

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.

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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 subobjectives:

- 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 was developed.

2.6.2 Habitat Use by MUS and Trends in Habitat Condition

American Samoa is made up of five high volcanic islands (Tutuila, Aunu'u, Ofu, Olosega, and Ta'u) with fringing reefs, two coral atolls (Rose Atoll or Muliava and Swains Island), and several seamounts and banks. The high islands have surrounding banks where sand can accumulate, in contrast with the Rose and Swains, where slopes plunge steeply to abyssal depths (PIFSC, 2011). Tutuila is the largest island in the territory and has banks (320 sq. km) surrounding the island that extend between one and nine km offshore (according to the PIBHMC) and extends more than three km from shore in most places (PIFSC, 2011). The islands

of Ofu, Olosega, and Ta'u make up the Manu'a Islands group, which have more limited shallow submerged banks (Figure 29). The nearshore habitat consists of narrow reef flat lagoons and fringing coral reefs (PIFSC, 2011). While the five high, volcanic islands are part of the hot-spot chain that also includes the surrounding seamounts of Muli, Vailulu'u, South Bank and independent Samoa, Swains Island is part of the Tokelau hot-spot chain (Neill and Trewick, 2008). Rose Atoll's geological origin is not well studied.

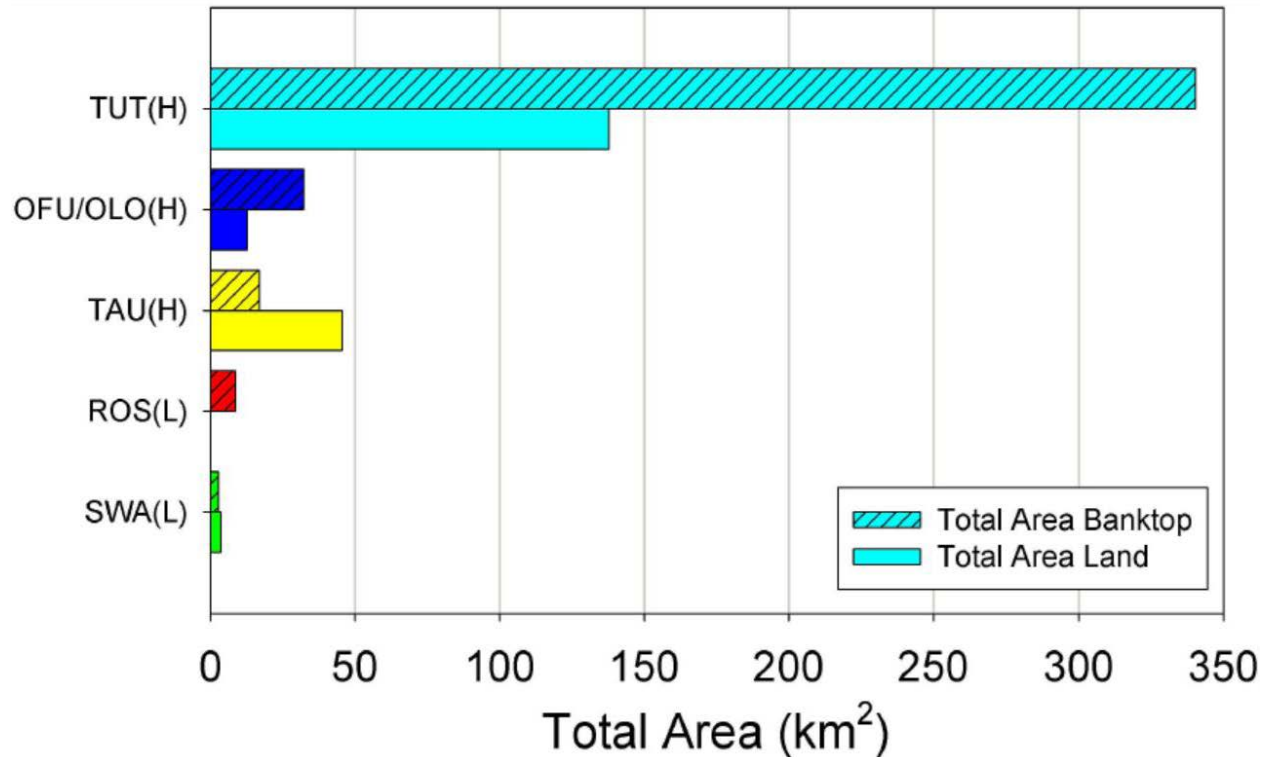


Figure 1. Bank top and terrestrial land area on high (H) or low (L) islands of Tutuila and Aunu'u (TUT), Ofu and Olosega (OFU/OLU), Ta'u (TAU), Rose (ROS), and Swains (SWA)

EFH in the Territory of American Samoa for the four previous MUS comprises all substrate from the shoreline to the 700 m isobath (Figure 30). 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 American Samoa have been the subject of a comprehensive monitoring program through the PIFSC Coral Reef Ecosystem Division (CRED), the offshore banks and pelagic environment in which MSA-managed fisheries operate have been less studied. However, American Samoa's Territorial Monitoring Program has been monitoring bleaching in two backreef lagoon pools on Tutuila from December 2003 to present.

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.

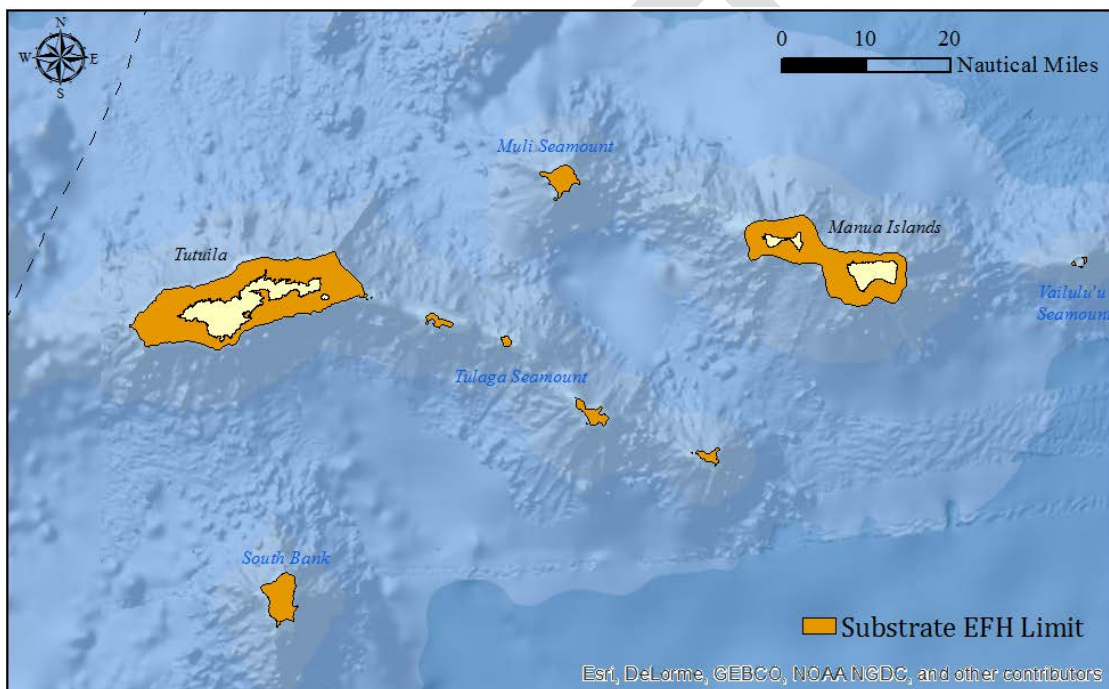


Figure 2. Substrate EFH limit of 700 m isobath around American Samoa (from Ryan et al., 2009)

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 American Samoa (Miller et al., 2011). Between the Pacific Islands Benthic Habitat Mapping Center (PIBHMC) and academically collected data, there is nearly 100% multibeam coverage of the territory between 20 and 3000 m depths.

Table 1. Summary of habitat mapping in American Samoa

Depth Range	Timeframe/Mapping Product	Progress	Source
0-30 m	2000-2010 Bathymetry	39%	DesRochers (2016)

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Depth Range	Timeframe/Mapping Product	Progress	Source
	IKONOS Benthic Habitat Maps	All	NCCOS Data Collections: Territory Benthic Habitat Maps
	2011-2015 Satellite WorldView 2 Bathymetry	1%	DesRochers (2016)
	2011-2015 Multibeam Bathymetry	-	DesRochers (2016)
30-150 m	2000-2010 Bathymetry	97%	DesRochers (2016)
	2011 – 2015 Multibeam Bathymetry	-	DesRochers (2016)
20-3000 m	Multibeam Bathymetry	Nearly 100% coverage	Pacific Islands Benthic Habitat Mapping Center

The land and seafloor area surrounding the islands of American Samoa as well as primary data coverage are reproduced from Miller et al. (2011) in Figure 31.

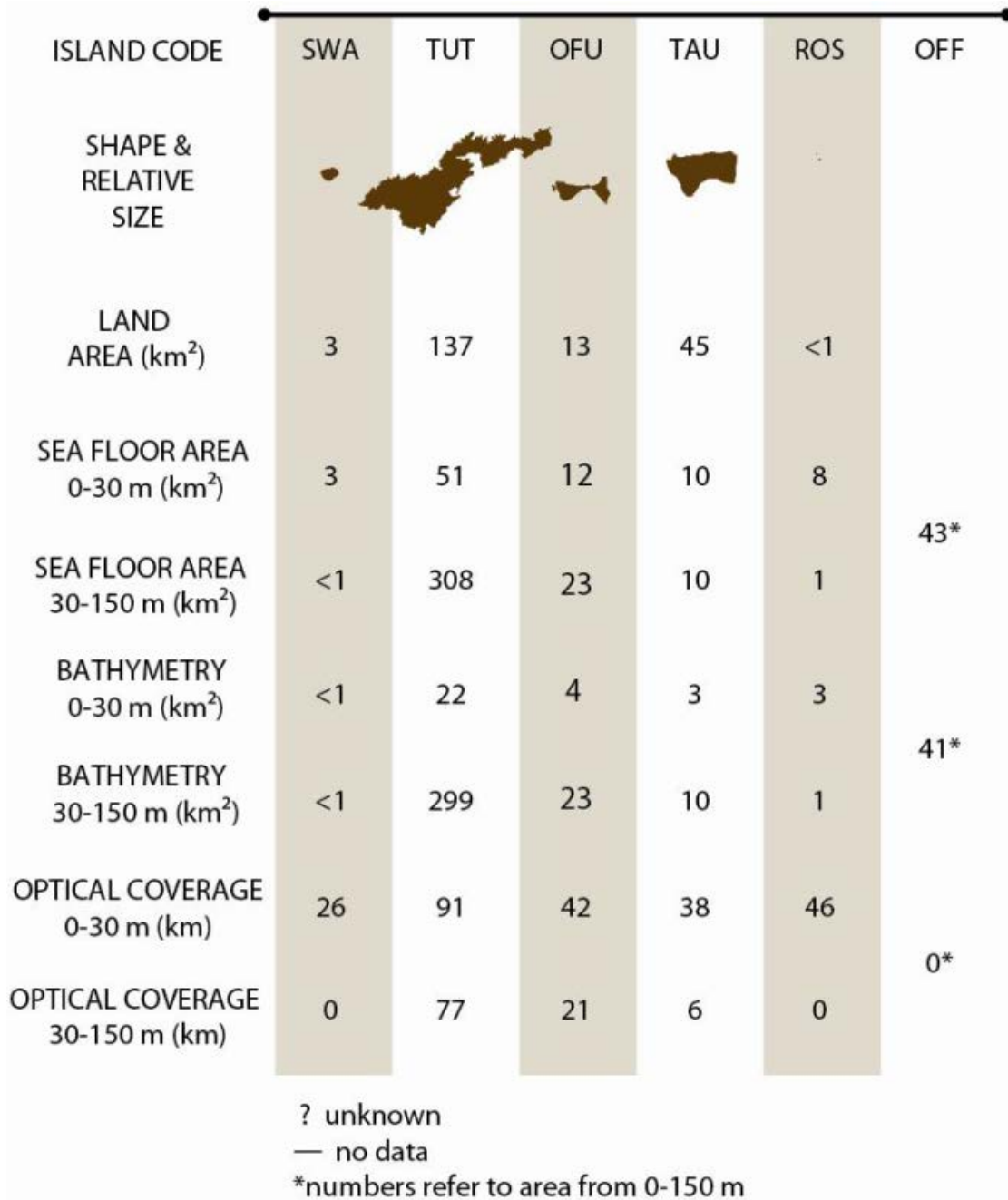


Figure 3. American Samoa land and seafloor area and primary data coverage (from Miller et al., 2011)

2.6.2.1.1 Benthic Habitat

Juvenile and adult life stages of coral reef MUS 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,

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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 deep-water shrimp habitat extends from the 300 m isobath to the 700 m isobath (73 FR 70603, November 21, 2008).

Table 33 shows the depths of geologic features, the occurrence of MUS EFH at that feature, and the availability of long-term monitoring data at diving depths.

Table 2. Occurrence of EFH by feature

Feature	Summit Minimum Depth	Coral Reef/Crustaceans (w/o Deepwater Shrimp)	Bottomfish	Deepwater Shrimp	Long Term Monitoring
Tutuila	Emergent	✓	✓	✓	✓
Manu'a Group	Emergent	✓	✓	✓	✓
Swains Island	Emergent	✓	✓	✓	✓
Rose Atoll	Emergent	✓	✓	✓	✓
Muli Seamount	50 m	✓	✓	✓	
Tulaga Seamount		✓	✓	✓	
South Bank		✓	✓	✓	2010 only
Vailulu'u Seamount	580 m			✓	

2.6.2.1.2 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 33 through Table 35. 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 36 through Table 38. A stratified random sampling design is used to determine status, trends, and variability of benthic

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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 3. Mean percent cover of live coral from RAMP sites collected from towed-diver surveys using previous methodology in American Samoa

Island	2002	2004	2006	2008	2010	2012	2015
Ofu and Olosega	18.1	14.21	17.76	21.21	18.88	31.43	38.4
Rose	26.23	24.2	17.99	17.83	14.45	23.83	27.8
South Bank	-	-	-	-	2.09	-	-
Swains	59.92	32.36	43.91	37.5	31.82	53.13	39.54
Tau	28.39	23.35	19.04	20.22	18.21	29.93	35.22
Tutuila	26.17	18.93	13.52	19.75	18.2	27.55	26.56

Table 4. Mean percent cover of macroalgae from RAMP sites collected from towed-diver surveys using previous methodology in American Samoa

Island	2002	2004	2006	2008	2010	2012	2015
Ofu and Olosega	14.74	24.76	5.35	7.74	4.61	8.64	6.42
Rose	16.1	26.46	5.99	16.86	12.67	18.52	25.13
South Bank	-	-	-	-	26.25	-	-
Swains	14.6	26.69	36.07	30.44	23.8	27.45	26.69
Tau	12.43	30.14	9.15	7.5	4.12	5.8	5.59
Tutuila	12.71	32.38	10.24	10.49	7.25	9.17	11.54

Table 5. Mean percent cover of crustose coralline algae from RAMP sites collected from towed-diver surveys using previous methodology in American Samoa

Island	2002	2004	2006	2008	2010	2012	2015
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Ofu and Olosega	38.13	41.58	42.97	37.93	19.86	24.34	30.05
Rose	35.4	43.13	47.45	42.74	59.12	55.44	50.53
South Bank	-	-	-	-	1.76	-	-
Swains	15.29	30.48	19.4	17.08	22.76	24.61	17.08
Tau	31.83	21.46	27.7	29.38	19.72	20.88	25.25
Tutuila	17.46	28.23	17.09	25.25	17.58	16.94	18.2

Table 6. Mean percent cover of live coral from RAMP sites collected from belt transect surveys using updated methodology in American Samoa

Island	Island Area	2010	2015	2015-16	2016	2018
Ofu & Olosega	Ofu & Olosega	24.48		32.37	24.25	28.73
Rose Atoll	Rose Atoll Lagoon	1.27		7.55		7.45
Rose Atoll	Rose Atoll (NMS)	15.95	14.32	20.06	21.63	16.67
South Bank	South Bank	2.28				
Swains	Swains (Open)			68.58		5.92
Swains	Swains (NMS)			37.64		23.78
Swains	Swains (Both)	34.47				
Tau	Tau (Both)	24.96				
Tau	Tau (Open)			33.84	33.21	35.09
Tau	Tau (NMS)			29.36	19.59	12.63
Tutuila	Aunu'u (NMS)			7.53		
Tutuila	Fagatele Bay (NMS)			39.65	28.24	33.05
Tutuila	Northeast (NMS)	19.62				
Tutuila	Northeast (Open)			28.65	32.33	27.73
Tutuila	Northwest (NMS)	29.92				
Tutuila	Northwest (Open)			24.64	22.40	18.61
Tutuila	Southeast (NMS)	21.12				
Tutuila	Southeast (Open)			18.39		8.60
Tutuila	Southwest (Open)	39.07		35.91	33.64	32.16

Note: "NMS" means the survey area was within the National Marine Sanctuary of American Samoa; "Open" means the survey area was outside the National Marine Sanctuary boundary; "Both" means the survey area was both within and outside the National Marine Sanctuary boundary.

Table 7. Mean percent cover of macroalgae from RAMP sites collected from belt transect surveys using updated methodology in American Samoa

Island	Island Area	2010	2015	2015-16	2016	2018
Ofu & Olosega	Ofu & Olosega	0.78		1.65	0.70	0.62
Rose Atoll	Rose Atoll Lagoon	0.27		0.35		0.34
Rose Atoll	Rose Atoll (NMS)	5.50	0.36	7.65	0.52	1.97
South Bank	South Bank	24.17				
Swains	Swains (Open)			3.06		3.50
Swains	Swains (NMS)			10.20		6.59

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Island	Island Area	2010	2015	2015-16	2016	2018
Swains	Swains (Both)	7.33				
Tau	Tau (Both)	0.15				
Tau	Tau (Open)			0.86	0.25	0.36
Tau	Tau (NMS)			0.44	0.10	0.47
Tutuila	Aunu'u (NMS)			2.17		
Tutuila	Fagatele Bay (NMS)			2.42	0.83	0.69
Tutuila	Northeast (NMS)	0.44				
Tutuila	Northeast (Open)			2.67	1.72	0.77
Tutuila	Northwest (NMS)	0.95				
Tutuila	Northwest (Open)			2.84	0.43	1.67
Tutuila	Southeast (NMS)	2.40				
Tutuila	Southeast (Open)			6.69		3.97
Tutuila	Southwest (Open)	0.79		2.35	0.79	0.87

Note: "NMS" means the survey area was within the National Marine Sanctuary of American Samoa; "Open" means the survey area was outside the National Marine Sanctuary boundary; "Both" means the survey area was both within and outside the National Marine Sanctuary boundary.

Table 8. Mean percent cover of crustose coralline algae from RAMP sites collected from belt transect surveys using updated methodology in American Samoa

Island	Island Area	2010	2015	2015-16	2016	2018
Ofu & Olosega	Ofu & Olosega	38.29		22.86	20.75	24.68
Rose Atoll	Rose Atoll Lagoon	12.34		3.51		5.34
Rose Atoll	Rose Atoll (NMS)	44.64	48.69	41.36	45.65	51.20
South Bank	South Bank	2.63				
Swains	Swains (Open)			10.27		70.00
Swains	Swains (NMS)			19.93		36.71
Swains	Swains (Both)	17.03				
Tau	Tau (Both)	28.46				
Tau	Tau (Open)			15.02	15.40	18.90
Tau	Tau (NMS)			13.00	22.36	16.40
Tutuila	Aunu'u (NMS)			2.85		
Tutuila	Fagatele Bay (NMS)			24.28	26.08	26.97
Tutuila	Northeast (NMS)	14.90				
Tutuila	Northeast (Open)			9.80	12.78	14.82
Tutuila	Northwest (NMS)	17.20				
Tutuila	Northwest (Open)			7.90	13.90	12.62
Tutuila	Southeast (NMS)	33.29				
Tutuila	Southeast (Open)			19.42		25.31
Tutuila	Southwest (Open)	31.14		23.28	23.14	24.76

2.6.2.2 Oceanography and Water Quality

The water column is also designated as EFH for selected 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

There were no EFH reviews completed in 2019 for American Samoa, however a review of the biological components of crustacean EFH in Guam and Hawaii was finalized in 2019. This review can be found in the 2019 Archipelagic SAFE Reports for the Mariana and Hawaii Archipelagos. 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 37. EFH was not designated in American Samoa. There has been very little survey effort to identify precious corals in the management area of the American Samoa FEP.

Table 9. 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 (<i>Corallium</i>)			
<i>Pleurocorallium secundum</i> (prev. <i>Corallium secundum</i>)	0	1	Figueroa and Baco (2014); HURL Database
<i>C. regale</i>	0	1	HURL Database
<i>Hemicorallium laauense</i> (prev. <i>C. laauense</i>)	0	1	HURL Database
Gold Coral			
<i>Kulamanamana haumeaee</i>	0	1	Sinniger et al. (2013); HURL Database
<i>Callogorgia gilberti</i>	0	1	HURL Database
<i>Narella</i> spp.	0	1	HURL Database
Bamboo Coral			
<i>Lepidisis olapa</i>	0	1	HURL Database
<i>Acanella</i> spp.	0	1	HURL Database
Black Coral			
<i>Antipathes griggi</i> (prev. <i>Antipathes dichotoma</i>)	0	1	Opresko (2009); HURL Database
<i>A. grandis</i>	0	1	HURL Database
<i>Myriopathes ulex</i> (prev. <i>A. ulex</i>)	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 10. Level of EFH information available for former and current W. Pacific BMUS and seamount groundfish MUS

Life History Stage	Eggs	Larvae	Juvenile	Adult
<i>Aphareus rutilans</i> (red snapper/silvermouth)	0	0	0	1
<i>Aprion virescens</i> (gray snapper/jobfish)	0	0	1	1
<i>Caranx ignobilis</i> (giant trevally/jack)	0	0	1	1
<i>C. lugubris</i> (black trevally/jack)	0	0	0	1
<i>Epinephelus faciatus</i> (blacktip grouper)	0	0	0	1
<i>E. quernus</i> (sea bass)	0	0	1	1
<i>Etelis carbunculus</i> (red snapper)	0	0	1	1
<i>E. coruscans</i> (red snapper)	0	0	1	1
<i>Lethrinus amboinensis</i> (ambon emperor)	0	0	0	1
<i>L. rubrioperculatus</i> (redgill emperor)	0	0	0	1

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Life History Stage	Eggs	Larvae	Juvenile	Adult
<i>Lutjanus kasmira</i> (blueline snapper)	0	0	1	1
<i>Pristipomoides auricilla</i> (yellowtail snapper)	0	0	0	1
<i>P. filamentosus</i> (pink snapper)	0	0	1	1
<i>P. flavipinnis</i> (yelloweye snapper)	0	0	0	1
<i>P. seiboldi</i> (pink snapper)	0	0	1	1
<i>P. zonatus</i> (snapper)	0	0	0	1
<i>Pseudocaranx dentex</i> (thicklip trevally)	0	0	1	1
<i>Seriola dumerili</i> (amberjack)	0	0	0	1
<i>Variola louti</i> (lunartail grouper)	0	0	0	1
<i>Beryx splendens</i> (alfonsin)	0	1	2	2
<i>Hyperoglyphe japonica</i> (ratfish/butterfish)	0	0	0	1
<i>Pseudopentaceros richardsoni</i> (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 deep water shrimp through an amendment to the Crustaceans FMP in 2008 (73 FR 70603, November 21, 2008).

Table 11. Level of EFH information available for former and current W. Pacific crustacean MUS

Life History Stage	Eggs	Larvae	Juvenile	Adult
Spiny lobster (<i>Panulirus marginatus</i>)	2	1	1-2	2-3
Spiny lobster (<i>Panulirus pencillatus</i>)	1	1	1	2
Common slipper lobster (<i>Scyllarides squammosus</i>)	2	1	1	2-3
Ridgeback slipper lobster (<i>Scyllarides haanii</i>)	2	0	1	2-3
Chinese slipper lobster (<i>Parribacus antarcticus</i>)	2	0	1	2-3
Kona crab (<i>Ranina ranina</i>)	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 that 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 MUS 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 crustacean populations.
- 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 American Samoa.