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. Fishery management actions must be evaluated for impacts to all EFH and HAPC in the area of effect and not just the EFH and HAPC for the fishery to which the management action applies.

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, most of which are no longer MUS: pelagic (PMUS), bottomfish (BMUS), crustaceans (CMUS), former coral reef ecosystem species (CREMUS), and precious corals (PCMUS). Only bottomfish remain designated as MUS after Amendment 4 to the American Samoa FEP that reduced the number of MUS from 205 species/families to 11, with the other species being classified as ECS (84 FR 2767, February 8, 2019).

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 0;
- Updated research and information needs, which can be found in Section 0. 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.

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.

At its 182nd meeting in June 2020, the Council requested that NMFS work with the Council to determine "non-essential" fish habitat to look at ways to remove areas that are degraded from being considered EFH.

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 km^2) 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 1). 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 (Neall and Trewick 2008). Rose Atoll's geological origin is not well studied.

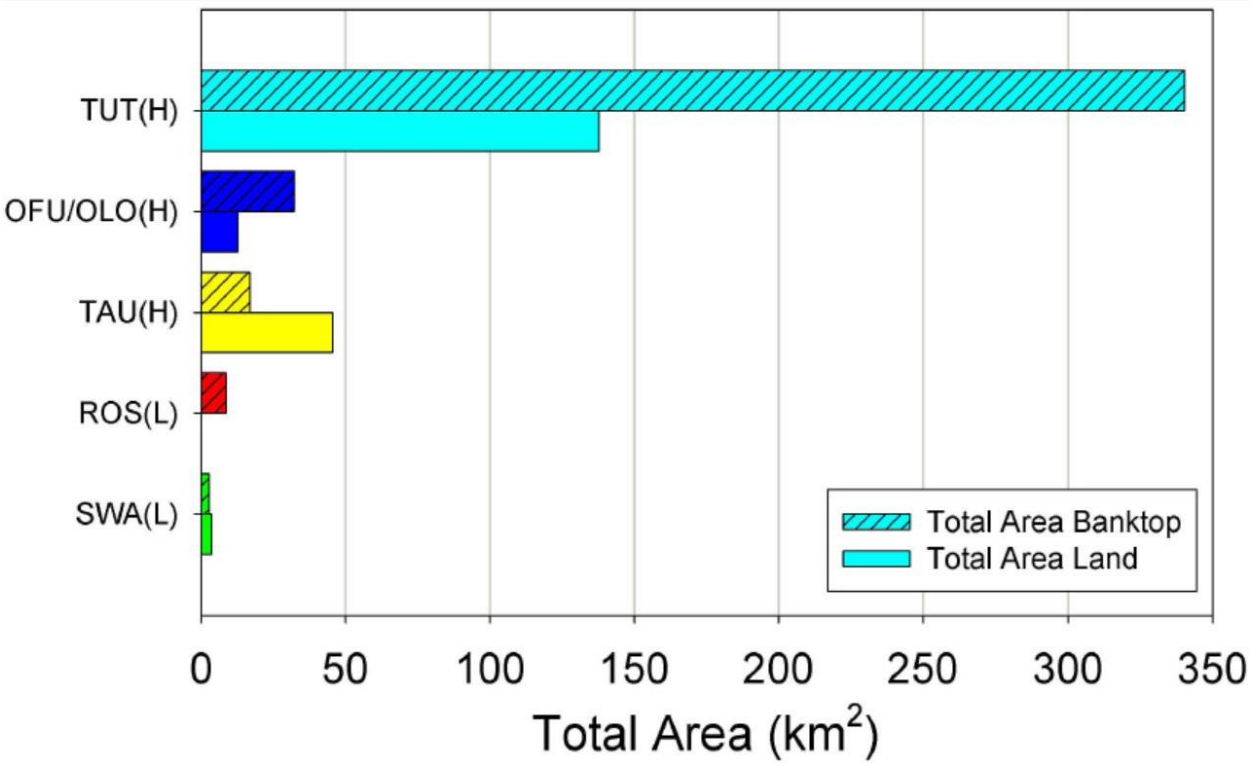

Figure 1. Bank top and terrestrial land area on high (H) or low (L) islands of Tutuila and Aunu'u (TUT), Ofu and Olosega (OFU/OLU), Ta'u (TAU), Rose (ROS), and Swains (SWA)

While the coral reef ecosystems surrounding the islands in the American Samoa 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 and 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). 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.

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 3,000 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)
	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 2.

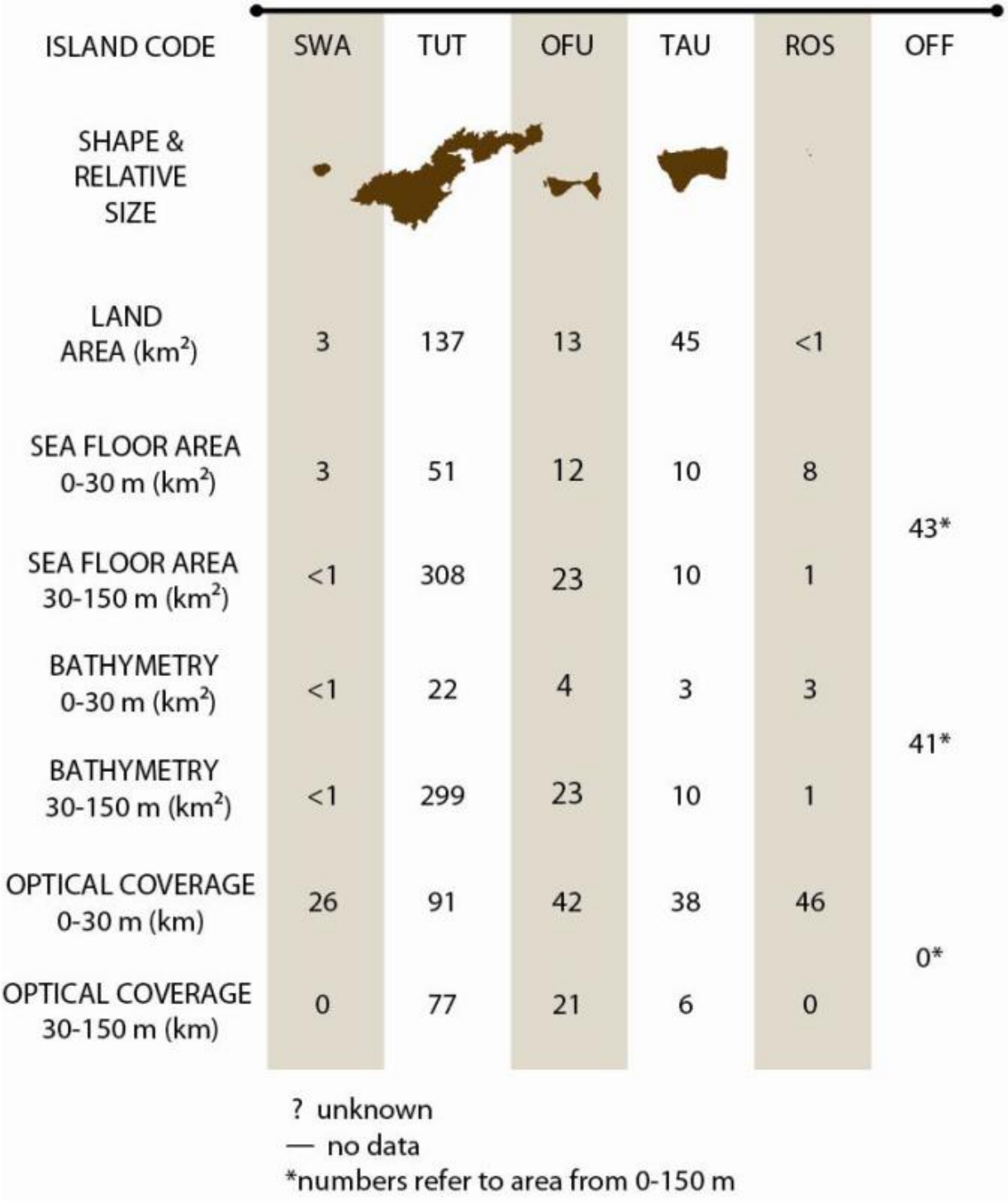

Figure 2. American Samoa land and seafloor area and primary data coverage (from Miller et al. 2011)

2.6.2.1.1 Benthic Habitat

Juvenile and adult bottomfish EFH extends from the shoreline to the 400 m isobath (64 FR 19067, April 19, 1999).

Table 2 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	Bottomfish	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 ESD. Previously, Pacific RAMP surveys had benthic cover data collected by towed-diver survey and summarized by island. These data were shown in previous reports but have since been replaced by more recent data using different collection methods.

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 3 through Table 5. A stratified random sampling design is used to determine status, trends, and variability of benthic communities at Rapid Ecological Assessment (REA) sites. Starting 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 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 4. 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
Swains	Swains (Both)	7.33				
Tau	Tau (Both)	0.15				
Tau	Tau (Open)			0.86	0.25	0.36

Island	Island Area	2010	2015	2015-16	2016	2018
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 5. 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 **Error! Reference source not found.**) for information related to oceanography and water quality.

2.6.3 Report on Review of EFH Information

There were no EFH reviews completed in 2020 for American Samoa, however a habitat analysis of the biological components of crustacean EFH in Guam and Hawaii was finalized in 2019 and can be found in the 2019 Archipelagic SAFE Reports for the Mariana and Hawaii Archipelagos. Non-fishing and cumulative impacts to EFH 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 Bottomfish

EFH for bottomfish was originally designated in Amendment 6 to the Bottomfish and Seamount Groundfish FMP (64 FR 19067, April 19, 1999), and the levels of EFH information available for American Samoa BMUS are shown in Table 6. The designated areas of EFH and HAPC for American Samoa FEP bottomfish by life stage are summarized in Table 7. To analyze the potential effects of a proposed fishery management action on EFH, one must consider all designated EFH.

Table 6. Level of EFH information available for American Samoa BMUS

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

Life History Stage	Eggs	Larvae	Juvenile	Adult
Caranx lugubris (black trevally/jack)	0	0	0	1
Etelis carbunculus (red snapper)	0	0	1	1
E. coruscans (red snapper)	0	0	1	1
Lethrinus rubrioperculatus (redgill emperor)	0	0	0	1
Lutjanus kasmira (blueline snapper)	0	0	1	1
Pristipomoides filamentosus (pink snapper)	0	0	1	1
P. flavipinnis (yelloweye snapper)	0	0	0	1
P. zonatus (snapper)	0	0	0	1
Variola louti (lunartail grouper)	0	0	0	1

Table 7. EFH and HAPC for American Samoa BMUS

American Samoa BMUS	EFH	HAPC
Aphareus rutilans (red snapper/silvermouth) *Aprion virescens* (gray snapper/jobfish) *Caranx lugubris* (black trevally/jack) *Etelis carbunculus* (red snapper) E. *coruscans* (red snapper) *Lethrinus rubrioperculatus* (redgill emperor) *Lutjanus kasmira* (blueline snapper) *Pristipomoides filamentosus* (pink snapper) *P. flavipinnis* (yelloweye snapper) *P. zonatus* (snapper) *Variola louti* (lunartail grouper)	**Eggs and larvae:** the water column extending from the shoreline to the outer limit of the EEZ down to a depth of 400 m (200 fm). **Juvenile/adults:** the water column and all bottom habitat extending from the shoreline to a depth of 400 m (200 fm)	All slopes and escarpments between 40–280 m (20 and 140 fm)

2.6.5 Project Updates

No field work related to EFH was conducted in American Samoa in 2020. A land based sources of pollution (LBSP) project was completed that identified nearshore coastal areas that were most subject to sediment runoff. This project completed an assessment of actions in the watershed of Faga'alu and provides baseline surveys of the Aua watershed. It supports efforts to reduce land-based sources of pollution impacts in priority watersheds and to contextualize spatio-temporal benthic community change with physical drivers. Results of this study were presented and delivered to American Samoa management agencies and are available in GIS format through the Pacific Islands Ocean Observing System (PacIOOS).

A collaborative effort between the PIFSC Life History Program and Am. Samoa was planned for Tutuila and the Manu'a Islands for 2020 but was delayed due to COVID-19. In 2021, they plan to conduct shore-based bottomfish research to provide life history (e.g., growth rate, size-at-maturity), population dynamics (e.g., mortality rate), and ecological (e.g., how the life history and population dynamics vary over space and time) information for a large variety of economical, recreational, and subsistence valued coral reef fishes, deepwater snappers and groupers, and pelagic fishes. Parts of this work should contribute to the understanding of bottomfish habitats in American Samoa. Samoa. Other recent and ongoing research in the Samoa Archipelago by the Life History Program includes:

- Giant ruby snapper/palu malau (*Etelis* sp.) age, growth, size-at-maturity. In review.
- Yelloweye snapper/palu-sina (*Pristipomoides flavinnis*) age, growth, and mortality differences (O'Malley et al. 2019).
- Eight bar grouper (*Hyporthodus octofasciatus*) age, growth, genetics (DiBattista et al. 2018).
- Humpback red snapper/mala'i (*Lutjanus gibbus*), yellow-lined snapper/savane-ulasama (*Lutjanus rufolineatus*), yellow-lip emperor (*Lethrinus xanthochilus*) age, growth, size-at-maturity (Taylor et al. 2018)
- Red-lip parrotfish/laea-mala (*Scarus rubroviolaceus*) age, growth, size-at-maturity (Taylor and Pardee 2017).
- Blue-striped snapper/savane (*Lutjanus kasmira*) age and growth. Cooperative research between the PIFSC Life History Program and DMWR. In progress.
- Lehi/palu-gutusiliva (*Aphareus rutilans*) population genetics. Cooperative research between the PIFSC Life History Program and DMWR. In progress.

2.6.6 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:

2.6.6.1 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.

2.6.6.2 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.