2.6   ESSENTIAL FISH HABITAT

2.6.1   Introduction

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) includes provisions concerning the identification and conservation of essential fish habitat (EFH) and, under the EFH final rule, habitat areas of particular concern (HAPC) (50 Code of Federal Regulations [CFR] 600.815). The MSA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." HAPC are those areas of EFH identified pursuant to 50 CFR 600.815(a)(8), and meeting one or more of the following considerations: (1) ecological function provided by the habitat is important; (2) habitat is sensitive to human-induced environmental degradation; (3) development activities are, or will be, stressing the habitat type; or (4) the habitat type is rare.

NMFS and the regional fishery management councils must describe and identify EFH in fishery management plans (FMPs) or fishery ecosystem plans (FEPs), minimize to the extent practicable the adverse effects of fishing on EFH, and identify other actions to encourage the conservation and enhancement of EFH. Federal agencies that authorize, fund, or undertake actions that may adversely affect EFH must consult with NMFS, and NMFS must provide conservation recommendations to federal and state agencies regarding actions that would adversely affect EFH. Councils also have the authority to comment on federal or state agency actions that would adversely affect the habitat, including EFH, of managed species.

The EFH Final Rule strongly recommends regional fishery management councils and NMFS to conduct a review and revision of the EFH components of FMPs every five years (600.815(a)(10)). The council's FEPs state that new EFH information should be reviewed, as necessary, during preparation of the annual reports by the Plan Teams. Additionally, the EFH Final Rule states "Councils should report on their review of EFH information as part of the annual Stock Assessment and Fishery Evaluation (SAFE) report prepared pursuant to §600.315(e)." The habitat portion of the annual SAFE report is designed to meet the FEP requirements and EFH Final Rule guidelines regarding EFH reviews.

National Standard 2 guidelines recommend that the SAFE report summarize the best scientific information available concerning the past, present, and possible future condition of EFH described by the FEPs.

2.6.1.1   EFH Information

The EFH components of FMPs include the description and identification of EFH, lists of prey species and locations for each managed species, and optionally, HAPC. Impact-oriented components of FMPs include federal fishing activities that may adversely affect EFH, non-federal fishing activities that may adversely affect EFH; non-fishing activities that may adversely affect EFH, conservation and enhancement recommendations, and a cumulative impacts analysis on EFH. The last two components include the research and information needs section, which feeds into the Council's Five-Year Research Priorities, and the EFH update procedure, which is described in the FEP but implemented in the annual SAFE report.

The Council has described EFH for five management unit species (MUS) under its management authority, some of which are no longer MUS: pelagic (PMUS), bottomfish (BMUS), crustaceans (CMUS), former coral reef ecosystem species (CREMUS), and precious corals (PCMUS).

EFH reviews of the biological components, including the description and identification of EFH, lists of prey species and locations, and HAPC, consist of three to four parts:

- Updated species descriptions, which can be found appended to the SAFE report. These can be used to directly update the FEP;
- Updated EFH levels of information tables, which can be found in Section 2.6.4;
- Updated research and information needs, which can be found in Section 2.6.5. These can be used to directly update the FEP; and
- An analysis that distinguishes EFH from all potential habitats used by the species, which is the basis for an options paper for the Council. This part is developed if enough information exists to refine EFH.

2.6.1.2 Habitat Objectives of FEP

The habitat objective of the FEP is to refine EFH and minimize impacts to EFH, with the following sub-objectives:

- Review EFH and HAPC designations every five years based on the best available scientific information and update such designations based on the best available scientific information, when available; and
- Identify and prioritize research to assess adverse impacts to EFH and HAPC from fishing (including aquaculture) and non-fishing activities, including, but not limited to, activities that introduce land-based pollution into the marine environment.

This annual report reviews the precious coral EFH components and non-fishing impacts components, resetting the five-year timeline for review. The Council's support of non-fishing activities research is monitored through the program plan and five-year research priorities, not the annual report.

2.6.1.3 Response to Previous Council Recommendations

At its 172nd meeting in March 2018, the Council recommended that staff develop an omnibus amendment updating the non-fishing impact to EFH sections of the FEPs, incorporating the non-fishing impacts EFH review report by Minton (2017) by reference. An options paper has been developed. The CNMI Joint Advisory Group provided comments on the non-fishing impacts review at a meeting held November 15, 2017, in Garapan. The Guam Joint Advisory Group also reviewed the report at their meeting held on November 17, 2017, in Tumon.

2.6.2 Habitat Use by MUS and Trends in Habitat Condition

The Mariana Archipelago is a chain of islands in the western Pacific roughly oriented north-south. It is anchored at the southern end by the relatively large island of Guam at 13.5° north latitude. The Commonwealth of the Northern Mariana Islands (CNMI) stretches off to the north. The entire chain is approximately 425 miles long. The archipelago was named by Spanish explorers in the 16th Century in honor of Spanish Queen Mariana of Austria.

The total land area of Guam is approximately 212 square miles and its EEZ is just over 84,000 square miles. The CNMI consists of 14 main islands. From north to south these are: Farallon de Pajaros, Maug, Asuncion, Agrihan, Pagan, Alamagan, Guguan, Sarigan, Anatahan, Farallon de Medinilla, Saipan, Tinian, Aguijan, and Rota. Only Saipan, Rota, and Tinian are permanently

inhabited, with 90% of the population residing on the island of Saipan. The total land area of the CNMI is 176.5 square miles and its EEZ is almost 300,000 square miles.

Guam and the southern islands of the CNMI are limestone, with level terraces and fringing coral reefs. The CNMI's northern islands are volcanic and sparsely inhabited, with active volcanoes on several islands, including Anatahan, Pagan, and Agrihan (the highest, at 3,166 feet). The archipelago has a tropical maritime climate moderated by seasonal northeast trade winds. While there is little seasonal temperature variation, there is a dry season (December to June) and a rainy season (July to November). The rainy season coincides with hurricane season, and the Mariana Archipelago is periodically impacted by powerful typhoons.

The Mariana Trench is located to the east of the chain and includes the deepest point in the world's oceans. The vertical measurement from the seafloor to Mount Tapotchau is 37,752 ft.

Essential fish habitat in the Marianas for the four MUS comprises all substrate from the shoreline to the 700 m isobath. The entire water column is described as EFH from the shoreline to the 700 m isobath, and the water column to a depth of 400 m is described as EFH from the 700 m isobath to the limit or boundary of the EEZ. While the coral reef ecosystems surrounding the islands in the Mariana Archipelago have been the subject of a comprehensive monitoring program through the PIFSC Coral Reef Ecosystem Division (CRED) biennially since 2002, surveys are focused on the nearshore environments surrounding the islands, atolls, and reefs .

PIFSC CRED is now the Coral Reef Ecosystem Program (CREP) within the PIFSC Ecosystem Sciences Division (ESD) whose mission is to conduct multidisciplinary research, monitoring, and analysis of integrated environmental and living resource systems in coastal and offshore waters of the Pacific Ocean. This mission includes field research activities that cover near-shore island ecosystems such as coral reefs to open ocean ecosystems on the high seas. The ESD research focus includes oceanography, coral reef ecosystem assessment and monitoring, benthic habitat mapping, and marine debris surveys and removal. This broad focus enables ESD to analyze not only the current structure and dynamics of marine environments, but also to examine potential projections of future conditions such as those resulting from climate change impacts. Because humans are a key part of the ecosystem, our research includes the social, cultural, and economic aspects of fishery and resource management decisions. (PIFSC, 2020. https://www.fisheries.noaa.gov/about/pacific-islands-fisheries-science-center) The CREP continues to "provide high-quality, scientific information about the status of coral reef ecosystems of the U.S. Pacific islands to the public, resource managers, and policymakers on local, regional, national, and international levels" (PIFSC, 2011). CREP conducts comprehensive ecosystem monitoring surveys at about 50 islands, atolls, and shallow bank sites in the Western Pacific Region on a rotating schedule, based on operational capabilities. CREP coral reef monitoring reports provide the most comprehensive description of nearshore habitat quality. in the region.
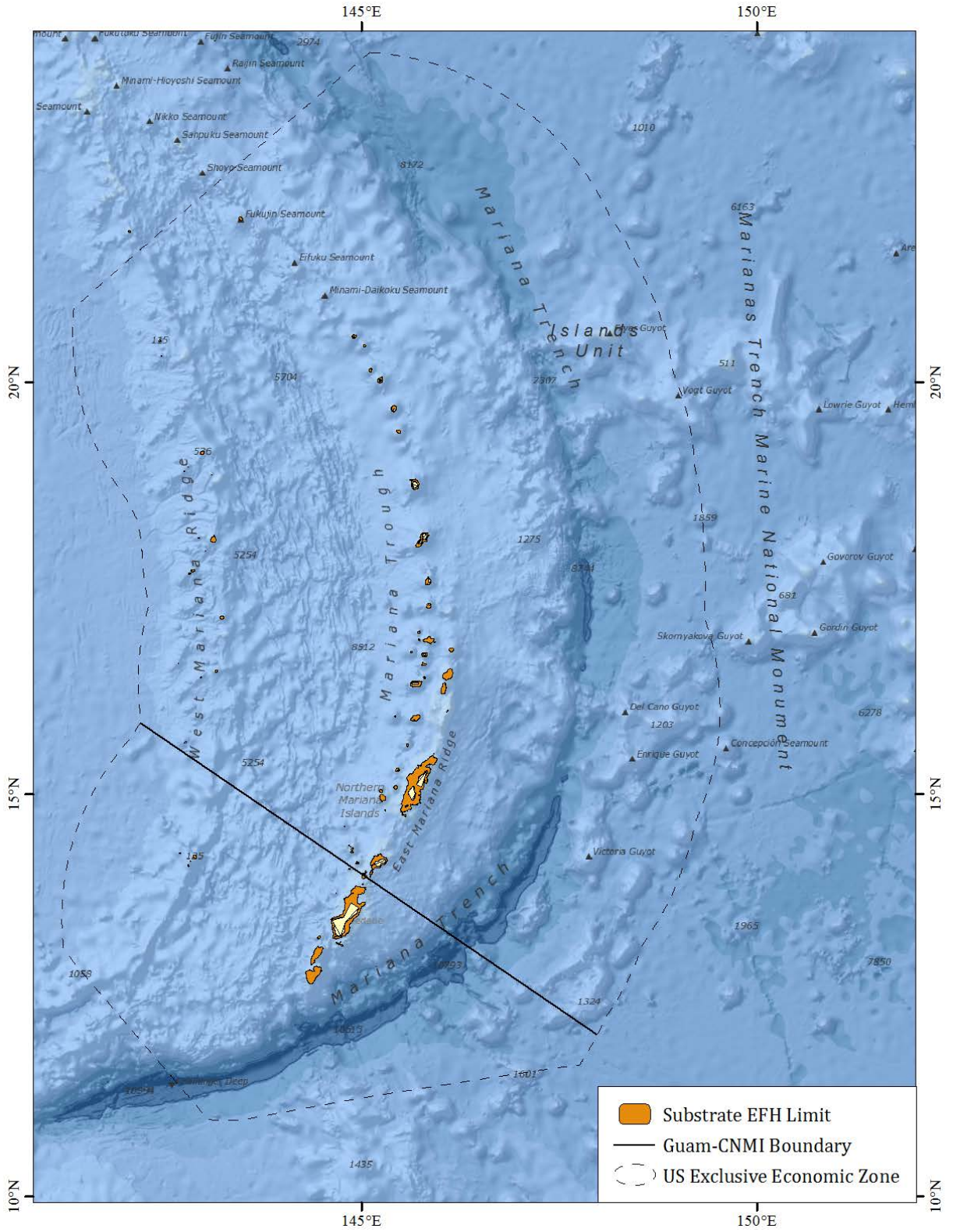
Figure 1. Substrate EFH Limit of 700 m isobath around the Mariana Archipelago (from Ryan et al., 2009)

2.6.2.1 Habitat Mapping

Interpreted IKONOS benthic habitat maps in the 0-30 m depth range have been completed for all islands in the CNMI (Miller et al., 2011). Mapping products for the Marianas are available from the Pacific Islands Benthic Habitat Mapping Center (PIBHMC).

Table 1. Summary of habitat mapping in the Mariana Archipelago

Depth Range	Timeline/Mapping Product	Progress	Source
0-30 m	IKONOS Benthic Habitat Maps	All Islands	Miller et al. (2011)
	2000-2010 Bathymetry	70%	DesRochers (2016)
	2011-2015 Multibeam Bathymetry	-	DesRochers (2016)
	2011-2015, Satellite Worldview 2 Bathymetry	15%	DesRochers (2016)
30-150 m	2000-2010 Bathymetry	85%	DesRochers (2016)
	2011-2015 Multibeam Bathymetry	-	DesRochers (2016)
15-2000 m	Multibeam Bathymetry	Complete around all islands except Guam, Rota, and Agrigan	Pacific Islands Benthic Habitat Mapping Center
	Derived Products	Backscatter available for all 60 m multibeam Geomorphology products – see website	Pacific Islands Benthic Habitat Mapping Center

The land and seafloor area surrounding the islands of the Marianas as well as primary data coverage are reproduced from Miller et al. (2011) in Figure 42.
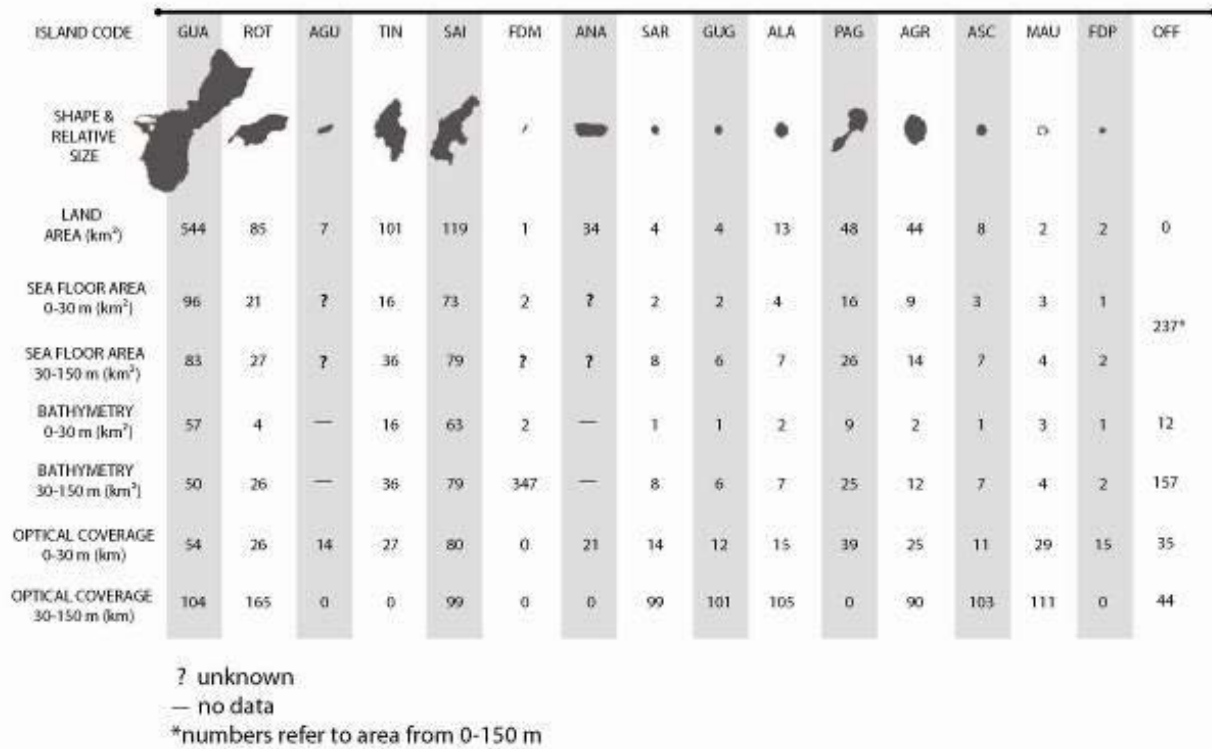
ISLAND CODE	GUA	ROT	AGU	TIN	SAI	FDM	ANA	SAR	GUG	ALA	PAG	AGR	ASC	MAU	FDP	OFF
SHAPE & RELATIVE SIZE																
LAND AREA (km²)	544	85	7	101	119	1	34	4	4	13	48	44	8	2	2	0
SEA FLOOR AREA 0-30 m (km²)	96	21	?	16	73	2	?	2	2	4	16	9	3	3	1	237*
SEA FLOOR AREA 30-150 m (km²)	83	27	?	36	79	?	?	8	6	7	26	14	?	4	2	
BATHYMETRY 0-30 m (km²)	57	4	—	16	63	2	—	1	1	2	9	2	1	3	1	12
BATHYMETRY 30-150 m (km²)	50	26	—	36	79	347	—	8	6	7	25	12	7	4	2	157
OPTICAL COVERAGE 0-30 m (km)	54	26	14	27	80	0	21	14	12	15	39	25	11	29	15	35
OPTICAL COVERAGE 30-150 m (km)	104	165	0	0	99	0	0	99	101	105	0	90	103	111	0	44

? unknown
— no data
*numbers refer to area from 0-150 m

Figure 2. Mariana Archipelago land and seafloor area and primary data coverage (from Miller et al., 2011)

2.6.2.2 Benthic Habitat

Juvenile and adult life stages of coral reef species and crustaceans including spiny and slipper lobsters and Kona crab extends from the shoreline to the 100 m isobath (64 FR 19067, April 19, 1999). All benthic habitat is considered EFH for crustacean species (64 FR 19067, April 19, 1999), while the type of bottom habitat varies by family for coral reef species (69 FR 8336, February 24, 2004). Juvenile and adult bottomfish EFH extends from the shoreline to the 400 m isobath (64 FR 19067, April 19, 1999), and juvenile and adult deepwater shrimp habitat extends from the 300 m isobath to the 700 m isobath (73 FR 70603, November 21, 2008).

2.6.2.2.1 RAMP Indicators

Benthic percent cover of coral, macroalgae, and crustose coralline algae are surveyed as a part of the Pacific Reef Assessment and Monitoring Program (RAMP) led by the PIFSC Ecosystem Sciences Division (ESD). Previously, Pacific RAMP surveys had benthic cover data summarized by island; these data are shown in Table 56 through Table 58. The benthic towed-diver survey method was used to monitor change in benthic communities. In this method, a pair of scuba divers (one collecting fish data, the other collecting benthic data) would be towed about one meter above the reef roughly 60 m behind a small boat at a constant speed of about 1.5 kt. Each diver maneuvers a tow board platform, which is connected to the boat by a bridle and towline and outfitted with a communications telegraph and various survey equipment including a downward-facing digital SLR camera. The benthic towed diver records general habitat complexity and type (e.g., spur and groove, pavement), percent cover by functional-group (hard corals, stressed corals, soft corals, macroalgae, crustose coralline algae, sand, and rubble) and for

macroinvertebrates (crown-of-thorns sea stars, sea cucumbers, free and boring urchins, and giant clams). The surveys are typically 50 minutes long and cover about two to three kilometers of habitat (PIFSC, 2016). However, this method was retired in 2016, and no new data will be appended to the time series.

More recently, the surveys began focusing on geographic sub-regions of islands for a more fine-scale summary of benthic cover; these data are shown in Table 59 through Table 61. A stratified random sampling design is used to determine status, trends, and variability of benthic communities at Rapid Ecological Assessment (REA) sites. In 2018, surveys at each REA site were conducted with one 10-meter squared belt transects, whereas two belt transects were used from 2013 to 2017. The survey domain encompasses the majority of the mapped area of reef and hard bottom habitats from 0 to 30 m depth. The stratification scheme includes (1) three depth categories (shallow: 0 to 6 m; mid-depth: >6 to 18 m; and deep: >18 to 30 m); (2) regional sub-island sectors; (3) reef zone components, including back reef, lagoon, and fore reef.

Coral colonies and their morphology are identified before measuring the colony size and assessing colony condition. Photoquadrats are used to derive estimates of benthic cover. The photoquadrat consists of a high-resolution digital camera mounted on a photoquadrat pole. Photoquadrat images are collected along the same two transects used for coral surveys at one-meter intervals, starting at 1 m and progressing to the 15-meter mark (images are not collected at the 0 m mark). This provides a total of 15 images per transect and 30 per site. In 2018, a single stage sampling scheme was implemented, which designates primary sample units (referred to sites) as grid cells containing >10% hard-bottom reef habitats. Also in 2018, a new method of determining survey effort was used by first determining the number of days spent at each island then by strata area and variance of target species at the island level (Swanson et al, 2018; Winston et al., 2019).

Table 2. Mean percent cover of live coral from RAMP sites collected from towed-diver surveys using previous methodology in the Mariana Archipelago

Year	2003	2005	2007	2009	2011	2014
Agrihan	16.03	15.45	13.68	16.03	19.83	
Aguijan	17.88	17.25	11.68	15.61	21.88	33.46
Alamagan	18.23	17.39	22.21	23.34	30.28	27.58
Anatahan	7.93					
Arakane	24.06	11.83				
Asuncion	18.15	15.58	15.66	18.57	28	40.56
Farallon de Pajaros	10.13	4.82	4.94	11.28	11.69	16.45
Guam	19.58	23.3	11.72	13.71	19.06	17.58
Guguan	23	10.18	26.58	24.97	30.23	37.23
Maug	26.86	21.43	26.25	28.09	38	46.17
Pagan	18.51	9.84	12.04	13.09	16.23	27.87
Pathfinder	24.17	24.75				
Rota	8.98	6.04	4.36	4.45	9.94	17.39
Saipan	20.85	10.63	10.18	10.18	13.73	24.99
Santa Rosa	7.31	7.8				

Sarigan	18.02	12.88	14.21	23.37	18.01	31.98
Stingray	54.86					
Supply	38.75					
Tatsumi	7.92					
Tinian	12.46	8.99	8.08	9.33	12.02	17.37

Table 3. Mean percent cover of macroalgae from RAMP sites collected from towed-diver surveys using previous methodology in the Mariana Archipelago

Year	2003	2005	2007	2009	2011	2014
Agrihan	48.25	22.65	8.55	3.2	4.63	
Aguijan	44.56	38.81	28.31	20.8	21.52	25.1
Alamagan	41.21	26.03	15.65	15.47	12.81	8.33
Anatahan	14.31					
Arakane	52.26	45.75				
Asuncion	51.1	5.37	19.11	7.54	7.47	3.86
Farallon de Pajaros	60.2	4.32	3.38	0.05	0.91	0.18
Guam	46.19	52.67	43.22	26.82	29.61	41.64
Guguan	45	10.18	19.5	17	12.59	8.66
Maug	45.91	27.2	8.17	3.26	4.37	12.01
Pagan	45.96	18.4	16.74	9.84	7.36	19.3
Pathfinder	37.29	29				
Rota	54.34	56.05	38.76	30.95	35.16	29.33
Saipan	48.57	30.75	31.87	20.39	15.26	25.18
Santa Rosa	42.5	70.54				
Sarigan	42.23	23.95	16.47	12.51	9.41	11.55
Stingray	33.89					
Supply	19.17					
Tatsumi	67.22					
Tinian	46.94	56.38	39.95	30.4	25.92	34.91

Table 4. Mean percent cover of crustose coralline algae from RAMP sites collected from towed-diver surveys using previous methodology in the Mariana Archipelago

Year	2003	2005	2007	2009	2011	2014
Agrihan	8.64	5.7	9.94	5.57	3.91	
Aguijan	14.69	10.59	12.67	7.32	11.47	18.33
Alamagan	7.63	4.85	10.29	5.33	4.29	6.25
Anatahan	7.72					
Arakane	5.28	3.58				
Asuncion	7.96	8.99	9.53	3.67	4.62	2.19
Farallon de Pajaros	3.44	8.03	5.39	2.94	2.29	0.05
Guam	12.75	4.04	8.54	6.13	9.39	6.9

Year	2003	2005	2007	2009	2011	2014
Guguan	17.13	15	12.95	14.59	7.35	9.91
Maug	10.22	7.53	12.32	7.73	5.38	8.23
Pagan	6.61	12.41	14.16	8.42	6.33	2.48
Pathfinder	5.56	10				
Rota	18.39	4.56	12.42	5.22	6.67	5.49
Saipan	10.04	8.74	15.03	8.27	6.31	5.61
Santa Rosa	7.13	0.55				
Sarigan	10.64	3.24	7.58	3.84	2.59	4.57
Stingray	1.54					
Supply	35					
Tatsumi	6.11					
Tinian	6.25	5.18	16.16	4.07	7.59	5.96

Table 5. Mean percent cover of live coral from RAMP sites collected from belt transect surveys using updated methodology in the Mariana Archipelago

Island Area	2011	2014	2017
Agrihan	13.34		7.33
Alamagan	24.69	11.05	9.19
Guguan	18.20	13.18	11.35
Sarigan	10.49	6.02	5.42
Aguijan	19.38	13.54	17.65
Asuncion	12.06	18.04	6.56
Farallon de Pajaros	11.03	5.95	3.31
Guam (East)	11.62	11.27	10.02
Guam (MPAs)	15.25		10.67
Guam (MPAs minus Achang)		15.02	
Guam (West)	16.48	13.99	13.52
Maug	30.50	27.97	7.34
Pagan	12.58	11.21	9.41
Rota	14.85	6.74	9.05
Saipan	10.49	14.13	14.59
Tinian	13.80	12.95	10.42

Table 6. Mean percent cover of macroalgae from RAMP sites collected from belt transect surveys using updated methodology in the Mariana Archipelago

Island Area	2011	2014	2017
Agrihan	3.25		3.59
Alamagan	0.35	2.59	2.51
Guguan	0.71	1.63	1.43
Sarigan	1.14	3.67	1.09
Aguijan	2.35	3.00	8.89
Asuncion	5.47	2.11	3.43

Island Area	2011	2014	2017
Farallon de Pajaros	0.13	0.31	0.21
Guam (East)	6.70	7.92	5.20
Guam (MPAs)	7.20		5.00
Guam (MPAs minus Achang)		3.97	
Guam (West)	10.87	19.35	10.70
Maug	2.34	3.69	2.18
Pagan	3.74	8.00	3.35
Rota	4.45	6.03	5.26
Saipan	1.95	6.06	4.10
Tinian	3.01	5.36	6.44

Table 7. Mean percent cover of crustose coralline algae from RAMP sites collected from belt transect surveys using updated methodology in the Mariana Archipelago

Island Area	2011	2014	2017
Agrihan	2.71		5.19
Alamagan	1.31	2.20	3.81
Guguan	7.62	7.73	6.62
Sarigan	1.71	3.50	3.23
Aguijan	2.95	4.18	7.87
Asuncion	3.29	1.67	6.47
Farallon de Pajaros	1.58	0.70	1.70
Guam (East)	7.43	4.13	6.78
Guam (MPAs)	7.25		5.85
Guam (MPAs minus Achang)		6.49	
Guam (West)	5.87	3.21	5.11
Maug	2.97	4.00	7.48
Pagan	4.03	2.35	4.72
Rota	1.73	4.43	10.00
Saipan	1.52	3.59	3.12
Tinian	1.46	2.45	3.87

2.6.2.3 Oceanography and Water Quality

The water column is also designated as EFH for selected MUS life stages at various depths. For larval stages of all species except deep water shrimp, the water column is EFH from the shoreline to the EEZ. Coral reef species egg and larval EFH is to a depth of 100 m; crustaceans, 150 m; and bottomfish, 400 m. Please see the Climate and Oceanic Indicators section (Section 2.5) for information related to oceanography and water quality.

2.6.3 Report on Review of EFH Information

A review of the biological components of crustacean EFH in Guam and Hawaii was finalized in 2019. This review can be found in Appendix C of this report. The non-fishing impacts and

cumulative impacts components were reviewed in 2016 through 2017, which can be found in Minton (2017).

2.6.4   EFH Levels

NMFS guidelines codified at 50 C.F.R. § 600.815 recommend Councils organize data used to describe and identify EFH into the following four levels:

- Level 1: Distribution data are available for some or all portions of the geographic range of the species.
- Level 2: Habitat-related densities of the species are available.
- Level 3: Growth, reproduction, or survival rates within habitats are available.
- Level 4: Production rates by habitat are available.

The Council adopted a fifth level, denoted Level 0, for situations in which there is no information available about the geographic extent of a managed species' life stage. The existing level of data for individual MUS in each fishery are presented in tables per fishery.

The Hawaii Undersea Research Laboratory (HURL) is a center operating under the School of Ocean and Earth Sciences and Technology (SOEST) at the University of Hawaii and NOAA's Office of Ocean Exploration and Research. The unique deep-sea research operation runs the Pisces IV and V manned submersibles and remotely operated vehicles (ROVs) for investigating the undersea environment through hypothesis driven projects that address gaps in knowledge or scientific needs. HURL maintains a comprehensive video database, which includes biological and substrate data extracted from their dive video archives. Submersible and ROV data are collected from depths deeper than 40 m. Observations from the HURL video archives are considered Level 1 EFH information for deeper bottomfish and precious coral species which exist in the database though cannot be considered to observe absence of species. Survey effort is low compared to the range of species observed.

2.6.4.1   Precious Corals

EFH for precious corals was originally designated in Amendment 4 to the Precious Corals FMP (64 FR 19067, April 19, 1999) using the level of data found in Table 62.

Table 8. Level of EFH information available for former and current W. Pacific PCMUS from Hawaii

Species	Pelagic Phase (Larval Stage)	Benthic Phase	Source(s)
Pink Coral (*Corallium*)			
Pleurocorallium secundum (prev. *Corallium secundum*)	0	1	Figueroa and Baco (2014); HURL Database
C. regale	0	1	HURL Database
Hemicorallium laauense (prev. *C. laauense*)	0	1	HURL Database
Gold Coral			
Kulamanamana haumeaae	0	1	Sinniger et al. (2013); HURL Database
Callogorgia gilberti	0	1	HURL Database

Species	Pelagic Phase (Larval Stage)	Benthic Phase	Source(s)
Narella spp.	0	1	HURL Database
Bamboo Coral			
Lepidisis olapa	0	1	HURL Database
Acanella spp.	0	1	HURL Database
Black Coral			
Antipathes griggi (prev. *Antipathes dichotoma*)	0	1	Opresko (2009); HURL Database
A. grandis	0	1	HURL Database
Myriopathes ulex (prev. *A. ulex*)	0	1	Opresko (2009); HURL Database

2.6.4.2 Bottomfish and Seamount Groundfish

EFH for bottomfish and seamount groundfish was originally designated in Amendment 6 to the Bottomfish and Seamount Groundfish FMP (64 FR 19067, April 19, 1999).

Table 9. Level of EFH information available for former and current W. Pacific BMUS and seamount groundfish MUS complexes

Life History Stage	Eggs	Larvae	Juvenile	Adult
Aphareus rutilans (red snapper/silvermouth)	0	0	0	1
Aprion virescens (gray snapper/jobfish)	0	0	1	1
Caranx ignoblis (giant trevally/jack)	0	0	1	1
C. lugubris (black trevally/jack)	0	0	0	1
Epinephelus faciatus (blacktip grouper)	0	0	0	1
E. quernus (sea bass)	0	0	1	1
Etelis carbunculus (red snapper)	0	0	1	1
E. coruscans (red snapper)	0	0	1	1
Lethrinus amboinensis (ambon emperor)	0	0	0	1
L. rubrioperculatus (redgill emperor)	0	0	0	1
Lutjanus kasmira (blueline snapper)	0	0	1	1
Pristipomoides auricilla (yellowtail snapper)	0	0	0	1
P. filamentosus (pink snapper)	0	0	1	1
P. flavipinnis (yelloweye snapper)	0	0	0	1
P. seiboldi (pink snapper)	0	0	1	1
P. zonatus (snapper)	0	0	0	1
Pseudocaranx dentex (thicklip trevally)	0	0	1	1
Seriola dumerili (amberjack)	0	0	0	1
Variola louti (lunartail grouper)	0	0	0	1
Beryx splendens (alfonsin)	0	1	2	2
Hyperoglyphe japonica (ratfish/butterfish)	0	0	0	1
Pseudopentaceros richardsoni (armorhead)	0	1	1	3

2.6.4.3   Crustaceans

EFH for crustacean MUS was originally designated in Amendment 10 to the Crustaceans FMP (64 FR 19067, April 19, 1999). EFH definitions were also approved for deepwater shrimp through an amendment to the Crustaceans FMP in 2008 (73 FR 70603, November 21, 2008).

Table 10. Level of EFH information available for former and current W. Pacific CMUS

Life History Stage	Eggs	Larvae	Juvenile	Adult
Spiny lobster (*Panulirus marginatus*)	2	1	1-2	2-3
Spiny lobster (*Panulirus pencillatus*)	1	1	1	2
Common slipper lobster (*Scyllarides squammosus*)	2	1	1	2-3
Ridgeback slipper lobster (*Scyllarides haanii*)	2	0	1	2-3
Chinese slipper lobster (*Parribacus antarcticus*)	2	0	1	2-3
Kona crab (*Ranina ranina*)	1	0	1	1-2

2.6.5   Research and Information Needs

Based, in part, on the information provided in the tables above the Council identified the following scientific data which are needed to more effectively address the EFH provisions:

2.6.5.1   All FMP Fisheries

- Distribution of early life history stages (eggs and larvae) of management unit species by habitat.
- Juvenile habitat (including physical, chemical, and biological features that determine suitable juvenile habitat).
- Food habits (feeding depth, major prey species etc.).
- Habitat-related densities for all MUS life history stages.
- Growth, reproduction, and survival rates for MUS within habitats.

2.6.5.2   Bottomfish Fishery

- Inventory of marine habitats in the EEZ of the Western Pacific region.
- Data to obtain a better SPR estimate for American Samoa's bottomfish complex.
- Baseline (virgin stock) parameters (CPUE, percent immature) for the Guam/CNMI deep-water and shallow water bottomfish complexes.
- High resolution maps of bottom topography/currents/water masses/primary productivity.
- Habitat utilization patterns for different life history stages and species.

2.6.5.3   Crustaceans Fishery

- Identification of post-larval settlement habitat of all CMUS.
- Identification of "source/sink" relationships in the NWHI and other regions (i.e. relationships between spawning sites settlement using circulation models, genetic techniques, etc.).
- Establish baseline parameters (CPUE) for the Guam/Northern Marinas crustaceans.
- Research to determine habitat-related densities for all CMUS life history stages in American Samoa, Guam, Hawaii, and CNMI.

- High resolution mapping of bottom topography, bathymetry, currents, substrate types, algal beds, and habitat relief.

2.6.5.4 Precious Corals Fishery

- Distribution, abundance, and status of precious corals in the CNMI and Guam.