U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1845 Wasp Blvd. Bldg.176
Honolulu, Hawaii 96818
(808) 725-5000 • Fax (808) 725-5215

Environmental Assessment

Specification of Annual Catch Limits and Accountability Measures for Pacific Island Coral Reef Ecosystem Fisheries in Fishing Years 2015 through 2018

(RIN 0648-XD558)

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Responsible Agency: National Oceanic and Atmospheric Administration (NOAA)
National Marine Fisheries Service (NMFS)
Pacific Islands Regional Office (PIRO)

Responsible Official: Michael D. Tosatto
Regional Administrator, PIRO
1845 Wasp Blvd., Bldg 176
Honolulu, HI 96818
Tel (808)725-5000
Fax (808)725-5215

Responsible Council: Western Pacific Fishery Management Council
1164 Bishop St. Suite 1400
Honolulu, HI 96813
Tel (808)522-8220
Fax (808)522-8226

Abstract:

The Western Pacific Fishery Management Council (Council) recommended NMFS specify multi-year annual catch limits (ACL) and accountability measures (AM) effective in fishing years 2015-2018, the environmental effects of which are analyzed in this document. NMFS proposes to implement the specifications for fishing year 2015, 2016, 2017, and 2018 separately prior to each fishing year. The specifications pertain to ACLs for coral reef ecosystem fisheries in the Exclusive Economic Zone (EEZ or federal waters; generally 3-200 nautical miles or nm) around American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), Guam, and Hawaii, and a post-season AM to correct the overage of an ACL if it occurs. Because of the large number of individual coral reef ecosystem management unit species (CREMUS) in each island area, individual species were aggregated into higher taxonomic groups, generally at the family level. As a result, NMFS proposes to specify ACLs for 19 CREMUS groups each in American Samoa, Guam and the CNMI, and for 17 CREMUS groups in Hawaii for a total of 74 ACL specifications. The proposed ACLs are associated with a probability of

overfishing ranging between 30 to 35 percent for Guam CREMUS, 30 to 40 percent for Hawaii CREMUS, and 35 to 40 percent for American Samoa, and CNMI CREMUS. The fishing year for coral reef ecosystem fisheries in all island areas begins January 1 and ends December 31 annually. Unless modified by NMFS, the ACLs and AMs would be applicable in fishing years 2015, 2016, 2017, and 2018. Each fishing year, catches of individual species that comprise each CREMUS group from both local state/territorial waters (generally from the shoreline to three mile offshore), and federal waters of the EEZ would be counted towards the specified ACLs.

Historically, there has been little to no fishing for coral reef species in federal waters around American Samoa, Guam, the CNMI and the Hawaii. This is because the majority of coral reef habitat occurs in nearshore state and territorial waters and it is much easier and safer for fishers to harvest coral reef associated species in close to shore, than offshore in the EEZ. Therefore, catch of coral reef ecosystem species in 2015 through 2018 is expected to continue to come almost exclusively from nearshore state/territorial waters.

Currently, catch data from coral reef ecosystem fisheries in nearshore state/territorial waters are generally not available until at least six months after the end of the fishing year. Therefore, in-season monitoring of catch, and in-season AMs applied in federal waters to prevent an ACL from being exceeded (e.g. fishery closures) are not possible in any island area at this time. For this reasons, only a post-season AM is possible. Specifically, after the end of each fishing year, if NMFS and the Council determines that the average catch from the most recent three-year period exceeds the specified ACL for any taxonomic group, NMFS proposes to reduce the ACL for that taxonomic group in the subsequent fishing years by the amount of the overage. Prior to implementing a reduced ACL, NMFS would conduct additional environmental analyses, if necessary, and the public would have the opportunity to provide input and comment on the reduced ACL specification at that time. If an ACL is exceeded more than once in a four-year period, the Council is required to re-evaluate the ACL process, and adjust the system, as necessary, to improve its performance and effectiveness.

The proposed action is needed to comply with the Magnuson-Stevens Fishery Conservation and Management Act and is consistent with the provisions of the fishery ecosystem plans for American Samoa, the Mariana Archipelago, and Hawaii through which NMFS specifies ACLs and AMs for all federally managed species. The Council recommended the ACLs and AMs and developed its recommendations in accordance with the ACL process approved by NMFS, and in consideration of the best available scientific, commercial, and other information.

NMFS prepared this environmental assessment (EA) to evaluate the potential environmental impact of the proposed ACL specifications and AMs in fishing years 2015 through 2018. The EA includes a description of the information and methods used by the Council to develop the proposed ACLs, and alternatives to the proposed ACL specifications.

The analysis in the EA indicates that the proposed ACL specifications and post-season AMs regardless of which alternative is selected, would not result in large beneficial or adverse effects on target, non-target, or bycatch species, protected species, or on marine habitats. This is because the proposed federal action would not actually limit or constrain catch of coral reef resources in

any island area, or change the conduct of any federal or state/territorial coral reef fisheries in any way. Therefore, impacts of the proposed action would be unchanged from the status quo.

Copies of this EA and final rule can be found by searching on RIN 0648-XD558 at www.regulations.gov, or by contacting the responsible official or Council at the above address.

Environmental Assessment

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Acronyms and Abbreviations

ABC – Acceptable Biological Catch
ACL – Annual Catch Limit
ACT – Annual Catch Target
AM – Accountability Measure
APA – Administrative Procedure Act
CFR – Code of Federal Regulations
CNMI – Commonwealth of the Northern Mariana Islands
Council – Western Pacific Fishery Management Council
CPUE – Catch per Unit of Effort
CHCRT – Currently Harvested Coral Reef Taxa
CREMUS – Coral Reef Ecosystem MUS
DAWR – Guam Division of Aquatic and Wildlife Resources
DAR – State of Hawaii Division of Aquatic Resources
DMWR – American Samoa Department of Marine and Wildlife Resources
DFW – Northern Mariana Islands Division of Fish and Wildlife
EA – Environmental Assessment
EC – Ecosystem Component
EFH – Essential Fish Habitat
ESA – Endangered Species Act
EEZ – Exclusive Economic Zone
FEP – Fishery Ecosystem Plan
FMP – Fishery Management Plan
FR – *Federal Register*
HAPC – Habitat Areas of Particular Concern

HDAR – Hawaii Division of Aquatic Resources
MHI – Main Hawaiian Islands
Magnuson-Stevens Act – Magnuson-Stevens Fishery Conservation and Management Act
MFMT – Maximum Fishing Mortality Threshold
MMPA – Marine Mammal Protection Act
MPA – marine protected area
MRFSS – Marine Recreational Fisheries Statistics Survey
MSST – Minimum Stock Size Threshold
MSY – Maximum Sustainable Yield
MUS – Management Unit Species
NEPA – National Environmental Policy Act
nm – Nautical Miles
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
OFL – Overfishing Limit
OY – Optimum Yield
P* - Risk of overfishing percentile
PIFSC – NMFS Pacific Islands Fisheries Science Center
PHCRT – Potentially Harvested Coral Reef Taxa
SCREP – special coral reef ecosystem permit
PIRO – Pacific Islands Regional Office
SEEM – Social, Economic, and Ecological factors and Management Uncertainty
SSC – Scientific and Statistical Committee
WPacFIN – Western Pacific Fisheries Information Network
WPFMC – Western Pacific Fishery Management Council

1 Background Information

The National Marine Fisheries Service (NMFS) and the Western Pacific Fishery Management Council (Council) manage fishing for coral reef ecosystem management unit species (CREMUS) in federal waters of the exclusive economic zone (EEZ; generally 3-200 nautical miles or nm) around American Samoa, Guam, the Commonwealth of the Northern Mariana Islands (CNMI) and the main Hawaiian Islands (MHI).[1] In accordance with the provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), the Council has developed and NMFS has implemented, five fishery ecosystem plans (FEP). Four of the FEPs are geographically-based and includes the American Samoa Archipelago FEP, the Hawaii Archipelago FEP, and the Mariana Archipelago FEP, which covers federal waters around Guam and the Commonwealth of Northern Mariana Islands or the CNMI), and the Pacific Remote Island Areas FEP, which covers federal waters around Palmyra Atoll, Kingman Reef, Jarvis Island, Baker Island, Howland Island, Johnston Atoll, and Wake Island. The fifth FEP governs pelagic fisheries operating in federal waters around all of the U.S. Pacific Islands and on the high seas.

Federal regulations at 50 CFR §665 defines CREMUS to include all coral reef associated species, families or subfamilies which spend the majority of their non-pelagic (post settlement) life stages within waters less than or equal to 50 fathoms (300 feet) in total depth. CREMUS do not include species defined in other sections of 50 CFR §665 as bottomfish, crustacean, precious coral or pelagic management unit species (MUS). Federal fishing regulations for coral reef ecosystem fisheries of the western Pacific include a prohibition on the use of destructive and non-selective gear methods including the use of toxins, and explosives and includes vessel identification and gear marking requirements. Federal regulations also require a special coral reef ecosystem fishing permit (SCERFP) and logbook reporting for harvesting certain CREMUS defined in federal regulations as Potentially Harvested Coral Reef Taxa, (PHCRT) and for fishing with non-FEP approved gear methods, or fishing in designated low-use marine protected areas (MPA). Federal requirements also direct NMFS to specify an annual catch limit (ACL) and implement accountability measures (AM) for all stocks and stock complexes of MUS included in each FEP, as recommended by the Council, and in consideration of the best available scientific, commercial, and other information about the fishery for that stock or stock complex. Additionally, other regulations implemented by other federal agencies and local state and territorial governments may also apply to fishing for CREMUS in the EEZ waters. Appendix A provides a list of CREMUS in each island area.

1.1 Overview of the ACL Specification Process

Federal regulations at 50 CFR 665.4 (76 FR 37285, June 27, 2011) require NMFS to specify ACLs and AMs for each stock or stock complex of MUS identified in an FEP, as recommended by the Council, and in consideration of the best available scientific, commercial, and other

[1]Nearshore waters, generally within three nm of the shoreline around American Samoa, Guam, the Northern Mariana Islands and Hawaii are subject to the respective jurisdiction and management authority of the Territory of American Samoa, the Territory of Guam, the Commonwealth of the Northern Mariana Islands, and the State of Hawaii and are not part of the FEP management area.

information about the fishery for that stock or stock complex. This section provides an overview of the ACL specification process.
In accordance with the Magnuson-Stevens Act and the FEPs, there are three required elements in the development of an ACL specification. The first requires the Council's Scientific and Statistical Committee (SSC) to calculate an acceptable biological catch (ABC) that is set at or below the stock or stock complex's overfishing limit (OFL). The OFL is an estimate of the catch level above which overfishing is occurring. ABC is the level of catch that accounts for the scientific uncertainty in the estimate of OFL and other scientific uncertainty. In determining the appropriate ABC, the SSC follows the ACL mechanism described in the FEPs, which includes a five-tiered system of "ABC control rules" that allows for different levels of scientific information to be considered (WPFMC and NMFS 2011). Tiers 1, 2 and 3 involve data-rich to data-moderate situations and include levels of scientific uncertainty derived from model-based stock assessments. Tiers 4 and 5 involve data-poor situations and include consideration of scientific uncertainty derived from ad-hoc procedures, including simulation models or expert opinion.

When calculating an ABC for a stock or stock complex[2], the SSC must first evaluate the available information and assign the stock or stock complex into one of the five tiers. The SSC must then apply the control rule assigned to that tier to determine an ABC. For stocks like CREMUS that have an estimate of OFL, maximum sustainable yield (MSY) and other MSY-based reference points (Tier 1-3 quality data), the ABC is calculated by the SSC based on an Tier 1-3 ABC control rule that accounts for scientific uncertainty in the estimate of the OFL, and the acceptable level of risk (as determined by the Council) that catch equal to the ABC would result in overfishing. In plain English, ABC is the maximum value for which the probability or risk of overfishing (P*) is less than 50 percent. In accordance with National Standard 1 guidelines of the Magnuson-Stevens Act the probability of overfishing cannot exceed 50 percent and should be a lower value (74 FR 3178, January 9, 2011). The process described in the FEPs includes a qualitative analysis by which the P* value may be reduced below 50 percent based on consideration of four dimensions of information, including assessment information, uncertainty characterization, stock status, and stock productivity and susceptibility to overfishing. The FEPs also allow the SSC to recommend an ABC that differs from the results of the ABC control rule calculation based on factors such as data uncertainty, recruitment variability, declining trends in population variables, and other factors determined relevant by the SSC. However, the SSC must explain its rationale.

The second step requires the Council to determine an ACL that may not exceed the SSC recommended ABC. The process includes methods by which the ACL may be reduced from the ABC based on social, economic, and ecological considerations, or management uncertainty (SEEM). An ACL set below the ABC further reduces the probability that actual catch will exceed the OFL, and result in overfishing.

[2] The Magnuson-Stevens Act defines the term "stock of fish" to mean a species, subspecies, geographic grouping, or other category of fish capable of management as a unit. Federal regulations at 50 CFR §660.310(c) defines "stock complex" to mean a group of stocks that are sufficiently similar in geographic distribution, life history, and vulnerability to the fishery such that the impact of management actions on the stock is similar.

The third and final step in the ACL process is the development of AMs. There are two categories of required AMs; in-season AMs, and post-season AMs, which make adjustments to an ACL if it is exceeded. In-season AMs prevent an ACL from being exceeded and may include, but are not limited to, closing the fishery, closing specific areas, changing bag limits, or other methods to reduce catch. An ACT is the management target of the fishery and accounts for management uncertainty in controlling the actual catch at or below the ACL.

If the Council determines an ACL has been exceeded, the Council may recommend, as a post-season AM, that NMFS reduce the ACL in the subsequent fishing year by the amount of the overage. Additionally, if an ACL is exceeded more than once in a four-year period, the Council is required to re-evaluate the ACL process, and adjust the system for setting ACLs, as necessary, to improve its performance and effectiveness.

Figure 1 illustrates the relationship among the OFL, ABC, and ACLs described in this section. For more details on the specific elements of the ACL specification mechanism and process, see Amendment 1 to the PRIA FEP, Amendment 2 to the American Samoa Archipelago FEP, Amendment 2 to the Mariana Archipelago FEP, Amendment 3 to the Hawaii Archipelago FEP (WPFMC and NMFS 2011), and the final implementing regulations at 50 CFR §665.4 (76 FR 37285, June 27, 2011).

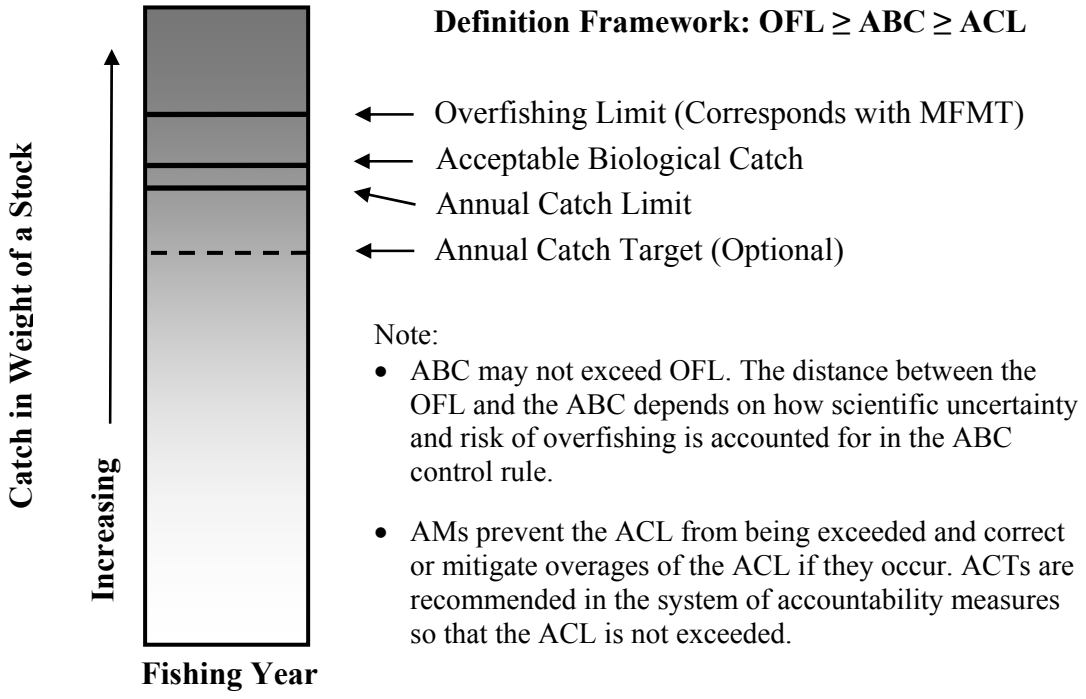

Figure 1. Relationship among OFL, ABC, ACL, ACT and AMs

1.2 Purpose and Need

The purpose of this action is to use the best scientific information available to specify an ACL and AM for coral reef ecosystem fisheries in federal waters around American Samoa, the CNMI, Guam and the MHI. ACLs are needed in order to comply with the Magnuson-Stevens Act and provisions of the FEPs for American Samoa, the Mariana Archipelago, and Hawaii, which require NMFS to specify ACL and AMs for all MUS identified in an FEP. The fishery management objective of this action is to specify an ACL for all CREMUS to prevent overfishing from occurring, and provide for long-term sustainability of the fishery resources while allowing fishery participants to continue to benefit from their utilization. Post-season AMs are intended to correct or mitigate overages of the ACL should they occur.

1.3 Proposed Action

The Western Pacific Fishery Management Council recommended NMFS specify multi-year annual catch limits (ACL) and accountability measures (AM) effective in fishing years 2015-2018, the environmental effects of which are analyzed in this document. NMFS proposes to implement the specifications for fishing year 2015, 2016, 2017, and 2018 separately prior to each fishing year. The specifications pertain to ACLs for coral reef ecosystem fisheries in the Exclusive Economic Zone (EEZ or federal waters; generally 3-200 nautical miles or nm) around American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), Guam, and Hawaii, and a post-season AM to correct the overage of an ACL if it occurs. Because of the large number of individual CREMUS in each island area, NMFS and the Council aggregated individual species into higher taxonomic groups, generally at the family level. As a result, NMFS proposes to specify ACLs for 19 CREMUS groups each in American Samoa, Guam and the CNMI, and for 17 CREMUS groups in Hawaii for a total of 74 ACL specifications. The proposed ACLs are associated with a probability of overfishing ranging between 30 to 35 percent for Guam CREMUS, 30 to 40 percent for MHI CREMUS and 35 to 40 percent for American Samoa, and CNMI CREMUS. In each island area, the Council removed species of management interest (i.e., bumphead parrotfish, and humphead wrasse) from their respective taxonomic groupings so they can be monitored separately. Therefore, NMFS proposes separate ACL specifications those stocks set at five percent of each stock's estimated biomass. Tables 6-9 summarize the proposed ACL specifications for CREMUS in American Samoa, Guam, the CNMI and the MHI in relation to the probability of overfishing and other reference points.

The fishing year for coral reef ecosystem fisheries in all island areas begins January 1 and ends December 31 annually. Unless modified by NMFS, the ACLs and AMs would be applicable in fishing years 2015, 2016, 2017, and 2018.

Each fishing year, catches of individual species that comprise each taxonomic group from both local state/territorial waters (generally from the shoreline to three mile offshore), and federal waters of the EEZ would be counted towards the specified ACL for each taxonomic group in each island area. Pursuant to federal regulations at 50 CFR 665.4, when an ACL is projected to be reached, based on best available information, NMFS must restrict fishing in federal waters around the applicable island area to prevent the ACL from being exceeded. The restriction may include, but is not limited to closure of the fishery, closure of specific areas, or restriction in

effort (76 FR 37286, June 27, 2011). However, projecting the date when an ACL might be reached is not possible for any western Pacific coral reef ecosystem fishery at this time because catch statistics from local state/territorial fisheries are generally not available until at least six months after the data have been collected (See Section 2.1 for more details on local state/territorial data collection programs). For this reason, the post-season AMs being proposed for CREMUS fisheries in all island areas is a downward adjustment to an ACL in the subsequent fishing year according to the procedures described below, should catches exceed the specified ACL.

Catches of CREMUS from local state/territorial data collection programs appear to be highly variable from year to year, and except for two species in Guam (e.g., bigeye scad and jacks), recent catches have remained below the current long-term estimates of MSY (see Tables 10-13). The reason for this inter-annual variability is unknown, but may be due to changes in local data collection methodologies over time (see Section 2.1). To reduce the influence of inter-annual variability in catch estimates in evaluating fishery performance against the proposed ACLs, NMFS and the Council propose to apply a moving three-year average. Specifically, for each taxonomic group, NMFS and the Council would use the average catch of fishing years 2013, 2014 and 2015 to evaluate fishery performance against the 2015 ACL; the average catch of fishing years 2014, 2015, and 2016 to evaluate performance against the 2016 ACL; and so on. After the end of each fishing year, the Council and NMFS will determine final catches for each taxonomic group in each island area. If the three-year average catch exceeded the specified ACL for a taxonomic group in any fishing year, NMFS would reduce the ACL for that group in the subsequent fishing years by the amount of the overage. Prior to implementing a reduced ACL, NMFS would conduct additional environmental analyses, if necessary, and the public would have the opportunity to provide input and comment on the reduced ACL specification at that time. Additionally, if an ACL is exceeded more than once in a four-year period, National Standard 1 guidelines of the Magnuson-Stevens Act (74 FR 3178, January 9, 2011) require the Council re-evaluate the ACL process, and adjust the system, as necessary, to improve its performance and effectiveness.

The proposed ACL specifications and AMs are based on the recommendations of the Council, and were developed in accordance with the approved ACL mechanism described in the FEPs and implementing federal regulations at 50 CFR §665.4, and in consideration of the best available scientific, commercial, and other information.

1.4 Decision to be Made

After considering public comments on the proposed action and alternatives considered, NMFS will specify ACLs and AMs for the coral reef ecosystem fisheries in federal waters around American Samoa, CNMI, Guam and Hawaii. The ACLs and AMs would be applicable in fishing years 2015 through 2018, which begin on January 1 and end December 31, annually. The Regional Administrator of the NMFS Pacific Islands Regional Office (PIRO) will also use the information in this EA and consider public comments, to make a determination about whether the selected ACL specifications and AMs would be a major federal action with the potential to have a significant environmental impact that would require the preparation of an environmental impact statement.

1.5 Public Involvement

At its 160th meeting, the Council considered and discussed issues relevant to ACL and AM specifications for western Pacific coral reef ecosystem fisheries in American Samoa, the CNMI, Guam, and the MHI, including the ABC recommendations of the 116th SSC. The 116th SSC and the 160nd Council meetings were held June 17-19, 2014, and June 25-27, 2014, respectively. Both meetings were open to the public and advertised through notices in the *Federal Register* (79 FR 31310, June 2, 2014), and on the Council's website. The public had an opportunity to comment at the meetings on the proposed ACL specifications and AMs and no public comment was provided at either meeting.

The proposed action was also discussed at the 117th SSC meeting held October 14-16, 2014, and the 161st Council meeting, held October 21-23, 2014. Both meetings were open to the public and advertised in Hawaii media as well as the *Federal Register* (79 FR 57887, September 26, 2014; 79 FR 59742, October 3, 2014), and on the Council's website. The public had an opportunity to comment at the meetings on the proposed ACL specifications and AMs and no public comment was provided at either meeting. Additionally, on July 21, 2015, NMFS published in the *Federal Register* the proposed specification and solicited public comments on the action and on the draft EA (80 FR 4346). NMFS received one comment from a federal agency regarding ACLs at Wake Island. NMFS responded to this comment in the final rule.

2 Description of the Alternatives

The alternatives considered in this document include a range of possible ACLs for coral reef ecosystem fisheries in federal waters around American Samoa, Guam, CNMI and the MHI. Although the estimate of the OFL and calculation of the ABC are part of the ACL mechanism, the establishment of these reference points is not part of the proposed federal action. However, a summary of their development is described in this section for informational purposes.[3]

2.1 Description of Ongoing Fishery Data Collection Programs

This section summarizes ongoing fishery data collection programs administered by the state/territorial governments of American Samoa, Guam, the CNMI and Hawaii, and by NMFS that were used to develop the ACLs and will be used to monitor catches in 2015-2018. None of the alternatives considered would change or modify any of these ongoing fishery data collection programs. For a detailed description of the data collection programs summarized here, visit http://www.pifsc.noaa.gov/wpacfin/.

2.1.1 Overview of Ongoing Data Collection Methods in the U.S. Pacific Islands

In American Samoa, Guam and the CNMI, local resource management agencies, with assistance from NMFS Pacific Islands Fisheries Science Center (PIFSC), Western Pacific Fisheries

[3] OFL is an estimate of the catch level above which overfishing is occurring, and was estimated by the Council using a Biomass Augmented MSY Model described in Sabater and Kleiber (2014). ABC accounts for scientific uncertainty in the estimate of OFL and was calculated at the 116th meeting of the Council's SSC. OFL and ABC are biologically-based reference points and are not part of the federal action.

Information Network (WPacFIN), collect fisheries information through three primary fisheries monitoring programs. They include: (1) the boat-based creel survey program, (2) the shore-based creel survey program, and (3) the commercial purchase system or trip ticket invoice program.

2.1.1.1 Boat-based Creel Survey Program

The boat-based creel survey program collects catch, effort, and participation data on offshore fishing activities conducted by commercial, recreational, subsistence and charter fishing vessels. Surveys are conducted at boat ports or ramps, and data collection consists of two main components - participation counts (trips) and fisher interviews. Survey days are randomly selected and the number of survey days range from 3-8 per month. Surveys are stratified by week-days, weekend-days and day- and night-time. Data expansion algorithms are applied by NMFS WPacFIN to estimate total boat-based catches, and are based on port, type of day (e.g., weekend/weekday), and fishing method (Impact Assessment, 2008). The boat-based creel surveys capture fishing activities by persons engaged in commercial, recreational, and subsistence fishing.

2.1.1.2 Shore-based Creel Survey Program

The shore-based creel survey program was established to randomly sample inshore fishing trip information and consists of two components: participation counts and fishers interviews. Participation counts are based on a 'bus route' method, with predefined stopping points and time constraints. Survey days are randomly selected, and range from 2-4 times per week. Data expansion algorithms are applied by NMFS WPacFIN to estimate total shore-based catches, and are based on island region, type of day and fishing method (Impact Assessment, 2008). The shore-based creel surveys capture fishing activities by persons engaged in commercial, recreational, and subsistence fishing.

As previously noted the data from both boat-based and shore-based creel survey programs are then expanded using algorithms developed by WPacFIN to generate estimates of total catches from both commercial and non-commercial sectors.

2.1.1.3 Commercial purchase system

The commercial purchase system or "trip ticket invoice" monitors fish sold locally and collects information submitted by vendors (fish dealers, hotels and restaurants) who purchase fish directly from fishers. Each invoice usually compiles daily trip landings. Only American Samoa has mandatory requirements for vendors to submit invoice reports; the other islands have voluntary programs (Impact Assessment, 2008).

2.1.2 Overview of Ongoing Fishery Data Collection Methods by the State of Hawaii

In Hawaii, the majority of fisheries information is collected from the commercial fishing sector through a mandatory license and monthly reporting system administered by the State of Hawaii Division of Aquatic Resources (HDAR). Under State law, anyone who takes marine life for commercial purposes is required to obtain a commercial marine license (CML) and submit a

catch report (popularly known as a "C3" form) on a monthly basis. Required information collected includes day fished, area fished, fishing method used, hours fished per method, and species caught (number/pounds caught and released).

Recreational catch information for finfish are also opportunistically collected by HDAR through the Hawaii Marine Recreational Fishing Survey (HMRFS) and annual catch amounts are reported by HDAR through NMFS Marine Fisheries Statistics Survey (MRFSS) at http://www.st.nmfs.noaa.gov/st1/index.html. A 2006 review of MRFSS by the National Resource Council (NRC) noted that the catch estimation method applied was not correctly matched with the catch sampling survey design, leading to potential bias in the estimates (National Resource Council 2006). In consideration of this finding, the Council in 2006 recommended that MRFSS catch estimates not be used as a basis for management or allocation decisions.

In 2008, NMFS established the National Saltwater Angler Registry Program as part of the Marine Recreational Information Program (MRIP) to improve recreational fisheries information (73 FR 79705, December 30, 2008). This national program requires all recreational anglers fishing in federal waters who are not otherwise permitted to fish under another federal or state/territorial fishing permit or license to register with NMFS. MRIP then collects information from registered recreational anglers about how often they fish and what they're catching using a system of surveys. Data from MRIP are integrated into MRFSS and are accessible from the MRFSS websites listed above.

2.1.3 Overview of Ongoing Federal Permit and Reporting Requirements

In addition to the data collection programs administered by local resource management agencies, regulations implementing the FEPs also establish a federal permit and reporting requirements for coral reef ecosystem fisheries in EEZ waters. Specifically, federal regulations at 50 CFR 665 requires a SCERFP and logbook reporting for harvesting certain CREMUS defined in federal regulations as PHCRT and for fishing with non-FEP approved gear methods, or fishing in designated low-use MPAs.

Historically, there has been little to no fishing for coral reef species in federal waters around American Samoa, Guam, the CNMI and the MHI. This is because the majority of coral reef habitat occurs in nearshore state and territorial waters and it is much easier and safer for fishers to harvest coral reef associated species in close to shore, than offshore in the EEZ.

Since the SCREFP requirement was established in 2004, NMFS has only issued two SCREFP permits. Both permits were issued to a single operator and authorized the cultivation and harvest (i.e., mariculture) of a PHCRT (i.e. *Seriola rivoliana*) within enclosed caged structures in EEZ waters off the west coast of Hawaii Island. The cultivated fish used in the authorized operations were hatchery produced and not caught from the wild populations.

Except for HMRFS and MRIP data, NMFS WPacFIN obtains all available fisheries information in the western Pacific, in accordance with cooperative agreements with the local resource management agencies in American Samoa, CNMI, Guam, and Hawaii, and provide the public

with access to non-confidential data on their website http://www.pifsc.noaa.gov/wpacfin. Generally, complete data for catches during a calendar year are not available until at least 6 months after the year has ended.

2.1.4 Data Limitations

Due to the lack of developed coral reef fisheries in federal waters, catch data for CREMUS comes solely from fishery data collection programs administered by the respective local resource management agencies, and NMFS expects this will continue to be the only data source for monitoring CREMUS catches in 2015 through 2018. However, these agencies presently do not have the personnel or resources to process catch data in near-real time, and so fisheries statistics are generally not available until at least six months after the data has been collected. Significant resources would be required to support the establishment of near-real time in-season monitoring capabilities in American Samoa, the CNMI, Guam and Hawaii. Until resources are made available, it will not be possible to monitor and track CREMUS catches towards the proposed ACL, and only AMs that consist of post-season management measures are possible at this time.

2.2 Development of the Alternatives

The SSC and Council developed their respective CREMUS ABC and ACL recommendations for 2015 through 2018 in accordance with the Magnuson-Stevens Act and Federal regulations at 50 CFR §665.4 that implement the ACL specification mechanism of the FEPs described in Section 1. This section summarizes the data, methods, and procedures the SSC and Council considered in their deliberations. Reports of all SSC and Council meetings cited in this EA can be obtained from the Council.

2.2.1 Determining the Level of Species Aggregations

Federal regulations at 50 CFR §665 define CREMUS in each FEP area to include all coral reef associated species, families or subfamilies which spend the majority of their non-pelagic (post settlement) life stages within waters less than or equal to 50 fathoms in total depth (75 FR 2198, January 14, 2010). However, CREMUS do not include species defined in 50 CFR §665 as a bottomfish management unit species (MUS), crustacean MUS (i.e., lobsters, kona crab and deepwater shrimps), precious coral MUS (i.e., black, pink and bamboo corals) or pelagic MUS (e.g., tunas and billfish). Appendix A provides a full listing of CREMUS in American Samoa, Guam the CNMI and Hawaii.

In the U.S. Pacific Islands, fisheries for CREMUS occur almost exclusively within state and territorial waters. However, the inclusion of all coral reef associated species in the FEPs was intended to be a proactive measure so that data could be collected if coral reef fisheries were to expand into the U.S. EEZ, and so that ecosystem considerations could be integrated into the management regime of the FEPs. Therefore, CREMUS include stocks are currently harvested by fishers in state or federal waters, as well as hundreds of stocks that are not generally harvested or retained in either state or federal waters.

In developing the ACL process for CREMUS, the Council recognized that an annual specification of hundreds of individual ABCs and ACLs would be administratively impossible to implement, monitor and enforce. Thus, at its 151st meeting, the Council, following the advice of its SSC, recommended aggregating individual CREMUS of each island area into higher taxonomic groups. The Council also recommended specifying ACLs for those taxonomic groups, which comprises the top 90% of the total coral reef fish catch over the available catch time series. To accomplish this, individual CREMUS in each island area were combined into their respective taxonomic group, generally at the family level. The taxonomic groupings also include general categories like, "miscellaneous reef fish," "miscellaneous bottomfish," and "miscellaneous shallow bottomfish" which are categories established in the data collection system for species that are not identified to the species or family level. Species that were identifiable, but not associated with any of the major harvested taxonomic families and, individually comprised a small percentage of the catch were included in the categories "other CRE-finfish" or "other invertebrates."

The catch percentage contribution of each taxonomic group was then calculated relative to the total estimated CREMUS landings throughout the available time series, and the results were sorted in order of decreasing value. Cumulative percentages were calculated by adding the respective cumulative percent contribution with the succeeding value until a 90% cut-off was reached. The taxonomic groups comprising the remaining 10% were then grouped into a single multi-species complex termed "All other CREMUS combined" for the purposes of the ACL specification. However, for the purposes of establishing ACLs, bumphead parrotfish *(Bolbometopon muricatum),* and humphead or Napoleon wrasse (*Cheilinus undulatus)* were removed from the taxonomic level aggregation so that separate ACLs could be specified for these species. These species are generally regarded as a rare occurrence in catch records and NMFS PIFSC underwater fish census surveys, and may be vulnerable to overfishing, and are, therefore, of special management interest to the Council.

In addition, two coral reef associated Hawaii bottomfish MUS – kahala (*Seriola dumerili)*, and taape (*Lutjanus kasmira*) – were included in the Hawaii CREMUS groupings Carangidae (jacks) and Lutjanidae (snapper), respectively, because these species are not considered in the NMFS stock assessments used to establish ACLs for Hawaii bottomfish MUS. Therefore, these species are included in the ACL specifications for Carangidae and Lutjanidae as described in this document.

The process of grouping individual CREMUS to their respective taxonomic families is considered by the SSC and Council to be the most optimal level of aggregation to meet the mandate to specify ACLs for coral reef ecosystem fisheries. This process is consistent with National Standard 1 guidelines (50 CFR §660.310(c)) as the family groupings consider similarity in life history strategy, morphological, biological and ecological characteristics. While fishermen can and do target individual species within a family group, assessing the vulnerability of individual stocks within a stock complex to fishing activities is difficult because species-level data are not standardized (expanded) for creel survey effort; hence they are inherently more variable than family-level data. Furthermore, while it is possible to identify species to the lowest taxonomic level, surveyors differ in their fish identification ability, and presumably, less experienced observers have more difficulty detecting the subtle morphological differences that

separate some species. Hence, fish that cannot be identified to the species level are often assigned to a broader taxonomic grouping (Hamm and Tao, 2010), such as a genus or family or even a general category such as "miscellaneous reef fish." In general, the groups that comprise the top 90% of the total catch frequently interact with the fishery and are most likely to be harvested at a higher rate than the remaining groups ("All other CREMUS combined"), which can be considered as incidental or a minor portion of the catch. Because the groupings are considered biologically closely related (e.g., to the family level), the effectiveness of management actions such as ACLs on individual stocks is likely be similar for all species within the group.

For more details on the formation of CREMUS taxonomic groupings, see WPFMC and NMFS (2011). Tables 1-4 summarize the outcome of the CREMUS taxonomic groupings process for American Samoa, Guam, the Commonwealth of the Northern Mariana Islands (CNMI), and Hawaii (See Appendix A for the list of the individual species that comprise each CREMUS grouping by island area as identified through the fishery monitoring programs administered by local resource management agencies.

Table 1. CREMUS grouping for ACL specifications in American Samoa

No.	American Samoa CREMUS Groupings
1	*Selar crumenophthalmus* – atule or bigeye scad
2	Acanthuridae – surgeonfishes
3	Carangidae – jacks
4	Carcharhinidae – reef sharks
5	Crustaceans - crabs
6	Holocentridae – squirrelfishes
7	Kyphosidae – rudderfishes
8	Labridae – wrasses[1]
9	Lethrinidae – emperors
10	Lutjanidae – snappers
11	Mollusks – turbo snail; octopus; giant clam
12	Mugilidae – mullets
13	Mullidae – goatfishes
14	Scaridae – parrotfishes[2]
15	Serranidae – groupers
16	Siganidae – rabbitfishes
17	*Cheilinus undulatus* – humphead (Napoleon) wrasse
18	*Bolbometopon muricatum* – bumphead parrotfish
19	All Other CREMUS Combined - Misc. bottomfish - Misc. reef fish - Misc. shallow bottomfish - Other CRE-finfish - Other invertebrates

[1] Family Labridae does not include *Cheilinus undulatus* (humphead or Napoleon wrasse)
[2] Family Scaridae does not include *Bolbometopon muricatum* (bumphead parrotfish)

Table 2. CREMUS grouping for ACL specifications in the CNMI

No.	CNMI CREMUS Groupings
1	*Selar crumenophthalmus* – atulai or bigeye scad
2	Acanthuridae – surgeonfishes
3	Carangidae – jacks
4	Carcharhinidae – reef sharks
5	Crustaceans - crabs
6	Holocentridae – squirrelfishes
7	Kyphosidae – rudderfishes
8	Labridae – wrasses[1]
9	Lethrinidae – emperors
10	Lutjanidae – snappers
11	Mollusks – turbo snail; octopus; giant clam
12	Mugilidae – mullets
13	Mullidae – goatfishes
14	Scaridae – parrotfishes[2]
15	Serranidae – groupers
16	Siganidae – rabbitfishes
17	*Cheilinus undulatus* – humphead (Napoleon) wrasse
18	*Bolbometopon muricatum* – bumphead parrotfish
19	All Other CREMUS Combined - Misc. bottomfish - Misc. reef fish - Misc. shallow bottomfish - Other CRE-finfish - Other invertebrates

[1] Family Labridae does not include *Cheilinus undulatus* (humphead or Napoleon wrasse)
[2] Family Scaridae does not include *Bolbometopon muricatum* (bumphead parrotfish)

Table 3. CREMUS grouping for ACL specifications in Guam

No.	Guam CREMUS Groupings
1	*Selar crumenophthalmus* – atulai or bigeye scad
2	Acanthuridae – surgeonfishes
3	Carangidae – jacks
4	Carcharhinidae – reef sharks
5	Crustaceans - crabs
6	Holocentridae – squirrelfishes
7	Kyphosidae – rudderfishes
8	Labridae – wrasses[1]
9	Lethrinidae – emperors
10	Lutjanidae – snappers
11	Mollusks – turbo snail; octopus; giant clam
12	Mugilidae – mullets

No.	Guam CREMUS Groupings
13	Mullidae – goatfishes
14	Scaridae – parrotfishes[2]
15	Serranidae – groupers
16	Siganidae – rabbitfishes
17	*Cheilinus undulatus* – humphead (Napoleon) wrasse
18	*Bolbometopon muricatum* – bumphead parrotfish
19	All Other CREMUS Combined - Misc. bottomfish - Misc. reef fish - Misc. shallow bottomfish - Other CRE-finfish - Other invertebrates

[1] Family Labridae does not include *Cheilinus undulatus* (humphead or Napoleon wrasse)
[2] Family Scaridae does not include *Bolbometopon muricatum* (bumphead parrotfish)

Table 4. CREMUS grouping for ACL specifications in the MHI

No.	MHI CREMUS Groupings
1	*Selar crumenophthalmus* – akule or bigeye scad
2	*Decapterus macarellus* – opelu or mackerel scad
3	Acanthuridae – surgeonfishes
4	Carangidae – jacks[1]
5	Carcharhinidae – reef sharks
6	Crustaceans – crabs
7	Holocentridae – squirrelfishes
8	Kyphosidae – rudderfishes
9	Labridae – wrasses
10	Lethrinidae – emperors
11	Lutjanidae – snappers[2]
12	Mollusks –octopus
13	Mugilidae – mullets
14	Mullidae – goatfishes
15	Scaridae – parrotfishes
16	Serranidae – groupers
17	All Other CREMUS Combined

Note: *Bolbometopon muricatum* (bumphead parrotfish) and *Cheilinus undulatus* (humphead or Napoleon wrasse) do not occur in Hawaii.
[1] Carangidae includes the BMUS, kahala (*Seriola dumerili*) since this species is not included in NMFS bottomfish stock assessments, and is a reef associated species.
[2] Lutjanidae includes the BMUS, taape (*Lutjanus kasmira*) since this species is not included in NMFS bottomfish stock assessments, and is a reef associated species.

2.2.2 Estimation of MSY and OFL

Estimates of MSY and OFL for CREMUS groupings in American Samoa, the CNMI, Guam, and Hawaii are based on a modeling approach that uses catch data from local resource management

agencies as described above; together with a measure of population growth (r), carrying capacity (k), and biomass data from NMFS PIFSC underwater fish census surveys (Williams 2010). This model, termed the "Biomass Augmented Catch-MSY" model is described in detail in Sabater and Kleiber (2014). In summary, the model creates annual biomass projections from a set of r and k combinations that would not result in biomass that would exceed the carrying capacity or the stock being depleted. The assumption behind the biomass can be informed by augmenting the model with an independent source of biomass information.

The Biomass Augmented Catch-MSY model is based on the Catch-MSY model developed by Martell and Froese (2013), but differs in that it incorporates biomass data. Application of the model provides the very first model-based estimate of MSY for CREMUS in each island area. In addition to estimates of MSY, the Biomass Augmented Catch-MSY model also generates a range of catches that if realized, would result in a probability of exceeding MSY ranging from five to 50 percent. See Appendix B for MSY estimates and probability of overfishing projection results from the Biomass Augmented Catch-MSY model.

Because of the large number of possible combinations of r and k values available to estimate MSY using the Biomass Augmented Catch-MSY model, the model explored two methods to define the most meaningful and most likely (most plausible) range of r and k combinations. Method A allows for only a very narrow range of starting r and k values, while method B allows for a broad range of starting r and k values, with each method providing different MSY estimates and associated probability of overfishing projections. In reviewing the two methods, the SSC at its 114th meeting held March 11-13, 2014, determined the resulting MSY estimates from method B be used for management decisions because this method provides a more complete range of most likely r and k combinations compared to method A. The 114th SSC also found that method B also yielded r and k density plots that generally correspond better to the estimates of MSY than the method A approach.

Currently, data for bumphead parrotfish, humphead or Napoleon wrasse in American Samoa, Guam and the CNMI, and reef sharks in the CNMI are insufficient for use in the Biomass Augmented Catch-MSY model. This is because these species occur infrequently in NMFS PIFSC underwater fish census surveys and have low overall catch. Therefore, it is not possible to estimate MSY and OFL for these species using the Biomass Augmented Catch-MSY model. Tables 6-9 provides the MSY and OFL estimates and other reference points for CREMUS groupings in American Samoa, Guam, the CNMI and the MHI. Consistent with National Standard 1 guidelines (74 FR 3178, January 9, 2011), the Council at its 160th meeting, set OFL for each CREMUS grouping equal to the level of catch associated with a 50 percent probability of exceeding MSY.

2.2.3 SSC's Calculation of ABC

Under Tier 3 of the ABC control rule for western Pacific fisheries, the SSC must set ABC at a level of catch associated with no more than a 50 percent probability of overfishing, with the appropriate probability of overfishing percentile (P*) established by the Council. The Council's P* working group met in May, June, and December 2013 to review a draft of Sabater and Kleiber (2014), and to apply the qualitative P* reduction analysis described in the FEPs WPFMC

and NMFS (2011). At its 115th meeting held March 11, 2014, the SSC reviewed the analysis conducted by the P* working group and adopted the final P* scores rounding each value to the nearest 5 or 10 percent. See Appendix C of this document for the precise values from the qualitative P* reduction analysis for each CREMUS group.

The reduction analyses resulted in final P* values ranging between 30 to 35 percent for CREMUS groupings in Guam, 30 to 40 percent for CREMUS groupings in Hawaii and 35 to 40 percent for CREMUS groupings in American Samoa, and CNMI. Based on the P* analysis and findings presented in the P* working group's December 2013 report, the SSC at its 116th meeting held June 17-19, 2014, set ABC for CREMUS grouping in American Samoa, Guam, the CNMI and Hawaii as shown in Tables 6-9.

As described in the previous section above, the available data for CNMI reef sharks, and bumphead parrotfish, and humphead or Napoleon wrasse in American Samoa, Guam and the CNMI are not sufficient for use in the Biomass Augmented Catch-MSY model. Therefore, the SSC recommended the ABCs for these species continue to be set at the same ABC applied in the 2014 fishing year (79 FR 4276, January 27, 2014). In that year, the SSC set the ABCs at 5 percent of each stock's estimated stock biomass. Table 5 provides the estimated biomass and ABC values for CNMI reef sharks and for bumphead parrotfish, and humphead or Napoleon wrasse in American Samoa, Guam and the CNMI. Stock biomass for bumphead parrotfish in the CNMI and Guam were estimated by NNMFS on an archipelagic basis through underwater visual census surveys (NMFS 2011). Therefore, biomass and ABC for this species are shared between the CNMI and Guam. For more details on calculation of ABC for these taxonomic groupings, see NMFS (2011).

Table 5. Estimated stock biomass (in lb) of humphead wrasse and bumphead parrotfish in American Samoa, Guam and CNMI and reef sharks in the CNMI

Island Area	Humphead wrasse		Bumphead parrotfish		Reef sharks	
	Biomass	5% of Biomass (ABC)	Biomass	5% of Biomass (ABC)	Biomass	5% of Biomass
CNMI	40,184	2,009	15,931	797	111,997	5,600
Guam	39,200	1,960				
American Samoa	34,860	1,743	4,699	235		

Source: NMFS (2011); Stock biomass for bumphead parrotfish in the CNMI and Guam were estimated on an archipelagic basis. Therefore, biomass and ABC for this species is shared between the CNMI and Guam.

2.2.4 Council ACL and AM Recommendations

2.2.4.1 ACL Recommendation

At its 160th meeting held June 25-27, 2014, the Council recommended NMFS specify an ACL set at the level of catch that is five percent lower than the SSC's fishing level recommendation in order to account for social, economic, and ecological factors and management uncertainty

(SEEM) See Appendix D of this document for the SEEM analysis. For CNMI reef sharks and bumphead parrotfish, and humphead or Napoleon wrasse in American Samoa, Guam and the CNMI, the Council recommended the ACLs for these species continue to be set at the same ACL applied in the 2014 fishing year (79 FR 4276, January 27, 2014), which is equal ABC described above. Tables 6-9 provides Council's ACL recommendations in relation to other reference points for CREMUS groupings in American Samoa, Guam, the CNMI and Hawaii.

Table 6. MSY, OFL, ABC and ACL values (in pounds) for American Samoa CREMUS

No.	CREMUS Groupings	MSY	OFL	ABC	ACL
1	*Selar crumenophthalmus* – atule or bigeye scad	43,300	41,100	133,800	37,400
2	Acanthuridae – surgeonfishes	148,600	142,500	133,800	129,400
3	Carangidae – jacks	24,300	23,200	20,800	19,900
4	Carcharhinidae – reef sharks	2,300	2,300	1,700	1,615
5	Crustaceans - crabs	7,800	7,300	4,700	4,300
6	Holocentridae – squirrelfishes	16,800	16,600	15,500	15,100
7	Kyphosidae – rudderfishes	2,600	2,600	2,200	2,000
8	Labridae – wrasses[1]	19,000	18,100	16,600	16,200
9	Lethrinidae – emperors	23,700	23,000	20,400	19,600
10	Lutjanidae – snappers	65,400	66,900	64,400	63,100
11	Mollusks – turbo snail; octopus; giant clam	29,600	27,500	20,200	18,400
12	Mugilidae – mullets	8,200	7,600	5,200	4,600
13	Mullidae – goatfishes	12,700	12,500	12,000	11,900
14	Scaridae – parrotfishes[2]	294,600	300,300	280,100	272,000
15	Serranidae – groupers	30,500	29,500	27,300	25,300
16	Siganidae – rabbitfishes	200	200	200	200
17	*Cheilinus undulatus* – humphead (Napoleon) wrasse	Unknown	Unknown	1,743	1,743
18	*Bolbometopon muricatum* – bumphead parrotfish	Unknown	Unknown	235	235
19	All Other CREMUS Combined	28,500	27,000	20,300	18,400

[1] Family Labridae does not include *Cheilinus undulatus* (humphead or Napoleon wrasse)
[2] Family Scaridae does not include *Bolbometopon muricatum* (bumphead parrotfish)

Table 7. MSY, OFL, ABC and ACL values (in pounds) for CNMI CREMUS

No.	CREMUS Groupings	MSY	OFL	ABC	ACL
1	*Selar crumenophthalmus* – atulai or bigeye scad	122,500	119,600	89,400	77,400
2	Acanthuridae – surgeonfishes	361,200	370,000	324,600	302,600
3	Carangidae – jacks	55,300	53,00	47,400	44,900
4	Carcharhinidae – reef sharks	Unknown	Unknown	5,600	5,600
5	Crustaceans - crabs	9,100	8,900	5,300	4,400
6	Holocentridae – squirrelfishes	78,500	78,000	69,300	66,100

No.	CREMUS Groupings	MSY	OFL	ABC	ACL
7	Kyphosidae – rudderfishes	29,500	30,500	24,600	22,700
8	Labridae – wrasses[1]	73,500	75,500	59,900	55,100
9	Lethrinidae – emperors	69,700	72,200	58,200	53,700
10	Lutjanidae – snappers	225,800	228,700	202,700	190,400
11	Mollusks – turbo snail; octopus; giant clam	16,700	16,300	11,600	9,800
12	Mugilidae – mullets	7,700	7,500	5,300	4,500
13	Mullidae – goatfishes	31,000	30,500	29,200	28,400
14	Scaridae – parrotfishes[2]	189,900	199,000	157,300	144,000
15	Serranidae – groupers	110,300	112,000	92,800	86,900
16	Siganidae – rabbitfishes	12,000	11,000	10,400	10,200
17	Cheilinus undulatus – humphead (Napoleon) wrasse	Unknown	Unknown	2,009	2,009
18	Bolbometopon muricatum – bumphead parrotfish	Unknown	Unknown	797 CNMI and Guam combined	797 CNMI and Guam combined
19	All Other CREMUS Combined	14,500	14,200	8,500	7,300

[1] Family Labridae does not include *Cheilinus undulatus* (humphead or Napoleon wrasse)
[2] Family Scaridae does not include *Bolbometopon muricatum* (bumphead parrotfish)

Table 8. MSY, OFL, ABC and ACL values (in pounds) for Guam CREMUS

No.	CREMUS Groupings	MSY	OFL	ABC	ACL
1	*Selar crumenophthalmus* – atulai or bigeye scad	61,300	60,800	52,300	50,200
2	Acanthuridae – surgeonfishes	118,000	114,700	101,700	97,600
3	Carangidae – jacks	31,700	32,200	29,900	29,300
4	Carcharhinidae – reef sharks	2,900	2,900	2,000	1,900
5	Crustaceans - crabs	8,600	8,600	7,600	7,300
6	Holocentridae – squirrelfishes	13,900	13,800	12,000	11,400
7	Kyphosidae – rudderfishes	10,300	10,300	9,800	9,600
8	Labridae – wrasses[1]	28,500	28,200	25,800	25,200
9	Lethrinidae – emperors	78,000	76,600	58,000	53,000
10	Lutjanidae – snappers	21,800	20,700	18,600	18,000
11	Mollusks – turbo snail; octopus; giant clam	29,000	28,600	25,000	23,800
12	Mugilidae – mullets	26,200	24,500	19,400	17,900
13	Mullidae – goatfishes	16,400	16,300	15,600	15,300
14	Scaridae – parrotfishes[2]	87,100	86,500	75,000	71,600
15	Serranidae – groupers	28,600	27,400	23,700	22,500
16	Siganidae – rabbitfishes	19,700	19,200	18,800	18,600
17	*Cheilinus undulatus* – humphead (Napoleon) wrasse	Unknown	Unknown	1,960	1,960

No.	CREMUS Groupings	MSY	OFL	ABC	ACL
18	*Bolbometopon muricatum* – bumphead parrotfish	Unknown	Unknown	797 CNMI and Guam combined	797 CNMI and Guam combined
19	All Other CREMUS Combined	211,300	209,200	191,300	185,000

[1] Family Labridae does not include *Cheilinus undulatus* (humphead or Napoleon wrasse)
[2] Family Scaridae does not include *Bolbometopon muricatum* (bumphead parrotfish)

Table 9. MSY, OFL, ABC and ACL values (in pounds) for Hawaii CREMUS

No.	CREMUS Groupings	MSY	OFL	ABC	ACL
1	*Selar crumenophthalmus* – akule or bigeye scad	1,150,800	1,138,000	1,025,000	988,000
2	*Decapterus macarellus* – opelu or mackerel scad	538,000	531,200	459,800	438,000
3	Acanthuridae – surgeonfishes	445,500	452,600	367,900	342,000
4	Carangidae – jacks[1]	185,100	183,700	168,100	161,200
5	Carcharhinidae – reef sharks	12,400	12,500	9,800	9,310
6	Crustaceans – crabs	43,100	42,800	35,400	33,500
7	Holocentridae – squirrelfishes	159,800	158,100	150,000	148,000
8	Kyphosidae – rudderfishes	122,800	119,600	108,600	105,000
9	Labridae – wrasses	229,200	227,400	211,000	205,000
10	Lethrinidae – emperors	39,600	39,400	36,600	35,500
11	Lutjanidae – snappers[2]	359,300	356,200	338,200	330,300
12	Mollusks –octopus	50,300	49,500	38,200	35,700
13	Mugilidae – mullets	24,600	24,500	20,100	19,200
14	Mullidae – goatfishes	195,700	197,500	173,100	165,000
15	Scaridae – parrotfishes	271,500	270,600	251,700	239,000
16	Serranidae – groupers	141,300	139,900	132,200	128,400
17	All Other CREMUS Combined	540,800	535,600	496,500	485,000

Note: *Bolbometopon muricatum* (bumphead parrotfish) and *Cheilinus undulatus* (humphead or Napoleon wrasse) do not occur in Hawaii.
[1] Carangidae includes the BMUS, kahala (*Seriola dumerili*) since this species is not included in NMFS bottomfish stock assessments, and is a reef associated species.
[2] Lutjanidae includes the BMUS, taape (*Lutjanus kasmira*) since this species is not included in NMFS bottomfish stock assessments, and is a reef associated species.

2.2.4.2 AM Recommendation

Because near real-time monitoring of catches are not possible, the Council recommended at its 161st meeting, held October 21-23, 2014, a post-season AM that utilizes a moving three-year average to evaluate fishery performance against the recommended ACL. Specifically, after the end of each fishing year, the Council and NMFS will determine final catches for each CREMUS group. NMFS and the Council would use the average catch of fishing years 2013, 2014 and 2015 to evaluate fishery performance against the 2015 ACL; the average catch of fishing years 2014,

2015, and 2016 to evaluate performance against the 2016 ACL; and so on. If the average three-year catch exceeds the recommended ACL, the Council recommended as an AM that NMFS reduce the ACL in the subsequent fishing year by the amount of the overage.

2.3 Description of the Alternatives Considered

This section describes the range of ACL alternatives for CREMUS in American Samoa, Guam, the CNMI and Hawaii as well as the associated probabilities of overfishing values for each CREMUS grouping in 2015-2018 based on the r and k method B risk projections from the Biomass Augmented Catch-MSY model (See Appendix B). Because the available data for CNMI reef sharks, and bumphead parrotfish, and humphead or Napoleon wrasse in American Samoa, Guam and the CNMI are not sufficient for use in the Biomass Augmented Catch-MSY model for the reasons noted in the previous section, MSY, OFL and probability of overfishing (P*) projections are not available for these species.

Tables 10-13 provides a summary of the ACL alternatives considered, the associated risks of overfishing (P*), MSY and OFL estimates and the average catch for most recent fishing years (e.g., 2011-2013). Alternative 3 is the NMFS preferred alternative in each island area as recommended by the Council.

Table 10. ACL alternatives (lb) and probability of overfishing (P*) for American Samoa CREMUS 2015-2018, including MSY-based reference points and 2011-2013 ave. catch (lb).

	Selar crumenophthalmus- atule or bigeye scad	**Acanthuridae- surgeonfishes**	**Carangidae- jacks**	**Carcharhinidae- reef sharks**	**Crustaceans- crabs**	**Holocentridae- squirrelfishes**	**Kyphosidae- rudderfishes**	**Labridae- wrasses**	**Lethrinidae- emperors**	**Lutjanidae- snappers**	**Mollusks- turbo snail; octopus; giant clam**	**Mugilidae- mullets**	**Mullidae- goatfishes**	**Scaridae- parrotfishes**	**Serranidae- groupers**	**Siganidae- rabbitfishes**	**All other CREMUS combined**
MSY	**45,300**	**148,600**	**24,300**	**2,300**	**7,800**	**16,800**	**2,600**	**19,000**	**23,700**	**65,400**	**29,600**	**8,200**	**12,700**	**294,600**	**30,500**	**200**	**28,500**
OFL Proxy *(P*=50%)*	**41,100**	**142,500**	**23,200**	**2,300**	**7,300**	**16,600**	**2,600**	**18,100**	**23,000**	**66,900**	**27,500**	**7,600**	**12,500**	**300,300**	**29,500**	**200**	**27,000**
ABC	**38,400** P*=40%	**133,800** P*=40%	**20,800** P*=35%	**1,700** P*=40%	**4,700** P*=30%	**15,500** P*=35%	**2,200** P*=35%	**16,600** P*=35%	**20,400** P*=35%	**64,400** P*=35%	**20,200** P*=35%	**5,200** P*=35%	**12,000** P*=35%	**280,100** P*=35%	**27,300** P*=35%	**200** P*=40%	**20,300** P*=35%
Alternative 1 *(No Action)*	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL
Alternative 2 *(Status Quo – 2014 ACL)*	8,396 P*<5%	19,516 P*<5%	9,490 P*<5%	1,309 P*=25%	2,248 P*<5%	2,585 P*<5%	†No ACL	†No ACL	7,350 P*<5%	18,839 P*<5%	16,694 P*<25%	2,857 P*<15%	†No ACL	8,145 P*<5%	5,600 P*<5%	†No ACL	18,910 P*<35%
Alternative 3 *(Preferred)*	**37,400 P*=35%**	**129,400 P*=35%**	**19,900 P*=30%**	**1,615 P*=35%**	**4,300 P*=25%**	**15,100 P*=30%**	**2,000 P*=30%**	**16,200 P*=30%**	**19,600 P*=30%**	**63,100 P*=30%**	**18,400 P*=30%**	**4,600 P*=30%**	**11,900 P*=30%**	**272,000 P*=30%**	**25,300 P*=30%**	**200 P*=35%**	**18,400 P*=30%**
Alternative 4 *(Lower than Preferred)*	35,600 P*=30%	125,000 P*=30%	19,300 P*=25%	1,500 P*=30%	3,800 P*=20%	14,700 P*=25%	1,900 P*=25%	15,700 P*=25%	18,600 P*=25%	62,000 P*=25%	16,800 P*=25%	4,100 P*=25%	11,700 P*=25%	268,000 P*=25%	24,300 P*=25%	200 P*30%	16,8,00 P*=25%
	35,000 P*=25%	122,000 P*=25%		1,300 P*=25%												200 P*25%	
	34,200 P*=20%	117,000 P*=20%	18,200 P*=20%	1,100 P*=20%		14,300 P*=20%	1,700 P*=20%	15,200 P*=20%	17,800 P*=20%	60,600 P*=20%	15,200 P*=20%	3,600 P*=20%	11,400 P*=20%	260,000 P*=20%	23,300 P*=20%	200 P*20%	15,200 P*=20%
	33,300 P*=15%	113,000 P*=15%	17,000 P*=15%	900 P*=15%	3,300 P*=15%	13,800 P*=15%	1,600 P*=15%	14,700 P*=15%	16,900 P*=15%	58,800 P*=15%	13,600 P*=15%	3,200 P*=15%	11,200 P*=15%	249,000 P*=15%	22,200 P*=15%	200 P*15%	13,700 P*=15%
	32,500 P*=10%	108,400 P*=10%	15,800 P*=10%	700 P*=10%	2,800 P*=10%	13,300 P*=10%	1,400 P*=10%	14,100 P*=10%	15,800 P*=10%	54,000 P*=10%	11,900 P*=10%	2,700 P*=10%	10,900 P*=10%	240,800 P*=10%	21,100 P*=10%	200 P*10%	12,100 P*=10%
	31,800 P*=5%	103,000 P*=5%	14,000 P*=5%	600 P*=5%	2,300 P*=5%	12,600 P*=5%	1,200 P*=5%	13,400 P*=5%	14,600 P*=5%	46,800 P*=5%	10,000 P*=5%	2,300 P*=5%	10,700 P*=5%	232,000 P*=5%	19,600 P*=5%	200 P*=5%	10,200 P*=5%
2012 Est. Biomass	n.a	2,222,908	276,540	66,973	n.a.	78,285	82,489	324,499	559,820	1,134,641	n.a	n.a.	n.a	1,832,548	474,837	596	2,609,732
Avg. 2011-2013 Catch	2,882	15,804	2,245	93	2,295	2,171	*349	*332	5,477	8,626	6,460	1,770	No data	6,689	2,755	No data	5,139

Source: Sabater and Kleiber (2014), provided in Appendix B of this EA.

Family Scaridae does not include *Bolbometopon muricatum* (bumphead parrotfish); Family Labridae does not include *Cheilinus undulatus* (humphead or Napoleon wrasse).

*Average includes 2010-2012 catch since there is no data for 2013 for this species.

† This species is included in "All other CREMUS combined."

Table 11. A ACL alternatives (lb) and probability of overfishing (P*) for CNMI CREMUS 2015-2018, including MSY-based reference points and 2011-2013 ave. catch (lb).

	Selar crumenophthalmus-atulai or bigeye scad	Acanthuridae-surgeonfishes	Carangidae-jacks	Carcharhinidae-reef sharks	Crustaceans-crabs	Holocentridae-squirrelfishes	Kyphosidae-rudderfishes	Labridae-wrasses	Lethrinidae-emperors	Lutjanidae-snappers	Mollusks- turbo snail; octopus; giant clam	Mugilidae-mullets	Mullidae-goatfishes	Scaridae-parrotfishes	Serranidae-groupers	Siganidae-rabbitfishes	All other CREMUS combined
MSY	**122,500**	**361,200**	**55,300**	**n.a.**	**9,100**	**78,500**	**29,500**	**73,500**	**69,700**	**225,800**	**16,700**	**7,700**	**31,000**	**189,900**	**110,300**	**12,000**	**14,500**
OFL Proxy *(P*=50%)*	**119,600**	**370,000**	**53,000**	**n.a.**	**8,900**	**78,000**	**30,500**	**75,500**	**72,200**	**228,700**	**16,300**	**7,500**	**30,500**	**199,000**	**112,000**	**11,000**	**14,200**
ABC	**89,400** P*=40%	**324,600** P*=40%	**47,400** P*=40%	**5,600** P* n.a	**5,300** P*=35%	**69,300** P*=35%	**24,600** P*=35%	**59,900** P*=35%	**58,200** P*=35%	**202,700** P*=40%	**11,600** P*=40%	**5,300** P*=40%	**29,200** P*=40%	**157,300** P*=35%	**92,800** P*=35%	**10,400** P*=35%	**8,500** P*=35%
Alternative 1 *(No Action)*	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL
Alternative 2 *(Status Quo – 2014 ACL*	7,459 P*<5%	6,884 P*<5%	21,512 P*<5%	5,600 P* n.a.	†No ACL	†No ACL	†No ACL	†No ACL	27,466 P*<5%	3,905 P*<5%	4,446 P*<15%	3,308 P*<30%	3,670 P*<5%	3,784 P*<5%	5,519 P*<5%	2,537 P*<5%	9,820 P*<40%
Alternative 3 *(Preferred)*	**77,400 P*=35%**	**302,600 P*=35%**	**44,900 P*=35%**	**5,600 P* n.a.**	**4,400 P*=30%**	**66,100 P*=30%**	**22,700 P*=30%**	**55,100 P*=30%**	**53,700 P*=30%**	**190,400 P*=35%**	**9,800 P*=35%**	**4,500 P*=35%**	**28,400 P*=35%**	**144,000 P*=30%**	**86,900 P*=30%**	**10,200 P*=30%**	**7,300 P*=30%**
Alternative 4 *(Lower than Preferred)*	66,900 P*=30%	279,000 P*=30%	42,300 P*=30%	5,300 P* n.a.	3,700 P*=25%	63,100 P*=25%	20,800 P*=25%	50,200 P*=25%	49,200 P*=25%	177,000 P*=30%	8,200 P*=30%	3,800 P*=30%	27,700 P*=30%	129,000 P*=25%	80,400 P*=25%	9,300 P*=25%	6,200 P*=25%
	58,200 P*=25%	258,000 P*=25%	39,800 P*=25%	5,000 P* n.a.						164,000 P*=25%	6,900 P*=25%	3,200 P*=25%	26,800 P*=25%				
	50,400 P*=20%	234,000 P*=20%	37,300 P*=20%	4,700 P* n.a.	3,100 P*=20%	59,900 P*=20%	18,900 P*=20%	45,200 P*=20%	44,500 P*=20%	150,000 P*=20%	5,800 P*=20%	2,700 P*=20%	26,100 P*=20%	117,000 P*=20%	74,100 P*=20%	8,700 P*=20%	5,200 P*=20%
	43,600 P*=15%	211,000 P*=15%	34,800 P*=15%	4,400 P* n.a.	2,600 P*=15%	56,700 P*=15%	17,000 P*=15%	40,400 P*=15%	39,700 P*=15%	137,000 P*=15%	4,800 P*=15%	2,300 P*=15%	25,500 P*=15%	103,000 P*=15%	67,300 P*=15%	8,400 P*=15%	4,400 P*=15%
	37,800 P*=10%	184,600 P*=10%	32,100 P*=10%	4,100 P* n.a.	2,100 P*=10%	53,300 P*=10%	15,100 P*=10%	35,200 P*=10%	34,700 P*=10%	123,400 P*=10%	3,900 P*=10%	1,900 P*=10%	24,900 P*=10%	88,900 P*=10%	60,200 P*=10%	8,100 P*=10%	3,700 P*=10%
	32,800 P*=5%	158,000 P*=5%	28,7000 P*=5%	3,800 P* n.a.	1,600 P*=5%	48,900 P*=5%	12,900 P*=5%	29,400 P*=5%	29,700 P*=5%	107,000 P*=5%	3,000 P*=5%	1,500 P*=5%	24,400 P*=5%	73,500 P*=5%	51,800 P*=5%	7,800 P*=5%	2,800 P*=5%
2011 Est. Biomass	n.a.	2,429,120	309,254	720,455	n.a.	317,319	192,828	517,775	304,310	1,485,716	n.a.	n.a.	124,112	1,238,201	719,062	5,116	2,525,669
Avg. 2011-2013 Catch	18,362	7,191	9,607	No data	*838	*1,325	*2,568	*792	19,268	2,413	2,394	704	3,157	5,568	3,620	2,566	10,972

Source: Sabater and Kleiber (2014), provided in Appendix B of this EA.

Family Scaridae does not include *Bolbometopon muricatum* (bumphead parrotfish); Family Labridae does not include *Cheilinus undulatus* (humphead or Napoleon wrasse).

*Average includes 2009-2011 catch since there is no data for 2012 and 2013 for this species.

† This species is included in "All other CREMUS combined."

Table 12. A ACL alternatives (lb) and probability of overfishing (P*) for Guam CREMUS 2015-2018, including MSY-based reference points and 2011-2013 ave. catch (lb).

	Selar crumenophthalmus-atulai or bigeye scad	Acanthuridae-surgeonfishes	Carangidae-jacks	Carcharhinidae-reef sharks	Crustaceans-crabs	Holocentridae-squirrelfishes	Kyphosidae-rudderfishes	Labridae-wrasses	Lethrinidae-emperors	Lutjanidae-snappers	Mollusks-octopus	Mugilidae-mullets	Mullidae-goatfishes	Scaridae-parrotfishes	Serranidae-groupers	Siganidae-rabbitfishes	All other CREMUS combined
MSY	**61,300**	**118,000**	**31,700**	**2,900**	**8,600**	**13,900**	**10,300**	**28,500**	**78,000**	**21,800**	**29,000**	**26,200**	**16,400**	**87,100**	**28,600**	**19,700**	**211,300**
OFL Proxy *(P*=50%)*	**60,800**	**114,700**	**32,200**	**2,900**	**8,600**	**13,800**	**10,300**	**28,200**	**76,600**	**20,700**	**28,600**	**24,500**	**16,300**	**86,500**	**27,400**	**19,200**	**209,200**
ABC	**52,300** P*=30%	**101,700** P*=35%	**29,900** P*=30%	**2000** P*=30%	**7,600** P*=35%	**12,000** P*=35%	**9,800** P*=35%	**25,800** P*=35%	**58,000** P*=35%	**18,600** P*=35%	**25,000** P*=35%	**19,400** P*=35%	**15,600** P*=40%	**75,000** P*=35%	**23,700** P*=35%	**18,800** P*=40%	**191,300** P*=35%
Alternative 1 *(No Action)*	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL
Alternative 2 *(Status Quo – 2014 ACL*	56,514 P*<45%	70,702 P*<5%	45,377 P*>50%	6,942 P*>50%	5,523 P*<10%	8,300 P*<10%	13,247 P*>50%	5,195 P*<5%	38,720 P*<15%	17,726 P*<30%	21,941 P*<25%	15,032 P*<20%	25,367 P*>50%	28,649 P*<5%	17,958 P*<15%	26,120 P*>50%	83,214 P*<5%
Alternative 3 *(Preferred)*	**50,200 P*=25%**	**97,600 P*=30%**	**29,300 P*=25%**	**1,900 P*<25%**	**7,300 P*=30%**	**11,400 P*=30%**	**9,600 P*=30%**	**25,200 P*=30%**	**53,000 P*=30%**	**18,000 P*=30%**	**23,800 P*=30%**	**17,900 P*=30%**	**15,300 P*=35%**	**71,600 P*=30%**	**22,500 P*=30%**	**18,600 P*=35%**	**185,000 P*=30%**
Alternative 4 *(Lower than Preferred)*	47,900 P*=20%	93,500 P*=25%	28,600 P*=20%	1,800 P*=25%	7,000 P*=25%	10,800 P*=25%	9,400 P*=25%	24,700 P*=25%	48,000 P*=25%	17,400 P*=25%	22,700 P*=25%	16,600 P*=25%	15,100 P*=30% / 14,800 P*=25%	68,100 P*=25%	21,400 P*=25%	18,400 P*=30% / 18,200 P*=25%	179,000 P*=25%
		90,100 P*=20%		1,600 P*=20%	6,600 P*=20%	10,200 P*=20%	9,100 P*=20%	24,500 P*=20%	43,700 P*=20%	16,800 P*=20%	21,600 P*=20%	15,400 P*=20%	14,300 P*=20%	64,600 P*=20%	20,300 P*=20%	18,100 P*=20%	173,000 P*=20%
	45,500 P*=15%	86,200 P*=15%	27,800 P*=15%	1,400 P*=15%	6,200 P*=15%	9,600 P*=15%	8,900 P*=15%	24,100 P*=15%	39,800 P*=15%	16,100 P*=15%	20,400 P*=15%	14,100 P*=15%	14,000 P*=15%	60,600 P*=15%	19,100 P*=15%	17,800 P*=15%	166,000 P*=15%
	42,800 P*=10%	81,100 P*=10%	26,800 P*=10%	1,200 P*=10%	5,800 P*=10%	9,000 P*=10%	8,500 P*=10%	23,800 P*=10%	36,200 P*=10%	15,400 P*=10%	19,200 P*=10%	12,700 P*=10%	13,600 P*=10%	56,200 P*=10%	17,900 P*=10%	17,400 P*=10%	159,000 P*=10%
	39,300 P*=5%	74,500 P*=5%	25,200 P*=5%	1,000 P*=5%	5,200 P*=5%	8,200 P*=5%	8,100 P*=5%	23,200 P*=5%	31,500 P*=5%	14,400 P*=5%	17,600 P*=5%	11,000 P*=5%	13,200 P*=5%	51,100 P*=5%	16,400 P*=5%	16,800 P*=5%	150,000 P*=5%
2011 Est. Biomass	n.a	1,483,179	65,210	35,178	n.a.	148,512	23,824	472,974	183,065	286,014	n.a.	103,302	n.a.	1,586,650	359,400	26,326	1,685,146
Avg. 2011-2013 Catch	107,271	35,500	54,050	953	1,845	2,934	1,316	1,378	27,749	8,283	7,914	10,339	12,142	22,172	7,881	12,467	35,860

Source: Sabater and Kleiber (2014), provided in Appendix B of this EA.
Family Scaridae does not include *Bolbometopon muricatum* (bumphead parrotfish); Family Labridae does not include *Cheilinus undulatus* (humphead or Napoleon wrasse).
† This species is included in "All other CREMUS combined."

Table 13. ACL alternatives (lb) and probability of overfishing (P*) for Hawaii CREMUS 2015-2018, including MSY-based reference points and 2011-2013 ave. catch (lb).

	Selar crumenophthalmus- akule or bigeye scad	Decapterus macarellus- opelu or mackerel scad	Acanthuridae- surgeonfishes	Carangidae- jacks	Carcharhinidae- reef sharks	Crustaceans- crabs	Holocentridae- squirrelfishes	Kyphosidae- rudderfishes	Labridae- wrasses	Lethrinidae- emperors	Lutjanidae- snappers	Mollusks- octopus	Mugilidae- mullets	Mullidae- goatfishes	Scaridae- parrotfishes	Serranidae- groupers	All other CREMUS combined
MSY	**1,150,800**	**538,000**	**445,500**	**185,100**	**12,400**	**43,100**	**159,800**	**122,800**	**229,200**	**39,600**	**359,300**	**50,300**	**24,600**	**195,700**	**271,500**	**141,300**	**540,800**
OFL Proxy *(P*=50%)*	**1,138,000**	**531,200**	**452,600**	**183,700**	**12,500**	**42,800**	**158,100**	**119,600**	**227,400**	**39,400**	**356,200**	**49,500**	**24,500**	**197,500**	**270,600**	**139,900**	**535,600**
ABC	**1,025,000** P*=35%	**459,800** P*=35%	**367,900** P*=35%	**168,100** P*=40%	**9,800** P*=35%	**35,400** P*=30%	**150,000** P*=30%	**108,600** P*=35%	**211,000** P*=35%	**36,600** P*=35%	**338,200** P*=40%	**38,200** P*=30%	**20,100** P*=30%	**173,100** P*=35%	**251,700** P*=35%	**132,200** P*=40%	**496,500** P*=35%
Alternative 1 *(No Action)*	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL	No ACL
Alternative 2 *(Status Quo – 2014 ACL*	651,292 P*<5%	393,536 P*<20%	80,545 P*<5%	193,423 P*>50%	111,566 P*>50%	20,686 P*<5%	44,122 P*<5%	†No ACL	†No ACL	†No ACL	65,102 P*<5%	28,765 P*<10%	41,112 P*>50%	125,813 P*<10%	33,326 P*<5%	†No ACL	142,282 P*<5%
Alternative 3 *(Preferred)*	**988,000 P*=30%**	**438,000 P*=30%**	**342,000 P*=30%**	**161,200 P*=35%**	**9,310 P*<35%**	**33,500 P*=25%**	**148,000 P*=25%**	**105,000 P*=30%**	**205,000 P*=30%**	**35,500 P*=30%**	**330,300 P*=35%**	**35,700 P*=25%**	**19,200 P*=25%**	**165,000 P*=30%**	**239,000 P*=25%**	**128,400 (P*=35%)**	**485,000 P*=30%**
Alternative 4 *(Lower than Preferred)*	952,000 P*=25%	418,000 P*=25%	313,000 P*=25%	154,000 P*=30%	8,800 P*=30%	31,400 P*=20%	146,000 P*=20%	101,000 P*=25%	200,000 P*=25%	34,300 P*=25%	321,000 P*=30%	33,400 P*=20%	18,200 P*=20%	157,000 P*=25%	232,000 P*=20%	125,000 P*=30%	471,000 P*=25%
				146,000 P*=25%	8,000 P*=25%						312,000 P*=25%					121,000 P*=25%	
	919,000 P*=20%	400,000 P*=20%	288,000 P*=20%	139,000 P*=20%	7,200 P*=20%			98,100 P*=20%	194,000 P*=20%	33,200 P*=20%	303,000 P*=20%			148,000 P*=20%		116,000 P*=20%	457,000 P*=20%
	886,000 P*=15%	381,000 P*=15%	259,000 P*=15%	131,000 P*=15%	6,300 P*=15%	29,100 P*=15%	144,000 P*=15%	94,500 P*=15%	188,000 P*=15%	32,100 P*=15%	292,000 P*=15%	31,300 P*=15%	17,100 P*=15%	138,000 P*=15%	223,000 P*=15%	111,000 P*=15%	440,000 P*=15%
	850,600 P*=10%	363,300 P*=10%	231,100 P*=10%	123,300 P*=10%	5,400 P*=10%	26,600 P*=10%	140,600 P*=10%	90,500 P*=10%	181,000 P*=10%	31,000 P*=10%	280,500 P*=10%	29,200 P*=10%	15,900 P*=10%	128,300 P*=10%	213,400 P*=10%	106,000 P*=10%	424,200 P*=10%
	807,000 P*=5%	346,000 P*=5%	196,000 P*=5%	114,000 P*=5%	4,300 P*=5%	23,900 P*=5%	138,000 P*=5%	86,000 P*=5%	175,000 P*=5%	29,400 P*=5%	264,000 P*=5%	26,600 P*=5%	14,300 P*=5%	116,000 P*=5%	201,000 P*=5%	98,700 P*=5%	405,000 P*=5%
2010 Est. Biomass	n.a.	n.a.	14,276,986	1,851,171	324,635	n.a.	1,209,295	2,081,020	4,273,341	735,752	6,505,508	n.a.	n.a.	2,550,326	4,845,563	2,325,704	10,033,442
Avg. 2011-2013 Catch	340,443	296,800	131,299	44,714	2,842	27,253	64,771	*27,511	*7,706	*6,599	45,086	39,272	9,761	60,255	80,568	*5,093	96,635

Source: Sabater and Kleiber (2014), provided in Appendix B of this EA.
Bolbometopon muricatum (bumphead parrotfish) and *Cheilinus undulatus* (humphead or Napoleon wrasse) do not occur in Hawaii and are not included in family Scaridae and Labridae, respectively.
Family Carangidae includes the BMUS, kahala (*Seriola dumerili*) since this species is a reef-associated species; Family Lutjanidae includes BMUS, taape (*Lutjanus kasmira*) since this species a reef-associated species.
*Average includes 2010-2012 catch since there is no data for 2013 for this species. † This species is included in "All other CREMUS combined."

2.3.1 American Samoa CREMUS Alternatives

2.3.1.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for American Samoa CREMUS for fishing year 2015. Under this alternative, NMFS would not specify an ACL for any American Samoa CREMUS and AMs would not be necessary. However, this alternative would not be in compliance with the Magnuson-Stevens Act, or the provisions of the American Samoa FEP and implementing federal regulations which require NMFS to specify an ACL for all stocks and stock complexes.

Expected Fishery Outcome

Although the potential for catch is unlimited without an ACL and AMs, the lack of an ACL or AMs is not expected to result in changes in the conduct of coral reef fisheries in American Samoa, including gear types used, areas fished, level of catch or effort. This is because even without ACLs and AMs, catches of CREMUS would remain sustainable based on the best available commercial and scientific information. As shown in Table 10, the recent average catch value for fishing years 2011-2013 for each CREMUS group is well below that group's estimated MSY and OFL proxy. During fishing years 2011 through 2013, the fishery for each CREMUS group remained open year round.

For every American Samoa CREMUS group, catches in 2015-2018 could be increased two to three times above the most recent three-year average catch level without approaching the OFL (See Table 10). The fishery is not expected to change much in the coming years. Therefore, under this alternative, the annual level of catch of each CREMUS group in 2015 through 2018 is expected to be similar to that described under Alternative 2 and is not expected to exceed the associated OFL proxy for that CREMUS group as shown in Table 10.

2.3.1.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each American Samoa CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 10 for the specific ACL values for each CREMUS group. Note that under this alternative, there would be no individual ACL for Kyphosidae (rudderfish), Labridae (Wrasses), Mullidae (goatfishes), or Siganidae (rabbitfish). This is because in the prior species level aggregation process described in Section 2.2.1 – Determining the Level of Species Aggregation, these species groups did not comprise the top 90% of the total coral reef fish catch over the long-term catch time series. Therefore, under this alternative, these species would remain in the category "All Other CREMUS" combined as they were in fishing year 2014 and in previous years.

The ACLs under Alternative 2 were developed using a different method than proposed under the preferred alternative (Alternative 3), and are equal to the 75th percentile of the long-term catch history. For detailed information on the how these ACLs were derived, please see the 2011 EA for coral reef ecosystem fisheries (NMFS 2011). Based on risk projections from method B of the

Biomass Augmented Catch-MSY model (Appendix B), no ACL specification under Alternative 2 is associated with greater than a 35% probability of overfishing should the entire ACL be caught (see Table 10). This shows that the proposed ACLs under Alternative 2 are overly conservative. Given the fact that there is no in-season closure associated with this Alternative, there would not be an impact to the fishery, even if the ACL were unduly conservative.

For American Samoa humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), NMFS specified the 2014 ACLs at 1,743 lb and 235 lb, respectively. This level of catch is equal to 5% of each stock's estimated biomass and identical to the ACL proposed under the preferred alternative (Alternative 3). As previously mentioned above, MSY, OFL and probability of overfishing projections for these species are not available.

Under this alternative, if the Council determines an ACL is exceeded, the Council as an AM would take action in accordance with 50 CFR 600.310(g) to correct the operational issue that caused the ACL overage. This may include a recommendation that NMFS reduce the ACL in the subsequent fishing year by the amount of the overage, or other measures, as appropriate. As the status quo, Alternative 2 is the NEPA baseline to which all other alternatives are compared.

Expected Fishery Outcome

The expected fishery outcome under Alternative 2 would be the same as under Alternative 1 (No action), and Alternative 3 and is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because annual catch of each American Samoa CREMUS group in fishing years 2015-2018 is expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 10, and remain below the ACLs proposed under this alternative. Regardless of the grouping or species, based on previous years' monitoring of the fishery, no American Samoa CREMUS fishery is expected to exceed the ACL in any of the four years.

Because statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached. Therefore, in-season AMs to prevent an ACL from being exceeded are not possible. However, six months after each fishing year, data would become available for NMFS and the Council to determine whether an ACL in the previous year was exceeded.

If NMFS and the Council determine catch exceeded an ACL proposed under this alternative, the Council is not expected to recommend as an AM, NMFS reduce the ACL in the subsequent fishing year by the amount of the overage. This is because the ACLs under this alternative were developed using a different method than is proposed under the preferred alternative (Alternative 3) and without knowledge of the estimate of MSY and OFL. For this reason, these ACLs are now considered overly conservative based on the best available information as described in Section 2.2.2. Based on recent catch data shown in Table 11, the annual level of catch for each CREMUS group in 2015-2018 is not expected to exceed the group's estimated OFL proxy.

2.3.1.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each American Samoa CREMUS group in 2015-2018 as shown in Table 10. This level of catch is five percent lower than each CREMUS group's ABC. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), no ACL under Alternative 3 is associated with greater than a 35 percent probability of overfishing should the entire ACL be caught (see Table 10). For American Samoa humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), NMFS proposes to specify the 2015-2018 ACL at 1,743 lb and 235 lb, respectively. This level of catch is identical to the ACL under the status quo/NEPA baseline (Alternative 2).

Under this alternative, if the Council determines the three-year average catch for any CREMUS group exceeded the specified ACL in any fishing year, NMFS would reduce the ACL by the amount of the overage in the subsequent years. See Section 1.3- Proposed Action for detailed information on how this AM would be triggered.

Expected Fishery Outcome

The expected fishery outcome under Alternative 3 would be the same as under Alternative 1 (No action), and Alternative 2 and is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because under this alternative, the annual catch of each American Samoa CREMUS group in fishing years 2015-2018 is expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 10, and remain below the ACLs proposed under this alternative. Regardless of the grouping or species, based on previous years' monitoring of the fishery, no American Samoa CREMUS fishery is expected to exceed the ACL in any of the four years.

Because statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached. Therefore, in-season AMs to prevent an ACL from being exceeded are not possible. However, six months after each fishing year, data would become available for NMFS and the Council to determine whether an ACL in the previous year was exceeded.

2.3.1.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each American Samoa CREMUS group that is lower than the preferred alternative (Alternative 3) for fishing years 2015 through 2018 (See Table 10). For each CREMUS group, NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment by the amount of the overage is necessary in a subsequent year. Under this alternative, the ACL for each CREMUS group would depend on the amount of the overage in the preceding year, but depending on the exact level of catch, would be associated with a probability of overfishing ranging from 30 percent down to 5 percent (See Table 10).

Expected Fishery Outcome

The expected fishery outcome under Alternative 4 would be the same as under Alternative 1 (No action), and Alternatives 2 (Status Quo) and 3 (Preferred) and the action of specifying ACLs and AMs is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because under this alternative, the annual catch of each American Samoa CREMUS group in fishing years 2015-2018 is expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 10, and remain below the lowest ACLs proposed under this alternative. Regardless of the grouping or species, based on previous years' monitoring of the fishery, no American Samoa CREMUS fishery is expected to exceed the ACL in any of the four years.

Because statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached. Therefore, in-season AMs to prevent an ACL from being exceeded are not possible. However, six months after each fishing year, data would become available for NMFS and the Council to determine whether an ACL in the previous year was exceeded.

2.3.2 CNMI CREMUS Alternatives

2.3.2.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for any CNMI CREMUS for fishing year 2015. Under this alternative, NMFS would not specify an ACL for any CNMI CREMUS and AMs would not be necessary. However, this alternative would not be in compliance with the Magnuson-Stevens Act, or the provisions of the Mariana Archipelago FEP and implementing federal regulations which require NMFS to specify an ACL for all stocks and stock complexes.

Expected Fishery Outcome

Although the potential for catch is unlimited without an ACL and AMs, the lack of an ACL or AMs is not expected to result in changes in the conduct of coral reef fisheries in the CNMI, including gear types used, areas fished, level of catch or effort. This is because even without ACLs and AMs, the catches of CREMUS would remain sustainable based on the best available commercial and scientific information. As shown in Table 11, the recent average catch value for fishing years 2011-2013 for each CREMUS group is well below that group's estimated MSY and OFL proxy. During fishing years 2011 through 2013, the fishery for each CREMUS group remained open year round.

For every CNMI CREMUS group except for "All Other CREMUS" catches in 2015-2018 could be increased two to three times above the most recent three-year average catch level without approaching the OFL (See Table 11). The fishery is not expected to change much in the coming years. Therefore, under this alternative, the annual level of catch of each CREMUS group in 2015 through 2018 is expected to be similar to that described under Alternative 2 and is not expected to exceed the associated OFL proxy for that CREMUS group as shown in Table 11.

2.3.2.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each CNMI CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 11 for the specific ACL values for each CREMUS group. Note that under this alternative, there would be no individual ACL for Crustacean (crabs), Holocentidae (squirrelfish), Kyphosidae (rudderfish), or Labridae (Wrasses). This is because in the prior species level aggregation process described in Section 2.2.1 – Determining the Level of Species Aggregation, these species groups did not comprise the top 90% of the total coral reef fish catch over the long-term catch time series. Therefore, under this alternative, these species would remain in the category "All Other CREMUS" combined as they were in fishing year 2014 and in previous years.

The ACLs under Alternative 2 were developed using a different method than proposed under the preferred alternative (Alternative 3), and are equal to the 75th percentile of the long-term catch history. For detailed information on the how these ACLs were derived, please see the 2011 EA for coral reef ecosystem fisheries (NMFS 2011). Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), no ACL specification under Alternative 2 is associated with greater than a 40 percent probability of overfishing should the entire ACL be caught (see Table 11). This shows that the proposed ACLs under Alternative 2 are overly conservative. Given the fact that there is no in-season closure associated with this Alternative, there would not be an impact to the fishery, even if the ACL were unduly conservative.

For the 2014 fishing year, NMFS specified the ACL for CNMI humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), at 2,009 lb and 797 lb, respectively. For the bumphead wrasse, the 2014 ACL was shared between the CNMI and Guam and would be shared again in 2015-2018 under this alternative. The 2014 ACLs were equal to 5% of each stock's estimated biomass and identical to the ACL proposed under the preferred alternative (Alternative 3). As previously mentioned above, MSY, OFL and probability of overfishing projections for these species are not available.

Under this alternative, if the Council determines an ACL is exceeded, the Council as an AM would take action in accordance with 50 CFR 600.310(g) to correct the operational issue that caused the ACL overage. This may include a recommendation that NMFS reduce the ACL in the subsequent fishing year by the amount of the overage, or other measures, as appropriate. As the status quo, Alternative 2 is the NEPA baseline to which all other alternatives are compared.

Expected Fishery Outcome

The expected fishery outcome under Alternative 2 would be the same as under Alternative 1 (No action), and Alternative 3 and is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because annual catch of each CNMI CREMUS group in fishing years 2015-2018 is expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 11, and remain below the ACLs proposed under this alternative. Regardless of the grouping or species, based on

previous years' monitoring of the fishery, no CNMI CREMUS fishery is expected to exceed the ACL in any of the four years.

Because statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached. Therefore, in-season AMs to prevent an ACL from being exceeded are not possible. However, six months after each fishing year, data would become available for NMFS and the Council to determine whether an ACL in the previous year was exceeded.

If NMFS and the Council determine catch exceeded an ACL proposed under this alternative, the Council is not expected to recommend as an AM, NMFS reduce the ACL in the subsequent fishing year by the amount of the overage. This is because the ACLs under this alternative were developed using a different method than is proposed under the preferred alternative (Alternative 3) and without knowledge of the estimate of MSY and OFL. For this reason, these ACLs are now considered overly conservative based on the best available information as described in Section 2.2.2. Based on recent catch data shown in Table 11, the annual level of catch for each CREMUS group in 2015-2018 is not expected to exceed the group's estimated OFL proxy.

2.3.2.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each CNMI CREMUS group in 2015-2018 as shown in Table 11. This level of catch is five percent lower than each CREMUS group's ABC. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), no ACL under Alternative 3 is associated with greater than a 35% percent probability of overfishing should the entire ACL be caught (see Table 11).

For CNMI humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), NMFS would specify the ACL at the same level proposed under Alternative 2, which is 2,009 lb and 797 lb, respectively. Like in Alternative 2, the ACL for bumphead wrasse would be shared between the CNMI and Guam in 2015-2018. As previously mentioned above, MSY, OFL and probability of overfishing projections for these species are not available.

Under this alternative, if the Council determines the three-year average catch for any CREMUS group exceeded the specified ACL in any fishing year, NMFS would reduce the ACL by the amount of the overage in the subsequent years. See Section 1.3- Proposed Action for detailed information on how this AM would be triggered.

Expected Fishery Outcome

The expected fishery outcome under Alternative 3 would be the same as under Alternative 1 (No action), and Alternative 2 and is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because under this alternative, the annual catch of each CNMI CREMUS group in fishing years 2015-2018 is

expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 11, and remain below the ACLs proposed under this alternative. Regardless of the grouping or species, based on previous years' monitoring of the fishery, no CNMI CREMUS fishery is expected to exceed the ACL in any of the four years.
Because statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached. Therefore, in-season AMs to prevent an ACL from being exceeded are not possible. However, six months after each fishing year, data would become available for NMFS and the Council to determine whether an ACL in the previous year was exceeded.

2.3.2.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each CNMI CREMUS group that is lower than the preferred alternative (Alternative 3) for fishing years 2015 through 2018 (See Table 11). For each CREMUS group, NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment by the amount of the overage is necessary in a subsequent year. Under this alternative, the ACL for each CREMUS group would depend on the amount of the overage in the preceding year, but depending on the exact level of catch, would be associated with a probability of overfishing ranging from 30 percent down to 5 percent (See Table 11).

Expected Fishery Outcome

The expected fishery outcome under Alternative 4 would be the same as under Alternative 1 (No action), and Alternatives 2 (Status Quo) and 3 (Preferred) and the action of specifying ACLs and AMs is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because under this alternative, the annual catch of each CNMI CREMUS group in fishing years 2015-2018 is expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 11, and remain below the lowest ACLs proposed under this alternative. Regardless of the grouping or species, based on previous years' monitoring of the fishery, no CNMI CREMUS fishery is expected to exceed the ACL in any of the four years.

Because statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached. Therefore, in-season AMs to prevent an ACL from being exceeded are not possible. However, six months after each fishing year, data would become available for NMFS and the Council to determine whether an ACL in the previous year was exceeded.

2.3.3 Guam CREMUS Alternatives

2.3.3.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for any Guam CREMUS for fishing year 2015. Under this alternative, NMFS would not specify an ACL for any Guam CREMUS and AMs would not be necessary. However, this alternative would not be in compliance with the Magnuson-Stevens Act, or the provisions of the Mariana Archipelago FEP and implementing federal regulations which require NMFS to specify an ACL for all stocks and stock complexes.

Expected Fishery Outcome

Under Alternative 1 (No Action), catches of Guam CREMUS are expected to be similar to the most recent three-year average catch level shown in Table 12. During these years, the fishery remained open year round. Except for *Selar crumenopthalmus* or bigeye scad and Carangidae or jacks, the average 2011-2013 catch of all other Guam CREMUS groups were well below the MSY and OFL reference points and are sustainable.

For Guam bigeye scad and jacks, the average 2011-2013 catch was nearly twice the stocks' MSY and OFL reference points (Table 12). The fishery could become unsustainable if this level of catch is realized again in 2015-2018. If NMFS determines that a stock is subject to overfishing, the Council would be required to take action pursuant to Section 304(e) of the Magnuson-Stevens Act to end overfishing in the fishery.

2.3.3.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each Guam CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 12 for the specific ACL values for each CREMUS group. The ACLs under Alternative 2 were developed using a different method than proposed under the preferred alternative (Alternative 3), and are equal to the 75th percentile of the long-term catch history. For detailed information on the how these ACLs were derived, please see the 2011 EA for coral reef ecosystem fisheries (NMFS 2011).

Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), the ACL for several CREMUS groups would be associated with a probability of overfishing greater than 50 percent (Table 12). These are Carangidae (jacks), Carcharhinidae (reef sharks), Kyphosidae (rudderfish), Mullidae (goatfish) and Siganidae (rabbitfish). By law, the probability of overfishing cannot exceed 50 percent (74 FR 3178, January 9, 2011). Therefore, these ACLs would not be in compliance with the Magnuson-Stevens Act. For all other Guam CREMUS groups, the ACL specifications under Alternative 2 are associated with probability of overfishing no greater than 30 percent should the entire ACL be caught (see Table 12).

For the 2014 fishing year, NMFS specified the ACL for Guam humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), at 1,960 lb and 797

lb, respectively. For the bumphead wrasse, the 2014 ACL was shared between the CNMI and Guam and would be shared again in 2015-2018 under this alternative. The 2014 ACLs were equal to 5% of each stock's estimated biomass and identical to the ACL proposed under the preferred alternative (Alternative 3). As previously mentioned above, MSY, OFL and probability of overfishing projections for these species are not available.

Under this alternative, if the Council determines an ACL is exceeded, the Council as an AM would take action in accordance with 50 CFR 600.310(g) to correct the operational issue that caused the ACL overage. This may include a recommendation that NMFS reduce the ACL in the subsequent fishing year by the amount of the overage, or other measures, as appropriate. As the status quo, Alternative 2 is the NEPA baseline to which all other alternatives are compared.

Expected Fishery Outcome

The expected fishery outcome under Alternative 2 would be the same as under Alternative 1 (No action), and Alternative 3 (Preferred), and is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because even if NMFS specifies ACLs, catch statistics are not available until at least six months after the data have been collected, and so NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached. Therefore, in-season AMs to prevent an ACL from being exceeded are not possible and the fishery would remain open year round. However, six months after each fishing year, data would become available for NMFS and the Council to determine whether an ACL in the previous year was exceeded.

In fishing years 2015-2018 annual catch of each Guam CREMUS group is expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 12. Like in Alternative 1, this level of catch would be sustainable, except for bigeye scad and jacks. For Guam bigeye scad and jacks, the average 2011-2013 catch was nearly twice the stocks' MSY and OFL reference points (Table 12).

If NMFS and the Council determine catch exceeded an ACL proposed under this alternative but not the MSY or OFL reference points, the Council is not expected to recommend as an AM, NMFS reduce the ACL in the subsequent fishing year by the amount of the overage. This is because the ACLs under this alternative were developed using a different method than is proposed under the preferred alternative (Alternative 3) and without knowledge of the estimate of MSY and OFL. Except for Guam bigeye scad and jacks, these ACLs are now considered overly conservative based on the best available information as described in Section 2.2.2.

However, if NMFS and the Council determine catch exceeded an ACL proposed under this alternative and the MSY or OFL reference points as occurred in 2012, Council would likely recommend as an AM, NMFS reduce the ACL in the subsequent fishing year by the amount of the overage. Additionally, if NMFS determines that a stock is subject to overfishing, the Council would be required to take action pursuant to Section 304(e) of the Magnuson-Stevens Act to end overfishing in the fishery.

2.3.3.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each Guam CREMUS group in 2015-2018 as shown in Table 12. This level of catch is five percent lower than each CREMUS group's ABC. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), no ACL under Alternative 3 is associated with greater than a 35% percent probability of overfishing should the entire ACL be caught (see Table 12).

For Guam humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), NMFS would specify the ACL at the same level proposed under Alternative 2, which is 1,960 lb and 797 lb, respectively. Like in Alternative 2, the ACL for bumphead wrasse would be shared between the CNMI and Guam in 2015-2018. As previously mentioned above, MSY, OFL and probability of overfishing projections for these species are not available.

Under this alternative, if the Council determines the three-year average catch for any CREMUS group exceeded the specified ACL in any fishing year, NMFS would reduce the ACL by the amount of the overage in the subsequent years. See Section 1.3- Proposed Action for detailed information on how this AM would be triggered.

Expected Fishery Outcome

The expected fishery outcome under Alternative 3 would be the same as under Alternative 1 (No action), and Alternative 2 (Status Quo), and is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because even if NMFS specifies ACLs, catch statistics are not available until at least six months after the data have been collected, and so NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached. Therefore, in-season AMs to prevent an ACL from being exceeded are not possible and the fishery would remain open year round. However, six months after each fishing year, data would become available for NMFS and the Council to determine whether an ACL in the previous year was exceeded.

In fishing years 2015-2018 annual catch of each Guam CREMUS group is expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 12. Like in Alternative 1, this level of catch would be sustainable, except for bigeye scad and jacks. For Guam bigeye scad and jacks, the average 2011-2013 catch was nearly twice the stocks' MSY and OFL reference points. If NMFS and the Council determine the three-year average catch for any CREMUS group exceeded the specified ACL in any fishing year, NMFS would reduce the ACL in the subsequent fishing year by the amount of the overage. Additionally, if NMFS determines that a stock is subject to overfishing, the Council would be required to take action pursuant to Section 304(e) of the Magnuson-Stevens Act to end overfishing in the fishery.

2.3.3.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each Guam CREMUS group that is lower than the preferred alternative (Alternative 3) for fishing years 2015 through 2018 (See Table 12). For each CREMUS group, NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment by the amount of the overage is necessary in a subsequent year. Under this alternative, the ACL for each CREMUS group would depend on the amount of the overage in the preceding year, , but depending on the exact level of catch, would be associated with a probability of overfishing ranging from 30 percent down to 5 percent (See Table 12).

Expected Fishery Outcome

The expected fishery outcome under Alternative 4 would be the same as under Alternative 1 (No action), and Alternatives 2 (Status Quo) and 3 (Preferred) and the action of specifying ACLs and AMs is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because even with a lower ACL, NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached as statistics are not available until at least six months after the data have been collected. Therefore, even with a lower ACL, the annual catch of each Guam CREMUS group in fishing years 2015-2018 is expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 12. For Guam bigeye scad and jacks, the average 2011-2013 catch was nearly twice the stocks' MSY and OFL reference points (Table 12). If the three-year average catch for any CREMUS group exceeded the specified ACL in any fishing year, that level of catch would be unstainable. Additionally, if NMFS determines that a stock is subject to overfishing, the Council would be required to take action pursuant to Section 304(e) of the Magnuson-Stevens Act to end overfishing in the fishery.

2.3.4 Hawaii CREMUS Alternatives

2.3.4.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for Hawaii CREMUS for fishing year 2015. Under this alternative, NMFS would not specify an ACL for any Hawaii CREMUS and AMs would not be necessary. However, this alternative would not be in compliance with the Magnuson-Stevens Act, or the provisions of the American Samoa FEP and implementing federal regulations which require NMFS to specify an ACL for all stocks and stock complexes.

Expected Fishery Outcome

Although the potential for catch is unlimited without an ACL and AMs, the lack of an ACL or AMs is not expected to result in changes in the conduct of coral reef fisheries in Hawaii, including gear types used, areas fished, level of catch or effort. This is because even without ACLs and AMs, catches of CREMUS would remain sustainable based on the best available commercial and scientific information. As shown in Table 13, the recent average catch value for

fishing years 2011-2013 for each CREMUS group is well below that group's estimated MSY and OFL proxy. During fishing years 2011 through 2013, the fishery for each CREMUS group remained open year round.

Catches of most Hawaii CREMUS group in 2015-2018 could be increased two times above the most recent three-year average catch level without approaching the OFL (See Table 13). The fishery is not expected to change much in the coming years. Therefore, under this alternative, the annual level of catch of each CREMUS group in 2015 through 2018 is expected to be similar to that described under Alternative 2 and is not expected to exceed the associated OFL proxy for that CREMUS group as shown in Table 13.

2.3.4.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each Hawaii CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 13 for the specific ACL values for each CREMUS group. Note that under this alternative, there would be no individual ACL for Kyphosidae (rudderfish), Labridae (wrasses), Lethrinidae (emperors), or Serranidae (groupers). This is because in the prior species level aggregation process described in Section 2.2.1 – Determining the Level of Species Aggregation, these species groups did not comprise the top 90% of the total coral reef fish catch over the long-term catch time series. Therefore, under this alternative, these species would remain in the category "All Other CREMUS" combined as they were in fishing year 2014 and in previous years.

The ACLs under Alternative 2 were developed using a different method than proposed under the preferred alternative (Alternative 3), and are equal to the 75th percentile of the long-term catch history. For detailed information on the how these ACLs were derived, please see the 2011 EA for coral reef ecosystem fisheries (NMFS 2011).

Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), the ACL for several CREMUS groups would be associated with a probability of overfishing greater than 50 percent (Table 13). These are Carangidae (jacks), Carcharhinidae (reef sharks), and Mugilidae (mullets). By law, the probability of overfishing cannot exceed 50 percent (74 FR 3178, January 9, 2011). Therefore, these ACLs would not be in compliance with the Magnuson-Stevens Act. For all other Hawaii CREMUS groups, the ACL specifications under Alternative 2 are associated with probability of overfishing no greater than 20 percent should the entire ACL be caught (see Table 13).

Under this alternative, if the Council determines an ACL is exceeded, the Council as an AM would take action in accordance with 50 CFR 600.310(g) to correct the operational issue that caused the ACL overage. This may include a recommendation that NMFS reduce the ACL in the subsequent fishing year by the amount of the overage, or other measures, as appropriate. As the status quo, Alternative 2 is the NEPA baseline to which all other alternatives are compared.

Expected Fishery Outcome

The expected fishery outcome under Alternative 2 would be the same as under Alternative 1 (No action), and Alternative 3 and is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because annual catch of each Hawaii CREMUS group in fishing years 2015-2018 is expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 13, and remain below the ACLs proposed under this alternative. Regardless of the grouping or species, based on previous years' monitoring of the fishery, no Hawaii CREMUS fishery is expected to exceed the ACL in any of the four years.

Because statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached. Therefore, in-season AMs to prevent an ACL from being exceeded are not possible. However, six months after each fishing year, data would become available for NMFS and the Council to determine whether an ACL in the previous year was exceeded.

If NMFS and the Council determine catch exceeded an ACL proposed under this alternative, the Council is not expected to recommend as an AM, NMFS reduce the ACL in the subsequent fishing year by the amount of the overage. This is because the ACLs under this alternative were developed using a different method than is proposed under the preferred alternative (Alternative 3) and without knowledge of the estimate of MSY and OFL. For this reason, these ACLs are now considered overly conservative based on the best available information as described in Section 2.2.2. Based on recent catch data shown in Table 13, the annual level of catch for each CREMUS group in 2015-2018 is not expected to exceed the group's estimated OFL proxy.

2.3.4.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each Hawaii CREMUS group in 2015-2018 as shown in Table 13. This level of catch is five percent lower than each CREMUS group's ABC. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), no ACL under Alternative 3 is associated with greater than a 35 percent probability of overfishing should the entire ACL be caught (see Table 13).

Under this alternative, if the Council determines the three-year average catch for any CREMUS group exceeded the specified ACL in any fishing year, NMFS would reduce the ACL by the amount of the overage in the subsequent years. See Section 1.3- Proposed Action for detailed information on how this AM would be triggered.

Expected Fishery Outcome

The expected fishery outcome under Alternative 3 would be the same as under Alternative 1 (No action), and Alternative 2 and is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because under this

alternative, the annual catch of each Hawaii CREMUS group in fishing years 2015-2018 is expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 13, and remain below the ACLs proposed under this alternative. Regardless of the grouping or species, based on previous years' monitoring of the fishery, no Hawaii CREMUS fishery is expected to exceed the ACL in any of the four years.

Because statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached. Therefore, in-season AMs to prevent an ACL from being exceeded are not possible. However, six months after each fishing year, data would become available for NMFS and the Council to determine whether an ACL in the previous year was exceeded.

2.3.4.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each Hawaii CREMUS group that is lower than the preferred alternative (Alternative 3) for fishing years 2015 through 2018 (See Table 13). For each CREMUS group, NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment by the amount of the overage is necessary in a subsequent year. Under this alternative, the ACL for each CREMUS group would depend on the amount of the overage in the preceding year, , but depending on the exact level of catch, would be associated with a probability of overfishing ranging from 30 percent down to 5 percent (See Table 13).

Expected Fishery Outcome

The expected fishery outcome under Alternative 4 would be the same as under Alternative 1 (No action), and Alternatives 2 (Status Quo) and 3 (Preferred) and the action of specifying ACLs and AMs is not expected to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch or effort. This is because under this alternative, the annual catch of each Hawaii CREMUS group in fishing years 2015-2018 is expected to be similar to the average annual catch from the most recent three-year period (2011-2013) shown in Table 13, and remain below the lowest ACLs proposed under this alternative. Regardless of the grouping or species, based on previous years' monitoring of the fishery, no Hawaii CREMUS fishery is expected to exceed the ACL in any of the four years.

Because statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during any fishing year whether the ACL for any CREMUS group might be reached. Therefore, in-season AMs to prevent an ACL from being exceeded are not possible. However, six months after each fishing year, data would become available for NMFS and the Council to determine whether an ACL in the previous year was exceeded.

2.4 Alternatives Not Considered in Detail

Although required by the Pacific Remote Island Areas (PRIA) FEP, the Council did not recommend and NMFS does not propose to specify an ACL for CREMUS in EEZ waters around the PRIA. This is because current federal regulations (78 FR 32996, June 3, 2013) prohibit all fishing, including non-commercial fishing within 12 nautical miles around the seven islands and atolls that comprise the PRIA,

NMFS will not specify an ACL for CREMUS in EEZ waters around the PRIA. This is because current federal regulations implementing the PRIA FEP (78 FR 32996, June 3, 2013) prohibit commercial and non-commercial fishing within 12 nautical miles around each of the seven islands and atolls that comprise the PRIA, unless authorized the U.S. Fish and Wildlife Service under their respective authorities. Additionally, there is no coral reef habitat seaward of the 12 nautical mile prohibited fishing area. Therefore, there continues to be a functional equivalent of an ACL of zero for CREMUS in the PRIA.

3 Affected Environment

This section describes the affected federal coral reef ecosystem fisheries and fishery resources, and other biological and physical resources that could be affected by federal coral reef fisheries in EEZ waters around American Samoa, CNMI, Guam, and the MHI. Fishing communities are described as are protected marine areas and fishery administration and enforcement.

3.1 American Samoa

3.1.1 Target and Non-Target Species

In American Samoa, coral reef fishes and invertebrates are harvested almost exclusively in nearshore territorial waters by subsistence and small-scale commercial fisheries using various gear types including hook and line, spear gun, and gillnets (WPFMC 2012). Due to the lack of a developed coral reef ecosystem fisheries in federal waters, the Council at its 151st, 154th and 157th meeting directed Council staff to conduct analyses to identify coral reef associated species that may meet the criteria for an "ecosystem component species" designation in accordance with National Standard 1 guidelines of the Magnuson Stevens Act (76 FR 37285, June 27, 2011). Ecosystem component species are species that are generally not harvested or retained in the EEZ and do not require the specification of reference points such as an ACL, but should be monitored and actively managed in the EEZ if necessary.

3.1.1.1 Summary of American Samoa CREMUS Catch

It is difficult to determine "target" and "non-target" stocks in American Samoa's territorial coral reef fisheries because resources harvested in these fisheries are highly diverse, with approximately 300 species appearing in catch records (Appendix A). As shown in Table 1, there are 19 major CREMUS groups. Eighteen of those CREMUS groups comprise 90 percent of the total CREMUS catches in American Samoa nearshore waters, with other fish and invertebrates, and miscellaneous fish that cannot be identified to the species level comprising the remaining 10

percent of the overall catch. Therefore, it could be argued that there are no non-targets stocks in coral reef fisheries, except for species that are discarded. In American Samoa, discards levels are unknown but are believed to be limited to fish that are below legal size limits, or taboo due to cultural beliefs. Additionally, people may also avoid certain reef fish that are poisonous or associated with ciguatera (WPFMC 2001).

Based on the average estimated annual CREMUS catch for the most recent three-year period shown in Table 10, catches are dominated by five families/groups: Acanthuridae or surgeonfishes (15,804 lb), Lutjanidae or snappers (8,626 lb), Scaridae or parrotfishes (6,689 lb), mollusks including turbo snail, octopus, and giant clams (6,460 lb), and Lethrinidae or emperors (5,477 lb). Catches of other CREMUS families/groups ranged between 93 lb (Carcharhinidae or reef sharks) to 2,295 (Crustaceans or crabs with catches of miscellaneous species comprising the group "All Other CREMUS Combined" accounting for 5,139 lb.

In 2013, the commercial price for individual coral reef associated species ranged between $2.63 (bigeye scad) and $4.83 (octopus)[4] per pound, with an average CREMUS price of $3.10/lb over all groupings (http://www.pifsc.noaa.gov/wpacfin/as/Pages/as_data_8.php, accessed on Dec. 3, 2014). Multiplying the average 2011-2013 catch of each CREMUS group shown in Table 14 by the 2013 average price of $3.10 equally, the average annual estimated commercial value of the coral reef fisheries of American Samoa for this three-year period was approximately $195,075.

Table 14 provides the estimate average annual American Samoa CREMUS catch and average fleet-wide revenue by CREMUS group for the most recent three-year period where data is available, and the OFL proxy. Based on current estimates of MSY and OFL proxies shown in Table 10, average annual catches of all American Samoa CREMUS groups in 2011-2013 are well below these reference points are at sustainable levels.

Table 14. Average estimated catch and revenue of American Samoa CREMUS (2011-2013)

No.	CREMUS Groupings	OFL (lb)	Estimated Ave. Catch (2011-2013)[1] (lb)	Estimated Value of Ave. Catch based on 2013 Price of $3.10/lb[2]
1	*Selar crumenophthalmus* – atule or bigeye scad	43,300	2,882	$8,934
2	Acanthuridae – surgeonfishes	148,600	15,804	$48,982
3	Carangidae – jacks	24,300	2,245	$6,960
4	Carcharhinidae – reef sharks	2,300	93	$288
5	Crustaceans - crabs	7,800	2,295	$7,115
6	Holocentridae – squirrelfishes	16,800	2,171	$6,730
7	Kyphosidae – rudderfishes	2,600	*349	$1,082
8	Labridae – wrasses[1]	19,000	*332	$1,029
9	Lethrinidae – emperors	23,700	5,477	$16,979

[4] In 2013, fishermen reported selling 689 lb of bigeye scad and 41 lb of octopus.

No.	CREMUS Groupings	OFL (lb)	Estimated Ave. Catch (2011-2013)[1] (lb)	Estimated Value of Ave. Catch based on 2013 Price of $3.10/lb[2]
10	Lutjanidae – snappers	65,400	8,626	$26,741
11	Mollusks – turbo snail; octopus; giant clam	29,600	6,460	$20,026
12	Mugilidae – mullets	8,200	1,770	$5,487
13	Mullidae – goatfishes	12,700	No data	No data
14	Scaridae – parrotfishes[2]	294,600	6,689	$20,736
15	Serranidae – groupers	30,500	2,755	$8,541
16	Siganidae – rabbitfishes	200	No data	No data
17	*Cheilinus undulatus* – humphead (Napoleon) wrasse	Unknown	No data	No data
18	*Bolbometopon muricatum* – bumphead parrotfish	Unknown	No data	No data
19	All Other CREMUS Combined	28,500	5,139	$15,931
TOTAL			**62,406**	**$195,570**

[1] Source: Appendix 3 in Sabater and Kleiber (2014); Appendix 3 in Sabater and Kleiber (2014) does not include catch data for 2013. Therefore, the source of 2013 information is the 2013 ACL monitoring report presented at the 160th Council meeting in June 2014 (WPFMC 2014).
[2] Source: Estimated average price across all CREMUS groupings based on total revenue and landings for 2013 (http://www.pifsc.noaa.gov/wpacfin/as/Pages/as_data_8.php, accessed on 12/03/2014).
*Average based on 2010-2012 catch since there is no data for 2013 for these species.

3.1.2 Fishery Participants and Fishing Communities

3.1.2.1 Fishing Participants

Currently, harvest of CREMUS in American Samoa occurs almost exclusively within territorial waters. However, aside from average catch and general estimated revenue data, there is no information available on American Samoa's territorial coral reef fisheries in terms of number of participation or level of fishing effort.

3.1.2.2 Fishing Communities

The Magnuson-Stevens Act defines a fishing community as "...a community that is substantially dependent upon or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew, and fish processors that are based in such communities" (16 U.S.C. § 1802(16)). NMFS further specifies in the National Standard guidelines that a fishing community is "...a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries dependent services and industries (for example, boatyards, ice suppliers, tackle shops)". National Standard 8 of the

Magnuson-Stevens Act requires that conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and the rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (a) provide for the sustained participation of such communities and (b) to the extent practicable, minimize adverse economic impacts on such communities. In 1999, the Council identified American Samoa, as a fishing community. The Secretary of Commerce approved this definition on April 19, 2009 (64 FR 19067). Sustainable management of the coral reef fisheries of American Samoa will allow continued harvest of a resource that is important to fishermen, their families, community networks, markets, and visitors for personal consumption (sustenance), supplemental income, and customary exchange.

3.1.3 Fishery Administration and Enforcement

3.1.3.1 Federal Fishery Management Provisions

Federal fishing regulations for coral reef ecosystem fisheries in EEZ waters around American Samoa include a prohibition on the use of destructive and non-selective gear methods, vessel identification and gear marking requirements. A SCERFP and logbook reporting is also required for harvesting certain CREMUS defined in federal regulations as PHCRT. Additionally, all fishing, including non-commercial fishing is prohibited within 12 nautical miles from the shoreline Rose Atoll, which is marine national monument (78 FR 32996, June 3, 2013). Enforcement of federal fishing regulations is conducted by NOAA's Office of Law Enforcement and the U.S. Coast Guard.

In addition to fishing regulations, Federal law also requires the Council-appointed American Samoa FEP plan team to prepare an annual report on the performance of all federal fisheries, including American Samoa coral reef fisheries by July 31 of each year. Federal regulations also require NMFS to specify ACLs and AMs for each stock or stock complex of MUS identified in an FEP, as recommended by the Council, and in consideration of the best available scientific, commercial, and other information about the fishery for that stock or stock complex. Monitoring of catch against a specified ACL and implementation of AMs is conducted by NMFS and the Council.

3.1.3.2 American Samoa Fishery Management Provisions

In local territorial waters, the American Samoa Department of Marine and Wildlife Resources and the American Samoa legislature have establish numerous laws to conserve coral reef fishery resources, including a ban on scuba spear fishing, gear and species restrictions, and other specific management measures. Additionally, American Samoa has established 14 marine protected areas (MPA) where fishing is strictly regulated or prohibited. These include special management areas, national parks, and community-based MPAs (Wushinich-Mendez and Trappe 2007). Fishing is also regulated within territorial waters designated as the American Samoa National Marine Sanctuary (77 FR 43942, July 26, 2012). Together, these measures help to manage and conserve coral reef resources and habitats in local territorial waters.

3.1.4 Protected Resources

3.1.4.1 Species Protected under the Endangered Species Act (ESA)

A number of protected species are known or believed to occur in the waters around American Samoa. Table 15 identifies species listed as endangered or threatened under the ESA that are known to occur or could reasonably be expected to occur in marine waters around American Samoa, which may have the potential to interact with coral reef ecosystem fisheries. They include five whales, five sea turtles, a shark, seven species of shallow reef-building corals, and a seabird. There is no critical habitat designated for ESA-listed marine species around American Samoa.

Table 15. Endangered and threatened marine species and seabirds known to occur or reasonably expected to occur in waters around the American Samoa Archipelago.

Endangered and threatened marine species and seabirds known to occur or reasonably expected to occur in waters around the American Samoa Archipelago			
Common name	**Scientific Name**	**ESA listing status in American Samoa**	**Occurrence in American Samoa**
Listed Sea Turtles			
Green sea turtle (laumei enaena and fonu)	*Chelonia mydas*	Threatened	Frequently seen. Nest at Rose Atoll. Known to migrate to feeding grounds.
Hawksbill sea turtle (laumei uga)	*Eretmochelys imbricata*	Endangered	Frequently seen. Nest at Rose Atoll and Swain's Island.
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Very rare in American Samoa. One recovered dead in experimental longline fishing.
Olive ridley sea turtle	*Lepidochelys olivacea*	Threatened	Uncommon in American Samoa. Three sightings.
South Pacific Loggerhead sea turtle distinct population segment (DPS)	*Caretta caretta*	Endangered	Not known to occur in American Samoa.
Listed Marine Mammals			
Blue whale	*Balaenoptera musculus*	Endangered	No known sightings.
Fin whale	*Balaenoptera physalus*	Endangered	No known sightings.
Humpback whale (tafola or i`a manu)	*Megaptera novaeangliae*	Endangered	Most common during Sept. and October. Southern humpback whales mate and calve from June – Sept.

Endangered and threatened marine species and seabirds known to occur or reasonably expected to occur in waters around the American Samoa Archipelago			
Common name	**Scientific Name**	**ESA listing status in American Samoa**	**Occurrence in American Samoa**
Sei whale	*Balaenoptera borealis*	Endangered	No known sightings.
Sperm whale	*Physeter macrocephalus*	Endangered	Occurs in all months except. Feb. and March.
Listed Sharks			
Scalloped hammerhead shark (Indo-West Pacific DPS)	*Sphyrna lewini*	Threatened	Known to occur.
Listed Shallow Reef-building Corals			
None	*Acropora globiceps*	Threatened	Depth range is 0 to 8 meters (m).
None	*A. jacquelineae*	Threatened	Depth range is 10 to 35 m.
None	*A. retusa*	Threatened	Depth range is 1 to 5 m.
None	*A. speciosa*	Threatened	Depth range is 12 to 40 m, and may occur in mesophotic habitat (<50 m depth).
None	*Euphyllia paradivisa*	Threatened	Depth range is two to 25 m.
None	*Isopora crateriformis*	Threatened	Depth range is 0 to 12 m, and and may occur in mesophotic habitat (<50 m depth).
None	*Seriatopora aculeata*	Threatened	Depth range is three to 40m.
Listed Sea Birds			
Newell's Shearwater	*Puffinus auricularis newelli*	Threatened	Uncommon visitor.

Source: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm, accessed October 31, 2014.

Applicable ESA Consultations – American Samoa Coral Reef Fisheries

NMFS has evaluated the potential impact of American Samoa FEP coral reef ecosystem fisheries on ESA listed species under NMFS jurisdiction and has determined that coral reef fisheries that operate in accordance with regulations implementing the American Samoa FEP are not likely to adversely affect ESA-listed species or their habitats. NMFS documented these determinations in letters of concurrence dated March 7, 2002, and April 9, 2015. The basis for this determination is generally due to the rare occurrence of ESA-listed species in EEZ waters where federal coral reef fisheries are authorized to operate, combined with the low level of coral reef fishing occurring in the EEZ, which makes interactions unlikely to occur.

Newell's shearwater (*Puffinus auricularis newelli*) is listed as threatened under the ESA. Generally known with other shearwaters and petrels as ta`i`o in Samoan, this species breeds only in the main Hawaiian Islands, primarily in burrows on steep forested mountain slopes at medium elevation. Newell's shearwater has been sighted once in American Samoa, and is considered an uncommon visitor to the archipelago (Grant et al 1993). Because its presence in American Samoa is rare, and coral reef fishermen do not interact with seabirds, the fishery has no effect on this seabird.

3.1.4.2 Species Protected under the Marine Mammal Protection Act (MMPA)

Several non-ESA listed whales, dolphins and porpoises occur in waters around American Samoa and are protected under the MMPA. Table 16 provides a list of non-ESA listed marine mammals known to occur or reasonably expected to occur in waters around American Samoa that have the potential to interact with with coral reef ecosystem fisheries of American Samoa.

Table 16. Non ESA-listed marine mammals known to occur or reasonably expected to occur in waters around American Samoa.

Non ESA-listed marine mammals known to occur or reasonably expected to occur in waters around American Samoa	
Common Name	**Scientific Name**
Blainville's beaked whale	*Mesoplodon densirostris*
Bottlenose dolphin	*Tursiops truncatus*
Bryde's whale	*Balaenoptera edeni*
Common dolphin	*Delphinus delphis*
Cuvier's beaked whale	*Ziphius cavirostris*
Dwarf sperm whale	*Kogia sima*
False killer whale	*Pseudorca crassidens*
Fraser's dolphin	*Lagenodelphis hosei*
Killer whale	*Orcinus orca*
Melon-headed whale	*Peponocephala electra*
Minke whale	*Balaenoptera acutorostrata*
Pygmy killer whale	*Feresa attenuata*
Pygmy sperm whale	*Kogia breviceps*
Risso's dolphin	*Grampus griseus*
Rough-toothed dolphin	*Steno bredanensis*
Short-finned pilot whale	*Globicephala macrorhynchus*
Spinner dolphin	*Stenella longirostris*
Spotted dolphin (Pantropical spotted dolphin)	*Stenella attenuata*
Striped dolphin	*Stenella coeruleoalba*
Longman's beaked whale	*Indopacetus pacificus*

Sources: NMFS PIRO and PIFSC unpublished data; Council website: http://www.wpcouncil.org

Applicable MMPA Coordination – American Samoa Coral Reef Fisheries

The MMPA prohibits, with certain exceptions, taking of marine mammals in the U.S., and by persons aboard U.S. flagged vessels (i.e., persons and vessels subject to U.S. jurisdiction). Under section 118 of the MMPA, NMFS must publish, at least annually, a List of Fisheries (LOF) that classifies U.S. commercial fisheries into one of three categories based upon the level of serious injury and mortality of marine mammals that occurs incidental to each fishery. A Category 1 fishery is one with frequent incidental morality and serious injury of marine mammals. A Category 2 fishery is one with occasional incidental morality and serious injury of marine mammals. A Category 3 fishery is one with a remote likelihood or no known incidental morality and serious injury of marine mammals.

On December 29, 2014, (79 FR 77919), NMFS published the final LOF for 2015 which classified all gear types used in Hawaii's coral reef fisheries, including the inshore gillnet, lift net, inshore purse seine net, throw net, cast net, seine net, offshore pen culture, rod and reel, crab trap, fish trap, crab net, inshore handline, bullpen trap, hand pick, and spearfishing as Category 3 fisheries under Section 118 of the MMPA. To date, NMFS has not included any gear type used in American Samoa's coral reef fisheries in the annual LOF. There is no information available regarding marine mammal interactions in coral reef fisheries in American Samoa as no interactions have been reported or observed. However, because the gear types used in American Samoa's coral reef fisheries, such as hook and line, spear gun, and gillnets, are similar to those used in Hawaii's coral reef fisheries, it is reasonable to assume that the impacts to marine mammals would be comparable to Hawaii's rod and reel, spearfishing and inshore gillnet fisheries, and would have a remote likelihood of incidental mortality and serious injury of marine mammals. Participants in Category 3 fisheries are not required to register in the Marine Mammal Authorization Program prior to engaging in commercial fishing.

3.1.4.3 Seabirds of American Samoa

Seabirds found on and around American Samoa that could potentially interact with fisheries are listed in Table 17. There have been no reports of interactions between the American Samoa coral reef fisheries and migratory birds and none are expected to occur.

Table 17. Seabirds occurring in American Samoa.

Resident seabirds in American Samoa		
Samoan name	**Common name**	***Scientific name***
ta'i'o	Wedge-tailed shearwater	*Puffinus pacificus*
ta'i'o	Audubon's shearwater	*Puffinus lherminieri*
ta'i'o	Christmas shearwater	*Puffinus nativitatis*
ta'i'o	Tahiti petrel	*Pterodroma rostrata*
ta'i'o	Herald petrel	*Pterodroma heraldica*
ta'i'o	Collared petrel	*Pterodroma brevipes*
fua'o	Red-footed booby	*Sula sula*
fua'o	Brown booby	*Sula leucogaster*
fua'o	Masked booby	*Sula dactylatra*

tava'esina	White-tailed tropicbird	*Phaethon lepturus*
tava'e'ula	Red-tailed tropicbird	*Phaethon rubricauda*
atafa	Great frigatebird	*Fregata minor*
atafa	Lesser frigatebird	*Fregata ariel*
gogouli	Sooty tern	*Onychoprion fuscatus;* previously *Sterna fuscata*
gogo	Brown noddy	*Anous stolidus*
gogo	Black noddy	*Anous minutus*
laia	Blue-gray noddy	*Procelsterna cerulea*
manu sina	White tern / Common fairy-tern	*Gygis alba*

Note: The ta'i'o, or Newell's shearwater is an uncommon visitor in American Samoa.
Source: WPFMC 2009a; and http://www.birdlife.org/datazone/species/factsheet/22694740: retrieved 12/8/14.

3.2 CNMI

3.2.1 Target and Non-Target Species

Fishing for CREMUS in the CNMI is conducted from both the shoreline and from small boats (less than 25 ft in length) predominantly in nearshore territorial waters between 0-3 nautical miles from shoreline (WPMFC 2012). While the CNMI includes 14 islands, fishing is mostly limited to the nearshore waters around three southernmost islands of Saipan, Rota, and Tinian. Cast nets, spearfishing, hook and line, and hand gleaning are some of the common fishing techniques used in the CNMI (WPFMC 2012).

Due to the lack of a developed coral reef ecosystem fisheries in federal waters, the Council at its 151st, 154th and 157th meeting directed Council staff to conduct analyses to identify coral reef associated species that may meet the criteria for an "ecosystem component species" designation in accordance with National Standard 1 guidelines of the Magnuson Stevens Act (76 FR 37285, June 27, 2011). Ecosystem component species are species that are generally not harvested or retained in the EEZ and do not require the specification of reference points such as an ACL, but should be monitored and actively managed in the EEZ if necessary.

3.2.1.1 Summary of CNMI CREMUS Catch

Like in other island areas, it is difficult to determine "target" and "non-target" stocks in CNMI's territorial coral reef fisheries because resources harvested are highly diverse, with over one hundred species appearing in catch records (Appendix A). As shown in Table 2, there are 19 major CREMUS groups. Eighteen of those CREMUS groups comprise 90 percent of the total CREMUS catches in CNMI nearshore waters, with other fish and invertebrates, and miscellaneous fish that cannot be identified to the species level comprising the remaining 10 percent of the overall catch. Therefore, it could be argued that there are no non-targets stocks in coral reef fisheries, except for species that are discarded. In the CNMI, discards levels are unknown but are believed to be limited to fish that are below legal size limits, or taboo due to

cultural beliefs. Additionally, people may also avoid certain reef fish that are poisonous or associated with ciguatera (WPFMC 2001).

Based on the average estimated annual CREMUS catch for the most recent three-year period shown in Table 11, catches are dominated by five families/groups: Lethrinidae or emperors (19,268 lb), *Selar crumenophthalmus* or atule or bigeye scad (18,362 lb), Carangidae or jacks (9,607 lb), Acanthuridae or surgeonfishes (7,191 lb), and Scaridae or parrotfishes (5,568 lb). Catches of other CREMUS families/groups ranged between 704 lb (Mugilidae or mullets) to 3,620 lb (Serranidae or groupers) with catches of miscellaneous species comprising the group "All Other CREMUS Combined" accounting for 10,972 lb.

In 2013, the commercial price for individual coral reef associated species ranged between $2.43 (rainbow runner) and $6.90 (invertebrates)[5] per pound, with an average CREMUS price of $3.15/lb over all groupings (http://www.pifsc.noaa.gov/wpacfin/cnmi/Pages/cnmi_data_2.php), accessed on Dec. 3, 2014). Multiplying the average 2011-2013 catch of each CREMUS group shown in Table 18 by the 2013 average price of $3.15 equally, the average annual estimated commercial value of the coral reef fisheries of the CNMI for this three-year period was approximately $287,737.

Table 18 provides the estimate average annual CNMI CREMUS catch and average fleet-wide revenue by CREMUS group for the most recent three-year period where data is available, and the OFL proxy. Based on current estimates of MSY and OFL proxies shown in Table 11, average annual catches of all CNMI CREMUS groups in 2011-2013 are well below these reference points are at sustainable levels.

Table 18. Average estimated catch and revenue of CNMI CREMUS (2011-2013)

No.	CREMUS Groupings	OFL (lb)	Estimated Ave. Catch (2011-2013)[1] (lb)	Estimated Value of Ave. Catch Based on 2013 Price of $3.15/lb[2]
1	*Selar crumenophthalmus* – atulai or bigeye scad	119,600	18,362	$57,840
2	Acanthuridae – surgeonfishes	370,000	7,191	$22,652
3	Carangidae – jacks	53,00	9,607	$30,262
4	Carcharhinidae – reef sharks	Unknown	No data	No data
5	Crustaceans - crabs	8,900	*838	$2,640
6	Holocentridae – squirrelfishes	78,000	*1,325	$4,174
7	Kyphosidae – rudderfishes	30,500	*2,568	$8,089
8	Labridae – wrasses[1]	75,500	*792	$2,495
9	Lethrinidae – emperors	72,200	19,268	$60,694

[5] Rainbow runner is included in the Jack grouping, while invertebrates, comprised primarily of sea cucumbers, are included within the all other CREMUS Combined grouping. In 2013, fishermen reported selling 700 lb of rainbow runner and 3,960 lb of invertebrates.

No.	CREMUS Groupings	OFL (lb)	Estimated Ave. Catch (2011-2013)[1] (lb)	Estimated Value of Ave. Catch Based on 2013 Price of $3.15/lb[2]
10	Lutjanidae – snappers	228,700	2,413	$7,601
11	Mollusks – turbo snail; octopus; giant clam	16,300	2,394	$7,541
12	Mugilidae – mullets	7,500	704	$2,218
13	Mullidae – goatfishes	30,500	3,157	$9,945
14	Scaridae – parrotfishes[2]	199,000	5,568	$17,539
15	Serranidae – groupers	112,000	3,620	$11,403
16	Siganidae – rabbitfishes	11,000	2,566	$8,083
17	*Cheilinus undulatus* – humphead (Napoleon) wrasse	Unknown	No data	No data
18	*Bolbometopon muricatum* – bumphead parrotfish	Unknown	No data	No data
19	All Other CREMUS Combined	14,200	10,972	$34,562
TOTAL			**85,822**	**$287,737**

[1] Source: Appendix 3 in Sabater and Kleiber (2014); Appendix 3 in Sabater and Kleiber (2014) does not include catch data for 2013. Therefore, the source of 2013 information is the 2013 ACL monitoring report presented at the 160th Council meeting in June 2014 (WPFMC 2014).
[2] Source: Estimated average price across all CREMUS groupings based on total revenue and landings for 2013 (http://www.pifsc.noaa.gov/wpacfin/cnmi/Pages/cnmi_data_2.php, accessed on 12/03/2014).
*Average based on 2009-2011 catch since there is no data for 2012 or 2013 for these species.

3.2.2 Fishery Participants and Fishing Communities

3.2.2.1 Fishery Participants

Currently, harvest of CREMUS in CNMI occurs almost exclusively within territorial waters. However, aside from average catch and revenue data, there is no information available on CNMI's territorial coral reef fisheries in terms of number of participation or level of fishing effort.

3.2.2.2 Fishing Communities

The Magnuson-Stevens Act defines a fishing community as "...a community that is substantially dependent upon or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew, and fish processors that are based in such communities" (16 U.S.C. § 1802(16)). NMFS further specifies in the National Standard guidelines that a fishing community is "...a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries dependent services and

industries (for example, boatyards, ice suppliers, tackle shops)". National Standard 8 of the Magnuson-Stevens Act requires that conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and the rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (a) provide for the sustained participation of such communities and (b) to the extent practicable, minimize adverse economic impacts on such communities. In 1999, the Council identified the CNMI as a fishing community. The Secretary of Commerce approved this definition on April 19, 2009 (64 FR 19067). Sustainable management of the CNMI coral reef fisheries will allow continued harvest of a resource that is important to fishermen, their families, community networks, markets, and visitors for personal consumption (sustenance), supplemental income, and customary exchange.

3.2.3 Fishery Administration and Enforcement

3.2.3.1 Federal Fishery Management Provisions

Federal fishing regulations for coral reef ecosystem fisheries in EEZ waters around the CNMI include a prohibition on the use of destructive and non-selective gear methods, vessel identification and gear marking requirements. A SCERFP and logbook reporting is also required for harvesting certain CREMUS defined in federal regulations as PHCRT. Additionally, all commercial fishing is prohibited within the Islands Unit of the Mariana Trench Marine National Monument, while non-commercial fishing and charter boat fishing may be allowed subject to a monument permit and logbook reporting requirements (78 FR 32996, June 3, 2013). Enforcement of federal fishing regulations is conducted by NOAA's Office of Law Enforcement and the U.S. Coast Guard.

In addition to fishing regulations, Federal law also requires the Council-appointed Mariana FEP plan team to prepare an annual report on the performance of all federal fisheries, including CNMI coral reef fisheries by July 31 of each year. Federal regulations also require NMFS to specify ACLs and AMs for each stock or stock complex of MUS identified in an FEP, as recommended by the Council, and in consideration of the best available scientific, commercial, and other information about the fishery for that stock or stock complex. Monitoring of catch against a specified ACL and implementation of AMs is conducted by NMFS and the Council.

3.2.3.2 CNMI Fishery Management Provisions

In local territorial waters, the CNMI Division of Fish and Wildlife and the CNMI legislature have established numerous laws to conserve coral reef fishery resources, including restrictions on certain gear types, harvest seasons and size limits for certain marine species, and an outright ban on scuba spearfishing. In addition, fishing is prohibited in several no-take marine protected areas including Managaha Marine Conservation Area on Saipan, Bird Island and Forbidden Island Sanctuaries on Saipan, and Sasanhaya Bay Fish Reserve on Rota (Wushinich-Mendez and Trappe 2007). Together, these measures help to manage and conserve spiny lobster resources in local territorial waters.

3.2.4 Protected Resources

3.2.4.1 Species Protected under the Endangered Species Act

A number of protected species are reported from the waters around the Mariana Islands. Table 19 identifies species listed as endangered or threatened under the ESA that are known to occur or could reasonably be expected to occur in marine waters around the Mariana Archipelago, including the CNMI, which may have the potential to interact with coral reef fisheries. Listed species include five whales, five sea turtles, a shark, three species of shallow reef-building corals and a seabird. There is no critical habitat designated for ESA-listed marine species around the CNMI.

Table 19. Endangered and threatened marine species and seabirds known to occur or reasonably expected to occur in waters around the Mariana Archipelago (CNMI).

Endangered and threatened marine species and seabirds known to occur or reasonably expected to occur in waters around the Mariana Archipelago (CNMI)			
Common name	**Scientific Name**	**ESA listing status in the CNMI**	**Occurrence in the CNMI**
Listed Sea Turtles			
Green sea turtle	*Chelonia mydas*	Threatened	Most common turtle in the Mariana Archipelago. Foraging and minor nesting confirmed on Guam, Rota, Tinian and Saipan.
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	Small population foraging around Guam and suspected low level around southern islands of CNMI. Low level nesting on Guam.
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Occasional sightings around Guam. Not known to what extent they are present around Guam and CNMI
Olive ridley sea turtle	*Lepidochelys olivacea*	Threatened	Range across Pacific: not confirmed in the Mariana Archipelago
North Pacific loggerhead sea turtle DPS	*Caretta caretta*	Endangered	No known reports of loggerhead turtles in waters around the Mariana Archipelago
Listed Marine Mammals			
Blue whale	*Balaenoptera musculus*	Endangered	Extremely rare
Fin whale	*Balaenoptera physalus*	Endangered	Infrequent sightings.

Endangered and threatened marine species and seabirds known to occur or reasonably expected to occur in waters around the Mariana Archipelago (CNMI)			
Common name	**Scientific Name**	**ESA listing status in the CNMI**	**Occurrence in the CNMI**
Humpback whale	*Megaptera novaeangliae*	Endangered	Infrequent sightings. Winter in the CNMI.
Sei whale	*Balaenoptera borealis*	Endangered	Infrequent sightings.
Sperm whale	*Physeter macrocephalus*	Endangered	Regularly sighted; most abundant large cetaceans in the region.
Listed Sharks			
Scalloped hammerhead shark (Indo-West Pacific DPS)	*Sphyrna lewini*	Threatened	Known to occur.
Listed Shallow Reef-building Corals			
None	*Acropora globiceps*	Threatened	Depths range is 0 to 8 m
None	*A. retusa*	Threatened	Depth range is one to five meters
None	*Seriatopora aculeata*	Threatened	Depth range is three to 40 meters
Listed Sea Birds			
Newell's Shearwater	*Puffinus auricularis newelli*	Threatened	Rare visitor

Source: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm, accessed October 31, 2014.

Applicable ESA Consultations – CNMI Coral Reef Fisheries

NMFS has evaluated the potential impact of Marian FEP coral reef ecosystem fisheries on ESA listed species under NMFS jurisdiction and has determined that coral reef fisheries that operate in accordance with regulations implementing the Mariana FEP are not likely to adversely affect ESA-listed species or their habitats. NMFS documented its determinations in letters of concurrence dated March 7, 2002, and April 29, 2015. The basis for this determination is generally due to the rare occurrence of ESA-listed species in EEZ waters where federal coral reef fisheries are authorized to operate, combined with the low level of coral reef fishing occurring in the EEZ, which makes interactions unlikely to occur.

Newell's shearwater (*Puffinus auricularis newelli*) is listed as threatened under the ESA. This species breeds only in the main Hawaiian Islands, primarily in burrows on steep forested mountain slopes at medium elevation. Newell's shearwater has been sighted in the Marianas, but is considered an uncommon visitor to the archipelago (Drahos 1977; Jouanin 1956). Because its presence in the Mariana Archipelago is rare, and coral reef fishermen do not interact with seabirds, the fishery has no effect on this seabird.

3.2.4.2 Species Protected under the Marine Mammal Protection Act

Several non-ESA listed whales, dolphins, and porpoises occur in waters around the CNMI and are protected under the MMPA. Table 20 provides a list of non-ESA listed marine mammals known to occur or reasonably expected to occur in waters around the Mariana Archipelago that have the potential to interact with the CNMI coral reef fisheries.

Table 20. Non ESA-listed marine mammals known to occur or reasonably expected to occur in waters around the Mariana Archipelago (CNMI).

Non ESA-listed marine mammals known to occur or reasonably expected to occur in waters around the Mariana Archipelago (CNMI)	
Common Name	**Scientific Name**
Blainville's beaked whale	*Mesoplodon densirostris*
Bottlenose dolphin	*Tursiops truncatus*
Bryde's whale	*Balaenoptera edeni*
Common dolphin	*Delphinus delphis*
Cuvier's beaked whale	*Ziphius cavirostris*
Dwarf sperm whale	*Kogia sima*
False killer whale	*Pseudorca crassidens*
Fraser's dolphin	*Lagenodelphis hosei*
Killer whale	*Orcinus orca*
Longman's beaked whale	*Indopacetus pacificus*
Melon-headed whale	*Peponocephala electra*
Minke whale	*Balaenoptera acutorostrata*
Northern elephant Seal	*Mirounga angustirostris*
Pilot whale	*Globicephala malaena*
Pygmy killer whale	*Feresa attenuata*
Pygmy sperm whale	*Kogia breviceps*
Risso's dolphin	*Grampus griseus*
Rough-toothed dolphin	*Steno bredanensis*
Short-finned pilot whale	*Globicephala macrorhynchus*
Spinner dolphin	*Stenella longirostris*
Spotted dolphin	*Stenella attenuata*
Striped dolphin	*Stenella coeruleoalba*

Source: Eldredge 2003; Randall et al. 1975; Council website: http://www.wpcouncil.org

Applicable MMPA Coordination – CNMI Coral Reef Fisheries

The MMPA prohibits, with certain exceptions, taking of marine mammals in the U.S., and by persons aboard U.S. flagged vessels (i.e., persons and vessels subject to U.S. jurisdiction). Under section 118 of the MMPA, NMFS must publish, at least annually, a List of Fisheries (LOF) that classifies U.S. commercial fisheries into one of three categories based upon the level of serious injury and mortality of marine mammals that occurs incidental to each fishery. A Category 1

fishery is one with frequent incidental morality and serious injury of marine mammals. A Category 2 fishery is one with occasional incidental morality and serious injury of marine mammals. A Category 3 fishery is one with a remote likelihood or no known incidental morality and serious injury of marine mammals.

On December 29, 2014, (79 FR 77919), NMFS published the final LOF for 2015 which classified all gear types used in Hawaii's coral reef fisheries, including the inshore gillnet, lift net, inshore purse seine net, throw net, cast net, seine net, offshore pen culture, rod and reel, crab trap, fish trap, crab net, inshore handline, bullpen trap, hand pick, and spearfishing as Category 3 fisheries under Section 118 of the MMPA. To date, NMFS has not included any gear type used in CNMI's coral reef fisheries in the annual LOF. There is no information available regarding marine mammal interactions in coral reef fisheries in the CNMI as no interactions have been reported or observed. However, because the gear types used in CNMI's coral reef fisheries, such as cast nets, spearfishing, hook and line, and hand gleaning are similar to those used in Hawaii's coral reef fisheries, it is reasonable to assume that the impacts to marine mammals would be comparable to Hawaii's cast net, spearfishing, rod and reel, and hand pick fisheries, and would have a remote likelihood of incidental mortality and serious injury of marine mammals. Participants in Category 3 fisheries are not required to register in the Marine Mammal Authorization Program prior to engaging in commercial fishing.

3.2.4.3 Seabirds of the Mariana Archipelago

The following seabirds in Table 21 are considered residents of Mariana Archipelago: wedge-tailed shearwater (*Puffinus pacificus*), white-tailed tropicbird (*Phaethon lepturus*), red-tailed tropicbird (*Phaethon rubricauda*), masked booby (S*ula dactylatra*), brown booby (*Sula leucogaster*), red-footed booby (*Sula sula*), white tern (*Gygis alba),* sooty tern (*Onychoprion fuscatus; previously Sterna fuscata)*, brown noddy (*Anous stolidus*), black noddy (*Anous minutus*), and the great frigatebird (*Fregata minor*).

The following seabirds in Table 21 have been sighted and are considered visitors (some more common than others) to the Mariana Archipelago: short-tailed shearwater (*Puffinus tenuirostris* - common visitor), Newell's shearwater (*Puffinus auricularis*- rare visitor), Audubon's shearwater (*Puffinus iherminieri*), Leach's storm-petrel (*Oceanodroma leucorhoa*), and the Matsudaira's storm-petrel (*Oceanodroma matsudairae*). Of these, only the Newell's shearwater is listed (as threatened) under the ESA. There have been no sightings of the endangered short-tailed albatross (*Phoebastria albatrus*) in the CNMI although CNMI is within the range of the species' largest breeding colony at Torishima, Japan (WPFMC 2009b). There are no known interactions between seabirds and any of the Mariana Archipelago coral reef fisheries and none are expected to occur (WPFMC 2009b).

Table 21. Seabirds occurring in the Mariana Archipelago (CNMI).

Seabirds of the Mariana Archipelago (R= Resident/Breeding; V= Visitor; Vr=rare visitor; Vc= Common visitor)		
	Common name	***Scientific name***
Vr	Newell's shearwater	*Puffinus auricularis newelli* (ESA:Threatened) rare visitor
R	Wedge-tailed shearwater	*Puffinus pacificus*
V	Audubon's shearwater	*Puffinus lherminieri*
Vc	Short-tailed shearwater	*Puffinus tenuirostris* (common visitor)
V	Leach's storm-petrel	*Oceanodroma leucorhoa*
V	Matsudaira's storm-petrel	*Oceanodroma matsudairae*
R	Red-footed booby	*Sula sula*
R	Brown booby	*Sula leucogaster*
R	Masked booby	*Sula dactylatra*
R	White-tailed tropicbird	*Phaethon lepturus*
R	Red-tailed tropicbird	*Phaethon rubricauda*
R	Great frigatebird	*Fregata minor*
R	Sooty tern	*Onychoprion fuscatus; previously Sterna fuscata*
R	Brown noddy	*Anous stolidus*
R	Black noddy	*Anous minutus*
R	White tern / Common fairy-tern	*Gygis alba*

Source: WPFMC 2009b.

3.3 Guam

3.3.1 Target and Non-Target Species

In Guam, fishing for CREMUS is conducted from both the shoreline and from small boats (less than 25 ft.) predominantly in nearshore territorial waters between 0-3 nm from shoreline, although shore-based fishing accounts for most of the harvest (WPFMC 2012). Due to the lack of a developed coral reef ecosystem fisheries in federal waters, the Council at its 151st, 154th and 157th meeting directed Council staff to conduct analyses to identify coral reef associated species that may meet the criteria for an "ecosystem component species" designation in accordance with National Standard 1 guidelines of the Magnuson Stevens Act (76 FR 37285, June 27, 2011). Ecosystem component species are species that are generally not harvested or retained in the EEZ and do not require the specification of reference points such as an ACL, but should be monitored and actively managed in the EEZ if necessary.

3.3.1.1 Summary of Guam's CREMUS Catch

Like in other island areas, it is difficult to determine "target" and "non-target" stocks in Guam's territorial coral reef fisheries because resources harvested are highly diverse, with nearly 2,000 species appearing in catch records (Appendix A). As shown in Table 3, there are 19 major CREMUS groups. Eighteen of those CREMUS groups comprise 90 percent of the total

CREMUS catches in Guam nearshore waters, with other fish and invertebrates, and miscellaneous fish that cannot be identified to the species level comprising the remaining 10 percent of the overall catch. Therefore, it could be argued that there are no non-targets stocks in coral reef fisheries, except for species that are discarded. In Guam, discards levels are unknown but are believed to be limited to fish that are below legal size limits, or taboo due to cultural beliefs. Additionally, people may also avoid certain reef fish that are poisonous or associated with ciguatera (WPFMC 2001).

WPFMC (2012) reports that trolling, gillnet, snorkel/scuba spearfishing, and bottomfish fishing methods account for 89 percent of Guam's boat-based CREMUS catch. Of these methods, snorkel and scuba spear account for the majority of the catch. In Guam's shore-based fishery, hook and line, gillnet, snorkel spear, cast net and surround net are the most dominant gear-types, accounting for 87 percent of the shore-based CREMUS catch. Of these methods, hook-and-line and cast net account for nearly all of the catch (WPFMC 2012).

Based on the average estimated annual CREMUS catch for the most recent three-year period shown in Table 12, catches are dominated by eight families/groups: *Selar crumenophthalmus* – atulai (107,271 lb), Carangidae or jacks (54,050 lb), Acanthuridae or surgeonfishes (35,500 lb), Lethrinidae or emperors (27,749 lb), Scaridae or parrotfish (22,172 lb), Siganidae or rabbitfish (12,467 lb), Mullidae or goatfishes (12,142 lb) and Mugilidae or mullets (10,339 lb). Catches of other CREMUS families/groups ranged between 953 lb (Carcharhinidae or reef sharks) to 8,283 lb (Lutjanidae or snappers) with catches of miscellaneous species comprising the group "All Other CREMUS Combined" accounting for 35,860 lb.

In 2013, the commercial price for individual coral reef associated species ranged between $1.94 (dogtooth tuna) and $3.60 (rabbitfishes) per pound, with an average CREMUS price of $3.16/lb over all groupings (http://www.pifsc.noaa.gov/wpacfin/guam/dawr/Pages/gdawr_data_3.php, accessed on Dec. 3, 2014. Multiplying the average 2011-2013 catch of each CREMUS group shown in Table 22 by the 2013 average price of $3.16 equally, the average annual estimated commercial value of the coral reef fisheries of Guam for this three-year period was approximately $1,106,171.

Table 22 provides the estimate average annual Guam CREMUS catch and average fleet-wide revenue by CREMUS group for the most recent three-year period where data is available, and the OFL proxy. Except for *Selar crumenopthalmus* or bigeye scad and Carangidae or jacks, annual catches of Guam CREMUS groups in 2011-2013 are well below MSY and OFL reference points shown in Table 12, and are at sustainable levels.

For Guam bigeye scad, the average 2011-2012 catch level was 107,271 lb, which is nearly two times the stock's estimated MSY of 60,300 lb and OFL proxy of 60,800 lb. The Council (WPFMC 2014) reports that in 2012, Guam fishermen caught 120,513 lb of bigeye scad, dropping to 24,326 lb in 2013. FEP Plan Team members reported that increased participation in 2012 shore-based creel surveys by hook and line fishermen fishing for bigeye scad, coupled with a good 2012 fishing season resulted in the unusually large expanded catch number compared to previous years (WPFMC 2013). At the 2014 FEP Plan Team meeting held April 14, 2015, in Honolulu, FEP Plan Team members reported that preliminary 2014 data indicate that Guam

fishermen caught 15,233 lb of bigeye scad (WPFMC in prep). Thus, the unofficial three-year average 2012-2014 catch of bigeye scad in Guam could be 53,357 lb, which is below the stock's MSY and OFL. This data demonstrates the high degree of inter-annual variability in territorial data collection programs (see Section 2.1). Additionally, bigeye scad are coastal pelagic species, which have fast growth rates, short life spans and high natural mortality rates, and are more resilient to fishing pressure than most coral reef fish, which generally have longer life span and lower natural mortality rates.

For Guam jacks, the average 2011-12 catch level was 54,050 lb, which is above the stock's estimated MSY of 31,700 lb and OFL proxy of 32,200 lb. The Council (WPFMC 2014) reports that in Guam fishermen caught 18,122 lb of jacks in 2012, increasing to 60,469 lb in 2013. FEP Plan Team members report that 2013 was a good year for jacks due to a large run of juvenile called 'ie'ie in Chamorro. They also noted that the shore-based creel surveys interviewed more fishermen in 2013 than in previous years. They explain that this is may be due to the recent ban on the use of nets in harbors. In previous years, net fishermen used to utilize the harbor areas, however tend not to cooperate in creel surveys. Since the ban went into effect, areas that used to be occupied by net fishermen were now occupied by rod and reel fishermen which are better captured in the creel survey. Thus, better participation in creel survey by this group resulted in an increase in catch statistics in 2013. At the 2014 FEP Plan Team meeting held April 14, 2015, in Honolulu, FEP Plan Team members report that preliminary 2014 data indicates Guam fishermen caught 24,326 lb of jacks (WPFMC in prep). Thus, the unofficial average 2012-2014 catch of Guam jacks could be 34,306 lb, which is above the stock's MSY and OFL. This data demonstrates the high degree of inter-annual variability in territorial data collection programs (see Section 2.1). Due to the high degree of inter-annual variability in territorial data collection programs (see Section 2.1), Guam fishery scientists and managers do not consider the single year catch as an unsustainable level of fishing pressure.

Table 22. Average estimated catch and revenue of Guam CREMUS (2011-2013)

No.	**Guam CREMUS Groupings**	**OFL (lb)**	**Estimated Ave. Catch (2011-2013)**[1] (lb)	**Estimated Value of Ave. Catch Based on 2013 Price of $3.16/lb**[2]
1	*Selar crumenophthalmus* – atulai or bigeye scad	60,800	107,271	$33,8976
2	Acanthuridae – surgeonfishes	114,700	35,500	$112,180
3	Carangidae – jacks	32,200	54,050	$170,798
4	Carcharhinidae – reef sharks	2,900	953	$3,011
5	Crustaceans - crabs	8,600	1,845	$5,830
6	Holocentridae – squirrelfishes	13,800	2,934	$9,271
7	Kyphosidae – rudderfishes	10,300	1,316	$4,159
8	Labridae – wrasses[1]	28,200	1,278	$4,354
9	Lethrinidae – emperors	76,600	27,749	$87,687
10	Lutjanidae – snappers	20,700	8,283	$26,174

No.	Guam CREMUS Groupings	OFL (lb)	Estimated Ave. Catch (2011-2013)[1] (lb)	Estimated Value of Ave. Catch Based on 2013 Price of $3.16/lb[2]
11	Mollusks – turbo snail; octopus; giant clam	28,600	7,914	$25,008
12	Mugilidae – mullets	24,500	10,339	$32,671
13	Mullidae – goatfishes	16,300	12,142	$38,369
14	Scaridae – parrotfishes[2]	86,500	22,172	$70,064
15	Serranidae – groupers	27,400	7,881	$24,904
16	Siganidae – rabbitfishes	19,200	12,467	$39,396
17	*Cheilinus undulatus* – humphead (Napoleon) wrasse	Unknown	No data	No data
18	*Bolbometopon muricatum* – bumphead parrotfish	Unknown	No data	No data
19	All Other CREMUS Combined	209,200	35,860	$113,318
TOTAL			**350,054**	**$1,106,171**

[1] Source: Appendix 3 in Sabater and Kleiber (2014)
[2] Source: Estimated average price across all CREMUS groupings based on total revenues and landings for 2013 (http://www.pifsc.noaa.gov/wpacfin/guam/dawr/Pages/gdawr_data_3.php, accessed on 12/03/2014).

3.3.2 Fishery Participants and Fishing Communities

3.3.2.1 Fishery Participants

Currently, harvest of CREMUS in Guam occurs almost exclusively within territorial waters. However, aside from average catch and revenue data, there is no information available on Guam's territorial coral reef fisheries in terms of number of participation or level of fishing effort.

3.3.2.2 Fishing Communities

The Magnuson-Stevens Act defines a fishing community as "...a community that is substantially dependent upon or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew, and fish processors that are based in such communities" (16 U.S.C. § 1802(16)). NMFS further specifies in the National Standard guidelines that a fishing community is "...a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries dependent services and industries (for example, boatyards, ice suppliers, tackle shops)." National Standard 8 of the Magnuson-Stevens Act requires that conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and the

rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (a) provide for the sustained participation of such communities and (b) to the extent practicable, minimize adverse economic impacts on such communities. In 1999, the Council identified Guam as a fishing community. The Secretary of Commerce approved this definition on April 19, 2009 (64 FR 19067). Sustainable management of the Guam coral reef fisheries will allow continued harvest of a resource that is important to fishermen, their families, community networks, markets, and visitors for personal consumption (sustenance), supplemental income, and customary exchange.

3.3.3 Fishery Administration and Enforcement

3.3.3.1 Federal Fishery Management Provisions

Federal fishing regulations for coral reef ecosystem fisheries in EEZ waters around Guam include a prohibition on the use of destructive and non-selective gear methods, vessel identification and gear marking requirements. A SCERFP and logbook reporting is also required for harvesting certain CREMUS defined in federal regulations as PHCRT. Additionally, all commercial fishing is prohibited within the Islands Unit of the Mariana Trench Marine National Monument, while non-commercial fishing and charter boat fishing may be allowed subject to a monument permit and logbook reporting requirements (78 FR 32996, June 3, 2013). Enforcement of federal fishing regulations is conducted by NOAA's Office of Law Enforcement and the U.S. Coast Guard.

In addition to fishing regulations, Federal law also requires the Council-appointed Mariana FEP plan team to prepare an annual report on the performance of all federal fisheries, including Guam coral reef fisheries by July 31 of each year. Federal regulations also require NMFS to specify ACLs and AMs for each stock or stock complex of MUS identified in an FEP, as recommended by the Council, and in consideration of the best available scientific, commercial, and other information about the fishery for that stock or stock complex. Monitoring of catch against a specified ACL and implementation of AMs is conducted by NMFS and the Council.

3.3.3.2 Guam Fishery Management Provisions

In local territorial waters, the Guam Division of Aquatic and Wildlife Resources and the Guam legislature have established numerous laws to conserve coral reef fishery resources, including outright bans and restrictions on certain gear types, and harvest seasons and size limits for certain marine species. In addition, fishing is prohibited in five no-take marine preserves including the Pati Point Preserve, Tumon Bay Preserve, Sasa Bay Preserve, and the Achang Reef Flat Preserve (Wushinich-Mendez and Trappe 2007). Together, these measures help to manage and conserve spiny lobster resources in local territorial waters.

3.3.4 Protected Resources

3.3.4.1 Species Protected under the Endangered Species Act (ESA)

A number of protected species are reported from the waters around the Guam. Table 23 identifies species listed as endangered or threatened under the ESA that are known to occur or could reasonably be expected to occur in marine waters around the Mariana Archipelago, including Guam, which may have the potential to interact with fisheries. Listed species include five whales, five sea turtles, a shark, several species of shallow reef-building corals and a seabird. There is no critical habitat designated for ESA-listed marine species around Guam.

Table 23. Endangered and threatened marine species and seabirds known to occur or reasonably expected to occur in waters around the Mariana Archipelago (Guam).

Endangered and threatened marine species and seabirds known to occur or reasonably expected to occur in waters around the Mariana Archipelago (Guam)			
Common name	**Scientific Name**	**ESA listing status in Guam**	**Occurrence in Guam**
Listed Sea Turtles			
Green sea turtle Haggan Betde	*Chelonia mydas*	Threatened	Most common turtle in the Mariana Archipelago. Foraging and minor nesting confirmed on Guam, Rota, Tinian and Saipan.
Hawksbill sea turtle Haggan Karai	*Eretmochelys imbricata*	Endangered	Small population foraging around Guam and suspected low level around southern islands of CNMI. Low level nesting on Guam.
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Occasional sightings around Guam. Not known to what extent they are present around Guam and CNMI
Olive ridley sea turtle	*Lepidochelys olivacea*	Threatened	Range across Pacific: not confirmed in the Mariana Archipelago
North Pacific Loggerhead sea turtle DPS	*Caretta caretta*	Endangered	No known reports of loggerhead turtles in waters around the Mariana Archipelago.
Listed Marine Mammals			
Blue whale	*Balaenoptera musculus*	Endangered	Extremely rare
Fin whale	*Balaenoptera physalus*	Endangered	Infrequent sightings.

Endangered and threatened marine species and seabirds known to occur or reasonably expected to occur in waters around the Mariana Archipelago (Guam)			
Common name	**Scientific Name**	**ESA listing status in Guam**	**Occurrence in Guam**
Humpback whale	*Megaptera novaeangliae*	Endangered	Infrequent sightings. Winter in the CNMI.
Sei whale	*Balaenoptera borealis*	Endangered	Infrequent sightings.
Sperm whale	*Physeter macrocephalus*	Endangered	Regularly sighted
Listed Sharks			
Scalloped hammerhead shark (Indo-West Pacific DPS)	*Sphyrna lewini*	Threatened	Known to occur.
Listed Shallow Reef-building Corals			
None	*Acropora globiceps*	Threatened	Depths range is 0 to 8 m
None	*A. retusa*	Threatened	Depth range is one to five meters
None	*Seriatopora aculeata*	Threatened	Depth range is three to 40 meters
Listed Sea Birds			
Newell's Shearwater	*Puffinus auricularis newelli*	Threatened	Rare visitor

Source: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm, accessed October 31, 2014.

Applicable ESA Consultation – Guam Coral Reef Fisheries

NMFS has evaluated the potential impact of Mariana FEP coral reef ecosystem fisheries on ESA listed species under NMFS jurisdiction and has determined that coral reef fisheries that operate in accordance with regulations implementing the Mariana FEP are not likely to adversely affect ESA-listed species or their habitats. NMFS documented these determinations in letters of concurrence dated March 7, 2002, and April 29, 2015. The basis for this determination is generally due to the rare occurrence of ESA-listed species in EEZ waters where federal coral reef fisheries are authorized to operate, combined with the low level of coral reef fishing occurring in the EEZ, which makes interactions unlikely to occur.

Newell's shearwater (*Puffinus auricularis newelli*) is listed as threatened under the ESA. This species breeds only in the main Hawaiian Islands, primarily in burrows on steep forested mountain slopes at medium elevation. Newell's shearwater has been sighted in the Marianas, but is considered an uncommon visitor to the archipelago (Drahos 1977; Jouanin 1956). Because its

presence in the Mariana Archipelago is rare, and coral reef fishermen do not interact with seabirds, the fishery has no effect on this seabird.

3.3.4.2 Species Protected under the Marine Mammal Protection Act (MMPA)

Several non-ESA listed whales, dolphins and porpoises occur in waters around Guam and are protected under the MMPA. Table 24 provides a list of non-ESA listed marine mammals known to occur or reasonably expected to occur in waters around the Mariana Archipelago that have the potential to interact with the Guam lobster fishery. A single dugong, listed as endangered, was observed in Cocos Lagoon, Guam in 1975 (Randall et al. 1975). Several sightings were reported in 1985 on the southeastern side of Guam (Eldredge 2003). Since that time, however no reports of dugong sightings have been made.

Table 24. Non ESA-listed marine mammals known to occur or reasonably expected to occur in waters around the Mariana Archipelago (Guam).

Marine mammals known to occur or reasonably expected to occur in waters around the Mariana Archipelago (Guam)	
Common Name	**Scientific Name**
Blainville's beaked whale	*Mesoplodon densirostris*
Bottlenose dolphin	*Tursiops truncatus*
Bryde's whale	*Balaenoptera edeni*
Common dolphin	*Delphinus delphis*
Cuvier's beaked whale	*Ziphius cavirostris*
Dwarf sperm whale	*Kogia sima*
Dugong*	*Dugong dugong*
False killer whale	*Pseudorca crassidens*
Fraser's dolphin	*Lagenodelphis hosei*
Killer whale	*Orcinus orca*
Longman's beaked whale	*Indopacetus pacificus*
Melon-headed whale	*Peponocephala electra*
Minke whale	*Balaenoptera acutorostrata*
Pygmy killer whale	*Feresa attenuata*
Pygmy sperm whale	*Kogia breviceps*
Risso's dolphin	*Grampus griseus*
Rough-toothed dolphin	*Steno bredanensis*
Short-finned pilot whale	*Globicephala macrorhynchus*
Sperm whale	*Physeter macrocephalus*
Spinner dolphin	*Stenella longirostris*
Spotted dolphin	*Stenella attenuata*
Striped dolphin	*Stenella coeruleoalba*

Source: Eldredge 2003, Randall et al. 1975, (Guam DAWR 2009), Council website: http://www.wpcouncil.org

Applicable MMPA Coordination – Guam Coral Reef Fisheries

The MMPA prohibits, with certain exceptions, taking of marine mammals in the U.S., and by persons aboard U.S. flagged vessels (i.e., persons and vessels subject to U.S. jurisdiction). Under section 118 of the MMPA, NMFS must publish, at least annually, a List of Fisheries (LOF) that classifies U.S. commercial fisheries into one of three categories based upon the level of serious injury and mortality of marine mammals that occurs incidental to each fishery. A Category 1 fishery is one with frequent incidental morality and serious injury of marine mammals. A Category 2 fishery is one with occasional incidental morality and serious injury of marine mammals. A Category 3 fishery is one with a remote likelihood or no known incidental morality and serious injury of marine mammals.

On December 29, 2014, (79 FR 77919), NMFS published the final LOF for 2015 which classified all gear types used in Hawaii's coral reef fisheries, including the inshore gillnet, lift net, inshore purse seine net, throw net, cast net, seine net, offshore pen culture, rod and reel, crab trap, fish trap, crab net, inshore handline, bullpen trap, hand pick, and spearfishing as Category 3 fisheries under Section 118 of the MMPA. To date, NMFS has not included any gear type used in Guam's coral reef fisheries in the annual LOF. There is no information available regarding marine mammal interactions in coral reef fisheries in Guam as no interactions have been reported or observed. However, because the gear types used in Guam's coral reef fisheries, such as trolling with rod and reel, gillnets, and spearfishing are similar to those used in Hawaii's coral reef fisheries, it is reasonable to assume that the impacts to marine mammals would be comparable to Hawaii's rod and reel, spearfishing, and gillnet fisheries, and would have a remote likelihood of incidental mortality and serious injury of marine mammals. Participants in Category 3 fisheries are not required to register in the Marine Mammal Authorization Program prior to engaging in commercial fishing.

3.3.4.3 Seabirds of the Mariana Archipelago

The following seabirds are considered residents of Mariana Archipelago: wedge-tailed shearwater (*Puffinus pacificus*), white-tailed tropicbird (*Phaethon lepturus*), red-tailed tropicbird (*Phaethon rubricauda*), masked booby (S*ula dactylatra*), brown booby (*Sula leucogaster*), red-footed booby (*Sula sula*), white tern (*Gygis alba),* sooty tern (*Onychoprion fuscatus;* previously *Sterna fuscata)*, brown noddy (*Anous stolidus*), black noddy (*Anous minutus*), and the great frigatebird (*Fregata minor*). However, According to Wiles (2003), the only resident seabirds on Guam are the brown noddy and the white tern.

The following seabirds in Table 25 have been sighted and are considered visitors (some more common than others) to the Mariana Archipelago; short-tailed shearwater (*Puffinus tenuirostris;* common visitor), Newell's shearwater (*Puffinus auricularis;* rare visitor), Audubon's shearwater (*Puffinus iherminieri*), Leach's storm-petrel (*Oceanodroma leucorhoa*), and the Matsudaira's storm- petrel(*Oceanodroma matsudairae*). Of these, only the Newell's shearwater is listed as threatened under the ESA. There have been no sightings of the endangered short-tailed albatross (*Phoebastria albatrus*) in Guam although Guam is within the range of the largest breeding colony at Torishima, Japan (WPFMC 2009b). There are no known interactions between seabirds

and any of the Mariana Archipelago coral reef fisheries and none are expected to occur (WPFMC 2009b).

Table 25. Seabirds occurring in the Mariana Archipelago (Guam).

Seabirds of the Mariana Archipelago (R= Resident/Breeding; V= Visitor; Vr=rare visitor; Vc= Common visitor)		
	Common name	***Scientific name***
Vr	Newell's shearwater	*Puffinus auricularis newelli (ESA:Threatened)*
Vr	Wedge-tailed shearwater	*Puffinus pacificus*
V	Audubon's shearwater	*Puffinus lherminieri*
Vc	Short-tailed shearwater	*Puffinus tenuirostris (common visitor)*
V	Leach's storm-petrel	*Oceanodroma leucorhoa*
Vr	Matsudaira's storm-petrel	*Oceanodroma matsudairae*
Vr	Red-footed booby	*Sula sula*
Vr	Brown booby	*Sula leucogaster*
V	Masked booby	*Sula dactylatra*
Vr	White-tailed tropicbird	*Phaethon lepturus*
Vr	Red-tailed tropicbird	*Phaethon rubricauda*
Vr	Great frigatebird	*Fregata minor*
Vr	Sooty tern	*Onychoprion fuscatus;* previously *Sterna fuscata*
R	Brown noddy	*Anous stolidus*
V	Black noddy	*Anous minutus*
R	White tern / Common fairy-tern	*Gygis alba*

Source: WPFMC 2009b.

3.4 Hawaii

3.4.1 Target and Non-Target Species

Fishing for CREMUS in the Hawaii is limited to just the main Hawaiian Islands and almost exclusively in nearshore waters 0-3 miles from shore. Here, CREMUS is harvested in both commercial and non-commercial fisheries although reliable catch data is only available for the commercial sector. Under state law, anyone who takes marine life for commercial purposes is required to obtain a State of Hawaii commercial marine license (CML) and submit a catch report (popularly known as a "C3" form) on a monthly basis. Common gear types employed in nearshore coral reef fisheries in the MHI include inshore gillnet, lift net, inshore purse seine net, throw net, cast net, seine net, offshore pen culture, rod and reel, crab trap, fish trap, crab net, inshore handline, bullpen trap, hand pick, and spearfishing. However, catch by CREMUS group by gear type is not available.

Due to the lack of a developed coral reef ecosystem fisheries in federal waters, the Council at its 151st, 154th and 157th meeting directed Council staff to conduct analyses to identify coral reef associated species that may meet the criteria for an "ecosystem component species" designation in accordance with National Standard 1 guidelines of the Magnuson Stevens Act (76 FR 37285,

June 27, 2011). Ecosystem component species are species that are generally not harvested or retained in the EEZ and do not require the specification of reference points such as an ACL, but should be monitored and actively managed in the EEZ if necessary.

3.4.1.1 Summary of MHI CREMUS Catch

Like in other island areas, it is difficult to determine "target" and "non-target" stocks in Hawaii's nearshore coral reef fisheries because resources harvested are highly diverse, with over one hundred species appearing in catch records (Appendix A). As shown in Table 4, there are a total of 17 major CREMUS groups. Sixteen of those CREMUS groups comprise 90 percent of the total CREMUS catches in nearshore waters of the MHI, with other finfish fish, invertebrates, and algae comprising the remaining 10 percent of the overall catch. Therefore, it could be argued that there are no non-targets stocks in coral reef fisheries, except for species that are discarded. In Hawaii, discards levels are unknown but are believed to be limited to fish that are below legal size limits, or taboo due to cultural beliefs. Additionally, people may also avoid certain reef fish that are poisonous or associated with ciguatera (WPFMC 2001).

Based on the average estimated annual CREMUS catch for the most recent three-year period shown in Table 13, catches are dominated by seven families/groups: *Selar crumenophthalmus* or akule or bigeye scad (340,443 lb), Decapterus macarellus or opelu or mackerel scad (296,800 lb), Acanthuridae or surgeonfishes (131,299 lb), Scaridae or parrotfish (80,568 lb), Holocenridae or squirrelfish (64,771 lb), Mullidae or goatfish (60,255 lb), Lutjanidae or snapper (45,086 lb) Catches of other CREMUS families/groups ranged between 2,842 lb (Carcharhinidae or reef sharks) to 27,253 lb (Crustaceans or crabs) with catches of miscellaneous species comprising the group "All Other CREMUS Combined" accounting for 96,635 lb.

In 2013, the commercial price for individual coral reef associated species[6] ranged between $1.26 (bonefish) and $8.70 (algae)[7] per pound, with an average CREMUS price of $3.52/lb over all groupings (http://www.pifsc.noaa.gov/wpacfin/hi/dar/Pages/hi_data_3.php, accessed on Dec. 3, 2014). Multiplying the average 2011-2013 catch of each CREMUS group shown in Table 26 by the 2013 average price of $3.52 equally, the average annual estimated commercial value of the coral reef fisheries of Hawaii for this three-year period was approximately $4,528,860.

Table 26 provides the estimate average annual Hawaii CREMUS catch and average fleet-wide revenue by CREMUS group for the most recent three-year period where data is available, and OFL proxy. Based on current estimates of MSY and OFL proxies shown in Table 13, average annual catches of Hawaii CREMUS groups in 2011-2013 are well below these reference points are at sustainable levels.

[6] Price per lb of "Unknown reef fish" was lower, at $0.97/lb for 39 lb sold.
[7] Both bonefish and algae are included in the all other CREMUS Combined grouping. In 2013, fishermen reported selling 12,344 lb of bonefish and 3,960 lb of 16,921 lb of algae.

Table 26. Average estimated catch and revenue of MHI CREMUS (2011-2013)

No.	MHI CREMUS Groupings	OFL (lb)	Estimated Ave. Catch in lb (2011-2013)[1]	Estimated Value of Ave. Catch Based on 2013 Price of $3.52/lb[2]
1	*Selar crumenophthalmus* – akule or bigeye scad	1,138,000	340,443	$1,198,359
2	*Decapterus macarellus* – opelu or mackerel scad	531,200	296,800	$1,044,736
3	Acanthuridae – surgeonfishes	452,600	131,299	$462,172
4	Carangidae – jacks[1]	183,700	44,714	$157,393
5	Carcharhinidae – reef sharks	12,500	2,842	$10,004
6	Crustaceans – crabs	42,800	27,253	$95,931
7	Holocentridae – squirrelfishes	158,100	64,771	$227,994
8	Kyphosidae – rudderfishes	119,600	*27,511	*$96,839
9	Labridae – wrasses	227,400	*7,706	*$27,125
10	Lethrinidae – emperors	39,400	*6,599	*$23,228
11	Lutjanidae – snappers[2]	356,200	45,086	$158,703
12	Mollusks –octopus	49,500	39,272	$138,237
13	Mugilidae – mullets	24,500	9,761	$34,359
14	Mullidae – goatfishes	197,500	60,255	$212,098
15	Scaridae – parrotfishes	270,600	80,568	$283,599
16	Serranidae – groupers	139,900	*5,093	*$17,927
17	All Other CREMUS Combined	535,600	96,635	$340,155
TOTAL			**1,239,699**	**$4,528,860**

[1] Source: Appendix 3 in Sabater and Kleiber (2014); Appendix 3 in Sabater and Kleiber (2014) does not include catch data for 2013. Therefore, the source of 2013 information is the 2013 ACL monitoring report presented at the 160th Council meeting in June 2014 (WPFMC 2014).
[2] Source: Estimated average price across all CREMUS groupings based on total revenue and landings in 2013 http://www.pifsc.noaa.gov/wpacfin/hi/dar/Pages/hi_data_3.php, accessed on 12/03/2014.
*Average based on 2010-2012 catch since there is no data for 2013 for these species.

3.4.2 Fishery Participants and Fishing Communities

3.4.2.1 Fishery Participants

Currently, harvest of CREMUS in the MHI occurs almost exclusively within nearshore state waters. However, aside from average catch and revenue data, there is no information available on nearshore coral reef fisheries in the MHI in terms of number of participation or level of fishing effort.

3.4.2.2 Fishing Communities

The Magnuson-Stevens Act defines a fishing community as "...a community that is substantially dependent upon or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew, and fish processors that are based in such communities" (16 U.S.C. § 1802(16)). NMFS further specifies in the National Standard guidelines that a fishing community is "...a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries dependent services and industries (for example, boatyards, ice suppliers, tackle shops)". National Standard 8 of the Magnuson-Stevens Act requires that conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and the rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (a) provide for the sustained participation of such communities and (b) to the extent practicable, minimize adverse economic impacts on such communities.

In 2002, the Council identified each of the islands of Kauai, Niihau, Oahu, Maui, Molokai, Lanai and Hawaii as a fishing community for the purposes of assessing the effects of fishery conservation and management measures on fishing communities, providing for the sustained participation of such communities, minimizing adverse economic impacts on such communities, and for other purposes under the Magnuson-Stevens Act. The Secretary of Commerce subsequently approved these definitions on August 5, 2003 (68 FR 46112). Sustainable management of the Hawaii's coral reef fisheries will allow continued harvest of a resource that is important to fishermen, their families, community networks, markets, and visitors for personal consumption (sustenance), and supplemental income.

3.4.3 Fishery Administration and Enforcement

3.4.3.1 Federal Fishery Management Provisions

Federal fishing regulations for coral reef ecosystem fisheries in EEZ waters around the MHI include a prohibition on the use of destructive and non-selective gear methods, vessel identification and gear marking requirements. A SCERFP and logbook reporting is also required for harvesting certain CREMUS defined in federal regulations as PHCRT. Additionally, all commercial fishing is prohibited within the NWHI in accordance with Presidential Proclamation establishing the Papahanaumokuakea Marine National Monument (71 FR 51134, August 29, 2006). Enforcement of federal fishing regulations is conducted by NOAA's Office of Law Enforcement and the U.S. Coast Guard.

In addition to fishing regulations, Federal law also requires the Council-appointed Hawaii FEP plan team to prepare an annual report on the performance of all federal fisheries by July 31 of each year. Federal regulations also require NMFS to specify ACLs and AMs for each stock or stock complex of MUS identified in an FEP, as recommended by the Council, and in consideration of the best available scientific, commercial, and other information about the fishery for that stock or stock complex. Monitoring of catch against a specified ACL and implementation of AMs is conducted by NMFS and the Council.

3.4.3.2 Hawaii Fishery Management Provisions

In local state waters, The Hawaii Department of Land and Natural Resources, Division of Aqutic Resources have established numerous laws to conserve coral reef fishery resources, including restrictions on certain gear types, harvest seasons and size limits for certain marine species. In addition, fishing is also regulated or prohibited in numerous locations throughout the state, including marine life conservation districts, fish replenishment areas, natural area reserves (Wushinich-Mendez and Trappe 2007). Together, these measures help to manage and conserve spiny lobster resources in local state waters.

3.4.4 Protected Resources

3.4.4.1 Species Protected under the Endangered Species Act (ESA)

A number of protected species are documented as occurring in the waters around the Hawaiian Islands. Table 27 lists endangered or threatened species occurring in the waters around Hawaii. They include five whales, the Hawaiian monk seal, five listed sea turtles, and three seabirds. Although there is currently no critical habitat designated for ESA-listed marine species around the main Hawaiian Islands, NMFS has proposed to revise designated critical habitat for endangered Hawaiian monk seals to include areas in the MHI (76 FR 32026, June 2, 2011). However, NMFS has not yet made a determination on whether to designate critical habitat in the MHI.

Table 27. Endangered and threatened marine species and seabirds occurring in the waters of the MHI.

Endangered and threatened marine species and seabirds known to occur or reasonably expected to occur in waters of the Hawaiian Archipelago			
Common name	**Scientific Name**	**ESA listing status in Hawaii**	**Occurrence in Hawaii**
Listed Sea Turtles			
Green sea turtle	*Chelonia mydas*	Threatened	Most common turtle in the Hawaiian Islands. Most nesting occurs in the northwestern Hawaiian Islands. Foraging and haulout in the MHI.
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	Small population foraging around Hawaii and low level nesting on Maui and Hawaii Islands.
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Not common in Hawaii.
Olive ridley sea turtle	*Lepidochelys olivacea*	Threatened	Range across Pacific:

Endangered and threatened marine species and seabirds known to occur or reasonably expected to occur in waters of the Hawaiian Archipelago			
Common name	**Scientific Name**	**ESA listing status in Hawaii**	**Occurrence in Hawaii**
North Pacific loggerhead sea turtle DPS	*Caretta caretta*	Endangered	Not common in Hawaii.
Listed Marine Mammals			
Hawaiian Monk seal	*Neomonachus schauinslandi*	Endangered	Endemic tropical seal. Occurs throughout the archipelago. Overall population in decline; MHI population increasing
Blue whale	*Balaenoptera musculus*	Endangered	No sightings or strandings reported in Hawaii but acoustically recorded off of Oahu and Midway Atoll.
Fin whale	*Balaenoptera physalus*	Endangered	Infrequent sightings in Hawaii waters.
Humpback whale	*Megaptera novaeangliae*	Endangered	Migrate through the archipelago and breed during the winter. Est. 6,000-10,000 individuals.
Sei whale	*Balaenoptera borealis*	Endangered	Worldwide distribution. Primarily found in cold temperate to subpolar latitudes. Rare in Hawaii.
Sperm whale	*Physeter macrocephalus*	Endangered	Found in tropical to polar waters worldwide, most abundant cetaceans in the region. Sighted off the NWHI and the MHI.
MHI insular false killer whale DPS	*Pseudorca crassidens*	Endangered	Found in waters within 140 km (60 nm) of the MHI.
Listed Sea Birds			
Newell's Shearwater	*Puffinus auricularis newelli*	Threatened	Rare. Breeds only in colonies on the MHI where it is threatened by predators and urban development.
Hawaiian petrel	*Pterodroma phaeopygia*	Endangered	Rare.
Short-tailed Albatross	*Phoebastria albatrus*	Endangered	Nest in small numbers on Midway in the NWHI.

Source: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm, accessed October 31, 2014.

Applicable ESA Consultations – Hawaii Coral Reef Fisheries

NMFS has evaluated the potential impact of Hawaii FEP coral reef ecosystem fisheries on ESA listed species under NMFS jurisdiction and has determined that coral reef fisheries that operate in accordance with regulations implementing the Hawaii FEP are not likely to adversely affect ESA-listed species or their habitats. NMFS documented these determinations in letters of concurrence dated March 7, 2002, and December 5, 2013. The basis for this determination is generally due to the rare occurrence of ESA-listed species in EEZ waters where federal coral reef fisheries are authorized to operate, combined with the low level of coral reef fishing occurring in the EEZ, which makes interactions unlikely to occur.

On June 2, 2011 (76 FR 32026), NMFS published a proposed rule to designate areas in the main Hawaiian Islands (MHI) as monk seal critical habitat. Specific areas proposed include terrestrial and marine habitats from 5 m inland from the shoreline extending seaward to the 500 m depth contour around Kaula Island, Niihau, Kauai, Oahu, Maui Nui (including Kahoolawe, Lanai, Maui and Molokai) and Hawaii Island. The final determinations on whether to designate monk seal critical habitat in the MHI have not been made. Should NMFS designate critical habitat for this species, or any other ESA-listed species in the future, NMFS will initiate consultation in accordance with Section 7 of the ESA to ensure that Hawaii FEP fisheries, including the coral reef ecosystem fisheries in the MHI, would not result in the destruction or adverse modification of critical habitat.

3.4.4.2 Species Protected under the Marine Mammal Protection Act (MMPA)

Several non-ESA listed whales, dolphins and porpoises, occur in waters around Hawaii and are protected under the MMPA. Table 28, provides a list of non-ESA marine mammals known to occur or reasonably expected to occur around the Hawaiian Archipelago that have the potential to interact with coral reef fisheries in federal waters around the MHI.

Table 28. Non-ESA-listed marine mammals occurring in the MHI.

Non-ESA-listed marine mammals known to occur or reasonably expected to occur in waters around the MHI	
Common Name	**Scientific Name**
Blainville's beaked whale	*Mesoplodon densirostris*
Bottlenose dolphin	*Tursiops truncatus*
Bryde's whale	*Balaenoptera edeni*
Common dolphin	*Delphinus delphis*
Cuvier's beaked whale	*Ziphius cavirostris*
Dall's porpoise	*Phocoenoides dalli*
Dwarf sperm whale	*Kogia sima*
False killer whale	*Pseudorca crassidens*
Fraser's dolphin	*Lagenodelphis hosei*
Killer whale	*Orcinus orca*
Longman's beaked whale	*Indopacetus pacificus*
Melon-headed whale	*Peponocephala electra*

Non-ESA-listed marine mammals known to occur or reasonably expected to occur in waters around the MHI	
Common Name	**Scientific Name**
Minke whale	*Balaenoptera acutorostrata*
Pantropical spotted dolphin	*Stenella attenuata*
Pygmy killer whale	*Feresa attenuata*
Pygmy sperm whale	*Kogia breviceps*
Risso's dolphin	*Grampus griseus*
Rough-toothed dolphin	*Steno bredanensis*
Short-finned pilot whale	*Globicephala macrorhynchus*
Spinner dolphin	*Stenella longirostris*
Spotted dolphin	*Stenella attenuata*
Striped dolphin	*Stenella coeruleoalba*

Source: Council website: http://www.wpcouncil.org

Applicable MMPA Coordination – Hawaii Coral Reef Ecosystem Fisheries

The MMPA prohibits, with certain exceptions, taking of marine mammals in the U.S., and by persons aboard U.S. flagged vessels (i.e., persons and vessels subject to U.S. jurisdiction). Under section 118 of the MMPA, NMFS must publish, at least annually, a List of Fisheries (LOF) that classifies U.S. commercial fisheries into one of three categories based upon the level of serious injury and mortality of marine mammals that occurs incidental to each fishery. A Category 1 fishery is one with frequent incidental morality and serious injury of marine mammals. A Category 2 fishery is one with occasional incidental morality and serious injury of marine mammals. A Category 3 fishery is one with a remote likelihood or no known incidental morality and serious injury of marine mammals.

On December 29, 2014, (79 FR 77919), NMFS published the final LOF for 2015 which classified all gear types used in Hawaii's coral reef fisheries, including the inshore gillnet, lift net, inshore purse seine net, throw net, cast net, seine net, offshore pen culture, rod and reel, crab trap, fish trap, crab net, inshore handline, bullpen trap, hand pick, and spearfishing as Category 3 fisheries under Section 118 of the MMPA. Participants in Category 3 fisheries are not required to register in the Marine Mammal Authorization Program prior to engaging in commercial fishing. The proposed action does not change the conduct of coral reef fisheries in any way and therefore will not introduce impacts not previously considered in prior MMPA determinations.

3.4.4.3 Seabirds of the Hawaiian Archipelago

Seabirds found on and around Hawaii that could potentially interact with fisheries are listed in Table 29. The short-tailed albatross, which is listed as endangered under the ESA, is a migratory seabird that has nested in the NWHI and could be present in the waters of the Hawaii Archipelago. Other listed seabirds found in the region are the endangered Hawaiian petrel (*Pterodroma phaeopygia)* and the threatened Newell's shearwater (*Puffinus auricularis newelli*). Non-listed seabirds known to be present in Hawaii include the black-footed albatross

(*Phoebastria nigripes*); Laysan albatross (*P. immutabilis*); wedge-tailed (*Puffinus pacificus*), Audubon's (*P. griseus*), short-tailed (*P. tenuirostris*) and Christmas (*P. nativitatis*) shearwaters, as well as the masked (*Sula dactylatra*), brown (*S. leucogaster*), and red-footed *(S. sula*) boobies (or gannets), and a number of petrels and terns, frigate birds, and tropicbirds). Seabirds forage in both State and federal waters, but are not known to and are unlikely to interact with the Hawaii coral reef fisheries. There have been no reports of adverse interactions between the Hawaii coral reef fisheries and migratory seabirds.

Table 29. Seabirds occurring in the MHI.

Seabirds of the Hawaiian Archipelago (R= Resident/Breeding; V= Visitor; Vr=rare visitor; Vc= Common visitor)		
	Common name	***Scientific name***
R	Hawaiian petrel	*Pterodroma phaeopygia (ESA: Endangered)*
R	Newell's shearwater	*Puffinus auricularis newelli (ESA:Threatened)*
R	Short-tailed albatross	*Phoebastria albatrus (ESA: Endangered)*
R	Black-footed albatross	*Phoebastria nigripes*
R	Laysan albatross	*Phoebastria immutabilis*
R	Wedge-tailed shearwater	*Puffinus pacificus*
V	Audubon's shearwater	*Puffinus lherminieri*
Vc	Short-tailed shearwater	*Puffinus tenuirostris (common visitor)*
R	Christmas shearwater	*Puffinus nativitatis*
V	Leach's storm-petrel	*Oceanodroma leucorhoa*
V	Matsudaira's storm-petrel	*Oceanodroma matsudairae*
R	Red-footed booby	*Sula sula*
R	Brown booby	*Sula leucogaster*
R	Masked booby	*Sula dactylatra*
R	White-tailed tropicbird	*Phaethon lepturus*
R	Red-tailed tropicbird	*Phaethon rubricauda*
R	Great frigatebird	*Fregata minor*
R	Sooty tern	*Onychoprion fuscatus; previously Sterna fuscata*
R	Brown noddy	*Anous stolidus*
R	Black noddy	*Anous minutus*
R	White tern / Common fairy-tern	*Gygis alba*

Source: WPFMC 2009c

4 Potential Impacts of the Alternatives

This section describes the potential impacts of the proposed ACL and AM specifications on the elements of the affected environment described in Section 3.

4.1 American Samoa

4.1.1 Potential Impacts to Target and Non-Target Stocks

4.1.1.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for any American Samoa CREMUS for fishing year 2015. Under Alternative 1, ACLs would not be specified for CREMUS in American Samoa and AMs would not be necessary. However, NMFS and the Council would continue to monitor catches based on all available sources of information. As shown in Table 10, the average catch 2011-2013 value for each CREMUS group is well below the group's estimated MSY and OFL proxy. During fishing years 2011 through 2013, the fishery for each CREMUS group would remained open year round. Without ACLs and AMs, the annual catch of each CREMUS group in 2015 through 2018 is expected be similar to the average harvest from 2011-2013, and would be sustainable. Therefore, under this alternative, the lack of an ACL or AMs in fishing year 2015 through 2018 is not likely to result in overfishing of any American Samoa CREMUS in any year.

As noted in Section 3.1.1, it is difficult to determine "target" and "non-target" stocks in American Samoa's territorial coral reef fisheries because resources harvested in these fisheries are highly diverse, with approximately 300 species appearing in catch records. While discards levels are unknown, given the low level of catch in American Samoa coral reef fisheries and that most of the resources caught are retained and recorded in catch records, fishery scientists and managers have not identified problems with bycatch or non-target species. Ongoing fisheries monitoring by the Council's FEP plan team will help fishery scientists and managers to detect any problems if they occur, and address them in future management measures, as needed. For these reasons, even without ACL or AM management, the expected impacts to target and non-target stocks would be that harvests of each American Samoa CREMUS group would remain well the stocks' MSY and OFL reference points, and the fishery would continue to be sustainably managed in the upcoming years.

4.1.1.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each American Samoa CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 10 for the specific ACL values for each CREMUS group associated with Alternative 2. Note that under this alternative, there would be no individual ACL for Kyphosidae (rudderfish), Labridae (Wrasses), Mullidae (goatfishes), or Siganidae (rabbitfish). This is because in the prior species level aggregation process described in Section 2.2.1 – Determining the Level of Species Aggregation, these species groups did not comprise the top 90% of the total coral reef fish catch over the long-term catch time series. Therefore, under this alternative, these species would remain in the category "All Other

CREMUS" combined as they were in fishing year 2014 and in previous years. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), no ACL specification under Alternative 2 is associated with greater than a 35% probability of overfishing should the entire ACL be caught (see Table 10).

For American Samoa humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), NMFS proposes to specify the 2015-2018 ACL at 1,743 lb and 235 lb, respectively. This level of catch is equal to 5% of each stock's estimated biomass (See Table 5) and is identical to the ACLs NMFS specified in 2014 (79 FR 4276, January 27, 2014). As previously mentioned above, MSY, OFL and probability of overfishing projections for these species are not available.

Under this alternative, NMFS and the Council would continue to monitor CREMUS catches based on all available sources of information. However, because catch statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during the fishing year whether the ACL for any CREMUS group might be reached, and cannot prevent any ACL from being exceeded. Therefore, fishers would be able to fish for CREMUS throughout the fishing year in the same manner as under Alternative 1 and as recently occurred in 2011-2013.

Based on recent catch data shown in Table 10, the annual level of catch for each American Samoa CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and would not exceed any group's ACL proposed under Alternative 2, or any group's estimated OFL proxy, where known. However, six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded.

If the Council determines an ACL is exceeded, the Council as an AM would take action in accordance with 50 CFR 600.310(g) to correct the operational issue that caused the ACL overage. This may include a recommendation that NMFS reduce the ACL for that CREMUS group in the subsequent fishing year by the amount of the overage, or other measures, as appropriate. However, the Council would not likely recommend a reduced ACL in the subsequent fishing year. This is because the ACLs under Alternative 2 were developed using a different method than is proposed under the preferred alternative (Alternative 3), and without knowledge of the estimate of MSY and OFL. Therefore, the ACLs under this alternative are not based on the best scientific information available as described in Section 2.2.2 – Estimation of MSY and OFL, and are considered overly conservative but are included in order to evaluate the potential impacts of other alternatives compared with the status quo baseline.

If the Council does recommend a reduced ACL, the reduced ACL is not likely to result in changes in the conduct of the fishery, including gear types used, areas fished, or level of catch. This is because in-season AMs to prevent the ACL from being exceeded are not possible in any fishing year. Therefore, even with a reduced ACL in subsequent fishing years, fishers would still be able to fish for American Samoa CREMUS throughout the fishing year in the same manner as under Alternative 1. Therefore, compared to Alternative 1, Alternative 2 is not likely to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch.

Furthermore, the fishery is expected to continue to fish in much the same manner as it has in recent years and the fishery is not known to be having a, or have large beneficial or adverse effects on target or non-target stocks.

4.1.1.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each American Samoa CREMUS group in 2015-2018 as shown for Alternative 3 in Table 10. This level of catch is five percent lower than each CREMUS group's ABC. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), no ACL under Alternative 3 is associated with greater than a 35 percent probability of overfishing should the entire ACL be caught (see Table 10).

For American Samoa humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), NMFS proposes to specify the 2015-2018 ACL identical to the ACL under the status quo/NEPA baseline (Alternative 2). This level of catch is equal to 5% of each stock's estimated biomass (See Table 5) and is identical to the ACLs NMFS specified in 2014 (79 FR 4276, January 27, 2014). As previously mentioned above, MSY, OFL and probability of overfishing projections for these species are not available.

Under this alternative, NMFS and the Council would continue to monitor CREMUS catches based on all available sources of information. However, because catch statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during the fishing year whether the ACL for any CREMUS group might be reached, and cannot prevent any ACL from being exceeded. Therefore, fishers would be able to fish for CREMUS throughout the fishing year in the same manner as under Alternative 2 (status quo) and as recently occurred in 2011-2013.

Based on recent catch data shown in Table 10, the annual level of catch for each American Samoa CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and is not expected to exceed any group's ACL proposed under Alternative 2, or any group's estimated OFL proxy, where known. Therefore, because there would not be a closure of the fishery under Alternative 3 in any of the next 4 years, the fishery would not change and impacts to target and non-target stocks would be identical to the impacts under Alternative 2 (status quo), which is identical to the impacts under Alternative 1 (no action).

Six months after the end of each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. Under this alternative, if the Council determines the most recent three-year average catch for any American Samoa CREMUS Group exceeded the proposed ACL in any fishing year, NMFS would reduce the ACL by the amount of the overage in the subsequent years. See Section 1.3- Proposed Action for detailed information on how this AM would be triggered. The impacts of a reduced ACL to target and non-target stocks are described in Alternative 4 below.

4.1.1.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each American Samoa CREMUS group in 2015-2018 that is lower than the preferred alternative (Alternative 3) as shown for Alternative 4 in Table 10. NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment in the amount of the overage is necessary in a subsequent year. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), the ACL for each CREMUS group under Alternative 4 are associated with probabilities of overfishing ranging from 30 percent down to five percent (see Table 10). In other words, the lower the ACL, the lower the associated risk of overfishing.

Under Alternative 4, the American Samoa CREMUS fishery is expected to continue to perform as it has in recent years and catches in 2015-2018 are expected to be similar to the average harvest from 2011-2013. As shown in Table 10, average harvest from 2011-2013 did not exceed the lowest possible ACL for any group or that group's estimated OFL proxy, where known. Therefore, even if an ACL lower that what is proposed in Alternative 3 is selected, fishery would not change and impacts to target and non-target stocks would be the same as the impacts under Alternatives 1-3.

Under all alternatives considered, if an ACL is exceeded more than once in a four-year period, the Council is required to re-evaluate the ACL process, and adjust the system for setting ACLs, as necessary, to improve its performance and effectiveness. Additionally, if NMFS determines overfishing is occurring, NMFS would immediately notify the Council to take action to end overfishing in the fishery.

4.1.2 Potential Impacts to Fishery Participants and Fishing Communities

In 2013, the commercial price for individual coral reef associated species in American Samoa ranged between $2.63 and $4.83 per pound, with an average overall CREMUS price of $3.10/lb. Multiplying the average 2011-2013 catch of each CREMUS group shown in Table 14 by the 2013 average price of $3.10 equally, the average annual estimated commercial value of the coral reef fisheries of American Samoa for this three-year period was approximately $195,570. The number of participants in American Samoa coral reef fisheries is unknown.

4.1.2.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for any American Samoa CREMUS for fishing year 2015. Under the no-action alternative, ACLs would not be specified for CREMUS in American Samoa and AMs would not be necessary. Therefore, each year, fishing would continue throughout the entire fishing year. If there were no ACLs and AMs, CREMUS catch in 2015-2018 would be similar to the average catch of all American Samoa CREMUS in 2011-2013, which was 62,406 lb. Using the 2013 average price per pound of $3.10, the expected annual fleet-wide revenue during 2015-2018 under Alternative 1 would be approximately $195,570.

Coral reef fisheries in American Samoa provide fresh fish for sustenance, customary exchange and other gifts, and allows some resources to enter local markets. This provides positive social and economic benefits to fishermen, buyers and the American Samoa fishing community.

4.1.2.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each American Samoa CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 10 for the specific ACL values for each CREMUS group associated with Alternative 2.

Based on recent catch data shown in Table 10, the annual level of catch for each CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and would not exceed the group's ACL proposed under Alternative 2, or the group's estimated OFL proxy where known. During each of these years, the fishery remained opened throughout the year.

Because there would not be in-season closure of the fishery under Alternative 2 in any of the next 4 years, the fishery would not change and fishers would be able to fish for CREMUS throughout each fishing year in the same manner as under Alternative 1, and as recently occurred in 2011-2013. Therefore, in each fishing year, the total annual catch of all CREMUS groups combined is expected be similar to the average catch of all American Samoa CREMUS combined in 2011-2013, which was 62,406 lb. Using the 2013 average price per pound of $3.10, the expected annual fleet-wide revenue during 2015-2018 would be same as under Alternative 1 or approximately $195,570.

Six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. If the Council determined an ACL was exceeded, it could recommend NMFS reduce the ACL for that CREMUS group in the subsequent fishing years. However, even with a reduced ACL, the expected impacts to fishery participants and the American Samoa fishing community under Alternative 2 would be the same as the impacts described in Alternative 1, because without in-season closures, fishers would be able to fish for American Samoa CREMUS throughout the fishing year, even with a lower ACL.

4.1.2.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each American Samoa CREMUS group in 2015-2018 as shown for Alternative 3 in Table 10, which are higher than the ACLs under Alternatives 2 and 4. Therefore, the potential revenue that fishery participants could earn under this alternative is also higher than the potential revenue under Alternatives 2 and 4.

However, based on recent catch data shown in Table 10, the annual level of catch for each CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013 and would not reach the group's ACL proposed under this alternative, or the group's estimated OFL proxy where known. During each of these years, the fishery remained opened throughout the year.

Because there would not be in-season closure of the fishery under Alternative 3 in any of the next 4 years, the fishery would not change and fishers would be able to fish for CREMUS throughout each fishing year in the same manner as under Alternatives 1 and 2, and as recently occurred in 2011-2013. Therefore, in each fishing year, the total annual catch of all CREMUS groups combined is expected be similar to the average catch of all American Samoa CREMUS combined in 2011-2013, which was 62,406 lb. Using the 2013 average price per pound of $3.10, the expected annual fleet-wide revenue during 2015-2018 would be same as under Alternatives 1 and 2 or approximately $195,570.

Six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. If the Council determined an ACL was exceeded, NMFS would reduce the ACL for that CREMUS group in the subsequent fishing years by the amount of the overage. However, even with a reduced ACL, the expected impacts to fishery participants and the American Samoa fishing community under Alternative 3 would be the same as the impacts described in Alternatives 1 and 2, because without in-season closures, fishers would be able to fish for CREMUS throughout the fishing year, even with a lower ACL.

4.1.2.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each American Samoa CREMUS group in 2015-2018 that is lower than the preferred alternative (Alternative 3) as shown for Alternative 4 in Table 10. NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment in the amount of the overage is necessary in a subsequent year.

Because the ACLs under Alternative 4 are lower than the ACLs proposed under Alternative 3, the potential revenue is also lower. However, the ACLs for most CREMUS groups are higher than the ACLs under Alternative 2. Therefore, the potential revenue under Alternative 4 are higher than under Alternative 2. However, based on recent catch data shown in Table 11, the annual level of catch for each American Samoa CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and is not expected to reach the lowest possible ACL. Therefore, even if a lower ACL is selected, expected impacts to fishery participants and the American Samoa fishing community under Alternative 4 would be the same as the impacts described in Alternatives 1, 2, and 3.

Because none of the alternatives considered would result in changes in the conduct of the fishery including gear types used, areas fished, species targeted, level of catch or effort, none of the alternatives considered would affect the safety of fishermen at sea.

4.1.3 Potential Impacts to Fishery Administration and Enforcement

Under all alternatives considered, NMFS and the Council would continue to monitor catches of American Samoa CREMUS based on all available sources of information, and federal regulations would continue to require the Council-appointed FEP plan team to prepare an annual

report on the performance of coral reef fisheries, including the commercial and non-commercial fishing sector by July 31 of each year. Additionally, all other regulations implemented by other federal agencies and the Territory of American Samoa would continue to apply fishing vessels operating in the U.S. EEZ.

While Alternatives 2, 3 (Preferred), and 4 would implement ACLs and a post-season accounting of the catch relative to the ACL, this would not result in commitment of additional resources or increased need for fishery enforcement as monitoring of catch is required under all alternatives, including the no action alternative. Additional fishery enforcement would not be needed for any alternative because the Council and NMFS are not proposing to implement a fishery closure.

4.1.4 Potential Impacts to Protected Resources

None of the alternatives considered would modify operations of American Samoa coral reef fisheries in any way that would be expected to affect populations of endangered or threatened species or critical habitat in any manner not previously considered in previous ESA or MMPA consultations described in Section 3.1.4.

While Alternatives 2, 3 (Preferred), and 4 would implement ACLs and a possible reduction to the ACL in a subsequent fishing year, if necessary, fishery managers do not have the ability to conduct in-season tracking of catch towards an ACL, and so there is no in-season closure being proposed. Therefore, under Alternatives 2, 3 and 4, participants in American Samoa coral reef fisheries would continue to fish as they would under the Alternative 1, which does not include the specification of ACLs and AMs.

Because no alternative would result in a change to the way in which coral reef ecosystem fishing is conducted in federal waters, none of the alternatives would result in a change to current impacts on protected species, which have been evaluated in accordance with provisions of the ESA and MMPA and other applicable laws. None of the alternatives would result in large beneficial or adverse impacts protected species described in Section 3.1.4.

4.2 CNMI

4.2.1 Potential Impacts to Target and Non-Target Stocks

4.2.1.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for any CNMI CREMUS for fishing year 2015. Under Alternative 1, ACLs would not be specified for CREMUS in the CNMI and AMs would not be necessary. However, NMFS and the Council would continue to monitor catches based on all available sources of information. As shown in Table 11, the average catch 2011-2013 value for each CREMUS group is well below the group's estimated MSY and OFL proxy. During fishing years 2011 through 2013, the fishery for each CREMUS group would remained open year round. Without ACLs and AMs, the annual catch of each CREMUS group in 2015 through 2018 is expected be similar to the average harvest from 2011-2013, and would be

sustainable. Therefore, under this alternative, the lack of an ACL or AMs in fishing year 2015 through 2018 is not likely to result in overfishing of any CNMI CREMUS in any year.

As noted in Section 3.2.1, it is difficult to determine "target" and "non-target" stocks in CNMI's territorial coral reef fisheries because resources harvested in these fisheries are highly diverse, with over a hundred species appearing in catch records. While discards levels are unknown, given the low level of catch in CNMI coral reef fisheries and that most of the resources caught are retained and recorded in catch records, fishery scientists and managers have not identified problems with bycatch or non-target species. Ongoing fisheries monitoring by the Council's FEP plan team will help fishery scientists and managers to detect any problems if they occur, and address them in future management measures, as needed. For these reasons, even without ACL or AM management, the expected impacts to target and non-target stocks would be that harvests of each CNMI CREMUS group would remain well the stocks' MSY and OFL reference points, and the fishery would continue to be sustainably managed in the upcoming years.

4.2.1.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each CNMI CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 11 for the specific ACL values for each CREMUS group associated with Alternative 2. Note that under this alternative, there would be no individual ACL for Crustacean (crabs), Holocentidae (squirrelfish), Kyphosidae (rudderfish), or Labridae (Wrasses). This is because in the prior species level aggregation process described in Section 2.2.1 – Determining the Level of Species Aggregation, these species groups did not comprise the top 90% of the total coral reef fish catch over the long-term catch time series. Therefore, under this alternative, these species would remain in the category "All Other CREMUS" combined as they were in fishing year 2014 and in previous years. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), no ACL specification under Alternative 2 is associated with greater than a 40 percent probability of overfishing should the entire ACL be caught (see Table 11).

For CNMI humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), NMFS proposes to specify the 2015-2018 ACL at 2,009 lb and 797 lb, respectively. For both species, the ACL is equal to 5% of each stock's estimated biomass (See Table 5) and is identical to the ACLs NMFS specified in 2014 (79 FR 4276, January 27, 2014). For the bumphead wrasse, 2015-2018 ACL would be shared between the CNMI and Guam as was done in 2014. As previously mentioned above, MSY, OFL and probability of overfishing projections for these species are not available.

Under this alternative, NMFS and the Council would continue to monitor CREMUS catches based on all available sources of information. However, because catch statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during the fishing year whether the ACL for any CREMUS group might be reached, and cannot prevent any ACL from being exceeded. Therefore, fishers would be able to fish for CREMUS throughout the fishing year in the same manner as under Alternative 1 and as recently occurred in 2011-2013.

Based on recent catch data shown in Table 11, the annual level of catch for each CNMI CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and would not exceed any group's ACL proposed under Alternative 2, or any group's estimated OFL proxy, where known. However, six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded.

If the Council determines an ACL is exceeded, the Council as an AM would take action in accordance with 50 CFR 600.310(g) to correct the operational issue that caused the ACL overage. This may include a recommendation that NMFS reduce the ACL for that CREMUS group in the subsequent fishing year by the amount of the overage, or other measures, as appropriate. However, the Council would not likely recommend a reduced ACL in the subsequent fishing year. This is because the ACLs under Alternative 2 were developed using a different method than is proposed under the preferred alternative (Alternative 3), and without knowledge of the estimate of MSY and OFL. Therefore, the ACLs under this alternative are not based on the best scientific information available as described in Section 2.2.2 – Estimation of MSY and OFL, and are considered overly conservative but are included in order to evaluate the potential impacts of other alternatives compared with the status quo baseline.

If the Council does recommend a reduced ACL, the reduced ACL is not likely to result in changes in the conduct of the fishery, including gear types used, areas fished, or level of catch. This is because in-season AMs to prevent the ACL from being exceeded are not possible in any fishing year. Therefore, even with a reduced ACL in subsequent fishing years, fishers would still be able to fish for CNMI CREMUS throughout the fishing year in the same manner as under Alternative 1. Therefore, compared to Alternative 1, Alternative 2 is not likely to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch. Furthermore, the fishery is expected to continue to fish in much the same manner as it has in recent years and the fishery is not known to be having a, or have large beneficial or adverse effects on target or non-target stocks.

4.2.1.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each CNMI CREMUS group in 2015-2018 as shown in Table 11. This level of catch is five percent lower than each CREMUS group's ABC. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), no ACL under Alternative 3 is associated with greater than a 35% percent probability of overfishing should the entire ACL be caught (see Table 11).

For CNMI humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), NMFS would specify the ACL at the same level proposed under Alternative 2, which is 2,009 lb and 797 lb, respectively. Like in Alternative 2, the ACL for bumphead wrasse would be shared between the CNMI and Guam in 2015-2018. As previously mentioned above, MSY, OFL and probability of overfishing projections for these species are not available.

Under this alternative, NMFS and the Council would continue to monitor CNMI CREMUS catches based on all available sources of information. However, because catch statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during the fishing year whether the ACL for any CREMUS group might be reached, and cannot prevent any ACL from being exceeded. Therefore, fishers would be able to fish for CREMUS throughout the fishing year in the same manner as under Alternative 2 (status quo) and as recently occurred in 2011-2013.

Based on recent catch data shown in Table 11, the annual level of catch for each CNMI CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and is not expected to exceed any group's ACL proposed under Alternative 2, or any group's estimated OFL proxy, where known. Therefore, because there would not be a closure of the fishery under Alternative 3 in any of the next 4 years, the fishery would not change and impacts to target and non-target stocks would be identical to the impacts under Alternative 2 (status quo), which is identical to the impacts under Alternative 1 (no action).

Six months after the end of each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. Under this alternative, if the Council determines the most recent three-year average catch for any CNMI CREMUS Group exceeded the proposed ACL in any fishing year, NMFS would reduce the ACL by the amount of the overage in the subsequent years. See Section 1.3- Proposed Action for detailed information on how this AM would be triggered. The impacts of a reduced ACL to target and non-target stocks are described in Alternative 4 below.

4.2.1.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each CNMI CREMUS group in 2015-2018 that is lower than the preferred alternative (Alternative 3) as shown for Alternative 4 in Table 11. NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment in the amount of the overage is necessary in a subsequent year. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), the ACL for each CREMUS group under Alternative 4 are associated with probabilities of overfishing ranging from 30 percent down to five percent (see Table 11). In other words, the lower the ACL, the lower the associated risk of overfishing.

Under Alternative 4, the CNMI CREMUS fishery is expected to continue to perform as it has in recent years and catches in 2015-2018 are expected to be similar to the average harvest from 2011-2013. As shown in Table 11, average harvest from 2011-2013 did not exceed the lowest possible ACL for any group or that group's estimated OFL proxy, where known. Therefore, even if an ACL lower that what is proposed in Alternative 3 is selected, fishery would not change and impacts to target and non-target stocks would be the same as the impacts under Alternatives 1-3.

Under all alternatives considered, if an ACL is exceeded more than once in a four-year period, the Council is required to re-evaluate the ACL process, and adjust the system for setting ACLs,

as necessary, to improve its performance and effectiveness. Additionally, if NMFS determines overfishing is occurring, NMFS would immediately notify the Council to take action to end overfishing in the fishery.

4.2.2 Potential Impacts to Fishery Participants and Fishing Communities

In 2013, the commercial price for individual coral reef associated species in the CNMI ranged between $2.43 and $6.90 per pound, with an average CREMUS price of $3.15/lb. Multiplying the average 2011-2013 catch of each CREMUS group shown in Table 18 by the 2013 average price of $3.15 equally, the average annual estimated commercial value of the coral reef fisheries of the CNMI for this three-year period was approximately $287,737. The number of participants in coral reef fisheries in the CNMI is unknown.

4.2.2.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for any CNMI CREMUS for fishing year 2015. Under the no-action alternative, ACLs would not be specified for CREMUS in the CNMI and AMs would not be necessary. Therefore, each year, fishing would continue throughout the entire fishing year. If there were no ACLs and AMs, CREMUS catch in 2015-2018 would be similar to the average catch of all CNMI CREMUS in 2011-2013, which was 85,822 lb. Using the 2013 average price per pound of $3.15, the expected annual fleet-wide revenue during 2015-2018 under Alternative 1 would be approximately $287,737.

Coral reef fisheries in the CNMI provide fresh fish for sustenance, customary exchange and other gifts, and allows some resources to enter local markets. This provides positive social and economic benefits to fishermen, buyers and the American Samoa fishing community.

4.2.2.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each CNMI CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 11 for the specific ACL values for each CREMUS group associated with Alternative 2.

Based on recent catch data shown in Table 11, the annual level of catch for each CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and would not exceed the group's ACL proposed under Alternative 2, or the group's estimated OFL proxy where known. During each of these years, the fishery remained opened throughout the year.

Because there would not be in-season closure of the fishery under Alternative 2 in any of the next 4 years, the fishery would not change and fishers would be able to fish for CREMUS throughout each fishing year in the same manner as under Alternative 1, and as recently occurred in 2011-2013. Therefore, in each fishing year, the total annual catch of all CREMUS groups combined is expected be similar to the average catch of all CNMI CREMUS combined in 2011-2013, which was 85,822 lb. Using the 2013 average price per pound of $3.15, the expected

annual fleet-wide revenue during 2015-2018 would be same as under Alternative 1 or approximately $287,737.

Six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. If the Council determined an ACL was exceeded, it could recommend NMFS reduce the ACL for that CREMUS group in the subsequent fishing years. However, even with a reduced ACL, the expected impacts to fishery participants and the CNMI fishing community under Alternative 2 would be the same as the impacts described in Alternative 1, because without in-season closures, fishers would be able to fish for CNMI CREMUS throughout the fishing year, even with a lower ACL.

4.2.2.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each CNMI CREMUS group in 2015-2018 as shown for Alternative 3 in Table 11, which are higher than the ACLs under Alternatives 2 and 4. Therefore, the potential revenue that fishery participants could earn under this alternative is also higher than the potential revenue under Alternatives 2 and 4.

However, based on recent catch data shown in Table 11, the annual level of catch for each CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013 and would not reach the group's ACL proposed under this alternative, or the group's estimated OFL proxy where known. During each of these years, the fishery remained opened throughout the year.

Because there would not be in-season closure of the fishery under Alternative 3 in any of the next 4 years, the fishery would not change and fishers would be able to fish for CREMUS throughout each fishing year in the same manner as under Alternatives 1 and 2, and as recently occurred in 2011-2013. Therefore, in each fishing year, the total annual catch of all CREMUS groups combined is expected be similar to the average catch of all CNMI CREMUS combined in 2011-2013, which was 85,822 lb. Using the 2013 average price per pound of $3.15, the expected annual fleet-wide revenue during 2015-2018 under Alternatives 1 and 2 would be approximately $287,737.

Six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. If the Council determined an ACL was exceeded, NMFS would reduce the ACL for that CREMUS group in the subsequent fishing years by the amount of the overage. However, even with a reduced ACL, the expected impacts to fishery participants and the CNMI fishing community under Alternative 3 would be the same as the impacts described in Alternatives 1 and 2, because without in-season closures, fishers would be able to fish for CREMUS throughout the fishing year, even with a lower ACL.

4.2.2.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each CNMI CREMUS group in 2015-2018 that is lower than the preferred alternative (Alternative 3) as shown for Alternative 4 in

Table 11. NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment in the amount of the overage is necessary in a subsequent year.

Because the ACLs under Alternative 4 are lower than the ACLs proposed under Alternative 3, the potential revenue is also lower. However, the ACLs for most CREMUS groups are higher than the ACLs under Alternative 2. Therefore, the potential revenue under Alternative 4 are higher than under Alternative 2. However, based on recent catch data shown in Table 11, the annual level of catch for each CNMI CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and is not expected to reach the lowest possible ACL. Therefore, even if a lower ACL is selected, expected impacts to fishery participants and the CNMI fishing community under Alternative 4 would be the same as the impacts described in Alternatives 1, 2, and 3.

Because none of the alternatives considered would result in changes in the conduct of the fishery including gear types used, areas fished, species targeted, level of catch or effort, none of the alternatives considered would affect the safety of fishermen at sea.

4.2.3 Potential Impacts to Fishery Administration and Enforcement

Under all alternatives considered, NMFS and the Council would continue to monitor catches of CNMI CREMUS based on all available sources of information, and federal regulations would continue to require the Council-appointed FEP plan team to prepare an annual report on the performance of coral reef fisheries, including the commercial and non-commercial fishing sector by July 31 of each year. Additionally, all other regulations implemented by other federal agencies and the CNMI would continue to apply fishing vessels operating in the U.S. EEZ.

While Alternatives 2, 3 (Preferred), and 4 would implement ACLs and a post-season accounting of the catch relative to the ACL, this would not result in commitment of additional resources or increased need for fishery enforcement as monitoring of catch is required under all alternatives, including the no action alternative. Additional fishery enforcement would not be needed for any alternative because the Council and NMFS are not proposing to implement a fishery closure.

4.2.4 Potential Impacts to Protected Resources

None of the alternatives considered would modify operations of CNMI coral reef fisheries in any way that would be expected to affect populations of endangered or threatened species or critical habitat in any manner not previously considered in previous ESA or MMPA consultations described in Section 3.2.4.

While Alternatives 2, 3 (Preferred), and 4 would implement ACLs and a possible reduction to the ACL in a subsequent fishing year, if necessary, fishery managers do not have the ability to conduct in-season tracking of catch towards an ACL, and so there is no in-season closure being proposed. Therefore, under Alternatives 2, 3 and 4, participants in CNMI coral reef fisheries

would continue to fish as they would under the Alternative 1, which does not include the specification of ACLs and AMs.

Because no alternative would result in a change to the way in which coral reef ecosystem fishing is conducted in federal waters, none of the alternatives would result in a change to current impacts on protected species, which have been evaluated in accordance with provisions of the ESA and MMPA and other applicable laws. None of the alternatives would result in large beneficial or adverse impacts protected species described in Section 3.2.4.

4.3 Guam

4.3.1 Potential Impacts to Target and Non-Target Stocks

4.3.1.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for any Guam CREMUS for fishing year 2015. Under Alternative 1, ACLs would not be specified for CREMUS in Guam and AMs would not be necessary. However, NMFS and the Council would continue to monitor catches based on all available sources of information. Except for *Selar crumenopthalmus* or bigeye scad and Carangidae or jacks, the average catch 2011-2013 value for each CREMUS group is well below the group's estimated MSY and OFL proxy. Without ACLs and AMs, the annual catch of those CREMUS group in 2015 through 2018 is expected be similar to the average harvest from 2011-2013, and would be sustainable. Therefore, under this alternative, the lack of an ACL or AMs in fishing year 2015 through 2018 is not likely to result in overfishing of those CREMUS in any year.

For Guam bigeye scad and jacks, the average 2011-2013 catch was 107,271 lb, and 54,050 lb, nearly twice the stocks' OFL reference points, which are 60,800 lb and 32,200 lb, respectively. Without ACL and AMs, catches in 2015-2018 could exceed these reference points again, and if they occur, would be unstainable. However, if NMFS determines that a stock is subject to overfishing, the Council would be required to take action pursuant to Section 304(e) of the Magnuson-Stevens Act to end overfishing in the fishery.

As noted in Section 3.3.1, it is difficult to determine "target" and "non-target" stocks in Guam's territorial coral reef fisheries because resources harvested in these fisheries are highly diverse, with nearly 2,000 species appearing in catch records. While discards levels are unknown, given the low level of catch in Guam's coral reef fisheries and that most of the resources caught are retained and recorded in catch records, fishery scientists and managers have not identified problems with bycatch or non-target species. Ongoing fisheries monitoring by the Council's FEP plan team will help fishery scientists and managers to detect any problems if they occur, and address them in future management measures, as needed. For these reasons, even without ACL or AM management, the expected impacts to target and non-target stocks, except for Guam bigeye scad and jacks, would be that harvests would remain well the stocks' MSY and OFL reference points, and the fishery would continue to be sustainably managed in the upcoming years.

4.3.1.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each Guam CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 12 for the specific ACL values for each CREMUS group associated with Alternative 2.

Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), the ACL for several CREMUS groups would be associated with a probability of overfishing greater than 50 percent (Table 12). These are Carangidae (jacks), Carcharhinidae (reef sharks), Kyphosidae (rudderfish), Mullidae (goatfish) and Siganidae (rabbitfish). By law, the probability of overfishing cannot exceed 50 percent (74 FR 3178, January 9, 2011). Therefore, these ACLs would not be in compliance with the Magnuson-Stevens Act. For all other Guam CREMUS groups, the ACL specifications under Alternative 2 are associated with probability of overfishing no greater than 30 percent should the entire ACL be caught (see Table 12).

For the 2014 fishing year, NMFS specified the ACL for Guam humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), at 1,960 lb and 797 lb, respectively. For the bumphead wrasse, the 2014 ACL was shared between the CNMI and Guam and would be shared again in 2015-2018 under this alternative. The 2014 ACLs were equal to 5% of each stock's estimated biomass and identical to the ACL proposed under the preferred alternative (Alternative 3). As previously mentioned above, MSY, OFL and probability of overfishing projections for these species are not available.

Under this alternative, NMFS and the Council would continue to monitor Guam CREMUS catches based on all available sources of information. However, because catch statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during the fishing year whether the ACL for any CREMUS group might be reached, and cannot prevent any ACL from being exceeded. Therefore, fishers would be able to fish for CREMUS throughout the fishing year in the same manner as under Alternative 1 and as recently occurred in 2011-2013. Six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded.

Based on recent catch data shown in Table 12, the annual level of catch for each CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013. Therefore, it is possible that catches of Guam bigeye scad and jacks could exceed the ACL proposed under this alternative as well as the stocks' OFLs, which are 60,800 lb and 32,200 lb, respectively. For all other Guam CREMUS, catches in 2015-2018 are not expected to exceed any group's ACL proposed under Alternative 2, or any group's estimated OFL proxy, where known.

If the Council determines an ACL is exceeded, the Council as an AM would take action in accordance with 50 CFR 600.310(g) to correct the operational issue that caused the ACL overage. This may include a recommendation that NMFS reduce the ACL for that CREMUS group in the subsequent fishing year by the amount of the overage, or other measures, as

appropriate. However, unless catch exceeded the OFL, the Council would not likely recommend a reduced ACL in the subsequent fishing year. This is because the ACLs under Alternative 2 were developed using a different method than is proposed under the preferred alternative (Alternative 3), and without knowledge of the estimate of MSY and OFL. Therefore, the ACLs under this alternative are not based on the best scientific information available as described in Section 2.2.2 – Estimation of MSY and OFL, and are considered overly conservative but are included in order to evaluate the potential impacts of other alternatives compared with the status quo baseline.

If the Council does recommend a reduced ACL, the reduced ACL is not likely to result in changes in the conduct of the fishery, including gear types used, areas fished, or level of catch. This is because in-season AMs to prevent the ACL from being exceeded are not possible in any fishing year. Therefore, even with a reduced ACL in subsequent fishing years, fishers would still be able to fish for CREMUS throughout the fishing year in the same manner as under Alternative 1. Therefore, compared to Alternative 1, Alternative 2 is not likely to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch. Furthermore, the fishery is expected to continue to fish in much the same manner as it has in recent years and the fishery is not known to be having a, or have large beneficial or adverse effects on target or non-target stocks. However, if NMFS determines that a stock is subject to overfishing, the Council would be required to take action pursuant to Section 304(e) of the Magnuson-Stevens Act to end overfishing in the fishery.

4.3.1.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each Guam CREMUS group in 2015-2018 as shown in Table 12. This level of catch is five percent lower than each CREMUS group's ABC. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), no ACL under Alternative 3 is associated with greater than a 35% percent probability of overfishing should the entire ACL be caught (see Table 13).

For Guam humphead or Napoleon wrasse (*Cheilinus undulatus*), and bumphead parrotfish (*Bolbometopon muricatum*), NMFS would specify the ACL at the same level proposed under Alternative 2, which is 1,960 lb and 797 lb, respectively. Like in Alternative 2, the ACL for bumphead wrasse would be shared between the CNMI and Guam in 2015-2018. As previously mentioned above, MSY, OFL and probability of overfishing projections for these species are not available.

Under this alternative, NMFS and the Council would continue to monitor CREMUS catches based on all available sources of information. However, because catch statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during the fishing year whether the ACL for any CREMUS group might be reached, and cannot prevent any ACL from being exceeded. Therefore, fishers would be able to fish for CREMUS throughout the fishing year in the same manner as under Alternative 2 (status quo) and as recently occurred in 2011-2013.

Based on recent catch data shown in Table 12, the annual level of catch for each Guam CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013. Therefore, it is possible that catches of Guam bigeye scad and jacks could exceed the ACL proposed under this alternative as well as the stocks' OFLs, which are 60,800 lb and 32,200 lb, respectively. For all other Guam CREMUS, catches in 2015-2018 are not expected to exceed any group's ACL proposed under Alternative 3, or any group's estimated OFL proxy, where known.

However, because there would not be a closure of the fishery under Alternative 3 in any of the next 4 years, the fishery would not change and impacts to target and non-target stocks would be identical to the impacts under Alternative 2 (status quo), which is identical to the impacts under Alternative 1 (no action).

Six months after the end of each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. Under this alternative, if the Council determines the most recent three-year average catch for any Guam CREMUS Group exceeded the proposed ACL in any fishing year, NMFS would reduce the ACL by the amount of the overage in the subsequent years. See Section 1.3- Proposed Action for detailed information on how this AM would be triggered. The impacts of a reduced ACL to target and non-target stocks are described in Alternative 4 below. Additionally, if NMFS determines that a stock is subject to overfishing, the Council would be required to take action pursuant to Section 304(e) of the Magnuson-Stevens Act to end overfishing in the fishery.

4.3.1.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each Guam CREMUS group in 2015-2018 that is lower than the preferred alternative (Alternative 3) as shown for Alternative 4 in Table 12. NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment in the amount of the overage is necessary in a subsequent year. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), the ACL for each CREMUS group under Alternative 4 are associated with probabilities of overfishing ranging from 30 percent down to five percent (see Table 12). In other words, the lower the ACL, the lower the associated risk of overfishing.

Under Alternative 4, the Guam CREMUS fishery is expected to continue to perform as it has in recent years and catches in 2015-2018 are expected to be similar to the average harvest from 2011-2013. As shown in Table 12, except for Guam bigeye scad and jacks, average harvest from 2011-2013 did not exceed the lowest possible ACL for any group or that group's estimated OFL proxy, where known. However, because there would not be a closure of any fishery for Guam CREMUS under Alternative 3 in any of the next 4 years, even if an ACL lower than what is proposed in Alternative 3 is selected, Guam CREMUS fisheries would not change and impacts to target and non-target stocks would be the same as the impacts under Alternatives 1-3.
As is true for Alternatives 1-3, if NMFS determines that a stock is subject to overfishing, the Council would be required to take action pursuant to Section 304(e) of the Magnuson-Stevens Act to end overfishing in the fishery.

Under all alternatives considered, if an ACL is exceeded more than once in a four-year period, the Council is required to re-evaluate the ACL process, and adjust the system for setting ACLs, as necessary, to improve its performance and effectiveness. Additionally, if NMFS determines overfishing is occurring, NMFS would immediately notify the Council to take action to end overfishing in the fishery.

4.3.2 Potential Impacts to Fishery Participants and Fishing Communities

In 2013, the commercial price for individual coral reef associated species in Guam ranged between $1.94 and $3.60 per pound, with an average CREMUS price of $3.16/lb. Multiplying the average 2011-2013 catch of each CREMUS group shown in Table 22 by the 2013 average price of $3.16 equally, the average annual estimated commercial value of the coral reef fisheries of Guam for this three-year period was approximately $1,106,171.

4.3.2.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for any Guam CREMUS for fishing year 2015. Under the no-action alternative, ACLs would not be specified for CREMUS in Guam and AMs would not be necessary. Therefore, each year, fishing would continue throughout the entire fishing year. If there were no ACLs and AMs, CREMUS catch in 2015-2018 would be similar to the average catch of all Guam CREMUS in 2011-2013, which was 350,054 lb. Using the 2013 average price per pound of $3.16, the expected annual fleet-wide revenue during 2015-2018 under Alternative 1 would be approximately $1,106,171.

Coral reef fisheries in the CNMI provide fresh fish for sustenance, customary exchange and other gifts, and allows some resources to enter local markets. This provides positive social and economic benefits to fishermen, buyers and the CNMI fishing community.

4.3.2.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each Guam CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 12 for the specific ACL values for each CREMUS group associated with Alternative 2.

Because there would not be in-season closure of the fishery under Alternative 2 in any of the next 4 years, the fishery would not change and fishers would be able to fish for CREMUS throughout each fishing year in the same manner as under Alternative 1, and as recently occurred in 2011-2013.

Based on recent catch data shown in Table 12, the annual level of catch for each CREMUS group in 2015-2018 is expected be similar to the average catch of all Guam CREMUS combined in 2011-2013, which was 350,054 lb. Using the 2013 average price per pound of $3.16, the expected annual fleet-wide revenue during 2015-2018 would be same as under Alternative 1 or approximately $1,106,171.

Six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. If the Council determined an ACL was exceeded, it could recommend NMFS reduce the ACL for that CREMUS group in the subsequent fishing years. However, even with a reduced ACL, the expected impacts to fishery participants and the Guam fishing community under Alternative 2 would be the same as the impacts described in Alternative 1, because without in-season closures, fishers would be able to fish for CREMUS throughout the fishing year, even with a lower ACL.

4.3.2.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each Guam CREMUS group in 2015-2018 as shown for Alternative 3 in Table 12, which are higher than the ACLs under Alternatives 2 and 4. Therefore, the potential revenue that fishery participants could earn under this alternative is also higher than the potential revenue under Alternatives 2 and 4.

Because there would not be in-season closure of the fishery under Alternative 3 in any of the next 4 years, the fishery would not change and fishers would be able to fish for CREMUS throughout each fishing year in the same manner as under Alternatives 1 and 2, and as recently occurred in 2011-2013.

Based on recent catch data shown in Table 12, the annual level of catch for each Guam CREMUS group in 2015-2018 is expected be similar to the average catch of all CNMI CREMUS combined in 2011-2013, which was 350,054 lb. Using the 2013 average price per pound of $3.16, the expected annual fleet-wide revenue during 2015-2018 would be same as under Alternatives 1 and 2 or approximately $1,106,171.

Six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. If the Council determined an ACL was exceeded, NMFS would reduce the ACL for that Guam CREMUS group in the subsequent fishing years by the amount of the overage. However, even with a reduced ACL, the expected impacts to fishery participants and the Guam fishing community under Alternative 3 would be the same as the impacts described in Alternatives 1 and 2, because without in-season closures, fishers would be able to fish for CREMUS throughout the fishing year, even with a lower ACL.

4.3.2.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each Guam CREMUS group in 2015-2018 that is lower than the preferred alternative (Alternative 3) as shown for Alternative 4 in Table 12. NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment in the amount of the overage is necessary in a subsequent year.

Because the ACLs under Alternative 4 are lower than the ACLs proposed under Alternative 3, the potential revenue is also lower. However, the ACLs for most CREMUS groups are higher than the ACLs under Alternative 2. Therefore, the potential revenue under Alternative 4 are higher than under Alternative 2. However, based on recent catch data shown in Table 12, the annual level of catch for each Guam CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and except for Guam bigeye scad and jacks, is not expected to reach the lowest possible ACL. Therefore, even if a lower ACL is selected, expected impacts to fishery participants and the Guam fishing community under Alternative 4 would be the same as the impacts described in Alternatives 1, 2, and 3.

Because none of the alternatives considered would result in changes in the conduct of the fishery including gear types used, areas fished, species targeted, level of catch or effort, none of the alternatives considered would affect the safety of fishermen at sea.

4.3.3 Potential Impacts to Fishery Administration and Enforcement

Under all alternatives considered, NMFS and the Council would continue to monitor catches of Guam CREMUS based on all available sources of information, and federal regulations would continue to require the Council-appointed FEP plan team to prepare an annual report on the performance of coral reef fisheries, including the commercial and non-commercial fishing sector by July 31 of each year. Additionally, all other regulations implemented by other federal agencies and the Territory of Guam would continue to apply fishing vessels operating in the U.S. EEZ.

While Alternatives 2, 3 (Preferred), and 4 would implement ACLs and a post-season accounting of the catch relative to the ACL, this would not result in commitment of additional resources or increased need for fishery enforcement as monitoring of catch is required under all alternatives, including the no action alternative. Additional fishery enforcement would not be needed for any alternative because the Council and NMFS are not proposing to implement a fishery closure.

4.3.4 Potential Impacts to Protected Resources

None of the alternatives considered would modify operations of Guam coral reef fisheries in any way that would be expected to affect populations of endangered or threatened species or critical habitat in any manner not previously considered in previous ESA or MMPA consultations described in Section 3.3.4.

While Alternatives 2, 3 (Preferred), and 4 would implement ACLs and a possible reduction to the ACL in a subsequent fishing year, if necessary, fishery managers do not have the ability to conduct in-season tracking of catch towards an ACL, and so there is no in-season closure being proposed. Therefore, under Alternatives 2, 3 and 4, participants in Guam coral reef fisheries would continue to fish as they would under the Alternative 1, which does not include the specification of ACLs and AMs.

Because no alternative would result in a change to the way in which coral reef ecosystem fishing is conducted in federal waters, none of the alternatives would result in a change to current

impacts on protected species, which have been evaluated in accordance with provisions of the ESA and MMPA and other applicable laws. None of the alternatives would result in large beneficial or adverse impacts protected species described in Section 3.3.4.

4.4 Hawaii

4.4.1 Potential Impacts to Target and Non-Target Stocks

4.4.1.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for any Hawaii CREMUS for fishing year 2015. Under Alternative 1, ACLs would not be specified for CREMUS in Hawaii and AMs would not be necessary. However, NMFS and the Council would continue to monitor catches based on all available sources of information. As shown in Table 13, the average catch 2011-2013 value for each CREMUS group is well below the group's estimated MSY and OFL proxy. During fishing years 2011 through 2013, the fishery for each CREMUS group would remained open year round. Without ACLs and AMs, the annual catch of each CREMUS group in 2015 through 2018 is expected be similar to the average harvest from 2011-2013, and would be sustainable. Therefore, under this alternative, the lack of an ACL or AMs in fishing year 2015 through 2018 is not likely to result in overfishing of any Hawaii CREMUS in any year.

As noted in Section 3.4.1, it is difficult to determine "target" and "non-target" stocks in Hawaii's State coral reef fisheries because resources harvested in these fisheries are highly diverse, with over 100 species appearing in catch records. While discards levels are unknown, given the low level of catch in Hawaii coral reef fisheries and that most of the resources caught are retained and recorded in catch records, fishery scientists and managers have not identified problems with bycatch or non-target species. Ongoing fisheries monitoring by the Council's FEP plan team will help fishery scientists and managers to detect any problems if they occur, and address them in future management measures, as needed. For these reasons, even without ACL or AM management, the expected impacts to target and non-target stocks would be that harvests of each Hawaii CREMUS group would remain well the stocks' MSY and OFL reference points, and the fishery would continue to be sustainably managed in the upcoming years.

4.4.1.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each Hawaii CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 13 for the specific ACL values for each CREMUS group. Note that under this alternative, there would be no individual ACL for Kyphosidae (rudderfish), Labridae (wrasses), Lethrinidae (emperors), or Serranidae (groupers). This is because in the prior species level aggregation process described in Section 2.2.1 – Determining the Level of Species Aggregation, these species groups did not comprise the top 90% of the total coral reef fish catch over the long-term catch time series. Therefore, under this alternative, these species would remain in the category "All Other CREMUS" combined as they were in fishing year 2014 and in previous years.

Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), the ACL for several CREMUS groups would be associated with a probability of overfishing greater than 50 percent (Table 13). These are Carangidae (jacks), Carcharhinidae (reef sharks), and Mullidae (goatfish). By law, the probability of overfishing cannot exceed 50 percent (74 FR 3178, January 9, 2011). Therefore, these ACLs would not be in compliance with the Magnuson-Stevens Act. For all other Hawaii CREMUS groups, the ACL specifications under Alternative 2 are associated with probability of overfishing no greater than 20 percent should the entire ACL be caught (see Table 13).

Under this alternative, NMFS and the Council would continue to monitor Hawaii CREMUS catches based on all available sources of information. However, because catch statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during the fishing year whether the ACL for any CREMUS group might be reached, and cannot prevent any ACL from being exceeded. Therefore, fishers would be able to fish for CREMUS throughout the fishing year in the same manner as under Alternative 1 and as recently occurred in 2011-2013.

Based on recent catch data shown in Table 13, the annual level of catch for each CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and would not exceed any group's ACL proposed under Alternative 2, or any group's estimated OFL proxy, where known. However, six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded.

If the Council determines an ACL is exceeded, the Council as an AM would take action in accordance with 50 CFR 600.310(g) to correct the operational issue that caused the ACL overage. This may include a recommendation that NMFS reduce the ACL for that Hawaii CREMUS group in the subsequent fishing year by the amount of the overage, or other measures, as appropriate. However, the Council would not likely recommend a reduced ACL in the subsequent fishing year. This is because the ACLs under Alternative 2 were developed using a different method than is proposed under the preferred alternative (Alternative 3), and without knowledge of the estimate of MSY and OFL. Therefore, the ACLs under this alternative are not based on the best scientific information available as described in Section 2.2.2 – Estimation of MSY and OFL, and are considered overly conservative but are included in order to evaluate the potential impacts of other alternatives compared with the status quo baseline.

If the Council does recommend a reduced ACL, the reduced ACL is not likely to result in changes in the conduct of the fishery, including gear types used, areas fished, or level of catch. This is because in-season AMs to prevent the ACL from being exceeded are not possible in any fishing year. Therefore, even with a reduced ACL in subsequent fishing years, fishers would still be able to fish for Hawaii CREMUS throughout the fishing year in the same manner as under Alternative 1. Therefore, compared to Alternative 1, Alternative 2 is not likely to result in changes in the conduct of the fishery, including gear types used, areas fished, level of catch. Furthermore, the fishery is expected to continue to fish in much the same manner as it has in recent years and the fishery is not known to be having a, or have large beneficial or adverse effects on target or non-target stocks.

4.4.1.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each Hawaii CREMUS group in 2015-2018 as shown for Alternative 3 in Table 13. This level of catch is five percent lower than each CREMUS group's ABC. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), no ACL under Alternative 3 is associated with greater than a 35 percent probability of overfishing should the entire ACL be caught (see Table 13).

Under this alternative, NMFS and the Council would continue to monitor CREMUS catches based on all available sources of information. However, because catch statistics are not available until at least six months after the data have been collected, NMFS and the Council have no way to determine during the fishing year whether the ACL for any CREMUS group might be reached, and cannot prevent any ACL from being exceeded. Therefore, fishers would be able to fish for CREMUS throughout the fishing year in the same manner as under Alternative 2 (status quo) and as recently occurred in 2011-2013.

Based on recent catch data shown in Table 13, the annual level of catch for each Hawaii CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and is not expected to exceed any group's ACL proposed under Alternative 2, or any group's estimated OFL proxy, where known. Therefore, because there would not be a closure of the fishery under Alternative 3 in any of the next 4 years, the fishery would not change and impacts to target and non-target stocks would be identical to the impacts under Alternative 2 (status quo), which is identical to the impacts under Alternative 1 (no action).

Six months after the end of each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. Under this alternative, if the Council determines the most recent three-year average catch for any Hawaii CREMUS Group exceeded the proposed ACL in any fishing year, NMFS would reduce the ACL by the amount of the overage in the subsequent years. See Section 1.3- Proposed Action for detailed information on how this AM would be triggered. The impacts of a reduced ACL to target and non-target stocks are described in Alternative 4 below.

4.4.1.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each Hawaii CREMUS group in 2015-2018 that is lower than the preferred alternative (Alternative 3) as shown for Alternative 4 in Table 13.

NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment in the amount of the overage is necessary in a subsequent year. Based on risk projections from method B of the Biomass Augmented Catch-MSY model (Appendix B), the ACL for each CREMUS group under Alternative 4 are associated with probabilities of overfishing ranging from 35 percent down to

five percent (see Table 13). In other words, the lower the ACL, the lower the associated risk of overfishing.

Under Alternative 4, the Hawaii CREMUS fishery is expected to continue to perform as it has in recent years and catches in 2015-2018 are expected to be similar to the average harvest from 2011-2013. As shown in Table 13, average harvest from 2011-2013 did not exceed the lowest possible ACL for any group or that group's estimated OFL proxy, where known. Therefore, even if an ACL lower that what is proposed in Alternative 3 is selected, fishery would not change and impacts to target and non-target stocks would be the same as the impacts under Alternatives 1-3.

Under all alternatives considered, if an ACL is exceeded more than once in a four-year period, the Council is required to re-evaluate the ACL process, and adjust the system for setting ACLs, as necessary, to improve its performance and effectiveness. Additionally, if NMFS determines overfishing is occurring, NMFS would immediately notify the Council to take action to end overfishing in the fishery.

4.4.2 Potential Impacts to Fishery Participants and Fishing Communities

In 2013, the commercial price for individual coral reef associated species in Hawaii ranged between $1.26 (bonefish) and $8.70 (algae)[8] per pound, with an average CREMUS price of $3.52/lb. Multiplying the average 2011-2013 catch of each CREMUS group shown in Table 26 by the 2013 average price of $3.52 equally, the average annual estimated commercial value of the coral reef fisheries of Hawaii for this three-year period was approximately $4,528,860.

4.4.2.1 Alternative 1: No ACL and AM Management (No Action)

Currently, NMFS has not specified an ACL and AM for any Hawaii CREMUS for fishing year 2015. Under the no-action alternative, ACLs would not be specified for CREMUS in Hawaii and AMs would not be necessary. Therefore, each year, fishing would continue throughout the entire fishing year. If there were no ACLs and AMs, CREMUS catch in 2015-2018 would be similar to the average catch of all Hawaii CREMUS in 2011-2013, which was 1,239,699 lb. Using the 2013 average price per pound of $3.52, the expected annual fleet-wide revenue during 2015-2018 under Alternative 1 would be approximately $4,528,860

Coral reef fisheries in Hawaii provide fresh fish for sustenance, gifts, and allows some resources to enter local markets. This provides positive social and economic benefits to fishermen, buyers and the fishing communities of Hawaii.

4.4.2.2 Alternative 2: Specify 2014 ACLs (Status Quo/NEPA Baseline)

Under Alternative 2, NMFS would specify the ACL for each Hawaii CREMUS group in fishing years 2015-2018 at the same level NMFS specified for each CREMUS group in 2014 (79 FR 4276, January 27, 2014). See Table 13 for the specific ACL values for each CREMUS group associated with Alternative 2.

[8] Both bonefish and algae are included in the all other CREMUS Combined grouping. In 2013, fishermen reported selling 12,344 lb of bonefish and 3,960 lb of 16,921 lb of algae.

Based on recent catch data shown in Table 13, the annual level of catch for each CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and would not exceed the group's ACL proposed under Alternative 2, or the group's estimated OFL proxy where known. During each of these years, the fishery remained opened throughout the year.

Because there would not be in-season closure of the fishery under Alternative 2 in any of the next 4 years, the fishery would not change and fishers would be able to fish for CREMUS throughout each fishing year in the same manner as under Alternative 1, and as recently occurred in 2011-2013. Therefore, in each fishing year, the total annual catch of all CREMUS groups combined is expected be similar to the average catch of all Hawaii CREMUS combined in 2011-2013, which was 1,239,699 lb. Using the 2013 average price per pound of $3.52, the expected annual fleet-wide revenue during 2015-2018 would be same as under Alternative 1 or approximately $4,528,860

Six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. If the Council determined an ACL was exceeded, it could recommend NMFS reduce the ACL for that CREMUS group in the subsequent fishing years. However, even with a reduced ACL, the expected impacts to fishery participants and the fishing communities of Hawaii under Alternative 2 would be the same as the impacts described in Alternative 1, because without in-season closures, fishers would be able to fish for Hawaii CREMUS throughout the fishing year, even with a lower ACL.

4.4.2.3 Alternative 3: Specify Council Recommended ACLs (Preferred)

Under Alternative 3 (the Council's and NMFS' Preferred Alternative), NMFS would specify the ACL for each Hawaii CREMUS group in 2015-2018 as shown for Alternative 3 in Table 13, which are higher than the ACLs under Alternatives 2 and 4. Therefore, the potential revenue that fishery participants could earn under this alternative is also higher than the potential revenue under Alternatives 2 and 4.

However, based on recent catch data shown in Table 13, the annual level of catch for each CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013 and would not reach the group's ACL proposed under this alternative, or the group's estimated OFL proxy where known. During each of these years, the fishery remained opened throughout the year.

Because there would not be in-season closure of the fishery under Alternative 3 in any of the next 4 years, the fishery would not change and fishers would be able to fish for CREMUS throughout each fishing year in the same manner as under Alternatives 1 and 2, and as recently occurred in 2011-2013. Therefore, in each fishing year, the total annual catch of all CREMUS groups combined is expected be similar to the average catch of all Hawaii CREMUS combined in 2011-2013, which was 1,239,699 lb. Using the 2013 average price per pound of $3.52, the expected annual fleet-wide revenue during 2015-2018 would be same as under Alternatives 1 and 2 or approximately $4,528,860.

Six months after the each fishing year, data would become available for NMFS and the Council to determine whether any ACL in the previous year was exceeded. If the Council determined an ACL was exceeded, NMFS would reduce the ACL for that CREMUS group in the subsequent fishing years by the amount of the overage. However, even with a reduced ACL, the expected impacts to fishery participants and the fishing communities of Hawaii under Alternative 3 would be the same as the impacts described in Alternatives 1 and 2, because without in-season closures, fishers would be able to fish for Hawaii CREMUS throughout the fishing year, even with a lower ACL.

4.4.2.4 Alternative 4: Specify ACLs Lower than the Preferred Alternative

Under Alternative 4, NMFS would specify an ACL for each Hawaii CREMUS group in 2015-2018 that is lower than the preferred alternative (Alternative 3) as shown for Alternative 4 in Table 13. NMFS included a range of ACLs lower than the ACL that would be established under the preferred alternative in the event that the proposed ACL under Alternative 3 is implemented and exceeded in 2015, 2016 or 2017, and a downward overage adjustment in the amount of the overage is necessary in a subsequent year.

Because the ACLs under Alternative 4 are lower than the ACLs proposed under Alternative 3, the potential revenue is also lower. However, the ACLs for most CREMUS groups are higher than the ACLs under Alternative 2. Therefore, the potential revenue under Alternative 4 are higher than under Alternative 2. However, based on recent catch data shown in Table 13, the annual level of catch for each Hawaii CREMUS group in 2015-2018 is expected be similar to the average harvest from 2011-2013, and is not expected to reach the lowest possible ACL. Therefore, even if a lower ACL is selected, expected impacts to fishery participants and the fishing communities of Hawaii under Alternative 4 would be the same as the impacts described in Alternatives 1, 2, and 3.

Because none of the alternatives considered would result in changes in the conduct of the fishery including gear types used, areas fished, species targeted, level of catch or effort, none of the alternatives considered would affect the safety of fishermen at sea.

4.4.3 Potential Impacts to Fishery Administration and Enforcement

Under all alternatives considered, NMFS and the Council would continue to monitor catches of Hawaii CREMUS based on all available sources of information, and federal regulations would continue to require the Council-appointed FEP plan team to prepare an annual report on the performance of coral reef fisheries, including the commercial and non-commercial fishing sector by July 31 of each year. Additionally, all other regulations implemented by other federal agencies and the State of Hawaii would continue to apply fishing vessels operating in the U.S. EEZ.

While Alternatives 2, 3 (Preferred), and 4 would implement ACLs and a post-season accounting of the catch relative to the ACL, this would not result in commitment of additional resources or increased need for fishery enforcement as monitoring of catch is required under all alternatives,

including the no action alternative. Additional fishery enforcement would not be needed for any alternative because the Council and NMFS are not proposing to implement a fishery closure.

4.4.4 Potential Impacts to Protected Resources

None of the alternatives considered would modify operations of Hawaii coral reef fisheries in any way that would be expected to affect populations of endangered or threatened species or critical habitat in any manner not previously considered in previous ESA or MMPA consultations described in Section 3.4.4.

While Alternatives 2, 3 (Preferred), and 4 would implement ACLs and a possible reduction to the ACL in a subsequent fishing year, if necessary, fishery managers do not have the ability to conduct in-season tracking of catch towards an ACL, and so there is no in-season closure being proposed. Therefore, under Alternatives 2, 3 and 4, participants in Hawaii coral reef fisheries would continue to fish as they would under the Alternative 1, which does not include the specification of ACLs and AMs.

Because no alternative would result in a change to the way in which coral reef ecosystem fishing is conducted in federal waters, none of the alternatives would result in a change to current impacts on protected species, which have been evaluated in accordance with provisions of the ESA and MMPA and other applicable laws. None of the alternatives would result in large beneficial or adverse impacts protected species described in Section 3.4.4.

4.5 Potential Impacts to Essential Fish Habitat

Essential fish habitat (EFH) is defined as those waters and substrate as necessary for fish spawning, breeding, feeding, and growth to maturity. This includes the marine areas and their chemical and biological properties that are utilized by the organism. Substrate includes sediment, hard bottom, and other structural relief underlying the water column along with their associated biological communities. In 1999, the Council developed and NMFS approved EFH definitions for management unit species (MUS) of the Bottomfish and Seamount Groundfish FMP (Amendment 6), Crustacean FMP (Amendment 10), Pelagic FMP (Amendment 8), and Precious Corals FMP (Amendment 4) (74 FR 19067, April 19, 1999). NMFS approved additional EFH definitions for coral reef ecosystem species in 2004 as part of the implementation of the Coral Reef Ecosystem FMP (69 FR8336, February 24, 2004). EFH definitions were also approved for deepwater shrimp through an amendment to the Crustaceans FMP in 2008 (73 FR 70603, November 21, 2008).

Ten years later, in 2009, the Council developed and NMFS approved five new archipelagic-based fishery ecosystem plans (FEP). The FEP incorporated and reorganized elements of the Councils' species-based FMPs into a spatially-oriented management plan (75 FR 2198, January 14, 2010). EFH definitions and related provisions for all FMP fishery resources were subsequently carried forward into the respective FEPs. In addition to and as a subset of EFH, the Council described habitat areas of particular concern (HAPC) based on the following criteria: ecological function of the habitat is important, habitat is sensitive to anthropogenic degradation, development activities are or will stress the habitat, and/or the habitat type is rare. In considering

the potential impacts of a proposed fishery management action on EFH, all designated EFH must be considered. Table 30 summarizes the designated areas of EFH and HAPC for all FEP MUS by life stage.

At its 154th meeting held June 2012, the Council recommended amending the Hawaii FEP to refine the EFH descriptions for Hawaii bottomfish and seamount groundfish and modify the extent of HAPC designations for these stocks. However, the recommended revisions would not change the overall designation of EFH shown in Table 30 below. While the Council recommended additional HAPC be added, such designations are a subset of EFH and would do not result in any changes to management or administrative requirements. Until the amendment is transmitted to by the Council for Secretarial review, and approved by the Secretary, the EFH/HAPC designations summarized in Table 30 below remains in effect.

Table 30. EFH and HAPC for FEP MUS

MUS	Species Complex	EFH	HAPC
Bottomfish MUS	**American Samoa, Guam and CNMI bottomfish species:** lehi (*Aphareus rutilans*) uku (*Aprion virescens*), giant trevally (*Caranx ignoblis*), black trevally (*Caranx lugubris*), blacktip grouper *(Epinephelus fasciatus)*, Lunartail grouper *(Variola louti)*, ehu (*Etelis carbunculus*), onaga (*Etelis coruscans*), ambon emperor *(Lethrinus amboinensis)*, redgill emperor *(Lethrinus rubrioperculatus)*, taape (*Lutjanus kasmira*), yellowtail kalekale (*Pristipomoides auricilla*), opakapaka (*P. filamentosus*), yelloweye snapper (*P. flavipinnis*), kalekale (*P. sieboldii*), gindai (*P. zonatus*), and amberjack (*Seriola dumerili*).	**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)

MUS	Species Complex	EFH	HAPC
	Hawaii bottomfish species: uku (*Aprion virescens*), thicklip trevally (*Pseudocaranx dentex*), giant trevally (*Caranx ignoblis*), black trevally (*Caranx lugubris*), amberjack (*Seriola dumerili*), taape (*Lutjanus kasmira*), ehu (*Etelis carbunculus*), onaga (*Etelis coruscans*), opakapaka (*Pristipomoides filamentosus*), yellowtail kalekale (*P. auricilla*), kalekale (*P. sieboldii*), gindai (*P. zonatus*), hapuupuu (*Epinephelus quernus*), lehi (*Aphareus rutilans*)	**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 fathoms) **Juvenile/adults:** the water column and all bottom habitat extending from the shoreline to a depth of 400 meters (200 fm)	All slopes and escarpments between 40–280 m (20 and 140 fm) Three known areas of juvenile opakapaka habitat: two off Oahu and one off Molokai
Seamount Groundfish MUS	**Hawaii Seamount groundfish species (50–200 fm):** armorhead (*Pseudopentaceros wheeleri*), raftfish/butterfish (*Hyperoglyphe japonica*), alfonsin (*Beryx splendens*)	**Eggs and larvae:** the (epipelagic zone) water column down to a depth of 200 m (100 fm) of all EEZ waters bounded by latitude 29°–35° **Juvenile/adults:** all EEZ waters and bottom habitat bounded by latitude 29°–35° N and longitude 171° E–179° W between 200 and 600 m (100 and 300 fm)	No HAPC designated for seamount groundfish
Crustaceans MUS	**Spiny and slipper lobster complex (all FEP areas):** spiny lobster (*Panulirus marginatus*), spiny lobster (*P. penicillatus, P.* sp.), ridgeback slipper lobster (*Scyllarides haanii*), Chinese slipper lobster (*Parribacus antarcticus*) **Kona crab :** Kona crab (*Ranina ranina*)	**Eggs and larvae:** the water column from the shoreline to the outer limit of the EEZ down to a depth of 150 m (75 fm) **Juvenile/adults:** all of the bottom habitat from the shoreline to a depth of 100 m (50 fm)	All banks in the NWHI with summits less than or equal to 30 m (15 fathoms) from the surface
	Deepwater shrimp (all FEP areas): (*Heterocarpus* spp.)	**Eggs and larvae:** the water column and associated outer reef slopes between 550 and 700 m **Juvenile/adults:** the outer reef slopes at depths between 300-700 m	No HAPC designated for deepwater shrimp.

MUS	Species Complex	EFH	HAPC
Precious Corals MUS	**Shallow-water precious corals (10-50 fm) all FEP areas:** black coral (*Antipathes dichotoma*), black coral (*Antipathis grandis*), black coral (*Antipathes ulex*) **Deep-water precious corals (150–750 fm) all FEP areas:** Pink coral (*Corallium secundum*), red coral (*C. regale*), pink coral (*C. laauense*), midway deepsea coral (*C.* sp nov.), gold coral (*Gerardia* sp.), gold coral (*Callogorgia gilberti*), gold coral (*Narella* sp.), gold coral (*Calyptrophora* sp.), bamboo coral (*Lepidisis olapa*), bamboo coral (*Acanella* sp.)	EFH for Precious Corals is confined to six known precious coral beds located off Keahole Point, Makapuu, Kaena Point, Wespac bed, Brooks Bank, and 180 Fathom Bank EFH has also been designated for three beds known for black corals in the Main Hawaiian Islands between Milolii and South Point on the Big Island, the Auau Channel, and the southern border of Kauai	Includes the Makapuu bed, Wespac bed, Brooks Banks bed For Black Corals, the Auau Channel has been identified as a HAPC
Coral Reef Ecosystem MUS	**Coral Reef Ecosystem MUS (all FEP areas)**	EFH for the Coral Reef Ecosystem MUS includes the water column and all benthic substrate to a depth of 50 fm from the shoreline to the outer limit of the EEZ	Includes all no-take MPAs identified in the CREFMP, all Pacific remote islands, as well as numerous existing MPAs, research sites, and coral reef habitats throughout the western Pacific

To prevent and minimize adverse coral reef fishing impacts to EFH, which include shallow-reef building corals, the FEPs prohibit the use of destructive and non-selective gear methods, and authorizes a specific list allowable gear methods to be used in coral reef fisheries (WPFMC 2009a; 2009b and 2009c). These gear types include: hand harvest, spear, slurp gun, hand, dip, hoop, throw, and barrier nets, and surround nets that must be attended to at all times, handlines, and crab and fish traps and remotely operated vehicles and submersibles. When properly used these allowable gear types are not known to have large adverse effects on EFH or HAPC for any western Pacific MUS.

None of the alternatives, including the preferred alternative (Alternative 3) are expected to change the way in which fisheries are conducted in terms of species targeted, gear types used, areas fished, level of catch or effort as compared to baseline conditions. For this reason, none of the alternatives considered are expected to lead to substantial physical, chemical, or biological alterations to ocean, corals or coastal habitats, or result in loss of, or injury to managed species, or their prey or adverse impacts to the marine habitat, including areas designated as EFH, HAPC, or unique areas such as marine protected areas, marine sanctuaries or marine monuments.

4.6 Potential Impacts to Biodiversity/Ecosystem Function

The management of coral reef fisheries in EEZ waters around American Samoa, Guam, the CNMI, and Hawaii using ACLs and AMs helps provide for sustainable fisheries management in accordance with the Magnuson-Stevens Act. The proposed ACL and AMs specifications for western Pacific CREMUS were developed using the best available scientific information, in a manner that accords with the fishery regulations and after considering catches, participation trends, and estimates of the status of the fishery resources. When compared against recent fishing harvests, the proposed ACLs are higher than recent harvest (Tables 10-14), but lower than current estimates of MSY and OFL, with the exception of *Selar crumenopthalmus* or atulai and Carangidae or jacks in Guam. For these species, recent three-year harvest averages are higher than the proposed ACL, MSY and OFL. However, as explained in Section 3.3.1.1, the high level of recent harvest were driven primarily by greater participation by fishermen in the Guam shore-based creel survey program in a single year (2012 for bigeye scad and 2013 for jacks), resulting in an unusually large expanded catch number compared to previous years. Due to the high degree of inter-annual variability in territorial data collection programs (see Section 2.1), Guam fishery scientists and managers do not consider the single year catch as an unsustainable level of fishing pressure. However, NMFS and the Council and local agency partners will continue to make improvements to data collection programs to more accurately determine sustainable fishing levels. If NMFS determines overfishing is occurring, NMFS would immediately notify the Council to take action to end overfishing in the fishery.

Under the action alternatives considered, the specification of an ACL is not accompanied by a fishery closure because the lack of in-season catch monitoring precludes forecasting a date when an ACL might be reached. However, the lack of an in season AM in Federal waters is not expected to result in large adverse impacts to any fish stock or on biodiversity or ecosystem function. This is because coral reef fisheries occur at relatively low levels of intensity, and the methods used, are target specific and non-destructive. Additionally, there have been no identified impacts to marine biodiversity and/or ecosystem function from coral reef fisheries in federal waters of American Samoa, Guam, the CNMI and the MHI and none of the alternatives are expected to result in impacts to these environmental features.

4.7 Potential Impacts to Scientific, Historic, Archeological or Cultural Resources

There are no known districts, sites, highways, structures or objects that are listed in or eligible for listing in the National Register of Historic Places within EEZ waters where coral reef fishing is authorized. Shipwrecks and other objects from the Pacific theatre in World War II could possibly occur in federal waters around the U.S. Pacific Islands. However, coral reef fishing methods and activities are not known to be having an adverse effect on bottom habitat and are not expected to result in the destruction of any objects that might be found.

Most coral reef fishing occurs State or territorial waters in American Samoa, Guam, the CNMI, and Hawaii. Coral reef fishing gears and methods authorized under the FEPs are not known to cause the loss or destruction of scientific, cultural or historical resources because the FEP allows the only gears and methods that are selective and non-destructive. These methods are also not known to cause damage to the ocean, coastal habitats, corals, or marine habitats. Because the

specification of ACLs and AMs would not result in changes to the way any coral reef fishery is conducted including type of gear used, area fished, or level of catch or effort as compared with baseline conditions, none of the alternatives are expected to result in large adverse impacts to resources of scientific, historic, cultural, or ecological importance. Coral reef fishing in marine protected areas would continue to be subject to permits, reporting, and monitoring that help to ensure the marine resources of these special areas are sustainable.

4.8 Cumulative Effects of the Proposed Action

Cumulative effects refer to the impact on the environment, which results from the incremental effects of a proposed action when added to other past, present, or reasonably foreseeable future actions within the geographic area of the proposed action. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

4.8.1 Multi-year ACLs and AMs for CREMUS Groups

The specification of multi-year ACLs and AMs for Pacific Island CREMUS in 2015, 2016, 2017 and again in 2018, is not expected to result in cumulative environmental effects. This is because the proposed action would set the ACL for each CREMUS group in each island area at levels substantially lower than the stock's estimated OFL proxy, and annual catches in fishing years 2015-2018 are expected to remain below the proposed ACLs.

As noted in Section 3.3.1.1, this does not apply to *Selar crumenopthalmus* or atulai and Carangidae or jacks in Guam. For these species, recent harvest are higher than the proposed ACL, MSY and OFL. However, the high level of recent harvests were driven primarily by greater participation in the Guam shore-based creel survey program in recent years, and may not represent an unsustainable level of fishing pressure. Regardless of which alternative is selected, NMFS and the Council and local agency partners will continue to monitor catches, evaluate catches and stock status, make improvements to data collection programs to more accurately determine sustainable fishing levels, and modify ACL specifications as necessary to help ensure fishing for all CREMUS is managed sustainably.

4.8.2 ACL and AM specifications for other western Pacific fisheries

In addition to the ACLs and AMs for CREMUS being considered in this EA, NMFS is proposing to implement the Council's ACL and AM recommendations for all other western Pacific fisheries for 2015-18 including crustacean fisheries (lobsters, Kona crab and deepwater shrimp), precious coral, MHI non-Deep 7 bottomfish. NMFS will also continue to specify annual catch limits for MHI Deep 7 bottomfish on an annual basis. These fisheries have been managed using ACLs and AMs since 2012; and these specifications do not have unknown or uncertain impacts. NMFS developed environmental impact analysis documents on the proposed specifications for these fisheries, which can be obtained from NMFS or the Council by request, or at www.regulations.gov using the regulatory identification number (RIN) 0648-XD558.

The coral reef fisheries in all four areas that are being considered in this EA do not overlap with other demersal fisheries to a large extent such that ACLs and AMs in the coral reef fishery would

result in more fishing in other demersal (or pelagic) fisheries. For this reason, the impacts of the proposed CREMUS ACLs and AMs can be considered separately from the other ACL and AM specifications. ACL specifications and AMs for other fisheries are not expected to result in impacts that would combine with impacts from coral reef fisheries to then have large and adverse impacts.

4.8.3 Foreseeable management actions related to western Pacific fisheries

In the foreseeable future, the Council may re-evaluate the need for conservation and management for federal coral reef fisheries and may recommend NMFS remove coral reef species from the FEPs and/or re-classify species as "ecosystem component" (EC) species. To be considered for possible classification as an EC species, the species should be: 1) a non-target species; 2) a stock that is not determined to be subject to overfishing, approaching overfished, or overfished; 3) not likely to become subject to overfishing or overfished; and 4) generally not retained for sale or personal use. Various methods for categorizing species and EC components have been preliminarily discussed at Council meetings. These include, but are not limited to, species that are caught exclusively or predominately in state/territorial waters, species that occur infrequently in the available time series, species that are non-native to an FEP area, and species associated with ciguatoxin poisoning and are generally discarded.

In accordance with National Standard 1 guidelines found in 50 CFR §600.310(d), EC species are not considered to be "in the fishery" and thus, do not require specification of an ACL. EC species may, but are not required to remain in the FEP for data collection purposes, for ecosystem considerations related to the specification of optimum yield for associated MUS, for consideration in the development of conservation and management measures for a fishery; and/or to address other ecosystem issues (e.g., such as management of bycatch). However, until such time a particular CREMUS is classified as an EC species, it will remain in the fishery and be subject to the ACL requirements.

The specification of ACLs and implementation of AMs for these four archipelagic areas would not foreclose the future designation of any species as an EC species. Continued management of Federal coral reef ecosystem fisheries using ACLs and AMs would not change the status of any CRE MUS in a way that would make it more or less likely to be classified as an EC species.

4.8.4 Other foreseeable NOAA/NMFS management actions in federal waters

On June 2, 2011, NMFS published a proposed rule (76 FR 32026) to designate areas in the main Hawaiian Islands (MHI) as monk seal critical habitat. Specific areas proposed include terrestrial and marine habitats from 5 m inland from the shoreline extending seaward to the 500 m depth contour around Kaula Island, Niihau, Kauai, Oahu, Maui Nui (including Kahoolawe, Lanai, Maui and Molokai) and Hawaii Island. The final determinations on whether designate monk seal critical habitat in the MHI have not been made.

At this point in time there is insufficient information in the proposal to allow NMFS to evaluate the potential impact of a designation of monk seal critical habitat on the MHI coral reef fisheries.

However, a designation of critical habitat for monk seals in the MHI is not expected to affect the efficacy of using ACLs and AMs to promote long-term sustainability of MHI coral reef fisheries.

While recent quantitative fatty acid signature analysis results indicate that monk seals consume a wide range of species including certain CREMUS (Iverson et al. 2011); under current levels of fishing pressure in the MHI, the monk seal population is growing, pupping is increasing, and the pups appear to be foraging successfully. In contrast, the Hawaiian monk seal subpopulation continue to decline in the NWHI where fishing has been minimized in past years and recently terminated completely.

Considering that monk seal foraging success appears to be higher in the MHI than in the NWHI despite higher fishing pressure in the MHI, competition for forage with MHI coral reef fisheries does not appear to be adversely impacting monk seals in the MHI. Therefore, the proposed ACL specifications and AMs is not considered to be affecting monk seals through completion for prey and is not expected to affect the quality of habitat being considered for designation as monk seal critical habitat because no change to the conduct of the existing MHI coral reef fisheries is likely to occur with under the proposed action.

Specifying ACLs will not have an environmental outcome that would affect the agency's decision of whether or not to revise designated critical habitat. The specification would not change the likelihood of interactions, or affect the survival, distribution or behavior of the species in any way. However, if the pending Hawaiian monk seal actions are approved, NMFS will initiate consultation in accordance with Section 7 of the ESA to ensure that Hawaii's fisheries are not likely to jeopardize the continued existence of the species, or result in the destruction or adverse modification of critical habitat.

4.8.5 Other Foreseeable NOAA Actions

On March 26, 2015, NOAA's Office of National Marine Sanctuaries (ONMS) published a proposed rule to expand the boundaries of the Humpback Whale National Marine Sanctuary in the main Hawaiian Islands (80 FR 16224). The purpose of this action is to transition the sanctuary from a single species management approach to an ecosystem-based management approach. The proposal would also change the name of the sanctuary to Na Kai Ewalu National Marine Sanctuary. The phrase means "the eight seas" in Hawaiian language and refers to the channels between the MHI and a poetic reference to the islands themselves.

Because there are no in-season management measures proposed, the ways in which Hawaii's coral reef fisheries are conducted is not expected to change and, therefore, the proposed ACL specification and AMs would not have an environmental effect that would affect future decisions about possible changes to the sanctuary management plan nor would the proposed action affect sanctuary resources to an extent that comprehensive effective management of the Sanctuary would not be possible.

4.8.6 Climate change

Changes in the environment from global climate change have the potential to affect coral reef fisheries. Effects of climate change may include: sea level rise; increased intensity or frequency of coastal storms and storm surges; changes in rainfall (more or less) that can affect salinity nearshore or increase storm runoff and pollutant discharges into the marine environment; increased temperatures resulting in coral bleaching, and hypothermic responses in some marine species (IPCC 2007). Increased carbon dioxide uptake can increase ocean acidity, which can disrupt calcium uptake processes in corals, crustaceans, mollusk, reef-building algae, and plankton, among other organisms (Houghton et al. 2001; The Royal Society 2005; Caldeira and Wickett 2005; Doney 2006; Kleypas et al. 2006). Climate change can also lead to changes in ocean circulation patterns, which can affect the availability of prey, migration, survival, and dispersal (Buddenmeier et al. 2004). Damage to coastal areas due to storm surge or sea level rises as well as changes to catch rates, migratory patterns, or visible changes to habitats are among the most likely changes that would be noted first. Climate change has the potential to adversely affect some organisms, while others could benefit from changes in the environment to ensure that the coral reef catches are sustainable, regardless of environmental conditions.

The impacts to coral reef fisheries from climate change may be difficult to discern from other impacts; however monitoring of physical conditions and biological resources by a number of agencies will continue to occur and will allow fishery managers to continually make adjustments in fishery management regimes in response to changes in the environment for any alternative. Thus, if in the future, climate change impacts were affecting any marine resource in ways that were decreasing the ability of a fishery to maintain sustainable harvest levels, mangers would be able to respond by adjusting ACLs or other fishery management requirements.

The efficacy of the proposed ACL and AM specifications in providing for sustainable levels of fishing for CREMUS is not expected to be adversely affected by climate change. Recent catches relative to MSY and OFL estimates helped to inform the development of the ACLs and AMs. Monitoring would continue, and, if monitoring shows overfishing is occurring, ACLs and other fishery management provisions could be adjusted in the future. The proposed specifications are not expected to result in a change to the manner in which any of the affected fisheries are conducted, so no change in greenhouse gas emissions is expected.

For these reasons, climate change, considered in addition to all other factors affecting CREMUS (including fishing), is not expected to result in a large and adverse a cumulative impact on CREMUS. None of the action alternative is not expected to change the coral reef fisheries and therefore, none of the action alternatives would result in changes in climate change-promoting gas emissions.

5 Consistency with Other Applicable Laws

5.1 National Environmental Policy Act

NOAA Administrative Order (NAO) 216-6, Environmental Review Procedures for Implementing the National Environmental Policy Act, in accordance with NEPA, requires the consideration of effects of proposed agency actions and alternatives on the human environment and allows for involvement of interested and affected members of the public before a decision is made. The NMFS Regional Administrator will use the analysis in this EA and public received on the draft EA to determine whether the proposed action would have a significant environmental impact, which, if so, would require the preparation of an environmental impact statement.

5.2 Preparers and Reviewers

Nikhil Mehta, Fishery Biologist, SERO, SFD (preparer)
Jarad Makaiau, Natural Resource Management Specialist, PIRO, SFD (preparer)
Phyllis Ha, Resource Management Specialist, PIRO, SFD NEPA (reviewer)
Michelle McGregor, Regional Economist, PIRO, SFD (reviewer)

5.3 Agencies and Persons Consulted

The proposed action described in this EA was developed in coordination with various federal and local government agencies that are represented on the Western Pacific Fishery Management Council. Specifically, agencies that participated in the deliberations and development of the proposed management measures include:

- American Samoa Department of Marine and Wildlife Resources
- Coastal Zone Management Program of American Samoa
- Guam Department of Agriculture, Division of Aquatic and Wildlife Resources
- Coastal Zone Management Program of Guam
- Hawaii Department of Land and Natural Resources, Division of Aquatic Resources
- Coastal Zone Management Program of Hawaii
- Commonwealth of the Northern Marina Islands Department of Land and Natural
- Coastal Zone Management Program of the CNMI
- Resources, Division of Fish and Wildlife
- U.S. Coast Guard
- U.S. Fish and Wildlife Service
- U.S. Department of State

5.4 Public Coordination

The development of the proposed ACL and AM specifications for coral reef fisheries of American Samoa, Guam, the CNMI, and MHI took place in public meetings of the SSC and the Council. In addition, the Council advertised the need to focus on federal annual catch limits and accountability measures in media releases, newsletter articles, and on the Council's website, http://www.wpcouncil.org. Additionally, NMFS solicited public comment on the proposed ACL

and AM specifications described in this EA (80 FR 43046, July 21, 2015). The comment period for the proposed specifications ended on August 5, 2015. Additionally, on July 21, 2015, NMFS published in the *Federal Register* the proposed specification and solicited public comments on the action and on the draft EA (80 FR 4346). NMFS received one comment from a federal agency regarding ACLs at Wake Island. NMFS responded to this comment in the final rule.

5.5 Endangered Species Act

The Endangered Species Act (ESA) provides for the protection and conservation of threatened and endangered species. Section 7(a)(2) of the ESA requires federal agencies to ensure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species.

Pursuant to Section 7 of the ESA, NMFS has evaluated the coral reef fisheries managed under the FEPs, for potential impacts on ESA-listed species under the jurisdiction of NMFS. Table 31 summarizes ESA section 7 consultations for these fisheries managed under the FEPs for American Samoa, the Marianas (including Guam and CNMI) and Hawaii.

Table 31. ESA section 7 consultations for western Pacific coral reef fisheries.

FEP Fishery	ESA Consultation	NMFS Determination
American Samoa Coral Reef Fisheries	March 7, 2002, Letter of Concurrence	Not likely to adversely affect any ESA-listed species or critical habitat
	April 9, 2015, Letter of Concurrence	
CNMI Coral Reef Fisheries	March 7, 2002, Letter of Concurrence	Not likely to adversely affect any ESA-listed species or critical habitat
	April 29, 2015, Letter of Concurrence	
Guam Coral Reef Fisheries	March 7, 2002, Letter of Concurrence	Not likely to adversely affect any ESA-listed species or critical habitat
	April 29, 2015, Letter of Concurrence	
Hawaii Coral Reef Fisheries	March 7, 2002, Letter of Concurrence	Not likely to adversely affect any ESA-listed species or critical habitat
	December 5, 2013, Letter of Concurrence	Not likely to adversely affect any ESA-listed species or critical habitat

Because the proposed action is not expected to modify vessel operations or other aspects of any coral reef fishery in the four areas, NMFS concludes that coral reef fisheries in American Samoa, Guam, CNMI, and Hawaii under the preferred proposed action alternatives would not have an adverse effect on ESA listed species or any designated critical habitats that was not considered in prior consultations, and that no further consultation is required at this time.

5.6 Marine Mammal Protection Act

The MMPA prohibits, with certain exceptions, taking of marine mammals in the U.S., and by persons aboard U.S. flagged vessels (i.e., persons and vessels subject to U.S. jurisdiction). Under section 118 of the MMPA, NMFS must publish, at least annually, a List of Fisheries (LOF) that classifies U.S. commercial fisheries into one of three categories based upon the level of serious injury and mortality of marine mammals that occurs incidental to each fishery. A Category 1 fishery is one with frequent incidental morality and serious injury of marine mammals. A Category 2 fishery is one with occasional incidental morality and serious injury of marine mammals. A Category 3 fishery is one with a remote likelihood or no known incidental morality and serious injury of marine mammals.

On December 29, 2014, (79 FR 77919), NMFS published the final LOF for 2015 which classified all gear types used in Hawaii's coral reef fisheries, including the inshore gillnet, lift net, inshore purse seine net, throw net, cast net, seine net, offshore pen culture, rod and reel, crab trap, fish trap, crab net, inshore handline, bullpen trap, hand pick, and spearfishing as Category 3 fisheries under Section 118 of the MMPA. Participants in Category 3 fisheries are not required to register in the Marine Mammal Authorization Program prior to engaging in commercial fishing. NMFS has not yet included the commercial coral reef fisheries of American Samoa, Guam, and CNMI in the annual List of Fisheries. However, because coral reef fisheries in these island areas employ similar gears and methods used in Hawaii's coral reef fisheries, it is reasonable to assume that impacts to marine mammals would be comparable, and would have a remote likelihood of incidental mortality and serious injury of marine mammals.

Because the proposed action would not modify vessel operations or other aspects of the coral reef fisheries in American Samoa, Guam, CNMI and the MHI, coral reef fisheries as conducted under the proposed action, are not expected to affect marine mammals in any manner not previously considered or authorized the commercial fishing take exemption under section 118 of the MMPA.

5.7 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) requires a determination that a recommended management measure has no effect on the land, water uses, or natural resources of the coastal zone or is consistent to the maximum extent practicable with an affected state's enforceable coastal zone management program. NMFS determined that the proposed specifications are consistent to the maximum extent practicable with the enforceable policies of the approved coastal zone management programs of American Samoa, Guam, the Northern Mariana Islands, and Hawaii. NMFS submitted this determination on June 1, 2015, for review by the appropriate agencies under section 307 of the CZMA.

5.8 National Historic Preservation Act

The National Historic Preservation Act (NHPA) requires federal agencies undergo a review process for all federally funded and permitted projects that will impact sites listed on, or eligible for listing on, the National Register of Historic Places. Currently, there are no known sites or

historic properties in EEZ waters 3 to 200 nm offshore of American Samoa, Guam, the CNMI or the MHI that are listed on or eligible for listing on the National Register of Historic Places. Although shipwrecks and other objects from the Pacific theatre in World War II could possibly occur in federal waters around the U.S. Pacific Islands, coral reef fisheries, there is little to no fishing for coral reef species in federal waters around American Samoa, Guam, the CNMI and the MHI. This is because the majority of coral reef habitat occurs in nearshore state and territorial waters and it is much easier and safer for fishers to harvest coral reef associated species in close to shore, than offshore in the EEZ. Additionally, coral reef fisheries are not known to have a damaging impact on the marine environment, because the FEPs allow only selective and non-destructive gears and methods. Because the proposed action would not change the manner in which any coral reef fishery is conducted, the proposed action would have no potential to effect on sites protected by the NHPA.

5.9 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act is to minimize the paperwork burden on the public resulting from the collection of information by or for the Federal government. It is intended to ensure the information collected under the proposed action is needed and is collected in an efficient manner (44 U.S.C. 3501(1)). The proposed action would not establish any new permitting or reporting requirements and therefore it is not subject to the provisions of the Paperwork Reduction Act.

5.10 Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) (5 U.S.C. 601 *et seq.*) requires government agencies to assess and present the impact of their regulatory actions on small entities including small businesses, small organizations, and small governmental jurisdictions. The assessment is done by preparing an Initial Regulatory Flexibility Analysis and Final Regulatory Flexibility Analysis (FRFA) for each proposed and final rule, respectively. Under the RFA, an agency does not need to conduct an IRFA or FRFA if a certification can be made that the proposed rule, if adopted, will not have a significant adverse economic impact on a substantial number of small entities.

On June 12, 2014, the Small Business Administration issued an interim final rule revising small business size standards, effective July 14, 2014 (79 FR 33647). The rule increased the size standard for finfish fishing from 19.0 to $20.5 million, shellfish fishing from $5.0 million to $5.5 million, and other marine fishing from $7.0 million to $7.5 million.

Based on available information presented in this EA, NMFS has determined that all vessels participating in coral reef fisheries in American Samoa, Guam, the CNMI and the MHI are small entities under the Small Business Administration's definition of a small entity. That is, they are engaged in the business of fish harvesting, are independently owned or operated, are not dominant in their field of operation, and have annual gross receipts not in excess of any of the small business size standard for fishing.

Even though this proposed ACL and AM would apply to a substantial number of vessels, i.e., 100 percent of the coral reef fishing vessels, if fishing were to occur in federal waters, NMFS

does not expect the rule will have a significantly adverse economic impact to individual vessels. This is because there is no in-season AM to prevent the fishery from exceeding an ACL, such as a fishery closure. Therefore, fishermen would not be required to alter any aspect of their fishing operations. Additionally, the catch limit does not favor any fisherman or disproportionately adversely affect a certain type of participant. Therefore, there are no disproportionate economic impacts between large and small entities and the proposed action, if implemented, would not have a significant economic impact on small entities. Furthermore, there are no disproportionate economic impacts among the universe of vessels based on gear, home port, or vessel length. NMFS may request that the Department of Commerce Chief Counsel for Regulation certify to the Small Business Administration that the proposed rule and specifications would not have a significant economic impact on a substantial number of small entities.

5.11 Administrative Procedure Act

All federal rulemaking is governed under the provisions of the Administrative Procedure Act (APA) (5 U.S.C. Subchapter II) which establishes a "notice and comment" procedure to enable public participation in the rulemaking process. Under the APA, NMFS is required to publish notification of proposed rules in the *Federal Register* and to solicit, consider and respond to public comment on those rules before they are finalized. The APA also establishes a 30-day waiting period from the time a final rule is published until it becomes effective, with rare exceptions.

The specification of ACLs for CREMUS in American Samoa, Guam, the CNMI and Hawaii complies with the provisions of the APA. In developing the proposed ACL specifications and AM recommendations, the Council and the SSC held public meetings, provided opportunities for the public to give comments on the proposed methods, specifications and recommendations, and the Council considered comments from the public and membership. NMFS will publish in the *Federal Register*, a proposed specification announcing the proposed ACL specifications and AMs described in this document. The proposed specification will include requests for public comments and inform the public of the availability of the EA and request comments on the EA. After considering public comments, NMFS will publish in the *Federal Register* a final specification, which will become effective 30 days after publication, unless there is good cause to waive the 30-day delay of effectiveness period.

5.12 Executive Order 12898 Environmental Justice

NMFS considered the effect of the proposed ACL specifications and AMs on Environmental Justice communities that include members of minority and low-income groups. The ACLs would apply to everyone that catches CREMUS in federal waters, and no new monitoring is required for the ACL specification or the AM to be implemented. The environmental review in this EA establishes that the proposed specifications of ACLs and provisions for post-season harvest reviews as the AMs in western Pacific coral reef fisheries are not expected to result in a change to the way these fisheries are conducted.

The ACLs and AMs are intended to provide for long-term sustainability of CREMUS in American Samoa, Guam, the CNMI and Hawaii. Specification of the ACLs and post-season

reviews are expected to benefit the target resources by providing annual review of the fishery performance and other information related to evaluating status of CREMUS. This in turn, is expected to benefit fishery participants and fishing communities that rely on this resource for food, employment, recreation and enjoyment. The proposed specifications are not likely to result in a large adverse impact to the environment that could have disproportionately large or adverse effects on members of Environmental Justice communities in American Samoa, Guam, the CNMI, or Hawaii.

5.13 Executive Order 12866 Regulatory Impact Review

A "significant regulatory action" means any regulatory action that is likely to result in a rule that may –

1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal government or communities;
2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

The specification of ACLs and AMs for Pacific Island coral reef fisheries is exempt from the procedures of E.O. 12866 because this action contains no implementing regulations.

5.14 Information Quality Act

The Information Quality Act requires federal agencies to ensure and maximize the quality, objectivity, utility, and integrity of information disseminated by federal agencies. To the extent feasible, the information in this document is current. Much of the information was made available to the public during the deliberative phases of developing the proposed specifications during meetings of the Council and its SSC. The information was also improved based on the guidance and comments from the Council's advisory groups.

NMFS staffs prepared the documents based on information provided to the Council by NMFS Pacific Islands Fisheries Science Center (PIFSC) and NMFS Pacific Islands Regional Office (PIRO) and after providing opportunities for members of the public to comment at Council meetings. Additionally, this EA will be made available to the public during the comment period for the proposed specification. The process of public review of this document provides an opportunity for comments on the information contained in this document, as well as for the provision of additional information regarding the proposed specifications and potential environmental effects.

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Appendix A List of CREMUS Comprising Each Taxonomic Group by FEP Area

Table A1. American Samoa CREMUS

American Samoa CREMUS	Common Name	Scientific Name
Atulai	Bigeye scad	*Selar crumenophthalmus*
Surgeonfish	Achilles tang	*Acanthurus achilles*
Surgeonfish	Barred unicornfish	*Naso thynnoides*
Surgeonfish	Bignose unicornfish	*Naso vlamingii*
Surgeonfish	Black tongue unicornfish	*Naso hexacanthius*
Surgeonfish	Blackstreak surgeonfish	*Acanthurus nigricauda*
Surgeonfish	Blue-banded surgeonfish	*Acanthurus lineatus*
Surgeonfish	Bluelined surgeonfish	*Acanthurus nigroris*
Surgeonfish	Bluespine unicornfish	*Naso unicornis*
Surgeonfish	Brown surgeonfish	*Acanthurus nigrofuscus*
Surgeonfish	Convict tang	*Acanthurus triostegus*
Surgeonfish	Elongate surgeonfish	*Acanthurus mata*
Surgeonfish	Eye-striped surgeonfish	*Acanthurus dussumeiri*
Surgeonfish	Gray unicornfish	*Naso caesius*
Surgeonfish	Humpback unicornfish	*Naso brachycentron*
Surgeonfish	Humpnose unicornish	*Naso tuberosus*
Surgeonfish	Mimic surgeonfish	*Acanthurus pyorferus*
Surgeonfish	Naso tang	*Naso* sp.
Surgeonfish	Orangespine unicornfish	*Naso lituratus*
Surgeonfish	Orange-spot surgeonfish	*Acanthurus olivaceus*
Surgeonfish	Pacific sailfin tang	*Zebrasoma veliferum*
Surgeonfish	Ringtail surgeonfish	*Acanthurus blochii*
Surgeonfish	Spotted unicornfish	*Naso brevirostris*
Surgeonfish	Striped bristletooth	*Ctenochaetus striatus*
Surgeonfish	Surgeonfishes/tangs	*Acanthurus* sp.
Surgeonfish	Twospot bristletooth	*Ctenochaetus binotatus*
Surgeonfish	Unicornfishes (misc)	*Naso* sp.
Surgeonfish	Whitebar surgeonfish	*Acanthurus leucopareius*
Surgeonfish	Whitecheek surgeonfish	*Acanthurus nigricans*
Surgeonfish	Whitemargin unicornfish	*Naso annulatus*
Surgeonfish	Whitespotted surgeonfish	*Acanthurus guttatus*
Surgeonfish	Yellow-eyed bristletooth	*Ctenochaetus strigosus*
Surgeonfish	Yellowfin surgeonfish	*Acanthurus xanthopterus*
Jacks	Blue kingfish trevally	*Carangoides caeruleopinnatus*
Jacks	Goldspot trevally	*Carangoides orthogrammus*
Jacks	Trevally (misc)	*Carangoides* sp.

American Samoa CREMUS	Common Name	Scientific Name
Jacks	Jacks (misc)	*Caranx* sp.
Jacks	Black jack	*Caranx lugubris*
Jacks	Bluefin trevally	*Caranx melampygus*
Jacks	Brassy trevally	*Caranx papuensis*
Jacks	Bigeye trevally	*Caranx sexfasciatus*
Jacks	Rainbow runner	*Elagatis bipinnulatus*
Jacks	Leatherback	*Scomberoides lysan*
Jacks	Snubnose pompano	*Trachinotus blochii*
Jacks	Whitemouth trevally	*Uraspis secunda*
Carcharhinidae	Reef sharks (misc)	*Carcharhinidae*
Carcharhinidae	Silvertip shark	*Carcharhinus albimarginatus*
Carcharhinidae	Grey Reef shark	*Carcharhinus amblyrhynchos*
Carcharhinidae	Galapagos shark	*Carcharhinus galapagenis*
Carcharhinidae	Black tip reef shark	*Carcharhinus melanopterus*
Carcharhinidae	White tip reef shark	*Carcharhinus triaenodon*
Crustaceans	Crabs	*Decapoda*
Crustaceans	Grapsid crab	*Graspidae*
Crustaceans	Pa'a crab	*Ocypode ceratopthalma*
Crustaceans	Seven-11 crab	*Carpilius maculatus*
Crustaceans	Small crab	*Decapoda*
Crustaceans	Mangrove crab	*Scylla serrate*
Crustaceans	Large red crab	*Sesama erythrodactyla*
Crustaceans	Hermit crab	*Coenobita clypeatus*
Squirrelfish	Bigscale soldierfish	*Myripristis berndti*
Squirrelfish	Blackfin squirrelfish	*Neoniphon opercularis*
Squirrelfish	Blackspot squirrelfish	*Sargocentron melanospilos*
Squirrelfish	Blotcheye soldierfish	*Myripristis murdjan*
Squirrelfish	Bluelined squirrelfish	*Sargocentron tiere*
Squirrelfish	Brick soldierfish	*Myripristis amaena*
Squirrelfish	Bronze soldierfish	*Myripristis adusta*
Squirrelfish	Crown squirrelfish	*Sargocentron diadema*
Squirrelfish	Double tooth soldierfish	*Myripristis hexagona*
Squirrelfish	Filelined squirrelfish	*Sargocentron microstoma*
Squirrelfish	Hawaiian squirrelfish	*Sargocentron xantherythrum*
Squirrelfish	Pearly soldierfish	*Myripristis kuntee*
Squirrelfish	Peppered squirrelfish	*Sargocentron punctatissimum*
Squirrelfish	Pink squirrelfish	*Sargocentron tieroides*
Squirrelfish	Saber squirrelfish	*Sargocentron spiniferum*
Squirrelfish	Sammara squirrelfish	*Neoniphon sammara*
Squirrelfish	Scarlet soldierfish	*Myripristis pralinius*

American Samoa CREMUS	Common Name	Scientific Name
Squirrelfish	Squirrelfish	*Sargocentron* sp.
Squirrelfish	Tailspot squirrelfish	*Sargocentron caudimaculatum*
Squirrelfish	Violet soldierfish	*Myripristis violaceus*
Squirrelfish	Violet squirrelfish	*Sargocentron violaceum*
Squirrelfish	Whitetip soldierfish	*Myripristis vittata*
Squirrelfish	Yellowfin soldierfish	*Myripristis chryseres*
Squirrelfish	Yellowstriped squirrelfish	*Neoniphon aurolineatus*
Rudderfish	Rudderfish (bigibus)	*Kyphosus bigibus*
Rudderfish	Rudderfish (cinerascens)	*Kyphosus cinerascens*
Rudderfish	Western drummer	*Kyphosus cornelii*
Rudderfish	Rudderfish	*Kyphosus* sp.
Rudderfish	Lowfin drummer	*Kyphosus vaigiensis*
Wrasse	Arenatus wrasse	*Oxycheilinus arenatus*
Wrasse	Bandcheck wrasse	*Oxycheilinus diagrammus*
Wrasse	Barred thicklip	*Hemigymnus fasciatus*
Wrasse	Bird wrasse	*Hemigymnus fasciatus*
Wrasse	Blackeye thicklip	*Hemigymnus melapterus*
Wrasse	Checkerboard wrasse	*Halichoeres hortulanus*
Wrasse	Cheilinus wrasse (misc)	*Cheilinus* sp.
Wrasse	Christmas wrasse	*Thalassoma trilobata*
Wrasse	Cigar wrasse	*Cheilio inermus*
Wrasse	Red ribbon wrasse	*Thalassoma quinquevittaitum*
Wrasse	Rockmover wrasse	*Novaculichthys taeniorus*
Wrasse	Sunset wrasse	*Thalassoma lutescens*
Wrasse	Surge wrasse	*Thalassoma purpureum*
Wrasse	Triple tail wrasse	*Cheilinus trilobatus*
Wrasse	Weedy surge wrasse	*Halichoeres margaritaceus*
Wrasse	Whitepatch wrasse	*Xyrichtys aneitensis*
Wrasse	Wrasses (misc.)	*Labridae*
Wrasse	Floral wrasse	*Cheilinus chlorourus*
Wrasse	Harlequin tuskfish	*Cheilinus fasciatus*
Emperors	Emperors (misc)	*Lethrinidae*
Emperors	Goldenline bream	*Gnathodentex aureolineatus*
Emperors	Yellowspot emperor	*Gnathodentex aurolineatus*
Emperors	Blueline bream	*Gymnocranius grandoculis*
Emperors	Orangespot emperor	*Lethrinus erythracanthus*
Emperors	Longnose emperor	*Lethrinus elongatus*
Emperors	Bigeye emperor	*Monotaxis grandoculis*
Emperors	Sweetlip emperor	*Lethrinus miniatus*
Snappers	Inshore snappers	*Lutjanidae*

American Samoa CREMUS	Common Name	Scientific Name
Snappers	Brown jobfish	*Aphareus furca*
Snappers	Scarlet snapper	*Etelis radiosus*
Snappers	Red snapper	*Lutjanus bohar*
Snappers	Twinspot/red snapper	*Lutjanus bohar*
Snappers	Yellow margined snapper	*Lutjanus fulvus*
Snappers	Humpback snapper	*Lutjanus gibbus*
Snappers	Onespot snapper	*Lutjanus monostigma*
Snappers	Rufous snapper	*Lutjanus rufolineatus*
Snappers	Blood snapper	*Lutjanus sanguineus*
Snappers	Timor snapper	*Lutjanus timorensis*
Snappers	Black snapper	*Macolor niger*
Snappers	Kusakar's snapper	*Paracaesio kusakarii*
Snappers	Stone's snapper	*Paracaesio stonei*
Snappers	Multidens snapper	*Pristipomoides multidens*
Mollusks	Mangrove clam	*Anodontia edentula*
Mollusks	Pen shell clam	*Atrina rigida*
Mollusks	Pipi clam	*Donax deltoides*
Mollusks	Squid	*Teuthida*
Mollusks	Clams (misc)	*Bivalvia*
Mollusks	Cone snail	*Conus* sp.
Mollusks	Octopus (cyanea)	*Octopus cyanea*
Mollusks	Octopus (ornatus)	*Octopus ornatus*
Mollusks	Octopus	*Octopus* sp.
Mollusks	Giant clam	*Tridacna* sp.
Mollusks	Turban snail	*Trochus* sp.
Mollusks	Green snails	*Turbo* sp.
Mullets	Mullets	*Mugilidae*
Mullets	Fringelip mullet	*Crenimugil crenilabis*
Mullets	Diamond scale mullet	*Ellochelon vaigiensis*
Mullets	False mullet	*Neomyxus leuciscus*
Goatfish	Goatfish (misc)	*Mullidae*
Goatfish	Yellowstripe goatfish	*Mulloidichthys flavolineatus*
Goatfish	Orange goatfish	*Mulloidichthys pfluegeri*
Goatfish	Yellow goatfishes	*Mulloidichthys* sp.
Goatfish	Yellowfin goatfish	*Mulloidichthys vanicolensis*
Goatfish	Dash-and-dot goatfish	*Parupeneus barberinus*
Goatfish	Doublebar goatfish	*Parupeneus bifasciatus*
Goatfish	White-lined goatfish	*Parupeneus ciliatus*
Goatfish	Yellowsaddle goatfish	*Parupeneus cyclostomus*
Goatfish	Redspot goatfish	*Parupeneus heptacanthus*

American Samoa CREMUS	Common Name	Scientific Name
Goatfish	Indian goatfish	*Parupeneus indicus*
Goatfish	Parupenus insularis	*Parupeneus insularis*
Goatfish	Multi-barred goatfish	*Parupeneus multifasciatus*
Goatfish	Side spot goatfish	*Parupeneus pleurostigma*
Goatfish	Banded goatfish (misc)	*Parupeneus* sp.
Parrotfish	Stareye parrotfish	*Calotomus carolinus*
Parrotfish	Longnose parrotfish	*Hipposcarus longiceps*
Parrotfish	Yellowband parrotfish	*Scarus schlegeli*
Parrotfish	Parrotfishes (misc)	*Scarus* sp.
Groupers	Eightbar grouper	*Epinephelus octofasciatus*
Groupers	Giant grouper	*Epinephelus lanceolatus*
Groupers	Golden hind	*Cephalopholis aurantia*
Groupers	Greasy grouper	*Epinephelus tauvina*
Groupers	Groupers (misc)	*Epinephelus* sp.
Groupers	Hexagon grouper	*Epinephelus hexagonatus*
Groupers	Honeycomb grouper	*Epinephelus merra*
Groupers	Inshore groupers	*Serrandidae*
Groupers	Longspine grouper	*Epinephelus longispinnis*
Groupers	Netfin grouper	*Epinephelus miliaris*
Groupers	One-bloch grouper	*Epinephelus melanostigma*
Groupers	Peacock grouper	*Cephalopholis argus*
Groupers	Pygmy grouper	*Cephalopholis spiloparaea*
Groupers	Saddleback grouper	*Plectropomus laevis*
Groupers	Six-banded grouper	*Cephalopholis sexmaculatus*
Groupers	Slender grouper	*Anyperodon leucogrammicus*
Groupers	Smalltooth grouper	*Epinephelus microdon*
Groupers	Spotted grouper	*Epinephelus maculatus*
Groupers	Squaretail grouper	*Plectropomus areolatus*
Groupers	Striped grouper	*Epinephelus morrhua*
Groupers	Tomato grouper	*Cephalopholis sennerati*
Groupers	Ybanded grouper	*Cephalopholis igarashiensis*
Groupers	Yellowspot grouper	*Epinephelus timorensis*
Groupers	Leopard coral trout	*Plectropomus leopardus*
Groupers	Powell's grouper	*Saloptia powelli*
Groupers	White-edged lyretail	*Variola albimarginata*
Rabbitfish	Rabbitfish	*Siganidae*
Rabbitfish	Forktail rabbitfish	*Siganus aregenteus*
Rabbitfish	Scribbled rabbitfish	*Siganus spinus*
Species of Special Management Interest	Humphead (Napoleon) wrasse	*Cheilinus undulatus*

American Samoa CREMUS	Common Name	Scientific Name
Species of Special Management Interest	Bumphead parrotfish	*Bolbometopon muricatum*
Misc. Bottomfish	Bottomfish (misc)	*n/a*
Misc. Reef Fish	Reef fish (misc)	*n/a*
Misc. Shallow bottomfish	Shallow bottomfish (misc)	*n/a*
Other CRE-Finfish	Flyingfish	*Exocoetidae*
Other CRE-Finfish	Cornetfish	*Fistularia commersonii*
Other CRE-Finfish	Mojarras	*Gerreidae*
Other CRE-Finfish	Gobies	*Gobiidae*
Other CRE-Finfish	Sweetlips	*Plectorhinchus* sp.
Other CRE-Finfish	Halfbeaks	*Hemiramphidae*
Other CRE-Finfish	Flagtails	*Kuhliidae*
Other CRE-Finfish	Barred flagtail	*Kuhlia mugil*
Other CRE-Finfish	Mountain bass	*Kuhlia* sp.
Other CRE-Finfish	Ponyfish	*Leiognathidae*
Other CRE-Finfish	Tilefishes	*Malacanthus* sp.
Other CRE-Finfish	Sunfish	*Masturus lanceolatus*
Other CRE-Finfish	Filefishes	*Monacanthidae*
Other CRE-Finfish	Silver batfish	*Monodactylus argenteus*
Other CRE-Finfish	Moray eels	*Gymnothorax* sp.
Other CRE-Finfish	Dragon eel	*Enchelycore pardalis*
Other CRE-Finfish	Yellowmargin moray eel	*Gymnothorax flavimarginatus*
Other CRE-Finfish	Giant moray eel	*Gymnothorax javanicus*
Other CRE-Finfish	Spotted moray eels	*Gymnothorax* sp.
Other CRE-Finfish	Undulated moray eel	*Gymnothorax undulatus*
Other CRE-Finfish	Rays	*Batiodea*
Other CRE-Finfish	Eagle ray	*Aetobatis narinari*
Other CRE-Finfish	Monogram monocle bream	*Scolopsis monogramma*
Other CRE-Finfish	Nurse shark	*Pempheris* sp.
Other CRE-Finfish	Sweepers	*Pempheridae*
Other CRE-Finfish	Prettyfins	*Cyprinididae*
Other CRE-Finfish	Threadfin	*Polynemus* sp.
Other CRE-Finfish	Angelfishes	*Centropyge flavissimus*
Other CRE-Finfish	Emperor angelfish	*Pomacanthus imperator*
Other CRE-Finfish	Banded sergeant	*Abudefduf septemfasciatus*
Other CRE-Finfish	Sergeant major	*Abudefduf* sp.
Other CRE-Finfish	Damselfish	*Dascyllus trimaculatus*
Other CRE-Finfish	Bigeyes	*Priacanthidae*
Other CRE-Finfish	Glasseye	*Heteropriacanthus cruentatus*
Other CRE-Finfish	Paeony bulleye	*Priacanthus blochii*

American Samoa CREMUS	Common Name	Scientific Name
Other CRE-Finfish	Moontail bullseye	*Priacanthus hamrur*
Other CRE-Finfish	Bigeye squirrelfish	*Priacanthus* sp.
Other CRE-Finfish	Dottybacks	*Pseudochromidae*
Other CRE-Finfish	Scorpionfishes	*Scorpaenidae*
Other CRE-Finfish	Lionfish	*Pterois* sp.
Other CRE-Finfish	Stonefish	*Synaceia* sp.
Other CRE-Finfish	Small barracuda	*Sphyraenidae*
Other CRE-Finfish	Great barracuda	*Sphyraena barracuda*
Other CRE-Finfish	Bigeye barracuda	*Sphyraena forsteri*
Other CRE-Finfish	Heller's barracuda	*Sphyraena helleri*
Other CRE-Finfish	Blackfin barracuda	*Sphyraena qenie*
Other CRE-Finfish	Barracudas (misc)	*Sphyraena* sp.
Other CRE-Finfish	Seahorses	*Sygnathidae*
Other CRE-Finfish	Lizardfish	*Synodontidae*
Other CRE-Finfish	Terapon perch	*Terapon jarbua*
Other CRE-Finfish	Moorish Idol	*Zanclus cornutus*
Other CRE-Finfish	Freshwater eel	*Anguilla marmorata*
Other CRE-Finfish	Flashlightfishes	*Anomalopidae*
Other CRE-Finfish	Frogfishes	*Antennariidae*
Other CRE-Finfish	Cardinalfish	*Apogonidae*
Other CRE-Finfish	Silversides	*Hypoathernia temminckii*
Other CRE-Finfish	Trumpetfish	*Aulostomus chinensis*
Other CRE-Finfish	Triggerfish	*Balistidae*
Other CRE-Finfish	Orangestripe triggerfish	*Balistapus undulatus*
Other CRE-Finfish	Clown triggerfish	*Balistoides conspicillum*
Other CRE-Finfish	Titan triggerfish	*Balistoides viridescens*
Other CRE-Finfish	Needlefish	*Belonidae*
Other CRE-Finfish	Blennies	*Blennidae*
Other CRE-Finfish	Angler flatfish	*Asterorhombus fijiensis*
Other CRE-Finfish	Gold banded fusilier	*Caesio caerulaurea*
Other CRE-Finfish	Coral crouchers	*Caracanthus maculatus*
Other CRE-Finfish	Butterflyfishes (misc)	*Chaetodon* sp.
Other CRE-Finfish	Butterflyfish (auriga)	*Chaetodon auriga*
Other CRE-Finfish	Saddleback butterflyfish	*Chaetodon ephippium*
Other CRE-Finfish	Racoon butterflyfish	*Chaetodon lunula*
Other CRE-Finfish	Butterflyfish (melanotic)	*Chaetodon melannotus*
Other CRE-Finfish	Milkfish	*Chanos chanos*
Other CRE-Finfish	Tilapia	*Tilapia zillii*
Other CRE-Finfish	Two spotted hawkfish	*Amplycirrhitus bimacula*
Other CRE-Finfish	Stocky hawkfish	*Cirrhitus pinnalatus*

American Samoa CREMUS	Common Name	Scientific Name
Other CRE-Finfish	Flame hawkfish	*Neocirrhites armatus*
Other CRE-Finfish	Herrings	*Clupeidae*
Other CRE-Finfish	White eel	*Conger cinereus*
Other CRE-Finfish	Conger eels	*Conger* sp.
Other CRE-Finfish	Porcupinefish	*Diodon (Porcupine)* sp.
Other CRE-Finfish	Remoras	*Echeneidae*
Other CRE-Finfish	Anchovies	*Engraulidae*
Other CRE-Finfish	Batfishes	*Ephippidae*
Invertebrates	Invertebrates (misc)	*n/a*
Invertebrates	Sea urchins (misc)	*Diadema*
Invertebrates	Black sea urchin	*Diadema*
Invertebrates	White sea urchin	*Salmacis* sp.
Invertebrates	Cubed loli	*Holothuria atra (cubed)*
Invertebrates	Cubed leapord sea cucumber	*Bahadschia argus (cubed)*
Invertebrates	Surf redfish	*Actinopyga maurtiana*
Invertebrates	Sea cucumber (misc)	*Cucumariidae*
Invertebrates	Sea cucumber - gau	*Cucumariidae*
Invertebrates	Sea cucumber gonads	*Cucumariidae*
Invertebrates	Leapord sea cucumber	*Bahadschia argus*
Invertebrates	Loli	*Holothuria atra*
Algae	Red algae	*Red Algae*
Algae	Seaweeds	*Seaweeds*

Table A2. Mariana CREMUS (CNMI)

Mariana CREMUS (CNMI)	Common Name	Scientific Name
Atulai	Bigeye Scad	*Selar crumenopthalmus*
Surgeonfish	Bluebanded Surgeonfish	*Acanthurus lineatus*
Surgeonfish	Bluelined Surgeon	*Acanthurus nigroris*
Surgeonfish	Bluespine Unicornfish	*Naso unicornis*
Surgeonfish	Convict Tang	*Acanthurus triostegus*
Surgeonfish	Orangespine Unicornfish	*Naso lituratus*
Surgeonfish	Surgeonfish (misc.)	*Acanthurus* sp.
Surgeonfish	Unicornfish (misc.)	*Naso* sp.
Surgeonfish	Yellowfin Surgeonfish	*Acanthurus xanthopterus*
Jacks	Bigeye Trevally	*Caranx sexfasciatus*
Jacks	Bluefin Trevally	*Caranx melampygus*
Jacks	Brassy Trevally	*Caranx papuesis*
Jacks	EE: Juvenile Jacks	*Canranx* sp.
Jacks	Jacks (misc.)	*Caranx* sp.
Jacks	Leatherback	*Scomberoides lysan*
Jacks	Mackerel Scad	*Decapterus macarellus*
Jacks	Rainbow Runner	*Elagatis bipinnulatus*
Jacks	Small-spotted pompano	*Trachinotus bailloni*
Jacks	Snubnose pompano	*Trachinotus blochii*
Jacks	Yellow Spotted Trevally	*Carangoides orthogrammus*
Species of Special Management Interest	Reef sharks (misc)	*Carcharhinidae*
Crustaceans	Crabs (misc)	*n/a*
Crustaceans	Coconut Crab	*Birgus latro*
Squirrelfish	Squirrelfish	*Holocentridae*
Squirrelfish	Soldierfish (misc.)	*Holocentridae*
Rudderfish	Rudderfish (guilli)	*Kyphosus* sp.
Rudderfish	Highfin Rudderfish Silver	*Kyphosus cinerascens*
Wrasse	Wrasse (misc.)	*Labridae*
Wrasse	Tripletail Wrasse	*Cheilinus trilobatus*
Emperors	Bigeye Emperor	*Monotaxis grandoculus*
Emperors	Blackspot Emperor	*Lethrinus harak*
Emperors	Emperor (mafute/misc.)	*Lethrinus* sp.
Emperors	Flametail Emperor	*Lutjanus fulvus*
Emperors	Longnose Emperor	*Lethrinus olivaceus*
Emperors	Orangefin Emperor	*Lethrinus erythracanthus*
Emperors	Ornate Emperor	*Lethrinus ornatus*
Emperors	Stout Emperor	*Gymnocranius* sp.
Emperors	Yellowlips Emperor	*Lethrinus xanthochilis*

Mariana CREMUS (CNMI)	Common Name	Scientific Name
Emperors	Yellowspot emperor	*Gnathodentex aurolineatus*
Emperors	Yellowstripe Emperor	*Lethrinus obsoletus*
Emperors	Yellowtail Emperor	*Lethrinus atkinsoni*
Snappers	Snapper (misc. shallow)	*Lutjanidae*
Snappers	Humpback Snapper	*Lutjanus gibbus*
Snappers	Onespot Snapper	*Lutjanus monostigmus*
Snappers	Red Snapper	*Lutjanus bohar*
Snappers	Smalltooth Jobfish	*Aphareus furca*
Mollusks	Octopus	*Octopus* sp.
Mollusks	Squid	*Teuthida*
Mollusks	Trochus	*Trochus* sp.
Mollusks	Clam/bivalve	*Bivalvia*
Mullet	Mullet	*Mugilidae*
Goatfish	Dash & Dot Goatfish	*Parupeneus barberrinus*
Goatfish	Goatfish (juvenile-misc)	*Mullidae*
Goatfish	Goatfish (misc.)	*Mullidae*
Goatfish	Sidespot Goatfish	*Parupeneus pleurostigma*
Goatfish	Two-barred Goatfish	*Parupeneus bifasciatus*
Goatfish	Yellowstripe Goatfish	*Mulloidichthys flavolineatus*
Parrotfish	Parrotfish (misc.)	*Scarus* sp.
Parrotfish	Seagrass Parrotfish	*Leptoscarus vaigiensis*
Groupers	Coral Grouper	*Epinephelus corallicola*
Groupers	Flagtail Grouper	*Cephalopholis urodeta*
Groupers	Grouper (misc.)	*Serannidae*
Groupers	Highfin Grouper	*Epinephelus maculatus*
Groupers	Honeycomb Grouper	*Epinephelus merra*
Groupers	Lyretail Grouper	*Variola louti*
Groupers	Marbled Grouper	*Epinephelus polyphekadion*
Groupers	Peacock Grouper	*Cephalopholis argus*
Groupers	Pink Grouper	*Saloptia powelli*
Groupers	Saddleback Grouper	*Plectropomus laevis*
Groupers	Tomato Grouper	*Cephanopholis sonnerati*
Groupers	White Lyretail Grouper	*Variola albimarginata*
Groupers	Yellow Banded Grouper	*Cephalopholis igarashiensis*
Rabbitfish	Rabbitfish (hitting)	*Siganus* sp.
Rabbitfish	Rabbitfish (h.feda)	*Siganus puntatus*
Rabbitfish	Rabbitfish (sesjun)	*Siganus spinus*
Species of Special Management Interest	Humphead (Napoleon) wrasse	*Cheilinus undulatus*
Species of Special Management Interest	Bumphead parrotfish	*Bolbometopon muricatum*

Mariana CREMUS (CNMI)	Common Name	Scientific Name
Misc. Bottomfish	Bottom Fish	n/a
Misc. Reeffish	Reef Fish	n/a
Misc. Shallow bottomfish	Shallow Bottomfish	n/a
Other CRE-Finfish	Angelfish	*Pomacanthidae*
Other CRE-Finfish	Butterflyfish	*Chaetodontidae*
Other CRE-Finfish	Bigeye/glasseye	*Heteropriacanthus cruentatus*
Other CRE-Finfish	Blue Razorfish	*Xyrichtys pavo*
Other CRE-Finfish	Bronzespot Razorfish	*Xyrichtys celebicus*
Other CRE-Finfish	Cardinal Misc.	*Apogonidae*
Other CRE-Finfish	Cornetfish	*Fistularia commersonii*
Other CRE-Finfish	Damselfish	*Pomacentridae*
Other CRE-Finfish	Filefish (misc)	*Monacanthidae*
Other CRE-Finfish	Flounder (misc)	*Bothus* sp.
Other CRE-Finfish	Fusilier (misc.)	*Caesionidae*
Other CRE-Finfish	Goggle-eye	*Priacanthus hamrur*
Other CRE-Finfish	Lizardfish misc.	*Synodontidae*
Other CRE-Finfish	Milkfish	*Chanos chanos*
Other CRE-Finfish	Mojarra	*Gerres* sp.
Other CRE-Finfish	Moray eel	*Muraenidae*
Other CRE-Finfish	Needlefish	*Belonidae*
Other CRE-Finfish	Picasso Trigger	*Rhinecanthus aculeatus*
Other CRE-Finfish	Pufferfish	*Tetraodontidae*
Other CRE-Finfish	Razorfish (misc)	*Tribe Novaculini*
Other CRE-Finfish	Scorpionfishes	*Scorpaenidae*
Other CRE-Finfish	Sweetlips	*Plectorhinchus picus*
Other CRE-Finfish	Triggerfish (misc.)	*Balistidae*
Other CRE-Finfish	Trumpetfish	*Aulostomus chinensis*
Other CRE-Finfish	Wedge Trigger	*Rhinecanthus rectangulus*
Other Invertebrates	Invertebrates	n/a
Other Invertebrates	Sea Cucumber	*Cucumariidae*
Algae	Seaweeds	n/a
Algae	Lemu	n/a

Table A3. Mariana CREMUS (Guam)

Mariana CREMUS (Guam)	Common Name	Scientific Name
Atulai	Bigeye Scad	*Selar crumenopthalmus*
Surgeonfish	Surgeon/Unicornfishes	*Acanthuridae*
Surgeonfish	Achilles Tang	*Acanthurus achilles*
Surgeonfish	Bariene Surgeonfish	*Acanthurus bariene*
Surgeonfish	White-Bar Surgeonfish	*Acanthurus blochii*
Surgeonfish	Chronixis Surgeonfish	*Acanthurus chronixis*
Surgeonfish	Eye-Stripe Surgeonfish	*Acanthurus dussumieri*
Surgeonfish	Whitespotted Surgeonfish	*Acanthurus guttatus*
Surgeonfish	Palelipped Surgeonfish	*Acanthurus leucocheilus*
Surgeonfish	Whitebar Surgeonfish	*Acanthurus leucopareius*
Surgeonfish	Bluebanded Surgeonfish	*Acanthurus lineatus*
Surgeonfish	White-Freckled Surgeonfish	*Acanthurus maculiceps*
Surgeonfish	Elongate Surgeonfish	*Acanthurus mata*
Surgeonfish	Whitecheek Surgeonfish	*Acanthurus nigricans*
Surgeonfish	Epaulette Surgeonfish	*Acanthurus nigricauda*
Surgeonfish	Brown Surgeonfish	*Acanthurus nigrofuscus*
Surgeonfish	Bluelined Surgeonfish	*Acanthurus nigroris*
Surgeonfish	Surgeonfish	*Acanthurus nubilus*
Surgeonfish	Orangeband Surgeonfish	*Acanthurus olivaceus*
Surgeonfish	Chocolate Surgeonfish	*Acanthurus pyroferus*
Surgeonfish	Thompson'S Surgeonfish	*Acanthurus thompsoni*
Surgeonfish	Convict Tang	*Acanthurus triostegus*
Surgeonfish	Yellowfin Surgeonfish	*Acanthurus xanthopterus*
Surgeonfish	2-Spot Bristletooth	*Ctenochaetus binotatus*
Surgeonfish	Black Surgeonfish	*Ctenochaetus hawaiiensis*
Surgeonfish	Blue-Spotted Bristletooth	*Ctenochaetus marginatus*
Surgeonfish	Striped Bristletooth	*Ctenochaetus striatus*
Surgeonfish	Goldring Surgeonfish	*Ctenochaetus strigosus*
Surgeonfish	Tomini Surgeonfish	*Ctenochaetus tominiensis*
Surgeonfish	Whmargin Unicornfish	*Naso annulatus*
Surgeonfish	Humpback Unicornfish	*Naso brachycentron*
Surgeonfish	Spotted Unicornfish	*Naso brevirostris*
Surgeonfish	Whtongue Unicornfish	*Naso caesius*
Surgeonfish	Bltongue Unicornfish	*Naso hexacanthus*
Surgeonfish	Orangespine Unicornfish	*Naso lituratus*
Surgeonfish	Lopez' Unicornfish	*Naso lopezi*
Surgeonfish	Whtongue Unicornfish	*Naso thynnoides*
Surgeonfish	Humpnose Unicornfish	*Naso tuberosus*
Surgeonfish	Bluespine Unicornfish	*Naso unicornis*
Surgeonfish	Bignose Unicornfish	*Naso vlamingii*
Surgeonfish	Hepatus Tang	*Paracanthurus hepatus*
Surgeonfish	Yellow Tang	*Zebrasoma flavescens*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Surgeonfish	Brown Tang	*Zebrasoma scopas*
Surgeonfish	Sailfin Tang	*Zebrasoma veliferum*
Jacks	Pennantfish	*Alectis ciliaris*
Jacks	Malabar Trevally	*Alectis indicus*
Jacks	Jacks, Trevallys	*Carangidae*
Jacks	Trevally	*Carangoides*
Jacks	Shadow Kingfish	*Carangoides dinema*
Jacks	Bar Jack	*Carangoides ferdau*
Jacks	Yell-Dotted Trevally	*Carangoides fulvoguttatus*
Jacks	Headnotch Trevally	*Carangoides hedlandensis*
Jacks	Yellow Spotted Jack	*Carangoides orthogrammus*
Jacks	Barcheek Trevally	*Carangoides plagiotaenia*
Jacks	Trevally	*Carangoides talamparoides*
Jacks	Longfin Trevally	*Carangoides uii*
Jacks	Juvenile Caranx	*Caranx i'e'*
Jacks	Bluefin Trevally	*Caranx melampygus*
Jacks	Brassy Trevally	*Caranx papuensis*
Jacks	Bigeye Trevally	*Caranx sexfasciatus*
Jacks	Mackerel Scad	*Decapterus macarellus*
Jacks	Mackerel Scad	*Decapterus macrosoma*
Jacks	Round Scad	*Decapterus maruadsi*
Jacks	Round Scad	*Decapterus russelli*
Jacks	Rainbow Runner	*Elagatis bipinnulatus*
Jacks	Golden Trevally	*Gnathanodon speciosus*
Jacks		*Megalaspis cordyla*
Jacks	Pilotfish	*Naucrates ductor*
Jacks	Elagatis, Scomberoides,	*Naucratini*
Jacks	Leatherback	*Scomberoides lysan*
Jacks	Almaco Jack	*Seriola rivoliana*
Jacks	Small Spotted Pompano	*Trachinotus bailloni*
Jacks	Silver Pompano	*Trachinotus blochii*
Jacks	Mandibular Kingfish	*Ulua mandibularis*
Jacks	Kingfish	*Uraspis helvola*
Jacks	Deep Trevally	*Uraspis secunda*
Jacks	Whitemouth Trevally	*Uraspis uraspis*
Carcharhinidae	Reef sharks	*Carcharhinidae*
Carcharhinidae	Blackfin shark	*Carcharhinus limbatus*
Carcharhinidae	White tip reef shark	*Triaenodon obesus*
Carcharhinidae	Blackfin Shark	*Carcharhinus limbatus*
Carharhinidae	Reef Whitetip Shark	*Triaenodon obesus*
Other	Nurse Shark	*Nebrius ferrugineus*
Other	Lemon Shark	*Negaprion acutidens*
Other	Bramble Shark	*Echinorhinidae*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other	Bramble Shark	*Echinorhinus brucus*
Other	Bramble Shark	*Echinorhinus cookei*
Other	Tiger Shark	*Galeocerdo cuvier*
Other	Nurse,Zebra,Carpet Sharks	*Orectolobidae*
Other	Leopard Shark	*Stegastoma varium*
Crustaceans	Spider Crab	*Achaeus japonicus*
Crustaceans	Snapping Shrimp	*Alphaeidae*
Crustaceans	Snapping Shrimp	*Alpheus bellulus*
Crustaceans	Snapping Shrimp	*Alpheus paracrinitus*
Crustaceans	Anchylomerids	*Anchylomeridae*
Crustaceans	Slipper Lobster	*Arctides regalis*
Crustaceans	Acorn Barnacle	*Balanus sp*
Crustaceans	Mantis Shrimp	*Bathysquillidae*
Crustaceans	Box Crab	*Calappa bicornis*
Crustaceans	Box Crab	*Calappa calappa*
Crustaceans	Box Crab	*Calappa hepatica*
Crustaceans	Box Crabs	*Calappidae*
Crustaceans	Decorator Crab	*Camposcia retusa*
Crustaceans	Cancrids	*Cancridae*
Crustaceans	7-11 Crab	*Carpilius convexus*
Crustaceans	7-11 Crab	*Carpilius maculatus*
Crustaceans	Red-Legged Sw Crab	*Charybdis erythrodactyla*
Crustaceans	Red Sw Crab	*Charybdis hawaiiensis*
Crustaceans	Box Crab	*Cycloes granulosa*
Crustaceans	Elbow Crab	*Daldorfia horrida*
Crustaceans	Marine Hermit Crab	*Dardanus gemmatus*
Crustaceans	Marine Hermit Crab	*Dardanus megistos*
Crustaceans	Marine Hermit Crab	*Dardanus pendunculatus*
Crustaceans	Marine Hermit Crab	*Dardanus* sp.
Crustaceans	Commensal Shrimp	*Dasycaris zanzibarica*
Crustaceans	Decapod Crustaceans	*Decapoda*
Crustaceans	Marine Hermit Crabs	*Diogenidae*
Crustaceans	Dorippid Crab	*Dorippe frascone*
Crustaceans	Sponge Crab	*Dromia dormia*
Crustaceans	Sponge Crabs	*Dromiidae*
Crustaceans	Mole Crab	*Emerita pacifica*
Crustaceans	Soft Lobster	*Enoplometopus debelius*
Crustaceans	Hairy Lobster	*Enoplometopus occidentalis*
Crustaceans	Redeye Crab	*Eriphia sebana*
Crustaceans	Red-Reef Crab	*Etisus dentatus*
Crustaceans	Red-Reef Crab	*Etisus splendidus*
Crustaceans	Brown-Reef Crab	*Etisus utilis*
Crustaceans	Mantis Shrimp	*Eurysquillidae*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Crustaceans	Squat Lobsters	*Galatheidae*
Crustaceans	Gecarcinids	*Gecarcinidae*
Crustaceans	Bbee And Harlequin Shrimp	*Gnathophyllidae*
Crustaceans	Bumblebee Shrimp	*Gnathophylloides mineri*
Crustaceans	Bumblebee Shrimp	*Gnathophyllum americanum*
Crustaceans	Mantis Shrimp	*Gonodactylaceus mutatus*
Crustaceans	Mantis Shrimp	*Gonodactylellus affinis*
Crustaceans	Mantis Shrimp	*Gonodactylidae*
Crustaceans	Mantis Shrimp	*Gonodactylus chiragra*
Crustaceans	Mantis Shrimp	*Gonodactylus platysoma*
Crustaceans	Mantis Shrimp	*Gonodactylus smithii*
Crustaceans	Shore Crabs	*Grapsidae*
Crustaceans	Shore Crab	*Grapsus albolineatus*
Crustaceans	Shore Crab	*Grapsus grapsus tenuicrustat*
Crustaceans	Hapalocarcinids	*Hapalocarcinidae*
Crustaceans	Mantis Shrimp	*Harposquillidae*
Crustaceans	Mantis Shrimp	*Hemisquillidae*
Crustaceans	Deepwater Shrimps	*Heteropenaeus sp*
Crustaceans	Hump-Backed Shrimp	*Hippolytidae*
Crustaceans	Homolids	*Homolidae*
Crustaceans	Soft Lobster	*Hoplometopus holthuisi*
Crustaceans	Harlequin Shrimp	*Hymenocera picta*
Crustaceans	Hyperid Amphipods	*Hyperiidae*
Crustaceans	Slipper Lobster	*Ibacus sp*
Crustaceans	True Crabs	*Io Brachyura*
Crustaceans	Long-Handed Lobster	*Justitia longimanus*
Crustaceans	Hump-Backed Shrimp	*Koror misticius*
Crustaceans	Elbow Crab	*Lambrus longispinis*
Crustaceans	Palaemonid Shrimp	*Leander plumosus*
Crustaceans	Lithodids	*Lithodidae*
Crustaceans	Swimming Crab	*Lupocyclus grimquedentatus*
Crustaceans	Lycaeids	*Lycaeidae*
Crustaceans	3-Toothed Frog Crab	*Lyreidus tridentatus*
Crustaceans	Mantis Shrimp	*Lysiosquillidae*
Crustaceans	Barnacles	*Lythoglyptidae*
Crustaceans	Telescope-Eye Crab	*Macrophthalmus telescopicus*
Crustaceans	Spider Crabs	*Majidae*
Crustaceans	Penaeid Prawn	*Metapenaeopsis sp 1*
Crustaceans	Penaeid Prawn	*Metapenaeopsis sp 2*
Crustaceans	Penaeid Prawn	*Metapenaeopsis sp 3*
Crustaceans	Box Crab	*Mursia spinimanus*
Crustaceans	Mantis Shrimp	*Nannosquillidae*
Crustaceans	Soft Lobsters	*Nephropidae*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Crustaceans	Large Ghost Crab	*Ocypode ceratopthalma*
Crustaceans	Ghost Crab	*Ocypode cordimana*
Crustaceans	Ghost Crab	*Ocypode saratum*
Crustaceans	Ocypodids	*Ocypodidae*
Crustaceans	Mantis Shrimp	*Odontodactylidae*
Crustaceans	Mantis Shrimp	*Odontodactylus brevirostris*
Crustaceans	Mantis Shrimp	*Odontodactylus scyallarus*
Crustaceans	Mantis Shrimp	*Oratosquilla oratoria*
Crustaceans	Mantis Shrimp	*Oratosquillidae*
Crustaceans	Soldier Hermit Crab	*Paguridae*
Crustaceans	Coral Hermit Crab	*Paguritta gracilipes*
Crustaceans	Coral Hermit Crab	*Paguritta harmsi*
Crustaceans	Palaemonid Shrimp	*Palaemonidae*
Crustaceans	Mole Lobster	*Palinurellus wieneckii*
Crustaceans	Painted Crayfish	*Panulirus albiflagellum*
Crustaceans	Painted Crayfish	*Panulirus versicolor*
Crustaceans	Elbow Crabs	*Parthenopidae*
Crustaceans	Panaeid Prawns	*Penaeidae*
Crustaceans	Penaeid Prawn	*Penaeus latisulcatus*
Crustaceans	Penaeid Prawn	*Penaeus monodon*
Crustaceans	Flat Rock Crab	*Percnon planissimum*
Crustaceans	Commensal Shrimp	*Periclimenes amboinensis*
Crustaceans	Commensal Shrimp	*Periclimenes brevicarpalis*
Crustaceans	Commensal Shrimp	*Periclimenes cf*
Crustaceans	Commensal Shrimp	*Periclimenes holthuisi*
Crustaceans	Commensal Shrimp	*Periclimenes imperator*
Crustaceans	Commensal Shrimp	*Periclimenes inornatus*
Crustaceans	Commensal Shrimp	*Periclimenes kororensis*
Crustaceans	Commensal Shrimp	*Periclimenes ornatus*
Crustaceans	Commensal Shrimp	*Periclimenes psamathe*
Crustaceans	Commensal Shrimp	*Periclimenes soror*
Crustaceans	Commensal Shrimp	*Periclimenes tenuipes*
Crustaceans	Commensal Shrimp	*Periclimenes venustus*
Crustaceans	Porcelain Crab	*Petrolisthes lamarkii*
Crustaceans	Phronimids	*Phronimidae*
Crustaceans	Shore Crab	*Plagusia depressa tuberculata*
Crustaceans	Platyscelids	*Platyscelidae*
Crustaceans	Commensal Shrimp	*Pliopotonia furtiva*
Crustaceans	Long-Eyed Swimming Crab	*Podophthalmus vigil*
Crustaceans	Commensal Shrimp	*Pontonides uncigar*
Crustaceans	Commensal Shrimp	*Pontoniidae*
Crustaceans	Porcellanid Crabs	*Porcellanidae*
Crustaceans	Swimming Crabs	*Portunidae*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Crustaceans	Blue Swimming Crab	*Portunus pelagicus*
Crustaceans	Swimming Crab	*Portunus sanguinolentus*
Crustaceans	Mantis Shrimp	*Protosquillidae*
Crustaceans	Mantis Shrimp	*Pseudosquilla ciliata*
Crustaceans	Mantis Shrimp	*Pseudosquillidae*
Crustaceans	Hingebeak Prawn	*Rhinchocinetes hiatti*
Crustaceans	Hinge-Beaked Prawns	*Rhynchocinetidae*
Crustaceans	Mangrove Crab	*Scylla serrata*
Crustaceans	Solenocerids	*Solenoceridae*
Crustaceans	Mantis Shrimp	*Squillidae*
Crustaceans	Commensal Shrimp	*Stegopontonia commensalis*
Crustaceans	Cleaner Shrimp	*Stenopodidae*
Crustaceans	Banded Coral Shrimp	*Stenopus hispidus*
Crustaceans	Mantis Shrimps	*Stomatopoda*
Crustaceans	Snapping Shrimp	*Synalpheus carinatus*
Crustaceans	Acorn Barnacle	*Tetraclitella divisa*
Crustaceans	Swimming Crab	*Thalamita crenata*
Crustaceans	Ambonian Shrimp	*Thor amboinensis*
Crustaceans	Xanthid Crab	*Unid Megalops*
Crustaceans	Portunid Crab	*Unid sp 1*
Crustaceans	Xanthid Crab	*Unid sp 1*
Crustaceans	Portunid Crab	*Unid sp 2*
Crustaceans	Xanthid Crab	*Unid sp 2*
Crustaceans	Palaemonid Shrimp	*Urocaridella antonbruunii*
Crustaceans	Dark-Finger Coral Crabs	*Xanthidae*
Crustaceans	Urchin Crab	*Zebrida adamsii*
Crustaceans	Shallow Reef Crab	*Zosymus aeneus*
Squirrelfish	Squirrel,Soldierfishes	*Holocentridae*
Squirrelfish	Squirrelfishes	*Holocentrinae*
Squirrelfish	Soldierfishes	*Myripristinae*
Squirrelfish	Bronze Soldierfish	*Myripristis adusta*
Squirrelfish	Brick Soilderfish	*Myripristis amaena*
Squirrelfish	Doubletooth Soldierfish	*Myripristis amaena*
Squirrelfish	Bigscale Soldierfish	*Myripristis berndti*
Squirrelfish	Yellowfin Soldierfish	*Myripristis chryseres*
Squirrelfish	Pearly Soldierfish	*Myripristis kuntee*
Squirrelfish	Red Soldierfish	*Myripristis murdjan*
Squirrelfish	Scarlet Soldierfish	*Myripristis pralinia*
Squirrelfish	Violet Soldierfish	*Myripristis violacea*
Squirrelfish	White-Tipped Soldierfish	*Myripristis vittata*
Squirrelfish	White-Spot Soldierfish	*Myripristis woodsi*
Squirrelfish	Clearfin Squirrelfish	*Neoniphon argenteus*
Squirrelfish	Yellowstriped Squirrelfish	*Neoniphon aurolineatus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Squirrelfish	Blackfin Squirrlefish	*Neoniphon opercularis*
Squirrelfish	Bloodspot Squirrelfish	*Neoniphon sammara*
Squirrelfish	Deepwater Soldierfish	*Ostichthys brachygnathus*
Squirrelfish	Deepwater Soldierfish	*Ostichthys kaianus*
Squirrelfish	Cardinal Squirrelfish	*Plectrypops lima*
Squirrelfish	Tailspot Squirrelfish	*Sargocentron*
Squirrelfish	3-Spot Squirrelfish	*Sargocentron cornutum*
Squirrelfish	Crown Squirrelfish	*Sargocentron diadema*
Squirrelfish	Spotfin Squirrelfish	*Sargocentron*
Squirrelfish	Furcate Squirrelfish	*Sargocentron furcatum*
Squirrelfish	Samurai Squirrelfish	*Sargocentron ittodai*
Squirrelfish	Squirrelfish	*Sargocentron lepros*
Squirrelfish	Blackspot Squirrelfish	*Sargocentron melanospilos*
Squirrelfish	Finelined Squirrelfish	*Sargocentron microstoma*
Squirrelfish	Dark-Striped Squirrelfish	*Sargocentron praslin*
Squirrelfish	Speckled Squirrelfish	*Sargocentron punctatissimum*
Squirrelfish	Long-Jawed Squirrelfish	*Sargocentron spiniferum*
Squirrelfish	Blue-Lined Squirrelfish	*Sargocentron tiere*
Squirrelfish	Pink Squirrelfish	*Sargocentron tieroides*
Squirrelfish	Violet Squirrelfish	*Sargocentron violaceum*
Rudderfish	Rudderfish	*Kyphosidae*
Rudderfish	Insular Rudderfish	*Kyphosus bigibbus*
Rudderfish	Highfin Rudderfish	*Kyphosus cinerascens*
Rudderfish	Lowfin Rudderfish	*Kyphosus vaigiensis*
Wrasse	Chiseltooth Wrasse	*Anampses caeruleopunctatus*
Wrasse	Geographic Wrasse	*Anampses geographicus*
Wrasse	Wrasse	*Anampses melanurus*
Wrasse	Yellowtail Wrasse	*Anampses meleagrides*
Wrasse	Yellowbreasted Wrasse	*Anampses twisti*
Wrasse	Lyretail Hogfish	*Bodianus anthioides*
Wrasse	Axilspot Hogfish	*Bodianus axillaris*
Wrasse	2-Spot Slender Hogfish	*Bodianus bimaculatus*
Wrasse	Diana'S Hogfish	*Bodianus diana*
Wrasse	Blackfin Hogfish	*Bodianus loxozonus*
Wrasse	Mesothorax Hogfish	*Bodianus mesothorax*
Wrasse	Hogfish	*Bodianus tanyokidus*
Wrasse	Floral Wrasse	*Cheilinus chlorourus*
Wrasse	Red-Breasted Wrasse	*Cheilinus fasciatus*
Wrasse	Snooty Wrasse	*Cheilinus oxycephalus*
Wrasse	Tripletail Wrasse	*Cheilinus trilobatus*
Wrasse	Cigar Wrasse	*Cheilio inermis*
Wrasse	Yel-Cheeked Tuskfish	*Choerodon anchorago*
Wrasse	Harlequin Tuskfish	*Choerodon fasciatus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Wrasse	Wrasse	*Cirrhilabrus balteatus*
Wrasse	Wrasse	*Cirrhilabrus cyanopleura*
Wrasse	Exquisite Wrasse	*Cirrhilabrus exquisitus*
Wrasse	Johnson'S Wrasse	*Cirrhilabrus johnsoni*
Wrasse	Wrasse	*Cirrhilabrus katherinae*
Wrasse	Yellowband Wrasse	*Cirrhilabrus luteovittatus*
Wrasse	Rhomboid Wrasse	*Cirrhilabrus rhomboidalis*
Wrasse	Red-Margined Wrasse	*Cirrhilabrus rubrimarginatus*
Wrasse	Clown Coris	*Coris aygula*
Wrasse	Dapple Coris	*Coris batuensis*
Wrasse	Pale-Barred Coris	*Coris dorsomacula*
Wrasse	Yellowtailed Coris	*Coris gaimardi*
Wrasse	Knife Razorfish	*Cymolutes praetextatus*
Wrasse	Finescale Razorfish	*Cymolutes torquatus*
Wrasse	Wandering Cleaner Wrasse	*Diproctacanthus xanthurus*
Wrasse	Sling-Jawed Wrasse	*Epibulus insidiator*
Wrasse	Sling-Jawed Wrasse	*Epibulus n sp*
Wrasse	Bird Wrasse	*Gomphosus varius*
Wrasse	2-Spotted Wrasse	*Halichoeres biocellatus*
Wrasse	Drab Wrasse	*Halichoeres chloropterus*
Wrasse	Canary Wrasse	*Halichoeres chrysus*
Wrasse	Wrasse	*Halichoeres dussumieri*
Wrasse	Checkerboard Wrasse	*Halichoeres hortulanus*
Wrasse	Weedy Surge Wrasse	*Halichoeres margaritaceus*
Wrasse	Dusky Wrasse	*Halichoeres marginatus*
Wrasse	Pinstriped Wrasse	*Halichoeres melanurus*
Wrasse	Black-Ear Wrasse	*Halichoeres melasmapomus*
Wrasse	Ornate Wrasse	*Halichoeres ornatissimus*
Wrasse	Seagrass Wrasse	*Halichoeres papilionaceus*
Wrasse	Wrasse	*Halichoeres prosopeion*
Wrasse	Wrasse	*Halichoeres purpurascens*
Wrasse	Richmond'S Wrasse	*Halichoeres richmondi*
Wrasse	Zigzag Wrasse	*Halichoeres scapularis*
Wrasse	Shwartz Wrasse	*Halichoeres shwartzi*
Wrasse	Wrasse	*Halichoeres sp*
Wrasse	3-Spot Wrasse	*Halichoeres trimaculatus*
Wrasse	Wrasse	*Halichoeres zeylonicus*
Wrasse	Striped Clown Wrasse	*Hemigymnus fasciatus*
Wrasse	1/2 &1/2 Wrasse	*Hemigymnus melapterus*
Wrasse	Wrasse	*Hologymnosus annulatus*
Wrasse	Ring Wrasse	*Hologymnosus doliatus*
Wrasse	Tubelip Wrasse	*Labrichthys unilineatus*
Wrasse	Bicolor Cleaner Wrasse	*Labroides bicolor*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Wrasse	Bluestreak Cleaner Wrasse	*Labroides dimidiatus*
Wrasse	Black-Spot Cleaner Wrasse	*Labroides pectoralis*
Wrasse	Allen'S Wrasse	*Labropsis alleni*
Wrasse	Micronesian Wrasse	*Labropsis micronesica*
Wrasse	Wedge-Tailed Wrasse	*Labropsis xanthonota*
Wrasse	Leopard Wrasse	*Macropharyngodon meleagris*
Wrasse	Negros Wrasse	*Macropharyngodon*
Wrasse	Seagrass Razorfish	*Novaculichthys*
Wrasse	Dragon Wrasse	*Novaculichthys taeniourus*
Wrasse	Arenatus Wrasse	*Oxycheilinus arenatus*
Wrasse	2-Spot Wrasse	*Oxycheilinus bimaculatus*
Wrasse	Celebes Wrasse	*Oxycheilinus celebecus*
Wrasse	Bandcheek Wrasse	*Oxycheilinus digrammus*
Wrasse	Oriental Wrasse	*Oxycheilinus orientalis*
Wrasse	Ringtail Wrasse	*Oxycheilinus unifasciatus*
Wrasse	Wrasse	*Paracheilinus bellae*
Wrasse	Wrasse	*Paracheilinus sp*
Wrasse	Wrasse	*Polylepion russelli*
Wrasse	Wrasse	*Pseudocheilinops ataenia*
Wrasse	Striated Wrasse	*Pseudocheilinus evanidus*
Wrasse	6 Line Wrasse	*Pseudocheilinus hexataenia*
Wrasse	8 Line Wrasse	*Pseudocheilinus octotaenia*
Wrasse	Line Wrasse	*Pseudocheilinus sp*
Wrasse	4 Line Wrasse	*Pseudocheilinus tetrataenia*
Wrasse	Rust-Banded Wrasse	*Pseudocoris aurantiofasciata*
Wrasse	Torpedo Wrasse	*Pseudocoris heteroptera*
Wrasse	Yamashiro'S Wrasse	*Pseudocoris yamashiroi*
Wrasse	Chiseltooth Wrasse	*Pseudodax moluccanus*
Wrasse	Polynesian Wrasse	*Pseudojuloides atavai*
Wrasse	Smalltail Wrasse	*Pseudojuloides cerasinus*
Wrasse	Wrasse	*Pterogogus cryptus*
Wrasse	Wrasse	*Pterogogus guttatus*
Wrasse	Red-Shoulder Wrasse	*Stethojulis bandanensis*
Wrasse	Wrasse	*Stethojulis strigiventor*
Wrasse	Wrasse	*Stethojulis trilineata*
Wrasse	2 Tone Wrasse	*Thalassoma amblycephalum*
Wrasse	6 Bar Wrasse	*Thalassoma hardwickii*
Wrasse	Jansen'S Wrasse	*Thalassoma janseni*
Wrasse	Crescent Wrasse	*Thalassoma lunare*
Wrasse	Sunset Wrasse	*Thalassoma lutescens*
Wrasse	Surge Wrasse	*Thalassoma purpureum*
Wrasse	5-Stripe Surge Wrasse	*Thalassoma quinquevittatum*
Wrasse	Xmas Wrasse	*Thalassoma trilobatum*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Wrasse	Wh-Barred Pygmy Wrasse	*Wetmorella albofasciata*
Wrasse	Bl-Spot Pygmy Wrasse	*Wetmorella nigropinnata*
Wrasse	Wrasse	*Xiphocheilus sp*
Wrasse	Yblotch Razorfish	*Xyrichtys aneitensis*
Wrasse	Celebe'S Razorfish	*Xyrichtys celebecus*
Wrasse	Razorfish	*Xyrichtys geisha*
Wrasse	Yellowpatch Razorfish	*Xyrichtys melanopus*
Wrasse	Blue Razorfish	*Xyrichtys pavo*
Emperors	Yellow-Spot Emperor	*Gnathodentex aurolineatus*
Emperors	Japanese Bream	*Gymnocranius euanus*
Emperors	Blue-Lined Bream	*Gymnocranius grandoculus*
Emperors	Grey Bream	*Gymnocranius griseus*
Emperors	Blue-Spotted Bream	*Gymnocranius microdon*
Emperors	Stout Emperor	*Gymnocranius sp*
Emperors	Emperors	*Lethrinidae*
Emperors	Yellowtail Emperor	*Lethrinus atkinsoni*
Emperors	Orange-Spotted Emperor	*Lethrinus erythracanthus*
Emperors	Longfin Emperor	*Lethrinus erythropterus*
Emperors	Longspine Emperor	*Lethrinus genivittatus*
Emperors	Thumbprint Emperor	*Lethrinus harak*
Emperors	Pinkear Emperor	*Lethrinus lentjan*
Emperors	Smtoothed Emperor	*Lethrinus microdon*
Emperors	Orange-Striped Emperor	*Lethrinus obsoletus*
Emperors	Longface Emperor	*Lethrinus olivaceus*
Emperors	Ornate Emperor	*Lethrinus ornatus*
Emperors	Black-Blotch Emperor	*Lethrinus semicinctus*
Emperors	Slender Emperor	*Lethrinus variegatus*
Emperors	Yellowlip Emperor	*Lethrinus xanthochilus*
Emperors	Bigeye Emperor	*Monotaxis grandoculus*
Emperors	Large-Eye Bream	*Wattsia mossambica*
Snappers	Snappers	*Lutjanidae*
Snappers	River Snapper	*Lutjanus argentimaculatus*
Snappers	Two-Spot Snapper	*Lutjanus biguttatus*
Snappers	Red Snapper	*Lutjanus bohar*
Snappers	Snapper	*Lutjanus boutton*
Snappers	Checkered Snapper	*Lutjanus decussatus*
Snappers	Blackspot Snapper	*Lutjanus ehrenbergi*
Snappers	Snapper	*Lutjanus fulviflamma*
Snappers	Flametail Snapper	*Lutjanus fulvus*
Snappers	Humpback Snapper	*Lutjanus gibbus*
Snappers	Malabar Snapper	*Lutjanus malabaricus*
Snappers	Onespot Snapper	*Lutjanus monostigma*
Snappers	Scribbled Snapper	*Lutjanus rivulatus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Snappers	Snapper	*Lutjanus sebae*
Snappers	1/2-Barred Snapper	*Lutjanus semicinctus*
Snappers	One-Lined Snapper	*Lutjanus vitta*
Snappers	Bl And Wh Snapper	*Macolor macularis*
Snappers	Black Snapper	*Macolor niger*
Snappers	Fusilier	*Paracaesio sordidus*
Snappers	Yellowtail Fusilier	*Paracaesio xanthurus*
Snappers	Deepwater Snapper	*Randallichthys filamentosus*
Snappers	Shallow Snappers	*SHALLOW SNAPPERS*
Snappers	Sailfin Snapper	*Symphorichthys spilurus*
Mollusks	Spiney Chiton	*Acanthopleura spinosa*
Mollusks	Bubble Shells,Sea Hares	*Acteonidae*
Mollusks	Antique Ark	*Anadara antiquata*
Mollusks	Indo-Pacific Ark	*Arca navicularis*
Mollusks	Ventricose Ark	*Arca ventricosa*
Mollusks	Ark Shells	*Arcidae*
Mollusks	Common Paper Nautilus	*Argonauta argo*
Mollusks	Gruner'S Paper Nautilus	*Argonauta gruneri*
Mollusks	Brown Paper Nautilus	*Argonauta hians*
Mollusks	Nodose Paper Nautilus	*Argonauta nodosa*
Mollusks	Noury'S Paper Nautilus	*Argonauta nouri*
Mollusks	Paper Nautiluses	*Argonautidae*
Mollusks	Pacific Sand Clam	*Asaphis violescens*
Mollusks	Gaudy Sand Clam	*Aspaphis deflorata*
Mollusks	Peron'S Sea Butterfly	*Atlanta peroni*
Mollusks		*Atlantidae*
Mollusks	Wh Pacific Atys	*Atys naucum*
Mollusks	Almond Ark	*Babatia amygdalumtostum*
Mollusks	Goblets,Dwarf Tritons	*Buccinidae*
Mollusks	Ampule Bubble	*Bulla ampulla*
Mollusks	Bubble Shells	*Bullidae*
Mollusks	Lined Bubble	*Bullina lineata*
Mollusks	Giant Frog Shell	*Bursa bubo*
Mollusks	Warty Frog Shell	*Bursa bufonia*
Mollusks	Blood-Stain Frog Shell	*Bursa cruentata*
Mollusks	Granulate Frog Shell	*Bursa granularis*
Mollusks	Lamarck'S Frog Shell	*Bursa lamarcki*
Mollusks	Red-Mth Frog Shell	*Bursa lissostoma*
Mollusks	Udder Frog Shell	*Bursa mammata*
Mollusks	Ruddy Frog Shell	*Bursa rebeta*
Mollusks	Wine-Mth Frog Shell	*Bursa rhodostoma*
Mollusks	Frog Shells	*Bursidae*
Mollusks	Umbilicate Ovula	*Calpurnus verrucosus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Mollusks	File Miter	*Cancilla filaris*
Mollusks	Smoky Goblet	*Cantharus fumosus*
Mollusks	Waved Goblet	*Cantharus undosus*
Mollusks	Varitated Cardita	*Cardita variegata*
Mollusks	Carditid Clams	*Carditidae*
Mollusks	Vibex Bonnet	*Casmaria erinaceus*
Mollusks	Heavy Bonnet	*Casmaria ponderosa*
Mollusks	Helmet Shells	*Cassidae*
Mollusks	Horned Helmet	*Cassius cornuta*
Mollusks	3-Toothed Cavoline	*Cavolina tridentata*
Mollusks	Unicate Cavoline	*Cavolina uncinata*
Mollusks	Sea Butterfly	*Cavolinia cf globulosa*
Mollusks	Sea Butterflies	*Cavolinidae*
Mollusks	Turret,Worm-Shells	*Cerithiidae*
Mollusks	Column Certh	*Cerithium columna*
Mollusks	Giant Knobbed Certh	*Cerithium nodulosum*
Mollusks	Lazarus Jewel Box	*Chama lazarus*
Mollusks	Jewel Boxes	*Chamidae*
Mollusks	Triton Trumpet	*Charonia tritonis*
Mollusks	Ramose Murex	*Chicoreus ramosus*
Mollusks	Chitons	*Chitonidae*
Mollusks	Cook'S Scallop	*Chlamys cooki*
Mollusks	Squamose Scallop	*Chlamys squamosa*
Mollusks	Bivalves	*Class Bivalvia*
Mollusks	Pyramid Clio	*Clio cuspidata*
Mollusks	Irregular Urchins	*Clio pyramidata*
Mollusks	Morus Certh	*Clypeomorus concisus*
Mollusks	Punctate Lucina	*Codakia punctata*
Mollusks	Maculated Dwarf Triton	*Columbraria muricata*
Mollusks	Shiny Dwarf Triton	*Columbraria nitidula*
Mollusks	Twisted Dwarf Triton	*Columbraria tortuosa*
Mollusks	Cone Shells	*Conidae*
Mollusks	Sand-Dusted Cone	*Conus arenatus*
Mollusks	Princely Cone	*Conus aulicus*
Mollusks	Aureus Cone	*Conus aureus*
Mollusks	Gold-Leaf Cone	*Conus auricomus*
Mollusks	Banded Marble-Cone	*Conus bandanus*
Mollusks	Bubble Cone	*Conus bullatus*
Mollusks	Captain Cone	*Conus capitaneus*
Mollusks	Cat Cone	*Conus catus*
Mollusks	Chaldean Cone	*Conus chaldeus*
Mollusks	Comma Cone	*Conus connectens*
Mollusks	Crowned Cone	*Conus coronatus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Mollusks	Cylindrical Cone	*Conus cylandraceus*
Mollusks	Distantly-Lined Cone	*Conus distans*
Mollusks	Hebrew Cone	*Conus ebraeus*
Mollusks	Ivory Cone	*Conus eburneus*
Mollusks	Episcopus Cone	*Conus episcopus*
Mollusks	Pacific Yellow Cone	*Conus flavidus*
Mollusks	Frigid Cone	*Conus frigidus*
Mollusks	General Cone	*Conus generalis*
Mollusks	Geography Cone	*Conus geographus*
Mollusks	Acorn Cone	*Conus glans*
Mollusks	Imperial Cone	*Conus imperialis*
Mollusks	Ambassador Cone	*Conus legatus*
Mollusks	Leopard Cone	*Conus leopardus*
Mollusks	Lithography Cone	*Conus lithoglyphus*
Mollusks	Lettered Cone	*Conus litteratus*
Mollusks	Livid Cone	*Conus lividus*
Mollusks	Luteus Cone	*Conus luteus*
Mollusks	Dignified Cone	*Conus magnificus*
Mollusks	Soldier Cone	*Conus miles*
Mollusks	1000-Spot Cone	*Conus miliaris*
Mollusks	Morelet'S Cone	*Conus moreleti*
Mollusks	Muricate Cone	*Conus muriculatus*
Mollusks	Music Cone	*Conus musicus*
Mollusks	Weasel Cone	*Conus mustelinus*
Mollusks	Obscure Cone	*Conus obscurus*
Mollusks	Pertusus Cone	*Conus pertusus*
Mollusks	Flea-Bite Cone	*Conus pulicarius*
Mollusks	Rat Cone	*Conus rattus*
Mollusks	Netted Cone	*Conus retifer*
Mollusks	Blood-Stained Cone	*Conus sanguinolentus*
Mollusks	Leaden Cone	*Conus scabriusculus*
Mollusks	Marriage Cone	*Conus sponsalis*
Mollusks	Striatellus Cone	*Conus striatellus*
Mollusks	Striated Cone	*Conus striatus*
Mollusks	Terebra Cone	*Conus terebra*
Mollusks	Checkered Cone	*Conus tesselatus*
Mollusks	Textile Cone	*Conus textile*
Mollusks	Tulip Cone	*Conus tulipa*
Mollusks	Varius Cone	*Conus varius*
Mollusks	Flag Cone	*Conus vexillum*
Mollusks	Calf Cone	*Conus vitulinus*
Mollusks	Eroded Coral Shell	*Coralliophila erosa*
Mollusks	Violet Coral Shell	*Coralliophila neritodidea*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Mollusks	Coral Shells	*Coralliophilidae*
Mollusks	Giant Oyster	*Crassostrea gigas*
Mollusks	Mangrove Oyster	*Crassostrea mordax*
Mollusks	Bionic Rock Shell	*Cronia biconica*
Mollusks	Speciosus Scallop	*Cryptopecten speciosum*
Mollusks	Cigar Pteropod	*Cuvierina columnella*
Mollusks	Tritons	*Cymatiidae*
Mollusks	Clandestine Triton	*Cymatium clandestinium*
Mollusks	Jeweled Triton	*Cymatium gemmatum*
Mollusks	Liver Triton	*Cymatium hepaticum*
Mollusks	Wide-Lipped Triton	*Cymatium labiosum*
Mollusks	Black-Spotted Triton	*Cymatium lotorium*
Mollusks	Short-Neck Triton	*Cymatium muricinum*
Mollusks	Nicobar Hairy Triton	*Cymatium nicobaricum*
Mollusks	Common Hairy Triton	*Cymatium pileare*
Mollusks	Aquatile Hairy Triton	*Cymatium pilere aquatile*
Mollusks	Pear Triton	*Cymatium pyrum*
Mollusks	Red Triton	*Cymatium rubeculum*
Mollusks	Dwarf Hairy Triton	*Cymatium vespaceum*
Mollusks	Gold-Ringer Cowry	*Cypraea annulus*
Mollusks	Arabian Cowry	*Cypraea arabica*
Mollusks	Eyed Cowry	*Cypraea argus*
Mollusks	Golden Cowry	*Cypraea aurantium*
Mollusks	Beck'S Cowry	*Cypraea beckii*
Mollusks	Bistro Cowry	*Cypraea bistronatata*
Mollusks	Snake'S Head Cowry	*Cypraea caputserpentis*
Mollusks	Carnelian Cowry	*Cypraea carneola*
Mollusks	Chinese Cowry	*Cypraea chinensis*
Mollusks	Chick-Pea Cowry	*Cypraea cicercula*
Mollusks	Clandestine Cowry	*Cypraea clandestina*
Mollusks	Sieve Cowry	*Cypraea cribaria*
Mollusks	Sowerby'S Cowry	*Cypraea cylindrica*
Mollusks	Depressed Cowry	*Cypraea depressa*
Mollusks	Dillwyn'S Cowry	*Cypraea dillywini*
Mollusks	Eglantine Cowry	*Cypraea eglantina*
Mollusks	Eroded Cowry	*Cypraea erosa*
Mollusks	Globular Cowry	*Cypraea globulus*
Mollusks	Honey Cowry	*Cypraea helvola*
Mollusks	Swallow Cowry	*Cypraea hirundo*
Mollusks	Humphrey'S Cowry	*Cypraea humphreysi*
Mollusks	Isabelle Cowry	*Cypraea isabella*
Mollusks	Lined-Lip Cowry	*Cypraea labrolineata*
Mollusks	Limacina Cowry	*Cypraea limicina*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Mollusks	Lynx Cowry	*Cypraea lynx*
Mollusks	Reticulated Cowry	*Cypraea maculifera*
Mollusks	Map Cowry	*Cypraea mappa*
Mollusks	Marie'S Cowry	*Cypraea mariae*
Mollusks	Humpback Cowry	*Cypraea mauritiana*
Mollusks	Microdon Cowry	*Cypraea microdon*
Mollusks	Money Cowry	*Cypraea moneta*
Mollusks	Nuclear Cowry	*Cypraea nucleus*
Mollusks	Porus Cowry	*Cypraea poraria*
Mollusks	Punctata Cowry	*Cypraea punctata*
Mollusks	Jester Cowry	*Cypraea scurra*
Mollusks	Grape Cowry	*Cypraea staphlea*
Mollusks	Stolid Cowry	*Cypraea stolida*
Mollusks	Mole Cowry	*Cypraea talpa*
Mollusks	Teres Cowry	*Cypraea teres*
Mollusks	Tiger Cowry	*Cypraea tigris*
Mollusks	Ventral Cowry	*Cypraea ventriculus*
Mollusks	Pacific Deer Cowry	*Cypraea vitellus*
Mollusks	Undulating Cowry	*Cypraea ziczac*
Mollusks	Cowrys	*Cypraeidae*
Mollusks	3-Spined Cavoline	*Diacria trispinosa*
Mollusks	Anal Triton	*Distorso anus*
Mollusks	Dorid Nudibranchs	*Doridae*
Mollusks	Clatherate Drupe	*Drupa clathrata*
Mollusks	Elegant Pacific Drupe	*Drupa elegans*
Mollusks	Digitate Pacific Drupe	*Drupa grossularia*
Mollusks	Purple Pacific Drupe	*Drupa morum*
Mollusks	Prickley Pacific Drupe	*Drupa ricinus*
Mollusks	Strawberry Drupe	*Drupa rubusidacaeus*
Mollusks	Spectacular Scallop	*Excellichlamys spectiablis*
Mollusks	Spindles	*Fasciolariidae*
Mollusks	Pac Strawberry Cockle	*Fragum fragum*
Mollusks	Tumid Venus	*Gafrarium tumidum*
Mollusks	Rosy Gyre Triton	*Gyrineum roseum*
Mollusks	Purple Gyre Triton	*Gyrinium pusillum*
Mollusks	Little Love Harp	*Harpa amouretta*
Mollusks	True Harp	*Harpa harpa*
Mollusks	Major Harp	*Harpa major*
Mollusks	Harp Shells	*Harpidae*
Mollusks	Lance Auger	*Hastula lanceata*
Mollusks	Pencil Auger	*Hastula penicillata*
Mollusks	Spanish Dancer	*Hexabranchus sanguineus*
Mollusks	Giant Clam	*Hippopus hippopus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Mollusks	Anatomical Murex	*Homalocanthia anatomica*
Mollusks	Gr-Lined Paber Bubble	*Hydratina physis*
Mollusks	Cone-Like Miter	*Imbricaria conularis*
Mollusks	Olive-Shaped Miter	*Imbricaria olivaeformis*
Mollusks	Bonelike Miter	*Imbricaria punctata*
Mollusks	Saddle Tree Oyster	*Isognomon ephippium*
Mollusks	Tree Oysters	*Isognomonidae*
Mollusks	Janthina Snail	*Janthina janthina*
Mollusks	Pelagic Snails	*Janthinidae*
Mollusks	Chiragra Spider Conch	*Lambis chiragra*
Mollusks	Ormouth Spider Conch	*Lambis crocota*
Mollusks	Common Spider Conch	*Lambis lambis*
Mollusks	Scorpio Conch	*Lambis scorpius scorpius*
Mollusks	Spider Conch	*Lambis* sp.
Mollusks	Giant Spider Conch	*Lambis truncata*
Mollusks	Nobby Spindle	*Latirus nodatus*
Mollusks	Spindle	*Latirus rudis*
Mollusks	Fragile Lima	*Lima fragilis*
Mollusks	Indo-Pac Spiny Lima	*Lima vulgaris*
Mollusks	Limas	*Limidae*
Mollusks	Camp Pitar Venus	*Lioconcha castrensis*
Mollusks	Hieroglyphic Venus	*Lioconcha hieroglyphica*
Mollusks	Ornate Pitar Venus	*Lioconcha ornata*
Mollusks	Scabra Periwinkle	*Littorina scabra*
Mollusks	Undulate Periwinkle	*Littorina undulata*
Mollusks	Periwinkles	*Littorinidae*
Mollusks	Lucinas	*Lucinidae*
Mollusks	Apple Tun	*Malea pomum*
Mollusks	Pinnacle Murex	*Marchia bipinnatus*
Mollusks	Fenestrate Murex	*Marchia martinetana*
Mollusks	Melampus Shells	*Melampidae*
Mollusks	Yellow Melampus	*Melampus luteus*
Mollusks	Flamboyant Cuttlefish	*Metasepia pfefferi*
Mollusks	Mini Lined-Bubble	*Micromelo undatus*
Mollusks	Ventricose Milda	*Milda ventricosa*
Mollusks	Miraculous Scallop	*Mirapecten mirificus*
Mollusks	Imperial Miter	*Miter imperalis*
Mollusks	Acuminate Miter	*Mitra acuminata*
Mollusks	Cardinal Miter	*Mitra cardinalis*
Mollusks	Chrysalis Miter	*Mitra chrysalis*
Mollusks	Gold-Mth Miter	*Mitra chrysostoma*
Mollusks	Coffee Miter	*Mitra coffea*
Mollusks	Contracted Miter	*Mitra contracta*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Mollusks	Kettle Miter	*Mitra cucumaria*
Mollusks	Rusty Miter	*Mitra ferruginea*
Mollusks	Strawberry Miter	*Mitra fraga*
Mollusks	Tesselate Miter	*Mitra incompta*
Mollusks	Episcopal Miter	*Mitra mitra*
Mollusks	Papal Miter	*Mitra papalis*
Mollusks	Red-Painted Miter	*Mitra rubitincta*
Mollusks	Pontifical Miter	*Mitra stictica*
Mollusks	Miter Shells	*Mitridae*
Mollusks	Mollusca	*MOLLUSCA*
Mollusks	Burnt Murex	*Murex burneus*
Mollusks	Murex Shells	*Muricidae*
Mollusks	Mussels	*Mytilidae*
Mollusks	Tragonula Murex	*Naquetia trigonulus*
Mollusks	Triquetra Murex	*Naquetia triquetra*
Mollusks	Francolina Jopas	*Nassa francolina*
Mollusks	Nassa Mud Snails	*Nassariidae*
Mollusks	Granulated Nassa	*Nassarius graniferus*
Mollusks	Margarite Nassa	*Nassarius margaritiferus*
Mollusks	Pimpled Basket	*Nassarius papillosus*
Mollusks	Moon Shells	*Naticidae*
Mollusks	Nautilus	*Nautilidae*
Mollusks	Chambered Nautilus	*Nautilus ponpilius*
Mollusks	Clathrus Miter	*Neocancilla clathrus*
Mollusks	Flecked Miter	*Neocancilla granitina*
Mollusks	Butterfly Miter	*Neocancilla papilio*
Mollusks	Ox-Palate Nerite	*Nerita albicilla*
Mollusks	Plicate Nerite	*Nerita plicata*
Mollusks	Polished Nerite	*Nerita polita*
Mollusks	Reticulate Nerite	*Nerita signata*
Mollusks	Nerites	*Neritidae*
Mollusks	Diotocardia	*O Archaeogastropoda*
Mollusks	Octopus	*Octopodidae*
Mollusks	Common Octopus	*Octopus cyanea*
Mollusks	Red Octopus	*Octopus luteus*
Mollusks	Ornate Octopus	*Octopus ornatus*
Mollusks	Octopus	*Octopus sp*
Mollusks	Pelagic Octopus	*Octopus sp 1*
Mollusks	Long-Armed Octopus	*Octopus sp 2*
Mollusks	Elongate Octopus	*Octopus teuthoides*
Mollusks	Amethyst Olive	*Oliva annulata*
Mollusks	Carnelian Olive	*Oliva carneola*
Mollusks	Red-Mth Olive	*Oliva miniacea*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Mollusks	Peg Olive	*Oliva paxillus*
Mollusks	Olive Shells	*Olividae*
Mollusks	Squids	*Order Teuthoidea*
Mollusks	True Oysters	*Ostreidae*
Mollusks	Cat'S Ear Otopleura	*Otopleura auriscati*
Mollusks	Common Egg Cowry	*Ovula ovum*
Mollusks	Egg Shells	*Ovulidae*
Mollusks	Scallops	*Pectinidae*
Mollusks	Crispate Venus	*Periglypta crispata*
Mollusks	Youthful Venus	*Periglypta puerpera*
Mollusks	Reticulate Venus	*Periglypta reticulata*
Mollusks	Pearl Oyster	*Pinctada margaritfera*
Mollusks	Bicolor Pen Shell	*Pinna bicolor*
Mollusks	Pen Shells	*Pinnidae*
Mollusks	Breast-Shaped Moon	*Polinices mamatus*
Mollusks	Pear-Shaped Moon	*Polinices tumidus*
Mollusks	Strawberry Goblet	*Pollia fragaria*
Mollusks	Beautiful Goblet	*Pollia pulchra*
Mollusks	Fruit Ovula	*Prionovula fruticum*
Mollusks	Pearl Oysters	*Pteriidae*
Mollusks	Crenulate Miter	*Pterygia crenulata*
Mollusks	Fenestrate Miter	*Pterygia fenestrata*
Mollusks	Nut Miter	*Pterygia nucea*
Mollusks	Rough Miter	*Pterygia scabricula*
Mollusks	Club Murex	*Pterynotus elongatus*
Mollusks	Fluted Murex	*Pterynotus laqueatus*
Mollusks	3-Winged Murex	*Pterynotus tripterus*
Mollusks	Solid Pupa	*Pupa solidula*
Mollusks	Perssian Purpura	*Purpura persica*
Mollusks	Sulcate Pyram	*Pyramidella sulcata*
Mollusks	Pyram Shells	*Pyramidellidae*
Mollusks	Quoy'S Coral Shell	*Quoyula madreporarum*
Mollusks	Rapa Snail	*Rapa rapa*
Mollusks	Rough Vertigus	*Rhinoclavis aspera*
Mollusks	Obelisk Vertigus	*Rhinoclavis sinensis*
Mollusks	Chaste Miter	*Sabricola casta*
Mollusks	Tiger Scallop	*Semipallium tigris*
Mollusks	Broadclub Cuttlefish	*Sepia latimanus*
Mollusks	Cuttlefish	*Sepia* sp.
Mollusks	Bigfin Reef Squid	*Sepioteuthis lessoniana*
Mollusks	Box Mussel	*Septifer bilocularis*
Mollusks	Lacy Murex	*Siratus laciniatus*
Mollusks	Thorny Oysters	*Spondylidae*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Mollusks	Ducal Thorny Oyster	*Spondylus squamosus*
Mollusks	Baggy Pen Shell	*Streptopinna saccata*
Mollusks	True Conchs	*Strombidae*
Mollusks	Samar Conch	*Strombus dentatus*
Mollusks	Fragile Conch	*Strombus fragilis*
Mollusks	Gibbose Conch	*Strombus gibberulus*
Mollusks	Lavender-Mouth Conch	*Strombus haemastoma*
Mollusks	Silver-Lip Conch	*Strombus lentigninosus*
Mollusks	Red-Lip Conch	*Strombus luhuanus*
Mollusks	Micro Conch	*Strombus microurceus*
Mollusks	Mutable Conch	*Strombus mutabilis*
Mollusks	Pretty Conch	*Strombus plicatus*
Mollusks	Laciniate Conch	*Strombus sinuatus*
Mollusks	Bull Conch	*Strombus taurus*
Mollusks	Pyramid Top	*Tectus pyramis*
Mollusks	Box-Like Tellin	*Tellina capsoides*
Mollusks	Cat'S Tongue Tellin	*Tellina linguafelis*
Mollusks	Remie'S Tellin	*Tellina remies*
Mollusks	Rasp Tellin	*Tellina scobinata*
Mollusks	Tellin Clams	*Tellinidae*
Mollusks	Terebellum Conch	*Terebellum terebellum*
Mollusks	Similar Auger	*Terebra affinis*
Mollusks	Fly-Spotted Auger	*Terebra areolata*
Mollusks	Eyed Auger	*Terebra argus*
Mollusks	Babylonian Auger	*Terebra babylonia*
Mollusks	Certhlike Auger	*Terebra cerithiana*
Mollusks	Short Auger	*Terebra chlorata*
Mollusks	Crenulated Auger	*Terebra crenulata*
Mollusks	Dimidiate Auger	*Terebra dimidiata*
Mollusks	Tiger Auger	*Terebra felina*
Mollusks	Funnel Auger	*Terebra funiculata*
Mollusks	Spotted Auger	*Terebra gutatta*
Mollusks	Marlinspike Auger	*Terebra maculata*
Mollusks	Cloud Auger	*Terebra nubulosa*
Mollusks	Subulate Auger	*Terebra subulata*
Mollusks	Undulate Auger	*Terebra undulata*
Mollusks	Auger Shells	*Terebridae*
Mollusks	Belligerent Rock Shell	*Thais armigera*
Mollusks	Tuberose Rock Shell	*Thais tuberosa*
Mollusks	Partridge Tun	*Tonna perdix*
Mollusks	Tun Shells	*Tonnidae*
Mollusks	Angulate Cockle	*Trachycardium angulatum*
Mollusks	Giant Clam	*Tridacna crocea*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Mollusks	Lagoon Giant Clam	*Tridacna derasa*
Mollusks	Giant Clam	*Tridacna gigas*
Mollusks	Common Giant Clam	*Tridacna maxima*
Mollusks	Fluted Giant Clam	*Tridacna squamosa*
Mollusks	Giant Clams	*Tridacnidae*
Mollusks	Top Shells	*Trochidae*
Mollusks	Top Shell	*Trochus niloticus*
Mollusks	Radiate Top	*Trochus radiatus*
Mollusks	Vases	*Turbinellidae*
Mollusks	Turban Shell	*Turbinidae*
Mollusks	Silver-Mouth Turbin	*Turbo argyrostoma*
Mollusks	Tapestry Turbin	*Turbo petholatus*
Mollusks	Rough Turbin	*Turbo setosus*
Mollusks	Ceramic Vase	*Vasum ceramicum*
Mollusks	Common Pacific Vase	*Vasum turbinellus*
Mollusks	Venus Shells	*Veneridae*
Mollusks	Bernhard'S Miter	*Vexillum bernhardiana*
Mollusks	Cancellaria Miter	*Vexillum cancellarioides*
Mollusks	Saffron Miter	*Vexillum crocatum*
Mollusks	Roughened Miter	*Vexillum exasperatum*
Mollusks	Patriarchal Miter	*Vexillum patriarchalis*
Mollusks	Half-Banded Miter	*Vexillum semifasciatum*
Mollusks	Specious Miter	*Vexillum speciosum*
Mollusks	Bumpy Miter	*Vexillum tuberosum*
Mollusks	Turbin Miter	*Vexillum turbin*
Mollusks	Decorated Miter	*Vexillum unifasciatum*
Mollusks	Spotted Vitularia	*Vitularia miliaris*
Mullet	Fringelip Mullet	*Crenimugil crenilabis*
Mullet	Yellowtail Mullet	*Ellochelon vaigiensis*
Mullet	Engel'S Mullet	*Moolgarda engeli*
Mullet	Bluespot Mullet	*Moolgarda seheli*
Mullet	Gray Mullet	*Mugil cephalus*
Mullet	Mullets	*Mugilidae*
Mullet	Acute-Jawed Mullet	*Neomyxus leuciscus*
Goatfish	Goatfishes	*Mullidae*
Goatfish	Yellowstriped Goatfish	*Mulloidichthys flavolineatus*
Goatfish	Orange Goatfish	*Mulloidichthys pflugeri*
Goatfish	Juvenile Goatfish	*Mulloidichthys ti'ao*
Goatfish	Yellowfin Goatfish	*Mulloidichthys vanicolensis*
Goatfish		*Parupeneus barberinoides*
Goatfish	Dash And Dot Goatfish	*Parupeneus barberinus*
Goatfish		*Parupeneus bifasciatus*
Goatfish	White-Lined Goatfish	*Parupeneus ciliatus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Goatfish	Yellow Goatfish	*Parupeneus cyclostomus*
Goatfish	Redspot Goatfish	*Parupeneus heptacanthus*
Goatfish	Indian Goatfish	*Parupeneus indicus*
Goatfish	Multibarred Goatfish	*Parupeneus multifasciatus*
Goatfish	Sidespot Goatfish	*Parupeneus pleurostigma*
Goatfish	Goatfish	*Parupeneus* sp.
Goatfish	Goatfish	*Upeneus arge*
Goatfish	Band-Tailed Goatfish	*Upeneus taeniopterus*
Goatfish	Blackstriped Goatfish	*Upeneus tragula*
Goatfish	Yellowbanded Goatfish	*Upeneus vittatus*
Parrotfish	Bucktooth Parrotfish	*Calotomus carolinus*
Parrotfish	Spineytooth Parrotfish	*Calotomus spinidens*
Parrotfish	Bicolor Parrotfish	*Cetoscarus bicolor*
Parrotfish	Parrotfish	*Chlorurus bleekeri*
Parrotfish	Parrotfish	*Chlorurus bowersi*
Parrotfish	Tan-Faced Parrotfish	*Chlorurus frontalis*
Parrotfish	Steephead Parrotfish	*Chlorurus microrhinos*
Parrotfish	Parrotfish	*Chlorurus pyrrhurus*
Parrotfish	Bullethead Parrotfish	*Chlorurus sordidus*
Parrotfish	Parrotfish	*Hipposcarus longiceps*
Parrotfish	Seagrass Parrotfish	*Leptoscarus vaigiensis*
Parrotfish	Parrotfishes	*Scaridae*
Parrotfish	Fil-Finned Parrotfish	*Scarus altipinnis*
Parrotfish	Parrotfish	*Scarus chameleon*
Parrotfish	Parrotfish	*Scarus dimidiatus*
Parrotfish	Parrotfish	*Scarus festivus*
Parrotfish	Yellowfin Parrotfish	*Scarus flavipectoralis*
Parrotfish	Tricolor Parrotfish	*Scarus forsteni*
Parrotfish	Vermiculate Parrotfish	*Scarus frenatus*
Parrotfish	Blue-Barred Parrotfish	*Scarus ghobban*
Parrotfish	Parrotfish	*Scarus globiceps*
Parrotfish	Java Parrotfish	*Scarus hypselosoma*
Parrotfish	Parrotfish	*Scarus* sp.
Parrotfish	Black Parrotfish	*Scarus niger*
Parrotfish	Parrotfish	*Scarus oviceps*
Parrotfish	Greenthroat Parrotfish	*Scarus prasiognathos*
Parrotfish	Pale Nose Parrotfish	*Scarus psittacus*
Parrotfish	Parrotfish	*Scarus quoyi*
Parrotfish	Parrotfish	*Scarus rivulatus*
Parrotfish	Parrotfish	*Scarus rubroviolaceus*
Parrotfish	Chevron Parrotfish	*Scarus schlegeli*
Parrotfish	Parrotfish	*Scarus spinus*
Parrotfish	Tricolor Parrotfish	*Scarus tricolor*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Parrotfish	Parrotfish	*Scarus xanthopleura*
Groupers	Red-Flushed Grouper	*Aethaloperca rogaa*
Groupers	Grouper	*Anyperodon leucogrammicus*
Groupers	Orange Grouper	*Cephalopholis analis*
Groupers	Peacock Grouper	*Cephalopholis argus*
Groupers	Brownbarred Grouper	*Cephalopholis boenack*
Groupers	Ybanded Grouper	*Cephalopholis igarashiensis*
Groupers	Leopard Grouper	*Cephalopholis leopardus*
Groupers	Coral Grouper	*Cephalopholis miniata*
Groupers	Harlequin Grouper	*Cephalopholis polleni*
Groupers	6-Banded Grouper	*Cephalopholis sexmaculata*
Groupers	Tomato Grouper	*Cephalopholis sonnerati*
Groupers	Grouper	*Cephalopholis sp*
Groupers	Pygmy Grouper	*Cephalopholis spiloparaea*
Groupers	Flag-Tailed Grouper	*Cephalopholis urodeta*
Groupers	Grouper	*Cromileptes altivelis*
Groupers	Orange Grouper	*Epinephelus*
Groupers	Brown-Spotted Grouper	*Epinephelus chlorostigma*
Groupers	Grouper	*Epinephelus corallicola*
Groupers	Grouper	*Epinephelus cyanopodus*
Groupers	Blotchy Grouper	*Epinephelus fuscoguttatus*
Groupers	Hexagon Grouper	*Epinephelus hexagonatus*
Groupers	Grouper	*Epinephelus howlandi*
Groupers	Giant Grouper	*Epinephelus lanceolatus*
Groupers	Grouper	*Epinephelus macrospilos*
Groupers	Highfin Grouper	*Epinephelus maculatus*
Groupers	Malabar Grouper	*Epinephelus malabaricus*
Groupers	Bl-Spot Honeycomb Grouper	*Epinephelus melanostigma*
Groupers	Honeycomb Grouper	*Epinephelus merra*
Groupers	Grouper	*Epinephelus miliaris*
Groupers	Grouper	*Epinephelus morrhua*
Groupers	Wavy-Lined Grouper	*Epinephelus ongus*
Groupers	Marbled Grouper	*Epinephelus polyphekadion*
Groupers	Grouper	*Epinephelus retouti*
Groupers	7-Banded Grouper	*Epinephelus septemfasciatus*
Groupers	Tidepool Grouper	*Epinephelus socialis*
Groupers	4-Saddle Grouper	*Epinephelus spilotoceps*
Groupers	Greasy Grouper	*Epinephelus tauvina*
Groupers	Truncated Grouper	*Epinephelus truncatus*
Groupers	Wh-Margined Grouper	*Gracila albomarginata*
Groupers	Squaretail Grouper	*Plectropomus areolatus*
Groupers	Saddleback Grouper	*Plectropomus laevis*
Groupers	Leopard Coral Trout	*Plectropomus leopardus*

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Groupers	Blue-Lined Coral Trout	*Plectropomus oligacanthus*
Groupers	Powell'S Grouper	*Saloptia powelli*
Groupers	Sea Basses,Groupers	*Serranidae*
Groupers	Whmargin Lyretail Grouper	*Variola albimarginata*
Other	Grouper	*Cephalopholis cyanostigma*
Other	Orange-Spotted Grouper	*Epinephelus coioides*
Rabbitfish	Manahak (Forktail Rabbitfish)	*Siganus aregenteus*
Rabbitfish	Manahak	*Siganus sp*
Rabbitfish	Rabbitfish	*Siganidae*
Rabbitfish	Fork-Tail Rabbitfish	*Siganus argenteus*
Rabbitfish	Seagrass Rabbitfish	*Siganus canaliculatus*
Rabbitfish	Coral Rabbitfish	*Siganus corallinus*
Rabbitfish	Pencil-Streaked Rabbitfish	*Siganus doliatus*
Rabbitfish	Fuscescens Rabbitfish	*Siganus fuscescens*
Rabbitfish	Golden Rabbitfish	*Siganus guttatus*
Rabbitfish	Lined Rabbitfish	*Siganus lineatus*
Rabbitfish	White-Spotted Rabbitfish	*Siganus oramin*
Rabbitfish	Masked Rabbitfish	*Siganus puellus*
Rabbitfish	Peppered Rabbitfish	*Siganus punctatissimus*
Rabbitfish	Gold-Spotted Rabbitfish	*Siganus punctatus*
Rabbitfish	Randal'S Rabbitfish	*Siganus randalli*
Rabbitfish	Scribbled Rabbitfish	*Siganus spinus*
Rabbitfish	Vermiculated Rabbitfish	*Siganus vermiculatus*
Rabbitfish	Rabbitfish	*Siganus vulpinus*
Species of Special	Humphead (Napoleon) wrasse	*Cheilinus undulatus*
Species of Special	Bumphead parrotfish	*Bolbometopon muricatum*
Misc. Reef fish	Reef Fish	*Reef Fish*
Misc. Shallow bottomfish	Shallow Bottomfish	*Shallow Bottomfish*
Other CRE-finfish	Starry Triggerfish	*Abalistes stellatus*
Other CRE-finfish	Barred Needlefish	*Ablennes hians*
Other CRE-finfish	Blackspot Sergeant	*Abudefduf lorenzi*
Other CRE-finfish	Yellowtail Sergeant	*Abudefduf notatus*
Other CRE-finfish	Banded Sergeant	*Abudefduf septemfasciatus*
Other CRE-finfish	Scis-Tail Sgt Major	*Abudefduf sexfasciatus*
Other CRE-finfish	Black Spot Sergeant	*Abudefduf sordidus*
Other CRE-finfish	Sergeant-Major	*Abudefduf vaigiensis*
Other CRE-finfish	Spiney Basslets	*Acanthoclinidae*
Other CRE-finfish	Hiatt'S Basslet	*Acathoplesiops hiatti*
Other CRE-finfish	Goby	*Acentrogobius bonti*
Other CRE-finfish	Seagrass Filefish	*Acreichthys tomentosus*
Other CRE-finfish	Shrimpfish	*Aeoliscus strigatus*
Other CRE-finfish	Spotted Eagle Ray	*Aetobatis narinari*
Other CRE-finfish	Eagle Ray	*Aetomyleaus maculatus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Indo-Pacific Bonefish	*Albula glossodonta*
Other CRE-finfish	Bonefish	*Albula neoguinaica*
Other CRE-finfish	Bonefish	*Albulidae*
Other CRE-finfish	Lancetfishes	*Alepisauidae*
Other CRE-finfish	Lancetfish	*Alepisaurus ferox*
Other CRE-finfish	Dorothea'S Wriggler	*Allomicrodesmis dorotheae*
Other CRE-finfish	Blenny	*Alticus arnoldorum*
Other CRE-finfish	Unicorn Filefish	*Aluterus monoceros*
Other CRE-finfish	Filefish	*Aluterus scriptus*
Other CRE-finfish	Filefish	*Amanses scopas*
Other CRE-finfish	Glass Perch	*Ambassidae*
Other CRE-finfish	Glassie	*Ambassis buruensis*
Other CRE-finfish	Glassie	*Ambassis interrupta*
Other CRE-finfish	2-Spot Hawkfish	*Amblycirrhitus bimacula*
Other CRE-finfish	Goby	*Amblyeleotris faciata*
Other CRE-finfish	Goby	*Amblyeleotris fontaseni*
Other CRE-finfish	Goby	*Amblyeleotris guttata*
Other CRE-finfish	Goby	*Amblyeleotris randalli*
Other CRE-finfish	Brown-Barred Goby	*Amblyeleotris steinitzi*
Other CRE-finfish	Bluespotted Goby	*Amblyeleotris wheeleri*
Other CRE-finfish	Blue Pilchard	*Amblygaster clupeoides*
Other CRE-finfish	Spotted Pilchard	*Amblygaster sirm*
Other CRE-finfish	Damselfish	*Amblygliphidodon aureus*
Other CRE-finfish	Staghorn Damsel	*Amblygliphidodon curacao*
Other CRE-finfish	White-Belly Damsel	*Amblygliphidodon*
Other CRE-finfish	Ternate Damsel	*Amblygliphidodon ternatensis*
Other CRE-finfish	Goby	*Amblygobius decussatus*
Other CRE-finfish	Goby	*Amblygobius hectori*
Other CRE-finfish		*Amblygobius linki*
Other CRE-finfish	Goby	*Amblygobius nocturnus*
Other CRE-finfish	Goby	*Amblygobius phalaena*
Other CRE-finfish	Goby	*Amblygobius rainfordi*
Other CRE-finfish	Goby	*Amblygobius sp*
Other CRE-finfish	Evileye Puffer	*Amblyrhinchotus honckenii*
Other CRE-finfish	Prawn Goby	*Amlbyeleotris periophthalma*
Other CRE-finfish	Org-Fin Anemonefish	*Amphiprion chrysopterus*
Other CRE-finfish	Clark'S Anemonefish	*Amphiprion clarkii*
Other CRE-finfish	Tomato Anemonefish	*Amphiprion frenatus*
Other CRE-finfish	Dusky Anemonefish	*Amphiprion melanopus*
Other CRE-finfish	False Clown Anemonefish	*Amphiprion ocellaris*
Other CRE-finfish	Pink Anemonfish	*Amphiprion peridaeraion*
Other CRE-finfish	3-Banded Anemonefish	*Amphiprion tricinctus*
Other CRE-finfish	Dragonet	*Anaora tentaculata*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Allardice'S Moray	*Anarchias allardicei*
Other CRE-finfish	Canton Island Moray	*Anarchias cantonensis*
Other CRE-finfish	Seychelles Moray	*Anarchias seychellensis*
Other CRE-finfish	Freshwater Eel	*Anguilla bicolor*
Other CRE-finfish	Freshwater Eel	*Anguilla marmorata*
Other CRE-finfish	Freshwater Eel	*Anguillidae*
Other CRE-finfish	Flashlightfish	*Anomalopidae*
Other CRE-finfish	Flashlightfish	*Anomalops katoptron*
Other CRE-finfish	Anglerfish	*Antenariidae*
Other CRE-finfish	Pigmy Frogfish	*Antennarius analis*
Other CRE-finfish	Frogfish	*Antennarius biocellatus*
Other CRE-finfish	Freckled Frogfish	*Antennarius coccineus*
Other CRE-finfish	Giant Frogfish	*Antennarius commersonii*
Other CRE-finfish	Bandtail Frogfish	*Antennarius dorehensis*
Other CRE-finfish	Sargassumfish	*Antennarius maculatus*
Other CRE-finfish	Spotfin Frogfish	*Antennarius nummifer*
Other CRE-finfish	Painted Frogfish	*Antennarius pictus*
Other CRE-finfish	Randall'S Frogfish	*Antennarius randalli*
Other CRE-finfish	Spiney-Tufted Frogfish	*Antennarius rosaceus*
Other CRE-finfish	Bandfin Frogfish	*Antennatus tuberosus*
Other CRE-finfish	Boarfish	*Antigonia malayana*
Other CRE-finfish	Velvetfishes	*Aploactinidae*
Other CRE-finfish	Cardinalfish	*Apogon amboinensis*
Other CRE-finfish	Broad-Striped Cardinalfish	*Apogon angustatus*
Other CRE-finfish	Bigeye Cardinalfish	*Apogon bandanensis*
Other CRE-finfish	Cryptic Cardinalfish	*Apogon coccineus*
Other CRE-finfish	Ohcre-Striped Cardinalfish	*Apogon compressus*
Other CRE-finfish	Redspot Cardinalfish	*Apogon dispar*
Other CRE-finfish	Longspine Cardinalfish	*Apogon doryssa*
Other CRE-finfish	Elliot'S Cardinalfish	*Apogon ellioiti*
Other CRE-finfish	Cardinalfish	*Apogon eremeia*
Other CRE-finfish	Evermann'S Cardinalfish	*Apogon evermanni*
Other CRE-finfish	Eyeshadow Cardinalfish	*Apogon exostigma*
Other CRE-finfish	Bridled Cardinalfish	*Apogon fraenatus*
Other CRE-finfish	Cardinalfish	*Apogon fragilis*
Other CRE-finfish	Gilbert'S Cardinalfish	*Apogon gilberti*
Other CRE-finfish	Guam Cardinalfish	*Apogon guamensis*
Other CRE-finfish		*Apogon hartzfeldii*
Other CRE-finfish	Iridescent Cardinalfish	*Apogon kallopterus*
Other CRE-finfish	Inshore Cardinalfish	*Apogon lateralis*
Other CRE-finfish	Bluestreak Cardinalfish	*Apogon leptacanthus*
Other CRE-finfish	Black Cardinalfish	*Apogon melas*
Other CRE-finfish	Cardinalfish	*Apogon nigripinnis*

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Other CRE-finfish	Black-Striped Cardinalfish	*Apogon nigrofasciatus*
Other CRE-finfish	Cardinalfish	*Apogon notatus*
Other CRE-finfish	7-Lined Cardinalfish	*Apogon novemfasciatus*
Other CRE-finfish	Pearly Cardinalfish	*Apogon perlitus*
Other CRE-finfish	Cardinalfish	*Apogon rhodopterus*
Other CRE-finfish	Sangi Cardinalfish	*Apogon sangiensis*
Other CRE-finfish	Gray Cardinalfish	*Apogon savayensis*
Other CRE-finfish	Seale'S Cardinalfish	*Apogon sealei*
Other CRE-finfish	Cardinalfish	*Apogon sp*
Other CRE-finfish	Bandfin Cardinalfish	*Apogon taeniophorus*
Other CRE-finfish	Bandfin Cardinalfish	*Apogon taeniopterus*
Other CRE-finfish	3-Spot Cardinalfish	*Apogon trimaculatus*
Other CRE-finfish	Ocellated Cardinalfish	*Apogonichthys ocellatus*
Other CRE-finfish	Perdix Cardinalfish	*Apogonichthys perdix*
Other CRE-finfish	Cardinalfishes	*Apogonidae*
Other CRE-finfish	Angelfish	*Apolemichthys griffisi*
Other CRE-finfish	Flagfin Anglefish	*Apolemichthys trimaculatus*
Other CRE-finfish	Angelfish	*Apolemichthys*
Other CRE-finfish	2-Lined Soapfish	*Aporops bilinearis*
Other CRE-finfish	Snake Eel	*Apterichtus klazingai*
Other CRE-finfish	Twinspot Cardinalfish	*Archamia biguttata*
Other CRE-finfish	Orange-Lined Cardinalfish	*Archamia fucata*
Other CRE-finfish	Blackbelted Cardinalfish	*Archamia zosterophora*
Other CRE-finfish	Scheele'S Conger	*Ariosoma scheelei*
Other CRE-finfish	Flounder	*Arnoglossus intermedius*
Other CRE-finfish	Brown Puffer	*Arothron hispidus*
Other CRE-finfish	Puffer	*Arothron manilensis*
Other CRE-finfish	Puffer	*Arothron mappa*
Other CRE-finfish	White-Spot Puffer	*Arothron meleagris*
Other CRE-finfish	Black-Spotted Puffer	*Arothron nigropunctatus*
Other CRE-finfish	Star Puffer	*Arothron stellatus*
Other CRE-finfish	Black Spotted Sole	*Aseraggodes melanostictus*
Other CRE-finfish	Smith'S Sole	*Aseraggodes smithi*
Other CRE-finfish	Whitaker'S Sole	*Aseraggodes whitakeri*
Other CRE-finfish	Lance Blenny	*Aspidontus dussumieri*
Other CRE-finfish	Cleaner Mimic	*Aspidontus taeniatus*
Other CRE-finfish		*Asteropteryx semipunctatus*
Other CRE-finfish	Intermediate Flounder	*Asterorhombus intermedius*
Other CRE-finfish	Goby	*Asterropteryx ensiferus*
Other CRE-finfish	Silverside	*Atherinidae*
Other CRE-finfish	Tropical Silverside	*Atherinomorus duodecimalis*
Other CRE-finfish	Striped Silverside	*Atherinomorus endrachtensis*
Other CRE-finfish	Silverside	*Atherinomorus lacunosus*

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Other CRE-finfish	Hardyhead Silverside	*Atherinomorus lacunosus*
Other CRE-finfish	Bearded Silverside	*Atherion elymus*
Other CRE-finfish	Blenny	*Atrosalarius fuscus holomelas*
Other CRE-finfish	Trumpetfish	*Aulostomidae*
Other CRE-finfish	Trumpetfish	*Aulostomus chinensis*
Other CRE-finfish	Goby	*Austrolethops wardi*
Other CRE-finfish	Goby	*Awaous grammepomus*
Other CRE-finfish	Goby	*Awaous guamensis*
Other CRE-finfish	Undulate Triggerfish	*Balistapus undulatus*
Other CRE-finfish	Triggerfishes	*Balistidae*
Other CRE-finfish	Clown Triggerfish	*Balistoides conspicillum*
Other CRE-finfish	Titan Triggerfish	*Balistoides viridescens*
Other CRE-finfish	Goby	*Bathygobius cocosensis*
Other CRE-finfish	Goby	*Bathygobius cotticeps*
Other CRE-finfish	Goby	*Bathygobius fuscus*
Other CRE-finfish	Needlefish	*Belonidae*
Other CRE-finfish	Soapfish	*Belonoperca chaubanaudi*
Other CRE-finfish	Lantern-Eye Fish	*Berycidae*
Other CRE-finfish	Flashlightfish	*Beryx decadactylus*
Other CRE-finfish	Pipefish	*Bhanotia nuda*
Other CRE-finfish	Conger Eel	*Blachea xenobranchialis*
Other CRE-finfish	Blenny	*Blenniella cyanostigma*
Other CRE-finfish	Blenny	*Blenniella gibbifrons*
Other CRE-finfish		*Blenniella paula*
Other CRE-finfish	Blenny	*Blenniella periophthalmus*
Other CRE-finfish	Blennies	*Blenniidae*
Other CRE-finfish	Flounders	*Bothidae*
Other CRE-finfish	Peacock Flounder	*Bothus mancus*
Other CRE-finfish	Leopard Flounder	*Bothus pantherinus*
Other CRE-finfish	Taylor'S Inflator Filefish	*Brachaluteres taylori*
Other CRE-finfish	Snake Eel	*Brachysomophis sauropsis*
Other CRE-finfish	Codlet	*Bregmaceros nectabanus*
Other CRE-finfish	Codlets	*Bregmacerotidae*
Other CRE-finfish	Free-Tailed Brotula	*Brosmophyciops pautzkei*
Other CRE-finfish	Reef Cusk Eel	*Brotula multibarbata*
Other CRE-finfish	Townsend'S Cusk Eel	*Brotula townsendi*
Other CRE-finfish	Goby	*Bryaninops amplus*
Other CRE-finfish	Goby	*Bryaninops erythrops*
Other CRE-finfish	Goby	*Bryaninops natans*
Other CRE-finfish	Goby	*Bryaninops ridens*
Other CRE-finfish	Goby	*Bryaninops youngei*
Other CRE-finfish	Pipefish	*Bulbonaricus brauni*
Other CRE-finfish	Gudgeon	*Butis amboinensis*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Livebearing Brotulas	*Bythitidae*
Other CRE-finfish	Goby	*Cabillus tongarevae*
Other CRE-finfish	Snake Eel	*Caecula polyophthalma*
Other CRE-finfish	Scissor-Tailed Fusilier	*Caesio caerulaurea*
Other CRE-finfish	Fusilier	*Caesio cuning*
Other CRE-finfish	Lunar Fusilier	*Caesio lunaris*
Other CRE-finfish	Yellowback Caesio	*Caesio teres*
Other CRE-finfish	Fusilier	*Caesionidae*
Other CRE-finfish	Goldies	*Callanthiidae*
Other CRE-finfish	Snake Eel	*Callechelys marmorata*
Other CRE-finfish	Snake Eel	*Callechelys melanotaenia*
Other CRE-finfish	Dragonets	*Callionymidae*
Other CRE-finfish	Delicate Dragonet	*Callionymus delicatulus*
Other CRE-finfish	Mangrove Dragonet	*Callionymus enneactis*
Other CRE-finfish	Simple-Spined Dragonet	*Callionymus simplicicornis*
Other CRE-finfish	Goby	*Callogobious sp*
Other CRE-finfish	Goby	*Callogobius bauchotae*
Other CRE-finfish	Goby	*Callogobius centrolepis*
Other CRE-finfish	Goby	*Callogobius hasselti*
Other CRE-finfish	Goby	*Callogobius maculipinnis*
Other CRE-finfish	Goby	*Callogobius okinawae*
Other CRE-finfish	Goby	*Callogobius plumatus*
Other CRE-finfish	Goby	*Callogobius sclateri*
Other CRE-finfish	Longfin	*Calloplesiops altivelis*
Other CRE-finfish	Sleeper	*Calumia godeffroyi*
Other CRE-finfish	Gray Leatherjacket	*Cantherhines dumerilii*
Other CRE-finfish	Specktacled Filefish	*Cantherhines fronticinctus*
Other CRE-finfish	Honeycomb Filefish	*Cantherhines pardalis*
Other CRE-finfish	Rough Triggerfish	*Canthidermis maculatus*
Other CRE-finfish	Puffer	*Canthigaster amboinensis*
Other CRE-finfish	Puffer	*Canthigaster bennetti*
Other CRE-finfish	Puffer	*Canthigaster compressa*
Other CRE-finfish	Sharp Back Puffer	*Canthigaster coronata*
Other CRE-finfish	Puffer	*Canthigaster epilampra*
Other CRE-finfish	Puffer	*Canthigaster janthinoptera*
Other CRE-finfish	Puffer	*Canthigaster leoparda*
Other CRE-finfish	Circle-Barred Toby	*Canthigaster ocellicincta*
Other CRE-finfish	Papuan Toby	*Canthigaster papua*
Other CRE-finfish	Sharpnose Puffer	*Canthigaster solandri*
Other CRE-finfish	Saddle Shpns Puffer	*Canthigaster valentini*
Other CRE-finfish	Boarfishes	*Caproidae*
Other CRE-finfish	Coral Crouchers	*Caracanthidae*
Other CRE-finfish	Velvetfish	*Caracanthus maculatus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Velvetfish	*Caracanthus unipinna*
Other CRE-finfish	Pearlfish	*Carapodidae*
Other CRE-finfish	Pearlfish	*Carapus mourlani*
Other CRE-finfish	Shrimpfishes	*Centriscidae*
Other CRE-finfish	Golden Angelfish	*Centropyge aurantia*
Other CRE-finfish	Bicolor Angelfish	*Centropyge bicolor*
Other CRE-finfish	Dusky Angelfish	*Centropyge bispinosus*
Other CRE-finfish	Colin'S Angelfish	*Centropyge colini*
Other CRE-finfish	White-Tail Angelfish	*Centropyge flavicauda*
Other CRE-finfish	Lemonpeel Anglefish	*Centropyge flavissimus*
Other CRE-finfish	Herald'S Anglefish	*Centropyge heraldi*
Other CRE-finfish	Flame Anglefish	*Centropyge loriculus*
Other CRE-finfish	Multicolor Angelfish	*Centropyge multicolor*
Other CRE-finfish	Multibarred Angelfish	*Centropyge multifasciatus*
Other CRE-finfish	Black-Spot Anglefish	*Centropyge nigriocellus*
Other CRE-finfish	Midnight Angelfish	*Centropyge nox*
Other CRE-finfish	Shepard'S Anglefish	*Centropyge shepardi*
Other CRE-finfish	Keyhole Angelfish	*Centropyge tibicen*
Other CRE-finfish	Pearlscale Anglefish	*Centropyge vrolicki*
Other CRE-finfish	Triplefin	*Ceratobregma helenae*
Other CRE-finfish	Threadfin Butterflyfish	*Chaetodon auriga*
Other CRE-finfish	E Triangular Butterflyfish	*Chaetodon barronessa*
Other CRE-finfish	Bennetts Butterflyfish	*Chaetodon bennetti*
Other CRE-finfish	Burgess' Butterflyfish	*Chaetodon burgessi*
Other CRE-finfish	Speckled Butterflyfish	*Chaetodon citrinellus*
Other CRE-finfish	Saddleback Butterflyfish	*Chaetodon ephippium*
Other CRE-finfish	Ylw-Crn Butterflyfish	*Chaetodon flavocoronatus*
Other CRE-finfish	Kleins Butterflyfish	*Chaetodon kleinii*
Other CRE-finfish	Lined Butterflyfish	*Chaetodon lineolatus*
Other CRE-finfish	Racoon Butterflyfish	*Chaetodon lunula*
Other CRE-finfish	Redfinned Butterflyfish	*Chaetodon lunulatus*
Other CRE-finfish	Black-Back Butterflyfish	*Chaetodon melannotus*
Other CRE-finfish	Mertens Butterflyfish	*Chaetodon mertensii*
Other CRE-finfish	Meyer'S Butterflyfish	*Chaetodon meyeri*
Other CRE-finfish	Butterflyfish	*Chaetodon modestus*
Other CRE-finfish	Spot-Tail Butterflyfish	*Chaetodon ocellicaudus*
Other CRE-finfish	8-Banded Butterflyfish	*Chaetodon octofasciatus*
Other CRE-finfish	Ornate Butterflyfish	*Chaetodon ornatissimus*
Other CRE-finfish	Spot-Nape Butterflyfish	*Chaetodon oxycephalus*
Other CRE-finfish	Spotbnded Butterflyfish	*Chaetodon punctatofasciatus*
Other CRE-finfish	4-Spotted Butterflyfish	*Chaetodon quadrimaculatus*
Other CRE-finfish	Latticed Butterflyfish	*Chaetodon rafflesii*
Other CRE-finfish	Retculted Butterflyfish	*Chaetodon reticulatus*

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Other CRE-finfish	Dotted Butterflyfish	*Chaetodon semeion*
Other CRE-finfish	Oval-Spot Butterflyfish	*Chaetodon speculum*
Other CRE-finfish	Tinker'S Butterflyfish	*Chaetodon tinkeri*
Other CRE-finfish	Chevron Butterflyfish	*Chaetodon trifascialis*
Other CRE-finfish	Pac Dblsddl Butterflyfish	*Chaetodon ulietensis*
Other CRE-finfish	Teardrop Butterflyfish	*Chaetodon unimaculatus*
Other CRE-finfish	Vagabond Butterflyfish	*Chaetodon vagabundus*
Other CRE-finfish	Butterflyfish	*Chaetodontidae*
Other CRE-finfish	Vermiculated Angelfish	*Chaetodontoplus mesoleucus*
Other CRE-finfish	Saddled Sandburrower	*Chalixodytes tauensis*
Other CRE-finfish	Gaper	*Champsodon vorax*
Other CRE-finfish	Gapers	*Champsodontidae*
Other CRE-finfish	Milkfish	*Chanidae*
Other CRE-finfish	Long-Jawed Moray	*Channomuraena vittata*
Other CRE-finfish	Milkfish	*Chanos chanos*
Other CRE-finfish	Lined Cardinalfish	*Cheilodipterus artus*
Other CRE-finfish	Intermediate Cardinalfish	*Cheilodipterus intermedius*
Other CRE-finfish	Cardinalfish	*Cheilodipterus isostigma*
Other CRE-finfish	Lg-Toothed Cardinalfish	*Cheilodipterus macrodon*
Other CRE-finfish	5-Lined Cardinalfish	*Cheilodipterus quinquelineata*
Other CRE-finfish	Truncate Cardinalfish	*Cheilodipterus singapurensis*
Other CRE-finfish	Flying Fish	*Cheilopogon spilonopterus*
Other CRE-finfish	Flying Fish	*Cheilopogon spilopterus*
Other CRE-finfish	Flying Fish	*Cheilopogon unicolor*
Other CRE-finfish	Minstrel Fish	*Cheiloprion labiatus*
Other CRE-finfish	Ceram Mullet	*Chelon macrolepis*
Other CRE-finfish	False Moray Eel	*Chlopsidae*
Other CRE-finfish	Pipefish	*Choeroichthys brachysoma*
Other CRE-finfish	Pipefish	*Choeroichthys sculptus*
Other CRE-finfish	Duckbill	*Chrionema squamiceps*
Other CRE-finfish	Midget Chromis	*Chromis acares*
Other CRE-finfish	Bronze Reef Chromis	*Chromis agilis*
Other CRE-finfish	Yel-Speckled Chromis	*Chromis alpha*
Other CRE-finfish	Ambon Chromis	*Chromis amboinensis*
Other CRE-finfish	Yellow Chromis	*Chromis analis*
Other CRE-finfish	Black-Axil Chromis	*Chromis atripectoralis*
Other CRE-finfish	Dark-Fin Chromis	*Chromis atripes*
Other CRE-finfish	Blue-Axil Chromis	*Chromis caudalis*
Other CRE-finfish	Deep Reef Chromis	*Chromis delta*
Other CRE-finfish	Twin-Spot Chromis	*Chromis elerae*
Other CRE-finfish	Scaly Chromis	*Chromis lepidolepis*
Other CRE-finfish	Lined Chromis	*Chromis lineata*
Other CRE-finfish	Bicolor Chromis	*Chromis margaritifer*

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Other CRE-finfish	Black-Bar Chromis	*Chromis retrofasciata*
Other CRE-finfish	Ternate Chromis	*Chromis ternatensis*
Other CRE-finfish	Vanderbilt'S Chromis	*Chromis vanderbilti*
Other CRE-finfish	Blue-Green Chromis	*Chromis viridis*
Other CRE-finfish	Weber'S Chromis	*Chromis weberi*
Other CRE-finfish	Yel-Axil Chromis	*Chromis xanthochir*
Other CRE-finfish	Black Chromis	*Chromis xanthura*
Other CRE-finfish	2-Spot Demoiselle	*Chrysiptera biocellata*
Other CRE-finfish	Surge Demoiselle	*Chrysiptera brownriggii*
Other CRE-finfish	Blue-Line Demoiselle	*Chrysiptera caeruleolineata*
Other CRE-finfish	Blue Devil	*Chrysiptera cyanea*
Other CRE-finfish	Gray Demoiselle	*Chrysiptera glauca*
Other CRE-finfish	Blue-Spot Demoiselle	*Chrysiptera oxycephala*
Other CRE-finfish	King Demoiselle	*Chrysiptera rex*
Other CRE-finfish	Talbot'S Demoiselle	*Chrysiptera talboti*
Other CRE-finfish	Tracey'S Demoiselle	*Chrysiptera traceyi*
Other CRE-finfish	1-Spot Demoiselle	*Chrysiptera unimaculata*
Other CRE-finfish	Peacock Bass	*Cichla ocellaris*
Other CRE-finfish	Cichlids	*Cichlidae*
Other CRE-finfish	Threadfin Hawkfish	*Cirrhitichthys aprinus*
Other CRE-finfish	Falco'S Hawkfish	*Cirrhitichthys falco*
Other CRE-finfish	Pixy Hawkfish	*Cirrhitichthys oxycephalus*
Other CRE-finfish	Hawkfish	*Cirrhitidae*
Other CRE-finfish	Stocky Hawkfish	*Cirrhitus pinnulatus*
Other CRE-finfish	Fringelip Snake Eel	*Cirricaecula johnsoni*
Other CRE-finfish	Chestnut Blenny	*Cirripectes castaneus*
Other CRE-finfish	Spotted Blenny	*Cirripectes fuscoguttatus*
Other CRE-finfish	Blenny	*Cirripectes perustus*
Other CRE-finfish	Barred Blenny	*Cirripectes polyzona*
Other CRE-finfish	Squiggly Blenny	*Cirripectes quagga*
Other CRE-finfish	Red-Streaked Blenny	*Cirripectes stigmaticus*
Other CRE-finfish	Red-Speckled Blenny	*Cirripectes variolosus*
Other CRE-finfish	Air-Breath Catfish	*Clarias batrachus*
Other CRE-finfish	Air-Breath Catfish	*Clarias macrocephalus*
Other CRE-finfish	Air-Breath Catfish	*Clariidae*
Other CRE-finfish	Herring,Sprat,Sardines	*Clupeidae*
Other CRE-finfish	Velvetfish	*Cocotropis larvatus*
Other CRE-finfish	White Eel	*Conger cinereus cinereus*
Other CRE-finfish	Conger Eel	*Conger oligoporus*
Other CRE-finfish	Conger Eel	*Conger sp*
Other CRE-finfish	White,Conger,Garden Eel	*Congridae*
Other CRE-finfish	Deepwater Glasseye	*Cookeolus boops*
Other CRE-finfish	Bulleye	*Cookeolus japonicus*

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Other CRE-finfish	Orangebanded Coralfish	*Coradion chrysozonus*
Other CRE-finfish	Goby	*Coryphopterus signipinnis*
Other CRE-finfish	Network Pipefish	*Corythoichthys flavofasciatus*
Other CRE-finfish	Pipefish	*Corythoichthys*
Other CRE-finfish	Reef Pipefish	*Corythoichthys intestinalis*
Other CRE-finfish	Bl-Breasted Pipefish	*Corythoichthys nigripectus*
Other CRE-finfish	Ocellated Pipefish	*Corythoichthys ocellatus*
Other CRE-finfish	Many-Spotted Pipefish	*Corythoichthys polynotatus*
Other CRE-finfish	Guilded Pipefish	*Corythoichthys schultzi*
Other CRE-finfish	Roughridge Pipefish	*Cosmocampus banneri*
Other CRE-finfish	D'Arros Pipefish	*Cosmocampus darrosanus*
Other CRE-finfish	Maxweber'S Pipefish	*Cosmocampus maxweberi*
Other CRE-finfish	Sand Burrowers	*Creedidae*
Other CRE-finfish	Mullet	*Crenimugil heterochilos*
Other CRE-finfish	Goby	*Cristagobius sp*
Other CRE-finfish	Goby	*Cryptocentroides insignis*
Other CRE-finfish	Goby	*Cryptocentrus*
Other CRE-finfish	Goby	*Cryptocentrus cinctus*
Other CRE-finfish	Goby	*Cryptocentrus koumansi*
Other CRE-finfish	Goby	*Cryptocentrus leptocephalus*
Other CRE-finfish	Goby	*Cryptocentrus sp A*
Other CRE-finfish	Goby	*Cryptocentrus strigilliceps*
Other CRE-finfish	Goby	*Ctenogobiops aurocingulus*
Other CRE-finfish	Goby	*Ctenogobiops feroculus*
Other CRE-finfish	Goby	*Ctenogobiops pomastictus*
Other CRE-finfish	Long-Finned Prwn Goby	*Ctenogobiops tangarorai*
Other CRE-finfish	Flathead	*Cymbacephalus beauforti*
Other CRE-finfish	Swallowtail Hawkfish	*Cyprinocirrhites polyactis*
Other CRE-finfish	Flying Fish	*Cypselurus angusticeps*
Other CRE-finfish	Flying Fish	*Cypselurus poecilopterus*
Other CRE-finfish	Flying Fish	*Cypselurus speculiger*
Other CRE-finfish	Flying Gurnard	*Dactyloptena orientalis*
Other CRE-finfish	Flying Gurnard	*Dactyloptena petersoni*
Other CRE-finfish	Flying Gurnard	*Dactylopteridae*
Other CRE-finfish	Humbug Dascyllus	*Dascyllus aruanus*
Other CRE-finfish	Black-Tail Dascyllus	*Dascyllus melanurus*
Other CRE-finfish	Reticulated Dascyllus	*Dascyllus reticulatus*
Other CRE-finfish	3-Spot Dascyllus	*Dascyllus trimaculatus*
Other CRE-finfish	Stingray	*Dasyatididae*
Other CRE-finfish	Blue-Spotted Sting Ray	*Dasyatis kuhlii*
Other CRE-finfish	Scorpionfish	*Dendrochirus biocellatus*
Other CRE-finfish	Scorpionfish	*Dendrochirus brachypterus*
Other CRE-finfish	Zebra Lionfish	*Dendrochirus zebra*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Slatey Sweetlips	*Diagramma pictum*
Other CRE-finfish	Lanternfish	*Diaphus schmidti*
Other CRE-finfish	Bythitid	*Dinematichthys*
Other CRE-finfish	Porcupinefish	*Diodon eydouxi*
Other CRE-finfish	Porcupinefish	*Diodon hystrix*
Other CRE-finfish	Porcupinefish	*Diodon liturosus*
Other CRE-finfish	Porcupinefish	*Diodontidae*
Other CRE-finfish	Dragonet	*Diplogrammus goramensis*
Other CRE-finfish	Bristlemouth	*Diplophos sp*
Other CRE-finfish	White-Spot Damsel	*Dischistodus chrysopoecilus*
Other CRE-finfish	Black-Vent Damsel	*Dischistodus melanotus*
Other CRE-finfish	White Damsel	*Dischistodus perspicillatus*
Other CRE-finfish	Banded Pipefish	*Doryramphus dactyliophorus*
Other CRE-finfish	Bluestripe Pipefish	*Doryramphus excisus*
Other CRE-finfish	Janss' Pipefish	*Doryramphus janssi*
Other CRE-finfish	Negros Pipefish	*Doryramphus negrosensis*
Other CRE-finfish	Sprat	*Dussumieria elopsoides*
Other CRE-finfish	Sprats	*Dussumieria sp B*
Other CRE-finfish	Diskfishes	*Echeneidae*
Other CRE-finfish	Remora	*Echeneis naucrates*
Other CRE-finfish	Whiteface Moray	*Echidna leucotaenia*
Other CRE-finfish	Snowflake Moray	*Echidna nebulosa*
Other CRE-finfish	Girdled Moray Eel	*Echidna polyzona*
Other CRE-finfish	Unicolor Moray	*Echidna unicolor*
Other CRE-finfish	Banda Clown Blenny	*Ecsenius bandanus*
Other CRE-finfish	Blenny	*Ecsenius bicolor*
Other CRE-finfish	Blenny	*Ecsenius opsifrontalis*
Other CRE-finfish	Blenny	*Ecsenius sellifer*
Other CRE-finfish	Blenny	*Ecsenius yaeyamaensis*
Other CRE-finfish	Snake Eel	*Elapsopsis versicolor*
Other CRE-finfish	Sleepers	*Eleotrididae*
Other CRE-finfish	Gudgeon	*Eleotris fusca*
Other CRE-finfish	Bonnetmouth	*Emmelichthys karnellai*
Other CRE-finfish	Bonnet Mouths	*Emmelichtyidae*
Other CRE-finfish	Pearlfish	*Encheliophis boraboraensis*
Other CRE-finfish	Pearlfish	*Encheliophis gracilis*
Other CRE-finfish	Pearlfish	*Encheliophis homei*
Other CRE-finfish	Pearlfish	*Encheliophis vermicularis*
Other CRE-finfish	Bayer'S Moray	*Enchelycore bayeri*
Other CRE-finfish	Bikini Atoll Moray	*Enchelycore bikiniensis*
Other CRE-finfish	Dark-Spotted Moray	*Enchelycore kamara*
Other CRE-finfish	White-Margined Moray	*Enchelycore*
Other CRE-finfish	Viper Moray	*Enchelynassa canina*

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Other CRE-finfish	Blenny	*Enchelyurus kraussi*
Other CRE-finfish	Gold Anchovy	*Enchrasicholina devisi*
Other CRE-finfish	Blue Anchovy	*Enchrasicholina heterolobus*
Other CRE-finfish	Oceanic Anchovy	*Enchrasicholina punctifer*
Other CRE-finfish	Anchovies	*Engraulidae*
Other CRE-finfish	Flounder	*Engyprosopon sp*
Other CRE-finfish	Triplefin	*Enneapterygius hemimelas*
Other CRE-finfish	Triplefin	*Enneapterygius minutus*
Other CRE-finfish	Triplefin	*Enneapterygius nanus*
Other CRE-finfish	Blenny	*Entomacrodus caudofasciatus*
Other CRE-finfish	Blenny	*Entomacrodus cymatobiotus*
Other CRE-finfish	Blenny	*Entomacrodus decussatus*
Other CRE-finfish	Blenny	*Entomacrodus niuafooensis*
Other CRE-finfish	Blenny	*Entomacrodus sealei*
Other CRE-finfish	Blenny	*Entomacrodus stellifer*
Other CRE-finfish	Blenny	*Entomacrodus striatus*
Other CRE-finfish	Blenny	*Entomacrodus thalassinus*
Other CRE-finfish	Batfish	*Ephippidae*
Other CRE-finfish	Hagfish	*Eptaptretus carlhubbsi*
Other CRE-finfish	Bonnetmouth	*Erythrocles scintillans*
Other CRE-finfish	Spiny Dogfish	*Etmopterus pusillus*
Other CRE-finfish	Ribbon Halfbeak	*Euleptorhamphus viridis*
Other CRE-finfish	Dragon Fish	*Eurypegasus draconis*
Other CRE-finfish	Mantis Shrimp	*Eutremus teres*
Other CRE-finfish	Kawakawa	*Eviota afelei*
Other CRE-finfish	Herring	*Eviota albolineata*
Other CRE-finfish	Goby	*Eviota bifasciata*
Other CRE-finfish	Goby	*Eviota cometa*
Other CRE-finfish	Goby	*Eviota distigma*
Other CRE-finfish	Goby	*Eviota fasciola*
Other CRE-finfish	Goby	*Eviota herrei*
Other CRE-finfish	Goby	*Eviota infulata*
Other CRE-finfish	Goby	*Eviota lachdebrerei*
Other CRE-finfish	Goby	*Eviota latifasciata*
Other CRE-finfish	Goby	*Eviota melasma*
Other CRE-finfish	Goby	*Eviota nebulosa*
Other CRE-finfish	Goby	*Eviota pellucida*
Other CRE-finfish	Goby	*Eviota prasina*
Other CRE-finfish	Goby	*Eviota prasites*
Other CRE-finfish	Goby	*Eviota punctulata*
Other CRE-finfish	Goby	*Eviota queenslandica*
Other CRE-finfish	Goby	*Eviota saipanensis*
Other CRE-finfish	Goby	*Eviota sebreei*

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Other CRE-finfish	Goby	*Eviota sigillata*
Other CRE-finfish	Goby	*Eviota smaragdus*
Other CRE-finfish	Goby	*Eviota sp*
Other CRE-finfish	Goby	*Eviota sparsa*
Other CRE-finfish	Goby	*Eviota storthynx*
Other CRE-finfish	Goby	*Eviota zonura*
Other CRE-finfish	Snake Eel	*Evipes percinctus*
Other CRE-finfish	Blenny	*Exalias brevis*
Other CRE-finfish	Flying Fish	*Exocoetidae*
Other CRE-finfish	Flying Fish	*Exocoetus volitans*
Other CRE-finfish	Goby	*Exyrias belissimus*
Other CRE-finfish	Goby	*Exyrias puntang*
Other CRE-finfish	Cornetfish	*Fistularia commersoni*
Other CRE-finfish	Cornetfish	*Fistulariidae*
Other CRE-finfish	Bay Cardinalfish	*Foa brachygramma*
Other CRE-finfish	Cardinalfish	*Foa sp*
Other CRE-finfish	Longnosed Butterflyfish	*Forcipiger flavissimus*
Other CRE-finfish	Big Longnose Butterflyfish	*Forcipiger longirostris*
Other CRE-finfish	Cardinalfish	*Fowleria abocellata*
Other CRE-finfish	Marbled Cardinalfish	*Fowleria marmorata*
Other CRE-finfish	Spotcheek Cardinalfish	*Fowleria punctulata*
Other CRE-finfish	Variegated Cardinalfish	*Fowleria variegatus*
Other CRE-finfish	Goby	*Fusigobius longispinus*
Other CRE-finfish	Goby	*Fusigobius neophytus*
Other CRE-finfish	Lg-Toothed Ponyfish	*Gazza achlamys*
Other CRE-finfish	Toothed Ponyfish	*Gazza minuta*
Other CRE-finfish	Ornate Angelfish	*Genicanthus bellus*
Other CRE-finfish	Black-Spot Angelfish	*Genicanthus melanospilos*
Other CRE-finfish	Watanabe'S Angelfish	*Genicanthus watanabei*
Other CRE-finfish	Mojarras	*Gerreidae*
Other CRE-finfish	Deep-Bodied Mojarra	*Gerres abbreviatus*
Other CRE-finfish	Common Mojarra	*Gerres acinaces*
Other CRE-finfish	Filamentous Mojarra	*Gerres filamentosus*
Other CRE-finfish	Oblong Mojarra	*Gerres oblongus*
Other CRE-finfish	Oyena Mojarra	*Gerres oyena*
Other CRE-finfish	Mojarra	*Gerres punctatus*
Other CRE-finfish	Telescopefish	*Giganturidae*
Other CRE-finfish	Goby	*Gladigobius ensifera*
Other CRE-finfish	Goby	*Glossogobius biocellatus*
Other CRE-finfish	Goby	*Glossogobius celebius*
Other CRE-finfish	Goby	*Glossogobius guirus*
Other CRE-finfish	Blenny	*Glyptoparus delicatulus*
Other CRE-finfish	Goby	*Gnatholepis anjerensis*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish		*Gnatholepis caurensis*
Other CRE-finfish	Goby	*Gnatholepis scapulostigma*
Other CRE-finfish	Goby	*Gnatholepis sp A*
Other CRE-finfish	Clingfish	*Gobiesocidae*
Other CRE-finfish	Goby	*Gobiidae*
Other CRE-finfish	Goby	*Gobiodon albofasciatus*
Other CRE-finfish	Goby	*Gobiodon citrinus*
Other CRE-finfish	Goby	*Gobiodon okinawae*
Other CRE-finfish	Goby	*Gobiodon quinquestrigatus*
Other CRE-finfish	Goby	*Gobiodon rivulatus*
Other CRE-finfish	Goby	*Gobiopsis bravoi*
Other CRE-finfish	Bristlemouth	*Gonostoma atlanticum*
Other CRE-finfish	Bristlemouth	*Gonostoma ebelingi*
Other CRE-finfish	Bristlemouths	*Gonostomatidae*
Other CRE-finfish	Orange-Barred Garden Eel	*Gorgasia preclara*
Other CRE-finfish	Conger Eel	*Gorgasia sp*
Other CRE-finfish	Goldies	*Grammatonotus sp 1*
Other CRE-finfish	Goldies	*Grammatonotus sp 2*
Other CRE-finfish	2-Lined Mackerel	*Grammatorcynos bilineatus*
Other CRE-finfish	Yellowstripe Soapfish	*Grammistes sexlineatus*
Other CRE-finfish	Soapfish	*Grammistidae*
Other CRE-finfish	Ocellate Soapfish	*Grammistops ocellatus*
Other CRE-finfish	Wormfish	*Gunnellichthys monostigma*
Other CRE-finfish	Onestripe Wormfish	*Gunnellichthys pleurotaenia*
Other CRE-finfish	Wormfish	*Gunnellichthys viridescens*
Other CRE-finfish	Philippine Cardinalfish	*Gymnapogon philippinus*
Other CRE-finfish	Cardinalfish	*Gymnapogon urospilotus*
Other CRE-finfish	Fusilier	*Gymnocaesio gymnopterus*
Other CRE-finfish	Zebra Moray	*Gymnomuraena zebra*
Other CRE-finfish	Moray Eel	*Gymnothorax berndti*
Other CRE-finfish	Buro Moray	*Gymnothorax buroensis*
Other CRE-finfish	Moray Eel	*Gymnothorax elegans*
Other CRE-finfish	Enigmatic Moray	*Gymnothorax enigmaticus*
Other CRE-finfish	Fimbriated Moray	*Gymnothorax fimbriatus*
Other CRE-finfish	Yellow-Margined Moray	*Gymnothorax flavimarginatus*
Other CRE-finfish	Brown Spotted Moray	*Gymnothorax fuscomaculatus*
Other CRE-finfish	Graceful-Tailed Moray	*Gymnothorax gracilicaudus*
Other CRE-finfish	Moray Eel	*Gymnothorax hepaticus*
Other CRE-finfish	Giant Moray	*Gymnothorax javanicus*
Other CRE-finfish	Blotch-Necked Moray	*Gymnothorax*
Other CRE-finfish	Marshall Isles Moray	*Gymnothorax marshallensis*
Other CRE-finfish	Dirty Yellow Moray	*Gymnothorax melatremus*
Other CRE-finfish	Whitemouth Moray	*Gymnothorax meleagris*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Monochrome Moray	*Gymnothorax monochrous*
Other CRE-finfish	1-Spot Moray	*Gymnothorax monostigmus*
Other CRE-finfish	Moray Eel	*Gymnothorax neglectus*
Other CRE-finfish	Yellowmouth Moray	*Gymnothorax nudivomer*
Other CRE-finfish	Pinda Moray	*Gymnothorax pindae*
Other CRE-finfish	Moray Eel	*Gymnothorax polyuranodon*
Other CRE-finfish	Richardson'S Moray	*Gymnothorax richardsoni*
Other CRE-finfish	Yellow-Headed Moray	*Gymnothorax rueppelliae*
Other CRE-finfish	Moray Eel	*Gymnothorax sp cf*
Other CRE-finfish	Undulated Moray	*Gymnothorax undulatus*
Other CRE-finfish	Zonipectis Moray	*Gymnothorax zonipectus*
Other CRE-finfish	Dogtooth tuna	*Gymnosarda unicolor*
Other CRE-finfish	Sweetlips	*Haemulidae*
Other CRE-finfish	Brock'S Pipefish	*Halicampus brocki*
Other CRE-finfish	Duncker'S Pipefish	*Halicampus dunckeri*
Other CRE-finfish	Samoan Pipefish	*Halicampus mataafae*
Other CRE-finfish	Glittering Pipefish	*Halicampus nitidus*
Other CRE-finfish	Spikefish	*Halimochirurgus alcocki*
Other CRE-finfish	Triplefin	*Helcogramma capidata*
Other CRE-finfish	Triplefin	*Helcogramma chica*
Other CRE-finfish	Triplefin	*Helcogramma hudsoni*
Other CRE-finfish	Damselfish	*Hemiglyphidodon*
Other CRE-finfish	Halfbeak	*Hemiramphus archipelagicus*
Other CRE-finfish	Halfbeak	*Hemiramphus far*
Other CRE-finfish	Halfbeak	*Hemiramphus lutkei*
Other CRE-finfish	Halfbeak	*Hemirhamphidae*
Other CRE-finfish	Pyrimid Butterflyfish	*Hemitaurichthys polylepis*
Other CRE-finfish	Butterflyfish	*Hemitaurichthys thompsoni*
Other CRE-finfish	Longfinned Bannerfish	*Heniochus acuminatus*
Other CRE-finfish	Pennant Bannerfish	*Heniochus chrysostomus*
Other CRE-finfish	Bannerfish	*Heniochus diphreutes*
Other CRE-finfish	Masked Bannerfish	*Heniochus monoceros*
Other CRE-finfish	Singular Butterflyfish	*Heniochus singularis*
Other CRE-finfish	Humphead Bannerfish	*Heniochus varius*
Other CRE-finfish	Gold Spot Herring	*Herklotsichthys*
Other CRE-finfish	Conger Eel	*Heteroconger hassi*
Other CRE-finfish	Goby	*Heteroeleotris sp*
Other CRE-finfish	Glasseye	*Heteropriacanthus cruentatus*
Other CRE-finfish	Whipray	*Himantura fai*
Other CRE-finfish	Wh Tail Whipray	*Himantura granulata*
Other CRE-finfish	Leopard Ray	*Himantura uarnak*
Other CRE-finfish	Pipefish	*Hippichthys cyanospilos*
Other CRE-finfish	Pipefish	*Hippichthys spicifer*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Pipefish	*Hippocampus histrix*
Other CRE-finfish	Pipefish	*Hippocampus kuda*
Other CRE-finfish	Sargassum Fish	*Histrio histrio*
Other CRE-finfish	Fairy Basslet	*Holanthias borbonius*
Other CRE-finfish	Fairy Basslet	*Holanthias katayamai*
Other CRE-finfish	Tilefish	*Hoplolatilus cuniculus*
Other CRE-finfish	Tilefish	*Hoplolatilus fronticinctus*
Other CRE-finfish	Tilefish	*Hoplolatilus starcki*
Other CRE-finfish	Silverside	*Hypoatherina barnesi*
Other CRE-finfish	Silverside	*Hypoatherina cylindrica*
Other CRE-finfish	Silverside	*Hypoatherina ovalaua*
Other CRE-finfish	Halfbeak	*Hyporhamphus acutus acutus*
Other CRE-finfish	Halfbeak	*Hyporhamphus affinis*
Other CRE-finfish	Halfbeak	*Hyporhamphus dussumieri*
Other CRE-finfish	Snake Eel	*Ichthyapus vulturus*
Other CRE-finfish	Spiny Devilfish	*Inimicus didactylus*
Other CRE-finfish	Keeled Silverside	*Iso hawaiiensis*
Other CRE-finfish	6-Band Hawkfish	*Isocirrhitus sexfasciatus*
Other CRE-finfish	Keeled Silversides	*Isonidae*
Other CRE-finfish	Beautiful Rockskipper	*Istiblennius bellus*
Other CRE-finfish	Blenny	*Istiblennius chrysospilos*
Other CRE-finfish	Streaky Rockskipper	*Istiblennius dussumieri*
Other CRE-finfish	Blenny	*Istiblennius edentulus*
Other CRE-finfish	Interrupted Rockskipper	*Istiblennius interruptus*
Other CRE-finfish	Blenny	*Istiblennius lineatus*
Other CRE-finfish	Goby	*Istigobius decoratus*
Other CRE-finfish	Goby	*Istigobius ornatus*
Other CRE-finfish	Goby	*Istigobius rigilius*
Other CRE-finfish	Goby	*Istigobius spence*
Other CRE-finfish	Billfishes	*Istiophoridae*
Other CRE-finfish	Bl-Nostril False Moray	*Kaupichthys atronasus*
Other CRE-finfish	Shortfin False Moray	*Kaupichthys brachychirus*
Other CRE-finfish	Common False Moray	*Kaupichthys hyoproroides*
Other CRE-finfish	Goby	*Kellogella quindecimfasciata*
Other CRE-finfish	Goby	*Kelloggella cardinalis*
Other CRE-finfish	Sand Dart	*Kraemeria bryani*
Other CRE-finfish	Sand Dart	*Kraemeria cunicularia*
Other CRE-finfish	Sand Dart	*Kraemeria samoensis*
Other CRE-finfish	Sand Darts	*Kraemeriidae*
Other CRE-finfish	Dark-Margined Flagtail	*Kuhlia marginata*
Other CRE-finfish	Barred Flagtail	*Kuhlia mugil*
Other CRE-finfish	River Flagtail	*Kuhlia rupestris*
Other CRE-finfish	Flagtails	*Kuhliidae*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Longhorn Cowfish	*Lactoria cornuta*
Other CRE-finfish	Spiny Cowfish	*Lactoria diaphana*
Other CRE-finfish	Thornback Cowfish	*Lactoria fornasini*
Other CRE-finfish	Oceanic Blaasop	*Lagocephalus lagocephalus*
Other CRE-finfish	Silverstripe Blaasop	*Lagocephalus sceleratus*
Other CRE-finfish	Oriental Snake Eel	*Lamnostoma orientalis*
Other CRE-finfish	Ponyfishes	*Leiognathidae*
Other CRE-finfish	Slipmouth	*Leiognathus bindus*
Other CRE-finfish	Slipmouth	*Leiognathus elongatus*
Other CRE-finfish	Common Slipmouth	*Leiognathus equulus*
Other CRE-finfish	Slipmouth	*Leiognathus smithursti*
Other CRE-finfish	Oblong Slipmouth	*Leiognathus stercorarius*
Other CRE-finfish	Saddled Snake Eel	*Leiuranus semicinctus*
Other CRE-finfish	Clingfish	*Lepadichthys caritus*
Other CRE-finfish	Clingfish	*Lepadichthys minor*
Other CRE-finfish	Fusilier Damsel	*Lepidozygus tapienosoma*
Other CRE-finfish	Barracudina	*Lestidium nudun*
Other CRE-finfish	Sand Burrower	*Limnichthys donaldsoni*
Other CRE-finfish	Clingfish	*Liobranchia stria*
Other CRE-finfish	Swissguard Basslet	*Liopropoma lunulatum*
Other CRE-finfish	Swissguard Basslet	*Liopropoma maculatum*
Other CRE-finfish	Swissguard Basslet	*Liopropoma mitratum*
Other CRE-finfish	Swissguard Basslet	*Liopropoma multilineatum*
Other CRE-finfish	Pallid Basslet	*Liopropoma pallidum*
Other CRE-finfish	Pinstripe Basslet	*Liopropoma susumi*
Other CRE-finfish	Redstripe Basslet	*Liopropoma tonstrinum*
Other CRE-finfish	Blenny	*Litobranchus fowleri*
Other CRE-finfish	Giantscale Mullet	*Liza melinoptera*
Other CRE-finfish	Triplefin	*Lobotes surinamensis*
Other CRE-finfish	Tripletails	*Lobotidae*
Other CRE-finfish	Goby	*Lotilia graciliosa*
Other CRE-finfish	Magenta Slender Basslet	*Luzonichthys waitei*
Other CRE-finfish	Whitley'S Slender Basslet	*Luzonichthys whitleyi*
Other CRE-finfish	Goby	*Macrodontogobius wilburi*
Other CRE-finfish	Goby	*Mahidolia mystacina*
Other CRE-finfish	Tilefishes	*Malacanthidae*
Other CRE-finfish	Quakerfish	*Malacanthus brevirostris*
Other CRE-finfish	Striped Blanquillo	*Malacanthus latovittatus*
Other CRE-finfish	Manta Ray	*Manta birostris*
Other CRE-finfish	Sharptail Sunfish	*Masturus lanceolatus*
Other CRE-finfish	Tarpons	*Megalopidae*
Other CRE-finfish	Indo-Pacific Tarpon	*Megalops cyprinoides*
Other CRE-finfish	Poison-Fang Blenny	*Meiacanthus anema*

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Other CRE-finfish	Poison-Fang Blenny	*Meiacanthus atrodorsalis*
Other CRE-finfish	1-Stripe Poison-Fang Blenny	*Meiacanthus ditrema*
Other CRE-finfish	Striped Poison-Fang Blenny	*Meiacanthus grammistes*
Other CRE-finfish	Black Triggerfish	*Melichthys niger*
Other CRE-finfish	Pinktail Triggerfish	*Melichthys vidua*
Other CRE-finfish	Brotula	*Microbrotula sp*
Other CRE-finfish	Wormfish	*Microdesmidae*
Other CRE-finfish	Anderson'S Shrt-Nosed	*Micrognathus andersonii*
Other CRE-finfish	Pygmy Short-Nosed Pipefish	*Micrognathus brevirostris*
Other CRE-finfish	Pipefish	*Microphis brachyurus*
Other CRE-finfish	Pipefish	*Microphis brevidorsalis*
Other CRE-finfish	Pipefish	*Microphis leiaspis*
Other CRE-finfish	Pipefish	*Microphis manadensis*
Other CRE-finfish	Pipefish	*Microphis retzii*
Other CRE-finfish	Ventricose Milda	*Minyichthys myersi*
Other CRE-finfish	Myer'S Pipefish	*Mobulidae*
Other CRE-finfish	Ocean Sunfishes	*Molidae*
Other CRE-finfish	Filefishes	*Monacanthidae*
Other CRE-finfish	Monos	*Monodactylidae*
Other CRE-finfish	Mono	*Monodactylus argenteus*
Other CRE-finfish	Codlings	*Moridae*
Other CRE-finfish	Rusty Spaghetti Eel	*Moringua ferruginea*
Other CRE-finfish	Java Spaghetti Eel	*Moringua javanica*
Other CRE-finfish	Spaghetti Eel	*Moringua microchir*
Other CRE-finfish	Worm Eel	*Moringuidae*
Other CRE-finfish	Goby	*Mugilogobius tagala*
Other CRE-finfish	Goby	*Mugilogobius villa*
Other CRE-finfish	Pike Eels	*Muraenesocidae*
Other CRE-finfish	Pike Conger	*Muraenesox cinereus*
Other CRE-finfish	Snake Eel	*Muraenichthys gymnotus*
Other CRE-finfish	Snake Eel	*Muraenichthys laticaudata*
Other CRE-finfish	Snake Eel	*Muraenichthys macropterus*
Other CRE-finfish	Snake Eel	*Muraenichthys schultzi*
Other CRE-finfish	Snake Eel	*Muraenichthys sibogae*
Other CRE-finfish	Morays	*Muraenidae*
Other CRE-finfish	Lanternfishes	*Myctophidae*
Other CRE-finfish	Laternfish	*Myctophum brachygnathos*
Other CRE-finfish	Eagle Ray	*Myliobatidae*
Other CRE-finfish	Snake Eel	*Myrichthys bleekeri*
Other CRE-finfish	Banded Snake Eel	*Myrichthys colubrinus*
Other CRE-finfish	Spotted Snake Eel	*Myrichthys maculosus*
Other CRE-finfish	Snake Eel	*Myrophis uropterus*
Other CRE-finfish	Hagfish	*Myxinidae*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Combtooth Blenny	*Nannosalarius nativitatus*
Other CRE-finfish	Decorated Dartfish	*Nemateleotris decora*
Other CRE-finfish	Helfrichs' Dartfish	*Nemateleotris helfrichi*
Other CRE-finfish	Fire Dartfish	*Nemateleotris magnifica*
Other CRE-finfish	Threadfin Breams	*Nemipteridae*
Other CRE-finfish	Breams	*Nemipteridae*
Other CRE-finfish	Forktail Bream	*Nemipterus furcosus*
Other CRE-finfish	Butterfly Bream	*Nemipterus hexadon*
Other CRE-finfish	Notched Butterfly Bream	*Nemipterus peronii*
Other CRE-finfish	Butterfly Bream	*Nemipterus tolu*
Other CRE-finfish	Flame Hawkfish	*Neocirrhitus armatus*
Other CRE-finfish	Royal Damsel	*Neoglyphidodon melas*
Other CRE-finfish	Yellowfin Damsel	*Neoglyphidodon nigroris*
Other CRE-finfish	Coral Demoiselle	*Neopomacentrus nemurus*
Other CRE-finfish	Freshwater Demoiselle	*Neopomacentrus taeniurus*
Other CRE-finfish	Violet Demoiselle	*Neopomacentrus violascens*
Other CRE-finfish	Man-Of-War Fish	*Nomeidae*
Other CRE-finfish	Triplefin	*Norfolkia brachylepis*
Other CRE-finfish	Redtooth Triggerfish	*Odonus niger*
Other CRE-finfish	Foldlip Mullet	*Oedalechilus labiosus*
Other CRE-finfish	Mangrove Blenny	*Omobranchus obliquus*
Other CRE-finfish	Blenny	*Omobranchus rotundiceps*
Other CRE-finfish	Blenny	*Omox biporos*
Other CRE-finfish	Bivalve Pearlfish	*Onuxodon fowleri*
Other CRE-finfish	Snake Eel	*Ophichthidae*
Other CRE-finfish	Dark-Shouldered Snake Eel	*Ophichthus cephalozona*
Other CRE-finfish	Cusk Eel	*Ophidiidae*
Other CRE-finfish	Sleeper	*Ophieleotris aporos*
Other CRE-finfish	Sleeper	*Ophiocara porocephala*
Other CRE-finfish	Jawfishes	*Opisthognathidae*
Other CRE-finfish	Variable Jawfish	*Opisthognathus sp A*
Other CRE-finfish	Wass' Jawfish	*Opisthognathus sp B*
Other CRE-finfish	Knifejaws	*Oplegnathidae*
Other CRE-finfish	Spotted Knifejaw	*Oplegnathus punctatus*
Other CRE-finfish	Goby	*Oplopomops diacanthus*
Other CRE-finfish	Goby	*Oplopomus oplopomus*
Other CRE-finfish	Goby	*Opua nephodes*
Other CRE-finfish	Tilapia	*Oreochromis mossambicus*
Other CRE-finfish	Boxfish, Cowfish	*Ostraciidae*
Other CRE-finfish	Cube Trunkfish	*Ostracion cubicus*
Other CRE-finfish	Spotted Trunkfish	*Ostracion meleagris*
Other CRE-finfish	Reticulate Boxfish	*Ostracion solorensis*
Other CRE-finfish	Longnose Hawkfish	*Oxycirrhitus typus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Sleeper	*Oxyleotris lineolatus*
Other CRE-finfish	Longnose Filefish	*Oxymonacanthus longirostris*
Other CRE-finfish	Smallwing Flying Fish	*Oxyporhamphus micropterus*
Other CRE-finfish	Goby	*Oxyurichthys guibei*
Other CRE-finfish	Goby	*Oxyurichthys microlepis*
Other CRE-finfish	Goby	*Oxyurichthys ophthalmonema*
Other CRE-finfish	Goby	*Oxyurichthys papuensis*
Other CRE-finfish	Goby	*Oxyurichthys tentacularis*
Other CRE-finfish	Goby	*Padanka sp*
Other CRE-finfish	Goby	*Palutris pruinosa*
Other CRE-finfish	Goby	*Palutris reticularis*
Other CRE-finfish	Arc-Eyed Hawkfish	*Paracirrhitus arcatus*
Other CRE-finfish	Freckeled Hawkfish	*Paracirrhitus forsteri*
Other CRE-finfish	Whitespot Hawkfish	*Paracirrhitus hemistictus*
Other CRE-finfish	Goby	*Paragobiodon echinocephalus*
Other CRE-finfish	Goby	*Paragobiodon lacunicolus*
Other CRE-finfish	Goby	*Paragobiodon melanosoma*
Other CRE-finfish	Goby	*Paragobiodon modestus*
Other CRE-finfish	Goby	*Paragobiodon xanthosoma*
Other CRE-finfish	Seychelle'S Wormfish	*Paragunnellichthy*
Other CRE-finfish	Barracudinas	*Paralepididae*
Other CRE-finfish	Blacksaddle Mimic	*Paraluteres prionurus*
Other CRE-finfish	Filefish	*Paramonacanthus cryptodon*
Other CRE-finfish	Filefish	*Paramonacanthus japonicus*
Other CRE-finfish	Latticed Sandperch	*Parapercis clathrata*
Other CRE-finfish	Cylindrical Sandperch	*Parapercis cylindrica*
Other CRE-finfish	Blk-Dotted Sandperch	*Parapercis millipunctata*
Other CRE-finfish	Red-Barred Sandperch	*Parapercis multiplicata*
Other CRE-finfish	Black-Banded Sandperch	*Parapercis tetracantha*
Other CRE-finfish	Blotchlip Sandperch	*Parapercis xanthozona*
Other CRE-finfish	Sandperch	*Parapriacanthus ransonneti*
Other CRE-finfish	Mcadam'S Scorpionfish	*Parascorpaena mcadamsi*
Other CRE-finfish	Mozambique Scorpionfish	*Parascorpaena mossambica*
Other CRE-finfish	Peacock Sole	*Pardachirus pavoninus*
Other CRE-finfish	Blenny	*Parenchelyurus hepburni*
Other CRE-finfish	Flying Fish	*Parexocoetus brachypterus*
Other CRE-finfish	Flying Fish	*Parexocoetus mento*
Other CRE-finfish	Beautiful Hover Goby	*Parioglossus formosus*
Other CRE-finfish	Lined Hover Goby	*Parioglossus lineatus*
Other CRE-finfish	Naked Hover Goby	*Parioglossus nudus*
Other CRE-finfish	Palustris Hover Goby	*Parioglossus palustris*
Other CRE-finfish	Rainford'S Hover Goby	*Parioglossus rainfordi*
Other CRE-finfish	Rao'S Hover Goby	*Parioglossus raoi*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Taeniatus Hover Goby	*Parioglossus taeniatus*
Other CRE-finfish	Vertical Hover Goby	*Parioglossus verticalis*
Other CRE-finfish	Shortsnouted Ray	*Pasinachus sephen*
Other CRE-finfish	Dragonfish	*Pegasidae*
Other CRE-finfish	Sweepers	*Pempheridídae*
Other CRE-finfish	Bronze Sweeper	*Pempheris oualensis*
Other CRE-finfish	Armourheads	*Pentacerotidae*
Other CRE-finfish	Smalltooth Whiptail	*Pentapodus caninus*
Other CRE-finfish	3-Striped Whiptail	*Pentapodus trivittatus*
Other CRE-finfish	Duckbills	*Percophidae*
Other CRE-finfish	Goby	*Periophthalmus*
Other CRE-finfish	Goby	*Periophthalmus kalolo*
Other CRE-finfish	Yelloweye Filefish	*Pervagor alternans*
Other CRE-finfish	Orangetail Filefish	*Pervagor aspricaudatus*
Other CRE-finfish	Blackbar Filefish	*Pervagor janthinosoma*
Other CRE-finfish	Blackheaded Filefish	*Pervagor melanocephalus*
Other CRE-finfish	Blacklined Filefish	*Pervagor nigrolineatus*
Other CRE-finfish	Blenny	*Petroscirtes breviceps*
Other CRE-finfish	Blenny	*Petroscirtes mitratus*
Other CRE-finfish	Blenny	*Petroscirtes thepassi*
Other CRE-finfish	Blenny	*Petroscirtes variabilis*
Other CRE-finfish	Blenny	*Petroscirtes xestus*
Other CRE-finfish	Snake Eel	*Phenamonas cooperi*
Other CRE-finfish	Flashlightfish	*Photoblepheron palpebratus*
Other CRE-finfish	Pipefish	*Phoxocampus diacanthus*
Other CRE-finfish	Snake Eel	*Phyllophichthus xenodontus*
Other CRE-finfish	Codling	*Physiculus sp*
Other CRE-finfish	Sand Perch	*Pinguipedidae*
Other CRE-finfish	Blenny	*Plagiotremus laudandus*
Other CRE-finfish	Red Sabbertooth Blenny	*Plagiotremus rhynorhynchus*
Other CRE-finfish	Blenny	*Plagiotremus tapienosoma*
Other CRE-finfish	Batfish	*Platax orbicularis*
Other CRE-finfish	Pinnate Spadefish	*Platax pinnatus*
Other CRE-finfish	Longfin Spadefish	*Platax teira*
Other CRE-finfish	Keeled Needlefish	*Platybelone argalus platyura*
Other CRE-finfish	Flathead	*Platycephalidae*
Other CRE-finfish	2-Lined Sweetlips	*Plectorhinchus albovittatus*
Other CRE-finfish	Celebes Sweetlips	*Plectorhinchus celebecus*
Other CRE-finfish	Harlequin Sweetlips	*Plectorhinchus*
Other CRE-finfish	Sweetlip	*Plectorhinchus*
Other CRE-finfish	Gibbus Sweetlips	*Plectorhinchus gibbosus*
Other CRE-finfish	Lined Sweetlips	*Plectorhinchus lessonii*
Other CRE-finfish	Goldman'S Sweetlips	*Plectorhinchus lineatus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Giant Sweetlips	*Plectorhinchus obscurus*
Other CRE-finfish	Spotted Sweetlips	*Plectorhinchus picus*
Other CRE-finfish	Sweetlip	*Plectorhinchus sp*
Other CRE-finfish	Oriental Sweetlips	*Plectorhinchus vittatus*
Other CRE-finfish	Fourmanoir'S Basslet	*Plectranthias fourmanoiri*
Other CRE-finfish	Basslet	*Plectranthias kamii*
Other CRE-finfish	Long-Finned Basslet	*Plectranthias longimanus*
Other CRE-finfish	Pygmy Basslet	*Plectranthias nanus*
Other CRE-finfish	Basslet	*Plectranthias rubrifasciatus*
Other CRE-finfish	Basslet	*Plectranthias winniensis*
Other CRE-finfish	Dick'S Damsel	*Plectroglyphidodo dickii*
Other CRE-finfish	Bright-Eye Damsel	*Plectroglyphidodo*
Other CRE-finfish	Johnston Isle Damsel	*Plectroglyphidodo*
Other CRE-finfish	Jewel Damsel	*Plectroglyphidodo lacrymatus*
Other CRE-finfish	White-Band Damsel	*Plectroglyphidodo leucozonus*
Other CRE-finfish	Phoenix Isle Damsel	*Plectroglyphidodo*
Other CRE-finfish	Longfins	*Plesiopidae*
Other CRE-finfish	Red-Tipped Longfin	*Plesiops caeruleolineatus*
Other CRE-finfish	Bluegill Longfin	*Plesiops corallicola*
Other CRE-finfish	Sharp-Nosed Longfin	*Plesiops oxycephalus*
Other CRE-finfish	Goby	*Pleurosicya bilobatus*
Other CRE-finfish	Caroline Ghost Goby	*Pleurosicya carolinensis*
Other CRE-finfish	Blue Coral Ghost Goby	*Pleurosicya coerulea*
Other CRE-finfish	Fringed Ghost Goby	*Pleurosicya fringella*
Other CRE-finfish	Michael'S Ghost Goby	*Pleurosicya micheli*
Other CRE-finfish	Common Ghost Goby	*Pleurosicya mossambica*
Other CRE-finfish	Goby	*Pleurosicya muscarum*
Other CRE-finfish	Plicata Ghost Goby	*Pleurosicya plicata*
Other CRE-finfish	Eel Catfishes	*Plotosidae*
Other CRE-finfish	Striped Eel Catfish	*Plotosus lineatus*
Other CRE-finfish	Barred Sand Conger	*Poeciloconger fasciatus*
Other CRE-finfish	Spotted Soapfish	*Pogonoperca punctata*
Other CRE-finfish	6 Feeler Threadfin	*Polydactylus sexfilis*
Other CRE-finfish	Beardfish	*Polymixia japonica*
Other CRE-finfish	Beardfish	*Polymixiidae*
Other CRE-finfish	Threadfins	*Polynemidae*
Other CRE-finfish	Angelfishes	*Pomacanthidae*
Other CRE-finfish	Emperor Anglefish	*Pomacanthus imperator*
Other CRE-finfish	Blue-Girdled Angelfish	*Pomacanthus navarchus*
Other CRE-finfish	Semicircle Angelfish	*Pomacanthus semicirculatus*
Other CRE-finfish	6-Banded Angelfish	*Pomacanthus sexstriatus*
Other CRE-finfish	Blue-Faced Angelfish	*Pomacanthus xanthometopon*
Other CRE-finfish	Damselfishes	*Pomacentridae*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Damselfish	*Pomacentrus adelus*
Other CRE-finfish	Ambon Damsel	*Pomacentrus amboinensis*
Other CRE-finfish	Goldbelly Damsel	*Pomacentrus auriventris*
Other CRE-finfish	Speckled Damsel	*Pomacentrus bankanensis*
Other CRE-finfish	Charcoal Damsel	*Pomacentrus brachialis*
Other CRE-finfish	Burrough'S Damsel	*Pomacentrus burroughi*
Other CRE-finfish	White-Tail Damsel	*Pomacentrus chrysurus*
Other CRE-finfish	Neon Damsel	*Pomacentrus coelestis*
Other CRE-finfish	Outer Reef Damsel	*Pomacentrus emarginatus*
Other CRE-finfish	Blue-Spot Damsel	*Pomacentrus*
Other CRE-finfish	Lemon Damsel	*Pomacentrus moluccensis*
Other CRE-finfish	Nagasaki Damsel	*Pomacentrus nagasakiensis*
Other CRE-finfish	Black-Axil Damsel	*Pomacentrus nigromanus*
Other CRE-finfish	Sapphire Damsel	*Pomacentrus pavo*
Other CRE-finfish	Philappine Damsel	*Pomacentrus philippinus*
Other CRE-finfish	Reid'S Damsel	*Pomacentrus reidi*
Other CRE-finfish	Blueback Damsel	*Pomacentrus simsiang*
Other CRE-finfish	Princess Damsel	*Pomacentrus vaiuli*
Other CRE-finfish	Slender Reef-Damsel	*Pomachromis exilis*
Other CRE-finfish	Guam Damsel	*Pomachromis guamensis*
Other CRE-finfish	Common Javelinefish	*Pomadasyus kaakan*
Other CRE-finfish	Lg-Headed Scorpionfish	*Pontinus macrocephalus*
Other CRE-finfish	Scorpionfish	*Pontinus sp*
Other CRE-finfish	Scopionfish	*Pontinus tentacularis*
Other CRE-finfish	Blenny	*Prealticus amboinensis*
Other CRE-finfish	Blenny	*Prealticus natalis*
Other CRE-finfish	Bigeyes	*Priacanthidae*
Other CRE-finfish	Bigeye	*Priacanthus alalaua*
Other CRE-finfish	Goggle-Eye	*Priacanthus hamrur*
Other CRE-finfish	Goby	*Priolepis cincta*
Other CRE-finfish	Goby	*Priolepis farcimen*
Other CRE-finfish	Goby	*Priolepis inhaca*
Other CRE-finfish	Goby	*Priolepis semidoliatus*
Other CRE-finfish	Bigeye	*Pristigenys meyeri*
Other CRE-finfish	Flying Fish	*Prognichthys albimaculatus*
Other CRE-finfish	Flying Fish	*Prognichthys sealei*
Other CRE-finfish	Freckeled Driftfish	*Psenes cyanophrys*
Other CRE-finfish	Rhino Leatherjacket	*Pseudalutarias nasicornis*
Other CRE-finfish	Cardinalfish	*Pseudamia amblyuroptera*
Other CRE-finfish	Cardinalfish	*Pseudamia gelatinosa*
Other CRE-finfish	Cardinalfish	*Pseudamia hayashii*
Other CRE-finfish	Cardinalfish	*Pseudamia zonata*
Other CRE-finfish	Cardinalfish	*Pseudamiops gracilicauda*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Bartlet'S Fairy Basslet	*Pseudanthias bartlettorum*
Other CRE-finfish	Bicolor Fairy Basslet	*Pseudanthias bicolor*
Other CRE-finfish	Red-Bar Fairy Basslet	*Pseudanthias cooperi*
Other CRE-finfish	Peach Fairy Basslet	*Pseudanthias dispar*
Other CRE-finfish	Fairy Basslet	*Pseudanthias huchtii*
Other CRE-finfish	Lori'S Anthias	*Pseudanthias lori*
Other CRE-finfish	Purple Queen	*Pseudanthias pascalus*
Other CRE-finfish	Sq-Spot Fairy Basslet	*Pseudanthias pleurotaenia*
Other CRE-finfish	Randall'S Fairy Basslet	*Pseudanthias randalli*
Other CRE-finfish	Smithvaniz' Fairy Basslet	*Pseudanthias smithvanizi*
Other CRE-finfish	Fairy Basslet	*Pseudanthias sp*
Other CRE-finfish	Fairy Basslet	*Pseudanthias squammipinnis*
Other CRE-finfish	Y Striped Fairy Basslet	*Pseudanthias tuka*
Other CRE-finfish	L-Finned Fairy Basslet	*Pseudanthias ventralis*
Other CRE-finfish	White Ribbon Eel	*Pseudechidna brummeri*
Other CRE-finfish	Ymargin Triggerfish	*Pseudobalistes*
Other CRE-finfish	Blue Triggerfish	*Pseudobalistes fuscus*
Other CRE-finfish	Dottybacks	*Pseudochromidae*
Other CRE-finfish	Surge Dottyback	*Pseudochromis cyanotaenia*
Other CRE-finfish	Dusky Dottyback	*Pseudochromis fuscus*
Other CRE-finfish	Marshall Is Dottyback	*Pseudochromis marshallensis*
Other CRE-finfish	Dottyback	*Pseudochromis melanotaenia*
Other CRE-finfish	Long-Finned Dottyback	*Pseudochromis polynemus*
Other CRE-finfish	Magenta Dottyback	*Pseudochromis porphyreus*
Other CRE-finfish	Goby	*Pseudogobius javanicus*
Other CRE-finfish	Soapfish	*Pseudogramma polyacantha*
Other CRE-finfish	Soapfish	*Pseudogramma sp*
Other CRE-finfish	Soapfishes	*Pseudogrammidae*
Other CRE-finfish	Amourhead	*Pseudopentaceros pectoralis*
Other CRE-finfish	Robust Dottyback	*Pseudoplesiops*
Other CRE-finfish	Revelle'S Basslet	*Pseudoplesiops revellei*
Other CRE-finfish	Rose Island Basslet	*Pseudoplesiops rosae*
Other CRE-finfish	Basslet	*Pseudoplesiops sp*
Other CRE-finfish	Hidden Basslet	*Pseudoplesiops typus*
Other CRE-finfish	Blackfin Dartfish	*Ptereleotris evides*
Other CRE-finfish	Filament Dartfish	*Ptereleotris hanae*
Other CRE-finfish	Spot-Tail Dartfish	*Ptereleotris heteroptera*
Other CRE-finfish	Dartfish	*Ptereleotris lineopinnis*
Other CRE-finfish	Pearly Dartfish	*Ptereleotris microlepis*
Other CRE-finfish	Zebra Dartfish	*Ptereleotris zebra*
Other CRE-finfish	Yellowstreak Fusilier	*Pterocaesio lativittata*
Other CRE-finfish	Twinstripe Fusilier	*Pterocaesio marri*
Other CRE-finfish	Ruddy Fusilier	*Pterocaesio pisang*

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Other CRE-finfish	Mosaic Fusilier	*Pterocaesio tesselatata*
Other CRE-finfish	Bluestreak Fusilier	*Pterocaesio tile*
Other CRE-finfish	3-Striped Fusilier	*Pterocaesio trilineata*
Other CRE-finfish	Spotfin Lionfish	*Pterois antennata*
Other CRE-finfish	Clearfin Lionfish	*Pterois radiata*
Other CRE-finfish	Turkeyfish	*Pterois volitans*
Other CRE-finfish	Ocellated Gurnard	*Pterygiotrigla multiocellata*
Other CRE-finfish	Gurnard	*Pterygiotrigla sp*
Other CRE-finfish	Slender Suckerfish	*Ptheirichthys lineatus*
Other CRE-finfish	Regal Anglefish	*Pygoplites diacanthus*
Other CRE-finfish	Fairy Basslet	*Rabaulichthys sp*
Other CRE-finfish	Trunkfish	*Ranzania laevis*
Other CRE-finfish	Mackerel	*Rastrelliger brachysoma*
Other CRE-finfish	Striped Mackerel	*Rastrelliger kanagurta*
Other CRE-finfish	Goby	*Redigobius bikolanus*
Other CRE-finfish	Goby	*Redigobius horiae*
Other CRE-finfish	Goby	*Redigobius sapangus*
Other CRE-finfish	Remora	*Remora remora*
Other CRE-finfish	Cardinalfish	*Rhabdamia cypselurus*
Other CRE-finfish	Cardinalfish	*Rhabdamia gracilis*
Other CRE-finfish	Blenny	*Rhabdoblenius*
Other CRE-finfish		*Rhabdoblennius ellipes*
Other CRE-finfish	Blenny	*Rhabdoblennius snowi*
Other CRE-finfish	Guitarfish	*Rhinchobatus djiddensis*
Other CRE-finfish	Picassofish	*Rhinecanthus aculeatus*
Other CRE-finfish	Wedge Picassofish	*Rhinecanthus rectangulus*
Other CRE-finfish	Blackbelly Picassofish	*Rhinecanthus verrucosa*
Other CRE-finfish	Guitarfish	*Rhinobatidae*
Other CRE-finfish	Ribbon Eel	*Rhinomuraena quaesita*
Other CRE-finfish	Weedy Scorpionfish	*Rhinopias frondosa*
Other CRE-finfish	Remora	*Rhombochirus osteochir*
Other CRE-finfish	Smallnose Boxfish	*Rhynchostracion nasus*
Other CRE-finfish	Largenose Boxfish	*Rhynchostracion*
Other CRE-finfish	Telescopefish	*Rosaura indica*
Other CRE-finfish	Minute Filefish	*Rudarius minutus*
Other CRE-finfish		*Salarius alboguttatus*
Other CRE-finfish	Spotted Rock Blenny	*Salarius fasciatus*
Other CRE-finfish	Blenny	*Salarius luctuosus*
Other CRE-finfish	Blenny	*Salarius segmentatus*
Other CRE-finfish	Righteye Flounders	*Samaridae*
Other CRE-finfish	3 Spot Flounder	*Samariscus triocellatus*
Other CRE-finfish	Graceful Lizardfish	*Saurida gracilis*
Other CRE-finfish	Nebulous Lizardfish	*Saurida nebulosa*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Scats	*Scatophagidae*
Other CRE-finfish	Scat	*Scatophagus argus*
Other CRE-finfish	Schindleriid	*Schindleria praematurus*
Other CRE-finfish	Shindleriid	*Schindleriidae*
Other CRE-finfish	Snake Eel	*Schismorhinchus labialis*
Other CRE-finfish	Snake Eel	*Schultzidia johnstonensis*
Other CRE-finfish	Snake Eel	*Schultzidia retropinnis*
Other CRE-finfish	Spinecheek	*Scolopsis affinis*
Other CRE-finfish	2 Line Spinecheek	*Scolopsis bilineatus*
Other CRE-finfish	Ciliate Spinecheek	*Scolopsis ciliatus*
Other CRE-finfish	Bl And Wh Spinecheek	*Scolopsis lineatus*
Other CRE-finfish	Margarite'S Spinecheek	*Scolopsis margaritifer*
Other CRE-finfish	Spinecheek	*Scolopsis taeniopterus*
Other CRE-finfish	3 Line Spinecheek	*Scolopsis trilineatus*
Other CRE-finfish	Spinecheek	*Scolopsis xenochrous*
Other CRE-finfish	Narrow-Barred King Mackerel	*Scomberomorus commerson*
Other CRE-finfish	Scorpionfish	*Scorpaenidae*
Other CRE-finfish	Guam Scorpionfish	*Scorpaenodes guamensis*
Other CRE-finfish	Hairy Scorpionfish	*Scorpaenodes hirsutus*
Other CRE-finfish	Kellogg'S Scorpionfish	*Scorpaenodes kelloggi*
Other CRE-finfish	Minor Scorpionfish	*Scorpaenodes minor*
Other CRE-finfish	Coral Scorpionfish	*Scorpaenodes parvipinnis*
Other CRE-finfish	Blotchfin Scorpionfish	*Scorpaenodes varipinis*
Other CRE-finfish	Devil Scorpionfish	*Scorpaenopsis diabolus*
Other CRE-finfish	Pygmy Scorpionfish	*Scorpaenopsis fowleri*
Other CRE-finfish	Flasher Scorpionfish	*Scorpaenopsis macrochir*
Other CRE-finfish	Tassled Scorpionfish	*Scorpaenopsis oxycephala*
Other CRE-finfish	Papuan Scorpionfish	*Scorpaenopsis papuensis*
Other CRE-finfish	Scorpionfish	*Scorpaenopsis sp*
Other CRE-finfish	Tiger Snake Moray	*Scuticaria tigrinis*
Other CRE-finfish	Yellowspotted Scorpionfish	*Sebastapistes cyanostigma*
Other CRE-finfish	Galactacma Scorpionfish	*Sebastapistes galactacma*
Other CRE-finfish	Mauritius Scorpionfish	*Sebastapistes mauritiana*
Other CRE-finfish	Barchin Scorpionfish	*Sebastapistes strongia*
Other CRE-finfish	Pugnose Soapy	*Secutor ruconius*
Other CRE-finfish	Basslet	*Selenanthias myersi*
Other CRE-finfish	Hawkfish Anthias	*Serranocirrhitus latus*
Other CRE-finfish	Goby	*Sicyopterus macrostetholepis*
Other CRE-finfish	Goby	*Sicyopterus micrurus*
Other CRE-finfish	Goby	*Sicyopterus sp*
Other CRE-finfish	Goby	*Sicyopus leprurus*
Other CRE-finfish	Goby	*Sicyopus sp*
Other CRE-finfish	Goby	*Sicyopus zosterophorum*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Peppered Moray	*Sideria picta*
Other CRE-finfish	White-Eyed Moray	*Sideria prosopeion*
Other CRE-finfish	Goby	*Signigobius biocellatus*
Other CRE-finfish	Goby	*Silhouettea sp*
Other CRE-finfish	Sillagos	*Sillaginidae*
Other CRE-finfish	Cardinalfish	*Sillago sihama*
Other CRE-finfish	Cardinalfish	*Siphamia fistulosa*
Other CRE-finfish	Cardinalfish	*Siphamia fuscolineata*
Other CRE-finfish	Cardinalfish	*Siphamia versicolor*
Other CRE-finfish	Banded Sole	*Soleichthys heterohinos*
Other CRE-finfish	Soles	*Soleidae*
Other CRE-finfish	Ghost Pipefish	*Solenostomidae*
Other CRE-finfish	Ghost Pipefish	*Solenostomus cyanopterus*
Other CRE-finfish	Ornate Ghost Pipefish	*Solenostomus paradoxus*
Other CRE-finfish	Flathead	*Sorsogona welanderi*
Other CRE-finfish	Cardinalfish	*Sphaeramia nematoptera*
Other CRE-finfish	Cardinalfish	*Sphaeramia orbicularis*
Other CRE-finfish	Sharpfin Barracuda	*Sphyraena acutipinnis*
Other CRE-finfish	Great Barracuda	*Sphyraena barracuda*
Other CRE-finfish	Yellowtail Barracuda	*Sphyraena flavicauda*
Other CRE-finfish	Blackspot Barracuda	*Sphyraena forsteri*
Other CRE-finfish	Arrow Barracuda	*Sphyraena novaehollandiae*
Other CRE-finfish	Pygmy Barracuda	*Sphyraena obtusata*
Other CRE-finfish	Slender Barracuda	*Sphyraena putnamiae*
Other CRE-finfish	Blackfin Barracuda	*Sphyraena qenie*
Other CRE-finfish	Barracudas	*Sphyraenidae*
Other CRE-finfish	Blue Sprat	*Spratelloides delicatulus*
Other CRE-finfish	Silver Sprat	*Spratelloides gracilis*
Other CRE-finfish	Blenny	*Stanulus seychellensis*
Other CRE-finfish	White-Bar Gregory	*Stegastes albifasciatus*
Other CRE-finfish	Pacific Gregory	*Stegastes fasciolatus*
Other CRE-finfish	Farmerfish	*Stegastes lividus*
Other CRE-finfish	Dusky Farmerfish	*Stegastes nigricans*
Other CRE-finfish	Panatella Silverside	*Stenatherina panatella*
Other CRE-finfish	Goby	*Stenogobius genivittatus*
Other CRE-finfish	Goby	*Stenogobius sp*
Other CRE-finfish	Hatchetfishes	*Sternoptichidae*
Other CRE-finfish	Goby	*Stiphodon elegans*
Other CRE-finfish	Goby	*Stiphodon sp*
Other CRE-finfish	Samoan Anchovy	*Stolephorus apiensis*
Other CRE-finfish	Indian Anchovy	*Stolephorus indicus*
Other CRE-finfish	Gold Esurine Anchovy	*Stolephorus insularis*
Other CRE-finfish	Caroline Islands Anchovy	*Stolephorus multibranchus*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	West Pacific Anchovy	*Stolephorus pacificus*
Other CRE-finfish	Anchovy	*Stolephorus sp*
Other CRE-finfish	Reef Needlefish	*Strongylura incisa*
Other CRE-finfish	Littoral Needlefish	*Strongylura leiura leiura*
Other CRE-finfish	Giant Esturine Moray	*Strophidon sathete*
Other CRE-finfish	Scythe Triggerfish	*Sufflamen bursa*
Other CRE-finfish	Halfmoon Triggerfish	*Sufflamen chrysoptera*
Other CRE-finfish	Bridle Triggerfish	*Sufflamen freanatus*
Other CRE-finfish	Symphysanid	*Symphysanodon typus*
Other CRE-finfish	Sympysanodon	*Symphysanodontidae*
Other CRE-finfish	Stonefish	*Synanceia verrucosa*
Other CRE-finfish	Cutthroat Eel	*Synaphobranchidae*
Other CRE-finfish	Cutthroat Eel	*Synaphobranchus sp*
Other CRE-finfish	Cirlcled Dragonet	*Synchiropus circularis*
Other CRE-finfish	Ladd'S Dragonet	*Synchiropus laddi*
Other CRE-finfish	Morrison'S Dragonet	*Synchiropus morrisoni*
Other CRE-finfish	Ocellated Dragonet	*Synchiropus ocellatus*
Other CRE-finfish	Dragonet	*Synchiropus sp*
Other CRE-finfish	Mandarin Fish	*Synchiropus splendidus*
Other CRE-finfish	Pipefish, Seahorse	*Syngnathidae*
Other CRE-finfish	Alligator Pipefish	*Syngnathoides biaculeatus*
Other CRE-finfish	Lizardfish	*Synodontidae*
Other CRE-finfish	2-Spot Lizardfish	*Synodus binotatus*
Other CRE-finfish	Clearfin Lizardfish	*Synodus dermatogenys*
Other CRE-finfish	Reef Lizardfish	*Synodus englemanni*
Other CRE-finfish	Blackblotch Lizardfish	*Synodus jaculum*
Other CRE-finfish	Variegatus Lizardfish	*Synodus variegatus*
Other CRE-finfish	Leaf Fish	*Taenianotus triacanthus*
Other CRE-finfish	Goby	*Taenioides limicola*
Other CRE-finfish	Giant Reef Ray	*Taeniura meyeni*
Other CRE-finfish	Crescent-Banded Grunter	*Terapon jarbua*
Other CRE-finfish	Thornfishes	*Teraponidae*
Other CRE-finfish	Smooth Puffers	*Tetraodontidae*
Other CRE-finfish	Mangrove Waspfish	*Tetraroge barbata*
Other CRE-finfish	Waspfishes	*Tetrarogidae*
Other CRE-finfish	Little Priest	*Thryssa baelama*
Other CRE-finfish	Broadhead Flathead	*Thysanophrys arenicola*
Other CRE-finfish	Longsnout Flathead	*Thysanophrys chiltonae*
Other CRE-finfish	Fringlip Flathead	*Thysanophrys otaitensis*
Other CRE-finfish	Tilapia	*Tilapia zillii*
Other CRE-finfish	Banded Archerfish	*Toxotes jaculator*
Other CRE-finfish	Archerfishes	*Toxotidae*
Other CRE-finfish	Double-Ended Pipefish	*Trachyramphus bicoarctata*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Spikefishes	*Triacanthodidae*
Other CRE-finfish	Sand Divers	*Trichonotidae*
Other CRE-finfish	Micronesian Sand-Diver	*Trichonotus sp*
Other CRE-finfish	Gurnards	*Triglidae*
Other CRE-finfish	Goby	*Trimma caesiura*
Other CRE-finfish	Goby	*Trimma naudei*
Other CRE-finfish	Goby	*Trimma okinawae*
Other CRE-finfish	Goby	*Trimma sp A*
Other CRE-finfish	Goby	*Trimma sp B*
Other CRE-finfish	Goby	*Trimma taylori*
Other CRE-finfish	Goby	*Trimma tevegae*
Other CRE-finfish	Goby	*Trimmatom eviotops*
Other CRE-finfish	3 Tooth Puffer	*Triodon bursarius*
Other CRE-finfish	3 Tooth Puffer	*Triodon macropterus*
Other CRE-finfish	Tripletooth Puffers	*Triodontidae*
Other CRE-finfish	Triplefins	*Tripterygiidae*
Other CRE-finfish	Keeled Houndfish	*Tylosurus acus melanotus*
Other CRE-finfish	Houndfish	*Tylosurus crocodilis*
Other CRE-finfish	Longjaw Triplefin	*Ucla xenogrammus*
Other CRE-finfish	Stargazers	*Uranoscopidae*
Other CRE-finfish	Stargazer	*Uranoscopus sp*
Other CRE-finfish	Porcupine Ray	*Urogymnus africanus*
Other CRE-finfish	Unicolor Snake Moray	*Uropterygius concolor*
Other CRE-finfish	Fiji Moray Eel	*Uropterygius fijiensis*
Other CRE-finfish	Brown-Spotted Snake Eel	*Uropterygius fuscoguttatus*
Other CRE-finfish	Gosline'S Snake Moray	*Uropterygius goslinei*
Other CRE-finfish	Moon Moray	*Uropterygius kamar*
Other CRE-finfish	Lg-Headed Snake Moray	*Uropterygius macrocephalus*
Other CRE-finfish	Marbled Snake Moray	*Uropterygius marmoratus*
Other CRE-finfish	Tidepool Snake Moray	*Uropterygius micropterus*
Other CRE-finfish	Lg-Spotted Snake Moray	*Uropterygius polyspilus*
Other CRE-finfish	Moray Eel	*Uropterygius supraforatus*
Other CRE-finfish	Moray Eel	*Uropterygius xanthopterus*
Other CRE-finfish	Roundray	*Urotrygon daviesi*
Other CRE-finfish	Glass Goby	*Valenciennea muralis*
Other CRE-finfish	Parva Goby	*Valenciennea parva*
Other CRE-finfish	Goby	*Valenciennea puellaris*
Other CRE-finfish	Goby	*Valenciennea sexguttatus*
Other CRE-finfish	Goby	*Valenciennea sp*
Other CRE-finfish	Goby	*Valenciennea strigatus*
Other CRE-finfish	Goby	*Vanderhorstia ambanoro*
Other CRE-finfish	Goby	*Vanderhorstia lanceolata*
Other CRE-finfish	Goby	*Vanderhorstia ornatissima*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other CRE-finfish	Guilded Triggerfish	*Xanthichthys auromarginatus*
Other CRE-finfish	Bluelined Triggerfish	*Xanthichthys careuleolineatus*
Other CRE-finfish	Crosshatch Triggerfish	*Xanthichthys mento*
Other CRE-finfish	Wriggler	*Xenishthmus sp*
Other CRE-finfish	Flathead Wriggler	*Xenisthmidae*
Other CRE-finfish	Barred Wriggler	*Xenisthmus polyzonatus*
Other CRE-finfish	Triggerfish	*Xenobalistes tumidipectoris*
Other CRE-finfish	Blenny	*Xiphasia matsubarai*
Other CRE-finfish	Moorish Idols	*Zanclidae*
Other CRE-finfish	Moorish Idol	*Zanclus cornutus*
Other CRE-finfish	Esturine Halfbeak	*Zenarchopterus dispar*
Other Invertebrates	Crown-Of-Thorns	*Acanthaster planci*
Other Invertebrates	Stonefish	*Actinopyga lecanora*
Other Invertebrates	Blackfish	*Actinopyga miliaris*
Other Invertebrates	Sea Cucumber	*Actinopyga obesa*
Other Invertebrates	Sea Cucumber	*Actinopyga sp*
Other Invertebrates	Starfish	*Asterinidae*
Other Invertebrates	Starfish	*Asteropidae*
Other Invertebrates	Starfish	*Astropectinidae*
Other Invertebrates	Sea Cucumber	*Bohadschia argus*
Other Invertebrates	Sea Cucumber	*Bohadschia graeffei*
Other Invertebrates	Brown Sandfish	*Bohadschia marmorata*
Other Invertebrates	Sea Cucumber	*Bohadschia paradoxa*
Other Invertebrates	Sea Cucumber	*Bohadschia sp*
Other Invertebrates	Irregular Urchins	*Brissidae*
Other Invertebrates	Jellyfish	*Cephea sp*
Other Invertebrates	Cidarians	*Cidaridae*
Other Invertebrates	Crinoids	*Class Crinoidea*
Other Invertebrates	Sea Urchins	*Class Echinoidea*
Other Invertebrates		*Clypeasteridae*
Other Invertebrates	Sea Cucumbers	*Cucumariidae*
Other Invertebrates	Longspine Urchin	*Diadema savignyi*
Other Invertebrates	Longspine Urchin	*Diadema setosum*
Other Invertebrates	Sea Urchins	*Diadematidae*
Other Invertebrates	Sea Urchins	*Echinoidea*
Other Invertebrates	Sea Urchins	*Echinometridae*
Other Invertebrates	Reef Starfish	*Echinosteridae*
Other Invertebrates	Longspine Urchin	*Echinothrix calamaris*
Other Invertebrates	Longspine Urchin	*Echinothrix diadema*
Other Invertebrates	Sea Urchins	*Echinothuriidae*
Other Invertebrates	Slate Pencil Urchin	*Heterocentrotus mammillatus*
Other Invertebrates	Lollyfish	*Holothuria atra*
Other Invertebrates	Pinkfish	*Holothuria edulis*

Mariana CREMUS (Guam)	Common Name	Scientific Name
Other Invertebrates	White Teatfish	*Holothuria fuscogilva*
Other Invertebrates	Elephant'S Trunkfish	*Holothuria fuscopunctata*
Other Invertebrates	Sea Cucumber	*Holothuria hilla*
Other Invertebrates	Sea Cucumber	*Holothuria impatiens*
Other Invertebrates	Sea Cucumber	*Holothuria leucospilota*
Other Invertebrates	Sea Cucumber	*Holothuria sp*
Other Invertebrates	Sea Cucumber	*Holothuriidae*
Other Invertebrates	Sea Cucumbers	*Holothuroidea*
Other Invertebrates	Spiney-Armed Starfish	*Mithrodia bradleyi*
Other Invertebrates	Orange Starfish	*Ophidiaster confertus*
Other Invertebrates	Starfish	*Oreasteridae*
Other Invertebrates	Sea Cucumbers	*Phyllophoridae*
Other Invertebrates	Common Urchin	*Pseudoboletia maculata*
Other Invertebrates	Starfish	*Sc Asteroidea*
Other Invertebrates	Basket,Brittle, Serpentstars	*Sc Ophiuroidea*
Other Invertebrates	Starfish	*Sphaerasteridae*
Other Invertebrates	Sea Cucumbers	*Stichopodidae*
Other Invertebrates	Greenfish	*Stichopus chloronotus*
Other Invertebrates	Sea Cucumber	*Stichopus horrens*
Other Invertebrates	Sea Cucumber	*Stichopus noctivatus*
Other Invertebrates	Sea Cucumber	*Stichopus sp*
Other Invertebrates	Curryfish	*Stichopus variegatus*
Other Invertebrates	Sea Cucumber	*Synapta maculata*
Other Invertebrates	Sea Cucumber	*Synapta media*
Other Invertebrates	Sea Cucumber	*Synapta sp*
Other Invertebrates	Sea Cucumbers	*Synaptidae*
Other Invertebrates	Sea Urchins	*Temnopleuridae*
Other Invertebrates	Prickly Redfish	*Thelenota ananas*
Other Invertebrates	Amberfish	*Thelenota anax*
Other Invertebrates	Sea Cucumber	*Thelenota sp*
Other Invertebrates	Flower Urchin	*Toxopneustes pileolus*
Other Invertebrates	Shortspine Urchins	*Toxopneustidae*
Other Invertebrates	Shortspine Urchin	*Tripneustes gratilla*

Table A4. Hawaii CREMUS

Hawaii CREMUS	Common Name	Scientific Name
Akule	Bigeye scad	*Selar crumenopthalmus*
Opelu	Round scad	*Decapterus macarellus*
Surgeonfish	API	*Acanthurus guttatus*
Surgeonfish	BLACK KOLE	*Ctenochaetus hawaiiensis*
Surgeonfish	KALA	*Naso annulatus,*
Surgeonfish	KALA	*N. brevirostris,*
Surgeonfish	KALA	*N. unicornis*
Surgeonfish	KALALEI	*Naso lituratus*
Surgeonfish	KOLE	*Ctenochaetus strigosus*
Surgeonfish	MAIII	*Acanthurus nigrofuscus*
Surgeonfish	MAIKO	*Acanthurus nigroris*
Surgeonfish	MAIKOIKO	*Acanthurus leucopareius*
Surgeonfish	MANINI	*Acanthurus triostegus*
Surgeonfish	NAENAE	*Acanthurus olivaceus*
Surgeonfish	OPELU KALA	*Naso hexacanthus*
Surgeonfish	PAKUIKUI	*Acnthurus achilles*
Surgeonfish	PALANI	*Acanthurus dussumieri*
Surgeonfish	PUALU	*Acanthurus blochii,*
Surgeonfish	YELLOWFIN TANG	*A. xanthopterus*
Surgeonfish	YELLOW TANG	*Zebrasoma flavescens*
Jacks	DOBE	*Caranx (Urapsis) helvolus*
Jacks	KAGAMI	*Alectis ciliaris*
Jacks	KAHALA	*Seriola rivoliana*
Jacks	KAMANU	*Elagatis bipinnulata*
Jacks	LAE	*Scomberoides lysan,*
Jacks	LAE	*S. sancti-petri (synonym for S. lysan)*
Jacks	NO-BITE	*C. equula*
Jacks	OMAKA	*Atule mata*
Jacks	OMILU	*Caranx melampygus*
Jacks	PAOPAO	*Gnathanodon speciosus*
Jacks	PAPA	*Carangoides orthogrammus*
Jacks	PAPIO, ULUA (MISC.)	*Carangidae*
Carcharhinidae	Reef Sharks	*Carcharhinidae*
Crustaceans	A'AMA	*Graspus tenuicrustatus*
Crustaceans	BLUE PINCHER CRAB	*Callinectes sapidus*
Crustaceans	CRAB (MISC.)	*n/a*
Crustaceans	HAWAIIAN CRAB	*Podophthalmus vigil*
Crustaceans	KUAHONU CRAB	*Portunus sanguinolentus*

Hawaii CREMUS	Common Name	Scientific Name
Crustaceans	METABETAEUS LOHENA	*METABETAEUS LOHENA*
Crustaceans	MISC. SHRIMP/PRAWN	*n/a*
Crustaceans	OPAE ULA	*HALOCARIDINA RUBRA*
Crustaceans	A'AMA	*Graspus tenuicrustatus*
Squirrelfish	ALAIHI	*Holocentridae*
Squirrelfish	ALAIHI MAMA	*Adioryx spinifer*
Squirrelfish	MENPACHI	*Myripristis* sp.
Squirrelfish	PAUU	*Holocentridae*
Rudderfish	NENUE	*Kyphosus bigibbus,*
Rudderfish	NENUE	*K. cinerescens*
Wrasse	A'AWA	*Bodianus bilunulatus*
Wrasse	HILU	*Coris flavovittata*
Wrasse	HINALEA	*Thalassoma* sp.
Wrasse	KUPOUPOU	*Cheilio inermis*
Wrasse	LAENIHI	*Xyichthys pavo*
Wrasse	MALLATEA	*Labridae*
Wrasse	OPULE	*Decapterus macarellus*
Wrasse	POOU	*Cheilinus unifasciatus*
Wrasse	WRASSE (MISC.)	*Labridae*
Emperor	MU	*Monotaxis grandoculis*
Snappers	GOLDEN KALI	*Erythrocles schegelii*
Snappers	GURUTSU, GOROTSUKI	*Aphareus furca*
Snappers	RANDALL'S SNAPPER	*Randallichthys filamentosus*
Snappers	TAAPE	*Lutjanus kasmira*
Snappers	TOAU	*Lutjanus fulvus*
Snappers	WAHANUI	*Aphareus furcatus*
Mollusks	HE'E (DAY TAKO)	*Octopus cyanea*
Mollusks	HE'E PU LOA	*Octopus ornatus*
Mollusks	OLEPE	*Albula glossodonta*
Mullet	AMAAMA	*Mugil cephalus*
Mullet	SUMMER MULLET	*Mugil* sp.
Goatfish	KUMU	*Parupeneus porphyeus*
Goatfish	MALU	*Parupeneus pleurostigma*
Goatfish	MOANA	*Parupeneus* sp.
Goatfish	MOANO KALE	*Parupeneus cyclostomus*
Goatfish	MOELUA; GOAT FISH (RED)	*Mulloidichthys* sp.
Goatfish	MUNU	*Parupeneus bifasciatus*
Goatfish	WEKE (MISC.)	*Mullidae*
Goatfish	WEKE A'A	*Mulloidichthys flavolineatus*
Goatfish	WEKE NONO	*Mulloidichthys pflugeri*

Hawaii CREMUS	Common Name	Scientific Name
Goatfish	WEKE PUEO	*Upeneus arge*
Goatfish	WEKE-ULA	*Mulloidichthys vanicolensis*
Parrotfish	PANUHUNUHU	*Scarus* sp.
Parrotfish	PANUNU	*Scarus* sp.
Parrotfish	UHU (MISC.)	*Catalomus* sp.
Groupers	ROI	*Cephalopholis argus*
Other CRE Finfish	AWA	*Chanos chanos*
Other CRE Finfish	AWAAWA	*Elops hawaiensis*
Other CRE Finfish	AWEOWEO	*Heteropriacanthus cruentatus*
Other CRE Finfish	GOLD SPOT HERRING	*Herklotsichthys quadrimaculatus*
Other CRE Finfish	HAULIULI	*Gempylus serpens*
Other CRE Finfish	HOGO	*Pontinus macrocephalus*
Other CRE Finfish	HUMUHUMU	*Balistidae*
Other CRE Finfish	IAO	*Pranesus insularum*
Other CRE Finfish	IHEIHE	*Hemiramphidae*
Other CRE Finfish	KAKU	*Sphyraena barracuda*
Other CRE Finfish	KAWALEA	*Sphyraena helleri*
Other CRE Finfish	KUPIPI	*Abudefduf sordidus*
Other CRE Finfish	LAUWILIWILI	*Chaetodon auriga*
Other CRE Finfish	LOULU	*Monacanthidae*
Other CRE Finfish	MAKAIWA	*Etrumeus micropus*
Other CRE Finfish	MALOLO	*Exocoetidae*
Other CRE Finfish	MA'O MA'O	*Abudefduf abdominalis*
Other CRE Finfish	MOI	*Polydactylus sexfilis*
Other CRE Finfish	MOLA MOLA	*Mola mola*
Other CRE Finfish	NEHU	*Stolephorus purpureus*
Other CRE Finfish	NOHU	*Scorpaenopsis* sp.
Other CRE Finfish	NUNU	*Aulostomus chinensis*
Other CRE Finfish	OIO (bonefish)	*Albula glossodonta*
Other CRE Finfish	OOPU HUE	*Diodon* sp.
Other CRE Finfish	PAKII	*Bothus* sp.
Other CRE Finfish	PIHA	*Spratelloides delicatulus*
Other CRE Finfish	POO PAA	*Cirrhitus* sp.
Other CRE Finfish	PUHI (MISC.)	*Gymnothorax* sp.
Other CRE Finfish	PUHI (WHITE)	*Muraenidae*
Other CRE Finfish	PUPU	*Congridae* sp.
Other CRE Finfish	SABA	*Scomber japonicus*
Other CRE Finfish	TILAPIA	*Tilapia* sp.
Other CRE Finfish	UPAPALU	*Apogon kallopterus*
Other Invertebrates	HA'UKE'UKE	*Colobocentrotus atratus*

Hawaii CREMUS	Common Name	Scientific Name
Other Invertebrates	HAWAE	*Tripneustes gratilla*
Other Invertebrates	WANA (urchin)	*Dia dema* sp., *Echinothrix* sp.
Other Invertebrates	NAMAKO (sea cucumber)	*Holothuroidea*
Other Invertebrates	SLATE PENCIL URCHINS	*Heterocentrotus mammillatus*
Other Invertebrates	HA'UKE'UKE	*Colobocentrotus atratus*
Other CRE Finfish	AHOLEHOLE	*Kuhlia sandvicensis*
Algae	LIMU (MISC.)	*Gracilaria* sp.
Algae	LIMU KOHU	*Asparagopsis taxiformis*
Algae	MANAUEA	*Gracilaria coronopifolia*
Algae	OGO	*Aulostromus chinensis*
Algae	WAWAEIOLE	*Ulva fasciata*

Appendix B Results of the Biomass Augmented Catch-MSY Model

Tables B1-B4 below summarize the maximum sustainable yield (MSY) estimates and risk of overfishing percentages for CREMUS groups in Appendix 1 as reported in Sabater and Kleiber (2014). Risk projections are presented in 5 percent increments. In accordance with National Standard 1 guidelines of the Magnuson-Stevens Act, the probability of overfishing cannot exceed 50 percent and should be a lower value (74 FR 3178, January 9, 2011).

Table B1. American Samoa CREMUS (k-revise method B results, in thousands of pounds)

CREMUS Group	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	MSY
Selar crumenophthalmus – atule or bigeye scad	31.8	32.5	33.3	34.2	35	35.6	37.4	38.4	39.6	41.1	43.3
Acanthuridae (surgeonfishes)	103	108.4	113	117	122	125	129.4	133.8	138	142.5	148.6
Carangidae (jacks)	14	15.8	17	18.2	19.3	19.9	20.8	21.5	22.1	23.2	24.3
Carcharhinidae (reef sharks)	0.6	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.3
Crustaceans (crabs)	2.3	2.8	3.3	3.8	4.3	4.7	5.3	5.9	6.5	7.3	7.8
Holocentridae (squirrelfishes)	12.6	13.3	13.8	14.3	14.7	15.1	15.5	15.9	16.2	16.6	16.8
Kyphosidae (rudderfishes)	1.2	1.4	1.6	1.7	1.9	2	2.2	2.3	2.5	2.6	2.6
Labridae (wrasses)	13.4	14.1	14.7	15.2	15.7	16.2	16.6	17.1	17.5	18.1	19.0
Lethrinidae (emperors)	14.6	15.8	16.9	17.8	18.6	19.6	20.4	21.3	22.1	23	23.7
Lutjanidae (snappers)	46.8	54	58.8	60.6	62	63.1	64.4	65.3	66.1	66.9	65.4
Mollusks (turbo snail; octopus; giant clam)	10	11.9	13.6	15.2	16.8	18.4	20.2	22.4	24.7	27.5	29.6
Mugilidae (mullets)	2.3	2.7	3.2	3.6	4.1	4.6	5.2	5.9	6.7	7.6	8.2
Mullidae (goatfishes)	10.7	10.9	11.2	11.4	11.7	11.9	12	12.1	12.3	12.5	12.7
Scaridae (parrotfishes)	232	240.8	249	260	268	272	280.1	285.1	290.2	300.3	294.6
Serranidae (groupers)	19.6	21.1	22.2	23.3	24.3	25.3	26.3	27.3	28.3	29.5	30.5
Siganidae (rabbitfishes)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	200
All Other CREMUS Combined	10.2	12.1	13.7	15.2	16.8	18.4	20.3	22.2	24.5	27	28.5

Table B2. CNMI CREMUS (k-revise method B results, in thousands of pounds)

CREMUS Group	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	MSY
Selar crumenophthalmus – atulai or bigeye scad	32.8	37.8	43.6	50.4	58.2	66.9	77.4	89.4	103.3	119.6	122.5
Acanthuridae (surgeonfishes)	158	184.6	211	234	258	279	302.6	324.6	347.5	370	361.2
Carangidae (jacks)	28.7	32.1	34.8	37.3	39.8	42.3	44.9	47.4	50.1	53	55.3
Carcharhinidae (reef sharks)	Unknown										
Crustaceans (crabs)	1.6	2.10	2.6	3.1	3.7	4.4	5.3	6.3	7.5	8.9	9.1
Holocentridae (squirrelfishes)	48.9	53.3	56.7	59.9	63.1	66.1	69.3	72.1	75	78	78.5
Kyphosidae (rudderfishes)	12.9	15.1	17	18.9	20.8	22.7	24.6	26.5	28.5	30.5	29.5
Labridae (wrasses)	29.4	35.2	40.4	45.2	50.2	55.1	59.9	65.2	70.2	75.5	73.5
Lethrinidae (emperors)	29.7	34.7	39.7	44.5	49.2	53.7	58.2	62.5	67.2	72.2	69.7
Lutjanidae (snappers)	107	123.4	137	150	164	177	190.4	202.7	215.1	228.7	225.8
Mollusks (turbo snail; octopus; giant clam)	3	3.9	4.8	5.8	6.9	8.2	9.8	11.6	13.7	16.3	16.7
Mugilidae (mullets)	1.5	1.9	2.3	2.7	3.2	3.8	4.5	5.3	6.4	7.5	7.7
Mullidae (goatfishes)	24.4	24.9	25.5	26.1	26.8	27.7	28.4	29.2	29.8	30.5	31
Scaridae (parrotfishes)	73.5	88.9	103	117	129	144	157.3	171.1	185.1	199	189.9
Serranidae (groupers)	51.8	60.2	67.3	74.1	80.4	86.9	92.8	99.3	105.3	112	110.3
Siganidae (rabbitfishes)	7.8	8.1	8.4	8.7	9.3	10.2	10.4	10.6	10.9	11	12
All Other CREMUS Combined	2.8	3.7	4.4	5.2	6.2	7.3	8.5	10.1	12	14.2	14.5

Table B3. Guam CREMUS (k-revise method B results, in thousands of pounds)

CREMUS Group	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	MSY
Selar crumenophthalmus – atulai or bigeye scad	39.3	42.8	45.5	47.9	50.2	52.3	54.4	56.4	58.5	60.8	61.3
Acanthuridae (surgeonfishes)	74.5	81.1	86.2	90.1	93.5	97.6	101.7	106	109.8	114.7	118
Carangidae (jacks)	25.2	26.8	27.8	28.6	29.3	29.9	30.6	31.1	31.7	32.2	31.7
Carcharhinidae (reef sharks)	1	1.2	1.4	1.6	1.8	2	2.2	2.4	2.6	2.9	2.9
Crustaceans (crabs)	5.2	5.8	6.2	6.6	7	7.3	7.6	8	8.3	8.6	8.6
Holocentridae (squirrelfishes)	8.2	9	9.6	10.2	10.8	11.4	12	12.5	13.1	13.8	13.9
Kyphosidae (rudderfishes)	8.1	8.5	8.9	9.1	9.4	9.6	9.8	10	10.1	10.3	10.3
Labridae (wrasses)	23.2	23.8	24.1	24.5	24.7	25.2	25.8	26.6	27.3	28.2	28.5
Lethrinidae (emperors)	31.5	36.2	39.8	43.7	48	53	58	63.4	69.9	76.6	78
Lutjanidae (snappers)	14.4	15.4	16.1	16.8	17.4	18	18.6	19.2	19.9	20.7	21.8
Mollusks (turbo snail; octopus; giant clam)	17.6	19.2	20.4	21.6	22.7	23.8	25	26.3	27.5	28.6	29
Mugilidae (mullets)	11	12.7	14.1	15.4	16.6	17.9	19.4	20.8	22.6	24.5	26.2
Mullidae (goatfishes)	13.2	13.6	14	14.3	14.8	15.1	15.3	15.6	16	16.3	16.4
Scaridae (parrotfishes)	51.1	56.2	60.6	64.6	68.1	71.6	75	78.6	82.3	86.5	87.1
Serranidae (groupers)	16.4	17.9	19.1	20.3	21.4	22.5	23.7	24.8	26.1	27.4	28.6
Siganidae (rabbitfishes)	16.8	17.4	17.8	18.1	18.2	18.4	18.6	18.8	19	19.2	19.7
All Other CREMUS Combined	150	159	166	173	179	185	191.3	196.5	203	209.2	211.3

Table B4. Hawaii CREMUS (k-revise method B results, in thousands of pounds)

CREMUS Group	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	MSY
Selar crumenophthalmus – akule or bigeye scad	807	850.6	886	919	952	988	1025	1061	1099	1138	1,150
Decapterus macarellus – opelu or mackerel scad	346	363.3	381	400	418	438	459.8	483.5	507.1	531.2	538
Acanthuridae (surgeonfishes)	196	231.1	259	288	313	342	367.9	395.1	425.4	452.6	445.5
Carangidae (jacks)	114	123.3	131	139	146	154	161.2	168.1	175.6	183.7	185.1
Carcharhinidae (reef sharks)	4.3	5.4	6.3	7.2	8	8.8	9.8	10.6	11.6	12.5	12.4
Crustaceans (crabs)	23.9	26.6	29.1	31.4	33.5	35.4	37.1	38.9	40.9	42.8	43.1
Holocentridae (squirrelfishes)	138	140.6	144	146	148	150	152	154.3	156.3	158.1	159.8
Kyphosidae (rudderfishes)	86	90.5	94.5	98.1	101	105	108.6	112.1	115.7	119.6	122.8
Labridae (wrasses)	175	181.4	188	194	200	205	211	216.5	221.7	227.4	229.2
Lethrinidae (emperors)	29.4	31	32.1	33.2	34.3	35.5	36.6	37.5	38.5	39.4	39.6
Lutjanidae (snappers)	264	280.5	292	303	312	321	330.3	338.2	346.7	356.2	359.3
Mollusks (turbo snail; octopus; giant clam)	26.6	29.2	31.3	33.4	35.7	38.2	40.8	43.4	46.4	49.5	50.3
Mugilidae (mullets)	14.3	15.9	17.1	18.2	19.2	20.1	21.1	22.2	23.3	24.5	24.6
Mullidae (goatfishes)	116	128.3	138	148	157	165	173.1	181.5	189.4	197.5	195.7
Scaridae (parrotfishes)	201	213.4	223	232	239	246	251.7	257.6	264.2	270.6	271.5
Serranidae (groupers)	98.7	106	111	116	121	125	128.4	132.2	136.1	139.9	141.3
All Other CREMUS Combined	405	424.2	440	457	471	485	496.5	510.6	523.5	535.6	540.8

Appendix C Report of the P* Working Group

WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

P* Working Group Meeting

December 11-12, 2013
1:00 pm – 5:00 pm
Council Conference Room
WPRFMC Office

Day 1
Present On Site: Dr. Pierre Kleiber (ret. NMFS PIFSC), Dr. Bob Humphreys (NMFS PIFSC), Mr. Ed Watamura (Advisory Panel Chair), Mr. Roy Morioka (H-FACT), Mr. Ed Ebisui (Council member, Program Planning Chair), Marlowe Sabater (WPRFMC), Dr. Bob Skillman (ret. NMFS PIFSC), Paul Dalzell (WPRFMC)

On the Conference Line: Dr. Erik Franklin (UH HIMB), Dr. Domingo Ochavillo (DMWR, AS), Dr. Todd Miller (DFW, CNMI), Michael Tenorio (DFW, CNMI), Mr. Jarad Makaiau (NMFS – PIRO)

Day 2
Present On Site: Dr. Pierre Kleiber (ret. NMFS PIFSC), Dr. Bob Humphreys (NMFS PIFSC), Mr. Ed Watamura (Advisory Panel Chair), Mr. Roy Morioka (H-FACT), Mr. Ed Ebisui (Council member, Program Planning Chair), Marlowe Sabater (WPRFMC), Paul Dalzell (WPRFMC), Dr. Erik Franklin (UH HIMB), Gerard DiNardo (NMFS PIFSC), Lennon Thomas (NMFS PIFSC)

On the Conference Line: Dr. Domingo Ochavillo (DMWR, AS), Mr. Jarad Makaiau (NMFS – PIRO)

REPORT

Introductions

Mr. Edwin Ebisui chaired the third meeting of the P* Working Group. In attendance were Robert Skillman, Pierre Kleiber, Robert Humphreys, Ed Watamura, Roy Morioka, Jarad Makaiau, Erik Franklin, Domingo Ochavillo, Todd Miller and Michael Tenorio. Marlowe Sabater and Paul Dalzell provided technical and administrative support.

Recommendations from the SSC

Council staff presented on the summary of the recommendations by the Scientific and Statistical Committee from its 114th meeting. The recommendation focuses on the endorsement of the Martell, Froese and Kleiber (MFK) model for management purposes and directed staff to finalize the MSY estimates for P* analysis. In addition, the SSC recommended to reconvene the P* WG and finalize the criteria to determine the appropriate level of risk and associated acceptable biological catch for the fishing year 2015. The SSC also suggested applying the MFK model to fully assessed Tier 1 stocks (e.g., bottomfish) in order to gauge the MFK model's accuracy. Council staff reminded the working group members that it is critical to finalize the P* score in this meeting in order to meet the timeline needed to complete the specification package to utilize the new ABCs for fishing year 2015.

Review of the previous P* WG Meeting
Council staff summarized the accomplishments of the P* WG from the 2 previous meetings, held May 28-29, 2013 and June 12, 2013, respectively. Staff also presented on the action items of the WG from the second meeting and how those action items were addressed. The actions included: 1) Covert the PSA scores from Thomas (2013) to the same scale as what is used in the Productivity-Susceptibility Dimension of the P* Analysis. The converted values were included in the briefing materials (Document 7.0). This would serve as a proxy for the Guam P-S exercise; 2) Finish/refine the P* criteria particularly the scientific information and the stock status. The scientific information was revisited and the approach aspect elements were re-evaluated for changes; 3) Follow-up with SSC members on their P-S scores. All of the P* WG members assigned to provide P-S scores had submitted their scores and was included in the briefing materials; and 4) Finalize the technical paper. The technical paper was included in the briefing materials as the final draft.

Review of the biomass-augmented catch-MSY model
Dr. Pierre Kleiber presented on the results of the comparative analysis suggested by the SSC to determine accuracy of the MSY results from the augmented catch-MSY model. MSY estimates from the MFK model were compared to MSY estimates from two PIFSC bottomfish stock assessments, the 2011 MHI Deep 7 bottomfish stock assessment and the 2012 bottomfish stock assessment for American Samoa, Guam and the CNMI. In two instances, the results of the augmented catch-MSY model were more conservative than the stock assessment results. Specifically, the results for American Samoa showed more conservative results where the augmented catch-MSY model estimated MSY at 51,000 lbs and the stock assessment estimated MSY at 76,000 lbs. Similarly, the results for CNMI from the catch-MSY approach are less than half of the results of the stock assessment (catch-MSY = 100,000 lbs and stock assessment = 173,000 lbs).

For Guam bottomfish and MHI Deep 7 bottomfish, the augmented catch-MSY approach provided less conservative estimates of MSY. Specifically, for Guam bottomfish, the augmented catch-MSY model estimated an MSY of 60,000 lbs while the stock assessment estimated and MSY of 56,000 lbs. For all comparative analysis, the biomass estimates are incorporated to simulate what was done with the augmented catch MSY approach. However, there is some circularity in the approach because the biomass estimates used in the augmented catch-MSY approach came from the biomass generated by the stock assessment. Similarly for MHI Deep 7 bottomfish, the augmented catch-MSY model resulted in MSY estimates that are higher than the MSY estimated in the PIFSC 2011 stock assessment. The data used for the augmented catch-MSY analysis was catch scenario 2/CPUE scenario 1 where the unreported non-commercial landing was assumed to be 1:1 to the reported commercial landing. The resulting MSY estimate for the catch-MSY approach was 1,548,000 lbs whereas the resulting MSY from the stock assessment (using CPUE scenario 1) was 848,000 lbs which is 45% lower that the catch-MSY result. It was hoped that the estimates be more close to each other.

The discrepancy in the Hawaii results may be due to how the augmented catch-MSY model responds to assumptions in stock exploitation relative to stock biomass. Bottomfish fisheries in the territories (with perhaps the exception of Guam) have high biomass and low fishing mortality. However Hawaii has higher fishing mortality and therefore higher population turnover

per time step. Too much turnover per time step can cause the underlying population model in the catch-MSY approach to be erratic. This is not a problem inherent in the Schaefer model but rather a problem in way it is currently coded in the catch-MSY software. This could be fixed, though perhaps at the expense of longer running times for the model.

The data also for Hawaii goes all the way back to 1948. Simulation run was also conducted to test for effect of the long catch time series by truncating to the most catch data since 1970. The results were almost the same. Also checked was the r-k density plot to see if there is anything wrong, but the plot does not provide any indication that there is something wrong in the *r-k* algorithm.

The Hawaii data seemed to be anomalous in more than one case. The Chair liked the idea that the model is generating conservative results for data poor stocks. However, in the case for stocks that are exploited there must be some ancillary factors affecting the results that need to be accounted for.

Review and changes to the P* Dimensions and Criteria
Council staff presented the different dimensions of the P* analysis and the criteria under each dimension as revised by the P* WG members from the last 2 meetings. The WG members reviewed the preliminary scores of the Model Information and Uncertainty Characterization Dimensions. The WG members retained the preliminary scores and deemed it applicable for the current methods under Tier 3.

For the Model Information Dimension, the WG deemed the MFK model falls somewhere between 2 and 4 since it aspects captured within this range.

Model Information Description	Score
Highly quantitative probabilistic approach that provides estimates of depletion and biomass status; includes MSY benchmarks; model input parameters include fishery dependent and independent information with limited assumptions	0.0
Quantitative probabilistic approach that provides estimates of depletion and biomass status; includes MSY benchmarks; model input parameters include at least fishery dependent or fishery independent information with additional assumptions;	2.0
Quantitative assessment non-probabilistic approach utilizing bulk estimators providing measures of exploitation or B, proxy reference points, includes MSY benchmarks; some sources of mortality accounted for	4.0
Semi quantitative assessment; utilizes estimators that generate relative measures of exploitation or B, proxy reference points, no MSY benchmarks, absolute measures of stock unavailable	6.0
No benchmark values, but reliable catch history	8.0
Bad. No benchmark values, and scarce or unreliable catch records	10.0

In order to determine exactly where, the WG scored the approach aspect. The scores are as follows:

Approach Aspects (AAs)	Score
Reliable catch history	0
Measure of depletion	1
Species-specific data	1
All sources of mortality accounted for (z)	0.5
Fishery independent information	0.5
Probability distribution available (output)	0
Population/biological parameters (r or k etc.)	0.5
SUM	**3.5**

Using the scaling equivalency table, the score of 3.5 has a scaled equivalent of 3.0.

AAs Score	Scaled equivalent	AAs Score	Scaled equivalent
0.5	2.1	4	3.1
1	2.3	4.5	3.3
1.5	2.4	5	3.4
2	2.6	5.5	3.6
2.5	2.7	6	3.7
3	2.9	6.5	3.9
3.5	3.0	7	4.0

Hence for the **Model Information Dimension the score is 3.0.**

The Uncertainty Characterization Dimension had not been revised since this dimension is applicable for a Tier 1 to Tier 3 stock. The WG maintained the **score of 5** for this model-based approach under this Tier. The group scored this dimension as 5.0 since uncertainties can be adjusted by controlling for the range of r and k as well as the process error of the Schaefer Model (see P* WG second meeting report). By process of elimination it cannot be scored as 7.5 because there is an estimate of MSY and probability distribution around that MSY.

The table for this Dimension is shown below:

Uncertainty Characterization Description	Score
Complete. Key determinant – uncertainty in both assessment inputs and environmental conditions included	0.0
High. Key determinant – reflects more than just uncertainty in future recruitment	2.5
Medium. Uncertainties are addressed via statistical techniques and sensitivities, but full uncertainty is not carried forward in projections	**5.0**
Low. Distributions of Fmsy and MSY are lacking	7.5
None. Only single point estimates; no sensitivities or uncertainty evaluations	10.0

Fishing Level Scoring Session

This model approach provides an estimate of relative sustainable harvest level and has limited information on the stock status. Hence the third dimension had been revised to provide insight of F/F_{MSY} and not B/B_{MSY}. Council staff presented a summary of the Fishing Level Table (Document 4.0) and explained how the values were derived. Each of the families with MSY estimates were scored based on the criteria constructed by the P* Working Group at its second meeting. The summary of the scoring criteria is shown in the table below. A logical argument in Excel was crafted following the criteria designed by the WG members. In order to determine the final scores for each family, the WG was asked to define and determine 2 parameters:

1) Define catch – would the catch be defined as the point estimate of the most recent year in the time series; or an average of 3 years; or an average of 5 years
2) Determine MSY based on 2 different method in defining the r and k range – here termed as k-revise method A and k-revise method B

Description	Fishing level	Score
Lightly harvested	Catch << 1/3MSY	0.0
Moderately harvested	Catch < MSY	2.5
Fully harvested	Catch ≈ MSY	5.0
Over harvested	Catch > MSY	7.5
Severely Over harvested	Catch > 2x+MSY	10.0

Rationale for using 3 year average:

The WG members defined catch as average catch over a three year period. Using an average of a recent segment of the catch time series addresses short term fluctuation in catches brought about by variability in productivity and fishery dynamics. A three year average allows us to see trends that are occurring recently and is reasonable time frame for management to be reactive to recent changes in the fishery. This also balances random fluctuation in catch as opposed to real stock change which can then be used as point estimate for comparison with MSY reference points.

Rationale for using k-revise method B:

The catch-MSY method examines 30,000 randomly chosen points in a window in r-k space. Each point corresponds to a pair of r and k values. Plausible r-k pairs are identified if a Schaefer model run with those parameter values can generate a biomass time series that accommodates the catch time series as well as any measured values of biomass and satisfies other criteria such as biomass not going below zero or not exceeding k. The plausibility density in r-k space is interpreted as a probability density from which r, k, and hence MSY can be estimated where

$$MSY=rk/4. \quad (1)$$

At the outset the window in r-k space is determined by ranges of r and k assumed to contain the true values of r and k. These ranges are purposely wide -- perhaps orders of magnitude (particularly for k) -- to minimize the possibility that the true value of either r or k is outside the window. To focus into a region of high density, another set of 30,000 points is then examined

from a revised window and MSY estimated. The revised ranges are calculated based on the outcome from the first window.

There are two methods for calculating the revised range for k, method A and method B, and Figures 1 and 2 show plausibility density for method A and B respectively. The dashed lines in the density plots indicate the locus of points corresponding to a constant value for MSY determined by equation (1) above with r and k estimated from the plausible r-k pairs. Ideally the density plots should show a high density ridge with density sloping off on either side and the MSY line associated with that ridge. Good examples are in the siga-a plot in Figure 1 and most of the plots in Figure 2. Some of the plots in Figure 1 indicate that the final window in r-k space was missing the highest density ridge, being located too far below/left (e.g. caran-a) or too far above/right (e.g. holo-a). The scattering of holes in the density plots is another indication that the window was not well located, and the near verticality of the MSY lines in several plots indicates that the range in k values was too narrow and badly located. Mis-located windows are also indicated in truncated density distributions of MSY from method A (Figure 3).

Because k-revise method B was more consistent in finding a good k range, the WG members determined that MSY estimates generated from the k-revise method B is preferred over k-revise method A. However, it was suggested that determination of ranges for r and particularly for k might be improved with a more flexible and perhaps interactive method for final placement of the window in r-k space.

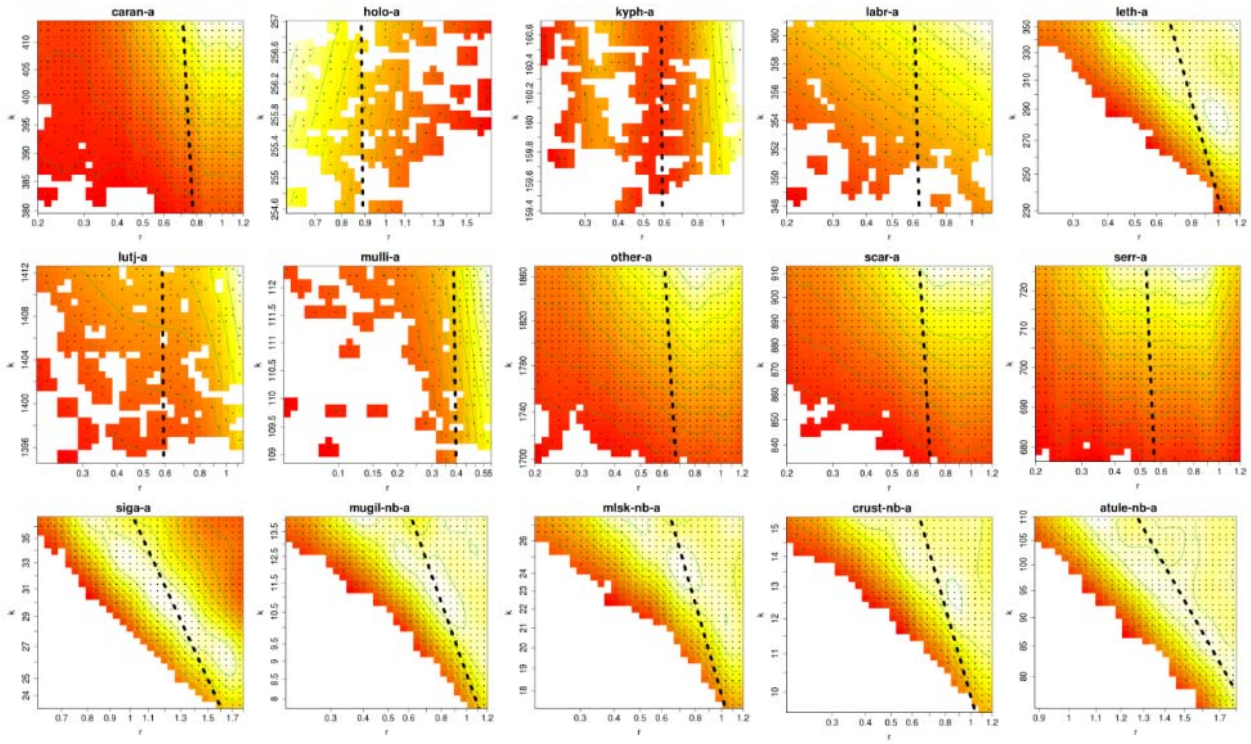

Figure 1. Density of plausible r-k combinations for the different families of reef fish and reef associated organisms using k-revise method A. Dashed lines show the locus of points corresponding to the estimated MSY.

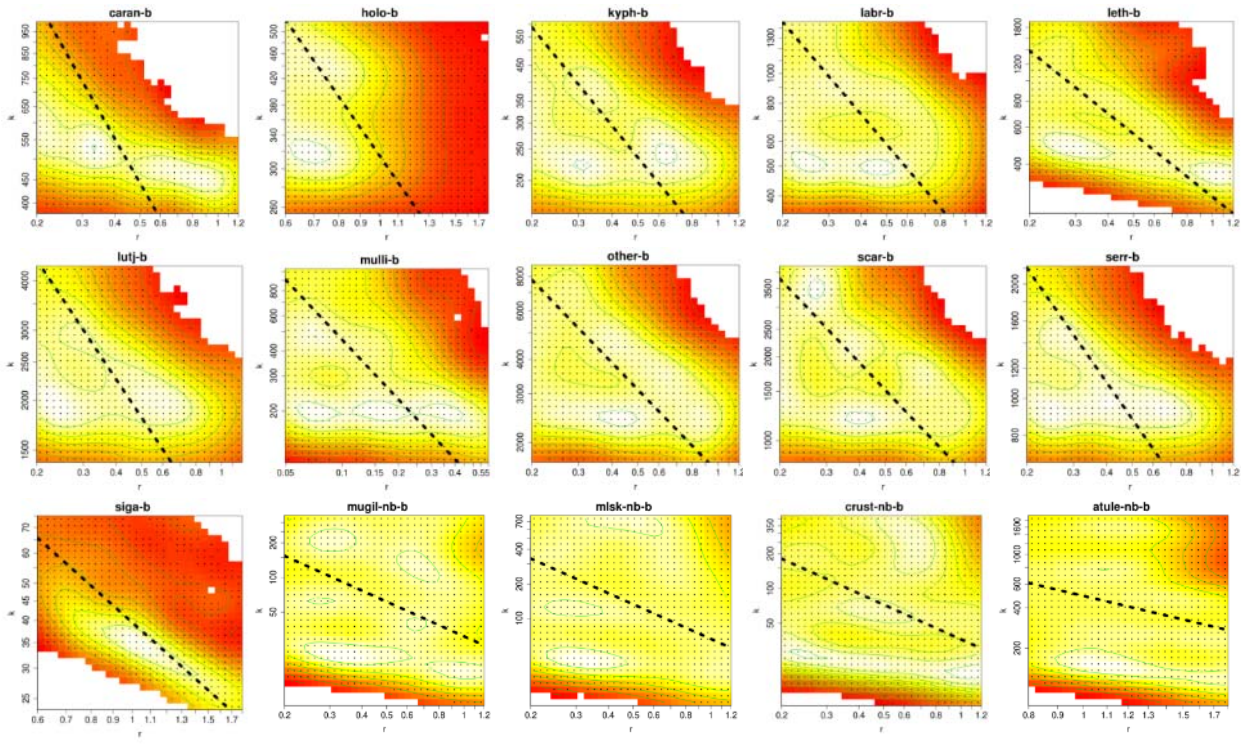

Figure 2. Density of plausible r-k combinations in r-k space for the different families of reef fish and reef associated organisms using k-revise method B. Dashed lines show the locus of points corresponding to the estimated MSY.

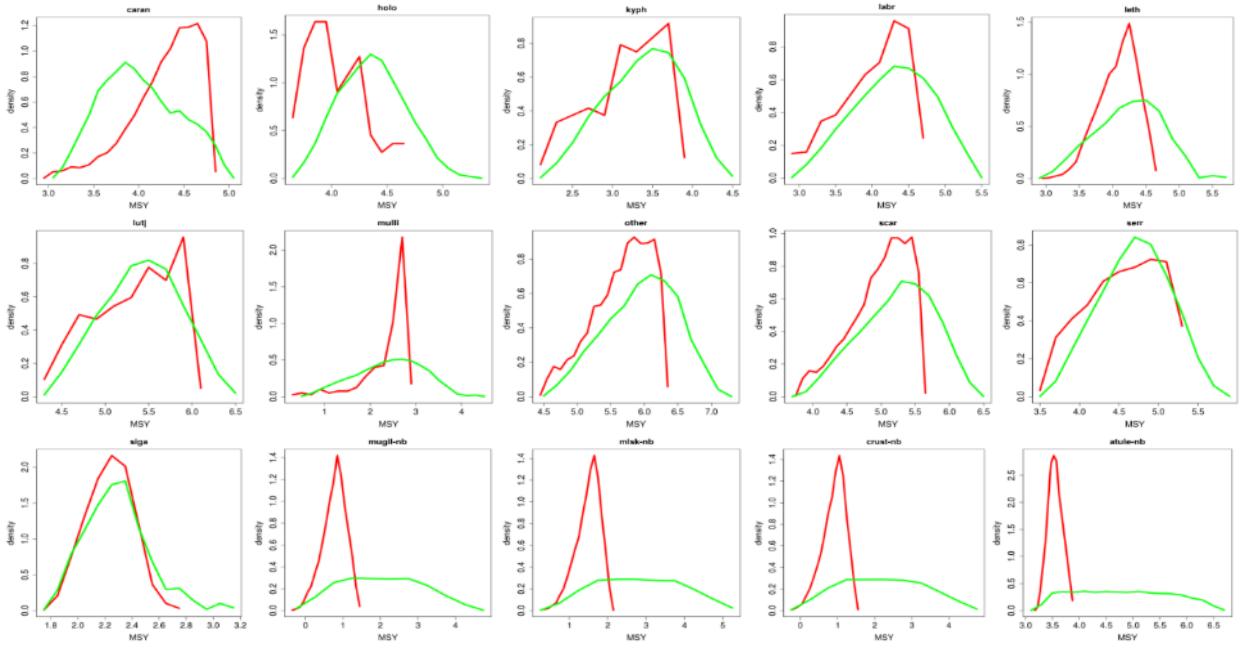

Figure 3. Density distributions of MSY values estimated by k-revise method A (red) and method B (green).

Productivity and Susceptibility Scoring Session
P* Working Group Members were requested to provide a score on the productivity and susceptibility for species that dominates the catch under each of their respective family grouping. When multiple species are scored under each family, the scores were averaged across species to represent the final score.

Productivity and Susceptibility Description	Score
Low risk. High productivity, susceptibility low.	0.0
Low/Medium	2.5
Medium risk. Moderate productivity, and susceptibility	**5.0**
Medium/High	7.5
High risk. Low productivity, high susceptibility	10

Hawaii – Bob Humphreys presented a summary of the Productivity Susceptibility scores (in collaboration with Ed DeMartini) for the coral reef MUS for Hawaii. The scores were given for species that make up the 90% of the coral reef catch. The productivity scores were based on the life history characteristics (e.g. age and growth, longevity, L_{inf} etc.) available from local studies or from the literature. Susceptibility scores were based on the type of fishery it was harvested as well as proximity of the habitat to human presence. If there is no information then a default risk score of 5 is assigned. Details of the PS scores are found in Appendix 1.

Guam – Lennon Thomas presented on the Productivity Susceptibility Analysis for the Guam coral reef MUS. The analysis utilized the expanded creel survey data and focused on 33 species that comprised more than 50% of the catch (Thomas 2013). These species represents the families of reef fishes that have ACLs. Six life history attributes were used to evaluate productivity: 1) Maximum age; 2) Maximum size; 3) Age at maturity; 4) Von Bertalanffy growth coefficient; 5) Natural mortality; and 6) Trophic level; were used to evaluate productivity. On the other hand, the four attributes used to evaluate susceptibility were: 1) Fishery value; 2) Vertical range; 3) Geographic distribution; and 4) Behavior and relationship to catchability; were used to evaluate susceptibility. All attributes were scored on a range of 1 to 3 where 1 is low, 2 is moderate, and 3 is high. The vulnerability of each species was then calculated which is the Euclidean distance from the *xy* orgin of a scatterplot. However, for the purposes of the P* analysis, only the final scores for the productivity and susceptibility were used. The final productivity and susceptibility scores were rescaled to the 0-10 scale of the P* PSA with 2.5 increments. The conversion table is shown below.

DESCRIPTION	PSA_scale	P_scale	S_scale
LOW	1	10	0
	1.1	9.5	0.5
	1.2	9	1
	1.3	8.5	1.5
	1.4	8	2
	1.5	7.5	2.5

DESCRIPTION	PSA_scale	P_scale	S_scale
	1.6	7	3
	1.7	6.5	3.5
	1.8	6	4
	1.9	5.5	4.5
MODERATE	2	5	5
	2.1	4.5	5.5
	2.2	4	6
	2.3	3.5	6.5
	2.4	3	7
	2.5	2.5	7.5
	2.6	2	8
	2.7	1.5	8.5
	2.8	1	9
	2.9	0.5	9.5
HIGH	3	0	10

To ensure compatibility with the study results, the converted scores for the P* PSA and the vulnerability scores were compared. Details of the PS scores are found in Appendix 2.

CNMI – Todd Miller presented on the summary of the Productivity Susceptibility scores (in collaboration with Michael Tenorio, Sean MacDuff and John Gourley) for the coral reef MUS for CNMI. The basis for the scoring was from its commonness or predominance in the underwater census surveys, creel survey, market survey and BioSampling program. For the productivity scores this was based on the frequency of sighting in the underwater surveys. The susceptibility scores were based on whether the species are targeted and its commonality in the commercial and non-commercial landing. Details of the PS scores are found in Appendix 3

American Samoa – Domingo Ochavillo presented the summary of the Productivity Susceptibility scores for the coral reef MUS for American Samoa. The scoring was based on the available life history characteristics for the productivity criteria. Scoring for the susceptibility was based on dominance in the coral reef fish catch. Details of the PS scores are found in Appendix 4.

P* for the Western Pacific Coral Reef Management Unit Species

Summing all the dimension scores yields the total uncertainties and when deducted from the 50% risk of overfishing will result in the P*. If accepted by the SSC, the level of catch associated with P* as provided in Sabater and Kleiber (2013) will correspond to the acceptable biological catch. Since the P* values in Sabater and Kleiber (2013) are presented in 5% increment, the SSC may consider rounding P* values up or down depending on the scores proximity to the incremental value.

Table 1. Summary of the dimension scores and the resulting P* for the Hawaii management unit species with ACLs for fishing year 2015.

Hawaii Grouping	**M.I.**	**U.C**	**S.S**	**P.S**	**∑**	**P***
Acanthuridae – surgeonfish	3	5	0	5.8	13.8	36.2
Atule - *Selar crumenophthalmus*	3	5	2.5	2.5	13.0	37.0
Carangidae – jacks	3	5	0	2.5	10.5	39.5
Carharhinidae – reef sharks	3	5				
Crustaceans – crabs	3	5	5	5	18.0	32.0
Holocentridae – squirrelfish	3	5	2.5	6.3	16.8	33.3
Kyphosidae - rudderfish	3	5	0	5	13.0	37.0
Labridae - wrasses	3	5	0	5	13.0	37.0
Lethrinidae - emperors	3	5	0	5	13.0	37.0
Lutjanidae – snappers	3	5	0	1.2	9.2	40.8
Mollusks – turbo snails; octopus	3	5	5	5	18.0	32.0
Mugilidae – mullets	3	5	2.5	6.6	17.1	32.9
Mullidae – goatfish	3	5	2.5	5.6	16.1	33.9
Opelu - *Decapterus macarellus*	3	5	2.5	5	15.5	34.5
Other CREMUS	3	5	0	6	14.0	36.0
Scaridae – parrotfish	3	5	0	7.5	15.5	34.5
Serranidae - groupers	3	5	0	0	8.0	42.0
Spiny lobster	3	5	0	5	13.0	37.0

Table 2. Summary of the dimension scores and the resulting P* and associated ABCs for the Guam management unit species with ACLs for fishing year 2015.

Guam Grouping	**M.I.**	**U.C**	**S.S**	**P.S**	**∑**	**P***
Acanthuridae – surgeonfish	3	5	2.5	3.9	14.4	35.6
Algae	3	5	0	5	13	37
Selar crumenophthalmus	3	5	7.5	4.3	19.8	30.2
Carangidae – jacks	3	5	5	5.7	18.7	31.3
Carcharhinidae – reef sharks	3	5				
Crustaceans – crabs	3	5	0	5	13	37
Holocentridae – squirrelfish	3	5	0	4.8	12.8	37.2
Kyphosidae – rudderfish	3	5	2.5	5.6	16.1	33.9
Labridae – wrasses	3	5	0	7.5	15.5	34.5
Lethrinidae – emperors	3	5	0	6.3	14.3	35.7
Lutjanidae – snappers	3	5	0	7.4	15.4	34.6
Mollusks – turbo snail; octopus	3	5	0	5	13	37
Mugilidae – mullets	3	5	0	5.8	13.8	36.2
Mullidae – goatfish	3	5	0	3.8	11.8	38.2

Other CREMUS	3	5	0	5	13	37
Scaridae – parrotfish	3	5	2.5	5.8	16.3	33.7
Serranidae – groupers	3	5	0	6.7	14.7	35.3
Siganidae – rabbitfish	3	5	0	4.1	12.1	37.9
Spiny lobster	3	5	0	5	13	37

Table 3. Summary of the dimension scores and the resulting P* and associated ABCs for the CNMI management unit species with ACLs for fishing year 2015.

CNMI Grouping	**M.I.**	**U.C**	**S.S**	**P.S**	**∑**	**P***
Acanthuridae – surgeonfish	3	5	0	4.3	12.3	37.7
Selar crumenophthalmus	3	5	0	2.5	10.5	39.5
Carangidae – jacks	3	5	0	4.2	12.2	37.8
Crustaceans-crab	3	5	0	5	13	37
Holocentridae - squirrelfish	3	5	0	4.8	12.8	37
Kyphosidae – rudderfish	3	5	0	5.6	13.6	36
Labridae – wrasses	3	5	0	7.5	15.5	35
Lethrinidae – emperors	3	5	2.5	4.9	15.4	34.6
Lutjanidae – snappers	3	5	0	3.2	11.2	38.8
Mollusks – turbo snail; octopus	3	5	0	3.2	11.2	38.8
Mugilidae – mullets	3	5	0	4	12	38
Mullidae – goatfish	3	5	0	4	12	38
Other CREMUS	3	5	0	4.8	12.8	37.2
Scaridae – parrotfish	3	5	0	6	14	36
Serranidae – groupers	3	5	0	5.3	13.3	36.7
Siganidae – rabbitfish	3	5	2.5	4	14.5	35.5
Spiny lobster	3	5	0	5	13	37

Table 4. Summary of the dimension scores and the resulting P* and associated ABCs for the American Samoa management unit species with ACLs for fishing year 2015.

American Samoa Grouping	**M.I.**	**U.C**	**S.S**	**P.S**	**∑**	**P***
Acanthuridae – surgeonfish	3	5	0	3.3	11.3	38.7
Selar crumenophthalmus	3	5	0	2.5	10.5	39.5
Carangidae – jacks	3	5	0	5	13	37
Carcharhinidae – reef sharks	3	5				
Crustaceans – crabs	3	5	5	6.3	19.3	30.8
Holocentridae – squirrelfish	3	5	0	6.3	14.3	35.8
Lethrinidae – emperors	3	5	0	5	13	37
Lutjanidae – snappers	3	5	0	7.5	15.5	34.5
Mollusks – turbo snail; octopus	3	5	0	7.5	15.5	34.5

Mugilidae – mullets	3	5	0	5	13	37
Kyphosidae – rudderfish	3	5	0	5	13	37
Labridae – wrasses	3	5	0	5	13	37
Mullidae – goatfish	3	5	0	5	13	37
Siganidae – rabbitfish	3	5	0	2.5	10.5	39.5
Other CREMUS	3	5	0	5	13	37
Scaridae – parrotfish	3	5	0	5	13	37
Serranidae – groupers	3	5	0	3.8	11.8	38.3
Spiny lobster	3	5	0	5	13	37

Rationale for the species grouping
In the initial 2012 ACL specifications, the different coral reef management unit species were grouped by family and ACLs were specified only for groups that comprised 90% of the total catch. This was done to reduce the number of species that would require ACLs as well as include all families that are harvested in large amounts in the fishery. The rest of the families were grouped as the bottom 10% of the catch and assumed not to be significant in terms of total landings.

The data used in the initial 2012 ACL specification was all available catch data up to 2008 for the territories and through 2009 for Hawaii. In the re-analysis of the data to be used in the model based approach, the data was updated to include all available catch through 2012. Catch data for the Territories was from the creel surveys (proxy for total catch to include shore-based and boat-based catch with varying levels of non-commercial catches from multiple gear) and dealer reports (commercial catch). The Hawaii data was only from commercial catch reports filed by fishermen with Commercial Marine Licenses. Non-commercial catch was not included. In the process of identifying the top 90%, the results yield a different grouping compared to the initial specification. This has legal ramifications because the National Standard 1 requires stocks subject to ACL specification be identified. This should be a static list to ensure consistent monitoring of each group over time. Process-wise this will result in the re-calculation of the top 90% every time new data is available otherwise it is not utilizing the best scientific information available. Shifting species groups that require ACLs is hard to monitor and will result in inconsistencies in the specification that ultimately will confuse the stakeholders. The species groupings that result from incorporating data through 2012 are the groups being monitored by the Archipelagic Plan Team and described in the Council annual reports. By using these fixed groupings into the future, it will enable consistent monitoring of catches and groups that would require ACLs should new data become available.

Rationale for the P* values
The assumption behind the tiered system approach is that the scientific uncertainties increase from a data-rich tier (e.g. Tier 1) to a catch-only tier (e.g. Tier 5). So in situations where less information is available regarding stock status as well as the fishery that harvests the stock, a larger buffer is needed to ensure that the stock is not going to be subject to overfishing or being overfished. This follows the precautionary principle in data poor situations. In the case for most of the Western Pacific stocks (e.g. coral reefs) where the current ACLs are based on catch-only information, the uncertainties were reduced when the augmented catch-MSY approach was used

to estimate MSY. Incorporating biomass from underwater census surveys into the model and some information regarding resilience and assumptions on carrying capacity enabled the Council to enhance the ACL specification from the catch-only approach. The critical factor is the biomass because this parameter is commonly estimated by using CPUE as a proxy in most surplus production models, yet these approaches are treated as a Tier 1.

Determining the appropriate level of scientific risk varies between regions. Other Regional Fishery Management Councils had specified either default P* values for each tier and a range of P* with a P*max. Currently, the omnibus amendment does not prescribe a range of P* values for each tier. Each tier is comprised of varying level of scientific information and model reliability. Tier 3 utilizes model based approaches where the uncertainty of OFL (in this case probability distribution around MSY as a proxy for OFL) can be estimated using Monte-Carlo simulation. The criteria for Tier 3 P* analysis was tweaked from the Tier 1 P* analysis applied to western Pacific bottomfish recognizing that the Tier 3 approach is not a real model based stock assessment. The model and scientific information are based on the merits and demerits of parameters and information that fits the Tier 3 methods. Hence a direct comparison between a Tier 1 P* score and a Tier 3 P* score is not feasible. Although intuitively based on the Tiered approach principle, the P* scores in Tier 3 should not exceed or be equal to the Tier 1 P* score. However, in this case, they do. Specifically, P* values for Hawaii CREMUS ranged from 32-42%. Species groups that exceeded or equaled the Tier 1 MHI Deep 7 Bottomfish (P*=40.8) were the families Lutjanidae and Serranidae from Hawaii at 40.8 and 42, respectively. These families are comprised of taape (*Lutjanus kasmira*) and roi (*Cephalopholis argus*) which are non-native species in Hawaii and considered invasive. There are some eradication efforts being conducted (on roi) by local fishing clubs to maintain ecological balance hence limiting catches for these species is not a priority for the Council.

The P* values for MUS groupings from all other jurisdiction falls generally below the P* values for the Tier 1 Territory Bottomfish (American Samoa 41%; Guam 40%; CNMI 39%). The stocks we analyzed and the Territory bottomfish stocks (majority of which are considered reef fish as well) both showed similar characteristics in which biomass levels are high relative to what is currently being harvested. Based on Tables 1-4 above, the P* range for CREMUS in each island area should be follows:

American Samoa - 30.8-39.5%
Guam – 30.2-37.9%
CNMI – 34.6-39.42%
Hawaii – 32-42%

A more detail comparison between the dimensions in the Tier 1 and the Tier 3 accounted for the scientific uncertainties by using a Tier 3 approach. Table 5 shows the comparative scores between assessments versus the augmented catch-MSY approach

Table 5. Comparative analysis of the dimension scores between Tier 1 and Tier 3.

Model	Tier level	D1 score	D2 score	D3 score	D4 score
MHI Deep 7 Bottomfish	1	1.3	0	3	4.9
Am. Samoa shallow/deep BF	1	1.6	5.0	0	1.95
Guam shallow/deep BF	1	1.6	5.0	0	4.45
CNMI shallow/deep BF	1	1.6	5.0	0	4.61
Biomass augmented catch_MSY	3	3.0	5.0	0-7.5	0-7.5

The tier 3 had higher reduced scores for dimension 1 (assessment information) accounting for the lower quality and less quantity of scientific information utilized in the augmented catch-MSY approach. For dimension 2 (uncertainty characterization), the augmented catch-MSY score is similar to the Territory Bottomfish. The territory bottomfish assessment and the augmented catch-MSY approach had uncertainties around the OFL estimates via the probability distribution around the MSY estimate. These uncertainties were not carried forward to future projections for the augmented catch-MSY approach but were accounted for in the Territory bottomfish assessment. In hindsight, the Territory bottomfish assessment should have been scored with a 2.5 instead of 5.

Hawaii Non-Deep 7 Bottomfish

The previous ACL specification of the Hawaii non-deep 7 bottomfish was based on a model result averaging between: 1) the analog approach with the MHI Deep 7 bottomfish; 2) the 75th percentile of the catch; and 3) the average of the past 3 years of catch. Concerns were raised regarding this method of model result averaging for this was not based on any simulation or re-sampling method but simply took an average of three point estimates. This also did not generate any probability distribution around the mean value. In order to be consistent with the current effort to standardize the ACL specification process using the tier 3 approach, the biomass-augmented catch-MSY approach was applied to the updated catch time series of the non-deep 7 and applied the MHI biomass estimate of *Aprion virescens* (locally known as uku) which makes up more than 87% of the non-deep 7 complex.

There were previous recommendations to remove uku from the non-deep 7 complex because of recent changes in the fishery whereby uku is no longer a substitute fish when the MHI deep 7 bottomfish fishery closes. The uku fishery had evolved on its own and is now a regular targeted fishery. If a separate ACL were to be specified for uku, an FEP amendment is required to establish uku as a different management unit. The working group members agreed to keep uku under the non-deep 7 but to also to treat uku as an indicator species to be monitored as a separate species and as a complex.

Using the biomass-augmented catch-MSY approach, the method-B MSY estimate for the non-deep 7 bottomfish is 265,000 lbs. Applying the same stock status determination methodology in the P* analysis, the stock status dimension score is 2.5. The P-S dimension yields a score of 7.5 (see table below for details). Combining all the dimension scores yield a score of **18** and a corresponding P* value of **32**. The risk table is shown below.

Hawaii Coral Reef Ecosystem (Mullidae-Goatfish) (non-FSSI)

Species Name	Scientific Name	Prod.	Susc.	Sum	Ave	Justification
UKU	Aprion virescens	7.5	7.5	15	7.5	Long lived (26 years); slow growing; highly targeted; takes 5 years to reach maturity; average length 50 cm from an Lmax of 81 cm

Risk table for the non-deep 7 bottomfish

risk table – k-revise b									
5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
112.2	129.9	144.5	158.1	172.3	187.1	203.7	221.2	239.9	259.2

Next Step

1. SSC review of the P* score
2. SSC decide which ABC to take given that the risk table is in 5% increment (round up or down

Appendix D Report of the SEEM Working Group

WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

Social, Economic, Ecological, and Management (SEEM) Working Group Meeting for Coral Reef Fisheries in Hawaii, Samoa, and Marianas Archipelagos

February 26-28, 2014
1:00 pm – 5:00 pm
Council Conference Room

DRAFT REPORT

Report Highlights

- Chair welcomed members and asked for introductions.
- Council staff provided background and described Working Group purpose.
- The Working Group discussed fishery attributes that facilitate the use of ACLs in policy and management and the need to consider SEEM factors when setting these catch limits.
- In all island areas (three archipelagos; four political jurisdictions), the current level of observed catch of each coral reef stock is generally far below the stock's assumed biomass (note: this is not the case for the MHI bottomfish fishery, which is managed under a separate management plan.)
- The Working Group decided to use SEEM factors for the NMI that were recently developed by researchers at the NMFS Pacific Islands Fisheries Science Center as a starting point to consider factors important to the other three jurisdictions.
- The Working Group decided to comprehensively describe and score all SEEM factors, but to use only the ecological and management uncertainty factor scores to reduce from ABC, since the Council cannot use the results of a SEEM analysis to increase an ACL.
- Outcome: Based on ecological and management uncertainty considerations, the SEEM Working Group determined that reductions from coral reef MUS ABC in American Samoa, Hawaii, and the Marianas archipelagos of 5%, 5%, and 3% respectively may be warranted.

Full Report

The Council's Coral Reef Fisheries SEEM Working Group met from February 26th – 28th, 2014 at the Council office in Honolulu to examine social, economic, ecological, and management uncertainty factors inherent in coral reef fisheries in American Samoa, Guam, Hawaii, and the Northern Mariana Islands.

Council Vice-Chair, Edwin Ebisui welcomed the Working Group members and opened the meeting with introductions.
Following introductions, Council staff provided a summary of the history of ACL management and the basis for conducting a SEEM analysis on the Region's coral reef fisheries. The Council now uses a catch-MSY model, augmented by Marlowe Sabater and Pierre Klieber to account for biomass, to specify ACLs for the Region's coral reef MUS and as such most of those fisheries are now considered Tier 3 stocks. Because of this change, the Council requested staff to convene a SEEM Working Group to examine SEEM factors for coral reef fisheries in the three island areas.

Staff also provided the Working Group with an overview of the Main Hawaiian Islands bottom fish fishery SEEM analysis, including process and scoring determinations, that was conducted in 2011. Staff recommended that the Working Group consider a similar process for the current analysis, since it has been accepted by the Council and NMFS, but that improvements to the process could be discussed and considered for future SEEM exercises.

The Group discussed the difference between setting ACLs for coral reef fisheries and the MHI bottomfish fishery. In the latter fishery, the ACL is more meaningful, since there is near-real time catch reporting, which enables in-season tracking of catch towards the ACL and ability to close the fishery if the ACL is going to be reached. After considering these differences, the Working Group affirmed the usefulness of conducting a thorough SEEM analysis on regional coral reef fisheries, to guide future SEEM-related research, to highlight the importance of WPacFIN, and to further the ecosystem fishery management approach the Council has undertaken.

Following this discussion, Drs. Cynthia Grace-McCaskey and Leila Sievanen (JIMAR-PIFSC) presented their recent research in the Northern Mariana Islands to determine how fishermen perceived the social and economic importance of reef fisheries, local knowledge of coral reef ecosystems and associated species, and perceptions about various management strategies. The team interviewed 38 fishermen and vendors and worked with Council staff to determine the scope of the research and appropriate questions. A purpose of the research was to provide data into the SEEM analysis for CNMI reef fisheries. Council staff discussed the extent to which this CNMI-specific information applied to regional coral reef fisheries.

Before proceeding to the four SEEM dimensions, the Working Group discussed several topics: fishermen discussing and practicing conservation; income from fishing should include money saved from food fishermen don't have to buy; conflict between ethnic groups; overfishing terminology and perceptions; and village net exceptions in the NMI.

After the presentation, the Group discussed the best way to proceed. It was decided to follow the existing approach and comprehensively describe and score all relevant SEEM factors. Each item will be scored between -2 and +2. This scale was developed by the MHI bottomfish SEEM Working Group. The main benefit of this approach is that it can be used by each member to highlight how important he believes each social and economic factor is and how serious a concern he believes each management uncertainty factor to be. It is also sensitive to the uniqueness of the ecological dimension, where scoring factors tends to be less one-sided

(positive or negative) than in the other three dimensions. Finally, since each ecological and management uncertainty factor can only be given a maximum of -2, there is less potential for one or two items to result in large reductions.

Like the MHI bottom fish SEEM group, the current working group decided that a net positive score across the S and E factors will equal no reduction. The reduction would thus come from the scores of the items in the ecological and management uncertainty factors. The Group also decided to use the NMI study factors as starting factors when discussing the other three jurisdictions. Finally, the Working Group decided to score all SEEM factors for all jurisdictions at the end.

Before proceeding to the four SEEM dimensions, the Group discussed several topics: fishermen discussing and practicing conservation; income from fishing should include money saved from food fishermen don't have to buy; conflict between ethnic groups; overfishing terminology and perceptions; and village net exceptions in the NMI.

Mariana Archipelago

Social Dimension Factors

The Group discussed the importance of understanding the cultural importance around sharing catch and post harvest distribution (fish flow) as well as the various effort triggers, since some of this information was not captured in the PIFSC study interviews. From the social attributes found in the PIFSC study, the Working Group decided to lump "food security" with "diet" and unpack "social identity" and "pride."

The final list of social factors the Working Group selected was:

Allows traditional practices and values to continue
Is an important part of Marianas food security and healthier diet
Reef fishing as part of social identity status
Provides fish important for culturally important events e.g. fiestas, funerals, parties
Is a highly skilled and well-respected practice and occupation
Sense of pride and accomplishment in producing food and cultural benefit to others

Economic Dimension Factors

Most discussion of economic factors centered on the notion that money associated with coral reef fishing in the NMI stayed local, as some interviewees claimed. It was pointed out that while some revenue might stay in the Commonwealth, some of it is remitted and that much of the gear and equipment is purchased off island. The second issue that was discussed was the relative importance of subsistence fishing in reducing an individual's or household's grocery bills.

The final list of economic factors the Working Group selected was:

Supports the local economy
Supplements income of those with part-time jobs or low wages
Is an important source of income and jobs (i.e. primary and secondary)
Acts as an economic "safety net"
Supports extractive tourism/service industries
Supports non extractive value (aesthetic and existence value)
House hold expenses are reduced by subsistence fishing

Ecological Factor Items

Coral reefs provide buffer from large scale perturbation
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climate changes)
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development)
De-facto MPAs provide additional protection for reef stocks

Management Uncertainty Dimension Factors

Level of education, outreach and enforcement
Management effectiveness (local-federal linkages; real-time accountability measure)
Availability of reliable fishery information (catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)
Data collection improvement efforts (mandatory reporting in CNMI)
Other management systems may provide additional protection of reef stocks (monuments, sanctuaries, military closed areas)

American Samoa

Social Dimension Factors

The Working Group discussed some of the important cultural differences around fish and fishing in AS. Notably, that there are prescribed ways in which fish are distributed throughout the chief system. The Group also discussed the importance of communal fishing activities, such as for palolo and atulai, and the fact that there tends to be more village control of local fisheries resources than in other areas.

The final list of social factors the Working Group selected was:

Allows traditional practices and values to continue
Is an important part of Am. Samoa food security and healthier diet
Reef fishing as part of social identity status
Provides fish important for culturally important events (e.g. Fa'lavalave, to‘ona‘i funerals, weddings, Chiefly investitures)
Is a highly skilled and well-respected practice and occupation Tautai?
Sense of pride and accomplishment in producing food and cultural benefit to others

Economic Dimension Factors

Members generally agreed that reef fish are not currently an important part of the local economy, but recognized that new fish markets are opening soon and that reef fishing is always there in the event of an economic downturn. In fact, it is not clear what will happen as federal money following the tsunami is phased out.

The final list of economic factors the Working Group selected was:

Supports the local economy
Supplements income of those with part-time jobs or low wages
Is an important source of income and jobs (i.e. primary and secondary)
Acts as an economic “safety net”
Supports extractive tourism/service industries
Supports non extractive value (aesthetic and existence value)
House hold expenses are reduced by subsistence fishing

Ecological Dimension Factors

American Samoa has some unique attributes relevant to ecological factors for ACL consideration. The islands are fairly small and high and receive a lot of annual rainfall, often in intense bouts. When this happens, people tend to stay out of the nearshore water because of pollution and reduced visibility. Members also discussed the ecological implications of management areas, such as community based fishery management sites.

The final list of ecological factors the Working Group selected was:

Coral reefs provide buffer from large scale perturbation
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climatological changes)
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development); frequency of high rain events and unfavorable weather and climatological conditions keeps people out of the water
Dominance of Community Based FMAs in most villages
Large biomass potential due to under-utilized stocks (due to changes in the social and economic status)

Management Uncertainty Dimension Factors

The Working Group discussed the data uncertainty problem in American Samoa. Improvements have been made, but there continue to no real time tracking of catch and no mechanism or process to close the coral reef fishery should the ACL be reached. There also is limited local capacity to conduct regular government enforcement of fishery regulations.

The final list of management uncertainty factors the Working Group selected was:

Management effectiveness (local-federal coordinated management regime; real-time accountability measure)
Availability of reliable fishery information (catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)
Timeliness of QA/QC input and output in catch and effort data which would affect the ability to conduct near-real-time monitoring of catch
Data collection improvement efforts (mandatory reporting in Am Samoa; improvement through efforts)
Other management systems may provide additional protection of reef stocks (monuments sanctuaries, CFMP closed areas)

Hawaii

Social Dimension Factors

The cultural context of the reef fishery in Hawaii is more fragmented than in the other archipelagos, owing mostly to demography. However, there are still parts of the islands where coral reef fishing retains its cultural connotations and subsistence importance. Reef fish are also connected to the wider social fabric through events and ceremonies such as luaus, parties and weddings.

The final list of social factors the Working Group selected was:

Allows a variety of cultural, ethnic and Hawaiian traditional practices and values to continue
Is an important part of Hawaii food security and healthier diet
Reef fishing as part of social identity and status (clubs built around these fisheries)
Provides fish important for culturally important events e.g. first birthday luau, weddings, graduations, holidays etc.
Is a highly skilled and well-respected practice and occupation
Sense of pride and accomplishment in producing food and cultural benefit to others
Practice of customary exchange and fish flow to the community is still tied to the contemporary social fabric

Economic Dimension Factors

Members agreed that direct revenue from reef fish sales is not large. However, the sales of fishing gear and other fishing related provisions is likely an economic benefit to each of the islands. In addition, the important tourism component of the economy in some ways depends upon the availability of reef fish (divers, etc.).

The final list of economic factors the Working Group selected was:

Supports the local economy (including the fishing supply chain, fish markets and support network related to fishing)
Supplements income of those with part-time jobs or low wages
Is a source of income and jobs (i.e. primary and secondary)
Acts as an economic “safety net”
Supports extractive tourism/service industries
Supports non extractive value (aesthetic and existence value)
Money stays in the local economy (local manufacturing of fishing gear and supplies)
House hold expenses are reduced by subsistence fishing

Ecological Dimension Factors

The comparatively large size of the Hawaiian Islands makes for additional ecological factors to consider. For example, unlike the other two archipelagos, the Working Group felt that invasive marine species are important to consider. Also, the scale of development and issues like injection wells were discussed.

The final list of ecological factors the Working Group selected was:

Coral reefs provide buffer from large scale perturbation
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climate changes)
Potential effects of fishing interaction with protected species (prey competition)
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development, injection wells, ecological alteration, physical habitat degradation)
Effects of invasive species on ecological functions and stability
Ecological effects of ciguatera "scare"
De-facto MPAs and MLCDs provide additional protection for reef stocks

Management Uncertainty Dimension Factors

Hawaii management uncertainty items largely mirror the other two areas. The state does benefit from more staff and financial resources, but the islands are larger, which stretch those resources thin. As a result, enforcement is challenging. Also though the State is in the process of improving data collection, reef fish catch and effort statistics can be unreliable, especially for non-commercial participants.

The final list of management uncertainty factors the Working Group selected was:

Level of education, outreach and enforcement
Management effectiveness (local-federal linkages; real-time accountability measure)
Availability of reliable fishery information (commercial catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)
Data collection improvement efforts (improvements in online reporting); revision of HMRFS
Availability of reliable fishery information (non-commercial catch and effort information is unknown, life history, real-time monitoring, late reporting, mis-reporting, under reporting)
Other management systems may provide additional protection of reef stocks (monuments, State MPAs, military closed areas, community based management areas)

Scoring and Final Scores

The Working Group discussed scoring and factor wording prior to voting, to ensure that all members were approaching the exercise the same way. Members generally agreed that the lack of socially-derived data specific to SEEM scoring for each archipelago was not ideal and discussed the need to conduct research into SEEM factors and the importance of each of those items to members of the fishery. However, most members felt fairly comfortable in making a determination, given that estimated catch is well below the estimated available biomass.

Appendix A contains the scores for each item in each SEEM factor for each archipelago. The table below contains the averaged scores for each factor for each archipelago and the corresponding percentage reduction from ABC recommended by the SEEM Working Group.

Archipelago	Social	Economic	Ecological	Management	% Reduction from ABC
American Samoa	7	6	2	-5	-5
Hawaii	9	8	-1.4	-3.2	-5
Marianas	9	8	0	-3	-3

Following the factor scoring, the Working Group discussed the issue that despite the fact that there is less management uncertainty surrounding MHI bottomfish management than the Region's coral reef fisheries, the management uncertainty scores in this SEEM analysis were less than those produced by the MHI bottomfish fishery SEEM Working Group in 2011. The Group came to three conclusions: 1) Membership of the two SEEM working groups differed, and this will produce different results, 2) the biomass-to-fishing effort ratio is much different for coral reef fisheries than for the MHI bottomfish fishery and it is likely that members were taking this into account when scoring, and 3) this working group worded some factors, especially ones in the ecological and management uncertainty dimensions, more neutrally.

Appendix A. SEEM scores

AMERICAN SAMOA	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Social n=6	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Allows traditional practices and values to continue	2	1	2	2	2	1	2	1	2
Is an important part of Am. Samoa food security and fishery development	1	1	0	1	1	1	1	0	2
Reef fishing as part of social identity status e.g. tautai	1	1	1	1	1	1	2	0	2
Provides fish important for culturally important events e.g. fa'a lave lave, funerals, weddings etc.	2	2	2	2	2	2	2	0	2
Is a highly skilled and well-respected practice and occupation	1	1	1	1	2	0	2	0	0
Sense of pride and accomplishment in producing food and cultural benefit to others	1	1	1	2	2	0	1	0	1
SUM	8	7	7	9	10	5	10	1	9

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Economic n=7	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Supports the local economy through fishery development	1	1	0	0	0	0	1	0	2
Supplements income of those with part-time jobs or low wages	0	2	0	1	0	1	2	0	2
Is an potential source of income and jobs (i.e. primary and secondary)	1	1	1	0	1	0	1	0	2
Acts as a potential economic "safety net"	0	2	1	2	1	1	1	1	2
Supports extractive tourism/service industries	0	1	1	0	0	0	1	0	0
Supports non extractive value (aesthetic and existence value)	0	0	1	1	0	2	1	0	0

House hold expenses are potentially reduced by subsistence fishing	1	1	1	2	1	2	2	0	2
SUM	3	8	5	6	3	6	9	1	10

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Ecological n=5	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Coral reefs provide buffer from large scale perturbation	-1	0	1	0	2	-1	1	2	-1
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climatological changes)	-1	-1	-1	-1	-2	0	-1	-2	-1
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development); frequency of high rain events and unfavorable weather and climatological conditions keeps people out of the water	0	1	-1	-1	-1	0	0	-2	0
Dominance of Community Based FMAs in most villages	0	1	1	2	2	2	2	2	0
Large biomass potential due to under-utilized stocks (due to changes in the social and economic status)	1	1	2	1	2	2	2	2	0
SUM	-1	2	2	1	3	3	4	2	-2

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Management n=6	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Level of education, outreach and enforcement	-1	-1	-1	-1	-1	0	-1	-1	0
Management effectiveness (local-federal coordinated management regime; real-time accountability measure)	-2	-2	-2	0	-2	0	-2	-1	-1
Availability of reliable fishery information (catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)	-2	-2	-2	-1	-2	-1	-2	-2	-1
Timeliness of QA/QC input and output in catch and effort data which would affect the ability to conduct near-real-time monitoring of catch	-2	-2	-1	-1	-2	-1	-2	-2	-1
Data collection improvement efforts (mandatory reporting in Am Samoa; improvement through efforts)	1	-1	-2	0	0	1	-1	-1	0
Other management systems may provide additional protection of reef stocks (monuments sanctuaries, CFMP closed areas)	2	1	1	-1	2	2	1	1	0
SUM	-4	-7	-7	-4	-5	1	-7	-6	-3

HAWAII	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Social n=7	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Allows a variety of cultural, ethnic and Hawaiian traditional practices and values to continue	2	2	2	2	2	1	2	1	1
Is an important part of Hawaii food security and healthier diet	2	1	2	2	2	0	2	1	0
Reef fishing as part of social identity and status (clubs built around these fisheries)	2	2	1	2	1	1	2	1	0
Provides fish important for culturally important events e.g. first birthday luau, weddings, graduations, holidays etc.	2	1	1	2	2	1	2	1	0
Is a highly skilled and well-respected practice and occupation	1	1	1	2	1	1	2	1	0
Sense of pride and accomplishment in producing food and cultural benefit to others	1	1	1	2	2	1	1	1	1
Practice of customary exchange and fish flow to the community is still tied to the contemporary social fabric	1	1	2	2	1	1	2	1	1
SUM	11	9	10	14	11	6	13	7	3

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Economic n=8	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Supports the local economy (including the fishing supply chain, fish markets and support network related to fishing)	1	2	2	1	2	0	2	1	1
Supplements income of those with part-time jobs or low wages	1	1	1	1	1	1	2	1	0
Is a source of income and jobs (i.e. primary and secondary)	1	2	0	0	0	1	2	1	0

Acts as an economic "safety net"	0	1	0	2	0	2	1	1	0
Supports extractive tourism/service industries	1	2	1	1	1	-1	2	1	1
Supports non extractive value (aesthetic and existence value)	1	-2	2	2	1	0	2	1	-2
Money stays in the local economy (local manufacturing of fishing gear and supplies)	1	1	1	1	2	1	1	1	1
House hold expenses are reduced by subsistence fishing	1	1	0	2	1	1	2	1	1
SUM	7	8	7	10	8	5	14	8	2

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Ecological n=7	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Coral reefs provide buffer from large scale perturbation	-1	0	0	0	2	-1	1	2	-1
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climatological changes)	-1	-1	-1	-1	-2	0	-1	-1	-1
Potential effects of fishing interaction with protected species (prey competition)	0	-1	1	0	-1	0	-1	-1	0
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development, injection well, ecological alteration, physical habitat degradation)	0	1	1	-2	-2	-1	-1	-2	-2
Effects of invasive species in ecological functions and stability	0	0	0	0	-1	-1	-1	-1	-1
Ecological effects of ciguatera "scare"	0	0	1	0	0	1	1	-1	0
De-facto MPAs provide additional protection for reef stocks	0	0	1	1	1	1	2	1	1
SUM	-2	-1	3	-2	-3	-1	0	-3	-4

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Management n=6	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Level of education, outreach and enforcement	-1	0	-2	-1	-1	1	-1	-1	0
Management effectiveness (local-federal linkages; real-time accountability measure)	-2	-1	-2	0	-2	-1	-2	-1	0
Availability of reliable fishery information (commercial catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)	-1	-1	-2	0	1	-1	-1	0	-1
Data collection improvement efforts (improvements in online reporting); revision of HMRFS	1	0	-2	0	1	0	-2	-1	0
Availability of reliable fishery information (non-commercial catch and effort information is unknown life history, real-time monitoring, late reporting, mis-reporting, under reporting)	-1	-1	-2	-1	-2	-1	-1	-2	-1
Other management systems may provide additional protection of reef stocks (monuments, State MPAs, military closed areas, community based management areas)	2	0	1	1	2	1	1	1	0
SUM	-2	-3	-9	-1	-1	-1	-6	-4	-2

MARIANAS	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Social n=6	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Allows traditional practices and values to continue	2	1	2	2	2	2	2	2	2
Is an important part of Marianas food security and healthier diet	2	2	2	2	2	1	2	0	2
Reef fishing as part of social identity status	2	1	1	1	1	2	1	1	2
Provides fish important for culturally important events e.g. fiestas, funerals, parties	2	2	2	2	2	1	2	2	2
Is a highly skilled and well-respected practice and occupation	2	2	1	1	1	1	2	0	0
Sense of pride and accomplishment in producing food and cultural benefit to others	2	2	1	1	2	1	1	1	1
SUM	12	10	9	9	10	8	10	6	9

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Economic n=7	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Supports the local economy	1	2	1	1	2	0	1	1	1
Supplements income of those with part-time jobs or low wages	2	2	2	1	2	1	2	1	1
Is an important source of income and jobs (i.e. primary and secondary)	2	1	1	1	2	0	1	1	1
Acts as an economic “safety net”	2	2	1	2	2	2	2	2	2
Supports extractive tourism/service industries	1	0	0	1	1	-1	2	0	1
Supports non extractive value (aesthetic and existence value)	1	0	-1	1	1	2	1	1	-1
House hold expenses are reduced by subsistence fishing	2	1	1	2	1	1	2	1	1
SUM	11	8	5	9	11	5	11	7	6

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Ecological n=4	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Coral reefs provide buffer from large scale perturbation	-1	1	-1	0	2	-1	1	2	-1
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climatological changes)	-1	-1	-1	-1	-2	0	-1	-2	-1
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development)	0	1	1	0	2	1	-1	-2	-1
De-facto MPAs provide additional protection for reef stocks	1	1	1	-1	2	2	1	1	-1
SUM	-1	2	0	-2	4	2	0	-1	-4

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Management n=5	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Level of education, outreach and enforcement	-1	-2	0	0	0	0	-1	-1	0
Management effectiveness (local-federal linkages; real-time accountability measure)	-2	-2	-1	0	-2	-2	-2	-2	-1
Availability of reliable fishery information (catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)	-2	-2	-2	0	0	-1	-2	-2	-1
Data collection improvement efforts (mandatory reporting in CNMI; improvement through efforts)	1	-1	-2	0	0	0	-1	-1	0
Other management systems may provide additional protection of reef stocks (monuments sanctuaries, military closed areas)	2	1	2	-1	2	1	-1	1	0
SUM	-2	-6	-3	-1	0	-2	-7	-5	-2