Critical Habitat Information Report: Appendix A Records of ESA-listed Coral Species in U.S. Pacific Islands Waters And Application to Critical Habitat

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Summary

This document describes existing records of ESA-listed coral species in the U.S. Pacific Islands and their application to critical habitat. The records were used to determine the geographic range of each listed species in terms of which islands are within its "occupied area." We conducted an extensive search for historical coral survey data from throughout all U.S. Pacific Islands, which produced records of 7 listed coral species from a total of 26 islands. The records were divided into 47 records groups by island and species, and factors affecting the validity of each records group were assessed, including their quality, quantity, age, species identification uncertainty, survey effort, and other factors. Then we systematically rated the level of evidence provided by each records group that the island was within the occupied area for the listed species at the time of listing in 2014. Finally, we interpreted the ratings of each records group to determine whether the island was within the occupied area for the listed species at the time of listing, and thus should be included in critical habitat. We concluded that 17 of the 47 records groups did not provide adequate evidence that the island was within the occupied area for the listed species at the time of listing. The remaining 30 records groups provided adequate evidence of being within the occupied area for the listed species at the time of listing from a total of 20 islands, including 19 islands for *Acropora globiceps*, 6 islands for *A. retusa*, 3 islands for *Isopora crateriformis*, and 1 island each for *A. speciosa* and *Fimbriaphyllia paradivisa* (formerly *Euphyllia paradivisa*). In addition, the 30 records groups were used to determine the depth range of each listed species around each island, another important component of critical habitat. For *A. globiceps*, the depth ranges were 0–20 m (3 islands), 0–12 m (11 islands), and 0–10 m (5 islands). For the other 4 species, the depth ranges were 0–20 m for *A. retusa* (6 islands) and *I. crateriformis* (3 islands), and 20–50 m for *A. speciosa* and *F. paradivisa* (1 island each).

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1 Introduction

This document describes the National Marine Fisheries Service Pacific Island Regional Office's (NMFS/PIRO's) current records of reef-building coral species listed under the Endangered Species Act (ESA) within U.S. Pacific Islands waters (American Samoa, Guam, the Commonwealth of the Northern Mariana Islands/CNMI, the Pacific Remote Island Areas/PRIA, and Hawaii). Within these areas, there are records of 7 ESA-listed species (*Acropora globiceps, A. jacquelineae, A. retusa, A. speciosa, Fimbriaphyllia paradivisa* (formerly *Euphyllia paradivisa*)*, Isopora crateriformis,* and *Seriatopora aculeata*), for which we considered critical habitat on 19 islands in 2020 (85 FR 76262; November 27, 2020). However, public comments on the 2020 proposed rule raised concerns about how the records were used to develop proposed critical habitat. In response, this document was developed specifically for application to the determination of coral critical habitat in the 2023 proposed rule (88 FR 83644, November 30, 2023) and subsequent final rule.

Section 1 describes the purpose of the document, and the central role of records in determining the "occupied area" for each listed species, a key step in determination of coral critical habitat under the ESA. Section 2 provides the methodology, including compilation, assessment, and application of the records. Section 3 lists and summarizes all the currently available records on a species-by-species and island-by-island basis. Section 4 interprets the results in terms of whether the records provide adequate evidence to conclude that each island was within the occupied area for any of the listed coral species at the time of listing or not.

1.1 Purpose of this Document

As described in Section 1.2 below, the designation of critical habitat for ESA-listed species begins with the determination of the geographic ranges of the listed species within U.S. waters, which in turn is based on the historical records of occurrence of the species. However, using the records for coral critical habitat requires overcoming three major challenges: (1) Finding all the records in the first place (compilation); (2) accounting for the high variability in the quality, quantity, age, species identification uncertainty, survey effort, and other factors associated with the records (assessment); and (3) interpreting the records in terms of occupied areas for critical habitat (application). Thus, the purpose of this document is to thoroughly compile the existing records of the listed coral species within U.S. Pacific Islands waters, and to provide a consistent and transparent methodology for assessing the records to determine which islands were within the occupied area for each ESA-listed coral species at the time of listing in 2014. In addition, a secondary purpose of this document is to determine the depth range of each listed species around each island, another important component of critical habitat.

1.2 Occupied Areas and Critical Habitat

Section 3(5)(A) of the ESA (16 U.S.C. §1532) defines critical habitat as (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the ESA, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protections; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the ESA, upon a determination by the Secretary that such areas are essential for the conservation of the species (16 U.S.C. § 1532(5)(A)). The phrase "Geographical area occupied by the species" is further defined in the ESA Section 4 implementing regulations as "An area that may generally be delineated around species' occurrences, as determined by the Secretary (i.e., range). Such areas may include those areas used throughout all or part of the species' life cycle, even if not used on a regular basis (e.g., migratory corridors, seasonal habitats, and habitats used periodically, but not solely by vagrant

individuals)." (50 CFR 424.02). That is, the "Geographical area occupied by the species" (hereafter abbreviated to "occupied area") refers to the range of the species at the time of listing, based on its historical records of occurrence.

The 2020 proposed rule (85 FR 76262; November 27, 2020) assumed that any expert record of a listed coral species was adequate to conclude that the island was within the occupied area for that species at the time of listing (2014). However, as pointed out in the public comments and also as indicated by new information, there are several reasons why expert records of these listed coral species may be ambiguous in terms of providing evidence that the island was within the occupied area of the listed species at the time of listing, including: (1) for listed species with high species identification uncertainty, the records may be misidentifications; (2) on islands where extensive expert surveys over many years or decades have produced only one or two records, the records may have been of vagrant individuals; and (3) in cases where extensive expert surveys were conducted both before and after listing, resulting in pre-listing records but no post-listing records, the records may be of a species that was no longer present at the time of listing.

In addition, the expert records of a given listed coral species vary greatly in quality, quantity, age, survey effort, and in other ways from island to island. Because of the ambiguity and variability in the expert records, a methodology is needed to consistently distinguish records that provide adequate evidence that the island was within the listed species' occupied area in 2014 from those that do not. This document describes the methodology we used to standardize our treatment of the records for determination of which U.S. islands were within the occupied area for each listed species, which is needed for determining critical habitat for these species.

An important consideration is the spatial scale of the components of the occupied area for each listed species. Since the listed corals occur within U.S. waters across very large areas, the occupied area for each listed species could potentially consist of ecoregions (e.g., Samoa/Tonga/Tuvalu archipelagos, Veron et al. 2016), archipelagos (e.g., Samoan Islands, Mariana Islands, Hawaiian Islands), or islands. However, in the U.S. Pacific Islands, many islands within ecoregions and archipelagos are very isolated, very small, or both. Some of these islands appear to be naturally unoccupied by any listed corals. That is, some islands within U.S. Pacific Islands waters may be inappropriate for coral critical habitat, but would be automatically included if the occupied areas were drawn at the ecoregion or archipelago scales. Thus, the ecoregion and archipelago spatial scales are too broad for coral critical habitat. Because the U.S. Pacific Islands consist of just a few dozen islands spread across a very large area, islands are the most logical spatial scale for the components of the occupied area of each listed species.

As noted in the opening paragraph to this section, the definition of occupied area does not include habitats used solely by vagrant individuals, but "vagrant individuals" is not defined. We consider the term "vagrant individuals" to be equivalent to waif colonies, defined as a single individual or small group of individuals found outside of its normal range, presumably advected by unusual currents or weather conditions (Johnson et al. 2000). Waifs are common among reef corals (Turak and DeVantier 2019) and fishes (Franklin et al. 2019). Waif colonies of the listed corals may occasionally occur on islands within U.S. waters. For example, on some islands, there has been sustained coral species survey effort by experts for many years, but only a single colony or a very small number of colonies of a coral species have ever been recorded on the island. Such records may be waifs, as discussed in the descriptions of the individual records in Section 3.

1.3 Sampling Biases and Potential Implications

Sampling bias occurs when surveys are conducted in such a way that colonies of coral species (including the listed corals) have a lower or higher probability of being detected than others within U.S. Pacific Islands waters. Sampling bias could only be avoided if all islands, habitats, and depths

would have been surveyed using the same methods, effort, and personnel. In reality, none of these conditions were met, since the records are from surveys done mainly on certain islands and within certain habitats and depths, using various methods, effort, and personnel. The resulting sampling biases may affect our conclusions regarding which islands are occupied areas for the listed corals. These geographic, habitat, depth, methods, effort, and personnel biases are described below, along with their potential implications.

Geographic Bias: A large number of field surveys by reef coral experts produced the records in this document, which were conducted on all islands in U.S. Pacific Islands waters over several decades. However, there is a strong geographic bias since many more surveys were conducted on the populated islands than on the unpopulated islands. For example, hundreds of expert surveys have been conducted on Tutuila and Guam, whereas only a handful of surveys have ever been conducted on some unpopulated islands (e.g., Swains, Anatahan, Jarvis, etc.). A potential implication of this geographic bias is that colonies of listed coral species may not have been detected on some of the unpopulated islands.

Habitat Bias: Most coral reefs consist of forereefs and backreefs, which in turn are typically characterized by a diversity of habitats (Smith 2019). The majority of the expert surveys were conducted on shallow forereefs (i.e., reef slopes <20 m in depth). Fewer surveys were conducted on deeper forereefs or within backreef habitats such as pools, lagoons, channels, and reef flats. A potential implication of this habitat bias is that colonies of listed coral species may not have not been detected in the less surveyed habitat types.

Depth Bias: The large majority of the expert surveys were conducted at approximately 5–20 m of depth. Some surveys were conducted at <5 m and >20 m of depth, while only a few surveys were conducted at >30 m of depth (i.e., in the mesophotic zone). A potential implication of this depth bias is that colonies of listed coral species may not have not been detected at <5 m and >20 m of depth, especially at >30 m of depth in the mesophotic zone.

Methods Bias: The expert surveys were conducted using a wide variety of methodologies, some of which are better designed to detect coral species than others. For example, the most widely implemented surveys were by the NMFS Pacific Islands Fisheries Science Center (PIFSC), which conducts standardized coral reef monitoring surveys designed to assess ecosystem health rather than species biodiversity. In contrast, the National Park Service (NPS) conducts coral reef monitoring surveys that focus on coral species biodiversity, but on far fewer islands than the PIFSC surveys. Furthermore, the records were also produced by many other surveys using methods that differ from both the PIFSC and NPS methods. A potential implication of this methods bias is that colonies of listed coral species may have been detected at higher or lower levels by certain methods than others.

Effort Bias: The expert surveys that produced the records were conducted at variable levels of effort across time and space. For example, PIFSC's monitoring surveys are conducted once every few years on each island, whereas NPS's monitoring surveys are conducted annually within National Park waters on each island, while other surveys were only conducted one time on one island for research or other reasons. Similar to the geographic bias, a potential implication of this effort bias is that colonies of listed coral species may not have been detected where effort was lowest.

Personnel Bias: The surveys that produced the records in this document were conducted by many different teams and individuals, including the coral species experts that did the species identifications for the surveys (see Section 2.2.1 below). However, as explained in Section 2.2.4, species identification uncertainty is high for many of the listed coral species, even for experts. Consequently, experts do not always agree on the species identification of a given colony. A

potential implication of this personnel bias is that coral colonies may have been misidentified as listed species or vice versa.

Conclusion: Overall, the most important potential implications of the sampling biases are that some locations were surveyed much less than others, especially unpopulated islands and mesophotic depths. Since the purpose of this document is to use the records to determine which U.S. islands are within the occupied area for each listed species, the sampling biases may result in some unpopulated islands being considered outside the occupied areas for all listed species when in fact they may be within the occupied area for at least one listed coral species. In addition, the records are needed to determine the depth ranges of listed corals, thus sampling biases may result in mesophotic depths not being included in depth ranges when they should be. Additional species surveys are needed to address these sampling biases, especially on unpopulated islands and at mesophotic depths.

In the meantime, we must use the best available data to make ESA-related decisions for listed corals, such as the determinations of occupied areas for critical habitat. We acknowledge the sampling biases and their potential implications, however we cannot assume that the least surveyed areas (e.g., unpopulated islands) are occupied by listed corals in the absence of expert records that provide adequate evidence, especially since all islands have been subject to standardized monitoring surveys that include species-level coral surveys since the listings in 2014. That is, as explained in the island and species-specific sub-sections of Section 3 below, all U.S. Pacific Islands have been surveyed by coral experts in the last few years, although some islands much more than others. We will update this document as future surveys produce new records.

2 Methods

The methods used for compilation, assessment, and application of the records are described below.

2.1 Compilation of Records

The available records for each listed coral species on each island within U.S. Pacific Islands waters were compiled via the following steps: (1) Reviewed all relevant NOAA Fisheries files, such as those used for the final coral listing rule and the 2020 and 2023 proposed critical habitat rules; (2) gathered records from government agencies that have conducted coral reef monitoring within these areas; (3) gathered records from other sources such as research projects, site surveys, area inventories, etc.; (4) conducted an exhaustive online search; (5) consulted with experts from the Territorial Governments (American Samoa, Guam, CNMI) and the Marine National Monuments (Rose Atoll, Pacific Remote Islands, Marianas Trench) to ensure that no records were overlooked; and (6) reviewed all public comments submitted for the 2020 and 2023 proposed rules as well as new information that has become available since publication of the proposed rules.

The records were organized by species and island: In this document, atolls (e.g., Rose Atoll) and stand-alone reefs (e.g., Kingman Reef), shoals (e.g., French Frigate Shoals), and pinnacles (e.g., Gardner Pinnacles) are all referred to as "islands." Records of listed species were compiled for each island where available in American Samoa, Guam, CNMI, PRIA, and the Northwestern Hawaiian Islands (NWHI) in Hawaii. No records for any listed species were available from any of the Main Hawaiian Islands. We organized all records for each listed species from each island into "records groups," then assessed each records group as described in the following section.

2.2 Assessment of Records

Each records group (i.e., all records of a listed species from an island) was assessed in terms of the following factors: (1) quality of records (Section 2.2.1); (2) quantity of records (Section 2.2.2); (3) age of records (Section 2.2.3); (4) species identification uncertainty (Section 2.2.4); (5) survey

effort (Section 2.2.5); and (6) other factors (Section 2.2.6). The assessment methods are described below.

2.2.1 Quality of Records

The quality of records was addressed by categorizing records as "photo records," "expert data records," or "other records." As explained below, the first two categories provide the highest quality records, and were relied upon the most. The different categories are defined below.

Photo Records. Because of species identification uncertainty (Fenner 2015, Fenner and Burdick 2016), photo records are ideal, as long as the following information is provided together with the digital photo:

1. Location of the record (island or smaller scale). Depth and habitat would be helpful but are not necessary.
2. Date of the record (at least year).
3. Colony photo, such that both colony and branch morphology are clear.

Photo records do not need to be provided by recognized Indo-Pacific reef-building coral species experts, unlike expert data records, as explained below.

Expert Data Records. Many records of coral species are in the form of data sheets or species lists and lack photos. Any such record collected by a recognized Indo-Pacific reef-building coral species expert is considered an expert data record. An observation of multiple colonies in close proximity at the same location is considered a single record because such colonies were likely clones. The experts who did the large majority of the species identifications for the expert data records cited in this document are listed below. In addition, colleagues of some of the experts also contributed to some of the records, especially more recent records.

Experts:

Dr. Charles Birkeland	University of Hawaii Zoology, retired
Dr. Victor Bonito	Reef Explorer Fiji, Ltd.
Dr. Eric Brown	National Park of American Samoa
Mr. Dave Burdick	University of Guam Marine Lab
Mr. Rodney Camacho	CNMI Division of Coastal Resources Management
Dr. Courtney Couch	NMFS Pacific Islands Fisheries Science Center
Dr. Douglas Fenner	Coral Consultant, NMFS/PIRO contractor
Mr. Kevin Foster	U.S. Fish & Wildlife Service, formerly
Dr. Peter Houk	University of Guam Marine Lab
Dr. Lyza Johnston	Johnston Applied Marine Sciences, Saipan
Dr. Jean Kenyon	U.S. Fish & Wildlife Service, retired
Dr. Jim Maragos	U.S. Fish & Wildlife Service, retired
Dr. Tony Montgomery	U.S. Fish & Wildlife Service
Dr. Denise Perez	CNMI Division of Coastal Resources Management
Dr. Richard Randall	University of Guam Marine Lab, retired
Dr. Laurie Raymundo	University of Guam Marine Lab
Dr. Steve Smith	U.S. Navy, retired
Dr. Nadiera Sukhraj	U.S. Fish & Wildlife Service
Dr. Bernardo Vargas-Ángel	NMFS Pacific Islands Fisheries Science Center

Other Records. Records that do not meet the criteria for photo records or expert data records described above are considered other records (e.g., personal communications). Such records have higher uncertainty than photo records or expert data records, but still may provide valuable information.

We confirmed all records via direct communication with the experts who took the records, or with experts who were able to vouch for the records. Our determinations of whether the island was within the occupied area for a listed species at the time of listing relied almost entirely upon photo records and expert data records. However, other records provided valuable information for some islands or parts thereof with very few records.

2.2.2 Quantity of Records

The quantity of records is an important consideration, since the more photo records and expert data records we have for a species from an island, the greater the likelihood that the island was within the occupied area for a listed species at the time of listing. The quantity of records is taken into consideration in the rating system as follows: Record groups that contain fewer records are given lower ratings, and vice-versa (Section 2.3).

2.2.3 Age of Records

Older records are not necessarily lower quality, thus age of records is not addressed in Quality of Records above. However, the older a record is, the less relevance it has to our determination of whether the island was within the occupied area for a listed species at the time of listing in 2014. The age of records is taken into consideration in the rating system as follows: Record groups that lack post-listing records are given lower ratings, and vice-versa.

2.2.4 Species Identification Uncertainty

As described in the final listing rule (NMFS 2014a) and other information (Fenner 2015), species identification uncertainty is substantial for most of the 15 listed Indo-Pacific reef coral species, even for experts. To help address this problem, PIRO developed a species identification guide for the listed corals (Fenner and Burdick 2016), and initiated a Coral Species Identification Training Program in 2017 that has been providing annual species ID trainings and materials for coral reef surveyors, managers, and scientists across the region and in neighboring countries (e.g., NMFS 2018, 2019). Because of the 2014 listings and subsequent coral species surveying efforts (e.g., PIFSC 2020), together with the ongoing coral species ID trainings, progress has been made with the identification of the listed corals.

For listed coral species that are consistently distinct from similar species and frequently observed, species identification uncertainty has decreased since listing, as survey effort and expertise have increased. This is the case with *A. globiceps* and *I. crateriformis*. In addition, *F. paradivisa* (formerly *Euphyllia paradivisa*) and *S. aculeata* are consistently distinct from similar species, although they are very infrequently observed within U.S. waters. For these four listed species, identification uncertainty is relatively low at this point in time for coral species experts based in the U.S. Pacific Islands.

In contrast, for listed species that are very similar to other species, the increase in survey effort since listing in 2014 has emphasized the difficulty in distinguishing them. This is the case with *A. retusa*, especially in the Marianas and PRIA. As explained in more detail in the *A. retusa* section (3.3), the combination of high colony morphological variability and low numbers of records in Guam-CNMI and PRIA is such that we have low confidence in these records, even though they are expert data records. Even more challenging are those listed species that are very similar to other species but are not frequently observed, such as *A. jacquelineae* and *A. speciosa*. For these three listed species, identification uncertainty is relatively high at this point in time, even for coral species experts who focus on the U.S. Pacific Islands.

Species identification uncertainty is taken into consideration in the rating system as follows: Records for species with high species identification uncertainty (*A. retusa*, *A. jacquelineae, A. speciosa*) are given lower ratings than species with low species identification uncertainty (*A.*

globiceps, I. crateriformis, *F. paradivisa*, *S. aculeata*). In order to incorporate species identification uncertainty into the rating system, it was necessary to double the number of possible ratings, as explained in Section 2.3 below.

2.2.5 Survey Effort

Survey effort refers to the amount of expert coral species surveys that have been conducted on an island historically. As noted in Section 1.3 above, historical survey effort has been highly variable from island to island, potentially influencing the interpretation of the records. However, all islands in this document except Farallon de Medinilla (FDM) in CNMI have been included in PIFSC's species-level standardized coral reef monitoring surveys at least one time since listing in 2014, and some islands have also been included in standardized surveys by other agencies. PIFSC's surveys are quite extensive on each island, including a large number of transects and covering wide depth ranges (Swanson et al. 2018, PIFSC 2020).

The Department of the Navy (DON) restricts access to FDM, hence PIFSC does not survey there. However, the Navy periodically conducts species-level coral surveys at FDM (DON 2013, Carilli et al. 2018), thus numerous surveys have been conducted on FDM both around and since the time of listing.

All islands have been subject to extensive species-level surveys (i.e., the PIFSC and DON surveys) around or since the time of listing, including within the depth ranges and habitat types of all listed coral species. The rating system takes into consideration whether such surveys have produced records or not (Section 2.3).

2.2.6 Other Factors

In addition, other factors should be taken into consideration in assessment of the records, such as taxonomic issues, morphological variability across archipelagos, and habitat preferences. By taxonomic issues, we are referring to confusion of *A. globiceps* with *A. humilis,* and the name change from *Acropora crateriformis* to *Isopora crateriformis*, both of which affect treatment of historical records. As described in more detail in the *A. globiceps* Tutuila (3.1.2.1) and French Frigate Shoals (3.1.3.9) sections below, *A. globiceps* was often mistaken for *A. humilis* before about 2000. Since both are valid species, the historical records may be either *A. globiceps* or *A. humilis*. Except for photo records, it is not possible to determine if *A. humilis* records were *A. globiceps*, thus no *A. humilis* expert data records are considered as *A. globiceps* records.

Isopora remained a subgenus of *Acropora* until Wallace et al. (2007) presented clear evidence that *Isopora* is a separate, valid genus. Since that time, *Isopora* has been treated as a genus, resulting in the name *Acropora crateriformis* being changed to *Isopora crateriformis*. But since *A. crateriformis* and *I. crateriformis* both refer to the same species, all expert data records of *A. crateriformis* are treated as *I. crateriformis* records.

A particular species identification uncertainty problem is the apparent variability in colony morphology of *A. retusa* and related species between the American Samoa, Guam-CNMI, and PRIA archipelagos. As explained in the *A. retusa* section, the combination of high colony morphological variability and low numbers of records in Guam-CNMI and PRIA is such that we have low confidence in these records, even though they are expert data records. However, in American Samoa, there is apparently lower colony morphological variability and higher numbers of records for *A. retusa*, thus we have high confidence in these records.

Finally, as noted in Section 1.3 above, some types of coral reef habitats are surveyed more than others, mainly because of accessibility and safety. Of the surveys that produced the records in this document, the majority took place on forereefs (AKA reef slopes) between about 5 and 20 m of depth, and some surveys included reef slopes of 20–30 m depth. Fewer surveys were done in

backreef habitats, such as pools, lagoons, and reef flats, raising the possibility that the records may not be representative of species' distributions across habitats. However, for some of the more frequently surveyed islands, some habitat-specific information is available, as noted in the species-island sections.

2.3 Application of Records

Based on all the assessment factors except species identification uncertainty, each records group (i.e., records for each species-island) was characterized as falling into one of the following five qualitative categories. The categories provide a range of evidence that the island was within the occupied area for the listed species at the time of listing in 2014, from the least to the most:

1. Up to a few pre-listing photo or expert data records are available, but no post-listing records are available.
2. Up to a few post-listing photo or expert data records are available, but post-listing standardized monitoring surveys have not detected colonies.
3. More than a few post-listing photo or expert data records are available, but post-listing standardized monitoring surveys have not detected colonies.
4. More than a few post-listing photo or expert data records are available, and post-listing standardized monitoring surveys have detected colonies.
5. At least dozens of post-listing photo and expert data records are available, and post-listing standardized monitoring surveys have detected colonies at multiple sites over multiple years.

In addition, the evidence provided by the records is influenced by species identification uncertainty, as described above in Section 2.2.4. Species identification uncertainty is factored into the evidence ratings as follows: For each of the five qualitative categories, evidence for species with high identification uncertainty is given less weight than species with low identification uncertainty, which is reflected in the evidence rating system described below.

Taking all the assessment factors into consideration, we rated each records group in terms of the evidence that the island was within an occupied area for the listed species at the time of listing as between 1 (least likely) and 10 (most likely; Table 1), based on the five categories of evidence x the two types of species identification uncertainty. For example, for evidence category #1, species with high identification uncertainty are rated as 1, and species with low identification uncertainty are rated as 2. When the records for species with high vs. low species identification uncertainty are in the same evidence category, species with high identification uncertainty are always rated lower (Table 1).

In summary, lower ratings provide weaker evidence that the island was within the occupied area for the listed species at the time of listing in 2014, and vice versa. Species x island results are provided in Sections 3.1–3.7, a results summary in Section 3.8, and our interpretations of the evidence in terms of which islands were within occupied areas for listed species at the time of listing are described in Section 4.

Table 1. Rating system for evidence provided by each records group that the island was within the occupied area for the listed species at the time of listing in 2014 (islands with no records of any listed species were not rated).

Rating	Species ID Uncertainty	Evidence Category for Records Groups
1	High	Up to a few pre-listing photo or expert data records are available, but no post-listing records are available.
2	Low	
3	High	Up to a few post-listing photo or expert data records are available, but post-listing standardized monitoring surveys have not detected colonies.
4	Low	
5	High	More than a few post-listing photo or expert data records are available, but post-listing standardized monitoring surveys have not detected colonies.
6	Low	
7	High	More than a few post-listing photo or expert data records are available, and post-listing standardized monitoring surveys have detected colonies.
8	Low	
9	High	At least dozens of post-listing photo and expert data records are available, and post-listing standardized monitoring surveys have detected colonies at multiple sites over multiple years.
10	Low	

3 Species x Island Results (Records Groups)

Records groups for each of the seven listed species are described below, in terms of photo records, expert data records, and other records. Each records group is then rated in terms of evidence that the island was within the occupied area for the listed species at the time of listing, using the scale in Table 1.

3.1 Acropora globiceps

Current species identification uncertainty for *A. globiceps* is described in Section 3.1.1. The records for the species in the U.S. Pacific Islands are provided in Section 3.1.2.

3.1.1 Species Identification Uncertainty

As noted in Section 2.2.4 above, species identification uncertainty has evolved since the listings in 2014, because of much greater effort by reef coral experts to identify the listed species during coral reef monitoring surveys and other work. PIRO's Coral Species Identification Training Program's annual workshops have facilitated this learning process (e.g., NMFS 2018, 2019). Since *A. globiceps* is found across most of the U.S. Pacific Islands, and its colonies usually have a typical and distinct appearance (Fenner and Burdick 2016, Fenner 2020b), current species identification uncertainty is considered low for *A. globiceps*.

3.1.2 Islands

3.1.2.1 Tutuila and Offshore Banks

Photo records: Many photo records (as defined in Section 2.2.1 above) of *A. globiceps* on Tutuila are available, including those shown in the figure below, provided by Doug Fenner and Eric Brown.

Figure 1. Photos of *A. globiceps* on Tutuila, taken by Doug Fenner in 2007 (left) and Eric Brown in 2021 (right).

Expert data records. Expert data records (as defined in Section 2.2.1 above) of *A. globiceps* on Tutuila are summarized here. The American Samoa Department of Marine and Wildlife Resources (DMWR) sponsors periodic, Territory-wide coral reef monitoring with sites on Tutuila, Ofu-Olosega, Ta'u, and Rose Atoll. All sites are on the reef slope at approximately 10 m depth. Coral species surveys of the long-term monitoring sites were conducted in 1995 (Mundy 1996), 2002 (Fisk and Birkeland 2002), and 2018 (Birkeland 2018). No colonies of *A. globiceps* were recorded in 1995 (but see note below about confusion of this species with *A. humilis*), three colonies were recorded in 2002 (two on Tutuila, one on Ta'u), and no colonies were recorded in 2018.

The National Park of American Samoa (NPSA) collects species-level coral data at both fixed and temporary sites for its coral reef monitoring program. Within the NPSA Tutuila Unit on the north shore of the island, transects were monitored most years between 2007 and 2019. Of the 375 times that transects were monitored, *A. globiceps* was present 29 times, including during most years, and made up between 0.08% (2019) and 3.08% (2016) of the total coral cover on the 29 transects. The depth ranges of these *A. globiceps* colonies was from 9.1 m to 19.5 m (NPSA 2020).

PIFSC's coral reef monitoring program began collecting species-level coral data in 2015. It surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around Tutuila in 2015, 2018, 2020, and 2023. PIFSC recorded no *A. globiceps* on Tutuila in 2015, five colonies in 2018, three colonies in 2020, and five colonies in 2023 (PIFSC 2021, 2024).

Other records. In addition to the above long-term monitoring program results, coral species surveys have been conducted by Doug Fenner at dozens of sites around Tutuila since 2005, where *A. globiceps* was most common on shallow forereefs (i.e., upper reef slopes), but was also recorded in backreef habitats such as the outer margins of reef flats and within pools and lagoons. Reef flats were regularly included in the surveys, but only a handful of *A. globiceps* colonies were recorded there, and typically no more than a single colony at a time. The minimum depths of *A. globiceps* colonies were <1 m on reef flats and maximum depths were typically approximately 10 m on reef slopes. However, colonies were recorded between approximately 10 and 20 m of depth at various sites around Tutuila in 2015, and a colony was recorded at approximately 25 m of depth on South Bank (60 km south of Tutuila) in 2010. In these surveys during any given year, *A. globiceps* was not a common species, but it was found at multiple sites (D. Fenner, pers. comm., 2021).

Other Information. As described in the *A. globiceps* sections of Montgomery et al. (2019a) and NMFS (2021), *A. globiceps* has often been mistaken for *A. humilis*. However, according to Wallace's worldwide revision of the genus *Acropora* (Wallace 1999), *A. globiceps* and *A. humilis* are both distinctive species, which was supported by Wallace et al.'s (2012) additional revision of the genus

Acropora. Both species are now recognized by the Corals of the World books (Veron 2000) and website (Veron et al. 2016), as well as the World Register of Marine Species (WoRMS, Hoeksma and Cairns 2021). Records of *A. humilis* by experts on Tutuila from that time (e.g., Mundy 1996, Fisk and Birkeland 2002, DiDonato et al. 2006) may have been *A. globiceps*, but that cannot be determined, thus no *A. humilis* records are considered as *A. globiceps* records.

In the 2020 proposed coral critical habitat rule, South Bank was included in this unit, but removed from consideration in the 2023 proposed rule (see Conclusion section below). South Bank is a sunken atoll with a minimum depth of approximately 25 m (Richards 2010, Wright et al. 2012). As noted above, a single colony of *A. globiceps* was recorded at 25 m depth at South Bank during surveys conducted in 2010. During that survey, 36 dives were conducted along approximately 5 km of the rim of the sunken atoll. Habitat consisted primarily of rubble and pavement flats with a high abundance of macroalgae and low coral cover and diversity. The area is subjected to high currents (Richards 2010, Fenner pers. comm. 2016).

Conclusion. There are dozens of photo and expert data records of *A. globiceps* from around Tutuila, including many since the listing of this species under the ESA in 2014. Both NPSA and PIFSC have detected many colonies of the species at multiple sites around Tutuila over multiple years since 2014. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Tutuila was within the occupied area for *A. globiceps* at the time of listing as a 10 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

Based on the records, *A. globiceps* on Tutuila is primarily found in high-relief forereef habitats such as spur-and-groove and aggregate reef to 20 m of depth. The species is also found in backreef habitats where there is adequate depth and complexity, such as within pools and lagoons enclosed by reef flats as well as the outer margins of reef flats. The species is much less common or absent in other habitats like those dominated by rubble and pavement such as most of Tutuila's reef flats, reef crests, and low-relief forereefs.

As noted above, South Bank has a minimum depth of approximately 25 m, and is made up primarily of rubble and pavement with low coral cover, although a single colony of *A. globiceps* has been recorded there. Because South Bank is quite isolated, is deeper than the depth range of *A. globiceps* on Tutuila, provides poor habitat, and only one colony was recorded despite surveying an extensive area, we do not believe that South Bank was within the occupied area for *A. globiceps* at the time of listing. No other listed coral species have been recorded at South Bank, and it is not considered further.

3.1.2.2 Ofu-Olosega

Photo records. Photo records of *A. globiceps* on Ofu and Olosega Islands (Ofu-Olosega) are provided by Doug Fenner (photos taken in 2011 and 2019), and Joel Moribe of NMFS/PIRO (video taken in 2019). The Moribe record is a short video, a frame of which is shown in the figure below. Both were taken in the Ofu backreef pools.

Figure 2. Photos of *A. globiceps* in the Ofu backreef pools, taken by Doug Fenner in 2011 (left) and Joel Moribe in 2019 (right).

Expert data records. Expert data records of *A. globiceps* in the Ofu backreef pools (0–2 m depth) include from DiDonato et al. (2006), Basch (Undated1, species identifications done by Birkeland), and Kenyon et al. (2011). In addition to the above photo record by Doug Fenner (Fig. 2), he also recorded *A. globiceps* several times between 2005 and 2010 on the Ofu forereef on surveys that were typically done at 5–20 m of depth but for which the depths of the colonies were not recorded (D. Fenner, pers. comm., 2021). PIFSC surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around Ofu and Olosega in 2015, 2018, and 2023, recording no *A. globiceps* in 2015 and 2018 but 11 colonies in 2023 (PIFSC 2021, 2024). DMWR states that, based on its coral species surveys, *A. globiceps* is "common in a reef in southwest Ofu," but no further details are provided (DMWR 2021).

Other Information. As noted above, before the early 2000s, *A. globiceps* may have been recorded as *A. humilis*. Records of *A. humilis* on Ofu-Olosega from that time (e.g., Mundy 1996, Birkeland et al. 2001, Fisk and Birkeland 2002, DiDonato et al. 2006) may have been *A. globiceps*, but that cannot be determined, thus no *A. humilis* records are considered as *A. globiceps* records.

Conclusion. There are many photo and expert data records of *A. globiceps* on Ofu-Olosega since the listing of this species under the ESA in 2014. While PIFSC did not record the species at Ofu-Olosega in either 2015 or 2018, DMWR reports it as common on Ofu in its surveys (DMWR 2021). Many of the expert data records are from within the Ofu backreef where PIFSC does not survey. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Ofu-Olosega was within the occupied area for *A. globiceps* at the time of listing as an 8 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.3 Ta'u

Photo records. We have no photos that meet our criteria for Photo Records, but see Other records.

Expert data records. Expert data records of *A. globiceps* on Ta'u include Fisk and Birkeland (2002) and Kenyon et al. (2010), both of which were at approximately 10 m of depth. Doug Fenner recorded *A. globiceps* on Ta'u several times between 2005 and 2016 (D. Fenner, pers. comm., 2021). PIFSC did not record any *A. globiceps* on Ta'u in 2015 or 2018 but recorded two colonies in 2023 (PIFSC 2021, 2024).

Other records. Photos taken in 2013 of *A. globiceps* are shown in Lawrence et al. (2013, Figures 8 and 9), an assessment of Faleasao Wharf on Ta'u. However, the photos are not clear enough to be certain of species identification.

Conclusion. There are more than a few expert data records of *A. globiceps* on Ta'u, including from before and after the listing, including from PIFSC in 2023 (PIFSC 2024). Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Ta'u was within the occupied area for *A. globiceps* at the time of listing as an 8 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.4 Rose Atoll

Photo records. A short video of an *A. globiceps* colony at Rose at 3 m of depth taken in 2017 was provided by Brian Peck, and other photos are available (B. Peck, pers. comm. Oct-21). A photo record of *A. globiceps* taken in 2022 on the forereef just outside the lagoon channel was provided by DMWR (D. Fenner, pers. comm., Apr-22).

Expert data records. An expert data record of *A. globiceps* at approximately 10 m of depth on Rose Atoll is provided by Kenyon et al. (2010). In 2017, Paolo Marra-Biggs recorded and photographed three colonies of *A. globiceps* on the reef slope at 3–4 m depth. Identification of the colonies was confirmed by Doug Fenner (Brian Peck, pers. comm., Oct-21). PIFSC did not record any *A. globiceps* at Rose in 2015, 2018, or 2023 (PIFSC 2021, 2024).

Other Records. The photo identified as *A. humilis* on p. 4-37 in USFWS (2014a) appears to be *A. globiceps* (D. Fenner, pers. comm., Oct-21). USFWS (2014a) includes *A. globiceps* on its species list for Rose Atoll, possibly based on Kenyon et al. (2010).

Conclusion. There are more than a few photo and expert data records of *A. globiceps* on Rose, including from before and after the listing. PIFSC did not record the species on Rose in 2015, 2018, or 2023. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Rose was within the occupied area for *A. globiceps* at the time of listing as a 6 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.5 Swains

Photo records. We do not have any photo records of *A. globiceps* on Swains.

Expert data records. PIFSC surveyed Swains in 2015, 2018, and 2023, but did not record any *A. globiceps* (PIFSC 2021, 2024). Montgomery et al. (2019a) includes Swains in *A. globiceps'* range. However, we have not been able to find any records of *A. globiceps* from Swains in any of the documents cited by Montgomery et al. (2019a).

Conclusion. There are no records of any kind for *A. globiceps* on Swains despite multiple surveys.

3.1.2.6 Guam

Photo records. Photo records of *A. globiceps* on Guam are provided by Victor Bonito (photo taken in 2013), and Joel Moribe (photo taken in 2016), shown in the figure below. Other photos of *A. globiceps* on Guam appear in DoN (2019) and other sources (Burdick 2021a,b).

Figure 3. Photos of *A. globiceps* on Guam, taken by Victor Bonito in 2013 (left) and Joel Moribe in 2016 (right).

Expert data records. Expert data records of *A. globiceps* on Guam collected both before and since listing include those in Maynard et al. (2017), Raymundo et al. (2019), Burdick (2021a,b), and Kawahigashi et al. (2021). Maynard et al. (2017) recorded *A. globiceps* at both shallow (5 m) and deep (12 m) sites, and all sites in Raymundo et al. (2019) were 5 m depth. Kawahigashi et al. (2021) recorded *A. globiceps* at two sites (both 6 m depth) in Guam National Wildlife Refuge at Ritidian Point. PIFSC surveyed multiple sites around Guam in 2017 and 2022, recording nine colonies of *A. globiceps* in 2017 and three in 2022 (PIFSC 2021, 2024). Although only a few colonies of *A. globiceps* were recorded at the PIFSC monitoring sites, the species was commonly recorded outside of PIFSC's monitoring sites throughout the Mariana Islands (Bernardo Vargas-Ángel, pers. comm., Jun-22).

Other Records. NMFS (2015) is a map showing observations of ESA-listed corals around Guam, including *A. globiceps*. However, we do not know who did the species identifications. Basch (Undated2) notes that *A. globiceps* is present in Guam, with the citation "From: Park Species List – NP Species Summary Report," but no further information regarding the source is provided.

Other Information. Raymundo et al. (2019) surveyed multiple upper reef slope sites around Guam each of four years (2013, 2015–17) and multiple reef flat sites annually between 2009 and 2017. The surveys recorded a total of 64 *A. globiceps* colonies on the upper reef slope sites but no colonies on the reef flat sites. This is consistent with the Tutuila records of *A. globiceps*, which show that the most common habitat for the species is the upper reef slope, and that it is not typically found on reef flats (see Section 3.1.2.1).

As noted above, before the early 2000s, *A. globiceps* may have been recorded as *A. humilis*. Records of *A. humilis* on Guam (e.g., Randall 1973a, 1973b, 2003; Randall and Myers 1983) may have been *A. globiceps*, but that cannot be determined, thus no *A. humilis* records are considered as *A. globiceps* records.

Guam's offshore banks, including Santa Rosa Reef (46 km to the southwest with a minimum depth of 8 m), Galvez Bank (22 km to the southwest with a minimum depth of 25 m), and 11-mile Reef (17 km to the west with a minimum depth of 20 m), were included in this unit in the 2020 proposed rule, but were removed in the 2023 proposed rule (see Conclusion section below). Since PIFSC started collecting species-level data in 2015, it has not surveyed any of Guam's offshore banks. The only coral data available for any of the banks is from PIFSC's 2003 and 2005 surveys, which

collected genus-level data. For Santa Rosa Reef (the only offshore bank within *A. globicep*'s depth range), total coral cover during the two surveys was 7% and 8%, respectively. While some *Acropora* colonies were observed, they were not among the most abundant six coral genera, which made up >99% of the coral cover in both years (Brainard et al. 2012, Fig. 4.10.5e).

Conclusion. There are dozens of photo and expert data records of *A. globiceps* from around Guam, including many since the listing of this species under the ESA in 2014. PIFSC detected colonies of the species at multiple sites around Guam in 2017 and 2022. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Guam was within the occupied area for *A. globiceps* at the time of listing as a 10 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

Based on the records, *A. globiceps* on Guam is primarily found in high-relief forereef habitats such as spur-and-groove and aggregate reef to 12 m of depth. The species is much less common or absent in other habitats like those dominated by rubble and pavement such as Guam's reef flats, reef crests, and low-relief forereefs.

As noted above, there are no records of *A. globiceps* or any other listed coral species from any of Guam's offshore banks, of which only Santa Rosa Reef has a minimum depth within *A. globicep*'s depth range. The available information about the coral community of Santa Rosa Reef indicates that it is unlikely to provide habitat for *A. globiceps* or any other listed coral species. Thus, we do not believe that Guam's offshore banks were within the occupied area for *A. globiceps*. No other listed coral species have been recorded at Guam's offshore banks, and they are not considered further.

3.1.2.7 Rota

Photo records. There are several photo records of *A. globiceps* on Rota taken by Dave Burdick, Doug Fenner, and Tony Montgomery since listing, including the 2016 photo by Doug Fenner shown in the figure below.

Figure 4. Photo of *A. globiceps* on Rota, taken by Doug Fenner in 2016.

Expert data records. Expert data records of *A. globiceps* on Rota are provided by: (1) Maynard et al. (2015) recorded *A. globiceps* at 13 of 24 sites on Rota in 2012 and 2014 (data combined for the 2 years); (2) Tony Montgomery (Montgomery 2017a), who recorded 119 colonies of *A. globiceps* from 1 to 12 m depth near the Rota Harbor in 2016; (3) PIFSC surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around Rota in 2017 and 2022,

recording 1 *A. globiceps* colony each year (PIFSC 2021, 2024); and (4) CNMI's Division of Coastal Resources Management's (DCRM) coral reef monitoring program recorded *A. globiceps* at 6 of its monitoring sites around Rota between 2014 and 2019 (Rodney Camacho, pers. comm., Oct-21).

Other information. Doug Fenner (2020a) notes that *A. globiceps* is more common near the Rota Harbor than elsewhere in CNMI.

Conclusion. There are dozens of photo and expert data records of *A. globiceps* from around Rota, including many since the listing of this species under the ESA in 2014. CNMI/DCRM's coral reef monitoring program has recorded *A. globiceps* at many of its sites around Rota. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Rota was within the occupied area for *A. globiceps* at the time of listing as a 10 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

Based on the records, *A. globiceps* on Rota is primarily found in high-relief forereef habitats such as spur-and-groove and aggregate reef to 12 m of depth. The species is much less common or absent in other habitats like those dominated by rubble and pavement such as Rota's reef flats, reef crests, and low-relief forereefs.

3.1.2.8 Aguijan

Photo records. We have no photo records of *A. globiceps* on Aguijan, although we are aware of some by Dave Burdick taken in 2009 (Burdick 2021b).

Expert data records. Dave Burdick recorded some *A. globiceps* colonies around Aguijan in 2009 (Burdick 2021b). Maynard et al. (2015) recorded *A. globiceps* at three of four sites on Aguijan in 2012 and 2014 (data combined for the two years). Denise Perez recorded *A. globiceps* at Aguijan in 2021 while conducting surveys for CNMI/DCRM's coral reef monitoring program (D. Perez, pers. comm., Oct-21). PIFSC did not record any *A. globiceps* at Aguijan in 2017 or 2022 (PIFSC 2021, 2024).

Conclusion. There are many expert data records of *A. globiceps* on Aguijan since the listing of this species under the ESA in 2014. CNMI/DCRM's coral reef monitoring program has recorded *A. globiceps* recently on Aguijan. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Aguijan was within the occupied area for *A. globiceps* at the time of listing as an 8 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.9 Tinian

Photo records. Photo records of *A. globiceps* on Tinian since listing are provided by Doug Fenner in 2017 and Joel Moribe in 2016, shown in the figure below. Other photos of *A. globiceps* on Tinian have been taken by taken by Dave Burdick, Doug Fenner, and Tony Montgomery since listing.

Figure 5. Photos of *A. globiceps* on Tinian, taken by Doug Fenner in 2017 (left) and Joel Moribe in 2016 (right).

Expert data records. Expert data records of *A. globiceps* on Tinian are provided by: (1) Tetra Tech (2014, species identifications done by Victor Bonito and Doug Fenner), who recorded several hundred *A. globiceps* colonies at various sites on Tinian in 2013; (2) Montgomery (2017b) who recorded 49 colonies of *A. globiceps* from 1–10 m depth near and within the Tinian Harbor in 2016; (3) an *A. globiceps* photo in DoN (2019, p. 11-55), which reports that "*A. globiceps* is relatively common and has been observed at most survey locations" around Tinian (based at least on Tetra Tech 2014); (4) Maynard et al. (2015) recorded *A. globiceps* at 12 of 21 sites on Tinian in 2012 and 2014 (data combined for the 2 years); and (5) CNMI/DCRM's coral reef monitoring program has recorded *A. globiceps* on Tinian several times since listing (Camacho and Perez, pers. comm., Oct-21). PIFSC did not record any *A. globiceps* at Tinian in 2017 but recorded two colonies in 2022 (PIFSC 2021, 2024).

Other Information. In the 2020 proposed coral critical habitat rule, Tatsumi Reef was included in this unit (2 km to the southwest with a minimum depth of 6 m). However, Tatsumi Reef was removed from consideration in the 2023 proposed rule and is not considered further due to the following: There are no records of *A. globiceps* from Tatsumi Reef, and it consists entirely of pavement and sand (NCCOS 2005), which does not provide suitable substrate. Because there are no records of *A. globiceps* or any other listed coral species from Tatsumi Reef, and it does not provide suitable substrate, we do not believe that Tatsumi Reef was within the occupied area for *A. globiceps* at the time of listing. No other listed coral species have been recorded at Tatsumi Reef.

Conclusion. There are dozens of photo and expert data records of *A. globiceps* from around Tinian, including many since the listing of this species under the ESA in 2014. CNMI/DCRM's coral reef monitoring program has recorded *A. globiceps* on Tinian since listing. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Tinian was within the occupied area for *A. globiceps* at the time of listing as a 10 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

Based on the records, *A. globiceps* on Tinian is primarily found in high-relief forereef habitats such as spur-and-groove and aggregate reef to 12 m of depth. The species is much less common or absent in other habitats like those dominated by rubble and pavement such as Tinian's reef flats, reef crests, and low-relief forereefs.

3.1.2.10 Saipan

Photo records. Photo records of *A. globiceps* on Saipan since listing are provided by Doug Fenner in 2018 and Joel Moribe in 2019, shown in the figure below. Other photos of *A. globiceps* on Saipan have been taken by at least Dave Burdick, Denise Perez, and Lyza Johnston since listing (Burdick, Perez, Johnston, pers. comm., Oct-21).

Figure 6. Photos of *A. globiceps* on Saipan, taken by Doug Fenner in 2018 (left) and Joel Moribe in 2019 (right, from a video).

Expert data records. Expert data records of *A. globiceps* on Saipan are provided by: (1) Maynard et al. (2015) recorded *A. globiceps* at 1 of 30 sites on Saipan in 2012 and 2014 (data combined for the 2 years); (2) Maynard et al. (2018) recorded *A. globiceps* at 12 of 30 sites in 2016; (3) PIFSC surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around Saipan in 2017 and 2022, recording 19 colonies of *A. globiceps* in 2017 and 1 colony in 2022 (PIFSC 2021, 2024); (4) CNMI/DCRM's coral reef monitoring program has recorded *A. globiceps* on Saipan several times since listing (Camacho and Perez, pers. comm., Oct-21); (5) Lyza Johnston recorded and photographed 8 *A. globiceps* colonies in 2019 at 4–6 m of depth at various forereef sites around Saipan (L. Johnston, pers. comm., Oct-21); and (6) Denise Perez reports *A. globiceps* colonies on Saipan from <2 m depth near Pau Pau Beach and Bird Island reef flat in 2021 (D. Perez, pers. comm., Oct-21).

Other Information. In the 2020 proposed coral critical habitat rule, Garapan Bank was included in this unit (3-6 km to the west with minimum depths of 20-25 m). However, Garapan Bank was removed from consideration in the 2023 proposed rule and is not considered further due to the following: There are no records of *A. globiceps* from Garapan Bank, although that is expected because the shallowest point on the bank (≈ 20 m) is deeper than the deepest records of *A. globiceps* in the Mariana Islands (12 m).

Conclusion. There are dozens of photo and expert data records of *A. globiceps* from around Saipan, including many since the listing of this species under the ESA in 2014. PIFSC and CNMI/DCRM have both detected colonies of the species at multiple sites around Saipan since listing. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Saipan was within the occupied area for *A. globiceps* at the time of listing as a 10 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below). Because there are no records of *A. globiceps* or any other listed coral species from Garapan Bank, and it is deeper than the depth range of *A. globiceps* in the Mariana Islands, Garapan Bank is not within the occupied area for *A. globiceps* and is therefore not considered from this point forward.

Based on the records, *A. globiceps* on Saipan is primarily found in high-relief forereef habitats such as spur-and-groove and aggregate reef to 12 m of depth. The species is also found in backreef habitats where there is adequate depth and complexity, such as within pools enclosed by reef flats as well as the outer margins of reef flats. The species is much less common or absent in other habitats like those dominated by rubble and pavement such as most of Saipan's reef flats, reef crests, and low-relief forereefs.

3.1.2.11 Farallon de Medinilla

Photo records. A photo record of *A. globiceps* on FDM is provided in Carilli et al. (2018).

Expert data records. Expert data records of *A. globiceps* on FDM are provided in Carilli et al. (2018, 2020) and DON (2013), and well as by Steve Smith (pers. comm. Aug-21).

Conclusion: There are more than a few photo and expert data records of *A. globiceps* on FDM, including from before and after the listing (Carilli et al. 2018, 2020, DON 2013, Steve Smith, pers. comm. Aug-21). The Department of Defense restricts access to FDM, hence PIFSC does not survey there. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that FDM was within the occupied area for *A. globiceps* at the time of listing as a 6 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.12 Anatahan

Photo records. We do not have any photo records of *A. globiceps* on Anatahan.

Expert data records. We do not have any expert data records of *A. globiceps* on Anatahan.

Other Information. The 2020 proposed coral critical habitat rule reported *A. globiceps* from Anatahan based on a single record that we have not been able to verify or obtain more information about. PIFSC surveyed this island in 2014 (no *A. globiceps* were recorded) but not in 2017 or 2022 (PIFSC 2021, 2024).

Conclusion. Currently, we do not have any photo or expert data records as evidence for *A. globiceps* on Anatahan.

3.1.2.13 Sarigan

PIFSC surveyed Sarigan in 2017 and 2022, but did not record any *A. globiceps* (PIFSC 2021, 2024). We are not aware of any other records or information about *A. globiceps* on Sarigan.

3.1.2.14 Guguan

PIFSC surveyed Guguan in 2017 and 2022, but did not record any *A. globiceps* (PIFSC 2021, 2024). We are not aware of any other records or information about *A. globiceps* on Guguan.

3.1.2.15 Alamagan

Photo records. There is only one photo record of an *A. globiceps* colony on Alamagan, which was taken by Dave Burdick in 2017 (Burdick 2021b).

Expert data records. There are no expert data records of A*. globiceps* on Alamagan. PIFSC surveyed Alamagan in 2017 and 2022, but did not record any *A. globiceps* (PIFSC 2021, 2024).

Conclusion. There is a single photo record of *A. globiceps* on Alamagan from 2017. PIFSC did not record the species on Alamagan in 2017 or 2022. Thus, we rate the evidence that Alamagan was within the occupied area for *A. globiceps* at the time of listing as a 4 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.16 Agrihan

PIFSC surveyed Agrihan in 2017 and 2022, but did not record any *A. globiceps* (PIFSC 2021, 2024). We are not aware of any other records or information about *A. globiceps* on Agrihan.

3.1.2.17 Asuncion

Photo records. None.

Expert data records. PIFSC surveyed Asuncion in 2017 and 2022, recording one colony of *A. globiceps* in 2022 (PIFSC 2021, 2024).

Conclusion. There is a single expert data record of *A. globiceps* on Asuncion from PIFSC's 2022 survey (PIFSC 2024). Thus, we rate the evidence that Asuncion was within the occupied area for *A. globiceps* at the time of listing as a 4 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.18 Pagan

Photo records. We have one photo record of *A. globiceps* on Pagan from 2013 provided by Victor Bonito, shown in the figure below. Victor Bonito also stated that he has multiple other photos of *A. globiceps* along the west coast of Pagan, also taken in 2013 (V. Bonito, pers. comm., Sep-21). We are aware of other photo records of *A. globiceps* on Pagan taken in 2017 (Burdick 2021b) and 2021 (D. Perez, pers. comm., Oct-21).

Figure 7. Photo of *A. globiceps* on Pagan, taken by Victor Bonito in 2013.

Expert data records. Expert data records of many *A. globiceps* colonies on Pagan are provided by Tetra Tech (2014) and Denise Perez (pers. comm., Oct-21). Victor Bonito and Doug Fenner both stated that they observed numerous *A. globiceps* on Pagan in 2013 during the field work done for the Tetra Tech (2014) report (Fenner and Bonito, pers. comm., Sep-21). PIFSC surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around Pagan in 2017 and 2022, recording one *A. globiceps* colony in 2017 but none in 2022 (PIFSC 2021, PIFSC 2024).

Conclusion. There are many photo and expert data records of *A. globiceps* on Pagan, including before and after the listing of this species under the ESA in 2014. PIFSC recorded one colony of the species on Pagan in 2017 but none in 2022. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Pagan was within the occupied area for *A. globiceps* at the time of listing as an 8 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.19 Maug Islands

Photo records. We have no photo records of *A. globiceps* on Maug Islands and Supply Reef.

Expert data records. PIFSC surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around the Maug Islands in 2017 and 2022, recording six *A. globiceps* colonies in 2017 and one in 2022 (PIFSC 2021, 2024).

We have no expert data records of *A. globiceps* on Supply Reef. It has been surveyed once (2003), but only coral cover data were collected (i.e., no genus or species-level data were collected). Mean live coral cover was 39%, and ranged up to >50% (Brainard et al. 2012).

Other Information. In the 2020 proposed coral critical habitat rule, Supply Reef was included in this unit (≈25 km to the north of Maug Islands, with a minimum depth of ≈10 m). However, Supply Reef was removed from consideration in the 2023 proposed rule and is not considered further due to the following: There are no photo or expert data records for *A. globiceps* on Supply Reef, and its minimum depth (10 m) is near the species' maximum depth in the Marianas.

Conclusion. There are more than a few expert data records of *A. globiceps* on the Maug Islands since the listing of this species under the ESA in 2014, all from PIFSC in 2017 and 2022. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Maug was within the occupied area for *A. globiceps* at the time of listing as an 8 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

One record of *A. globiceps* from Maug by PIFSC (2020) was from a deep site (i.e., 18–30 m, exact depth not recorded). This is the only record we have of *A. globiceps* in the Mariana Islands from >12 m of depth. There have been many hundreds of expert surveys in the Mariana Islands since 2014 between approximately 5 m and at least 20 m depth, yielding hundreds of records of *A. globiceps* between 5–12 m but only this one record of the species from >12 m. Thus, this record was most likely an anomalous colony and does not provide evidence that the depth range of the species is >12 m in the Mariana Islands.

3.1.2.20 Uracas (AKA Farallon de Pajaros)

Photo records. Dave Burdick photographed two colonies of *A. globiceps* on Uracas in 2017 (Burdick 2021b).

Expert data records. There are no expert data records of *A. globiceps* on Uracas. PIFSC surveyed Uracas in 2017 and 2022, but did not record any *A. globiceps* (PIFSC 2021, 2024).

Other information. Photos taken by the benthic team on PIFSC's 2014 coral reef monitoring cruise to northern CNMI show substrate at three sites on the west side and two sites on the east side of Uracas. All sites were made up of large boulders providing suitable substrate for corals, but no *A. globiceps* or other listed corals were recorded.

Conclusion. There are two photo records of *A. globiceps* on Uracas from 2017. PIFSC did not record the species on Uracas in 2017 or 2022. Thus, we rate the evidence that Uracas was within the occupied area for *A. globiceps* at the time of listing as a 4 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.21 Howland

Photo records. Two photos of "*Acropora* cf. *globiceps*" (the cf. abbreviation is used to express a possible identification) were taken and identified by Jim Maragos at Howland in 2004–06 were provided by Jean Kenyon (Kenyon pers. comm., 2021). Both colonies in these photos are somewhat

different than our current understanding of *A. globiceps* (see Fenner and Burdick 2016), and the species could not be identified (Fenner, pers. comm., 2021).

Expert data records. The above photos may be the source for inclusion of *A. globiceps* in the coral species list for Howland in USFWS (2008). PIFSC surveyed Howland in 2015 and 2018, but did not record any *A. globiceps* either year (PIFSC 2020).

Conclusion. There are two ambiguous photo records of *A. globiceps* on Howland from the early 2000s. Also, despite multiple surveys by PIFSC at Howland, no *A. globiceps* were detected. Thus we rate the evidence that Howland was within the occupied area for *A. globiceps* at the time of listing as a 2 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.22 Baker

Photo records. Two photos of "*Acropora* cf. *globiceps*" (the cf. abbreviation is used to express a possible identification) taken and identified by Jim Maragos at Baker Island in 2004–06 were provided by Jean Kenyon (Kenyon pers. comm., 2021). The colonies in these photos are somewhat different than *A. globiceps*, and the species could not be identified (Fenner, pers. comm., Sep-21).

Expert data records. USFWS (2007) includes *A. globiceps* on its species list for Baker Island, but does not mention the source. PIFSC surveyed Baker in 2015 and 2018, but did not record any *A. globiceps* either year (PIFSC 2020).

Conclusion. There are two ambiguous photo records of *A. globiceps* on Baker from the early 2000s. Also, despite multiple surveys by PIFSC at Baker, no *A. globiceps* were detected. Thus, we rate the evidence that Baker was within the occupied area for *A. globiceps* at the time of listing as a 2 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.23 Palmyra Atoll

Photo records. We have several photos of *A. globiceps* on Palmyra Atoll taken in 2017 provided by Kevin Foster (Foster 2017), two of which are shown below.

Figure 8. Photos of *A. globiceps* colonies on Palmyra in 2017, taken by Kevin Foster (Foster 2017).

Expert data records. Expert data records of *A. globiceps* on Palmyra are provided by Foster (2017), Kenyon et al. (2011), and Williams et al. (2008). Foster (2017) describes his observations of several *A. globiceps* colonies in 2017 at 3–10 m of depth, and provides habitat descriptions and photos. PIFSC surveyed Palmyra in 2015 and 2018, but did not record any *A. globiceps* either year (PIFSC 2020).

Conclusion. There are more than a few photo and expert data records of *A. globiceps* on Palmyra, including from before and after the listing of this species under the ESA in 2014. However, PIFSC

did not record the species on Palmyra in 2015 or 2018. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Palmyra was within the occupied area for *A. globiceps* at the time of listing as a 6 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.24 Kingman Reef

Photo records. A photo of "*Acropora* cf. *globiceps*" taken and identified by Jim Maragos at Kingman in 2004 was provided by Jean Kenyon. The colony in the photo is somewhat different than *A. globiceps*, and the species could not be identified (Fenner, pers. comm., Sep-21).

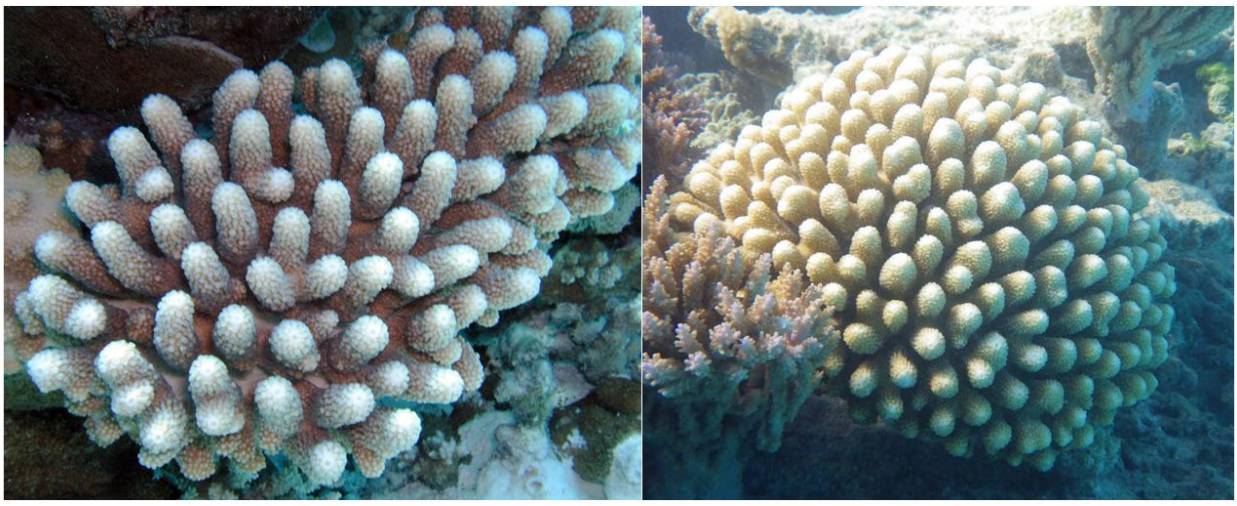
Expert data records. An expert data record of *A. globiceps* on Kingman is provided by Kenyon et al. (2011), based on the above photo. PIFSC surveyed Kingman in 2015 and 2018, but did not record any *A. globiceps* either year (PIFSC 2020).

Conclusion. There is a single ambiguous photo record of *A. globiceps* on Kingman. Also, despite multiple surveys by PIFSC at Kingman, no *A. globiceps* were detected. Thus we rate the evidence that Kingman was within the occupied area for *A. globiceps* at the time of listing as a 2 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.25 Johnston Atoll

Photo records. Two photos of "*Acropora* cf. *retusa*" taken and identified by Jim Maragos on Johnston in 2006 were provided by Jean Kenyon (Kenyon pers. comm., 2021), one of which is shown in the figure below. Based on our current understanding (see Fenner and Burdick 2016), both are *A. globiceps* (D. Fenner, pers. comm., Sep-21). A photo labeled as "*A. humilis*" in Marine Invertebrates of Johnston Atoll (USFWS 2014b) is clearly *A. globiceps*, and is also shown in the figure below. The photo was taken by Jane McGuire (Scheffer) in 2014 while conducting the marine survey described below.

Figure 9. Photos of a *A. globiceps* colony on Johnston, taken by Jim Maragos in 2006 (l) and by Jane McGuire (Sheffer) in 2014 (r).



Expert data records. PIFSC has not surveyed Johnston since beginning species-level surveys in 2015 (PIFSC 2020).

Other records. As noted above, before the early 2000s, *A. globiceps* may have been recorded as *A. humilis*, even by coral experts. Maragos and Jokiel (1986) recorded *A. humilis* at Johnston during surveys conducted from 1976 to 1983. In addition, McGuire (2014) recorded "*A. humilis*" at

multiple sites at 0–10 m of depth around Johnston in 2014 while conducting a marine survey. Although the report does not contain photos, the "*A. humilis*" photo in USFWS (2014b) is representative of the colonies recorded as *A. humilis* in the survey (J. McGuire, pers. comm., Oct-21) and is clearly *A. globiceps*, thus we assume that the colonies recorded as "*A. humilis*" in McGuire (2014) were *A. globiceps*.

Conclusion. There are several photo records of *A. globiceps* on Johnston from 2006 to 2014. While McGuire (2014) cannot be considered an expert data record, we interpret those records of "*A. humilis*" as *A. globiceps* for the reasons described above. PIFSC has not surveyed Johnston since beginning species-level surveys in 2015. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Johnston was within the occupied area for *A. globiceps* at the time of listing as a 6 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.26 Wake Atoll

Photo records. Many photos of *A. globiceps* are provided in a detailed report from the 2016 Wake Atoll reef slope survey, taken by co-authors Kevin Foster, Doug Fenner, and Tony Montgomery (Foster et al. 2017), including the photo of a large colony below. Doug Fenner also took many other *A. globiceps* photos on Wake that do not appear in the report (D. Fenner, pers. comm., Sep-21). Other photos of *A. globiceps* are available from a 2022 survey on Wake by USFWS (species ID done by D. Fenner, pers. comm., Mar-22).

Figure 10. Photos of a *A. globiceps* colony on Wake, taken by Kevin Foster in 2016.

Expert data records. Expert data records of *A. globiceps* on Wake Atoll are provided in Foster et al. (2017). Coral species identification for the survey and report were done by Doug Fenner and Tony Montgomery. Several dozen colonies of *A. globiceps* were observed on the forereef at 5–10 m depth (Foster et al. 2017). PIFSC surveyed Wake Atoll in 2017, but did not record any *A. globiceps* (PIFSC 2020). In 2021, USFWS surveyed the inner lagoon, but did not record any colonies of *A. globiceps* (Nadiera Sukraj, pers. comm., Oct-21). In 2022, USFWS surveyed the reef flat on the west side of the atoll between the lagoon and the forereef. The area had >40% live coral cover, little evidence of coral bleaching or disease, and was characterized by large *Porites* microatolls interspersed with deeper areas. Colonies of *A. globiceps* were common throughout the area (Jeremy Raynal, pers. comm., Apr-22; colony photos confirmed as *A. globiceps* by D. Fenner, Apr-22).

Other Information. As noted above, before the early 2000s, *A. globiceps* may have been recorded as *A. humilis*. Records of *A. humilis* on Wake in 2005 provided in Kenyon et al. (2013) may have been *A.*

globiceps, but that cannot be determined, thus no *A. humilis* records are considered as *A. globiceps* records.

Conclusion. There are many photo and expert data records of *A. globiceps* on Wake since the listing of this species under the ESA in 2014, but PIFSC did not record the species on Wake in 2017. Despite the lack of records from the single standardized monitoring survey conducted in 2017, we have many recent photo and data expert records. Therefore, based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Wake was within the occupied area for *A. globiceps* at the time of listing as an 8 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.27 Jarvis

Photo records. We do not have any photo records of *A. globiceps* on Jarvis.

Expert data records. None. PIFSC surveyed Jarvis in 2015 and 2018, but did not record any *A. globiceps* either year (PIFSC 2020).

Conclusion. Currently, we do not have any photo or expert data records as evidence for *A. globiceps* on Jarvis, despite multiple surveys.

3.1.2.28 French Frigate Shoals (Lalo)

When NMFS listed *A. globiceps* in 2014, the available information did not indicate that any part of the Hawaiian Archipelago was within its range (NMFS 2014b). Currently, neither the Northwestern Hawaiian Islands (NWHI) nor the Main Hawaiian Islands Ecoregions are considered to be within the range of *A. globiceps* by Charlie Veron's Corals of the World database. However, as explained in the Tutuila section above, *A. globiceps* has often been mistaken for *A. humilis*, which has been reported historically from NWHI multiple times, including from French Frigate Shoals/Lalo (FFS) and Maro Reef (e.g., Grigg et al. 1981, Kenyon 1992, Kenyon et al. 2006, Maragos et al. 2004). The two species are similar but can be reliably distinguished with practice, as shown in Fenner and Burdick (2016) and Fenner (2020b). With that in mind, we reviewed coral species records from FFS, and found numerous photo records for *A. globiceps* there, both before and since the listing.

Photo records. NMFS (2021b) provides seven photos or sets of photos of *A. globiceps* from FFS taken between approximately 1990 and 2017, two of which are shown in the figure below. During PIFSC's survey of FFS in 2014, Courtney Couch photographed a colony of *A. globiceps* outside of PIFSC's standard survey sites, shown in the figure below.

Figure 11. Photos of *A. globiceps* on French Frigate Shoals/Lalo, taken by Jean Kenyon in 2006 (left) and Courtney Couch (right) in 2014.

Expert data records. PIFSC surveyed FFS in 2014, 2015, and 2016, but did not record any *A. globiceps* (PIFSC 2020).

Conclusion. There are more than a few photo records of *A. globiceps* on FFS, including before and after the listing in 2014. However, PIFSC did not detect any colonies of the species during standard monitoring surveys at FFS in 2014, 2015, and 2016. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that FFS was within the occupied area for *A. globiceps* at the time of listing as a 6 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.29 Maro Reef

Photo records. We have one photo record of *A. globiceps* at Maro Reef from 2004 provided by Kenyon (NMFS 2021b).

Expert data records. We have no expert data records of *A. globiceps* at Maro Reef. PIFSC surveyed Maro Reef in 2015 but did not record any *A. globiceps* (McCoy et al. 2016).

Conclusion. There is a single photo record of *A. globiceps* at Maro Reef from 2004. A compilation of all coral species data from expert surveys collected in the NWHI from the mid-90s to approximately 2008, including multiple surveys at Maro Reef, did not provide additional *A. humilis* or *A. globiceps* records (Friedlander et al. 2009), and an expert survey in 2015 did not record any *A. globiceps* colonies (McCoy et al. 2016). Thus, we rate the evidence that Maro Reef was within the occupied area for *A. globiceps* at the time of listing as a 2 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.30 Gardner Pinnacles

Photo records. Marine photographer Keoki Stender's website https://www.marinelifephotography.com/corals/rice/acropora-globiceps.htm shows photos of a group of *A. globiceps* colonies at Gardner Pinnacles at a depth of 7 m. The photos were taken in October 2000 (K. Stender, pers. comm., Oct-21).

Expert data records. There are no expert data records of *A. globiceps* on Gardner Pinnacles. PIFSC surveyed Gardner Pinnacles in 2015 but did not record any *A. globiceps* (McCoy et al. 2016).

Conclusion. There are photo records of a group of *A. globiceps* colonies on Gardner Pinnacles from 2000. A compilation of all coral species data from expert surveys collected in the NWHI from the mid-90s to approximately 2008, including multiple surveys at Gardner Pinnacles, did not provide additional *A. humilis* or *A. globiceps* records (Friedlander et al. 2009), and an expert survey in 2015

did not record any *A. globiceps* colonies (McCoy et al. 2016). Thus, we rate the evidence that Gardner Pinnacles was within the occupied area for *A. globiceps* at the time of listing as a 2 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.1.2.31 All Others

Aside from the 30 islands above, PIFSC has also surveyed seven other islands or reefs in the NWHI as well as the eight main islands in the Main Hawaiian Islands between 2015 and 2019. However, no *A. globiceps* have been recorded in any of these surveys. We have no records of *A. globiceps* from any other sources from any of these islands.

3.2 Acropora jacquelineae

Current species identification uncertainty for *A. jacquelineae* is described in Section 3.2.1. The single record for the species is described in Section 3.2.2, which is from Tutuila.

3.2.1 Species Identification Uncertainty

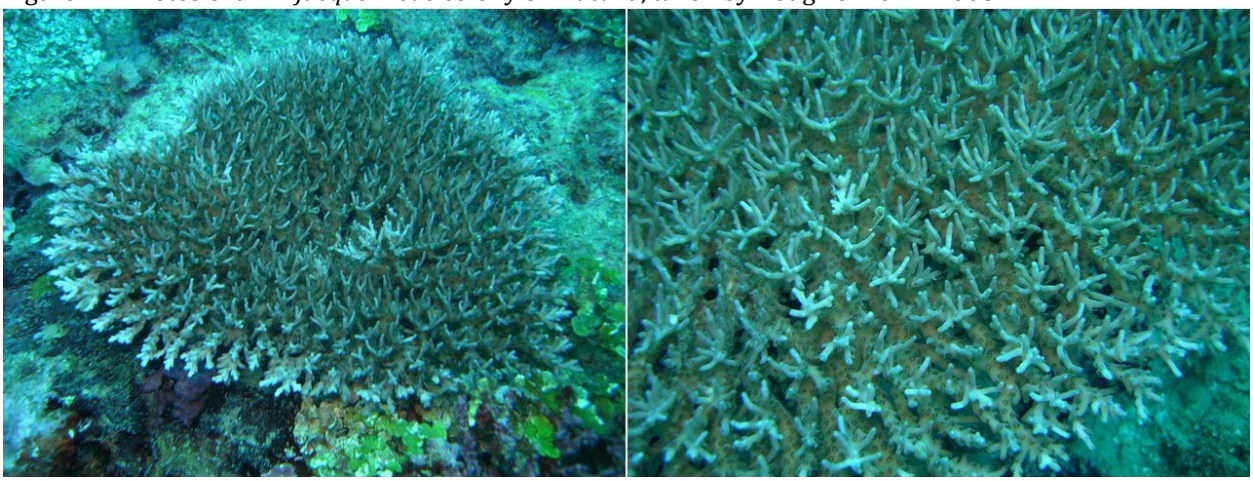
Colonies of *A. jacquelineae* are similar to several other *Acropora* species, especially *A. speciosa*. Fenner (2020b) describes the subtle differences that help distinguish the two species in the field. However, unequivocal distinction requires examination of a skeletal sample. Since this species cannot be reliably identified in the field even by trained experts, species identification uncertainty is considered to be high.

3.2.2 Islands

3.2.2.1 Tutuila and Offshore Banks

Photo records: A photo record of *A. jacquelineae* on Tutuila in 2008 is provided by Doug Fenner, shown in the figure below. This is the only colony of the species ever photographed in U.S. waters as far as we know. As noted in 2.2.1 above, unequivocal distinction requires examination of a skeletal sample, which was done for the colony in the figure below, as described next.

Figure 12. Photos of an *A. jacquelineae* colony on Tutuila, taken by Doug Fenner in 2008.



Expert data records. In 2008 when the colony in Figure 12 was photographed, a small skeletal sample was taken from the edge of the colony and examined under the microscope to verify species identification, as described in Fenner (2014a). DMWR, NPSA, and PIFSC have not reported *A. jacquelineae* in any of their surveys in American Samoa. Despite several dives in the same area, it was not found again, and may have been destroyed by the 2009 tsunami (D. Fenner, pers. comm., Oct-21). No other colonies of *A. jacquelineae* have been recorded on Tutuila.

Other records: Dr. Terry Hughes reported *A. jacquelineae* from American Samoa. However, no location or date was given (Hughes 2011), nor was a photo taken as far as we know, thus this cannot be considered an expert data record.

Other information: As noted in Section 1.2 above, the regulatory definition of "the geographical area occupied by the species" (i.e., occupied area) does not include habitats used solely by vagrant individuals (i.e., waifs). Waifs are a single individual or small group of individuals found outside of its normal range, presumably advected by unusual currents or weather conditions (Johnson et al. 2000), which are common among reef corals (Turak and DeVantier 2019) and fishes (Franklin et al. 2019). Based on the fact that no other colonies of *A. jacquelineae* have been observed before or since on Tutuila, even at the location of the original record, despite hundreds of coral surveys within the depth range of the species by multiple experts since the original observation, the single observed colony of *A. jacquelineae* on Tutuila may have been a waif colony.

Conclusion. There is a single photo record of a colony of *A. jacquelineae* on Tutuila from 2008. We have no other records of the species on Tutuila. E.g., DMWR, NPSA, and PIFSC have not reported *A. jacquelineae* in monitoring surveys on Tutuila, despite extensive species-level surveys by coral experts through 2023. As explained above, the 2008 record may have been of a waif colony. Thus, we rate the evidence that Tutuila was within the occupied area for *A. jacquelineae* at the time of listing as a 1 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.2.2.2 All Others

Based on the records described in this document and the cited sources, this species has not been recorded elsewhere in the U.S. Pacific Islands.

3.3 Acropora retusa

Current species identification uncertainty for *A. retusa* is described in Section 3.3.1. The records for the species in the U.S. Pacific Islands are provided in Section 3.3.2.

3.3.1 Species Identification Uncertainty

As noted in Section 2.2.4 above, species identification uncertainty has evolved since the listings in 2014, because of much greater effort by reef coral experts to identify the listed species during coral reef monitoring surveys and other work. PIRO's Coral Species Identification Training Program's annual workshops have facilitated this learning process (e.g., NMFS 2018, 2019). However, outside of American Samoa, *A. retusa* appears to be quite rare in most U.S. waters, and in contrast to *A. globiceps*, it does not necessarily have a typical and distinct appearance that distinguishes it from similar species (Burdick 2021a, Fenner 2020a). Thus, current species identification uncertainty is considered high for *A. retusa*.

3.3.2 Islands

3.3.2.1 Tutuila and Offshore Banks

Photo records. We have two photo records of *A. retusa* on Tutuila, shown in the figure below. We have no other photos that meet our criteria for Photo Records, but see Other records.

Figure 13. Photos of *A. retusa* on Tutuila, taken by Doug Fenner in 2009 and 2020.

Expert data records. Expert data records of *A. retusa* on Tutuila are provided by Fisk and Birkeland (2002), NPSA (2020), and PIFSC (2021, 2024): Fisk and Birkeland (2002) reported six colonies from Tutuila. Of the 375 times that transects in the Tutuila Unit of NPSA were monitored from 2007 to 2019, *A. retusa* was present 13 times, including during most years, and made up between 0.08% (2014) and 1.54% (2010) of the total coral cover on the 13 transects. The depth ranges of these *A. retusa* colonies was from 10.3 m to 19.5 m (NPSA 2020). PIFSC surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around Tutuila in 2015, 2018, 2020, and 2023. PIFSC recorded one *A. retusa* each year in 2015 and 2018, five colonies in 2020, and four colonies in 2023 (PIFSC 2021, 2024).

Other records. As of September 2021, NPSA provided a webpage showing photos of some corals in the park. There are five photos of *A. retusa*, however neither the dates nor the islands are provided. DiDonato et al. (2006) apparently refers to these same five photos of *A. retusa*. Since neither the dates nor the islands are provided, these photos do not meet our criteria for Photo Records (see Section 2.2.1 above). Also, Fenner (2020b) notes that *A. retusa* is rare on Tutuila but no details are provided.

Conclusion. There are two photo records and dozens of expert data records of *A. retusa* from around Tutuila, including many since the listing of this species under the ESA in 2014. Both NPSA and PIFSC have detected many colonies of the species at multiple sites around Tutuila over multiple years. Based on the records, the habitat of *A. retusa* is similar to that of *A. globiceps*. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Tutuila was within the occupied area for *A. retusa* at the time of listing as a 9 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.2 Ofu-Olosega

Photo records. A photo of *A. retusa* on the Ofu reef slope is shown in the figure below. Other photos of *A. retusa* from Ofu are available (D. Fenner, pers. comm., Sep-21).

Figure 14. Photo of *A. retusa* on Ofu taken by Doug Fenner in 2010.

Expert data records. Basch (Undated1) notes that Charles Birkeland has recorded *A. retusa* in the "Ofu Moat", which is also known as Ofu Lagoon, and is a series of backreef pools with a maximum depth of 2 m. PIFSC recorded one colony of *A. retusa* on Ofu-Olosega each year in 2018 and 2023 (PIFSC 2021, 2024). Fenner (2020b) notes that *A. retusa* has been found on Ofu and Olosega.

Other records. See Other records under Tutuila above.

Conclusion. There are more than a few photo and expert data records of *A. retusa* on Ofu-Olosega, including before and after the listing in 2014. PIFSC recorded one colony of the species on Ofu each year in 2018 and 2023. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Ofu-Olosega was within the occupied area for *A. retusa* at the time of listing as a 7 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.3 Ta'u

Photo records. We have no photo records of *A. retusa* on Ta'u.

Expert data records. An expert data record of *A. retusa* on Ta'u is provided by Kenyon et al. (2010). PIFSC did not record any *A. retusa* on Ta'u in 2015 or 2018, but recorded five colonies in 2023 (PIFSC 2021, 2024).

Other records. See Other records under Tutuila above.

Conclusion. There are a few expert data records of *A. retusa* on Ta'u, including several from PIFSC in 2023. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Ta'u was within the occupied area for *A. retusa* at the time of listing as a 7 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.4 Rose Atoll

Photo records. We have no photo records of *A. retusa* on Rose Atoll.

Expert data records. An expert data record of *A. retusa* on Rose Atoll is provided by Kenyon et al. (2010). PIFSC surveyed Rose in 2015, 2018, and 2023, recording no *A. retusa* colonies in 2015, 35 colonies in 2018, and 7 colonies in 2023 (PIFSC 2021, 2024).

Other records. See Other records under Tutuila above. Also, Fenner (2020b) notes that *A. retusa* has been found on Rose but no details are provided.

Conclusion. There are many expert data records of *A. retusa* on Rose. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Rose was within the occupied area for *A. retusa* at the time of listing as a 9 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.5 Swains

Photo records. None.

Expert data records. PIFSC did not record any *A. retusa* at Swains in 2015 and 2018, but recorded four colonies in 2023 (PIFSC 2021, 2024).

Conclusion. There are several expert data records of *A. retusa* on Swains from PIFSC's 2023 survey (PIFSC 2024). Thus, we rate the evidence that Swains was within the occupied area for *A. retusa* at the time of listing as a 7 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.6 Guam

Photo records. We have no photo records of *A. retusa* on Guam.

Expert data records. We are aware of only two records of *A.* cf *retusa* (the cf. abbreviation is used to express a possible identification) from Guam, both of which were by Dave Burdick several years before the listing (Burdick 2021a). As explained in Burdick (2021a,b) and Fenner (2020a), there is not a clear distinction between *A. retusa* and similar species such as *A. cophodactyla* in the Mariana Islands. For example, as of 2021, the photos of *A.* cf *cophodactyla* on Guam (Dave Burdick's website, Guam Reef Life), *A. cophodactyla* on Guam (Corals of the World website, Gustav Pauley photo), and "A colony of *Acropora retusa* or *Acropora* cf. *cophodactyla*" from CNMI (location not specified) on p. 96 in Fenner (2020a) demonstrate how similar *A. retusa* and *A. cophodactyla* are to one another. Doug Fenner agrees with Dave Burdick's assessment that *A. retusa* in the Marianas cannot be reliably identified in the field at this time, even by experts like himself and Burdick (D. Fenner, pers. comm., Sep-21). Recent taxonomic work on *Acropora* species in the Marianas suggests the presence of many localized undescribed species (D. Burdick, pers. comm., Oct-22), similar to other Indo-Pacific *Acropora* species (Ramirez-Portilla et al. 2022). That is, the records of *A.* cf *retusa* in Guam may be of colonies of undescribed species. Because of this taxonomic ambiguity in the Mariana Islands, the references in DoN (2019) to *A. retusa* in Guam cannot be considered expert data records. PIFSC did not record any *A. retusa* on Guam in 2017 or 2022 (PIFSC 2021, 2024).

Conclusion. While there are two expert data records for *A. retusa* on Guam, they were both recorded as possible identifications (i.e. *A.* cf *retusa*) because of the considerable taxonomic and species identification ambiguity for this species in the Mariana Islands. PIFSC did not record any *A. retusa* on Guam in 2017 or 2022. Thus, we rate the evidence provided by these records that Guam was within the occupied area for *A. retusa* at the time of listing as a 1 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.7 Rota

Photo records. A photo by Doug Fenner taken in 2010 labeled as *A. retusa* on Rota appears on p. 4-17 of DoN (2019), but see description of taxonomic ambiguity in Guam section above. Doug Fenner has observed the same species identification ambiguity with this species in Rota as described by Burdick (see Guam section above; D. Fenner, pers. comm., Aug-21). The photos in Fenner (2020a) labeled as "*A. retusa* or *A. cophodactyla"* are from CNMI, but the island is not given.

Expert data records. None. PIFSC did not record any *A. retusa* on Rota in 2017 or 2022 (PIFSC 2021, 2024).

Conclusion. Although there is one expert data record for *A. retusa* on Rota taken before listing, there is considerable taxonomic and species identification ambiguity for this species in the Mariana Islands, as explained in the Guam section above. PIFSC did not record any *A. retusa* on Rota in 2017 or 2022. Thus, we rate the evidence provided by this record that Rota was within the occupied area for *A. retusa* at the time of listing as a 1 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.8 Tinian

Photo records. We do not have any photo records of *A. retusa* on Tinian.

Expert data records. Colonies identified as either "*A. retusa* or *A. cophodactyla"* were noted by Fenner (2020a) as "common outside Tinian Harbor to the east in shallow water" in 2010. The extensive coral surveys on Tinian and Pagan by Tetra Tech (2014) did not record *A. retusa*. PIFSC did not record any *A. retusa* on Tinian in 2017 or 2022 (PIFSC 2021, 2024).

Other records. DoN (2019) notes a single colony of *A. retusa* from Tinian, but no photo or data are provided, and we do not know who identified the colony.

Conclusion. Although there are some expert data records of "*A. retusa* or *A. cophodactyla*" on Tinian, there is considerable taxonomic and species identification ambiguity for this species in the Mariana Islands, as explained in the Guam section above. PIFSC did not record any *A. retusa* colonies on Tinian in 2017 or 2022. Thus, we rate the evidence provided by these records that Tinian was within the occupied area for *A. retusa* at the time of listing as a 1 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.9 Howland

Photo records. A photo of "*Acropora* cf. *retusa"* taken and identified by Jim Maragos at Howland in 2004 was provided by Jean Kenyon (Kenyon pers. comm., 2021), which is the source for the *A. retusa* record at Howland in Kenyon et al. (2011). However, the colony in this photo is somewhat different than the typical *A. retusa* (Fenner, pers. comm., Sep-21).

Expert data records. We do not have any expert data records of *A. retusa* on Howland. PIFSC did not record any *A. retusa* on Howland in 2015 or 2018 (PIFSC 2020).

Conclusion. There is a single ambiguous photo record of *A. retusa* on Howland from 2004. PIFSC did not record any *A. retusa* on Howland in 2015 or 2018. Thus, we rate the evidence provided by these records that Howland was within the occupied area for *A. retusa* at the time of listing as a 1 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.10 Kingman Reef

Photo records. We do not have any photo records of *A. retusa* on Kingman Reef.

Expert data records. A data record of *A. retusa* on Kingman Reef is provided by Kenyon et al. (2011). However, Jean Kenyon recognized the difficulty of identifying this species in PRIA especially without a photo, and agreed it should be considered only as a possible identification (Kenyon pers. comm., 2021). PIFSC did not record any *A. retusa* on Kingman Reef in 2015 or 2018 (PIFSC 2020).

Conclusion. We have one expert data record of *A. retusa* on Kingman Reef, but as explained above, it is considered only as a possible identification. PIFSC did not record any *A. retusa* on Kingman Reef in 2015 or 2018. Thus, we rate the evidence provided by these records that Kingman was within the occupied area for *A. retusa* at the time of listing as a 1 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.11 Johnston Atoll

Photo Records. Two photos of "*Acropora* cf. *retusa*" taken and identified by Jim Maragos at Johnston in 2006 were provided by Jean Kenyon (Kenyon pers. comm., 2021), one of which is shown in Figure 9 in the *A. globiceps* section above. However, as noted in that section, based on our current understanding, the colonies in these photos are *A. globiceps* (Fenner, pers. comm., Sep-21).

Expert data records. The photos mentioned above are the sources for the *A. retusa* record at Johnston in Kenyon et al. (2011). PIFSC has not surveyed Johnston since beginning species-level surveys in 2015, and there are no other expert data records of the species at Johnston Atoll.

Conclusion. There are two photo records labeled "*A.* cf *retusa*" taken on Johnston in 2006 that we believe are *A. globiceps*. Thus, we rate the evidence that Johnston was within the occupied area for *A. retusa* at the time of listing as a 1 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.12 Wake Atoll

Photo records. Several photos of *A. retusa* are provided in a detailed report from the 2016 Wake Atoll reef slope survey, taken by co-authors Kevin Foster, Doug Fenner, and Tony Montgomery (Foster et al. 2017), including the photo below. Doug Fenner also took many other *A. retusa* photos on Wake that do not appear in the report (D. Fenner, pers. comm., Sep-21). Other photos of *A. retusa* are available from a 2022 survey on Wake by USFWS (species ID done by D. Fenner, pers. comm., Mar-22).

Figure 15. Photo of *A. retusa* on Wake, taken by Tony Montgomery in 2016.

Expert data records. Expert data records of *A. retusa* at 3–12 m of depth on the Wake forereef are provided in USAF (2017, species identifications by Doug Fenner and Tony Montgomery) and in data sheets by Doug Fenner, Tony Montgomery, and Jeremy Raynal (D. Fenner, pers. comm, Mar-22). PIFSC did not record any *A. retusa* on Wake in 2017 (PIFSC 2020). In 2021, USFWS surveyed the inner lagoon, but did not record any colonies of *A. retusa* (Nadiera Sukraj, pers. comm., Oct-21). In 2022, USFWS surveyed the reef flat on the west side of the atoll between the lagoon and the forereef. The area had >40% live coral cover, little evidence of coral bleaching or disease, and was characterized by large *Porites* microatolls interspersed with deeper areas. Several colonies of *A. retusa* were recorded in the area (Jeremy Raynal, pers. comm., Apr-22; colony photos confirmed as *A. retusa* by D. Fenner, Apr-22).

Conclusion. There are many photo and expert data records of *A. retusa* on Wake since the listing of this species under the ESA in 2014, but PIFSC did not record the species on Wake in 2017. Unlike

the records of *A. retusa* from the other PRIA islands and the Mariana Islands, the records from Wake are clearly *A. retusa* (D. Fenner, pers. comm., Apr-22). Despite the lack of records from the single standardized monitoring survey conducted in 2017, we have many recent photo and expert data records. Thus, based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Wake was within the occupied area for *A. retusa* at the time of listing as a 5 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.2.13 Jarvis

Photo records. A photo of *A. retusa* taken in 2018 appears in Vargas-Ángel at al. 2019 (Fig. 4d), who reported that the colony was observed outside of PIFSC's standard survey sites. However, the colony in this photo is somewhat different than the typical *A. retusa* (Fenner, pers. comm., May-22).

Expert data records. PIFSC did not record any *A. retusa* at its standard monitoring sites on Jarvis in 2015 or 2018 (PIFSC 2020, Vargas-Ángel at al. 2019).

Conclusion. There is a photo record of *A. retusa* on Jarvis from 2018, although it is somewhat different than the typical *A. retusa*. This is the only record of *A. retusa* on Jarvis. PIFSC did not record the species on Jarvis in either 2015 or 2018. Based on the quality, quantity and age of this record, as well as species identification uncertainty and survey effort, we rate the evidence provided by this record that Jarvis was within the occupied area for *A. retusa* at the time of listing as a 3 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.3.3 All Others

Based on the records described in this document and the cited sources, this species has not been recorded elsewhere in the U.S. Pacific Islands.

3.4 Acropora speciosa

Current species identification uncertainty for *A. speciosa* is described in Section 3.4.1. The records for the species in the U.S. Pacific Islands are provided in Section 3.4.2, which are only available for Tutuila, Guam, and Kingman Reef.

3.4.1 Species Identification Uncertainty

Colonies of *A. speciosa* are similar to several other *Acropora* species, especially *A. jacquelineae*. Fenner (2020b) describes the subtle differences that help distinguish the two species in the field. However, unequivocal distinction requires examination of a skeletal sample. Since this species cannot be reliably identified in the field even by trained experts, species identification uncertainty for *A. speciosa* is considered to be high.

3.4.2 Islands

3.4.2.1 Tutuila and Offshore Banks

Photo records: Photo records of *A. speciosa* are provided by Toonen and Montgomery (2018) and Montgomery (2021), an example of which is shown in the figure below. As noted in 3.4.1 above, unequivocal distinction requires examination of a skeletal sample, which was done for two of the colonies reported in Toonen and Montgomery (2018), including the colony in the figure below. These are the only two colonies of *A. speciosa* in American Samoa that have ever had skeletal samples taken to confirm species identification, as far as we know. We also have a photo record of the species from Tutuila taken in 2011 by Doug Fenner.

Figure 16. Photo of *A. speciosa* on Tutuila, taken by Tony Montgomery in 2016 (rom Fig. 6 in Toonen and Montgomery 2018).

Expert data records. During a mesophotic corals survey on Tutuila in 2016, *A. speciosa* was observed at three of eight sites (two at 43 m, and one at 46 m), two of which were offshore banks (Site #60 off the north shore, and Site #150 off the south shore). Skeletal samples were taken from two colonies, and confirmed as *A. speciosa*. The sites where *A. speciosa* was found each had >10 colonies of what also appeared to be *A. speciosa* (Toonen and Montgomery 2018, Montgomery 2021). These records are also documented in Montgomery et al. 2019 (a,b). PIFSC surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around Tutuila in 2015, 2018, 2020, and 2023 recording one *A. speciosa* colony in 2015 (deep), and none in the other years. No skeletal sample was taken to confirm species identification (PIFSC 2021. 2024). During coral reef monitoring surveys around Tutuila, *A. speciosa* was recorded twice in 2007 and six times in 2011 (Fenner 2014b). One of the 2011 colonies was photographed and a skeletal sample taken, resulting in the photo record mentioned above.

Other information. As noted above, hundreds of coral reef monitoring dives around Tutuila from 0 to 30 m of depth produced only 6 (5 unconfirmed, 1 confirmed by skeletal sample) records of *A. speciosa*, all 20–30 m of depth (Fenner 2014b). In contrast, *A. speciosa* was found at 3 of 8 sites >40 m of depth (two at 43 m, one at 46 m; Toonen and Montgomery 2018, Table 1, Montgomery 2021). As shown in Montgomery et al. (2019b), table-top coral cover by species such as *A. speciosa* can be high at >40 m of depth in American Samoa, raising the possibility that *A. speciosa* is abundant at mesophotic depths.

Conclusion. There are more than a few photo and expert data records of *A. speciosa* on Tutuila and Offshore Banks, including before and after the listing of the species under the ESA in 2014. PIFSC recorded one colony of the species on Tutuila in 2015. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Tutuila was within the occupied area for *A. speciosa* at the time of listing as a 5 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.4.2.2 Guam

Photo Records. Victor Bonito took several photos of a colony resembling *A. speciosa* in Apra Harbor in 2010 (Bonito pers. comm., Aug-21). However, no skeletal sample was taken, and as noted in 2.4.1 above, unequivocal distinction requires examination of a skeletal sample. The colony in the photos resembles *A. speciosa* and *A. caroliniana*, but in the absence of a skeletal sample, the species cannot be identified. Many subsequent expert dives or surveys were conducted in the area in the following

years, but neither the original colony nor any other colonies resembling *A. speciosa* were recorded (D. Burdick, pers. comm., Apr-22).

Expert data records. We have no expert data records of *A. speciosa* in Guam. PIFSC did not record any *A. speciosa* on Guam in 2017 or 2022 (PIFSC 2021, 2024).

Other Records. The Guam Marine Lab's coral collection includes a skeletal sample collected from a colony in Apra Harbor by Dave Burdick that has characteristics of *A. speciosa* and related species including *A. granulosa* (D. Burdick, pers. comm., Apr-22).

Conclusion. There are several photos of a single colony from 2010 that resemble *A. speciosa*, and a skeletal sample in the Guam Marine Lab's collection that resembles *A. speciosa* colony. Neither record can be unequivocally identified as *A. speciosa*. Further, PIFSC did not record any *A. speciosa* on Guam in 2017 or 2022. Thus, we rate the evidence provided by these records that Guam was within the occupied area for *A. speciosa* at the time of listing as a 1 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.4.2.3 Kingman Reef

Photo records. We do not have any photo records of *A. speciosa* on Kingman Reef.

Expert data records. An expert data record of *A. speciosa* on Kingman is provided by Kenyon et al. (2011), most likely collected between 2004 and 2006. However, we do not know if this record is a photo from Maragos or some other source. PIFSC surveyed Kingman in 2015 and 2018, but did not record any *A. speciosa* either year (PIFSC 2020).

Conclusion. There is one expert data record of *A. speciosa* on Kingman Reef from before the listing. PIFSC did not record any *A. speciosa* on Kingman in 2015 or 2018. Thus, we rate the evidence provided by this record that Kingman was within the occupied area for *A. speciosa* at the time of listing as a 1 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.4.2.4 All Others

Based on the records described in this document and the cited sources, this species has not been recorded elsewhere in the U.S. Pacific Islands.

3.5 Fimbriaphyllia paradivisa

Current species identification uncertainty for *F. paradivisa* (formerly *Euphyllia paradivisa*) is described in Section 3.5.1. The records for the species are provided in Section 3.5.2, which are only available for Tutuila.

3.5.1 Species Identification Uncertainty

As noted in Section 2.2.4 above, species identification uncertainty has evolved since the listings in 2014, because of much greater effort by reef coral experts to identify the listed species during coral reef monitoring surveys and other work. PIRO's Coral Species Identification Training Program's annual workshops have facilitated this learning process (e.g., NMFS 2018, 2019). Since the distinguishing characteristic of *F. paradivisa* is straightforward (tentacle shape), and its tentacles are usually extended, species identification uncertainty for *F. paradivisa* is considered low for trained, experienced experts.

3.5.2 Islands

3.5.2.1 Tutuila and Offshore Banks

Photo records: We have three photo records of *F. paradivisa* on Tutuila, two of which are shown in the figure below by Ian Moffitt taken in 2021 (28 m), and Tony Montgomery taken in 2016 (49 m). In addition, Doug Fenner provided a photo taken in 2006 (25 m).

Figure 17. Photos of *F. paradivisa* on Tutuila, taken by Ian Moffitt in 2021 (left) and Tony Montgomery in 2016 (right, from Fig. 7 in Toonen and Montgomery 2018).

Expert data records. In addition to the photo records described above, during a mesophotic corals survey on Tutuila in 2016, *F. paradivisa* was observed at 1 of 8 sites (49 m). The site had >10 colonies of *F. paradivisa* on a small mound that were separated by enough distance to indicate they were not clones of a single colony and likely recruited to the area (Toonen and Montgomery 2018). PIFSC surveyed Tutuila in 2015, 2018, 2020, and 2023 (including deep sites, i.e., 18–30 m), but no *F. paradivisa* colonies were recorded during any years (PIFSC 2020).

Conclusion. There are more than a few photo and expert data records of *F. paradivisa* on Tutuila, including recent photos. PIFSC did not record the species on Tutuila in 2015, 2018, 2020, or 2023. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Tutuila was within the occupied area for *F. paradivisa* at the time of listing as a 6 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.5.2.2 All Others

Based on the records described in this document and the cited sources, this species has not been recorded elsewhere in the U.S. Pacific Islands.

3.6 Isopora crateriformis

Current species identification uncertainty for *I. crateriformis* is described in Section 3.6.1. The records for the species in the U.S. Pacific Islands are provided in Section 3.6.2.

3.6.1 Species Identification Uncertainty

As noted in Section 2.2.4 above, species identification uncertainty has evolved since the listings in 2014, because of much greater effort by reef coral experts to identify the listed species during coral reef monitoring surveys and other work. PIRO's Coral Species Identification Training Program's

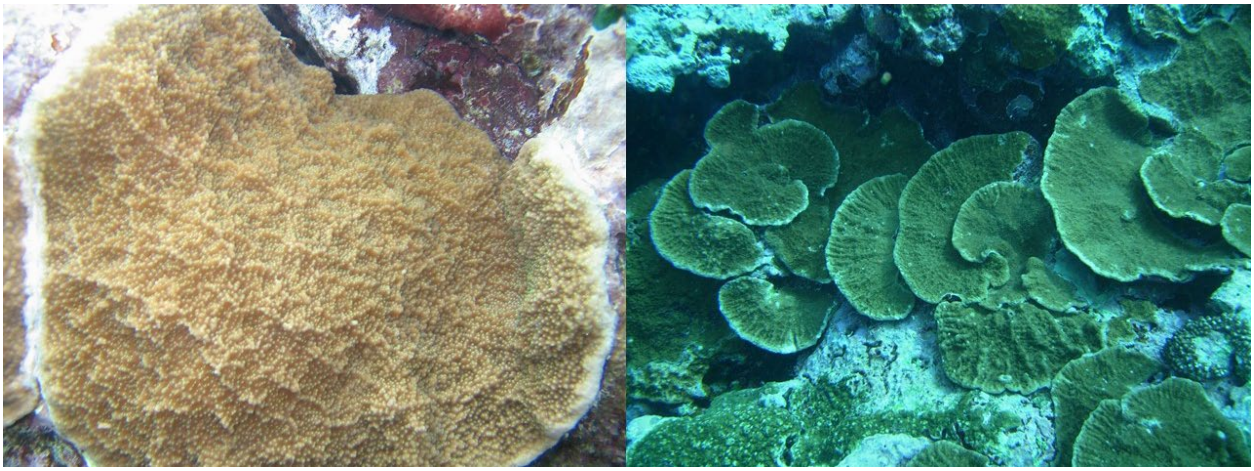
annual workshops have facilitated this learning process (e.g., NMFS 2018, 2019). Since *I. crateriformis* is found across most of American Samoa, and its colonies usually have a typical appearance (Fenner and Burdick 2016, Fenner 2020b), the overall species identification uncertainty for this species has decreased since listing, and is now considered to be low for trained, experienced experts.

3.6.2 Islands

3.6.2.1 Tutuila and Offshore Banks

Photo records. We have many photo records of *I. crateriformis* on Tutuila, two of which are shown in the figure below.

Figure 18. Photos of *I. crateriformis* on Tutuila, taken by Doug Fenner in 2004 (left) and 2009 (right).



Expert data records. Given that *I. crateriformis* is by far the most common ESA-listed species on Tutuila, there is an abundance of expert data records, including the Fagatele Bay monitoring reports (Birkeland et al. 1994, 1997, 2004; Fenner et al. 2008), the Territory-wide monitoring reports and data (Fisk and Birkeland 2002, Fenner 2013, Birkeland 2018), species lists and guides (Basch Undated3, Fenner 2020a), the NPSA and PIFSC monitoring data (NPSA 2020, PIFSC 2021, 2024), and the DMWR summary provided in the public comment letter on the 2020 proposed coral critical habitat rule (DMWR 2021). Since the species was formerly classified as *Acropora crateriformis*, the older reports use that name.

Of the 375 times that transects in the Tutuila Unit of NPSA were monitored from 2007 to 2019, *I. crateriformis* was present 13 times, including during most years, and made up between 0.06% (2010) and 1.92% (2013) of the total coral cover on the 13 transects. The depth ranges of these *I. crateriformis* colonies was from 10.9 m to 20.3 m (NPSA 2020). PIFSC surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around Tutuila in 2015, 2018, 2020, and 2023. PIFSC recorded 143 *I. crateriformis* colonies on Tutuila in 2015, 244 colonies in 2018, 51 colonies in 2020, and 561 colonies in 2023 (PIFSC 2021, 2024).

Other records. In addition to the above long-term monitoring program results, coral species surveys have been conducted by Doug Fenner at dozens of sites around Tutuila since 2005, where *I. crateriformis* was most common on upper reef slopes, but occasionally found on the outer margins of reef flats where currents were strong. Reef flats were regularly included in the surveys, but *I. crateriformis* colonies were not typically recorded there, except on the Fagatele Bay reef flat. The minimum depths of *I. crateriformis* colonies were <1 m on reef flats, and maximum depths were approximately 12 m on reef slopes. At some locations in some years, *I. crateriformis* was a dominant

species, especially in high energy habitats at approximately 5 m of depth (D. Fenner, pers. comm., 2021).

As of September 2021, NPSA provided a webpage showing photos of some corals in the park. There are three photos of "*A. crateriformis*" (i.e., "*Acropora crateriformis,*" since the species was formerly in *Acropora*), however neither the dates nor the islands are provided. DiDonato et al. (2006) apparently refers to these same three photos of *A. crateriformis*, but neither the dates nor the islands are provided.

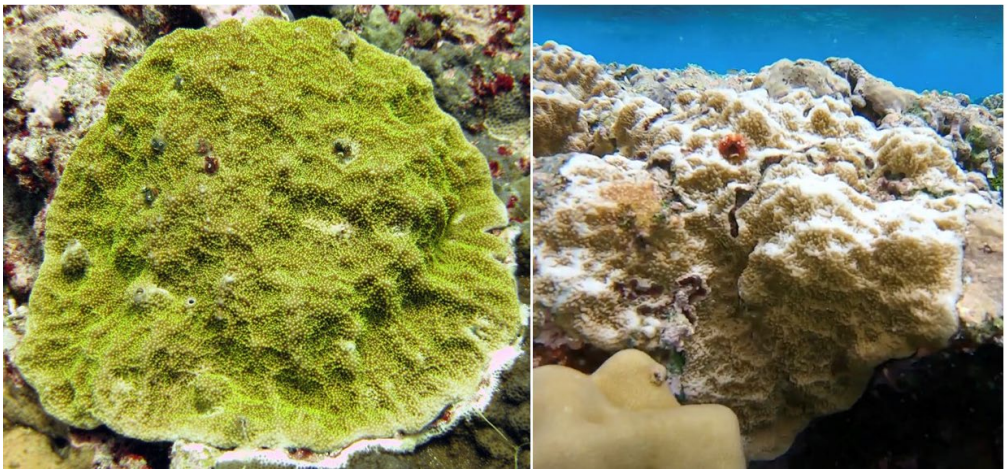
Conclusion. There are hundreds of photo and expert data records of *I. crateriformis* from around Tutuila, including many since the listing of this species under the ESA in 2014. Both NPSA and PIFSC have detected many colonies of the species at multiple sites around Tutuila over multiple years since 2014. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Tutuila was within the occupied area for *I. crateriformis* at the time of listing as a 10 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

Based on the records, *I. crateriformis* appears to be generally distributed around Tutuila to 20 m of depth in suitable habitats typically found on reef slopes (AKA forereef), such as spur-and-groove and aggregate reef. While the species also occurs on the outer margins of reef flats exposed to strong water motion, it is rare on the rubble and pavement typically found on Tutuila's reef flats as well as on low-relief forereefs.

3.6.2.2 Ofu-Olosega

Photo records. We have several photo records of *I. crateriformis* on Ofu, two of which are shown in the figure below.

Figure 19. Photos of *I. crateriformis* on Ofu, taken by Doug Fenner in 2010 (left) and Joel Moribe in 2019 (right).



Expert data records. Expert data records of *I. crateriformis* on Ofu-Olosega are provided by Basch (Undated1), Birkeland et al. (2001), Fisk and Birkeland (2002), Mundy (1996), and PIFSC (2020). PIFSC surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around Ofu-Olosega in 2015, 2018, and 2023. PIFSC recorded 20 *I. crateriformis* colonies around Ofu and Olosega in 2015, 101 colonies in 2018, and 197 colonies in 2023 (PIFSC 2021, 2024).

Conclusion. There are dozens of photo and expert data records of *I. crateriformis* from around Ofu-Olosega, including many since the listing of this species under the ESA in 2014. PIFSC detected

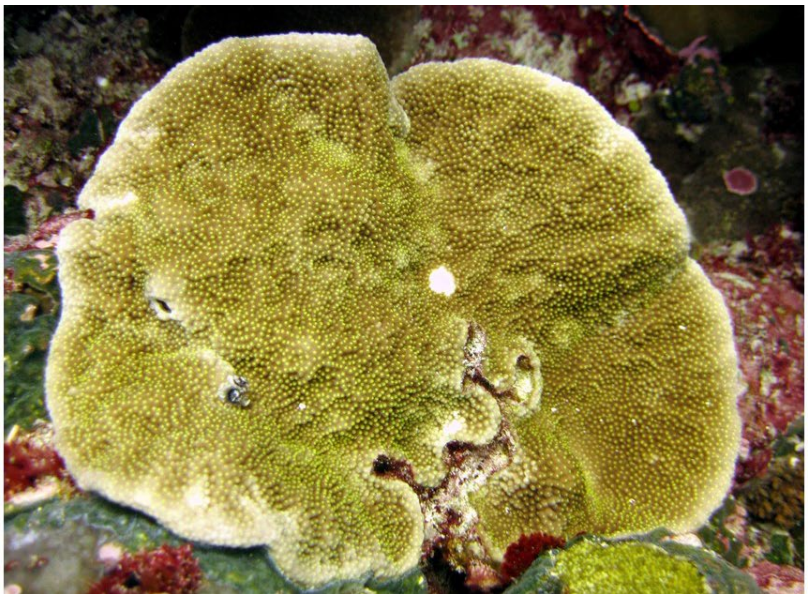
many colonies of the species at multiple sites around Ofu-Olosega over multiple years since 2014. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Ofu-Olosega was within the occupied area for *I. crateriformis* at the time of listing as a 10 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

Based on the records, *I. crateriformis* appears to be generally distributed around Ofu-Olosega to 20 m of depth in suitable habitats typically found on reef slopes (AKA forereef), such as spur-and-groove and aggregate reef. While the species also occurs on the outer margins of reef flats, it is rare on the rubble and pavement typically found on Ofu-Olosega's reef flats.

3.6.2.3 Ta'u

Photo records. We have several photo records of *I. crateriformis* on Ta'u from Doug Fenner taken in 2010, one of which is shown in the figure below. Other photo records of the species on Ta'u are shown in Lawrence et al. (2013, Fig. 8).

Figure 20. Photo of *I. crateriformis* on Ta'u, taken by Doug Fenner in 2010.



Expert data records. Expert data records of *I. crateriformis* on Ta'u are provided by Basch (Undated1), Fisk and Birkeland (2002), Mundy (1996), and PIFSC (2020). PIFSC surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around Ta'u in 2015 and 2018, recording 2 *I. crateriformis* colonies in 2015, 7 colonies in 2018, and 52 colonies in 2023 (PIFSC 2021, 2024).

Conclusion. There are many photo and expert data records of *I. crateriformis* on Ta'u before and since the listing of the species under the ESA in 2014, and PIFSC has recorded the species each time it has surveyed Ta'u. Based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Ta'u was within the occupied area for *I. crateriformis* at the time of listing as a 10 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

Based on the records, *I. crateriformis* appears to be generally distributed around Ta'u to 20 m of depth in suitable habitats typically found on reef slopes (AKA forereef), such as spur-and-groove and aggregate reef. While the species also occurs on the outer margins of reef flats, it is rare on the rubble and pavement typically found on Ta'u's reef flats.

3.6.2.4 Rose Atoll

Photo records. We do not have any photo records of *I. crateriformis* on Rose Atoll.

Expert data records. We do not have any expert data records of *I. crateriformis* on Rose Atoll. PIFSC surveyed multiple randomly-selected shallow (0–6 m), mid-depth (6–18 m), and deep (18–30 m) sites around Rose in 2015, 2018, and 2023, but did not record any *I. crateriformis* any year (PIFSC 2020). Birkeland (2018) also surveyed Rose, but did not record any *I. crateriformis*.

Conclusion. We have no photo or expert data records of *I. crateriformis* on Rose Atoll.

3.6.2.5 All Others

Based on the records described in this document and the cited sources, this species has not been recorded elsewhere in the U.S. Pacific Islands.

3.7 Seriatopora aculeata

Current species identification uncertainty for *S. aculeata* is described in Section 3.7.1. The records for the species in the U.S. Pacific Islands are provided in Section 3.7.2, which are only available for Guam and Saipan.

3.7.1 Species Identification Uncertainty

As noted in Section 2.2.4 above, species identification uncertainty has evolved since the listings in 2014, because of much greater effort by reef coral experts to identify the listed species during coral reef monitoring surveys and other work. PIRO's Coral Species Identification Training Program's annual workshops have facilitated this learning process (e.g., NMFS 2018, 2019). Since the distinguishing characteristic of *S. aculeata* are straightforward, species identification uncertainty is considered low for trained, experienced experts.

3.7.2 Islands

3.7.2.1 Guam

Photo records: Our determination in 2014 that *S. aculeata* occurs in Guam was based on a photo record in Randall and Myer (1983, photo taken in 1970s), and photos by Dave Burdick of a single *S. aculeata* colony taken in 2008 and 2010 at 20 m of depth off of Facpi Point (Burdick 2021a,b, Randall and Myer 1983). Since then, we have learned of another photo record of *S. aculeata* taken by Dick Randall in the 1970s at 27 m of depth in Pago Bay adjacent to the Marine Lab (Burdick 2021b).

Expert data records. Dick Randall's Coral Checklist of the Mariana Islands (Randall 2003) includes *S. aculeata*, based on the records of the species from Guam mentioned above that appear in Randall and Myers (1983). PIFSC surveyed multiple sites around Guam to 30 m depth in 2017 and 2022 but no *S. aculeata* were recorded (PIFSC 2021, 2024).

Other information. Although the *S. aculeata* records from Guam were at 20 and 27 m of depth, the general depth range of the species is thought to be 3 to 40 m (NMFS 2014, Coral Traits Database website 2022). Despite hundreds of dives by Dave Burdick on Guam within *S. aculeata*'s depth range since the photos were taken in 2008 and 2010 (including many dives at the same location where the photos were taken), and many dives by other coral experts on Guam especially after listing in 2014, no other colonies of the species have been observed. Since the most recent record was collected in 2010, there has been a sharp decline in coral cover throughout Guam, especially of branching corals such as *S. aculeata*, due to a multitude of disturbances including crown-of-thorn outbreaks, bleaching events, and others (CRCP 2018a, Maynard et al. 2017, Raymundo et al. 2019, Tusso et al. 2016).

Conclusion. There are three photo records of *S. aculeata* on Guam (two from the 1970s and one from 2008-2010), but none since then despite hundreds of expert dives and surveys within the habitat and depth range of the species. PIFSC did not record the species during its monitoring surveys on Guam in 2017 and 2022. Therefore, based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Guam was within the occupied area for *S. aculeata* at the time of listing as a 2 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.7.2.2 Saipan

Photo records. We do not have any photo records of *S. aculeata* in Saipan.

Expert data records. Peter Houk conducted coral species monitoring around Saipan in 2009–2012, recording a group of eight colonies of *S. aculeata* within close proximity in 2011 (Houk 2020). As noted in Section 2.2 above, such a group of colonies is considered a single record because of the high likelihood of clones. No photos were taken, and no colonies of the species have been observed on Saipan since that time, even at the location of the original record (P. Houk, pers. comm., Aug-21). PIFSC surveyed multiple sites around Saipan in 2017 and 2022 but no *S. aculeata* were recorded (PIFSC 2021, 2024).

Other information. There is a skeletal specimen of *S. aculeata* in the CNMI Bureau of Environmental and Coastal Quality's corals collection (Steve McKagan, pers. comm., 2016), but we have not been able to obtain details. Despite many dives by Houk and others on Saipan since *S. aculeata* was observed in 2011, and especially after listing in 2014, no other colonies of the species have been observed. Since the record was collected in 2011, there has been a sharp decline in coral cover throughout Saipan, especially of branching corals such as *S. aculeata*, due to a multitude of disturbances (CRCP 2018b, Maynard et al. 2018).

Conclusion. There are no photo records and only one expert data record of *S. aculeata* on Saipan dating from 2011. PIFSC did not record the species during its monitoring surveys on Saipan in 2017 and 2022. Therefore, based on the quality, quantity and age of these records, as well as species identification uncertainty and survey effort, we rate the evidence provided by this records group that Saipan was within the occupied area for *S. aculeata* at the time of listing as a 2 (rating system shown in Table 1 above, results shown in Table 2 in Section 4 below).

3.7.2.3 All Others

Based on the records described in this document and the cited sources, this species has not been recorded elsewhere in the U.S. Pacific Islands.

3.8 Summary of Ratings

Each of the 47 records group (i.e., records of a listed species from an island) was rated in terms of the evidence that the island was within the occupied area for the species at the time of listing (2014), based on the 10 evidence categories described in Table 1 above, and shown in Table 2 below:

1. Nine records groups were rated as 1: *A. jacquelineae* from Tutuila; *A. retusa* from Guam, Rota, Tinian, Howland, Kingman Reef, and Johnston Atoll; and *A. speciosa* from Guam and Kingman Reef.
2. Seven records groups were rated as 2: *A. globiceps* from Howland, Baker, Kingman Reef, Maro Reef, and Gardner Pinnacles; and *S. aculeata* from Guam and Saipan.
3. One records group was rated as 3: *A. retusa* from Jarvis.
4. Three records groups were rated as 4: *A. globiceps* from Alamagan, Asuncion and Uracas.

5. Two records groups were rated as 5: *A. retusa* from Wake Atoll; and *A. speciosa* from Tutuila.
6. Six records groups were rated as 6: *A. globiceps* from Rose, FDM, Palmyra, Johnston, and FFS; and *F. paradivisa* from Tutuila.
7. Three records groups were rated as 7: *A. retusa* from Ofu-Olosega, Ta'u, and Swains.
8. Six records groups were rated as 8: *A. globiceps* from Ofu-Olosega, Ta'u, Aguijan, Pagan, Maug Islands, and Wake Atoll.
9. Two records groups were rated as 9: *A. retusa* from Tutuila and Rose Atoll.
10. Eight records groups were rated as 10: *A. globiceps* from Tutuila, Guam, Rota, Tinian, and Saipan; and *I. crateriformis* from Tutuila, Ofu-Olosega, and Ta'u.

4 Interpretation of Ratings to Determine Occupied Areas

Finally, we interpreted the ratings of the records groups in terms of the likelihood that the island was within the occupied area for the listed species at the time of listing in 2014. As explained in more detail in Section 1.2, for the purposes of critical habitat, an occupied area is one that was used at the time of listing by the species for all or part of its life cycle, including migratory corridors, seasonal habitats, and habitats used periodically, but not areas used solely by vagrant individuals (i.e., waifs). When records groups include multiple records, typically such records provide strong evidence that the island was within the occupied area of the listed species at the time of listing.

However, for those records groups with very few records, there are several reasons why such records may not provide adequate evidence that the island was within the occupied area of the listed species at the time of listing, including: (1) for listed species with high species identification uncertainty, the records may be misidentifications; (2) on islands where extensive expert surveys over many years or decades have produced only one or two records, the records may have been of vagrant individuals; and (3) in cases were extensive expert surveys were conducted both before and after listing, resulting in pre-listing records but no post-listing records, the records may be of a species that was no longer present at the time of listing. That is, the mere existence of an expert record of a listed coral from an island is not necessarily adequate to assume that the island was within the occupied area of the species at the time of listing, hence the need to assess and interpret the records in a systematic manner.

The following sub-sections first describe our rationales for interpreting ratings of each records group as providing inadequate vs. adequate evidence that the island was within the occupied area for the listed species at the time of listing. Finally, the results of these interpretations are provided, for which we conclude that 17 of the 47 records groups provide inadequate evidence that the island was within an occupied area for the listed species, and that 30 records groups provide adequate evidence.

4.1 Rationales for Interpretation of the 47 Ratings

4.1.1 Ratings of 1–3 Provide Inadequate Evidence for Being Within An Occupied Area

Seventeen of the records groups were rated as 1–3, and all but one of these had only one or two records each. The remaining records group (*S. aculeata* from Guam) had a few records, two of which were collected approximately 50 years before listing. Of these 17 records groups, nine were rated as 1, seven as 2, and one as 3 (Table 2). The rationales for why these 17 records groups provide inadequate evidence for the species being within the occupied area at the time of listing are provided below.

4.1.1.1 Why The Nine Records Groups Rated as 1 Provide Inadequate Evidence

One *A. jacquelineae* records group was rated as 1 (Tutuila), a species with high species identification uncertainty even for trained experts. This record consists of photos of a single colony of *A. jacquelineae* on Tutuila taken in 2008. Since then, hundreds of expert surveys have been conducted on Tutuila within the habitat and depth range of the species, including at the location of the original record, but no other records have been documented. As noted in Section 1.2 above, the statutory definition of an occupied area does not include habitats used solely by vagrant individuals (i.e., waifs). Waifs are a single individual or small group of individuals found outside of its normal range, presumably advected by unusual currents or weather conditions (Johnson et al. 2000), which are common among reef corals (Turak and DeVantier 2019). Based on the fact that no other colonies of *A. jacquelineae* have been observed before or since 2008 on Tutuila despite very extensive expert surveys, there is considerable likelihood that the single observed colony of *A. jacquelineae* on Tutuila was a waif colony. Since occupied areas do not include habitats used solely by vagrant individuals (i.e., waifs), this record provides inadequate evidence that Tutuila was within the occupied area of *A. jacquelineae* at the time of listing in 2014.

Six *A. retusa* records groups were rated as 1 (Guam, Rota, Tinian, Howland, Kingman Reef, Johnston), a species with high species identification uncertainty even for trained experts. All six records groups consist of one or two records collected at least several years before listing (2004–2010). Five of the records groups each consist of one or two photo records that all appear to be of closely-related but undescribed species. The other records group (Rota) consists of a single expert data record but because of species identification uncertainty and lack of photos, identification could not be confirmed. Because these records groups each consist of only one or two ambiguous records collected at least several years before listing, and expert surveys of all seven islands since listing have not recorded any *A. retusa* colonies, these records groups provide inadequate evidence that any of the six islands were within the occupied area of *A. retusa* at the time of listing in 2014.

Two *A. speciosa* records groups were rated as 1 (Guam, Kingman Reef), a species with high species identification uncertainty even for trained experts. The Guam records group consists of several photos of a single colony in Apra Harbor of Guam taken in 2010. Definitive species identification requires examination of a skeletal sample, but no sample was taken. Many subsequent expert dives and surveys were conducted in the area in the following years, but neither the original colony nor any other colonies resembling *A. speciosa* were recorded. The Kingman Reef records group consists of a single expert data record collected between 2004 and 2006 with no photos or skeletal sample. Because these records groups each consist of only a single ambiguous colony recorded at least several years before listing, and expert surveys of both islands since listing have not recorded any *A. speciosa* colonies, these records groups provide inadequate evidence that either island was within the occupied area of *A. speciosa* at the time of listing in 2014.

4.1.1.2 Why The Seven Records Groups Rated as 2 Provide Inadequate Evidence

Five *A. globiceps* records were groups rated as 2 (Howland, Baker, Kingman Reef, Maro Reef, Gardner Pinnacles), a species with low species identification uncertainty for trained experts. All five records groups consist of one or two photo records collected at least several years before listing (2000–2006). The three records groups from PRIA (Howland, Baker, Kingman Reef) each consist of one or two photo records taken between 2004 and 2006 and identified by an expert at that time but that are clearly not *A. globiceps*, and thus provide no evidence that these three islands were within the occupied area of *A. globiceps* at the time of listing in 2014. The two records groups from NWHI (Maro Reef, Gardner Pinnacles) are a photo of a single colony from 2004 (Maro Reef) and photos of a group of colonies in close proximity from 2000 (Gardner Pinnacles). Because these records groups each consist of only a single colony or group of colonies (i.e., likely clones) collected many

years before listing, multiple expert surveys conducted at Maro Reef and Gardner Pinnacles through 2008 did not record any *A. globiceps* colonies, and an expert survey of both islands since listing did not record any *A. globiceps* colonies, these records groups provide inadequate evidence that either island was within the occupied area of *A. globiceps* at the time of listing in 2014.

Two *S. aculeata* records groups were rated as 2 (Guam, Saipan), a species with low species identification uncertainty for trained experts. The Guam records group consists of three photo records (two from the 1970s and one from 2008–2010), while the Saipan records group consists of an expert data record of a group of colonies in close proximity (i.e., likely clones) from 2011. Since 2010 and 2011, hundreds of expert surveys have been conducted on Guam and Saipan within the habitat and depth range of *S. aculeata*, but no additional records have been documented. Since the most recent of these records were collected in 2010 and 2011, there have been sharp declines in coral cover throughout Guam and Saipan, especially of branching corals such as *S. aculeata*, due to a multitude of disturbances. Because these records groups each consist of only a few records collected before listing, hundreds of expert surveys have been conducted on Guam and Saipan since listing but did not record any additional *S. aculeata* colonies, and sharp declines in coral cover of branching corals such as *S. aculeata* on Guam and Saipan started before listing, these records groups provide inadequate evidence that either island was within the occupied area of *S. aculeata* at the time of listing in 2014.

4.1.1.3 Why The One Record Group Rated as 3 Provides Inadequate Evidence

One *A. retusa* records group was rated as 3 (Jarvis), a species with high species identification uncertainty even for trained experts. This records group consists of a single photo taken in 2018 although the photo does not clearly show branch and colony morphology. Like the other *A. retusa* photo records from PRIA, the colony could only be identified as possible *A. retusa* colonies because of a combination of species identification uncertainty and taxonomic ambiguity. Because *A. retusa* has high species identification uncertainty especially in PRIA, the records group consists of only one poor quality and ambiguous photo record, and post-listing standardized monitoring surveys in 2015 and 2018 at Jarvis did not detect any *A. retusa* colonies, this records group does not provide adequate evidence that Jarvis within the occupied area of *A. retusa* at the time of listing in 2014.

4.1.2 Ratings of 4–10 Provide Adequate Evidence for Being Within An Occupied Area

Thirty of the records groups were rated as 4–10, each of which had between one and hundreds of records. Of these, three records groups were rated as 4, two as 5, six as 6, three as 7, six as 8, two as 9, and eight as 10 (Table 2). The rationales for why these 30 records groups provide adequate evidence for the species being within the occupied area at the time of listing are provided below.

4.1.2.1 Why The Three Records Groups Rated as 4 Provide Adequate Evidence

Three *A. globiceps* records groups were rated as 4 (Alamagan, Asuncion, Uracas), a species with low species identification uncertainty for trained experts. These records group consists of one (Alamagan and Asuncion) and two (Uracas) records from 2017 and 2022. Because *A. globiceps* has low species identification uncertainty, and these records consist of records from 2017 and 2022, these records groups provide adequate evidence that the three islands were within the occupied area of *A. globiceps* at the time of listing in 2014.

4.1.2.2 Why The Two Records Groups Rated as 5 Provide Adequate Evidence

Two records groups were rated as 5, *A. retusa* from Wake Atoll, and *A. speciosa* from Tutuila, species with high species identification uncertainty even for trained experts. The *A. retusa*/Wake records group consists of many photo and expert data records since listing in 2014 although standardized monitoring surveys have not detected the species on Wake. The *A. speciosa*/Tutuila records group consists of several photo and expert data records before and after listing in 2014, including two

from 2016 that were confirmed with skeletal samples, and one record from a standardized monitoring survey but it was not confirmed with a skeletal sample. Although both species have high species identification uncertainty even for trained experts, the *A. retusa*/Wake records group consists of many photo and expert data records since listing, and the *A. speciosa*/Tutuila records group includes multiple post-listing records that were confirmed with skeletal samples. Thus, the records groups provide adequate evidence that Wake Atoll was within the occupied area of *A. retusa*, and that Tutuila was within the occupied area of *A. speciosa*, at the time of listing in 2014.

4.1.2.3 Why The Six Records Group Rated as 6 Provide Adequate Evidence

Six records groups were rated as 6, five for *A. globiceps* (Rose Atoll, FDM, Palmyra Atoll, Johnston Atoll, FFS), and one for *F. paradivisa* from Tutuila, species with low species identification uncertainty for trained experts. Each of the six records groups include several records collected before and after listing in 2014. Because both species have low species identification uncertainty, multiple records are available for all six islands, and records were collected after listing, these records groups provide adequate evidence that the five islands were within the occupied area of *A. globiceps*, and that Tutuila was within the occupied area of *F. paradivisa*, at the time of listing in 2014.

4.1.2.4 Why The Three Records Groups Rated as 7 Provide Adequate Evidence

Three *A. retusa* records groups were rated as 7 (Ofu-Olosega, Ta'u, Swains), a species with high species identification uncertainty even for trained experts. Although *A. retusa* generally has high species identification uncertainty, colonies of the species have a typical and distinct appearance in American Samoa. Because multiple records are available from each island, most of which were collected after listing, these records groups provide adequate evidence that Ofu-Olosega, Ta'u, and Swains were within the occupied area of *A. retusa* at the time of listing in 2014.

4.1.2.5 Why The Six Records Groups Rated as 8 Provide Adequate Evidence

Six records groups were rated as 8, all of which were for *A. globiceps* (Ofu-Olosega, Ta'u, Aguihan, Pagan, Maug Islands, Wake Atoll), a species with low species identification uncertainty for trained experts. Each of the six records groups consist of many records collected after listing in 2014. Because this species has low species identification uncertainty, and many records are available for all six islands since listing, these records groups provide adequate evidence that the six islands were within the occupied area of *A. globiceps* at the time of listing in 2014.

4.1.2.6 Why The Two Records Groups Rated as 9 Provide Adequate Evidence

Two *A. retusa* records groups were rated as 9 (Tutuila, Rose Atoll), a species with high species identification uncertainty even for trained experts. These records groups each consist of dozens of records collected after listing in 2014. Although *A. retusa* generally has high species identification uncertainty, colonies of the species have a typical and distinct appearance in American Samoa. Because dozens of records are available from after listing for both islands, these records groups provides adequate evidence that Tutuila and Rose Atoll were within the occupied area of *A. retusa* at the time of listing in 2014.

4.1.2.7 Why The Eight Records Groups Rated as 10 Provide Adequate Evidence

Eight records groups were rated as 10, five for *A. globiceps* (Tutuila, Guam, Rota, Tinian, Saipan), and three for *I. crateriformis* (Tutuila, Ofu-Olosega, Ta'u), species with low species identification uncertainty for trained experts. Each of the eight records groups consist of dozens to hundreds of records collected after listing in 2014. Because both species have low species identification uncertainty, and many records are available for all eight islands since listing, these records groups

provide adequate evidence that the five islands were within the occupied area of *A. globiceps*, and that the three islands were within the occupied area of *I. crateriformis*, at the time of listing in 2014.

4.2 Results of Interpretation of the 47 Ratings

4.2.1 17 Records Groups Provide Inadequate Evidence for Being Within An Occupied Area

In summary, 17 records groups each provide inadequate evidence that the island was within the occupied area of the listed species at the time of listing for the following species and islands (pink shading in Table 2):

1. *A. globiceps* on the five islands where records groups were rated as 2 (Howland, Baker, Kingman Reef, Maro Reef, Gardner Pinnacles);
2. *A. jacquelineae* on the one island where the record group was rated as 1 (Tutuila);
3. *A. retusa* on the seven islands where records groups were rated as 1 (Guam, Rota, Tinian, Howland, Kingman Reef, Johnston) or 3 (Jarvis);
4. *A. speciosa* on the two islands where records groups were rated as 1 (Guam, Kingman Reef); and
5. *S. aculeata* on the two islands where the record groups were rated as 2 (Guam, Saipan).

4.2.2 30 Records Groups Provide Adequate Evidence for Being Within An Occupied Area

Finally, 30 records groups each provide adequate evidence that the island was within the occupied area of the listed species at the time of listing, including records groups from 19 islands for *A. globiceps*, 6 islands for *A. retusa*, 3 islands for *I. crateriformis*, and 1 island each for *A. speciosa* and *F. paradivisa* (green shading in Table 2):

1. *A. globiceps* on the 19 islands where records groups were rated as 4 (Alamagan, Asuncion, Uracas), 6 (Rose Atoll, FDM, Palmyra Atoll, Johnston Atoll, FFS), 8 (Ofu-Olosega, Ta'u, Aguihan, Pagan, Maug Islands, Wake Atoll), or 10 (Tutuila, Guam, Rota, Tinian, Saipan);
2. *A. retusa* on the six islands where records groups were rated as 5 (Wake Atoll), 7 (Ofu-Olosega, Ta'u, Swains), or 9 (Tutuila, Rose Atoll);
3. *I. crateriformis* on the three islands where the records groups were rated as 10 (Tutuila, Ofu-Olosega, Ta'u);
4. *A. speciosa* on the one island where the record group was rated as 5 (Tutuila); and
5. *F. paradivisa* on the one island where the record group was rated as 6 (Tutuila).

4.2.3 Many Islands Had No Records

Many islands had no records at all of certain listed species. These appear as blank cells in Table 2 and are listed below:

1. No records of *A. globiceps* on 6 islands;
2. No records of *A. jacquelineae* on 29 islands;
3. No records of *A. retusa* on 17 islands;
4. No records of *A. speciosa* on 27 islands;
5. No records of *F. paradivisa* on 29 islands;
6. No records of *I. crateriformis* on 27 islands; and
7. No records of *S. aculeata* on 28 islands.

4.3 Depth Ranges

In addition, the 30 records groups were used to determine the depth range of each listed species around each island. The depth ranges of each of the five listed species with an occupied area that includes U.S. waters is summarized below based on these records groups.

Acropora globiceps occurs primarily at 0–8 m of depth across its range, but may also be found to 20 m in some locations. In American Samoa, on Tutuila *A. globiceps* has been recorded at 0–20 m of depth, including multiple records from both extremes of the depth range. In Guam and CNMI, on the islands that have been most frequently surveyed (Guam, Rota, Tinian, Saipan), *A. globiceps* has been consistently recorded at 0–12 m of depth. On these islands, *A. globiceps* is typically most common at 5–6 m of depth, and has not been recorded at >12 m of depth despite hundreds of expert surveys between 12 and >20 m of depth. In PRIA, *A. globiceps* has been recorded at 3–10 m of depth on Palmyra Atoll, 0–10 m of depth on Johnston Atoll, and 0–10 m of depth on Wake Atoll. We have no depth information for *A. globiceps* at FFS/Lalo, although the species has been recorded at 7 m at the neighboring Gardner Pinnacles. Given what is known of the depth range of *A. globiceps* in similar habitats like the PRIA atolls as described above, we consider its depth range at FFS/Lalo to also be 0–10 m.

Acropora retusa has been recorded many times on the reef slope of Tutuila between 10 and 20 m of depth by several monitoring programs. In addition, PIFSC has recorded a few colonies of *A. retusa* on Tutuila from 0–6 m of depth. On Ofu, Ta'u, and Swains, *A. retusa* has been recorded on the reef slope at approximately 10 m of depth, and in the Ofu backreef pools at 0–2 m of depth. On Rose Atoll, PIFSC has recorded several dozen colonies of the species between 6 and 30 m of depth (lower depth limit not specified). On Wake Atoll, *A. retusa* has been recorded on the forereef at 3 – 12 m of depth, and on the backreef at 0–2 m of depth. Thus, we consider the depth range of *A. retusa* on Tutuila, Ofu-Olosega, Ta'u, Swains, Rose Atoll, and Wake Atoll to be 0–20 m.

Acropora speciosa typically occurs at 20–60 m of depth across its range. All records of the species on Tutuila are from 20–50 m of depth, even though suitable habitats from 50 to 70 m have been investigated. Thus, we consider the depth range of *A. speciosa* on Tutuila and Offshore Banks to be 20–50 m.

Fimbriaphyllia paradivisa typically occurs at 5–75 m of depth across its range. All records of the species on Tutuila are from 20–50 m of depth, even though suitable habitats from 50 to 70 m have been investigated. Thus, we consider the depth range of *F. paradivisa* on Tutuila and Offshore Banks to be 20–50 m.

Isopora crateriformis typically occurs at 0–12 m of depth, but may occur to 20 m. On Tutuila, *I. crateriformis* is most common at 5 m of depth in high energy habitats, but has been recorded many times across a depth range of 0–20 m. Similarly, records of *I. crateriformis* on Ofu-Olosega and Ta'u are from 0–20 m. Based on the records, we consider the depth range of *I. crateriformis* on Tutuila and Offshore Banks, Ofu-Olosega, and Ta'u to be 0–20 m.

4.4 Conclusions

We conclude that 17 of the 47 records groups provided inadequate evidence that the island was within the occupied area for the listed species at the time of listing. The remaining 30 records groups provided adequate evidence that the island was within the occupied area for the listed species at the time of listing. These 30 records groups were from 20 islands with 1–5 listed species each (Table 3), including: *A. globiceps* on 19 islands (4 in American Samoa, 1 in Guam, 10 in CNMI, 3 in PRIA, 1 in HI); *A. retusa* on 6 islands (5 in AS, 1 in PRIA); *A. speciosa* and *F. paradivisa* on Tutuila (American Samoa); and *I. crateriformis* on 3 islands (all in American Samoa). Records groups for *A. jacquelineae* (Tutuila) and *S. aculeata* (Guam and Saipan) provided inadequate evidence that any of these islands were within the occupied areas for either species at the time of listing.

Based on these results, 20 islands were within the occupied area at the time of listing for at least one ESA-listed coral species: Tutuila for 5 species, 2 islands (Ofu-Olosega and Ta'u) for 3 species each, 2 islands (Rose and Wake) for 2 species each, and 15 islands for one species each (Table 3).

These records do not provide any evidence that the historical ranges within U.S. waters for any of these species has been reduced.

In addition, the 30 records groups were used to determine the depth range of each listed species around each island. For *A. globiceps*, the depth ranges were 0–20 m (3 islands), 0–12 m (11 islands), and 0–10 m (5 islands). For the other 4 species, the depth ranges were 0–20 m for *A. retusa* (6 islands) and *I. crateriformis* (3 islands), and 20–50 m for *A. speciosa* and *F. paradivisa* (1 island each).

Table 2. Evidence ratings for each of the 47 records groups, based on the 10 categories from Table 1. Ratings of 1–3 are considered inadequate evidence that the island was within the occupied area for the listed species at the time of listing (pink), and ratings of 4–10 are considered adequate evidence (green). Blank cells indicate no records.

Jurisdiction	**AS**					**Gu**	**CNMI**														**PRIA**							**HI**		
Island Code*	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa	bb	cc	dd
A. globiceps	10	8	8	6		10	10	8	10	10	6				4	8		4	8	4	2	2	6	2	6	8		6	2	2
A. jacquelineae	1																													
A. retusa	9	7	7	9	7	1	1		1												1			1	1	5	3			
A. speciosa	5					1																		1						
F. paradivisa	6																													
I. crateriformis	10	10	10																											
S. aculeata						2				2																				

*Island Codes:

AS (American Samoa):
- a. Tutuila and Offshore Banks
- b. Ofu-Olosega
- c. Ta'u
- d. Rose Atoll
- e. Swains

Gu (Guam):
- f. Guam

CNMI (Commonwealth of the Northern Mariana Islands):
- g. Rota
- h. Aguijan
- i. Tinian
- j. Saipan
- k. Farallon de Medinilla
- l. Anatahan
- m. Sarigan
- n. Guguan
- o. Alamagan
- p. Pagan
- q. Agrihan
- r. Asuncion
- s. Maug Islands
- t. Uracas

PRIA (Pacific Remote Island Area):
- u. Howland
- v. Baker
- w. Palmyra Atoll
- x. Kingman Reef
- y. Johnston Atoll
- z. Wake Atoll
- aa. Jarvis

HI (Hawaii):
- bb. French Frigate Shoals/Lalo
- cc. Maro Reef
- dd. Gardner Pinnacles

Table 3. The 20 islands that we consider to have been within the occupied area for any of the ESA-listed coral species (X) at the time of listing (2014), based on the records in this document.

Jurisdiction	**AS**					**Gu**	**CNMI**														**PRIA**							**HI**			#
Island Code*	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa	bb	cc	dd	islands
A. globiceps	X	X	X	X		X	X	X	X	X	X				X	X		X	X	X			X		X	X		X			19
A. jacquelineae																															0
A. retusa	X	X	X	X	X																					X					6
A. speciosa	X																														1
F. paradivisa	X																														1
I. crateriformis	X	X	X																												3
S. aculeata																															0
# species	5	3	3	2	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1	1	0	0	1	0	1	2	0	1	0	0	-

*Island Codes:

AS (American Samoa):
- a. Tutuila and Offshore Banks
- b. Ofu-Olosega
- c. Ta'u
- d. Rose Atoll
- e. Swains

Gu (Guam):
- f. Guam

CNMI (Commonwealth of the Northern Mariana Islands):
- g. Rota
- h. Aguijan
- i. Tinian
- j. Saipan
- k. Farallon de Medinilla
- l. Anatahan
- m. Sarigan
- n. Guguan
- o. Alamagan
- p. Pagan
- q. Agrihan
- r. Asuncion
- s. Maug Islands
- t. Uracas

PRIA (Pacific Remote Island Area):
- u. Howland
- v. Baker
- w. Palmyra Atoll
- x. Kingman Reef
- y. Johnston Atoll
- z. Wake Atoll
- aa. Jarvis

HI (Hawaii):
- bb. French Frigate Shoals/Lalo
- cc. Maro Reef
- dd. Gardner Pinnacles

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