Hawaii Archipelago Fishery Ecosystem Plan 2009 Annual Report

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Western Pacific Regional Fishery Management Council
1164 Bishop St., Suite 1400
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WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

Hawaii Archipelago Fishery Ecosystem Plan
Annual Report

Information and data analysis for this document provided by scientists at NMFS Pacific Islands Fisheries Science Center, State of Hawaii Department of Land and Natural Resources, Division of Aquatic Resources and NMFS Pacific Islands Regional Office

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1.0 Introduction

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), requires fishery management councils to create fishery management plans (FMP) to manage fisheries in their respective regions. The Western Pacific Regional Fishery Management Council (Council) developed the Hawaii Islands Archipelago Fishery Ecosystem Plan[1] (FEP) as an FMP, consistent with the MSA and the national standards for fishery conservation and management, in 2009. The Council's archipelagic FEPs represent the first step in a collaborative approach to implementing an ecosystem-based approach to fishery management in the Hawaiian Islands. In addition, the organizational structure for developing and implementing the Hawaii Islands Archipelago FEP incorporates community input and local knowledge into the management process. This report is the first annual FEP report on Council-managed insular fisheries and activities in Hawaii.

The Hawaii Islands Archipelago FEP established the framework under which the Council manages Hawaii's fishery resources, and seeks to integrate and implement an ecosystem approaches to management. The FEP did not establish any new fisheries or fishery management regulations. The FEP identified as management unit species (MUS) those current management unit species known to be present in waters around Hawaii and incorporated all of the management provisions of the Bottomfish and Seamount Groundfish FMP, the Crustaceans FMP, the Precious Corals FMP, and the Coral Reef Ecosystems FMP currently applicable to the area.

1.1 Hawaii 2009

The most significant event in fisheries of the Hawaii Archipelago during 2009 was undoubtedly the end of bottomfishing in the northwestern Hawaiian Islands (NWHI).

The Hawaiian Archipelago stretches northwestward over 1,500 miles with nearly 80 percent (~1,200 mi) of that considered the northwestern Hawaiian Islands (NWHI). Much of the NWHI was included within the Papahanaumokuakea Marine National Monument, as designated in 2006, and all commercial fishing was mandated to cease in 2011 in accordance with the Monument Proclamation. Congress mandated that NMFS offer a compensation package to the NWHI fishermen who would be displaced when fishing ends. The compensation package NMFS offered included a caveat that if compensation is accepted, fishing permits must immediately be surrendered prohibiting any further fishing in the NWHI. NMFS published the final rule for this compensation package option on October 15, 2009, with a deadline of November 19, 2009, for fishermen to accept the compensation offer. By mid December 2009 all of the permit holders accepted the compensation package and the commercial fisheries in the NWHI

[1] Can be located at: http://wpcouncil.org/fep/WPRFMC%20American%20Samoa%20FEP%20(2009-09-22).pdf

have now come to an end after more than 100 years of sustainably supplying fish to Hawaii's communities and restaurants.

2.0 Archipelagic Fisheries

Other than pelagic fisheries, the major fisheries in the Hawaiian Islands Archipelago FEP include bottomfish, coral reef, crustaceans, and a precious coral fishery. The major commercial fishery in Hawaii, in terms of landings and revenue, is by far the pelagics fishery which includes longlining, trolling, pole-and-line fishing, shortlining, handlining, and a mixed gear fishery. Pelagic fisheries are not included in this report as they are managed under the Pacific Pelagics FEP and will be part of that annual report.

Recreational Catch

Total recreational catch for Hawaii Archipelago in 2009 was estimated at over 21.6 million lb (NMFS Office of Science and Technology data). Of this total over 20.4 million lb were pelagic MUS which are included in the Pelagics Fishery Ecosystem Plan (PFEP) and will be reported in the PFEP Annual Report. The remaining 1.2 million lb were jacks (ulua) at nearly 0.5 mill lb; and bottomfish/snappers; mullets; bonefish (oi`o); goatfish (weke); akule; surgeonfish, and others.

2.1 Bottomfish Fishery

2.1.1. Introduction to Bottomfish Fishery

The Hawaiian bottomfish fishery is a traditional deep-water fishery that targets bottomfish management unit species (BMUS, Table 1) primarily using deepwater handline gear. Historically, bottomfish were targeted by Hawaiians using deep handlines from canoes, for hundreds of years before the advent of modern gear after World War II (Schug 2001). The modern fishery employs similar deep handline gear, albeit with braided synthetic line, along with power reels to haul back gear, fish finders to locate schools of fish, and GPS units and other navigational aids to find fishing grounds (Brodziak et al. 2009). Although the efficiency of fishing vessels has improved through time (Moffitt et al. 2009), the Hawaiian bottomfish fishery still uses traditional deep handline capture methods for commercial and recreational harvest.

The MHI bottomfish fishery now managed under a total annual catch (TAC). In 2008/2009 the MHI deepwater bottomfish fishery TAC was set at 241,000 pounds. For 2009/2010 the TAC was increased to 254,050 pounds (74 FR 48422; September 29, 2009). Implementation of the TAC was a federally mandated management measure to end overfishing of specific deepwater bottomfish species within the MHI. The TAC only applies to a subset of deepwater BMUS or bottomfish managed species known as the "Deep 7", comprised of onaga, opakapaka, kalekale, hapuupuu, ehu, gindai, and lehi.

During 2009, the Hawaii Archipelago Advisory Panel recommended to the Council that they not pursue management of the MHI bottomfish fishery using catch shares at this time.

Table 1: Hawaii Archipelago Bottomfish MUS

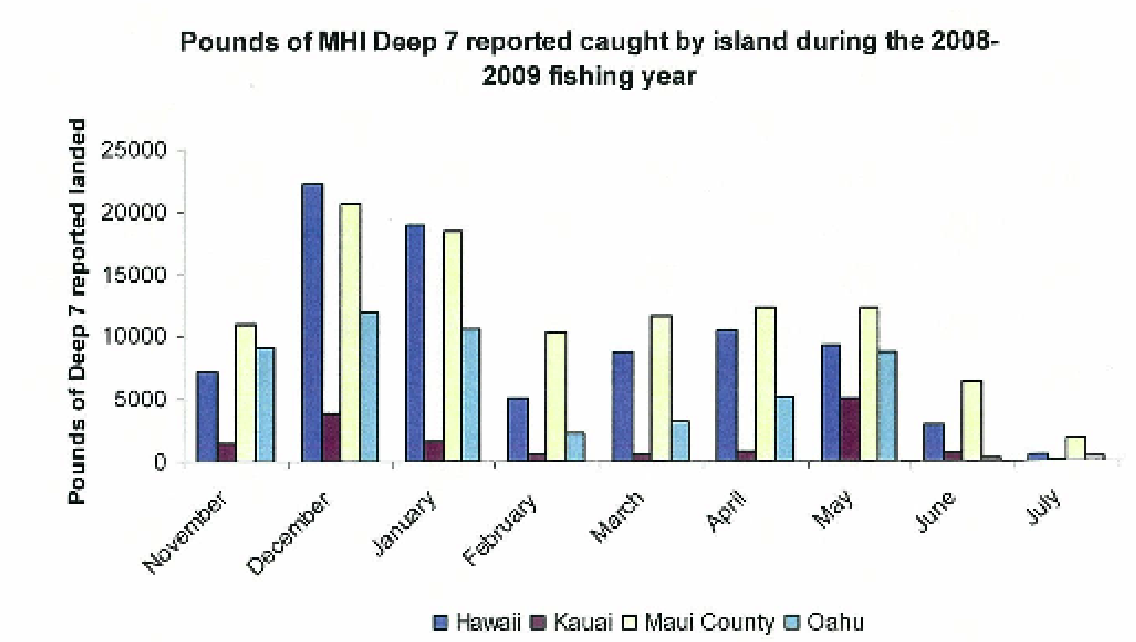
Local Name	English Common Name	Scientific Name
lehi	silver jaw jobfish	*Aphareus rutilans*
uku	gray jobfish	*Aprion virescens*
white papio/ulua au kea	giant trevally	*Caranx ignobilis*
ulua la‘uli	black jack	*C. lugubris*
hāpu‘upu‘u	sea bass	*E. quernus*
ehu	red snapper	*Etelis carbunculus*
onaga or ‘ula‘ula koa‘e	longtail snapper	*E. coruscans*
ta‘ape	blue stripe snapper	*Lutjanus kasmira*
kalekale	yellowtail snapper	*Pristipomoides auricilla*
‘ōpakapaka	pink snapper	*P. filamentosus*
kalekale	pink snapper	*P. seiboldii*
gindai	snapper	*P. zonatus*
pig ulua, butaguchi	thicklip trevally	*Pseudocaranx dentex*
kahala	amberjack	*Seriola dumerili*
NA	alfonsin	*Beryx splendens*
NA	armorhead	*Pseudopentaceros richardsoni*

2.1.2 Fishery Performance and Economic Data

2.1.2.1 Main Hawaiian Islands Catch & Effort

During the 2008/2009 fishing year the highest landings from all islands were during the winter months, December and January, which is typical as the inclusion of red fish such as the BMUS deep-water snappers is a culturally important part of the Christmas, New Year and Chinese New Year celebrations (Figures 1 and 2). The monthly BMUS catch varies quite considerably with the peak in winter (December) and the low in summer (August) (Figure 2). The average monthly price per pound does not vary nearly as radically as the catch does as shown in Figure 5.

Figure 1: MHI Bottomfish Landings by Month, 2009

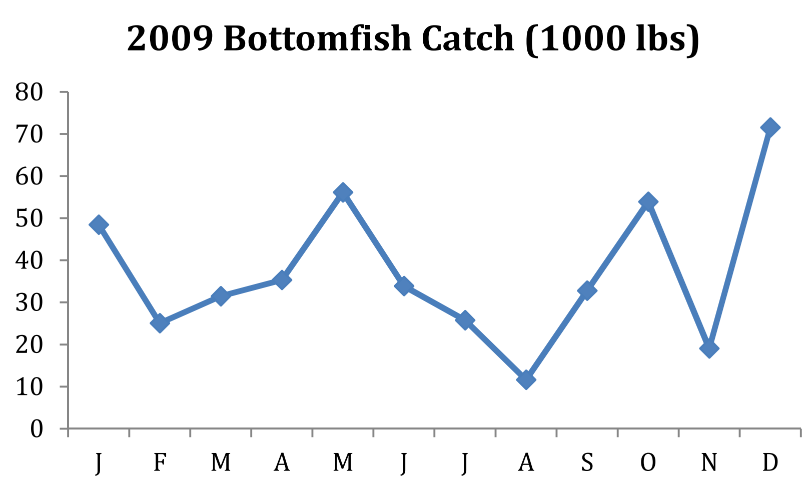


Source: HDAR's Bottomfish News, Volume 6, September 2009

During the 2007-2010 bottomfish fishing years, the Deep 7 bottomfish TAC was exceeded the first two years mainly due to the lag time between catching and reporting causing inaccurate estimations (shown in Figure 3) and was not reached during 2009. However, if the three years are combined the three-year cumulative TAC (673,050 lb) was not be reached as total landings were 662,373 lb. (Table 2).

The catch per unit of effort (CPUE) for the MHI bottomfish fishery has remained fairly constant over the past two decades at around 160 lb/trip (Figure 4).

Figure 2: 2009 Bottomfish Landings, by Month (1,000 lbs)



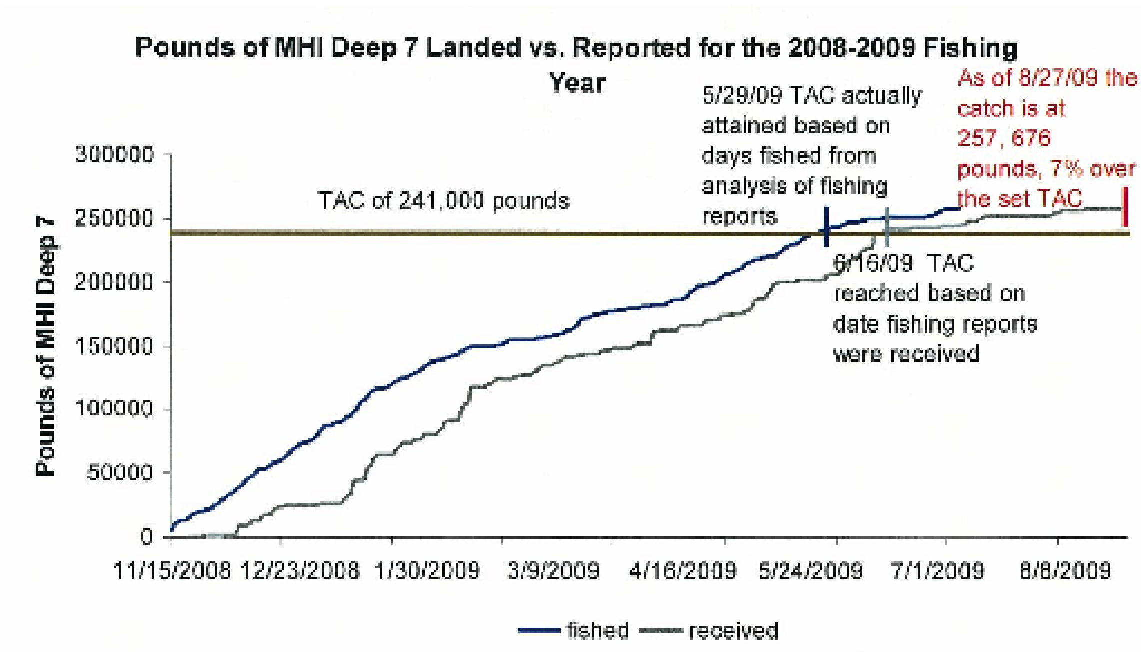
Source: WPacFIN data

Table 2: MHI Deep 7 Bottomfish TACs, Cumulative TACs, and Actual Landings, 2007-2010

	ANNUAL TAC	CUMULATIVE TAC	ACTUAL CATCH	CUMULATIVE CATCH
2007/2008	178,000	178,000	196,147	196,147
2008/2009	241,000	419,000	259,194	455,341
2009/2010	254,050	673,050	207,032	662,373

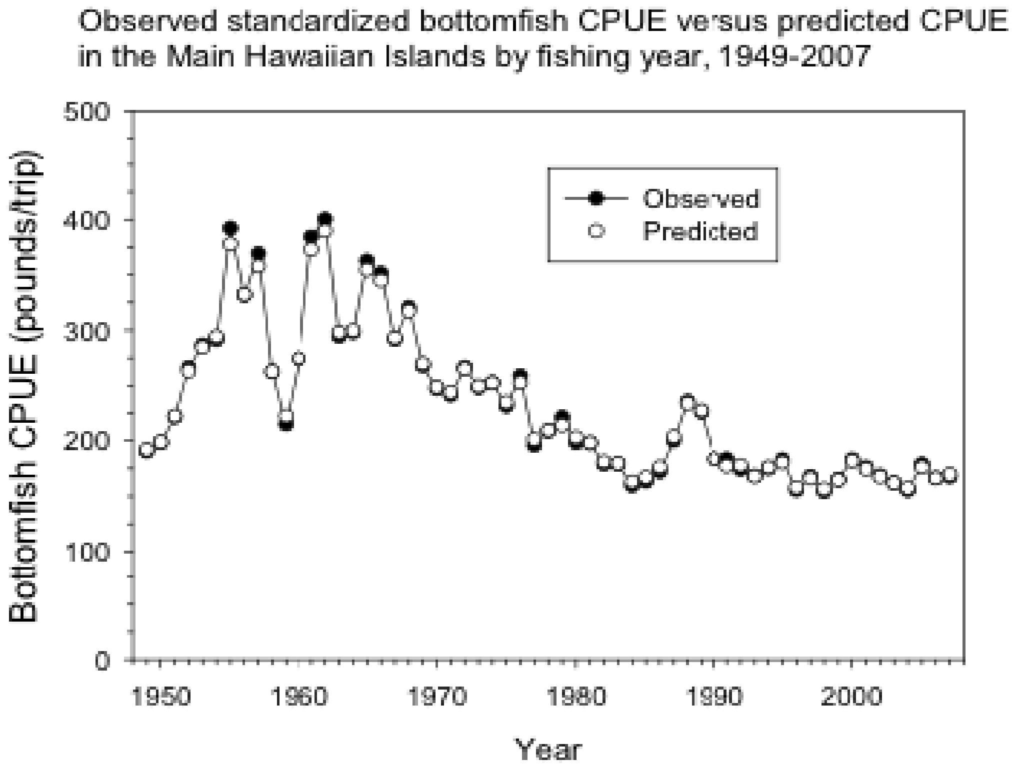
Note: Amounts in red exceeded the TAC and in green did not.

Figure 3: Reported MHI Deep 7 Catch vs. TAC, 2008/09 Fishing Year



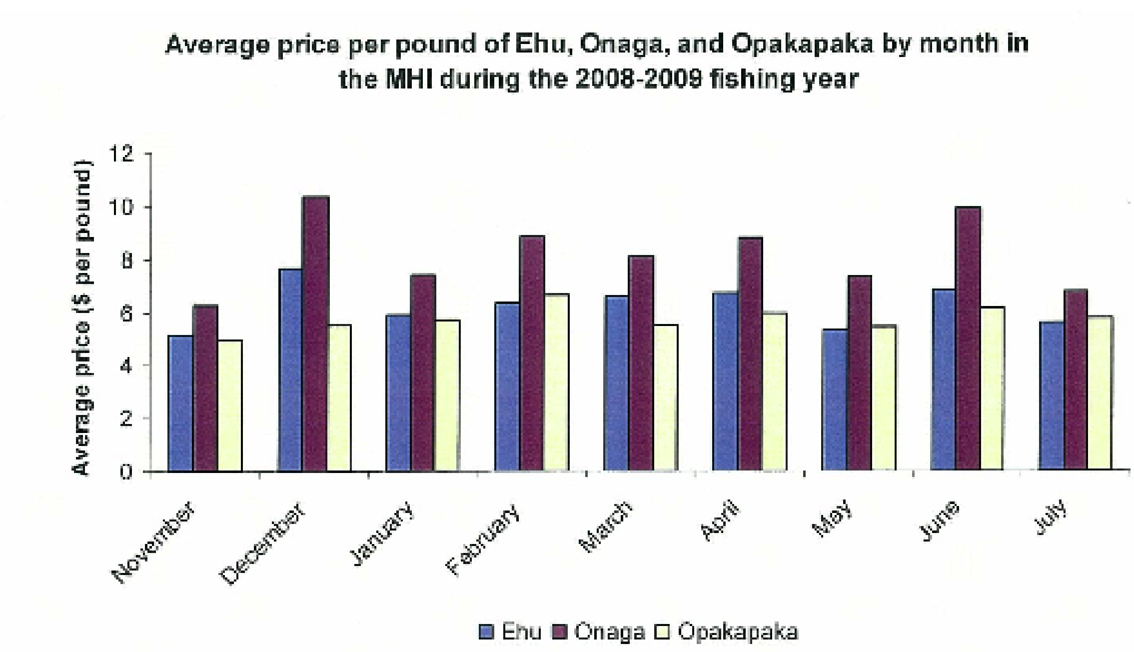
Source: HDAR's Bottomfish News, Volume 6, September 2009

Figure 4: Bottomfish Fishery CPUE, 1949-2007



Source: Brodziak et al. (2009)

Figure 5: Average Price/lb of Ehu, Onaga and Opakapaka by Month, 2008/09



Source: HDAR's Bottomfish News, Volume 6, September 2009

2009 Bottomfish Catch by Island Counties

For all BMUS, the largest catch in 2009 was landed by Oahu fishers with highest landings of opakapaka, uku, onaga, and ta`ape, respectively (Figure 6).

Looking at only catch of the Deep 7 MUS, 36% was landed in Hawaii, followed by Maui (30%), Oahu (25%) and Kauai (9%) and the main species landed was opakapaka followed by onaga (Figure 7).

Figure 6: 2009 Top BMUS Catch by County (lb)

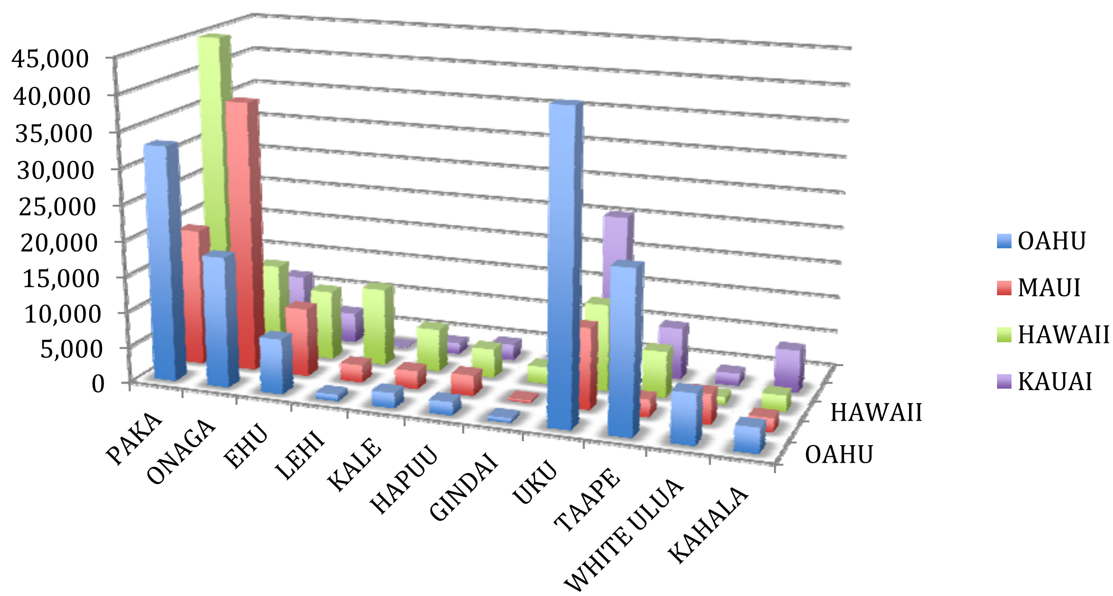
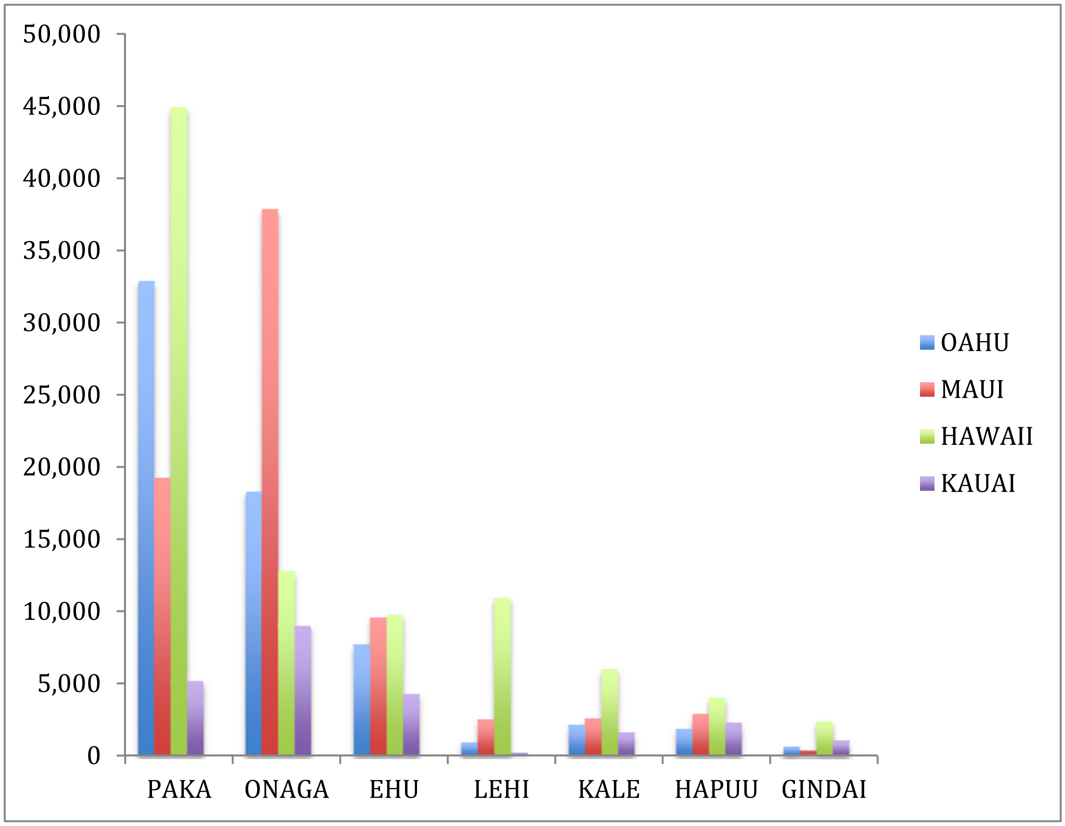


Figure 7: 2009 Deep 7 Catch by County (lb)



Note: The Deep 7 includes onaga, opakapaka, kalekale, hapuupuu, ehu, gindai, and lehi

2.1.2.2 Northwestern Hawaiian Islands Catch & Effort

When examining the bottomfish fishery in the NWHI for the last five years, effort was at a five-year low in 2009 with only five vessels fishing in the last year of the bottomfish fishery (Table 3). The fishery was due to end in 2011 in accordance with the Presidential Proclamation establishing the Papahanaumokuakea Marine National Monument, however, all remaining participants opted to accept NOAA's compensation package in 2009, which required immediate cessation of fishing and, therefore, all commercial fishing ended for good in 2009.

The End of an Era---the Last Bottomfish Caught in the NWHI by Longtime Bottomfishers (left to right) Tim Timmoney, Frank Goto, Troy Lanning, and Bobby Gomes.

Landings in 2009 were at a five-year low as effort decreased (Table 3) and catch and revenue followed suit (Table 4). Participation in 2009 was down to only 5 vessels making 22 trips and bringing in $165,000 worth of BMUS. The major species caught in 2009 was uku, followed by hapuupuu and opakapaka (Table 5).

Table 3: NWHI Bottomfish Fishery Statistics 2005-2009

Year	Total	
	Vessels	Trips
2005	8	58
2006	8	52
2007	7	47
2008	8	47
2009	5	22

Table 4: NWHI BMUS Landings (1000 lb) 2005- 2009 and Revenue ($1000)

Year	Pounds Caught	Pounds Sold	Revenue
2005	221	202	825
2006	198	182	702
2007	200	186	704
2008	146	128	544
2009	63	45	165

Table 5: NWHI BMUS Landings (1000 lb) by Major Species, 2005-2009

Species	2005	2006	2007	2008	2009
Onaga	28	30	31	35	3
Opakapaka	24	18	20	11	5
Ehu	10	6	4	4	>1
Uku	83	90	91	55	25
Hapuupuu	37	21	19	13	6
Butaguchi	12	9	11	5	3
White Ulua	1	2	4	1	>1
Other BMUS	6	4	5	3	1

2.1.3 Bycatch and Protected Species

2.1.3.1 Northwestern Hawaiian Islands

A certain portion of catch is released for a number of reasons (size, condition, lack of room in hold, etc.). BMUS releases in the NWHI have been increasing each year since the initiation of the NWHI bottomfish tagging project. Table 6 shows NWHI BMUS releases during 2008 and Table 7 during 2009. During both years most are released alive, but the overall number of releases is nearly an order of magnitude greater in 2008 then in 2009. This is in part due to the substantial reduction in overall NWHI fishing effort during 2009 with less than half as many trips as in 2008 (Table 2).

Table 6: NWHI 2008 Catch, Released alive, released dead, damaged

Species	Released alive	Released dead	Damaged
Hapuupuu	9	0	1
Kahala	1	0	1
Kalekale	63	0	0
Opakapaka	18	1	4
Uku	471	23	11
Ehu	386	0	0
Onaga	32	14	11
Gindai	30	0	0
Butaguchi	4	0	0
White papio/ulua	7	0	0
TOTALS	1021	38	28

Numbers for the releases have been increasing each year since the initiation of the NWHI bottomfish tagging project run by a commercial bottomfish fishermen, Gary Dill. At this time no tagging data are available for comparison. The greatest volume of species released alive in 2009 was ehu followed by kalekale; none were released dead (Table 7).

Table 7: NWHI 2009 Catch, released alive, released dead, damaged

Species	Released alive	Released dead	Damaged
Hapuupuu	8	0	9
Kalekale	57	0	0
Uku	0	0	4
Ehu	125	0	0
Onaga	0	0	11
Gindai	4	0	0
Butaguchi	1	0	0
TOTALS	195	0	24

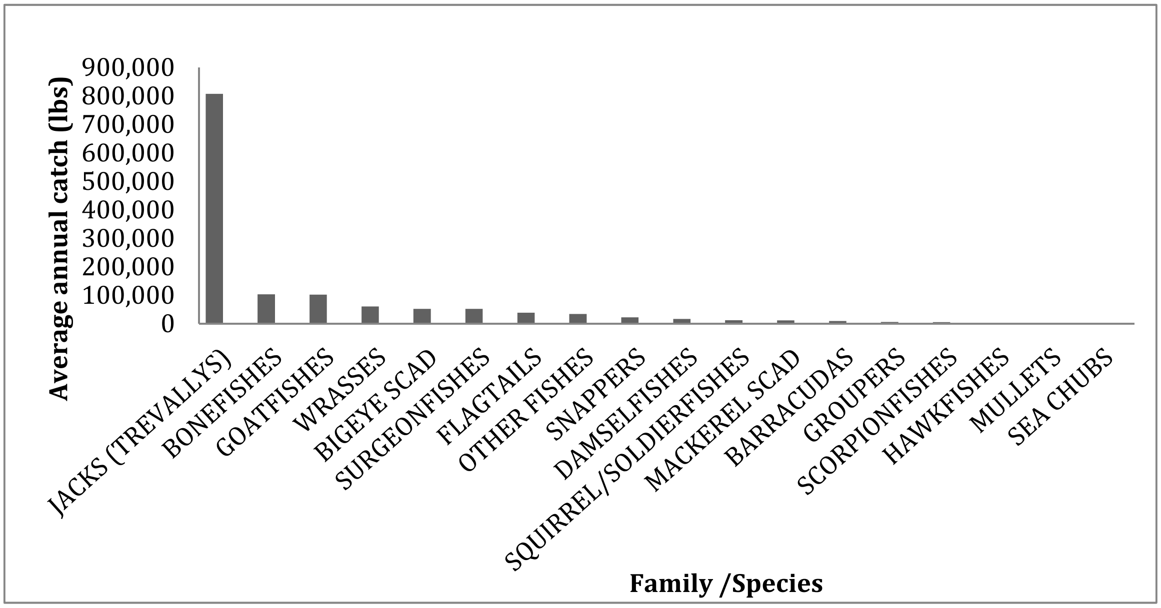
2.1.4 Non-commercial Fishery

Recreational or non-commercial bottomfish catch for 2009 was estimated at approximately 151,000 lb (Table 8). These data were estimated from information gathered through the Hawaii Marine Recreational Fisheries Survey. The main BMUS recreational catch by far, other than the snappers, is ulua and papio (jacks/trevally) as shown in Figure 8. All other fishes in the recreational catch shown in Figure 8 are reef fish.

Table 8: Recreational Bottomfish Catch, 2009

SNAPPERS	Catch
BLACKTAIL SNAPPER	0
BLUESTRIPE SNAPPER	0
UKU or GREEN JOBFISH	9,892
OTHER SNAPPERS	39,848
OPAKAPAKA or PINK SNAPPER	100,900
KALEKALE or VON SIEBOLDS SNAPPER	399
Snapper Total	151,039

Figure 8: 2005-2009 Average Recreational Catch (lb) of Jacks and Reef Fish by Family



2.1.5 Ecosystem Components

At the 102nd Scientific and Statistical Committee (SSC) meeting the SSC recommended that Essential Fish Habitat (EFH) definitions and depth ranges (shallow, mid and deepwater categories) for bottomfish be conducted on an archipelagic basis for further refinement of BMUS EFH.

In addition, during 2009, National Marine Fisheries Service Pacific Islands Fisheries Science Center (NMFS PIFSC) scientists developed their Fishing Ecosystem Analysis Tool (FEAT), a new software application for spatially analyzing commercial fish catch data, linking them to socioeconomic conditions, and displaying the output in Google Earth and other formats. This tool was demonstrated at the Council's October meeting's Fishers Forum.

2.1.6 Research

The cooperative research program in 2009 funded the continuing bottomfish tagging project. This project is a continuation of an ongoing study of the feasibility of conducting fishery-independent bottomfish surveys in the region and a bottomfish tagging study to assess movements between banks. Also the NMFS PIFSC Life History Program is developing new capabilities using more advanced techniques, such as lead-radium and carbon-14 age determination, to estimate age and growth of long-lived fishes such as the deep slope bottomfishes.

Further, in 2009, PIFSC' Economics Division undertook a study using recent advances in methodology, where an analysis of the market demand for Hawaii bottomfish was conducted. The objective of the research was to provide fishery managers with relevant economic information they can consider when making decisions about the bottomfish TAC and to enable fishery managers to examine trade-offs and frame more broadly based management policies that take into consideration not only biological, but also economic factors (Hospital and Pan 2009).

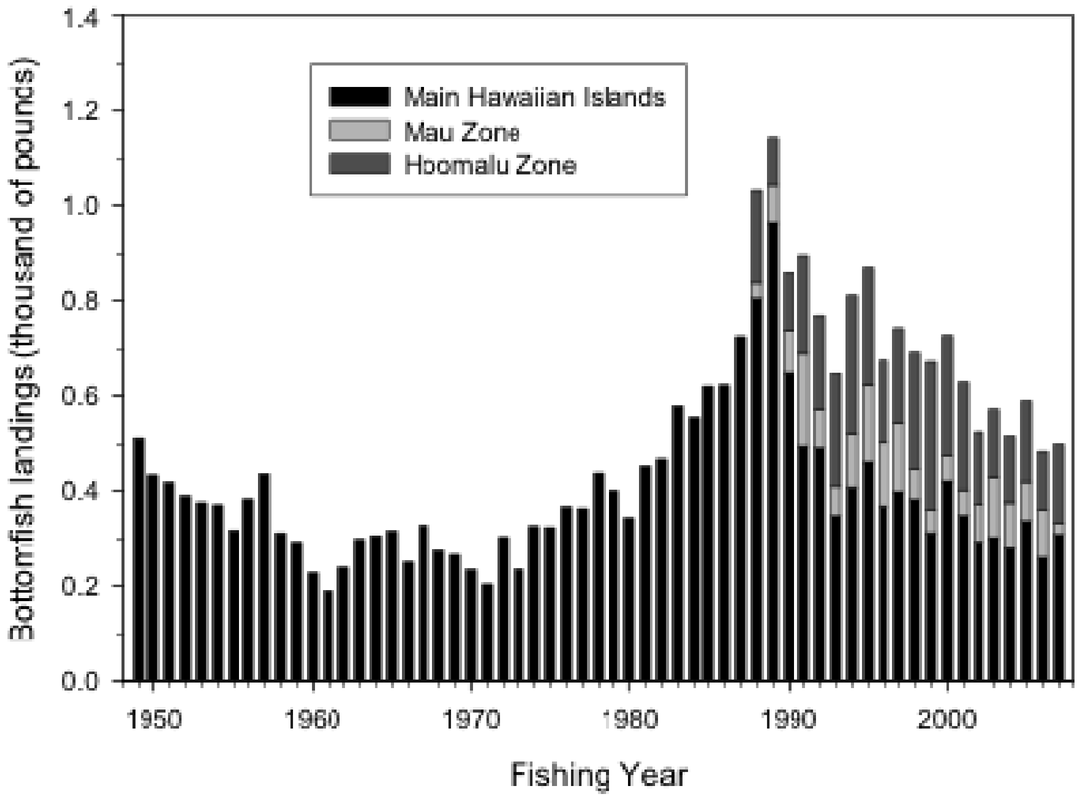
2.1.7 Stock Assessments

The most recent stock assessment for Hawaii Archipelago bottomfish used commercial bottomfish catch and effort data extracted from a total of 4,066,464 HDAR logbook catch records submitted by commercial fishers during fishing years 1949-2007 (Brodziak et al. 2009, Figure 9). As in the previous bottomfish assessment (Moffitt et al. 2006), the bottomfish catch used in the assessment update consisted of all reported bottomfish landings excluding the catches of kahala (*Seriola dumerili*) and ta`ape (*Lutjanus kasmira*).

Brodziak et al.'s (2009) assessment results indicated that the archipelagic bottomfish management unit was not overfished during 1988-2007 but had experienced overfishing in 1989 when the record bottomfish catch of roughly 1.144 million lb was harvested. Archipelagic biomass in 2007 was estimated to be about 13% above B_{MSY} with a harvest rate of roughly 60% of F_{MSY}. Thus, the archipelagic stock was not overfished and was not experiencing overfishing in 2007 (Brodziak et al. 2009).

Total Hawaiian bottomfish catch used in the assessment update by zone and fishing year (e.g., fishing 1949 corresponds to July 1st 1948 to June 30th 1949) and fishery zone.

Figure 9: Bottomfish Landings by Zone (1,000 lb)



3.1 Coral Reef Fishery

3.1.1. Introduction to Coral Reef Fishery

There is a long history of coral reef fishing in the Hawaii Archipelago as shown by evidence of fishing by the ancient Hawaiians as far north as Necker Island. Starting in the 1920s, a handful of commercial boats ventured into the NWHI to fish for shallow and deepwater bottomfish, spiny lobsters, and other reef and inshore species.

The majority of the total commercial catch of inshore fishes, invertebrates, and seaweed comes from nearshore reef areas around the MHI; however harvests of some coral reef species also occur in federal waters (e.g., around Penguin Bank). Information on the number of fishery participants is unavailable.

Under the FEP allowable gear types in Federal waters include: (1) hand harvest; (2) spear; (3) slurp gun; (4) hand/dip net; (5) hoop net for Kona crab; (6) throw net; (7) barrier net; (8) surround/purse net that is attended at all times; (9) hook-and-line (powered and unpowered handlines, rod and reel, and trolling); (10) crab and fish traps; and (11) remote operating vehicles/submersibles.

3.1.2 Fishery Performance and Economic Data

Table 8 gives the total catches and the coefficients of variation (CVs) for ten reef fish families with highest total catch in the Hawaii Archipelago (Luck and Dalzell 2010).

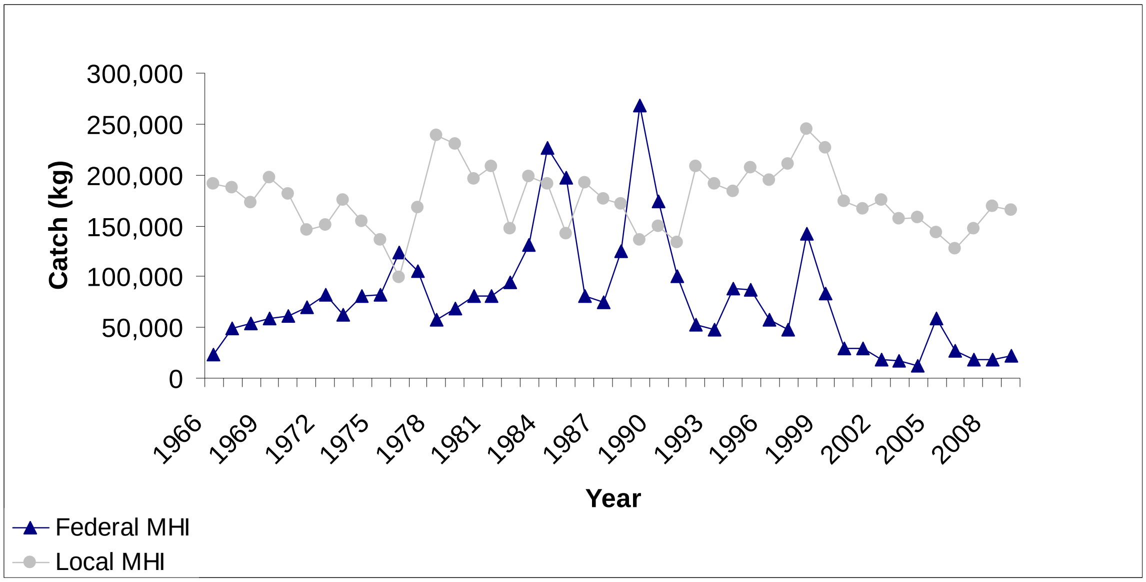
Table 9: Total catch and Coefficient of Variation for 10 Reef Fish Families

Family	Total Hawaiian Archipelago Catch (kg)	Mean Archipelagic Catch (kg), 2005-2009	CV, 2005-2009	Mean Archipelagic Catch (kg) , 1966-2009	CV, 1966-2009
Carangidae	2,524,731.95	20,938.07	0.21	57,380.27	0.48
Acanthuridae	1,365,142.36	35,368.38	0.09	31,025.96	0.25
Mullidae	1,317,387.58	5,395.61	0.28	29,940.63	0.46
Lutjanidae	824,376.09	17,335.22	0.14	20,152.71	0.59
Holocentridae	698,720.70	18,759.28	0.33	15,880.02	0.37
Scaridae	513,408.24	17,993.57	0.20	11,668.37	0.55
Carcharhinidae	306,489.98	334.22	0.38	6,965.68	1.67
Albulidae	303,024.05	3,459.69	0.43	6,886.91	0.70
Sphyraenidae	285,459.01	1,982.63	0.30	6,487.70	0.87
Kyphosidae	252,570.18	10,682.90	0.34	5,740.23	0.50

3.1.2.1 Landings

The MHI coral reef fishery overall annual catch, from 1966 through 2009, is shown in Figure 10. The reported catch in state waters has remained fairly constant over time while the catch in federal waters has decreased significantly and remains low (Table 9). The monthly reef fish catch varies considerably as shown in Figure 11.

Figure 10: MHI Coral Reef Fishery Annual Catch, 1966-2009



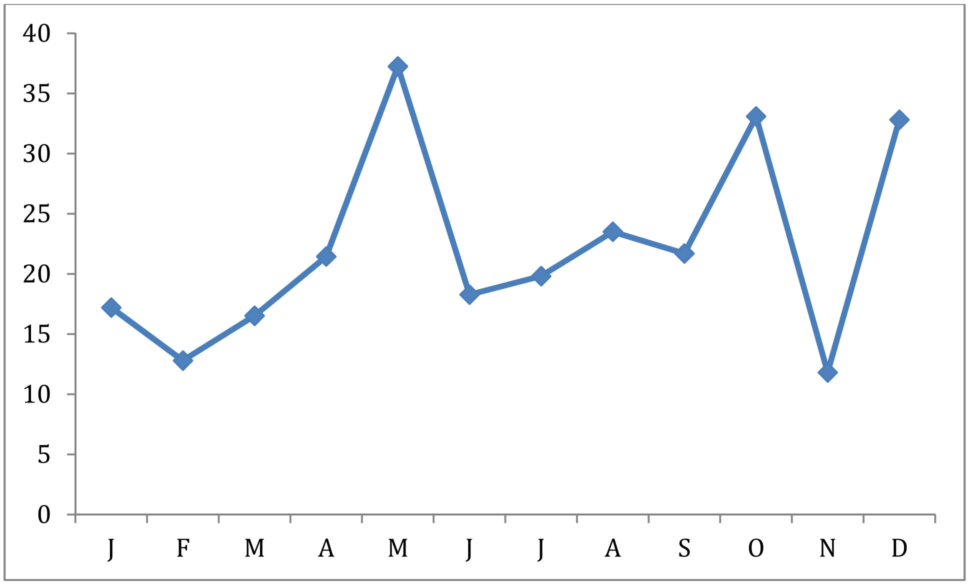
Source: Commercial marine license logbook data.

Table 10: Catch Statistics for MHI Coral Reef Fishery, federal and state waters, 2005-2009 and 1966-2009

2005-2009	Federal MHI	Local MHI
Mean Catch (kg)	28,808	150,594
Standard Deviation	17,043	17,046
Confidence Value	14,939	14,941
Upper Bound CI	43,746	165,535
Lower Bound CI	13,869	135,653

Total Record (1966-2009)	Federal MHI	Local MHI
Mean Catch (kg)	78,836	175,469
Standard Deviation	55,565	31,317
Confidence Value	16,418	9,253
Upper Bound CI	95,254	184,723
Lower Bound CI	62,418	166,216

Figure 11: 2009 Reef Fish Catch, by Month (1,000 lb)



Source: WPacFIN data

3.1.2.2 Catch per unit effort (CPUE) Trends

At this time catch rate data (i.e. catch per unit effort) are not available for the Hawaii coral reef fishery.

3.1.3 Bycatch and Protected Species

All gears used to catch coral reef species are essentially artisanal in nature. Catch rates are minimal, usually only a few pounds per man hour or other unit of effort. Large catches thus depend on fishing methods employing a lot of people, such as drive-in-net fishing or group spear fishing. Because of the characteristics of gear and methods, in most cases, coral reef fishing generates very little bycatch. Bycatch is further reduced because almost all reef fish taken are eaten.

There have been no reported or observed interactions between protected species and coral reef fisheries in Federal waters around Hawaii and the potential for interactions is believed to be low due to the gear types and fishing methods used.

NMFS received a petition, in October 2009 to list 83 species of corals under the Endangered Species Act (ESA) as threatened or endangered and designate critical habitat. NMFS determined that the petition presented substantial scientific or commercial information indicating that the petitioned action may be warranted, and issued a 90-day finding of their determination in the Federal Register (February 6, 2010; 75 FR 6616). Therefore, NMFS initiated a status review of the 83 coral species to determine if listing under the ESA is warranted. The 90-day finding includes soliciting for scientific and commercial information regarding the coral species found throughout much of the WPR.

3.1.4 Non-commercial Fishery

The five major coral reef MUS caught in terms of landings are akule, weke a`a, goldspot herring and opelu (Table 10). The top ten reef fish families reported as caught (numbers of fish) as estimated from the Marine Recreational Information program (MRIP) data program from state waters is shown in Table 11, and from Federal waters in Table 12. Both State and Federal catches were dominated by Carangids (includes jacks or ulua, opelu, akule) as the most numerous; catch in State waters had acanthurids (surgeonfish), mullids (goatfish), clupeids (herring), and kuhlids (flagtails (aholehole)) as the four most numerous. In Federal waters the next most numerous were lutjanids (snappers), labrids (wrasse), mullids (goatfish), and holocentrids (squirrelfish/soldierfish).

Table 11: Recreational Landings (lb) of Top Coral Reef MUS, 2005-2009

Local name	Common name	2005	2006	2007	2008	2009	Grand Total
AKULE	BIGEYE SCAD	682,514	587,037	1,022,023	352,490	720,587	3,364,651
OPELU	MACKEREL SCAD	43,665	224,541	67,055	49,059	381,869	766,189
	GOLDSPOT HERRING	65,363	77,432	96,243	553,620	941,770	1,734,427
WEKE A`A	YELLOWSTRIPE GOATFISH	322,434	722,981	202,543	410,966	644,332	2,303,255

Table 12: Recreational Catch by Family (#s of fish), 2005-2009, State Waters

	2005	2006	2007	2008	2009	Grand Total	5-yr Average
Carangidae	916383	818394	916622	707641	904069	4,263,109	852,622
Acanthuridae	632950	596479	233257	325679	1045551	2,833,916	566,783
Mullidae	436282	796608	295459	466506	704774	2,699,628	539,926
Clupeidae	129384	83616	134393	579197	1363494	2,290,084	458,017
Kuhlidae	192760	144938	178229	231722	179330	926,979	185,396
Labridae	247826	158387	67756	71342	87252	632,564	126,513
Lutjanidae	178718	128087	88785	104661	114551	614,802	122,960
Pomacentridae	102795	155500	59385	37137	63670	418,488	83,698
Kyphosidae	32921	70386	30670	77779	54793	266,549	53,310
Holocentridae	67748	26741	7187	78032	36386	216094	43219

Table 13: Recreational Catch by Family (#s of fish), 2005-2009, Federal Waters

	2005	2006	2007	2008	2009	Grand Total	5 YR AVERAGE
Carangidae	101197	228863	357748	11867	342913	1,042,589	208,518
Lutjanidae	44288	48632	15090	32955	32792	173,757	34,751
Labridae	21572	14344	621		16150	52,688	13,172
Mullidae	10593	15997	2325	1433	8423	38,772	7,754
Holocentridae	4002	3926			5377	13,306	4,435

3.1.5 Ecosystem Components

As noted in Section 2.1.5, PIFSC scientists developed their Fishing Ecosystem Analysis Tool (FEAT) during 2009; a new soft ware application for spatially analyzing commercial fish catch data, linking them to socioeconomic conditions, and displaying the output in Google Earth and other formats. This tool was demonstrated at the Council's October meeting's Fishers Forum.

3.1.6 Research and Monitoring

3.1.6.1 Current and Ongoing Research/Monitoring

The Pacific Islands Fisheries Science Center's Coral Reef Ecosystem Division's (CRED) Reef Assessment and Monitoring Program (RAMP) conducts biological surveys and associated habitat and bathymetric mapping operations on a biennial basis at 55 U.S. Pacific Islands, covering the majority of U.S. coral reef areas in the Pacific including American Samoa (PIFSC 2010). CRED scientists use consistent survey methods at all locations visited, and include both small-scale (belt or stationary point count) and large-scale (towed-diver) fish and benthic surveys. Since mid-2007, the survey design for small-scale surveys has been based on a stratified random sampling design within 0-30 m hard-bottom habitats which is the methodology used in biomass estimates. In the future this information may be used as part of biomass estimates for the Council and the SSC to use in setting annual catch limits (ACLs).

3.1.7 Stock Assessments

There are no existing stock assessments on CREMUS stocks. There are biomass estimates for reef fish populations provided by CRED described in this report which may be used, among other data, in determining CREMUS annual catch limits.

Overfished and Overfishing Determinations
To date coral reef fisheries around Hawaii have not been determined to be overfished or subject to overfishing.

MSY
No estimates of MSY are currently available for coral reef ecosystem associated species in Hawaii.

OY
Optimum yield for coral reef ecosystem associated species is defined as 75% of their MSY.

4.1 Crustaceans Fishery

4.1.1. Introduction to Crustaceans Fishery

With the exception of a few individual fishermen (highliners), the MHI commercial lobster fishery appears to be a part-time or opportunistic fishery, and as such, highliners have a dramatic influence on total pounds landed annually (Kelly and Messer 2005). Spiny lobster landings by fishing method are dominated by the hand capture/dive method; other methods used are nets and traps. Kelly and Messer's (2005) study reported a dramatic shift in gear preference occurring around 1994. Between 1984 and 1993, trap harvest accounted for twice as many landings (59%) as the next most productive gear type, hand harvest (27%). Between 1994 and 2004, hand harvest represented 79% of the reported landings, and accounted for 91% of landings between 2001 and 2004.

For Kona crab, the hoop net is the dominant method with other net and traps a small part of the landings (HDAR data). The crustaceans MUS are listed in Table 14 below.

A study on the Hawaii lobster fishery using catch data from 1984-2004 found that spiny lobsters consisted of nearly 90% of the reported catch, while slipper lobsters account for the remaining 10 percent and that the green spiny lobster (*Panulirus penicillatus*) was the predominant catch from Maui and Kauai (93%), while the red spiny lobster (*P. marginatus)* dominated the catch from Hawaii and Oahu (90%)(Kelly and Messer 2005).

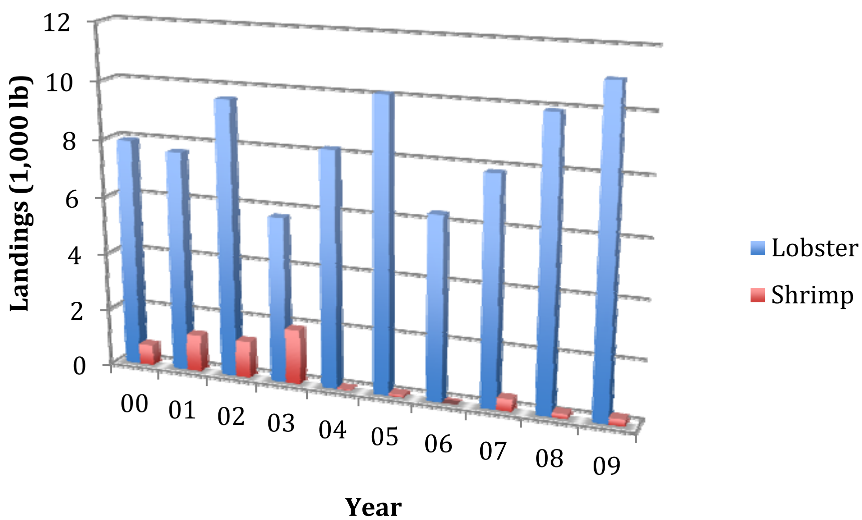
Table 14: Crustacean MUS

Local Name	English Common Name	Scientific Name
ula	spiny lobster	**Panulirus marginatus*
ula	spiny lobster	**Panulirus penicillatus*
ula papapa	slipper lobster	Family *Scyllaridae*
papa‘i kua loa	Kona crab	*Ranina ranina*
NA	deepwater shrimp	**Heterocarpus* spp.

4.1.2 Fishery Performance and Economic Data

Since 2000, lobster landings have ranged from a low of 5,738 lb in 2003 to a high of 11,000 lb in 2009 (Figure 12). *Heterocarpus* shrimp harvest has been limited with less than 1,000 lb annually reported for the past five years.

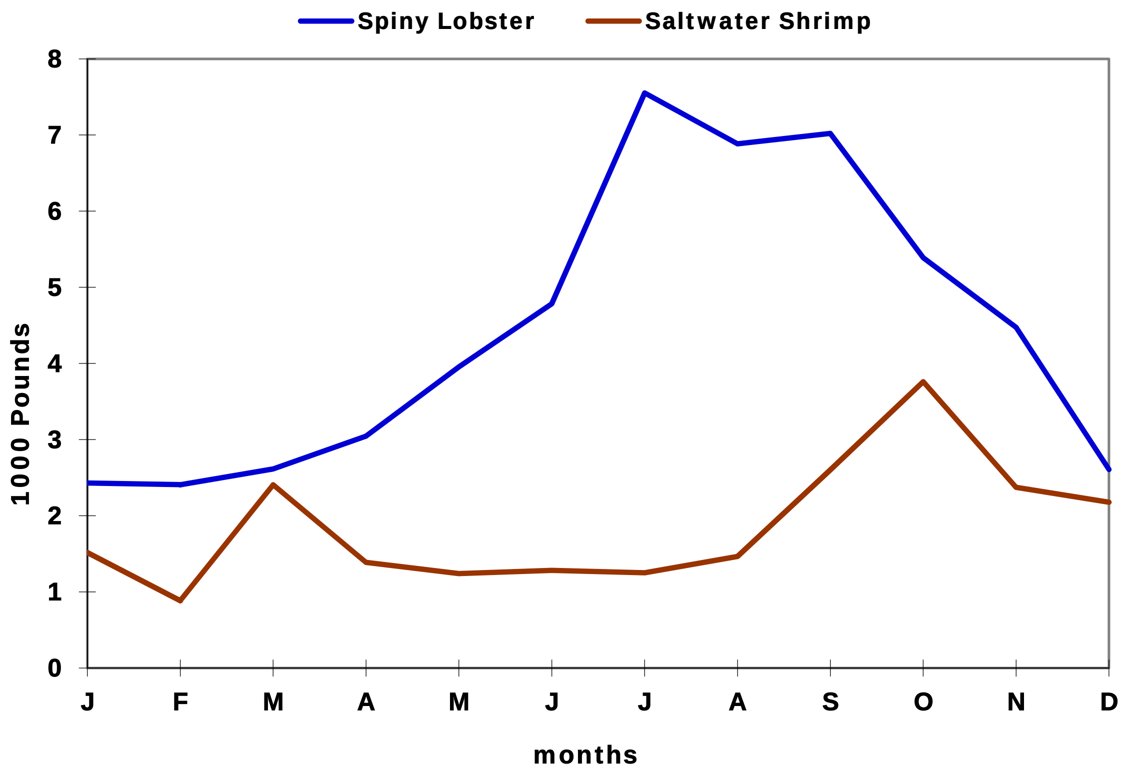
Figure 12: Hawaii Spiny Lobster and Shrimp Reported Annual Commercial Landings, 2000-2009 (1,000 lb)



Source: WPacFin

In terms of seasonality of lobster landings, over the past sixty years of data, reported commercial spiny lobster landings are greatest in the summer months (July-September) as shown in Figure 13.

Figure 13: 1948-2009 Average Monthly Reported Commercial Landings of Spiny Lobster and Shrimp



Source:WPacFin

4.1.3 Bycatch and Protected Species

At this time, there is no reported bycatch associated with this fishery. There have been no observed or reported interactions with protected species.

4.1.4 Non-commercial Fishery

There are currently no reporting requirements or specific fisher surveys for determining the non-commercial lobster catch in Hawaii.

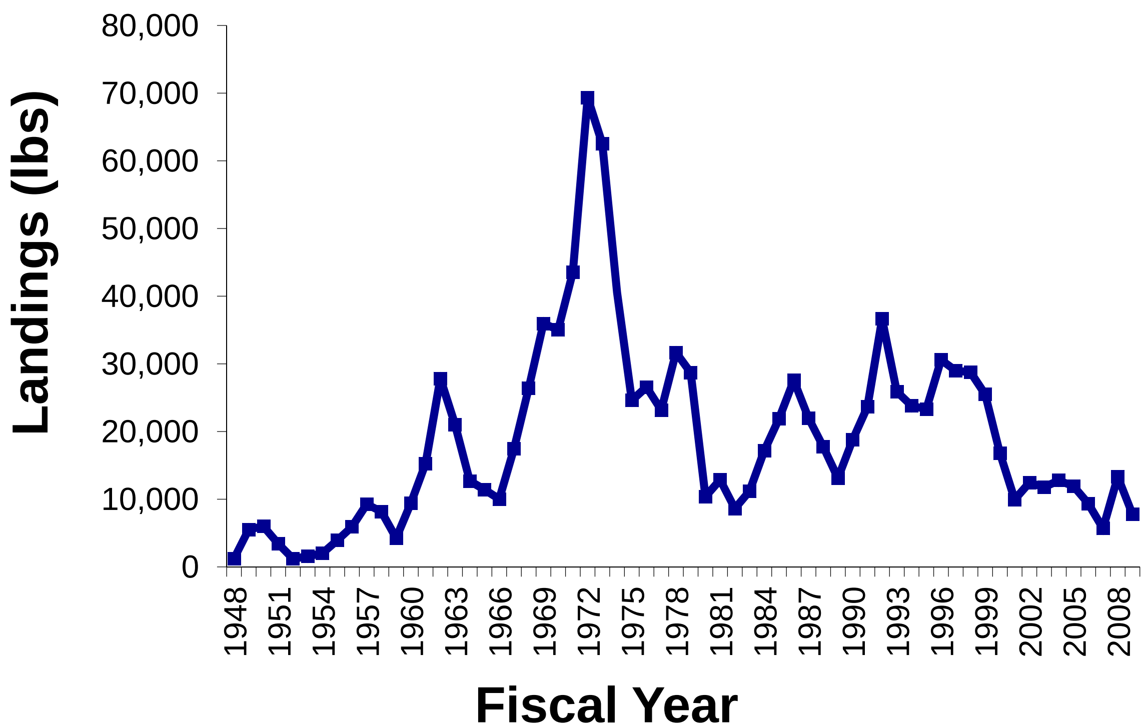
4.1.5 Ecosystem Components

Some studies have been conducted on identifying oceanographic pattern variability in the NWHI and its impact on spiny and slipper lobster recruitment in those waters. There is a paucity of information on the physical and biological parameters affecting lobster recruitment and carrying capacity in the main Hawaiian Islands that would provide useful information in managing the stocks.

4.1.6 Research

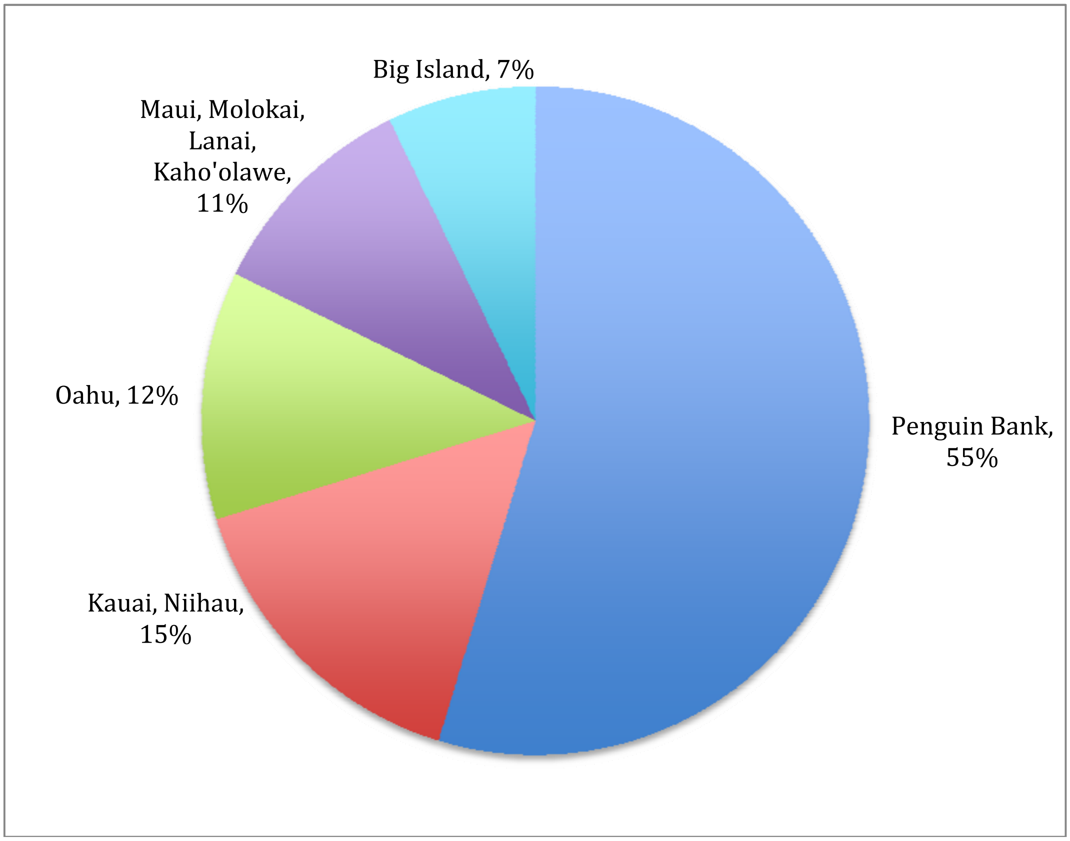
The Council provided funding to a graduate student from Hawaii Pacific University to undertake an assessment of the Hawaii Kona crab fishery. A fact sheet on the fishery was created for distribution to fishermen and the public. The next steps in the research project is to collect crab samples to determine stock characteristics including discard mortality, size frequency and other parameters related to life history as it relates to management of the fishery. Landings from 1949 through the present were obtained from HDAR's database (Figure 14). The majority of the Kona crab catch was from Penguin Bank, which is located between Moloka`i and Oahu, followed by Kaua`i, Maui, Oahu and Hawai`i counties (Figure 15).

Figure 14: Kona Crab landings (lb) from 1949-2009



Source: Lennon Thomas, pers. comm. based on HDAR catch data

Figure 15: Source of Kona Crab from 1949-2009 Catches



Source: Lennon Thomas, pers. comm. based on HDAR catch data

Also in 2009, PIFSC scientists published a technical report on preliminary growth estimates of Northwestern Hawaiian Islands spiny lobster (*Panulirus marginatus*) as indicator of spatial variability (O'Malley and MacDonald 2009).

4.1.7 Stock Assessments

Overfished and Overfishing Determinations
To date Hawaii crustacean fisheries have not been determined to be overfished or subject to overfishing.

MSY and OY
No values for MSY and OY are available for crustaceans in Hawaii. In the absence of more complete and accurate data, the FEP set the MSY for the spiny lobster stock around the MHI as provisionally estimated at approximately 15,000 – 30,000 lobsters per year of 8.26 cm carapace length or longer. There are insufficient data to estimate MSY values for MHI slipper lobsters or Kona crab. The MSY for the *Heterocarpus* deepwater shrimp has been estimated for the Hawaiian Islands at 40 kg/nmi^2 (Tagami and Ralston 1988 in King 1993 in WPRFMC 2007).

5.1 Precious Corals Fishery

5.1.1. Introduction to Precious Corals Fishery

Western Pacific corals are prohibited from harvest in the NWHI by establishment of the Papahanaumokuakea National Monument in 2006. Based on recommendations from scientists and as a precautionary measure, at its December 21, 2006 meeting, the Council recommended a five-year moratorium to fish for, take, or retain any gold coral in any precious coral permit area. This moratorium includes all U.S. EEZ waters of the Western Pacific Region and is currently in effect through June 30, 2013 (73 FR 47098). Also in 2008 the Auau Channel bed was designated as an Established Bed with an annual harvest quota of 5,000 kg every 2 years (11,023.11 lbs every 2 years). This quota applies to black corals in both State and Federal waters, and existing gear and size requirements continue to apply.

In 2009, a precious corals permit was issued for the Makapu`u Bed to harvesters who will be using remotely operated vehicles (ROVs) and not submersibles.

Corallium (Pink Coral) Issues

SeaWeb started a "too precious to wear" campaign for *Corallium spp*. NOAA held fact finding workshops at Corallium meetings in Hong Kong. Corallium was proposed for Appendix 2 listing at the CITES meeting and China listed 3 species under Appendix 3.

The CITES meeting was attended by Plan Team member, Dr. Frank Parrish who was the Chair of the CITES management group and created a matrix of all the regulations in the world from total bans (such as China) to no regulations. There was also a science working group that noted the weak points/gaps in science. Lastly there was an identification group that dealt with how enforcement officials will identify precious corals. They also reviewed the black coral Appendix 2 listing and will use it as the test case for listing Corallium.

The following table lists the Precious Coral MUS.

Table 15: Hawaii Archipelago Precious Corals MUS

English Common Name	Scientific Name
pink coral (also called red coral)	*Corallium secundum*
pink coral (also called red coral)	*Corallium regale*
pink coral (also called red coral)	*Corallium laauense*
gold coral	*Gerardia* spp.

English Common Name	Scientific Name
gold coral	*Narella* spp.
bamboo coral	*Lepidisis olapa*
black coral	*Antipathes dichotoma*
black coral	*Antipathes grandis*
black coral	*Antipathes ulex*

5.1.2 Fishery Performance and Economic Data

Due to confidentiality issues no landings information can be reported for the precious corals fishery during 2009.

5.1.3 Bycatch and Protected Species

Due to the selective nature of the gear used to harvest precious corals this fishery does not have any bycatch associated with it. There were no reported protected species interactions in the precious corals fishery.

5.1.4 Ecosystem Components

The deepwater ecosystem in which precious corals are found in Hawaii has become impacted by an invasive coral, called snowflake coral, *Carijoa riisei*, which appears to be outcompeting native species and potentially altering the ecosystem at many levels. In 2001, *Carijoa riisei*, was discovered overgrowing commercial black coral species, *Antipathes dichotoma* and *A. grandis*, in the Au'au Channel between the islands of Maui and Lanai (Grigg 2003). The unknown, long term ecological impact of this biological invasion raises new questions regarding the sustainable yield of the commercial black coral harvest in the Au'au Channel (Grigg 2004).

5.1.5 Research

5.1.5.1 Ongoing Research

The Council is funding research on the ecological impacts of the invasive coral, *Carijoa riisei*, which is currently ongoing. Results are not yet available but will be forthcoming.

State of Hawaii Black Coral Research

The black coral, *Antipathes dichotoma,* has been renamed *Antipathes griggi* in a new paper by Dennis Opresko (Opresko 2009). To examine the possibility of a deep refuge of black coral in the Auau channel, State scientists measured the density of black coral with divers in less than 60 m and submersibles above 100 m. They found *A. griggi* in low density in deep water in comparison to deeper water. Prior research showed predominantly *A. griggi* between 35-60 m with *A. grandis* in waters deeper than 60 meters. Samples were sent to Scott France for genetic identification and Opresko for morphology identification. From 61 samples that were analyzed, 23% (14 samples) were determined to have been initially misidentified. Ten of the 14 samples misidentified were found to be a new record (new genus-*Aphanipathes*). *Aphanipathes* is more common at the 100+m range, while the density of *A. griggi* at that depth is reduced. They also saw what might be a new genus at 200m but samples were not retrieved. The preliminary conclusion is that *A. griggi* is rare and not dominant in deeper waters, therefore, there may not be a deep refuge as some scientists had previously surmised.

NMFS PIFSC Gold Coral Research

A study on growth validation of gold coral in the Hawaiian Archipelago was conducted. While there are size frequency data for black and pink corals, no similar studies have been conducted for gold coral (see Parrish and Roark 2009). Studies on aging gold corals have resulted in large disparities (orders of magnitude) in the radial growth rates and life spans for gold coral ranging from tens of years to millennia (Roark et al. 2006). To further investigate this issue, NMFS PIFSC scientists tagged gold corals during past research cruises to determine growth measurements. Roark's (2006) research that showed that age determination using Carbon-14 gave an age of 450 years for a gold coral sample whereas the ring counts gave an age of 40 years (with 6.6 cm/yr linear growth). The NMFS PIFSC research collected live gold coral samples and marked and re-measured gold corals *in situ*. Roark's re-analysis of new/additional live coral samples did not change prior results. The NMFS PIFSC study examined gold coral linear growth rates on the *in situ* formations and no discernible change in size were visible. Whilst there may be some growth increments, the results suggest that a 6.6 cm/year growth rate was not apparent after a seven year time interval indicating the growth of gold coral is much slower than linear estimates derived from ring counts (Parrish and Roark 2009).

Parrish and Roark's (2009) study also noted that growth rings might be caused by environmental influences or nutrient availability. Further, reproduction may also provide annual marks through uneven growth. Future research plans include obtaining particulate matter and current flow data to determine what if any effects these environmental parameters may have on growth and growth rings.

5.1.5.2 Research Needs

Further research is necessary to resolve and understand the contradicting data on life spans and growth of gold corals (Parrish & Roark 2010), especially in light of the Council's 5-yr moratorium on the fishing of gold coral until the lifespan is confirmed which would cease in 2011 (WPFMC 2006).

Deep corals are slow growing, long-lived organisms that are sensitive to disturbance such as dredging or extraction, yet little is known about the gene flow between populations (Baco et al. 2006 *in* Tsounis et al. 2010). In addition to continuing work to determine growth rates and factors which may impact growth, research on reproductive capacities including gene flow among populations is important to ensure sustainable management. Tsounis et al. (2010) make several recommendations regarding management and research of precious corals including the need for research on the population structure and distribution of little-known species or deep populations in the case of *C. rubrum* and study of the larval biology and dispersion limits between shallow and deep populations.

5.1.6 Stock Assessments

There are no recent stock assessments for precious corals in Hawaii. To date Hawaii's precious corals fishery has not been determined to be overfished or subject to overfishing.

Optimum Yield for the precious corals fishery, stated in the Hawaii FEP, are as follows:

Table 16: MHI Precious Coral Optimum Yields (kg)

Coral Bed	Harvest quota in kilograms	Number of years
Auau Channel	Black: 5,000	2
Makapuʻu	Pink: 2,000	2
	Gold: 0 (zero)	--
	Bamboo: 500	2
180 Fathom Bank	Pink: 222	1
	Gold: 67	1
	Bamboo: 56	1
Brooks Bank	Pink: 17	1
	Gold: 133	1
	Bamboo: 111	1
Kaena Point	Pink: 67	1
	Gold: 20	1
	Bamboo: 17	1
Keahole Point	Pink: 67	1
	Gold: 20	1
	Bamboo: 17	1

6.0 Fishing Community

6.1 Community Demonstration Projects Program & Marine Education and Training

The Community Demonstration Projects Program (CDPP) Advisory Panel (AP) met on May 4 – 5, 2010, to review applications for funding under the Western Pacific Community Demonstration Project Program and the Western Pacific Marine Education and Training (MET) Mini Grant Program. Solicitations for applications were published on January 22, 2010 in the Federal Register. The Community Demonstration Project Program solicitation application deadlines were:

- Letter of Intent/pre-proposal, February 18, 2010,
- Review of pre-proposal and invitation to apply March 5, 2010
- Full application April 4, 2010.

Available Funding: $500,000 no minimum or maximum funding limit

Purpose: to foster and promote use of traditional indigenous fishing practices and/or develop or enhance community-based fishing opportunities.

Western Pacific Marine Education and Training mini grants deadline was:

- March 5, 2010, 5:00 PM Hawaii Standard time.
- Available Funding: $150,000, $15,000 funding limit
- Purpose: To improve communication, education and training on marine resource issues through the Western Pacific Region and increase education for marine-related professions among coastal community residents.

The Community Demonstration Project Program Advisory Panel consists of eight individuals two from each of the territorial areas in the Council's area of authority and responsibility:

American Samoa: Kitara Vaiau and Vaasa Simanu
Commonwealth of Northern Mariana Islands: Lino Olopai and Herman Tudela
Guam: Peter Perez and Dave Alvarez
Hawaii: Gary Beals and William Mossman

The process to review and rank the MET proposals and CDPP was to review each proposal through open discussion, individual ranking of the proposal using objective criteria to assign a numerical value, averaging the numerical points for an average score and listing the proposals in rank order at the end of the review. At that point the AP could reopen discussion and adjust the ranking to suit the consensus. Due diligence was applied in the initial review by Federal Program Officer(s) prior to the applications being distributed to the AP.

The MET Mini Grant proposals were ranked by the AP. Rank order of the MET Mini Grant proposals in The Hawaii Archipelago:

Maunalua Fishpond Education Project, Maunalua Fishpond Heritage Ctr	$ 15,000
Reef Watch Waikiki, UH	$ 14,485
Aquaculture Outreach in Hawaii and Pacific, CTSA/Oceanic Institute	$ 14,950
Hui Malama Loko I`a, Paepae o He`ei`a	$ 14,900
Bluewater Education Program, KCCEF	$ 15,000
Maunalua User Survey, Malama Maunalua	$ 15,000
Total amount expended for MET	$133,992
Unexpended MET funds	**16,008**
Total funds available for MET mini grants	$150,000

Rank order of Western Pacific Community Demonstration Projects:

There were seven proposals under the Demonstration Project Program. Funding is limited to $500,000. Funding limitations will result in the four top-ranked proposals being funded and three of those were in Hawaii, listed below. $49,839.25 is left after funding the top four projects.

Funded Projects

Multicultural Marine Conservation Exchange Demonstration Project, UH Sea Grant	$ 74,474
Reviving, Demonstrating and Teaching Pre-contact Indigenous fishing Techniques, TASI	$ 92,013
Malama Loko Ea, Alu Like	$125,000

Unfunded Projects

Ahupua`a Honua Maunalei Mauka Watershed Project, Uhane Pohaku Na Moku O Hawai`I	$127,300
Moloka`i Fishing Auwana, Moloka`i Community Service Council	$ 24,000

6.2 Outreach and Education

The Council participates in a wide variety of education and outreach activities which includes development and distribution of informational products, presence and participation at various events and meetings, in addition to information provided on the Council's website.

Council outreach and education activities during 2009 included participation in numerous community and outreach events in Hawaii including the Fishing and Seafood Festival in October; the 8th Annual Native Hawaiian Conference in August with a Hawaiian Lunar Calendar display; the Coastal America Traditional Ecological Knowledge Summit on Kaua`i where staff presented on continuing traditional practices; and the Hawaii Ocean Expo, among others.

Council booth at the Hawaii Ocean Expo, March 2009

The Council's summer high school course on marine fisheries and resources was held in Hawaii. Participants in the course are eligible for Hawaii Department of Education course credit.

High School Summer Course Field Trip to Ka`ena Point

7.0 Administrative and Enforcement Actions

7.1 Administrative Actions

An omnibus amendment to all FEPs establishing eligibility requirements and procedures for reviewing and approving community development plans for western Pacific fisheries was completed and approved by NMFS (and the final rule published in September 2010 (75 FR 54044)). The intent of the final rule is to promote the participation of island communities in fisheries that they have traditionally depended upon, but in which they may not have the capabilities to support continued and substantial participation.

Also in 2009, the Council recommended extending the Hancock Seamount Groundfish moratorium for a further six years until August 2016. The Council also revised its Aquaculture Policy and directed staff to develop an omnibus amendment to all the FEPs to manage aquaculture in the Western Pacific region.

7.2 Enforcement Actions

Reported by the U.S. Coast Guard at the 145th Council meeting in July 2009 were violations including a NWHI-permitted bottomfish vessel cited for trolling within the Gardner Pinnacles Special Preservation Area of the Papahanaumokuakea Marine National Monument (Monument). NOAA Office of Law Enforcement (OLE) reported that there was alleged illegal marketing and labeling of a Hawaii fish at a mainland location. At the 146th meeting in October 2009 NOAA OLE reported participating with Hawaii Department of (DOCARE) in a joint investigation of illegal fishing with a gill net and the case has been referred to NOAA General Counsel (GC) for law enforcement. At the 147th meeting, NOAA GC reported on two vessels violations of illegal fishing in the Monument.

7.3 Plan Team Recommendations

The Hawaii FEP Plan Team:

- Recommended the Council provide funding to support travel and participation in future CITES Corallium Workshops. The PT also noted that PIFSC and the State of Hawaii should monitor the Makapuu Bed closely for the quota in light of the permit issued.

- Supports the NMFS Habitat Assessment Improvement Plan and looks forward to future presentations on its implementation and associated future funding for integrating habitat and stock productivity.

- Recommended information on the effects of Kona crab appendage loss and survivability/mortality be provided to the public through current outreach efforts and flyers to tackle shops and boat ramps. The PT further recommended that NMFS cooperative research include projects on Kona crab to research mortality, size frequency, CPUE, etc.

In addition,

- The Hawaii FEP REAC recommended data collection on Kona crab (*Ranina ranina*) to fill in gaps on size frequency and variations throughout the state. Acquiring information from all parts of the state could be used to determine return rates; i.e. how the number thrown back compares to the number retained. This information can be used in stock assessment needed for ACL as Kona crab is high in the risk ranking.
  Status: Studies on Kona crab are ongoing as described in Section 4.1.6.

- The Scientific and Statistical Committee (SSC) recommended to conduct tagging studies of Hawaii Archipelago bottomfish MUS and a fishery independent bottomfish resource survey to assist in stock assessments.
  Status: The cooperative research program administered by NMFS PIFSC is continuing funding for bottomfish tagging studies in the MHI as described in section 2.1.6.

8.0 Conclusion

During 2009, fisheries of the Hawaii Archipelago lost access to the extensive fishing grounds in the northwestern Hawaiian Islands. Waters in the NWHI now within the Papahanaumokuakea Marine National Monument have been permanently closed to commercial fishing after the permit holders accepted the NMFS permit buyout. In the future, the bottomfish catch in the Hawaiian Archipelago will consist solely of bottomfish harvested from the MHI, which is managed under an annual TAC.

The most challenging future management of Hawaii's fisheries not currently managed under a TAC will be the national requirement to develop and implement annual catch limits for all MUS by the year 2011. This requirement will be especially challenging to implement in the coral reef fishery with its high species diversity given the absence of reliable catch and effort data, biomass data, and stock assessments for the many species included in the coral reef MUS. Further, the majority of the coral reef fish catch comes from State waters over which the Federal government has no control. Over the succeeding year these challenges will be addressed by the Council, the SSC, the Council's advisory groups and the public at large.

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10.0 APPENDIX A: CORAL REEF MUS

Currently Harvested Coral Reef Taxa

Family Name	Local Name	English Common Name	Scientific Name
Acanthuridae (Surgeonfishes)	na‘ena‘e	orange-spot surgeonfish	*Acanthurus olivaceus*
	pualu	yellowfin surgeonfish	*Acanthurus xanthopterus*
	manini	convict tang	*Acanthurus triostegus*
	palani	eye-striped surgeonfish	*Acanthurus dussumieri*
	maiko	blue-lined surgeon	*Acanthurus nigroris*
	maiko or maikoiko	whitebar surgeonfish	*Acanthurus leucopareius*
	NA	whitecheek surgeonfish	*Acanthurus nigricans*
	‘api	white-spotted surgeonfish	*Acanthurus guttatus*
	Pualu	ringtail surgeonfish	*Acanthurus blochii*
	mai‘i‘i	brown surgeonfish	*Acanthurus nigrofuscus*
	kole	yellow-eyed surgeonfish	*Ctenochaetus strigosus*
	NA	striped bristletooth	*Ctenochaetus striatus*
	kala	bluespine unicornfish	*Naso unicornus*
	kalalei or umaumalei	orangespine unicornfish	*Naso lituratus*
	kala holo	black tongue unicornfish	*Naso hexacanthus*
	kala	whitemargin	*Naso annulatus*

Family Name	Local Name	English Common Name	Scientific Name
Acanthuridae (Surgeonfishes)		unicornfish	
	kala lolo	spotted unicornfish	*Naso brevirostris*
	NA	gray unicornfish	*Naso caesius*
	lau‘ipala	yellow tang	*Zebrasoma flavescens*
Balistidae (Triggerfish)	humuhumu hi‘ukole	pinktail triggerfish	*Melichthys vidua*
	humuhumu ‘ele‘ele	black triggerfish	*Melichthys niger*
	humuhumu nukunuku apua‘a	picassofish	*Rhinecanthus aculeatus*
	NA	bridled triggerfish	*Sufflamen fraenatum*
Carangidae (Jacks)	akule or hahalu	bigeye scad	*Selar crumenophthalmus*
	‘opelu or ‘opelu mama	mackerel scad	*Decapterus macarellus*
Carcharhinidae (Sharks)	manō	grey reef shark	*Carcharhinus amblyrhynchos*
	manō	galapagos shark	*Carcharhinus galapagensis*
	manō	blacktip reef shark	*Carcharhinus melanopterus*
	manō lalakea	whitetip reef shark	*Triaenodon obesus*
Holocentridae (Solderfish/ Squirrelfish	menpachi or ‘u‘u	bigscale soldierfish	*Myripristis berndti*
	menpachi or ‘u‘u	brick soldierfish	*Myripristis amaena*
	menpachi or	yellowfin soldierfish	*Myripristis chryseres*

Family Name	Local Name	English Common Name	Scientific Name
	‘u‘u		
	menpachi or ‘u‘u	pearly soldierfish	*Myripristis kuntee*
	‘ala‘ihi	file-lined squirrelfish	*Sargocentron microstoma*
	‘ala‘ihi	crown squirrelfish	*Sargocentron diadema*
	‘ala‘ihi	peppered squirrelfish	*Sargocentron punctatissimum*
	‘ala‘ihi	blue-lined squirrelfish	*Sargocentron tiere*
	‘ala‘ihi	hawaiian squirrelfish	*Sargocentron xantherythrum*
	‘ala‘ihi	saber or long jaw squirrelfish	*Sargocentron spiniferum*
	‘ala‘ihi	spotfin squirrelfish	*Neoniphon* spp.
Kuhliidae (Flagtails)	‘aholehole	Hawaiian flag-tail	*Kuhlia sandvicensis*
Kyphosidae (Rudderfish)	nenue	rudderfish	*Kyphosus biggibus*
	nenue	rudderfish	*Kyphosus cinerascens*
	nenue	rudderfish	*Kyphosus vaigiensis*
Labridae (Wrasses)	‘a‘awa	saddleback hogfish	*Bodianus bilunulatus*
	po‘ou	ring-tailed wrasse	*Oxycheilinus unifasciatus*
	laenihi or nabeta	razor wrasse	*Xyrichtys pavo*
	kupoupou	cigar wrasse	*Cheilio inermis*
	ho‘u	surge wrasse	*Thalassoma purpureum*
	NA	red ribbon wrasse	*Thalassoma quinquevittatum*
	NA	sunset wrasse	*Thalassoma lutescens*
	NA	rockmover wrasse	*Novaculichthys taeniourus*
Mullidae (Goatfishes)	weke	yellow goatfish	*Mulloidichthys* spp.
	weke nono	orange goatfish	*Mulloidichthys pfleugeri*
	weke‘ula	yellowfin goatfish	*Mulloidichthys vanicolensis*
	weke‘a or	yellowstripe goatfish	*Mulloidichthys flavolineatus*

Family Name	Local Name	English Common Name	Scientific Name
	weke a‘a		
	kumu or moano	banded goatfish	*Parupeneus* spp.
	munu	doublebar goatfish	*Parupeneus bifasciatus*
	moano kea or moano kale	yellowsaddle goatfish	*Parupeneus cyclostomas*
	malu	side-spot goatfish	*Parupeneus pleurostigma*
	moano	multi-barred goatfish	*Parupeneus multifaciatus*
	weke pueo	bandtail goatfish	*Upeneus arge*
Mugilidae (Mullets)	‘ama‘ama	stripped mullet	*Mugil cephalus*
	uouoa	false mullet	*Neomyxus leuciscus*
Muraenidae (Moray eels)	puhi paka	yellowmargin moray eel	*Gymnothorax flavimarginatus*
	puhi	giant moray eel	*Gymnothorax javanicus*
	puhi laumilo	undulated moray eel	*Gymnothorax undulatus*
	puhi	dragon eel	*Enchelycore pardalis*
Octopodidae (Octopus)	he‘e mauli or tako	octopus	*Octopus cyanea*
	he‘e or tako	octopus	*Octopus ornatus*
Polynemidae	moi	threadfin	*Polydactylus sexfilis*
Priacanthidae (Big-eyes)	‘aweoweo	glasseye	*Heteropriacanthus cruentatus*
	‘aweoweo	bigeye	*Priacanthus hamrur*
Scaridae (Parrotfish)	uhu or palukaluka	parrotfish	*Scarus* spp.
	panuhunuhu	stareye parrotfish	*Calotomus carolinus*
Sphyraenidae (Barracuda)	kawele‘a or kaku	Heller’s barracuda	*Sphyraena helleri*
	kaku	great barracuda	*Sphyraena barracuda*
Turbinidae	NA	green snails	*Turbo* spp.

Family Name	**Local Name**	**English Common Name**	**Scientific Name**
		turban shells	
Zanclidae	kihikihi	moorish idol	*Zanclus cornutus*
Chaetodontidae	kikakapu	butterflyfish	*Chaetodon auriga*
	kikakapu	raccoon butterflyfish	*Chaetodon lunula*
	kikakapu	saddleback butterflyfish	*Chaetodon ephippium*
Sabellidae	NA	featherduster worm	

Potentially Harvested Coral Reef Taxa

Local Name	**English Common Name**	**Scientific Name**
hinalea	wrasses (Those species not listed as CHCRT)	Labridae
manō	sharks (Those species not listed as CHCRT)	Carcharhinidae Sphyrnidae
hihimanu	rays and skates	Dasyatididae Myliobatidae
roi, hapu‘upu ‘u	groupers, seabass (Those species not listed as CHCRT or in BMUS)	Serrandiae
NA	tilefishes	Malacanthidae
dobe, kagami, pa‘opa‘o, papa, omaka, ulua,	jacks and scads (Those species not listed as CHCRT or in BMUS)	Carangidae
‘u‘u	solderfishes and squirrelfishes (Those species not listed as CHCRT)	Holocentridae

Local Name	English Common Name	Scientific Name
weke, moano, kumu	goatfishes (Those species not listed as CHCRT)	Mullidae
na‘ena ‘e, maikoiko	surgeonfishes (Those species not listed as CHCRT)	Acanthuridae
NA	remoras	Echeneidae
puhi	eels (Those species not listed as CHCRT)	Muraenidae Congridae Ophichthidae
‘upapalu	cardinalfishes	Apogonidae
NA	herrings	Clupeidae
nehu	anchovies	Engraulidae
NA	coral crouchers	Caracanthidae
‘o‘opu	gobies	Gobiidae
to‘au	snappers (Those species not listed as CHCRT or in BMUS)	Lutjanidae
nunu	trumpetfish	Aulostomus chinensis
nunu peke	cornetfish	Fistularia commersoni
kihikihi	moorish Idols	Zanclidae
kikakapu	butterflyfishes	Chaetodontidae
NA	angelfishes	Pomacanthidae
mamo	damselfishes	Pomacentridae
nohu, okoze	scorpionfishes, lionfishes	Scorpaenidae
pa o’o	blennies	Blenniidae
kaku	barracudas (Those species not listed as CHCRT)	Sphyraenidae
NA	sandperches	Pinguipedidae

Local Name	English Common Name	Scientific Name
paki‘i	flounders and soles	Bothidae Soleidae Pleurnectidae
makukana	trunkfishes	Ostraciidae
humu humu	trigger fishes (Those species not listed as CHCRT)	Balistidae
nenue	rudderfishes (Those species not listed as CHCRT)	Kyphosidae
po‘opa‘a	hawkfishes (Those species not listed as CHCRT)	Cirrhitidae
‘o‘opu hue or fugu	puffer fishes and porcupine fishes	Tetradontidae
NA	frogfishes	Antennariidae
NA	pipefishes and seahorses	Syngnathidae
namako, lole, wana	sea cucumbers and sea urchins	Echinoderms
NA	(Those species not listed as CHCRT)	Mollusca
ko‘a	ahermatypic corals	Azooxanthellates
ko‘a	mushroom corals	Fungiidae
ko‘a	small and large coral polyps	
NA	soft corals and gorgonians	
NA	anemones	Actinaria
NA	soft zoanthid corals	Zoanthinaria
NA	hydroid corals	Solanderidae
ko‘a	lace corals	Stylasteridae

Local Name	English Common Name	Scientific Name
ula, a‘ama, mo‘ala, ‘alakuma	lobsters, shrimps, mantis shrimps, true crabs and hermit crabs (Those species not listed as CMUS)	Crustaceans
NA		Hydrozoans and Bryzoans
NA	black-lip pearl oyster	*Pinctada margaritifera*
NA	other clams	Other Bivalves
NA	sea squirts	Tunicates
NA	sponges	Porifera
tako, he‘e	octopi	Cephalopods
NA	sea snails	Gastropoda
NA	sea slugs	Opistobranchs
limu	seaweed	Algae
NA		Live rock
NA	segmented worms (Those species not listed as CHCRT)	Annelids
All other coral reef ecosystem management unit species that are marine plants, invertebrates, and fishes that are not listed in this table or are not bottomfish, crustacean, precious coral or Pacific pelagic management unit species.		