Specifying 2017 Annual Catch Limits and Accountability Measures for Kona Crab in Hawaii

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Table of Contents

Tables

Figures

Acronyms and Abbreviations

ABC – Acceptable Biological Catch
ACL – Annual Catch Limit
ACT – Annual Catch Target
AM – Accountability Measure
B - Biomass
CNMI – Commonwealth of the Northern Mariana Islands
Council – Western Pacific Fishery Management Council (also WPFMC)
CPUE – Catch Per Unit of Effort
EA – Environmental Assessment
EC – Ecosystem Component
EEZ – Exclusive Economic Zone
FEP – Fishery Ecosystem Plan
FMP – Fishery Management Plan
FR – Federal Register
HDAR – Hawaii Division of Aquatic Resources
MHI – Main Hawaiian Islands
MFMT – Maximum Fishing Mortality Threshold
Magnuson-Stevens Act – Magnuson-Stevens Fishery Conservation and Management Act
MSST – Minimum Stock Size Threshold
MSY – Maximum Sustainable Yield
MUS – Management Unit Species
NEPA – National Environmental Policy Act
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
OFL – Overfishing Limit
OY – Optimum Yield
PIFSC – NMFS Pacific Islands Fisheries Science Center
PIRO – Pacific Islands Regional Office
SSC – Scientific and Statistical Committee
WPacFIN – Western Pacific Fisheries Information Network
WPFMC – Western Pacific Fishery Management Council (also Council)

1 Introduction

Kona crab (*Ranina ranina*), sometimes referred to as the "spanner crab" or "frog crab," is the only species within its genus and is commercially harvested over much of its range in the equatorial Pacific (Figure 1). Very little is known about the life history of Kona crab. The crabs are dioecious (i.e., the species has separate male and female individuals) and displays sexual dimorphism, with males growing to a much larger size than females (Uchida 1986). Research in the 1970's found that there was a slightly higher frequency of males than females in Hawaii (Onizuka 1972; Vansant 1978). On average, Kona crabs spend ~22 hours per day buried in the sand, with males spending more time emerged than females (Skinner and Hill 1986). However, Kennelly and Watkins (1994) found feeding rates and emergence time in females to be highly correlated with their reproduction cycle. Ovarian growth for female Kona crabs occurs from February to May resulting in increased feeding during these months (Fielding and Haley 1976). Egg bearing (berried) females rarely emerge from the sand, with the highest frequency occurring between June and July (Onizuka 1972).

In Hawaii, males are believed to each maturity at 2.9 inch carapace length, while the majority of females reach sexual maturity at 2.6 inch carapace length (Fielding and Haley 1976; Onizuka 1972). It is important to note that males must be large enough to successfully dig female crabs out of the sand in order to reproduce (Skinner and Hill 1986; Minagawa 1993). Fishermen are readily able to distinguish the sexes of adult crabs.

Figure 1: NOAA's Oscar Elton Sette small boat kona crab fishing ring net deployment (Left). Dorsal view of male and female Kona crab Source: Hawaii Division of Aquatic Resources (Right)

Fishing for crustaceans in federal waters (that is, in the U.S. Exclusive Economic Zone (EEZ), generally 3-200 nm from shore) around Hawaii is managed under the Fishery Ecosystem Plan for the Hawaii Archipelago (Hawaii FEP) developed by the Western Pacific Fishery Management Council (Council) and implemented by the National Marine Fisheries Service (NMFS) under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). Kona crab are managed as part of the crustacean Management Unit Species (MUS) under the Hawaii FEP. Under the Hawaii FEP, NMFS and the Council manage fishing for Kona

crab under a system of annual catch limits (ACL) and accountability measures (AM). See Section 1.3 for more information on ACLs and AMs. There are no other management measures required under the Hawaii FEP.

Currently, among the U.S. Pacific Island areas, Kona crab fishing only occurs in Hawaii. There are numerous Hawaii state regulations to conserve Kona crab resources including prohibitions on taking of female Kona crab (since September 2006), minimum size for male crabs of 4 inches (carapace length, Hawaii Revised Statutes §188-58.5), seasonal closures (May-August), and gear restrictions (e.g. no spearing Kona crab, minimum net mesh size) (Hawaii Administrative Rule Title 13, Subtitle 4, Chapter 89 §13-95-52). Fishermen are also required to have a Commercial Marine License (CLM) issued by the State of Hawaii to harvest Kona crab for commercial purposes. This allows the Council, NMFS and the State of Hawaii to monitor commercial catches.

Participation in the fishery varies from year to year. Over the past 15 years, the number of CML holders in the Hawaii Kona crab fishery has steadily declined from 85 commercial fishermen in 2000 to a low of 26 fishermen in 2015 (Figure 2, Table 1). In the last four years, there were 30 or fewer CLM holders participating in the fishery.

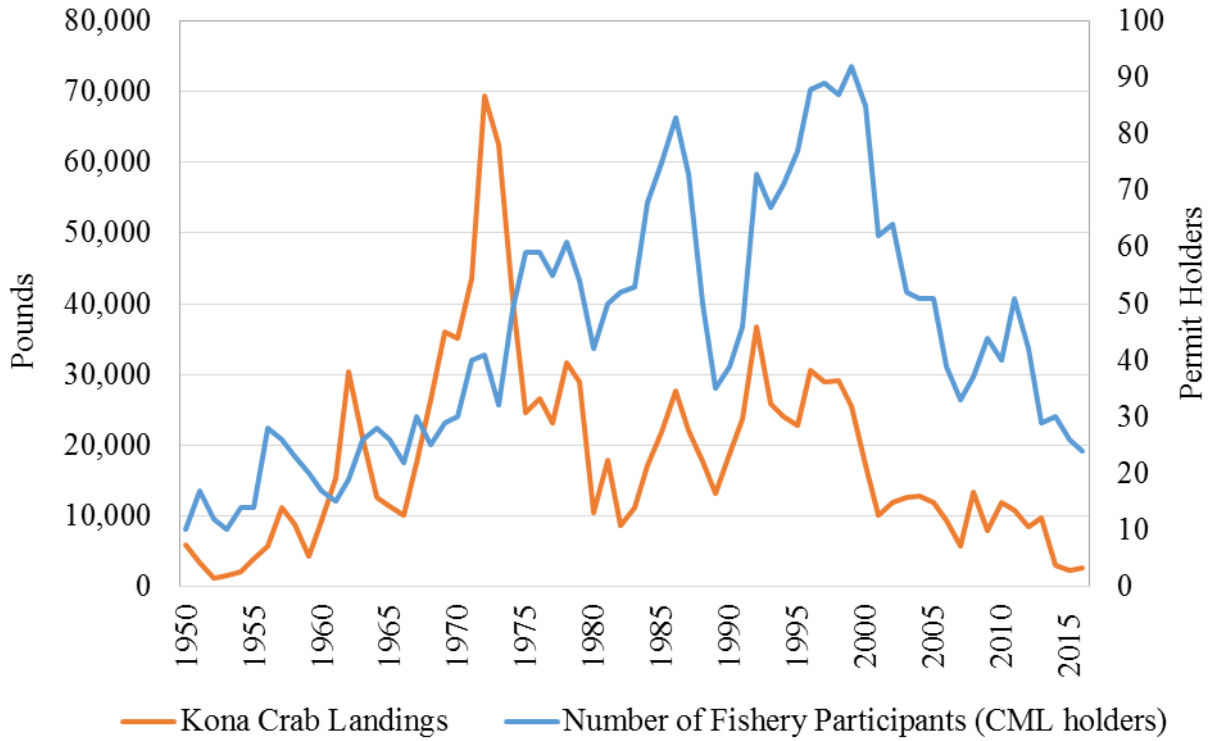

Figure 2: Number of Commercial Marine License holders and annual reported landings of Kona crab in the MHI (1950-2015). Source: Landings data from (HDAR 2016) State of Hawaii, Dept. of Land and Natural Resources Division of Aquatic Resources.

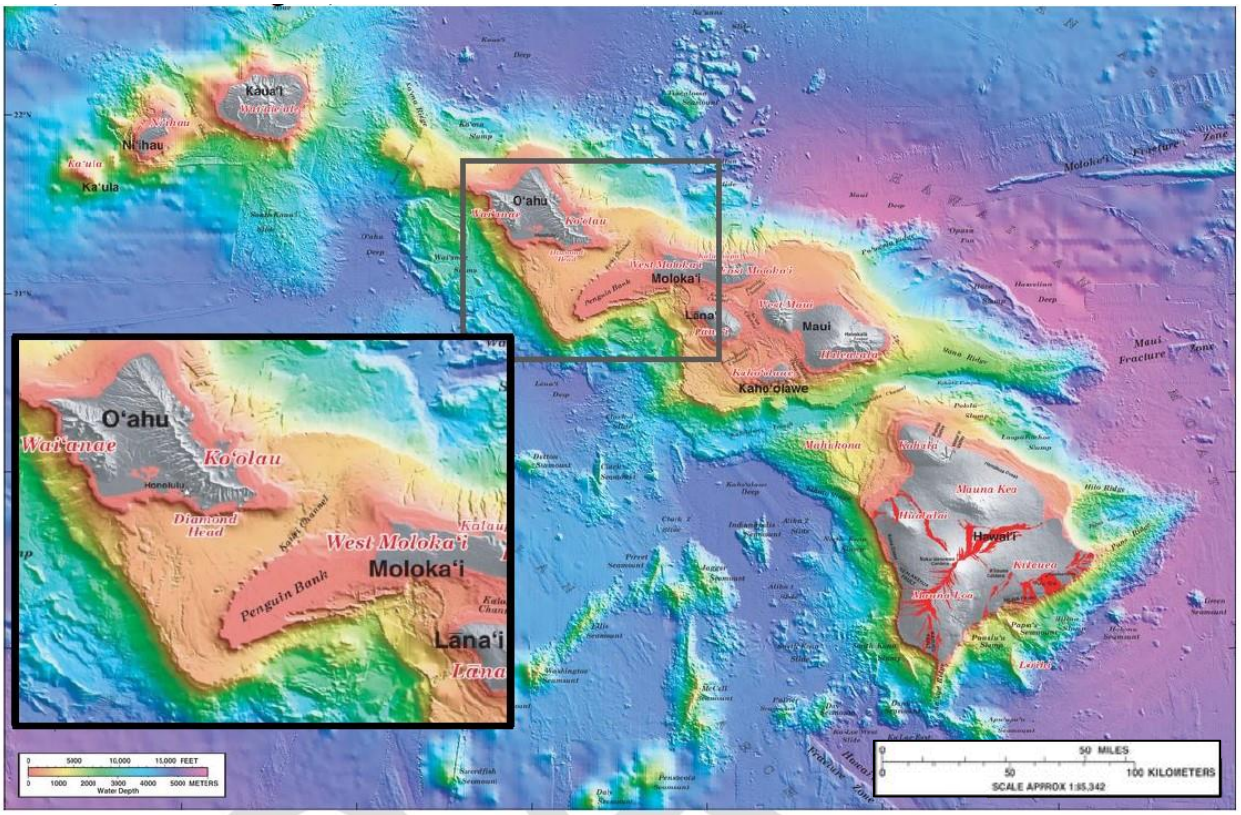

Figure 3. Bathymetric map of the Hawaiian Islands and (inset) Penguin Banks fishing grounds (USGS).

Commercial catches vary from year to year (Figure 2). Over the past ten years (2007 – 2016) the average annual reported harvest has been 7,569 pounds, although the average harvest in more recent years (2014 – 2016) declined to 2,658 pounds. From 2000 – 2010 a substantial amount (30–75%) of catch came from the EEZ (NMFS 2011). Penguin Bank, which is entirely in federal waters, is an important location for kona crab fishing (Figure 3; Onizuka 1972). Between 25 and 51 fishermen have been active in the commercial Kona crab fishery in Hawaii in the last decade, although the majority (~50-60%) of trips are attributed to only three fishermen (Table 1).

Fishing for Kona crab is conducted by setting strings of baited circular shaped nets on sandy bottom habitats for an average soak time of one hour (Kennelly and Craig 1989). Nets are set during day-long trips from small boats (Brown 1985). The net frames are built from ½ cm wire approximately 1 meter across (Figure 1). This frame is then covered in 1-2 layers of small gauge mesh netting which entangles the legs or claws of the crabs. Upon retrieval, crabs are untangled; female and undersized crabs are released. Disentangling crabs from nets may cause injuries and lead to high discard mortality rates. If a limb is lost the mortality rate can be up to 100% after 8 days as Kona crabs do not have the ability to regenerate limbs similar to other crab species (Thomas et al 2015). The incidental harvest of non-target species is minimal. Since the State of Hawaii implemented a prohibition on the retention of female Kona crabs, the only bycatch that occurs are regulatory discards of female crabs and undersized males.

Table 1: Number of Commercial Marine License Holders the reported landings of Kona crab from 2000-2016.

Fishing Year	Number of Fishermen (CML holders)	Kona Crab Landing (pounds)
2000	85	17,070
2001	62	10,128
2002	64	11,912
2003	52	12,669
2004	51	12,785
2005	51	11,904
2006	39	9,399
2007	33	5,690
2008	37	13,305
2009	44	7,987
2010	40	11,807
2011	51	10,883
2012	42	8,404
2013	29	9,625
2014	30	3,067
2015	26	2,332
2016	24	2,577

The impact of recreational landings and effort in Hawaii fisheries is unknown, as recreational fishers are not required to obtain a fishing license or report landings (Friedlander and Parrish 1997). Recreational fishing has significantly impacted stock abundance in other fisheries (Cardona et al. 2007), and the number of recreational crab fishers participating in the MHI Kona crab fishery is expected to be substantial (Brown 1985; Pooley 1993).

1.1 Purpose and Need

NMFS is required to specify ACLs and AMs for all stocks and stock complexes of MUS included in each FEP, with the exception of species with short life cycles, those stocks managed through international agreements, or those that qualify as ecosystem component species. AMs are to be used to correct or mitigate overages of the ACL should they occur.

The purpose of this action is to use the best available science to specify an ACL and AM for Kona crab fishery management. The ACL and AM is needed to prevent overfishing from occurring, and to provide for long-term sustainability of the fishery resources while allowing fishery participants to continue to benefit from their utilization. The use of the best available science is needed to ensure the ACL and AM specified are consistent with the Magnuson-Stevens Act National Standards 1 and 2.

1.2 Proposed Action

Based on recommendations by the Council, NMFS would specify an ACL and implement AMs for the Kona crab fishing year 2017, which began on January 1, 2017 and runs through December 31, 2017. Catches would be counted towards the ACL based on catch data collected by the Hawaii Division of Aquatic Resources (HDAR).

In-season AMs are not possible for Kona crab at this time because catch statistics are generally not available until at least six months after the data has been collected. For this reason, only a post-season AM is possible. After the end of each fishing year, if NMFS and the Council determine that the average catch from the most recent three-year period exceeds the specified ACL, NMFS would reduce the ACL in the subsequent fishing years by the amount of the overage. Specifically, NMFS and the Council will use the average catch during fishing year 2015, 2016, and 2017 to evaluate fishery performance against the appropriate 2017 ACL. NMFs proposes ACLs each year, including those that have been reduced by AMs, allowing for public review and comment before implementing the annual ACLs and AMs. As a performance measure specified in each FEP, 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. Each alternative also assumes continuation of all existing Federal and local resource management laws and regulations.

1.3 Overview of the ACL Specification Process

NMFS is required to specify ACLs and AMs for all crustacean stocks in fisheries of the Pacific Islands Region, 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. This section provides an overview of the steps taken by the Council in developing its ACL and AM recommendations.

In accordance with the Magnuson-Stevens Act and the FEPs, there are three required elements in the development of an ACL specification: calculating the ABC, determining the ACL, and developing AMs. 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 stock status. 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. Tiers 1 and 2 apply to data-rich to data-moderate stocks. Tiers 3 through 5 involve data-poor stocks for which only catch data are available and the OFL is unknown.

For stocks or stock complexes like bottomfish with estimates of maximum sustainable yield (MSY) and other MSY based reference points derived from statistically-based stock assessment models, the SSC calculates ABC based on an 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. ABC represents the maximum value for which the probability of overfishing (P*) is less than 50 percent. In accordance with Federal regulations, the probability of overfishing cannot exceed 50 percent (74 FR 3178, January 9, 2011). Each FEP includes a qualitative process by which the P* value may be reduced below 50 percent by the Council based on consideration of four dimensions of information, including assessment information, uncertainty characterization, stock status, and stock productivity and susceptibility.

For Tier 5 stocks, the ABC is calculated by multiplying the average catch from a time period when stock abundance is not declining ("Recent Catch") by a factor based on an estimate of relative stock size or biomass (B). In some data-poor stocks, the process allows for an approach based on informed judgment, including expert opinion and consensus-building methods. The ACL process also allows the SSC to utilize any other information deemed useful to establish an ABC and allows the SSC to recommend an ABC that differs from the results of the default ABC control rule calculation. Table Table 2 provides a summary of the Council's default ABC control rule for Tier 5 data poor stocks.

Table 2: Tier 5 ABC Control Rule (Data poor, Ad-hoc Approach to Setting ABCs)

If estimate of B is above B_{MSY}	Multiplier = 1 ABC = 1.00 x Recent Catch
If estimate of B is above minimum stock size threshold (MSST), but below B_{MSY}	Multiplier =0.67 ABC = 0.67 x Recent Catch
If estimate of B is below MSST (i.e., overfished)	Multiplier = 0.33 ABC = 0.33 x Recent Catch

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. Figure Figure 4 illustrates the relationship among the OFL, ABC, and ACLs described in this section.

The third and final step in the ACL process is the development of AMs. When an ACL for any stock or stock complex is projected to be reached, based on best available information, NMFS will restrict fishing for that stock or stock complex in Federal waters around the applicable U.S. EEZ to prevent the ACL from being exceeded. There are two categories of AMs: in-season AMs and post-season AMs. 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. If the Council determines that 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. In determining whether an overage adjustment is necessary, the Council would consider the magnitude of the overage and its impact on the affected stock's status. 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, as necessary, to improve its performance and effectiveness. For more details on the specific elements of the ACL specification mechanism and process, see Amendment 3 to the Hawaii Archipelago FEP and the final implementing regulations at 50 CFR §665.4 (76 FR 37285, June 27, 2011).

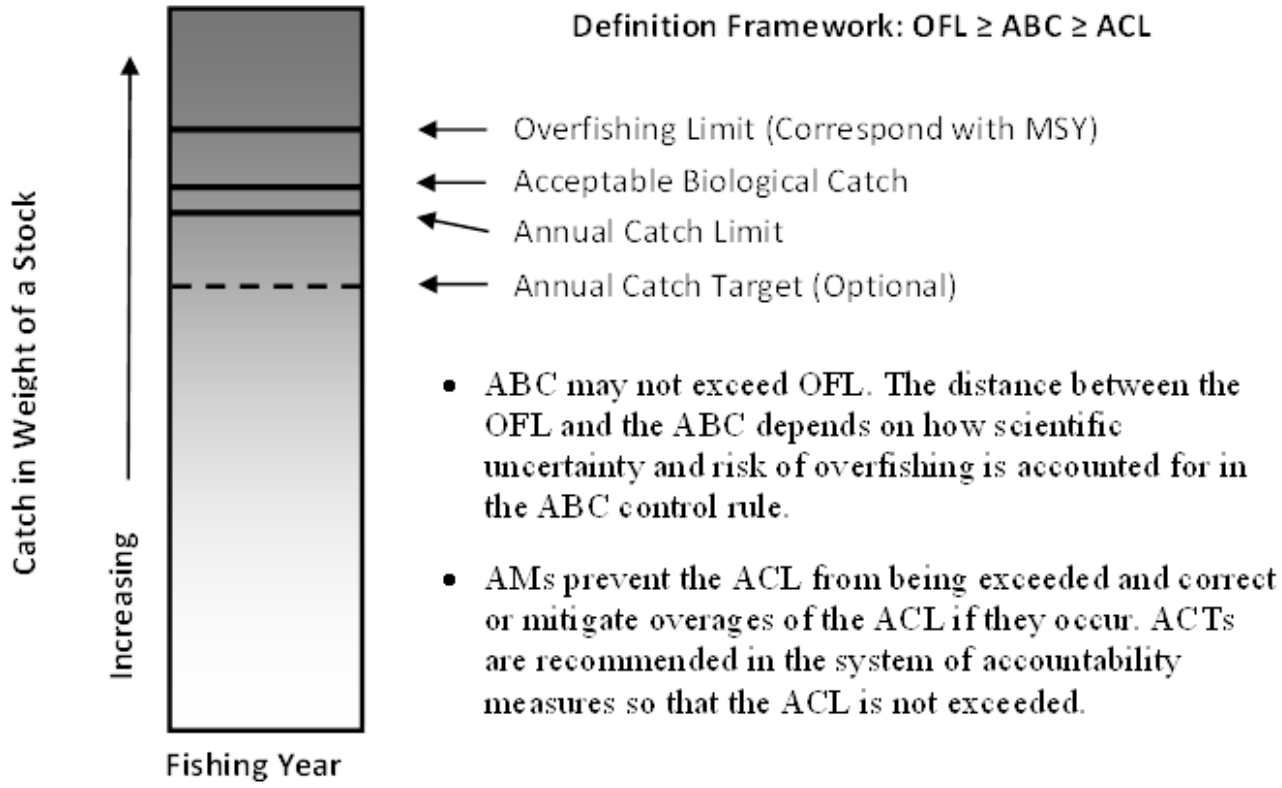

Figure 4: Relationship among OFL, ABC, ACL and ACT.

1.4 Hawaii Kona Crab Management History and Stock Status

Development of the Council's recommendations for Hawaii Kona crab ACLs and AMs for fishing years 2012 – 2015

The 2006 reauthorization of the Magnuson-Stevens Act included requirements to prevent and end overfishing, and rebuild overfished stocks. All Regional Fishery Management Councils were required to amend their fishery management plans to include a mechanism for specifying ACLs for all fisheries at a level such that overfishing does not occur and to implement AMs for adhering to these limits. The ACL and AM mechanism was required to be established by 2010 for fisheries subject to overfishing and by 2011 for all other fisheries. To comply with the Magnuson-Stevens Act, the Council, in coordination with NMFS, prepared an omnibus amendment to the five FEPs describing how the Council will specify ACLs and AMs for each

FEP fishery to ensure long term sustainability of the resources under the Council's jurisdiction. NMFS implemented final rulemaking in 2011 establishing the procedures for specifying the ACLs and AMs (76 FR 37285). Therefore, fishing year 2012 (beginning January 1, 2012) was the first year the Kona crab fishery was subject to ACLs and AMs.

In preparation for the start of fishing year 2012, in late 2011, the SSC recommended that, for species with no MSY estimates, the ABC be set in accordance with the Tier 5 ABC control rule (Table 2) as described in the Hawaii FEP (108th SSC meeting, October 17–19, 2011)[1]. In defining "Recent Catch" to apply the ABC control rule, the SSC recommended using the 75th percentile of the available catch history for Kona crab. The 75th percentile is the value of an array (in this case the level of catch in terms of pounds) below which 75% of the observations may be found. At the time the available catch history included data from 1950-2008. Catch from this time period included both males and females. The SSC determined a multiplier of 1 was warranted for Hawaii Kona crab because there had been no long-term decline in harvest over the last 30 years and there are numerous Hawaii state regulations to conserve Kona crab resources. Based on this approach, the SSC calculated the ABC for Kona crab to be 27,560 pounds, but rounded the ABC upward to 27,600 pounds (Table 3). The Council then recommended to NMFS and NMFS implemented an ACL of 27,600 pounds for the 2012 fishing season. A post-season AM was also implemented such that if the ACL is exceeded, the Council will take action which may include a recommendation that NMFS reduce the ACL for the subsequent fishing year by the amount of the overage, or other measure, as appropriate (77 FR 6019, February 7, 2012). The Council recommended and NMFS implemented the same ACL and AMs for fishing years 2013 and 2014 (78 FR 15885 and 79 FR4276 respectively).

In 2014, the SSC recommended that the ABCs of the fishing year 2014 be rolled over for fishing year 2015 - 2018 for species that:

- Have no new scientific information,
- Have no new catch data, and
- For which catches in the past years did not exceed the ACL.

The SSC recommended rolling over the Kona crab ACL from 2014 to 2015 even though recent catch data was available. According to the SSC, while "there are some new catch data available, re-calculating the ABC using the Tier 5 ABC control rule would result in a ratchet-down effect since the recent catches are below the ACLs" (116th SSC meeting). After considering the SSC's advice, the Council recommended that the Hawaii Kona crab ACLs and AMs for fishing years 2015 through 2018 remain the same as 2014 (160th Council meeting, June 25–27, 2014). NMFS then implemented a 27,600 pound ACL for the 2015 fishing year (80 FR 52415).

Although the Council recommends specifications for multiple fishing years, NMFS specifies the ACLs annually through proposed and final rulemaking in the Federal Register. This allows interested parties to comment on the proposed ACL each year. Additionally, the Council recommended and NMFS implemented AMs for the Hawaii Kona crab fishery that would

[1] Although the estimate of the OFL is part of the ACL mechanism, the establishment of this reference point is not part of the proposed Federal action because OFL is unknown.

compare the estimated stock or stock complex's running three-year average catch to the ACL. For example, in 2015, NMFS and the Council used the average landings of Kona crab from 2013 - 2015 to compare fishery performance against the 2015 ACL.

*Table 3: History of ACL and AM recommendations for Hawaii Kona crab. * Fishing year 2012 (beginning January 1, 2012) was the first year the Kona crab fishery was subject to ACLs and AMs*

Year	Council Recommended ACL	NMFS Implemented ACL	NMFS Implemented AM	Total Catch (pounds)	# of CML holders
2011	N/A	N/A	N/A	10,883	51
2012*	27,600	27,600	Post-season review	8,404	42
2013	27,600	27,600	Post-season review	9,625	29
2014	27,600	27,600	Post-season review	3,067	30
2015	27,600	27,600	Post-season review	2,332	26
2016	27,600	No ACL implemented	No AM implemented	2,577	24
2017	Under consideration				

Kona Crab Stock Assessment (Thomas et al. 2015)

In 2015, Thomas et al. prepared a stock assessment to estimate stock abundance, fishing mortality, and biomass for the Hawaii-based Kona crab fishery using commercial landings data from 1970 through 2006. The authors chose this time period since they believed that fishermen underreported landings by as much as 50% before 1970 and the fishery switched to a male-only retention fishery in 2006. Effort data used in Thomas et al. (2015) did not include any recreational fishery landings or fisheries independent information due to the lack of such data. The assessment found that Hawaii Kona crab stocks had reached an overfished status in 2006, and were likely still overfished in 2010. Further, Thomas et al. (2015) produced biomass projections for 2010-2030 under three commercial landings scenarios (males and females combined): zero pounds, 7,000 pounds, and 8,000 pounds (Table 4; Figure 4). At a constant zero-pound annual harvest rate, the authors predicted that Kona crab stocks would recover from overfished levels (<50 percent of B_{MSY}) after 2015. At a constant 7,000-pound annual commercial harvest rate, the authors estimated that Kona crab biomass would increase above 50% of B_{MSY} by 2030, but explained that there was a chance that stock biomass could decline to

zero pounds by 2020. At a constant 8,000-pound annual harvest rate, the authors predicted that the Hawaii Kona crab stock biomass could reach zero pounds by 2020. In their discussion, Thomas et al. (2015) acknowledge that their 2010–2030 stock status projections do not account for the effects of a male-only fishery (after September 2006) and, as a result, the projections are associated with a high degree of uncertainty.

Table 4: Thomas et al (2015) biomass projections and results following a future combined-sex catch mortality of 0, 7,000, and 8,000 pounds

Combined-sex catch mortality starting in 2010	Biomass projection result
0 lbs	Biomass will definitely increase, and will become greater than 50% of B_{MSY} by ~2015.
7,000 lbs	Biomass may increase to greater than 50% B_{MSY} by 2030; still a possibility of biomass decline to 0 lbs by ~2020.
8,000 lbs	Biomass likely to decline to 0 lbs by ~2020.

CIE Review of the Kona Crab Stock Assessment (Hall 2015)

In December 2015, the Center for Independent Experts (CIE) completed a peer review of the 2015 stock assessment for Hawaii Kona crab. Hall (2015) supported the conclusion that the Kona crab stock had been overfished in 2006. Furthermore, the review concurred with the conclusion that the stocks probably had not recovered and was still overfished in 2010. However, the review pointed out the significant amount of uncertainty with the current status of the stock as well as the assessment's future projections of the stock's status after 2006, when the State of Hawaii's began a prohibition on landing female crabs. The projections assume catch mortality after 2006 is from both male and female Kona crab, when in reality, catch starting in 2007 is male-only due to the State law. Additional areas of uncertainty in the 2015 stock assessment included that there was no information on Hawaii Kona crab stock structure, no assessment of the accuracy of the landings data (introduces errors into the conclusions), no estimates of discard biomass, non-commercial catch had not been estimated or considered, and the lack of any fishery-independent data.

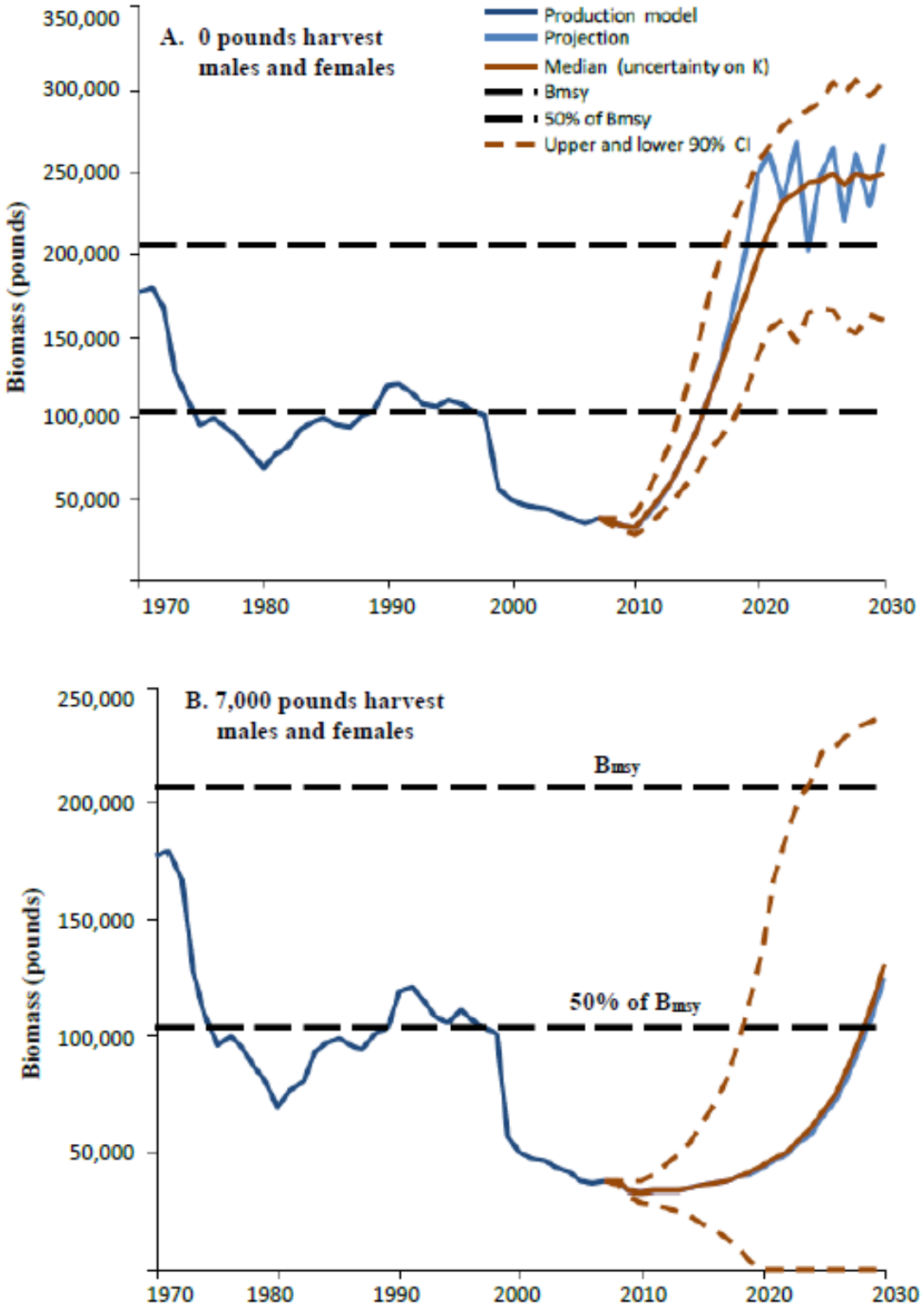

Figure 5: Thomas et al (2015) biomass projections and results following a future combined-sex catch mortality of (a) 0, (b) 7,000, and (c) 8,000 pounds (following page)

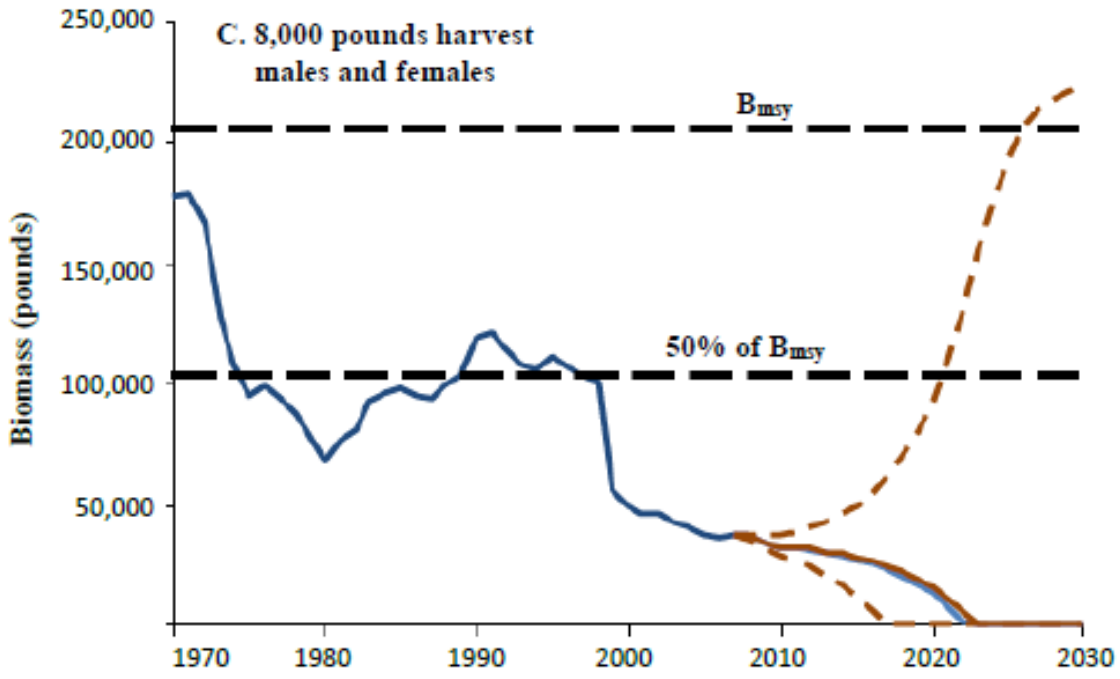

Figure 5 (cont'd): *Thomas et al (2015) biomass projections and results following a future combined-sex catch mortality of (a) 0, (b) 7,000 (preceding page), and (c) 8,000 pounds (above)*

PIFSC response to the Kona Crab Stock Assessment and CIE review

After reviewing the Thomas et al. stock assessment and the CIE review, and acting upon the request from the Council, NMFS Pacific Islands Regional Office (PIRO) requested additional review from NMFS Pacific Islands Fisheries Science Center (PIFSC). PIFSC concurred with concern expressed by Hall (2015) on the impacts of the 2006 Hawaii State regulation establishing a prohibition on retention of female Kona crabs since little is known about sex ratios, how sex ratios might bias the stock assessment, and post-release mortality impacts. Furthermore, when the Thomas et al. projections are compared to commercial landings from 2008–2013, the actual catch met or exceeded the mortality thresholds that were predicted to cause the Hawaii Kona crab stock to collapse by 2020. Therefore the Thomas et al. projection is not validated in the observed fishery landings, although PIFSC notes that the number of participants and landings were down in 2014 and 2015 (Table 1). Both Hall (2015) and PIFSC concur that the stock projections beyond 2006 probably do not accurately describe current Hawaii Kona crab stock size or structure.

While the PIFSC review echoed concerns similar to CIE review, it also noted that the stock assessment provided useful scientific information about stock status within the last decade. PIFSC agreed with the CIE review that further work is needed to provide advice on the current status of the population in more recent years. PIFSC is planning to complete a benchmark stock assessment for Hawaii Kona crab in 2018.

Development of the recommendations for Hawaii Kona crab ACLs and AMs for fishing year 2016

After reviewing the 2015 stock assessment, the CIE review, and the PIFSC response to the CIE review, the SSC did not recommend a modification to the Hawaii Kona crab ACL for fishing year 2016. Instead, the SSC recommended, and the Council concurred, that the ACL remain unchanged at 27,600 pounds. In their discussions, the SSC and the Council found that the assessment did not present information on the current status of the stock that was reliable enough to base an ACL recommendation. The Council recommended Hawaii Kona crab fishery should remain classified as a Tier 5 (data poor) fishery and the ABC control rule should be used to determine appropriate ACLs. The Council did, however, recommend additional funding support to research post-release survival of Kona crab and methods for improving survival.

On January 18, 2017, NMFS published the Council's proposed ACL's for most Pacific Island stocks for 2016 (82 FR 5517). An ACL for Kona crab was not included because the Council's ACL recommendation for that stock did not account for the Thomas et al (2015) assessment and was therefore inconsistent with requirements of the Magnuson-Stevens Act. NMFS recognizes that, while there are data gaps and methodological concerns with the 2015 stock assessment, it does contain, as noted by PIFSC, useful scientific information on the status of the stock over the last decade. NMFS provided guidance that the stock assessment, although flawed, should be accounted for when setting an ACL. NMFS requested that the Council review the available information again and work with the SSC and PIFSC to consider all the information in order to set an ACL for the stock consistent with the Magnuson-Stevens Act for fishing year 2017.

2 Description of the Alternatives

2.1 Features common to all alternatives

The alternatives considered in this document are limited to ACLs and AMs as they are the management measures to be applied to Hawaii Kona crab fishery. In accordance with the Magnuson-Stevens Act and the ACL mechanism described in all western Pacific FEPs, the ACL specification may not exceed the ABC recommendation made by the Council's SSC. These alternatives assume the ACL will be set equal to the ABC. The ACLs and AMs would be applied in fishing year 2017 which runs January 1 through December 31.

NMFS would continue to rely primarily on the HDAR fishery data collection programs to obtain catch and effort data for the Kona crab fishery in Hawaii. Additionally, because State law prohibits retention of female Kona crab, only male crabs retained are reported in State catch records. Pursuant to 50 CFR 665.4, when an ACL for any stock or stock complex is projected to be reached, based on best available information, NMFS will restrict fishing for that stock or stock complex in federal waters around the applicable U.S. EEZ 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 of effort. However, in-season restrictions are not possible for the Kona crab fishery at this time because catch statistics are generally not available until at least six months after the data have been collected. While the State of Hawaii has the capability to

monitor and track the catch of seven preferentially-targeted bottomfish species in near real time towards their specified catch limits, additional resources would be required to extend these capabilities to crustacean fisheries. Until resources are made available, only AMs that consist of non-in-season management measures are being recommended. For the Hawaii Kona crab fishery the Council would compare the estimated stock or stock complex's running three-year average catch to the ACL. For example, as an AM in 2015, NMFS and the Council used the landings of Kona crab reported in 2013, 2014, and 2015 for a three-year annual average of catch to compare against the 2015 ACL (27,600 pounds).

	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
ACL	No ACL	27,600 pounds	0 pounds	3,500 pounds	7,000 pounds
Compliant with MSA	NO	NO	YES	YES	Unknown
Impact to Stock (from *Thomas et al (2015)*)	Unknown, but catch could be similar to recent years	Stock biomass would reach 0 pounds after 10 years (*based on 8,000 pound catch*)	No longer overfished within five years	May not be overfished w/in 20 years, but stock biomass could also reach 0 pounds	Unknown
Impact to non-target or bycaught species	No additional impact to non-target or bycaught species	No additional impact to non-target or bycaught species	Elimination of post release mortality impacts to bycaught crabs	No additional impact to non-target or bycaught species	No additional impact to non-target or bycaught species
Economic Impact	Similar to recent years	Similar to recent years	Fisherman would experience zero revenue	Similar to recent years	Similar to recent years
Protected Resources Impact	No additional impact expected	No additional impact expected	No additional impact expected	No additional impact expected	No additional impact expected

Table 5. Comparison of Alternative 1 (No ACL), Alternative 2 (27,600 pounds ACL - Status Quo/Council Preferred), Alternative 3 (0 pounds ACL), Alternative 4 (3,500 pounds ACL) and Alternative 5 (7,000 pound ACL)

2.2 Alternatives for Hawaii Kona Crab

2.2.1 Alternative 1: No Action

Under this alternative, NMFS would not specify an ACL for Hawaii Kona crab and AMs would not be necessary. However, this alternative would not comply with the Magnuson-Stevens Act or the provisions of the FEPs, which require ACLs to be specified for all stocks and stock complexes. Alternative 1 serves as the baseline for the environmental effects analysis.

2.2.2 Alternative 2: ACL equal to 27,600 (Status Quo/Council Recommended)

Under this alternative, NMFS would specify an ACL and establish AMs for the Hawaii Kona crab stock. The proposed ACL recommended by the Council is 27,600 pounds for fishing year 2017, per the Tier 5 ABC Control Rule (Table 2).

While NMFS implemented this proposed ACL in 2012 – 2015, NMFS did not implement the Council's recommended ACL of 27,600 pounds in 2016. Based on Thomas et al (2015), this level of catch is unsustainable and is therefore inconsistent with requirements of the Magnuson-Stevens Act.

While there are numerous Hawaii state regulations to conserve Kona crab resources, disentangling crabs from nets may cause injuries and lead to high discard mortality rates. If a limb is lost the mortality rate can be up to 100% after 8 days as Kona crabs do not have the ability to regenerate limbs similar to other crab species (Thomas et al 2015). Based on previous research, the sex ratio is slightly above 50:50, in favor of males (i.e. males slightly outnumber females). Assuming a 100% post-release mortality rate for females and undersized males, the total mortality (harvest and discards) associated with this alternative could be more than twice as high as the ACL associated with this alternative of 55,200 pounds (males and females).

The Council and SSC found that the Thomas et al (2015) assessment did not present information that was reliable enough to base an ACL recommendation while NMFS stated it does contain useful scientific information on the status of the stock over the last decade. Landings have not been higher than the proposed ACL since 1998. While over the past ten years the average harvest has been 7,569 pounds (males only) the average harvest in 2014 – 2016 declined to 2,658 pounds (males only).

2.2.3 Alternative 3: ACL equal to 0 pounds

Under this alternative, NMFS would specify an ACL and establish AMs for the Hawaii Kona crab stock. The proposed ACL would be 0 pounds for Hawaii Kona crab for fishing year 2017. Based on Thomas et al (2015), in 2010 the fishery was probably overfished. At a constant zero-pound annual harvest rate, Thomas et al (2015) predicted that Kona crab stocks would no longer be overfished within five years.

2.2.4 Alternative 4: ACL equal to 3,500 pounds

Under this alternative, the ACL for Hawaii Kona crab would be set at 3,500 pounds. At a 7,000-pound annual commercial harvest rate, Thomas et al (2015) estimated that the Kona crab fishery may no longer be overfished within 20 years, but explained that there was a chance that stock biomass could decline to zero pounds within the same timeframe. While the Thomas et al (2015) analysis was based on male and female commercial landings data, the current regulations prohibit retention of females. Disentangling crabs from nets may cause injuries and lead to high discard mortality rates. If a limb is lost the mortality rate can be up to 100% after 8 days as Kona crabs do not have the ability to regenerate limbs similar to other crab species (Thomas et al 2015). Based on previous research, the sex ratio is slightly above 50:50, in favor of males (i.e. males slightly outnumber females). Assuming a 100% post-release mortality rate for females and undersized males, the total mortality (harvest and discards) associated with this alternative could be more than twice as high as the ACL associated with this alternative or 7,000 pounds (males and females).

2.2.5 Alternative 5: ACL equal to 7,000 pounds

Under this alternative, the ACL for Hawaii Kona crab would be set at 7,000 pounds. At a 7,000-pound annual commercial harvest rate, Thomas et al (2015) estimated that the Kona crab fishery may no longer be overfished within 20 years, but explained that there was a chance that stock biomass could decline to zero pounds within the same timeframe. While the Thomas et al (2015) analysis was based on male and female commercial landings data, the current regulations prohibit retention of females. Disentangling crabs from nets may cause injuries and lead to high discard mortality rates. If a limb is lost the mortality rate can be up to 100% after 8 days as Kona crabs do not have the ability to regenerate limbs similar to other crab species (Thomas et al 2015 Based on previous research, the sex ratio is slightly above 50:50, in favor of males (i.e. males slightly outnumber females). Assuming a 100% post-release mortality rate for females and undersized males, the total mortality (harvest and discards) associated with this alternative could be more than twice as high as the ACL associated with this alternative of 14,000 pounds (males and females).

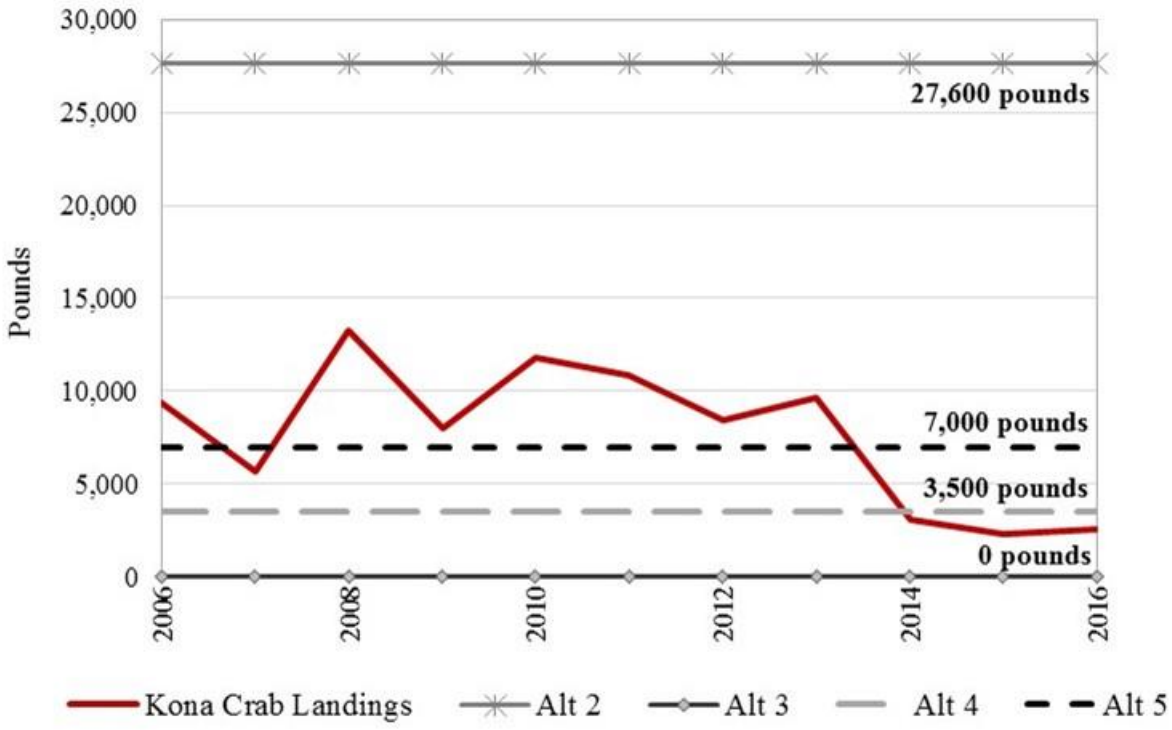

Figure 6. Catch of Kona crab in the MHI (2006-2016) compared to Alternative 2 (27,600 pounds ACL - Status Quo/Council Preferred), Alternative 3 (0 pounds), Alternative 4 (3,500 pounds ACL) and Alternative 5 (7,000 pound ACL)

3 Potentially Affected Environment and Potential Impacts of the Proposed ACL Specifications

This section describes the affected fisheries and fishery resources, other biological and physical resources, and potential effects implementing the alternatives would have on these resources. Climate change and environmental justice are considered, along with potential impacts to fishing communities, special marine areas and other resources, and fishery administration and enforcement.

3.1 Overview of Existing Fishery Monitoring

3.1.1 Fishery data collection systems in 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. 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 is also opportunistically collected through the Hawaii Marine Recreational Fishing Survey (HMRFS). Annual catch amounts are reported through NMFS Marine Fisheries Statistics Survey (MRFSS) at http://www.st.nmfs.noaa.gov/st1. It should be noted that because this survey only includes finfish, no information on crustaceans or precious corals is captured by this survey. A 2006 review of MRFSS by the National Resource Council (NRC) noted that the catch estimation method was not correctly matched with the catch sampling survey design, leading to potential bias in the estimates of finfish catch. 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.

Except for HMRFS data, NMFS WPacFIN obtains all crustacean fisheries information in the Pacific Islands, where available, and provides access to this data on their website 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.

3.1.2 Federal Permit and Reporting Requirements

Commercial Fisheries
Federal permits are not required to harvest Kona crab in any Pacific Island area at this time.

Recreational Fisheries
In 2008, NMFS established the National Saltwater Angler Registry Program as part of the Marine Recreational Information Program to improve recreational fisheries information nationwide (73 FR 79705, December 30, 2008). This program requires all recreational fishers in Federal waters that are not otherwise permitted (e.g., through a State CML license, or another Federal permit) to obtain a permit and report catches to NMFS. Recreational fishing for Kona crab does not occur in federal waters.

3.2 Hawaii Kona Crab Fishery, Affected Resources and Potential Effects

The Hawaiian Islands are made up of 137 islands, islets, and coral atolls that extend for nearly 1,500 miles from Kure Atoll in the northwest to the Island of Hawaii in the southeast. The Hawaiian Islands are often grouped into the Northwestern Hawaiian Islands (Nihoa to Kure) and the main Hawaiian Islands (Hawaii to Niihau). The total land area of the 19 primary islands and atolls is approximately 6,423 square miles. The majority (70 percent) of the 1.3-million people residing in Hawaii live on the island of Oahu. The seven other main Hawaiian Islands are Hawaii, Maui, Molokai, Lanai, Kahoolawe (uninhabited), Kauai, and Niihau.

3.2.1 Overview of Hawaii's Kona Crab Fishery

The Kona crab is found in the MHI and the NWHI at depths from 24 to 115 m. Kona crab fishing in Hawaii usually involves setting strings of baited tangle-nets on sandy bottom habitat for an average soak time of one hour (Kennelly and Craig 1989). Nets are set during day-trips from small boats (10-12 m in length) (Brown 1985). The net frames are built from ½ cm wire approximately 1 meter across. This frame is then covered in 1-2 layers of small gauge mesh

netting to entangle the crabs. There is some variation in size and type of material used to construct tangle nets (Onizuka 1972; Kennelly and Craig 1989). Upon retrieval, crabs are untangled; female and undersized crabs are released.

While there are no Federal permit and reporting requirements for Kona crab fishing in the EEZ, fishermen are required to have Hawaii Commercial Marine Licenses (CMLs) for commercial Kona crab harvest. The Kona crab fishery is subject to State regulations that include a prohibition on taking females, no taking of crabs less than 4 inches, and a closed season from June to August. Commercial landings of Kona crab peaked in 1972 with approximately 69,000 pounds landed. However, landings have declined since that time with catches between 11,807 pounds (2010) and 2,332 pounds (2015). During this time period, the number of CML holders catching Hawaii Kona crab declined from 40 to 26. Table 1summarizes Kona crab participation and landings in Hawaii from 1980 to 2016.

By the nature of the fishing method and fishing location on sandy bottoms, the Hawaii Kona crab incidental harvest of non-target species is minimal. Since the State of Hawaii implemented a prohibition on the retention of female Kona crabs, the only bycatch that occurs are regulatory discards of female crabs; however, the level of discards is currently unavailable.

3.2.1.1 Potential Effects of the Proposed ACL and AM Specifications on Target, Non-target and Bycatch Species in Hawaii

Alternative 1: No Management Action

Under the no-action alternative, an ACL would not be specified for the Hawaii Kona crab fishery and AMs would not be necessary. This alternative would not comply with the Magnuson-Stevens Act or the provisions of the FEPs, which require ACLs to be specified for all stocks and stock complexes. Under this alternative, the fishery would continue to catch Kona crab in the manner and at levels described above and catches would continue to be monitored through fisheries monitoring programs administered by Hawaii DAR. Under this alternative, NMFS expects catches to continue as it currently has in recent years, with catch ranging between 13,321 pounds (2008) and 2,331 pounds (2015). Based on existing information, NMFS could not ensure catch in 2017 would remain within levels the stock assessment projects would rebuild the stock. The stock status of Hawaii Kona crab would continue to be subject to ongoing discussion and review by the Council and NMFS.

The incidental harvest of non-target species is currently minimal. Since the State of Hawaii implemented a prohibition on the retention of female Kona crabs, the only bycatch that occurs are regulatory discards of female and undersized crabs. This alternative would not change the effects on non-target or bycaught species.

Alternative 2: Specify ACL at 27,600 pounds

Under this alternative, NMFS would specify an ACL of 27,600 pounds for Hawaii Kona crab in fishing years 2017. The ACL is equal to the ABC previously recommended by the Council's

SSC and is set at the 75th percentile of the long-term catch. Landings have not been above 27,600 pounds since 1998.

Based on Thomas et al (2015), this level of catch is unsustainable and is therefore inconsistent with requirements of the Magnuson-Stevens Act. Additionally, assuming a 100% post-release mortality rate for females and undersized males, the total mortality (harvest and discards) associated with this alternative could be more than twice as high as the ACL associated with this alternative or 55,200 pounds (male and female). The AMs are expected to provide additional management review (compared with Alternative 1) to promote sustainable harvests of Kona crabs.

The incidental harvest of non-target species is currently minimal. Since the State of Hawaii implemented a prohibition on the retention of female Kona crabs, the only bycatch that occurs are regulatory discards of female and undersized crabs. This alternative would not change the effects on non-target or bycaught species.

Alternative 3: Specify ACL 0 pounds

Under this alternative, NMFS would specify an ACL of 0 pounds. Alternative 3 is considered the most conservative alternative and based on Thomas et al (2015) could allow the stock biomass to become greater than B_{msy} (i.e. no longer overfished) within five years.

While the incidental harvest of non-target species is currently minimal, this alternative could potentially have a marginal benefit to non-target species since setting the ACL to 0 pounds would remove any opportunity for the fishery to interact with non-targeted species. The only bycatch that currently occurs are regulatory discards of female and undersized crabs as disentangling crabs from nets may cause injuries and lead to high discard mortality rates. Setting the ACL to 0 pounds would eliminate the post release mortality impacts to bycaught female and undersize crabs which can be significant. If a limb is lost the mortality rate can be up to 100% after 8 days as Kona crabs do not have the ability to regenerate limbs similar to other crab species (Thomas et al 2015).

Alternative 4: Specify ACL 3,500 pounds

Under this alternative, NMFS would specify an ACL of 3,500 pounds. The impacts of alternative 4 is expected to be more beneficial than Alternative 1 because it would establish a limit on the amount of Kona crab. Based on Thomas et al (2015)), an ACL at this level could allow the stock biomass to become greater than B_{msy} (i.e. no longer overfished) within 20 years, although there is still a chance that stock biomass could decline to zero pounds within the same timeframe. Assuming a 100% post-release mortality rate for females and undersized males, the total mortality (harvest and discards) associated with this alternative could be more than twice as high as the ACL associated with this alternative or 7,000 pounds (male and female). The AMs are expected to provide additional management review (compared with Alternative 1) to promote sustainable harvests of Kona crabs.
The incidental harvest of non-target species is currently minimal. Since the State of Hawaii

implemented a prohibition on the retention of female Kona crabs, the only bycatch that occurs are regulatory discards of female and undersized crabs. This alternative would not change the effects on non-target or bycaught species.

Alternative 5: Specify ACL 7,000 pounds

Under this alternative, NMFS would specify an ACL of 7,000 pounds. The impacts of alternative 5 is expected to be more beneficial than the no action alternative because it would establish a lower limit on the amount of Kona crab that may be harvested annually however it is not expected to be as beneficial as alternatives 3 or 4. Assuming a 100% post-release mortality rate for females and undersized males, the total mortality (harvest and discards) associated with this alternative could be more than twice as high as the ACL associated with this alternative or 14,000 pounds (male and female). The AMs are expected to provide additional management review (compared with Alternative 1) to promote sustainable harvests of Kona crabs.

The incidental harvest of non-target species is currently minimal. Since the State of Hawaii implemented a prohibition on the retention of female Kona crabs, the only bycatch that occurs are regulatory discards of female and undersized crabs. This alternative would not change the effects on non-target or bycaught species.

3.2.2 Overview of Fishery Participants in Hawaii

Participation in the fishery varies from year to year. Over the past 15 years, the number of CML holders in the Hawaii Kona crab fishery has steadily declined from 85 commercial fishermen in 2000, to a low of 24 fishermen in 2016. In the last four years, there were 30 or fewer CML holders participating in the fishery (Table 5). A substantial amount (>50%) of Hawaii Kona crab catches are from the EEZ or Federal waters, which is likely Penguin Bank (NMFS 2011). While Penguin Bank accounts for less than 20% of all trips taken for Kona crab, it has a significantly higher CPUE and occurrence of larger crabs (Thomas 2011).

The first full fishing year after the female crab prohibition took effect was 2007. From 2007 – 2009, the fleet averaged 38 fishermen annually who caught a total of 8,999 pounds over 204 trips (Table 6). The top three fishermen during that time accounted for an average of 60% of trips and 65% of the catch (in pounds). In more recent years, from 2014 – 2016, the fleet averaged 27 fishermen annually who caught a total of 2,659 pounds over 75 trips. The top three fishermen accounted during that time period accounted for 47% of trips and 33% of the catch (in pounds). In summary, when comparing the time period immediately after the female prohibition went into effect (2007 – 2009) to more recent years (2014 – 2016) the average number of fishermen, total catch, and total number of trips all decreased. In the years immediately after the female prohibition went into effect the top three fisherman accounted for approximately two-thirds of both the catch and number of trips while in more recent years the top three fishermen account for half of the total number of trips but only one-third of the catch.

In 2010 (the last year when price data was available), the commercial price per pound for Kona crab in Hawaii averaged $4.82. Based on that data, the annual commercial value of the fishery in

2016 was $12,423.

Assuming that three of the 24 participants accounted for a third of the total catch in 2016, these fishers would have caught 764 pounds of Kona crab with a value of $1,228 per fisherman. Assuming participation and effort of the remaining 21 participants were equal, each would have caught 86 pounds of Kona crab valued at $416 per fisherman.

Table 6. Comparison of catch and effort, by fleet and top 3 fishermen, between the periods 2007 – 2009 and 2014 – 2016.

	Time Period	Catch (pounds)	Trips	Fishermen
Fleet	2007 - 2009	8,999	204	38
	2014 - 2016	2,659	75	27
Top Three Fishermen	2007 - 2009	6,231 (65%)	124 (60%)	
	2014 - 2016	824 (33%)	36 (48%)	

3.2.2.1 Potential Effects of the Proposed ACL and AM Specifications on Hawaii's Kona Crab Fishery Participants

Alternative 1: No Management Action

Under the no-action alternative, which is the baseline alternative, the Hawaii Kona crab fishery would not be managed using annual catch limits, accountability measures would not be needed, and fishing would continue unconstrained and would be monitored by Hawaii DAR, NMFS and the Council with fisheries statistics becoming available approximately six months or longer after the data have been initially collected. This alternative would not comply with the Magnuson-Stevens Act or the provisions of the FEPs, which require ACLs to be specified for all stocks and stock complexes.

Under this alternative, NMFS expects fishing participation would remain relatively low and variable, with no more than 30 participants. NMFS also expects catches to continue as it currently has in recent years. Over the past ten years the average harvest has been 7,569 pounds; however the average harvest in 2014 – 2016 declined to 2,658 pounds. With similar catch and effort to recent years, landings value could range from approximately $1,228 for more active fisherman to $416 for less active fisherman.

Alternative 2: Specify ACL at 27,600 pounds

Under this Alternative, NMFS would specify an ACL of 27,600 pounds for Hawaii Kona crab in fishing year 2017. The ACL is equal to the ABC recommended by the Council's SSC and is set at the 75th percentile of the long-term catch. This ACL is the same ACL NMFS specified for the fishery in each 2012-2015. Under this alternative, NMFS does not expect the fishery would reach

the ACL and, therefore, the effects on fishery participants are expected to be similar to Alternative 1.

The AM for the Hawaii Kona crab fishery would require a post-season review of the catch data to determine whether the ACL was exceeded. If the ACL is exceeded, NMFS, as recommended by the Council would take action to correct the operational issue that caused the ACL overage. This could include a downward adjustment to the ACL in the subsequent fishing year. NMFS cannot speculate on operational measures or the magnitude of the overage adjustment that might be taken; therefore, the fishery and environmental impacts of future actions such as changes to the ACL or AM would be evaluated separately, once details are available.

Alternative 3: Specify ACL 0 pounds

Under this Alternative, NMFS would specify an ACL of 0 pounds for Hawaii Kona crab in fishing year 2017. While between 24 and 51 fishermen have been active in the commercial Kona crab fishery in Hawaii in the last decade, ~50% of trips are attributed to only three fishermen. Under this Alternative, the Kona crab fishery fleet as a whole and individual fisherman would experience zero revenue compared to Alternatives 1 and 2. The impact of this would be higher for the proportion of fishermen who are more frequently fishing for Kona crab.

Alternative 4: Specify ACL 3,500 pounds

Under this Alternative, NMFS would specify an ACL of 3,500 pounds for Hawaii Kona crab in fishing year 2017. If recent fishing trends continue, NMFS does not expect the fishery would reach the ACL but there is a chance it could be exceeded. While over the past ten years the average harvest has been 7,569 pounds the average harvest in 2014 – 2016 declined to 2,658 pounds. Therefore, the effects on fishery participants are expected to be similar to Alternative 1.

The AM for the Hawaii Kona crab fishery would require a post-season review of the catch data to determine whether the ACL was exceeded. If the ACL is exceeded, NMFS, as recommended by the Council would take action to correct the operational issue that caused the ACL overage. This could include a downward adjustment to the ACL in the subsequent fishing year. NMFS cannot speculate on operational measures or the magnitude of the overage adjustment that might be taken; therefore, the fishery and environmental impacts of future actions such as changes to the ACL or AM would be evaluated separately, once details are available.

Alternative 5: Specify ACL 7,000 pounds

Under this Alternative, NMFS would specify an ACL of 7,000 pounds for Hawaii Kona crab in fishing year 2017. If recent fishing trends continue, NMFS does not expect the fishery would reach the ACL but there is a chance it could be exceeded. Over the past ten years the average harvest has been 7,569 pounds; however the average harvest in 2014 – 2016 declined to 2,658 pounds. Therefore, the effects on fishery participants are expected to be similar to Alternative 1.

The AM for the Hawaii Kona crab fishery would require a post-season review of the catch data

to determine whether the ACL was exceeded. If the ACL is exceeded, NMFS, as recommended by the Council would take action to correct the operational issue that caused the ACL overage. This could include a downward adjustment to the ACL in the subsequent fishing year. NMFS cannot speculate on operational measures or the magnitude of the overage adjustment that might be taken; therefore, the fishery and environmental impacts of future actions such as changes to the ACL or AM would be evaluated separately, once details are available.

3.2.3 Protected Resources in Hawaii

A number of protected species are documented as occurring in the waters around the Hawaiian Islands and there is the potential for interactions with the crustacean fisheries of the Hawaii Archipelago. The Hawaii crustacean fisheries have been evaluated for impacts on protected resources and are managed in compliance with the requirements of the Magnuson-Stevens Act, the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA), the Migratory Bird Treaty Act, and other applicable statutes.

ESA listed species and ESA review of Hawaii Crustacean Fisheries

Table 5 lists endangered or threatened species occurring in the waters around Hawaii. They include a number of whales, the Hawaiian monk seal, and five listed sea turtles. NMFS evaluated Hawaii crustacean fisheries for potential impacts to ESA-listed marine species under NMFS jurisdiction and documented its conclusions in a March 13, 2008, Biological Opinion (BiOp). The BiOp concluded that Hawaii Crustacean fisheries are not likely to adversely affect ESA-listed species. In a letter of concurrence covering the Fishery Management Plan (FMP) for the Crustacean Fisheries of the Western Pacific, dated April 4, 2008, NMFS determined crustacean fisheries of Hawaii that operate in accordance with regulations implementing the FMP, inclusive of the spiny and slipper lobster fisheries, deepwater shrimp fisheries, and Kona crab fishery were not likely to adversely affect ESA-listed species or habitats.

In 2009, the Council recommended, and NMFS approved, the development of five archipelagic-based fishery ecosystem plans (FEPs) including the Hawaii Archipelago FEP. The FEP incorporated and reorganized elements of the Council's species-based FMPs, including the Crustacean FMP, into a spatially-oriented management plan (75 FR 2198, January 14, 2010). All applicable regulations concerning crustacean fishing were retained through the development and implementation of the FEP for the Hawaii Archipelago. No substantial changes to the crustacean fisheries around Hawaii have occurred since the FEP was implemented that have required further consultation.

In 2013, NMFS re-initiated ESA consultation for Hawaii crustacean fisheries in response to the listing of the MHI insular false killer whale DPS as an endangered species under the ESA. The consultation evaluated the effects of all Hawaii crustacean fisheries on all ESA-listed species and designated critical habitat. In a letter of concurrence dated December 5, 2013, NMFS determination that the continued authorization of crustacean fisheries in the Hawaiian Archipelago may affect, but is not likely to adversely affect, endangered or threatened species or designated critical habitat. Specifically, NMFS concluded that effects of the Hawaii crustacean

fisheries are expected to be insignificant, discountable or beneficial.

On August 21, 2015, NMFS designated critical habitat for the endangered Hawaiian monk seal in areas where the Hawaii Kona crab fishery fishes (80 FR 50926). Specific areas designated include sixteen occupied areas within the range of the species: ten areas in the Northwestern Hawaiian Islands and six in the MHI. These areas contain one or a combination of habitat types: preferred pupping and nursing areas, significant haul-out areas, and/or marine foraging areas, that will support conservation for the species. Specific areas designated as monk seal critical habitat in the MHI include marine habitat from the 200 m depth contour line, including the seafloor and all subsurface waters and marine habitat within 10 m of the seafloor, through the water's edge 5 m into the terrestrial environment from the shoreline between identified boundary points on the Islands of: Kaula, Niihau, Kauai, Oahu, Maui Nui (including Kahoolawe, Lanai, Maui, and Molokai), and Hawaii. In areas where critical habitat does not extend inland, the designation ends at a line that marks mean lower low water. The August 21, 2015, final rule designating monk seal critical habitat in the MHI, triggered consultation on the continuation of Crustacean fisheries in the Hawaiian Islands Archipelago. Given the generalist foraging habits of monk seals, the small number of participants in crustacean fisheries and the small area fished, potential effects to monk seals were expected to be insignificant. In a memo dated March 1, 2016, the consultation concluded with NMFS' finding that Crustacean fisheries are not likely to adversely affect the newly designated Hawaiian monk seal critical habitat, because the effects of the fisheries are expected to be discountable or insignificant.

On April 6, 2016, (81 FR 20058) NMFS published a final rule to list 11 DPS of the green sea turtle (*Chelonia mydas*) under the ESA. Based on the best available scientific and commercial data, and after considering comments on the proposed rule, NMFS determined that three DPS are endangered and eight DPS, including the Hawaiian green sea turtle (Central North Pacific DPS), are threatened. NMFS does not expect the number of green sea turtles taken in the Hawaii crustacean fisheries to change based on the designation of the DPS. The 2016 rule supersedes the 1978 final listing rule for green turtles and applies the existing protective regulations to the DPS. Critical habitat will be considered in future rulemaking.

3.2.3.1 Potential Effects of the Proposed ACL and AM Specifications on Protected Species in Hawaii

None of the alternatives considered would modify operations of the Hawaii Kona crab fishery in any way that would be expected to affect endangered or threatened species or critical habitat in any manner not previously considered in previous ESA or MMPA consultations.

Alternatives 2 – 5 would implement ACLs and a post season accounting of the catch relative to the ACL. There is currently no means of in-season tracking of catch in relation to an ACL, which precludes the ability to implement an in-season closure. This means participants in the Hawaii Kona crab fishery would continue to fish for Kona crab as they do under the current management regime. Since this fishery is currently subject to conservation measures in accordance with various resource conservation and management laws, and because no change would occur in the

Table 6*. Endangered and threatened marine species and seabirds occurring in the waters of the Hawaiian Archipelago*

Common name	Scientific Name	ESA listing status in Hawaii	Occurrence in Hawaii
Listed Sea Turtles			
Green sea turtle – Central North Pacific DPS	*Chelonia mydas*	Threatened DPS	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.
North Pacific loggerhead sea turtle	*Caretta caretta*	Endangered DPS	Not common in Hawaii.
Listed Marine Mammals			
Hawaiian Monk seal	*Neomonachus schauinslandi*	Endangered	Endemic tropical seal. Occurs throughout the archipelago. Declining population. Critical habitat established.
False Killer Whale, MHI Insular DPS	*Pseudorca crassidens*	Endangered	Rare.
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.
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, most abundant cetaceans in the region. Sighted off the NWHI and 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.
Dark-rumped petrel	*Pterodroma phaeopygia*	Endangered	Rare
Band-rumped storm-petrel	*Oceanodroma castro*	Endangered Hawaii DPS	Rare
Short-tailed Albatross	*Phoebastria albatrus*	Endangered	Found on Midway in the NWHI.

way fishing is conducted, none of the alternatives would result in a change to distribution, abundance, reproduction, or survival of ESA-listed species or increase interactions with protected resources. If at any time the fishery, environment, or status of a listed species or marine mammal species were to change substantially, or if the fishery were found to be occurring in or near areas that were designated as critical habitat, NMFS would undertake additional consultation as required to comply with requirements of the ESA and the MMPA.

3.3 Overview and Potential Effects of the Alternatives on Fishery Administration and Enforcement

3.3.1 Federal Agencies and the Council

The Council in accordance with the approved FEPs currently manages fisheries in Federal waters, and NMFS PIRO is responsible for implementing and enforcing fishery regulations that implement the FEPs. NMFS PIFSC conducts research and reviews fishery data provided through logbooks and fishery monitoring systems administered by state and territorial resource management agencies. The Council, PIRO and PIFSC collaborate with local agencies in the administration of fisheries of the western Pacific through other activities including coordinating meetings, conducting research, developing information, processing fishery management actions, training fishery participants, and conducting educational and outreach activities for the benefit of fishery communities.

NOAA's Office of Law Enforcement (OLE) is responsible for enforcement of the nation's marine resource laws, including those regulating fisheries and protected resources. OLE, Pacific Islands Division oversees enforcement of Federal regulations in American Samoa, Guam, the CNMI and Hawaii and enters into Joint Enforcement Agreements (JEA) with each participating state and territory.

The U.S. Coast Guard's (USCG) Fourteenth District (Honolulu) jurisdiction is the U.S. EEZ as well as the high seas in the Western and Central Pacific. At over 10 million square miles, its area of responsibility is the largest of any USCG District. The USCG patrols the region with airplanes, helicopters, and surface vessels, as well as monitors vessels through VMS. The USCG also maintains patrol assets on Guam.

The proposed ACL and AM specifications would not require a change to monitoring or collecting fishery data. However, monitoring of catch data towards an ACL would be conducted by PIFSC in collaboration with local resource management agencies, and is expected to result in improved timeliness in processing species specific catch reporting on an annual basis. No changes to the role of law enforcement agents or the U.S. Coast Guard would be required in association with implementing these specifications. The ACL and AM specifications would not result in any change to the fishery that would pose an additional risk to human safety at sea.

3.3.2 Local Agencies

Currently, local marine resource management agencies in each of the four areas are responsible for the conservation and management of fishery resources. These agencies monitor catches through licenses and fishery data collection programs, conduct surveys of fishermen and scientific surveys of fish stocks, establish and manage marine protected areas, provide outreach and educational services, serve on technical committees, and enforce local and Federal resource laws through Joint Enforcement Agreements, among other responsibilities.

The specification of ACLs and AMs for Kona crab in Hawaii is not expected to result in changes to fishery monitoring by the local resource management agencies, at this time. However, monitoring of catch data for ACL purposes would continue to be conducted by PIFSC in collaboration with local resource management agencies and the requirements to conduct post-season review of catch relative to the ACLs are expected to result in improved timeliness in processing species specific catch reporting on an annual basis.

No change to enforcement activities would be required in association with implementing these specifications because there is no fishery closure recommended for any of the areas. Additionally, the ACL and AM specifications would not result in any change to any fishery and therefore, the proposed specification would not result in additional risk to human safety associated with crustacean fishing in Hawaii.

3.4 Environmental Justice

Under the no-action alternative, the continued management of Federal crustacean fisheries without ACLs or AMs is not expected to have large adverse environmental effects because the fisheries of the western Pacific region are subject to ongoing regulations that help ensure fishing is sustainable. Under the action alternatives, the proposed ACLs and AMs would apply to all catches of Kona crab.

Fisheries management programs that are currently in place, and management under either of the action alternatives are intended to provide for sustainability of crustaceans. Sustainable fisheries management helps ensure that marine seafood resources and the human communities that rely on their harvest, are properly managed over the short and long term.

The proposed specifications are not likely result in any large adverse impacts to the environment that could have disproportionately large or adverse effects on members of Environmental Justice communities in Hawaii. None of the alternatives would have an adverse effect on sustenance harvests.

3.5 Climate Change

Changes in the environment from global climate change have the potential to affect crustacean and precious coral 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 (Buddemeier 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.

The impacts from climate change may be difficult to discern from other impacts; however monitoring of physical conditions and biological resources by a number of agencies would continue to occur and would allow fishery managers to continually make adjustments in fishery management regimes in response to changes in the environment.

Under the no-action alternative, fishing would occur as it has been in the recent past. No ACL or AM would be specified. As shown in the EA effects analyses above, the ACLs and AMs would not result in a change to any fishery including target species, gear used, areas fished, or effort. This is primarily because there is no in-season management measure (such as a fishery closure) to ensure a fishery does not exceed an ACL. Because the proposed specifications are not expected to result in a change to the manner in which any of the affected fisheries are conducted, neither of the action alternatives would result in a change in greenhouse gas emissions from fishing vessels.

3.6 Additional Considerations

3.6.1 Overall Effects

When compared against recent fishing harvests, most of the proposed ACLs would be higher than recent catches. The ACLs are considered an acceptable level of catch that would prevent overfishing and provide for long-term sustainability of the target stocks. However, the assumptions of the models that were used to develop an ACL are likely in need of scientific refinement and further review. NMFS will be obtaining new information on Kona crab through the revised stock assessment work that is scheduled for 2018. Per National Standard 2, mandatory management actions should not be delayed due to limitations in the scientific information or the promise of future data collection or analysis.

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