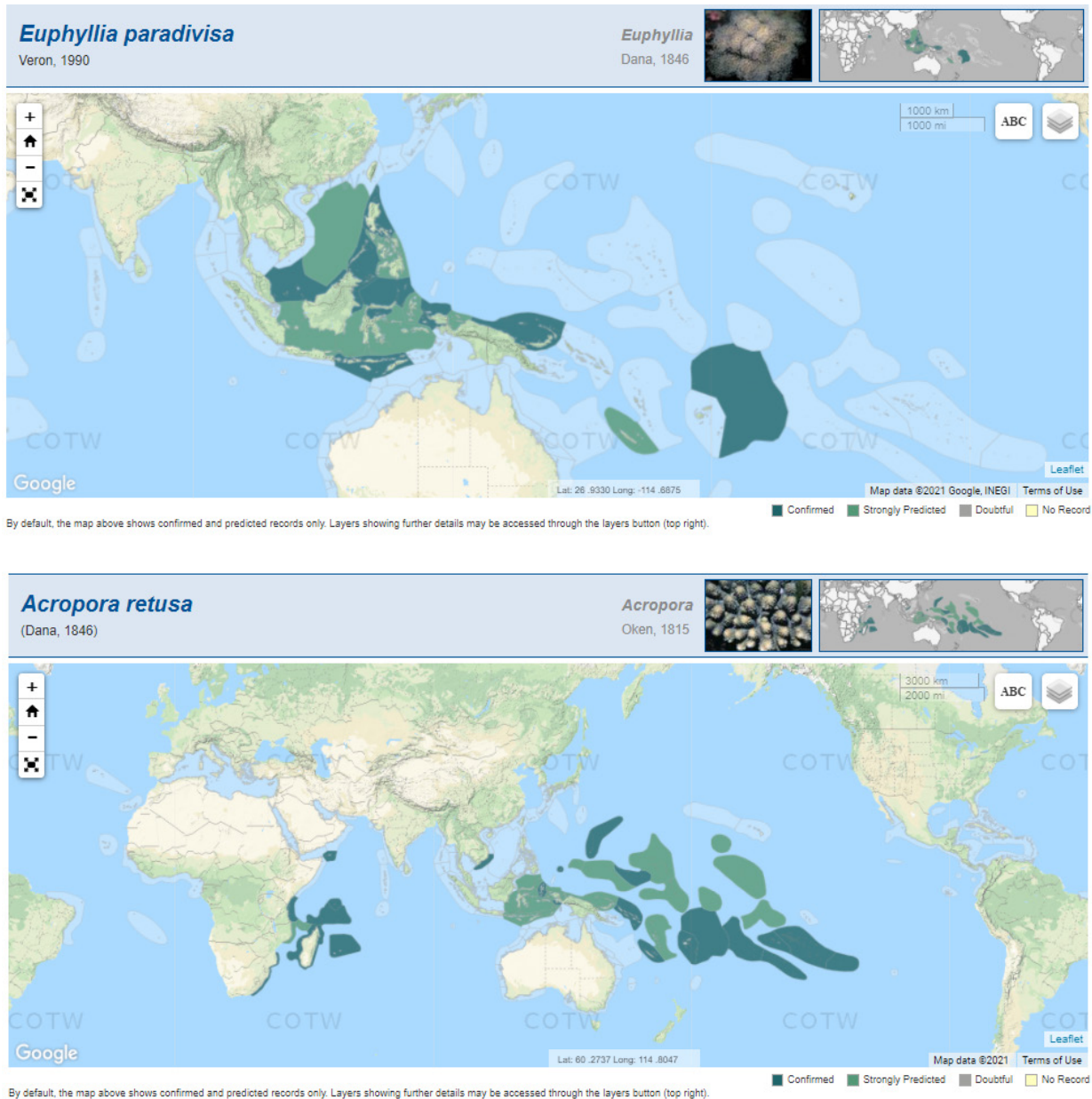


Figure 1. Distribution maps of *E. paradivisa* and *A. retusa*.
Source: www.coralsoftheworld.org (Accessed March 1, 2021).

NMFS should Modify Maps to Accurately Reflect Habitat Containing Essential Features

The coral critical habitat maps included in the proposed rule do not accurately reflect the full description of the designation and essential features. The maps show most areas around each applicable islands to be part of the designation based on the depth of the species confirmed to occur in that area. For example, the map for Saipan and Garapan Bank shows the critical habitat boundary as 0-40m based on the known depth of *S. aculeate*. However, the proposed regulatory description of critical habitat around Saipan suggests that areas with sandy bottoms, such as lagoons, or other substrate that does not meet the essential features, are excluded from the

designation. Ambiguous critical habitat maps will likely lead to confusion and inconsistencies for future ESA consultations.

Additionally, Dr. Veron's review indicate that the ESA-listed coral species only need small areas of reef habitat to settle and grow, and that any delineation of coral habitat should also be based on maps that have been ground-truthed for accuracy of reef areas.

NMFS should clearly define what types of substrate are not included in the critical habitat descriptions. Additionally, NMFS should redo the boundary maps to exclude areas that do not have suitable habitat based on publicly available sources, and make the maps available as GIS shapefiles available for download from the NMFS website⁶.

NMFS should Consult with Territory Governments in Developing Potential Critical Habitat Designations

The Council is concerned that NMFS did not coordinate with the governments of American Samoa, CNMI and Guam in the development of this proposed rule. Most of the proposed designation areas occur inside 3nm. While local agencies do not have the responsibility for initiating Section 7 consultations, many marine and coastal projects implemented by the Territory Governments require federal permitting or authorization, or are federally funded. Due to the broad range of the proposed critical habitat designation, terrestrial or coastal projects that may not have previously required a consultation with NMFS may require consultations in the future. Territory Governments would also have the expertise to identify managed areas for exclusion from the designations.

Government representatives from American Samoa, CNMI and Guam developed revised maps that exclude habitat features that are not essential, as well as other existing managed areas that do not qualify as containing essential features. The Council requests NMFS to work with the representatives from each area to refine the critical habitat areas within each jurisdiction, should NMFS proceed with the designation. NMFS should also conduct ground-truthing of reef areas prior to any designation of critical habitat.

Conclusions

The Council finds that critical habitat designations in U.S. jurisdiction are overly broad, and not based upon the best available scientific or economic information. Furthermore, the Council concludes that existing federal and local mechanisms also provide adequate protections for corals and their habitat, and designation of critical habitat is not likely to provide additional conservation benefits. The Council requests NMFS to reconsider the proposed designation of critical habitat. NMFS should focus on allocating resources to address the range-wide threats to the ESA-listed coral species, as well as on developing and implementing a recovery plan.

⁶ NMFS has previously made shapefiles available for other critical habitat designations. For example, see the proposed critical habitat designation for the Arctic subspecies of the ringed seal:

<https://www.fisheries.noaa.gov/action/designation-critical-habitat-arctic-subspecies-ringed-seal>

Thank you for considering the Council's comments regarding the proposed rule. Please do not hesitate to contact me or my staff if you would like to discuss these comments in further details.

Sincerely,



Kitty M. Simonds
Executive Director

Enclosure:

J.E.N. Veron. 2021. Review of the Endangered Species Act Critical Habitat Information Report

Cc: Paul Doremus, Acting Assistant Administrator for Fisheries
Sam Rauch, Deputy Assistant Administrator for Regulatory Programs
Lance Smith, Fishery Biologist, PIRO Protected Resources Division
Michael Seki, Director, Pacific Islands Fisheries Science Center
Archie Soliai, Chair, Western Pacific Regional Fishery Management Council; Director,
AS Department of Marine and Wildlife Resources
Anthony Benevante, Secretary, CNMI Department of Lands and Natural Resources
Chelsa Muña-Brecht, Director, Guam Department of Agriculture

Review of the Endangered Species Act Critical Habitat Information Report

J. E. N. Veron May, 2021

Critical Information according to Endangered Species Act Critical Habitat Information Report

General comments

- A. The report does not support the proposed designation of critical habitat for the 7 coral species considered. The report omits crucial scientific information about these species. Furthermore, the report fails to provide a global context, and does not consider the range-wide distribution of the 7 coral species, rendering the evaluation of habitat within American waters inaccurate and unreliable.
- B. For the 7 species considered, American territories have a minor global importance for their conservation and recovery. Broad designations of ocean areas in American territories are thus not warranted.
- C. Of the 7 species considered for critical habitat designation, 6 are 'least concern' in terms of conservation status based on the Corals of the World information, while one species is considered data deficient. In general, the 7 species are broadly distributed, and are not at risk other than to mass bleaching, which affect all corals around the world.
- D. All 7 species occur on reefs, and the corals need only small areas of reef habitat to settle and grow. The proposed critical habitat designations are overly broad because large areas of ocean around the reef areas are not essential for conservation or recovery of the species.
- E. There are no habitat characteristics in American territories that distinguish these areas from comparable regions elsewhere in the world. American territories provide no unique habitat features that are not provided elsewhere in the world.
- F. Any delineation or designation of coral critical habitat should be based on habitat maps that have been verified on the ground for accuracy of reef areas. Such maps were not used or considered in the report. Absent such verification, coral delineations are arbitrary because areas delineated may not be suitable to support coral species.
- G. Statements contained in the report indicate that there are multiple misidentifications of the 7 coral species in the analysis. This is not surprising because the 7 coral species at issue are commonly misidentified or require specialized expertise for identification. In general, over half of the scientific publications cited misidentify coral species.

Geographic data

Where American territories sit in a global context is all but ignored.

All 7 species have been mapped in some detail (in www.coralsofttheworld.org and professional references are given for these maps (Appendix A). Both this mapping and most of the references have been ignored. The report gives an extensive array of references ranging from peer reviewed to hearsay, but these are not nested in key references or any broader context. This is never accepted in science as detailed focus only has meaning in broader context.

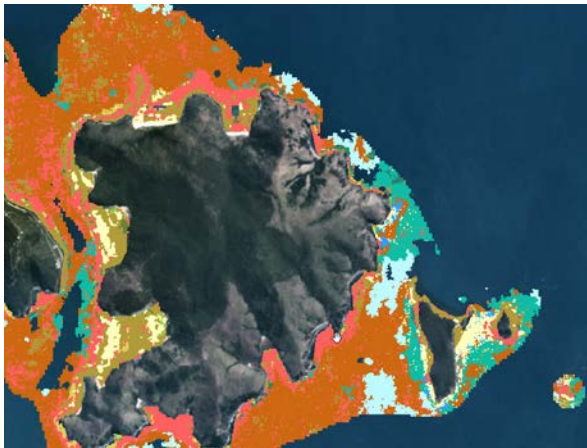
The biogeographic concept of 'waif' species is useful but is meaningless unless nested in full distributions.

Habitat data

Again, there is an extensive array of habitat data but none are nested in a broader context. To illustrate that point, the statement "monkeys on island X climb trees" might appear interesting but in the context that all monkeys on all islands climb trees it is not.

The habitat information and maps provided (Figures 2-13) have no contextual meaning. The following is a typical satellite image intended to distinguish reef areas (turquoise) from non-reef areas (other colours). This would require ground-truthing conducted by appropriate expertise to reflect the accuracy of the spectra used if this image were to be used for research of conservation purposes.

Low-level aerial photography usually yields more meaningful results than currently used satellite images.



The report's habitat maps are office productions presumably based on bathymetry. The ocean areas identified have no individual or unique properties, and none of the habitat proposed for designation are critical or even unusual for the applicable coral species.

There are no habitats characteristics which distinguish these American territories from comparable regions elsewhere in the world. A similar array of maps could apply to any geographic area anywhere. Consequently, the proposed designations are relatively meaningless, and do not accurately identify areas of the ocean that should be identified as critical habitat for these 7 species.

Species traits

Reproductive cycles of corals differ greatly among geographic regions. The American territories under consideration is a small enough in area to have a common mass spawning regime. Otherwise, there are no distinguishing aspects of the reproduction of the 7 species.

Environment

Corals around the world are severely impacted by mass bleaching and are becoming impacted by ocean acidification. Corals throughout the Indo-Pacific have, for a century at least, been severely impacted by the Crown-of-Thorns starfish. Corals in many locations around the world have been stressed by water quality, the nature of which varies greatly among countries. Sedimentation is by far the most harmful.

Individual locations may have environmental stressor which could and should be remedied. However, it is unlikely that any would be as harmful as Crown-of-Thorns starfish or (the most harmful of all) mass bleaching due to temperature stress.

There is no ocean acidification concern for the 7 species, or any other corals, other than occurrences in Hawaii, which are likely to be adversely impacted ahead of locations at lower latitudes.

Conservation

Six of the 7 species are 'of least concern', based on the Corals of the World data (Appendix A). The remaining one species, *Euphyllia paradivisa*, is 'data deficient'.

None of the 7 species are particularly at risk, other than by mass bleaching events, which is common to all corals species. Most Indo-Pacific corals, particularly staghorn *Acropora*, are impacted by Crown-of-Thorns starfish. This can be controlled.

American waters will be of minor global importance to the conservation of the 7 species. Overly-broad designations of critical habitat is neither warranted nor supported by available scientific information. The proposed designations are overly broad as noted above.

There are no distinguishing or unique life history traits of the 7 species.

Artificial substrates for colonisation have been made in many countries. Most have been failures. All those that have had any measure of success have followed expert advice.

Recommended science-based approach to coral habitat protection

Habitat selection and subsequent activities have been most successful if undertaken as follows:

1. Obtain satellite or aerial images of all proposed habitat areas. Such imagery is readily available from various sources.
2. Reef areas in satellite and aerial images should be ground-truthed. This can be done using a variety of methods. After conducting this evaluation, then geographic areas may be identified that warrant protection, including areas of the ocean at depth.
3. Undertake expert compilations of all species in selected places of interest. Experts should be identified that can correctly identify the species at issue to avoid misidentification. For example, the author of this report has extensively published information regarding coral species, and has not been contacted to provide input into these matters. Include independent experts to assist in identify key areas for protection.
4. Integrate compilations within full biogeographic range data.
5. Select most threatened species, or species whose conservation status warrants protection. Avoid overly-broad designations because that could be counterproductive to species conservation.
6. Assess whether reefs of interest are in sink or source categories.
7. Mitigate local impacts. Build artificial reefs under expert supervision.
8. Maintain samples of threatened species in biobanks.
9. Monitor and record all the above activities. Document the process of identification to verify it was correctly conducted.

Appendix A: Critical Species-specific Information according to widely accepted science

Principal references (Coded) below are the data behind Veron's 2014 report "Results of an Update of the Corals of the World Information Base for the Listing Determination of 66 Coral Species under the Endangered Species Act".

Acropora globiceps

Distribution

Map data: Incomplete but indicative distribution where ecoregion data is suitable for approximate assessment but where gaps may have any cause including missing records and non-occurrence. Quantitative assessments of these maps include both confirmed and predicted occurrences.

Summary References: Veron (2000), www.coralsoftheworld.org

Principal references (coded): **Seychelles(3):** Sheppard & Obura (2005); Obura, pers.comm.;
// **AndamanSea(2):** Turak et al 2005*; // **AndamanIs(2):** Fenner (2001)*;
// **LesserSunda(1):** Turak&DeVantier 2013 TL; Turak 2006 Komodo; // **MilneBay(1):** Turak & DeVantier 2007; // **SolomonIs(1):** Turak 2006 Solomons; Veron 2006 Solomons ; // **BismarckSea(1):** Turak et al 2006 Bismarck; // **Cenderawasih(1):** Turak and DeVantier (in prep); Turak and DeVantier 2006;
// **BirdsHead(1):** Veron (2002); Turak and Souhoka (2003a); // **Halmahera(1):** Turak and DeVantier 2008 Halmahera; // **Celebes(1):** Turak 2004 ST; Scaps et al (2007); // **SuluSea(1):** Turak and DeVantier Elnido;
// **NPhilippines(2):** Huang et al. (2014) W Luzon N Philippines *^; // **SChinaSea(2):** Bassett-Smith (1890a&b); // **SundaShelf(2):** Huang et al. (2014) W Malaysia Sunda Shelf *^; // **SVietnam(1):** DeVantier (2002, 2003); Huang et al. (2014) South Vietnam *^; // **Okinotorishima(2):** Kayanne et al (2012)*;
// **CoralSea(1):** Wallace et al. 2012; Oxley et al. 2004 MTQ Coral Sea records; // **Palau(1):** Turak and DeVantier (2009); // **YapIs(1):** Turak and DeVantier (2007)*; // **Marianas(1):** Randall & Burdick, in prep, Marianas; // **Carolines(2):** Houk (2008) Chuuk*; Houk 2008 Mortlock*; // **Pohnpei(1):** Turak and DeVantier (2005)*; // **NewCaledonia(1):** Fenner 2009 NewCal; Fenner and Muir (2009); Fenner (2013) New Caledonia; // **Fiji(1):** DeVantier & Turak 2010; Lovell, pers.comm. 2006; Lovell & McLardy (2008)^; Turak 2000 Naitaba Fiji; // **Samoa(1):** Fenner pers.comm. AmSam *; Wallace et al (2012) Niue; Kenyon et al (2010)*AmSam; Kenyon et al (2011)^; Kenyon, Maragos and Fenner (2011) ^; Maragos pers.comm. Samoa; // **PhoenixIs(2):** Obura PersComm; Maragos & Schmerfeld 2004 pers.comm. Howland;
// **LinelsNE(2):** Kenyon et al (2010)*; Williams et al (2008); Maragos pers.comm.^; Kenyon et al (2011)^;
// **CookIs(1):** Wallace et al (2012); // **SocietyIs(1):** Wallace et al (2012) SocietyIs; Carroll et al (2006); Bosserelle et al (2014); Wallace et al. (2012) Society Isl and French Polynesia; Dana (1846) TYPE LOCALITY; // **Pitcairn(1):** Palomares et al (2011)^; Wallace et al. 2012; Friedlander et al. (2014) Pitcairn Isl.; Irving and Dawson (2012) Pitcairn; //

Identification

Commonly mis-identified.

Similar species: *Acropora gemmifera*, which has radial corallites increasing in size down the sides of branches. Colonies exposed to strong wave action have a growth-form like that of *A. monticulosa*. Corallites are similar to those of *A. secale* and *A. retusa*.

Abundance

Seldom common.

Conservation status

Least concern.

Acropora jacquelineae

Distribution

Map data: Highly indicative, ecoregion data is suitable for detailed assessment. Gaps within the overall range is more likely to be due to missing records rather than non-occurrence. Quantitative assessments of these maps include both confirmed and predicted occurrences

Summary References: Veron (2000), www.coralsoftheworld.org

Principal distribution references (coded): **LesserSunda(1):**Wallace et al (2012); // **Makassar(1):**MR Wallace, Done and Muir (2012) Sulawesi; Wallace 1999-suppl.// **BandaSea(1):**Turak 2003 Wakatobi; Turak et al 2002 Banda; // **MilneBay(1):**Turak 2000 MB; Fenner & Turak 2003 MB; Wallace (1994) TYPE LOCALITY; // **SolomonIs(1):**Turak 2006 Solomons; Veron 2006 Solomons; Baird et al. (2000) Solomon Isl.; Wallace et al (2012); // **BismarckSea(1):**Turak et al 2006 Bismarck; Wallace (1994)*; // **Cenderawasih(1):**Turak and DeVantier (in prep); // **BirdsHead(1):**Veron (2002); Wallace et al (2012); // **Halmahera(1):**Turak and DeVantier 2008 Halmahera; Wallace et al (2012); // **GulfTomini(1):**Fenner 2001; // **Celebes(2):**MR Wallace, Done and Muir (2012) Sulawesi; // // **Pohnpei(1):**Wallace et al (2012)*; // **NewCaledonia(2):**Fenner 2009 NewCal; Fenner (2013) New Caledonia; // **Samoa(1):**Fenner (pers comm Am Samoa); Veron ID from NMFS images Am Samoa; //

Identification

Commonly mis-identified.

Similar species: *Acropora paniculata*, which has larger corallites.

Abundance

Uncommon.

Conservation status

Least concern.

Acropora retusa

Distribution

Map data: Incomplete but indicative distributions where ecoregion data is suitable for approximate assessment but where gaps may have any cause including missing records and non-occurrence. Quantitative assessments of these maps include both confirmed and predicted occurrences

Summary References: Veron (2000), www.coralsoftheworld.org

Principal distribution references (coded): **Socotra(1):** DeVantier 2014 Socotra; // **Kenya(1):** Obura 2012 Ken/Tnz*; Obura, pers.comm.; Riegl (1995)(as *A. mossambica*); Wallace 1999 suppl; // **NMozambique(2):** Obura 2012 N Moz; Riegl (1995); // **SMozambique(1):** Riegl 1996a (S Moz); Wallace et al (2012); Riegl (1995a); Riegl (1995a) SynTYPE LOCALITY as *Acropora mossambica*; // **ESouthAfrica(1):** Riegl 1996a (SA); Riegl (1995a); // **Mayotte(2):** Obura 2012 Mayotte; // **NSeychelles(1):** Wallace et al. 2012 N Seych; Veron, 1998; // **SSeychelles(1):** Sheppard & Obura (2005); Wallace et al. 2012 S Seych; Obura 2012 S Seych; Obura, pers.comm.; // **NMadagascar(1):** Veron and Turak 2005 N Madg; Obura 2012 N Madg; Wallace et al. 2012; // **SMadagascar(1):** Veron 1998; // **Mascarenes(1):** Faure et al 2008^; Pillay, Terashima, Venkatasami et al. (2002) Mauritius; Wallace et al (2012) Mauritius; // **StraitMalacca(3):** Bridge et al. (2013); Rudi et al. (2012) Pulau Weh Malacca Strait; // **LesserSunda(2):** Turak & DeVantier 2012 Bali; // **SWPapua(1):** Turak and DeVantier (in prep); // **SolomonIs(1):** Veron 2006 Solomons; // **Cenderawasih(2):** Turak and DeVantier (in prep) unconfirmed; // **Halmahera(1):** Turak and DeVantier 2008 Halmahera; // **SundaShelf(3):** Amri et al. 2005; Huang et al. (2014) W Malaysia Sunda Shelf ^; // **SVietnam(1):** DeVantier (2002, 2003); // **Palau(1):** Wallace et al (2012)*; // **Marianas(1):** Randall & Burdick, in prep, Marianas; Wallace et al. (2012); // **Carolines(2):** Houk (2008) Chuuk*; Houk 2008 Mortlock*; Maragos pers.comm.; // **Pohnpei(1):** Wallace et al (2012)*; P. Houk pers.comm.; Environmental Resources Section 1986; Donaldson and Maragos 2007 as cited in Richards (2014); // **Marshalls(2):** Maragos pers.comm.; // **NewCaledonia(1):** Fenner 2009 NewCal; Fenner and Muir (2009); Fenner (2013) New Caledonia; // **Fiji(1):** Fenner 2006a; Lovell & McLardy (2008)^; // **Samoa(1):** Wallace et al (2012) Niue; DiDonato et al (2006) AmSam; Kenyon et al (2010)* AmSam; Kenyon et al (2011)^; Kenyon, Maragos and Fenner (2011) ^; Maragos pers.comm. Samoa; // **PhoenixIs(2):** Obura PersComm; Maragos pers.comm.; Kenyon, Maragos & Fenner (2011)^; // **JohnstonAtoll(2):** Kenyon, Maragos & Fenner (2011)^; // **LinelsNE(2):** Kenyon et al (2010)*; Maragos pers.comm.^; Kenyon et al (2011)^; // **LinelsSE(2):** BL Maragos pers.comm.; // **CookIs(1):** Wallace et al (2012); // **AustralIs(1):** Wallace et al (2012)*; Adjeroud et al. (2012) Rapa Austral Isl ^; // **SocietyIs(1):** Pichon in Glynn et al (2007); Wallace et al (2012) Tahiti; Carroll et al (2006); Bosserelle et al (2014); Wallace et al. (2012) Society Isl and French Polynesia; // **WTuamotu(1):** Wallace (1994) as *A. pocilloporina*; // **Pitcairn(1):** Palomares et al (2011)^; Wallace et al. 2012; Friedlander et al. (2014) Pitcairn Isl.; Irving and Dawson (2012) Pitcairn; //

Identification

Requires specialist expertise.

Similar species: *Acropora globiceps* which has similar characters but has compact branches and neat rounded radial corallites. See also *A. gemmifera*, which has longer branchlets and more exsert basal radial corallites and *A. monticulosa*, which has corallites in rows.

Abundance

Common in South Africa, uncommon elsewhere

Conservation status

Least concern.

Acropora speciosa

Distribution

Map data: Highly indicative, ecoregion data is suitable for detailed assessment and where gaps within the overall range is more likely to be due to missing records rather than non-occurrence. Quantitative assessments of these maps include both confirmed and predicted occurrences

Summary References: Veron (2000), www.coralsoftheworld.org

Principal distribution references (coded): **Mayotte(1):**Wallace et al. 2012 Mayotte; // **Maldives(1):**Wallace et al (2012)*; // **LesserSunda(1):**Turak & DeVantier 2012 Bali; Turak&DeVantier 2013 TL; Turak 2006 Komodo; Wallace et al (2012); Stevanus and Trijoko (2014) Lesser Sunda; // **Makassar(1):**Wallace (1999); MR Wallace, Done and Muir (2012) Sulawesi; // **BandaSea(1):**Turak 2003 Wakatobi; Turak et al 2002 Banda; Wallace et al (2012); // **SWPapua(1):**Turak and DeVantier (in prep); // **MilneBay(1):**Turak & DeVantier 2007; Turak 2000 MB; Fenner & Turak 2003 MB; // **SolomonIs(1):**Turak 2006 Solomons; Veron 2006 Solomons ; Wallace et al (2012); // **BismarckSea(1):**Turak et al 2006 Bismarck; // **Cenderawasih(1):**Turak and DeVantier (in prep); Turak and DeVantier 2006; // **BirdsHead(1):**Veron (2002); Turak and Souhoka (2003a); Wallace et al (2012); // **Halmahera(1):**Turak and DeVantier 2008 Halmahera; Wallace et al (2012); // **GulfTomini(1):**Wallace 1999; // **Celebes(1):**Turak and DeVantier 2004 Bunaken ; Turak 2004 ST; Scaps et al (2007); MR Wallace, Done and Muir (2012) Sulawesi; // **SuluSea(1):**Turak and DeVantier ElNido; Turak and DeVantier Derawan; Wallace et al. (2012) SuluSea*^; Huang et al. (2014) Palawan Sulu Sea ^; // **SEPhilippines(1):**Nemenzo (1986) SE Philippines *^; // **NPhilippines(1):**Turak and DeVantier (2007) Batangas; Huang et al. (2014) W Luzon N Philippines *^; // **SChinaSea(1):**Latypov 2011; Vo Si Tuan (2013 list); Huang et al. (2014) Spratly Isl SCS *^; // **SundaShelf(1):**Turak and DeVantier 2011; Turak and DeVantier 2012; Turak and DeVantier 2014 Brunei III; Huang et al. (2014) W Malaysia Sunda Shelf *^; Huang et al. (2014) Brunei ^; // **SVietnam(2):**Latypov (2006); Huang et al. (2014) South Vietnam *^; // **TorresStrait(1):**Turak 2011 FNGBR Meso; // **CoralSea(1):**Wallace et al. 2012; Oxley et al. 2004 MTQ Coral Sea records; // **Palau(1):**Wallace et al (2012)*; // **Pohnpei(1):**Turak and DeVantier (2005)*; Wallace et al (2012)*; Muir and Wallace (2015) *; // **Marshalls(1):**Maragos pers.comm.; Wallace et al (2012); Richards & Beger (2013)* ; Wells (1954)* ; // **NewCaledonia(1):**Fenner 2009 NewCal; Fenner and Muir (2009); Fenner (2013) New Caledonia; Wallace et al. (2012); // **Fiji(1):**Devantier & Turak 2010; Fenner 2006a ; Lovell pers.comm. 2006; Wallace et al (2012); Lovell & McLardy (2008)^; Turak 2000 Naitauba Fiji; // **Samoa(3):**Fenner pers.comm. AmSam*; Maragos pers.comm. Samoa; // **LinelsNE(3):**Maragos pers.comm.^; Kenyon et al (2011)^; Kenyon et al (2010) LinesNE; // **SocietyIs(1):**Pichon in Glynn et al (2007); Quelch (1886) TYPE LOCALITY; // **WTuamotu(3):**Pichon in Glynn et al (2007); //

Identification

Commonly mis-identified.

Similar species: *Acropora echinata*, which has smaller corallites and does not form compact cushions. See also *A. granulosa*.

Abundance

Usually uncommon but conspicuous.

Conservation status

Least concern.

Euphyllia paradivisa

Distribution

Map data: Highly indicative where ecoregion data is suitable for detailed assessment and where gaps within the overall range is more likely to be due to missing records rather than non-occurrence. Quantitative assessments of these maps include both confirmed and predicted occurrences

Summary References: Veron (2000), www.coralsoftheworld.org

Principal distribution references (coded): **Socotra(1):** DeVantier et al. 2004; DeVantier 2014 Socotra; // **Chagos(3):** Sheppard 1999 Chagos; // **LesserSunda(1):** Turak and DeVantier 2013 TL; // **BismarckSea(1):** Turak et al 2006 Bismarck; Maragos pers.comm. Kimbe Bay; // **BirdsHead(1):** Veron (2002); Fenner (2002); // **GulfTomini(1):** Fenner 2001; // **Celebes(1):** Turak 2004 ST; Scaps et al (2007); // **SuluSea(1):** Veron & Fenner 2000 Calamianes; Waheed and Hoeksema (2013); Waheed et al. (2015) N tip Borneo Sulu Sea *; Huang et al. (2014) Palawan Sulu Sea ^; // **NPhilippines(1):** Veron (1990a)*; Vergara (2009)^*; Veron & Hodgson Bolinao; // **SundaShelf(1):** Turak and DeVantier 2012; Amri et al. 2005; Turak and DeVantier 2014 Brunei III; Huang et al. (2014) W Malaysia Sunda Shelf *^; Huang et al. (2014) W Sabah Sunda Shelf; // **NewCaledonia(2):** Fenner 2009 NewCal; // **Samoa(1):** Fenner pers.comm. AmSam*; //

Identification

Requires specialist expertise.

Similar species: *Euphyllia glabrescens*, *E. paraglabrescens* and *E. paraancora* can only be reliably distinguished by the characters of polyp tentacles. *Euphyllia yaeyamaensis* is similar but has both skeletal and tentacle distinctions.

Abundance

Usually uncommon.

Conservation status

Data deficient.

Isopora crateriformis

Distribution

Map data: Highly indicative, where ecoregion data is suitable for detailed assessment and where gaps within the overall range are more likely to be due to missing records rather than non-occurrence. Quantitative assessments of these maps include both confirmed and predicted occurrences

Summary References: Veron (2000), www.coralsoftheworld.org

Principal distribution references (coded): **SMadagascar(3):**Fenner Madagascar 2005*;
// **ChristmasIs(1):**Richards and Hobbs (2014) Christmas Island *^; // **LesserSunda(1):**Veron and Stafford-Smith (2002) Flores/Bali; // **BandaSea(1):**Wallace et al (2012); // **SWPapua(1):**Turak and DeVantier (in prep); // **MilneBay(1):**Fenner & Turak 2003 MB; // **SolomonIs(1):**Turak 2006 Solomons;
// **Cenderawasih(1):**Turak and DeVantier (in prep); Turak and DeVantier 2006; // **BirdsHead(1):**Turak and Souhoka (2003a); Wallace et al (2012); // **Halmahera(1):**Wallace et al (2012); // **Celebes(1):**Turak and DeVantier 2004 Bunaken ; Turak 2004 ST; Scaps et al (2007); // **SuluSea(1):**Turak and DeVantier Derawan; // **SChinaSea(2):**Huang et al. (2014) SCS Paracel Islands ^*; // **SundaShelf(1):**Turak and DeVantier2011; Huang et al. (2014) W Malaysia Sunda Shelf *^; Huang et al. (2014) Brunei ^;
// **CoralSea(2):**Ceccarelli et al. (2008); Oxley et al. 2005; Clua et al (2011); // **Marshalls(2):**Richards & Beger (2013)* ; // **NewCaledonia(1):**Fenner 2009 NewCal; Fenner and Muir (2009); Fenner (2013) New Caledonia; Wallace et al. (2012); // **Fiji(1):**Devantier & Turak 2010; Fenner 2006a; Fenner 2006b (Voli); Lovell pers.comm. 2006; Wallace et al (2012); Lovell & McLardy (2008)^; // **Samoa(1):**Birkeland et al (1994) AmSam; Fenner pers.comm. AmSam*; Wallace et al (2012) Samoa; DiDonato et al (2006) AmSam; Mundy (1996) AmSam; Lamberts (1983) AmSam; Kenyon, Maragos and Fenner (2011) ^; Gardiner (1898) Type locality; //

Identification

Requires expertise.

Similar species: *Isopora cuneata* has larger, more uniform corallites. See also *Acropora minuta*. Can readily be mistaken for an *Astreopora* with small corallites underwater.

Abundance

Common only in Indonesia.

Conservation status

Least concern.

Seriatopora aculeata

Distribution

Map data: Incomplete but indicative where ecoregion data is suitable for approximate assessment but where gaps may have any cause including missing records and non-occurrence. Quantitative assessments of these maps include both confirmed and predicted occurrences.

Summary References: Veron (2000), www.coralsoftheworld.org

Principal distribution references (coded): **NMadagascar(3):** Veron and Turak 2005 N Madg; Turak 2005 N Madg; // **LesserSunda(1):** Turak & DeVantier 2012 Bali; Turak&DeVantier 2013 TL; Turak 2006 Komodo; // **BandaSea(1):** Turak 2003 Wakatobi; Turak et al 2002 Banda; // **SWPapua(1):** Turak and DeVantier (in prep); // **MilneBay(1):** Turak & DeVantier 2007; Turak 2000 MB; Fenner & Turak 2003 MB; // **SolomonIs(1):** Turak 2006 Solomons; // **BismarckSea(1):** Turak et al 2006 Bismarck; // **Cenderawasih(1):** Turak and DeVantier (in prep); Turak and DeVantier 2006; // **BirdsHead(1):** Veron (2002); Turak and Souhoka (2003a); Fenner (2002); // **Halmahera(1):** Turak and DeVantier 2008 Halmahera; // **Celebes(1):** Turak and DeVantier 2004 Bunaken ; // **SuluSea(1):** Turak and DeVantier ElNido; Turak and DeVantier Derawan; Huang et al. (2014) Palawan Sulu Sea ^; // **NPhilippines(1):** Turak and DeVantier (2007) Batangas; Huang et al. (2014) W Luzon N Philippines ^; // **SundaShelf(2):** Turak and DeVantier 2012; // **Kimberleys(2):** Richards et al (unpubl data BonapArch); Richards et al (2014unpubl) Kimberley; Richards, Zoe (unpubl data 2014); // **AshmoreReef(1):** Kospartov et al. 2006; Richards et al (2009)*; // **Palau(1):** Turak and DeVantier (2009); Randall (1995); // **YapIs(1):** Turak and DeVantier (2007)*; Houk Yap Island 2007 (pers. comm.); // **Marianas(1):** Randall & Burdick, in prep, Marianas; Randall (2003)^; Kayanne et al. (2012) S Marianas; // **Carolines(2):** Houk (2008) Chuuk*; Houk 2008 Mortlock*; // **Pohnpei(1):** Turak and DeVantier (2005)*; // **Marshalls(1):** Richards & Beger (2013)* ; // **NewCaledonia(1):** Fenner and Muir (2009); // **Fiji(3):** Fenner 2006a (Mam); Lovell & McLardy (2008)^; //

Identification

Commonly mis-identified.

Similar species: *Seriatopora stellata*. See also *S. hystrix*, which can have similar branch shapes on shallow exposed reef flats.

Abundance

Usually uncommon.

Conservation status

Least concern.