WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

PRELIMINARY DRAFT

Updating the Acceptable Biological Catch (ABC) and Annual Catch Limits (ACLs) for the Hawaii Kona Crab Fishery for Fishing Year 2020-2023 to 2023-2026

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Prepared by the Western Pacific Regional Fishery Management Council's

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1 Introduction

At its upcoming 148th and 195th meeting, the SSC and Council will review options to specify a multi-year ACL, ACT and AMs in fishing years 2024-2026 for the Hawaii Kona crab fishery.

1.1 Background information

Fisheries for crustacean management unit species (MUS) in Federal waters of the exclusive economic zone (EEZ; generally 3-200 nmi) around the U.S. Pacific Islands are governed by one of four fishery ecosystem plans (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 or MSA). Three of the FEPs are archipelagic-based: the American Samoa Archipelago FEP, the Hawaii Archipelago FEP, and the Mariana Archipelago FEP (covering Federal waters around Guam and the Commonwealth of the Northern Mariana Islands, or the CNMI). The fourth FEP covers Federal waters of the U.S. Pacific remote island areas (PRIA), which include Palmyra Atoll, Kingman Reef, Jarvis Island, Baker Island, Howland Island, Johnston Atoll, and Wake Island.

In accordance with the Magnuson-Stevens Act, the FEPs, and regulations at 50 CFR 665.4, NMFS must specify an annual catch limit (ACL) and implement accountability measures (AM) for crustacean MUS as recommended by the Council and in consideration of the best available scientific and commercial information available about the fishery for that stock or stock complex. The ACL may not exceed the acceptable biological catch (ABC) recommended by the Council's Science and Statistical Committee (SSC). Throughout the Western Pacific region, fishing for Kona crab is only active in the Main Hawaiian Islands (MHI), with Penguin Banks in particular being an important location for the fishery (Onizuka 1972).

The Hawaii commercial Kona crab fishery is subject to a suite of management regulations, including a prohibition on taking of female Kona crab, minimum size for male crabs of 4 inches (carapace length, Hawaii Revised Statutes §13-95.51), 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). Commercial fishermen are required to have a Commercial Marine License (CML) issued by the State of Hawaii to harvest Kona crab for commercial purposes, and are required to report catch on a monthly basis. These reports allow for the in-season monitoring of commercial kona crab landings.

1.2 Best Scientific Information Available

A stock assessment of the Main Hawaiian Islands Kona crab fishery was conducted in 2018 using data from 1957 through 2016 (Kapur et al. 2019). This 2018 benchmark assessment improved upon filtering of data records by re-defining fishing effort as a single reported fishing day and exploring fisher effects (individual fisher effects and cumulative fishing experience) in catch per-unit effort (CPUE) standardization. Additionally, this 2018 assessment addressed uncertainty previously unaccounted for, including unreported catch, incidental mortality of female crab catch following the prohibition of female crab harvest in 2006, and a Bayesian prior on the initial ratio of biomass to carrying capacity. The assessment used a state-space Bayesian surplus production model in a new user-friendly framework, Just Another Bayesian Biomass Assessment (JABBA). The model fit standardized CPUE data in a generalized Pella-Tomlinson

surplus production model. Parameter distributions were estimated in a Bayesian framework, which estimates parameter posterior distributions starting from prior distributions and fitted to data. Annual harvest rates (H), harvest rate at maximum sustainable yield (H_{MSY}), annual biomass (B), and biomass at maximum sustainable yield (B_{MSY}) were estimated in JABBA, among other outputs.

Results from the benchmark stock assessment conclude that in 2016, the Hawaii Kona crab fishery was not overfished (defined as $B/B_{MSY} < 0.7$) with a 0.0 percent probability of the status being overfished in 2016. In 2016, the stock was not experiencing overfishing (defined as $H/H_{MSY} >1$), with 0.0 percent probability of overfishing occurring.

At its 131st meeting, the SSC deemed the 2018 benchmark assessment of the main Hawaiian islands Kona crab as the best scientific information available for the stock status determination and setting for harvest limits.

Table 1: Recent history of ACL and AM recommendations for Hawaii Kona crab

Fishing year	Council Recommended ACL/ACT	NMFS Implemented ACL/ACT	NMFS Implemented AM	Total Recorded Catch (pounds.)	Proportion of ACL or ACT caught
2011	N.A.	N.A.	N.A.	10,609	NA
2012[1]	27,600	27,600	Post-Season Review	8,149	30%
2013	27,600	27,600	Post-Season Review	9,551	35%
2014	27,600	27,600	Post-Season Review	2,999	11%
2015	27,600	27,600	Post-Season Review	2,293	8%
2016	27,600	N.A.	N.A.	2,518	9%
2017	3,500	3,500	Post-Season Review	1,690	48%
2018	N.A.	N.A.	N.A.	2,586	NA
2019[2]	3,500	3,500	Post-Season Review	5,688	163%
2020	30,802/25,491	30,802/25,491	Post-Season Review	4,201	16 %
2021	30,802/25,491	30,802/25,491	Post-Season Review	3,822	15%
2022	30,802/25,491	30,802/25,491	Post-Season Review	2,533	10%
2023	30,802/25,491	30,802/25,491	Post-Season Review	Current Year	Current Year

Source: Adapted from NMFS (2017).

2 Specification for the MHI Kona Crab Fishery

2.1 Current OFL, ABC, ACL Specification

2.1.1 *Estimation of OFL*

Estimated posterior distributions of base case assessment model parameters were used in forward projections for fishing years 2020–2026 to estimate the probability of overfishing, P*, from 2020–2026 under option future catches. The projection results accounted for uncertainty in the distribution of estimates of model parameters from the posterior of the base case model. The projections were conducted assuming each value for the future total catch was constant for each fishing year 2020–2026. Projections were used to compute reported catches for 2020–2026 that

[1] Fishing year 2012 (beginning January 1, 2012) was the first year the Kona crab fishery was subject to ACLs and AMs in the MHI.

[2] Fishing year 2019 was 63 percent over the ACL. Results from the 2019 assessment conclude that overfishing was not occurring (Kapur et al.)

would produce probabilities of overfishing varying from 0% to 50% at 1% intervals. The future catch corresponding to a 50% risk of overfishing can be considered the overfishing limit (OFL).

2.1.2 *Stock Status*

Under all of the western Pacific FEPs, overfishing occurs when the fishing mortality rate (F) is greater than the fishing mortality rate that produces MSY (F_{MSY}) for one year or more. This threshold is termed the maximum fishing mortality threshold (MFMT) and is expressed as a ratio, $F_{year}/F_{MSY} = 1.0$. Thus, if the F_{year}/F_{MSY} ratio is greater than 1.0 for one year or more, overfishing is occurring. For Kona crab, catch averaged over three years is used to calculate F_{year}. A stock is considered overfished when its biomass (B) has declined below the level necessary to produce MSY on a continuing basis (B_{MSY}). This threshold is termed the minimum stock size threshold (MSST) and is expressed as a ratio, $B/B_{MSY} = 0.7$. Thus, if the B/B_{MSY} ratio is less than 0.7, the stock complex is considered overfished.

In 2016, the most recent year for which stock status information is available, $H_{2016}/H_{MSY} = 0.07$ while $B_{2016}/B_{MSY} = 1.39$ (Kapur et al. 2019;

Table 2). The production model results indicate that the MHI Kona crab stock was not experiencing overfishing at that time, and was not overfished (

Table 2).

Table 2. Posterior estimates of parameters and results from Hawaii Kona crab production model presented in the 2018 benchmark stock assessment

Parameter	Median	95% LCI	95% UCI
K (lb)	1,445,595	917,297	2,809,544
r (yr^{-1})	0.17	0.10	0.26
M	1.50	0.72	3.03
Ψ	0.71	0.50	0.95
q_1	0.00005	0.00002	0.00009
q_2	0.00003	0.00001	0.00006
σ_η	0.09	0.05	0.13
$\sigma_{\tau_{estimated,1}}$	0.09	0.05	0.13
$\sigma_{\tau_{estimated,2}}$	0.08	0.04	0.19
H_{MSY}	0.11	0.05	0.24
B_{MSY} (lb)	640,489	342,488	1,392,849
MSY (total lb)	73,069	48,045	127,364
MSY (reported lb)	25,869	17,010	45,092
P_{2016}	0.61	0.39	0.84
B/B_{MSY} 2016	1.39	0.76	2.29
H/H_{MSY} 2016	0.07	0.02	0.17

Source: Kapur et al. (2019).

Commercial catch also varies from year to year (Figure 1). Over the past ten years (2012 – 2022) the average annual reported harvest has been 3,887 lbs., though the three-year (2020-2022) recent average catch has declined to 3,518 lbs. From 2000 to 2010 a substantial amount (30-75%) of catch came from within the EEZ (NMFS 2011). Penguin Bank, which is entirely in federal waters, is an important location for Kona crab fishing (Onizuka 1972).

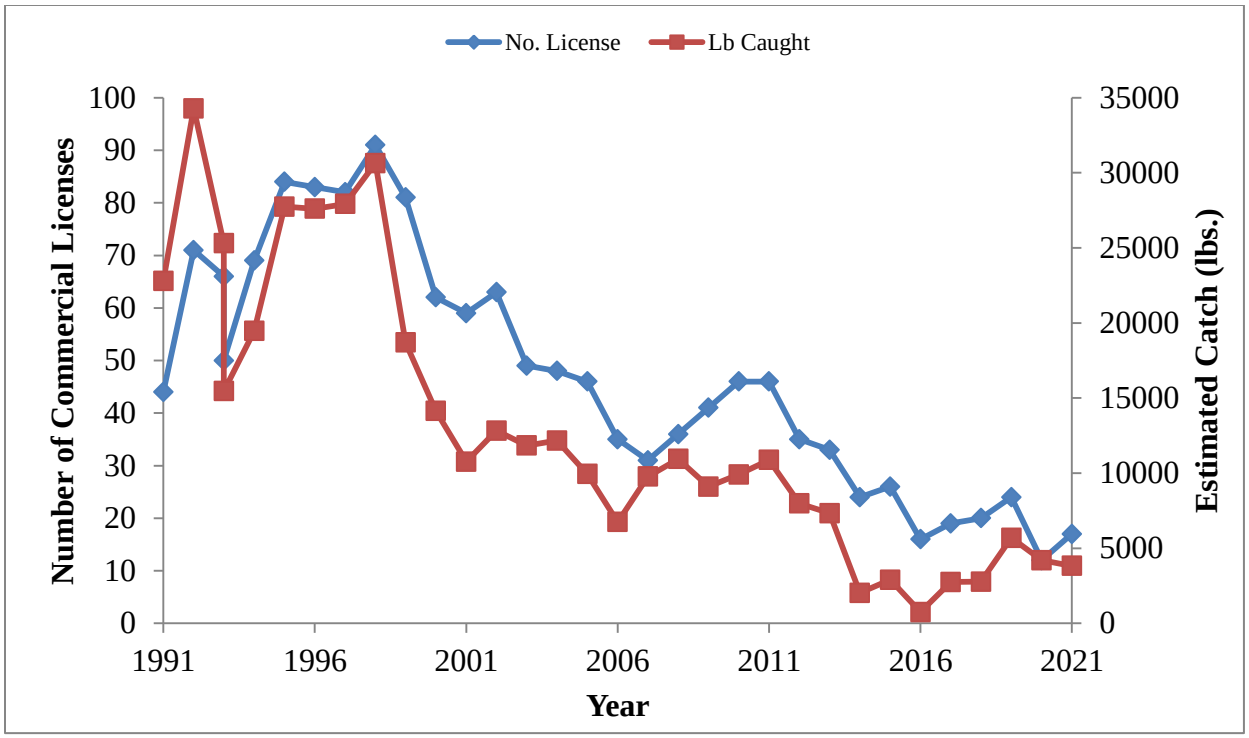

Figure 1. Number of Commercial Marine License holders reporting catch of Kona crab and annual reported landings of Kona crab in the Main Hawaiian Islands from 1991 to 2021.
Source: WPRFMC (2022).

Participation in the MHI Kona crab fishery varies from year to year. Over the past 20 years, the number of CML holders in the Hawaii Kona crab fishery has steadily declined from 64 commercial fishermen in 2002 to a low of 12 fishermen in 2020 (**Error! Reference source not found.**; Figure 1). In each of the last four years, there were 30 or fewer CML holders participating in the fishery accounting for less than 65 trips annually (**Error! Reference source not found.**), though the majority (~50-60%) of trips are attributed to only three fishermen.

Table 3: Annual fishery parameters for Kona crab harvested by loop net in Hawaii from 2002 to 2022

Year	Number of Licenses	Number of Fishing Trips	Estimated Total Catch (lbs.)	CPUE
2002	64	196	11,372	58.02
2003	51	165	11,755	71.24
2004	49	158	12,685	80.28
2005	51	170	11,750	69.12
2006	38	160	9,143	57.14
2007	33	133	5,653	42.50
2008	35	221	13,153	59.52
2009	43	168	7,519	44.76

Year	Number of Licenses	Number of Fishing Trips	Estimated Total Catch (lbs.)	CPUE
2010	39	209	11,449	54.78
2011	49	190	10,609	55.84
2012	41	128	8,149	63.66
2013	28	106	9,551	90.10
2014	29	59	2,999	50.83
2015	24	64	2,293	35.83
2016	23	49	2,518	51.39
2017	17	36	1,690	46.94
2018	22	57	2,561	44.93
2019	24	86	5,688	66.14
2020	12	60	4,201	70.02
2021	17	69	3,822	55.39
2022	19	53	2,533	47.79
Avg. 20-22	**16**	**61**	**3,518**	**57.73**

Source: WPRFMC (2023).

2.1.3 *Current ABC, ACL and ACT Specification*

In March 2019, the Pacific Island Fisheries Science Center (PIFSC) released the final 2018 benchmark stock assessment for the MHI Kona crab fishery (Kapur et al. 2019). This assessment underwent scientific peer review by a Western Pacific Stock Assessment Review (WPSAR) panel on September 10 to 14, 2018. The WPSAR was open to the public and advertised through notices in the *Federal Register* (83 FR 28808, June 21, 2018). Overall, the WPSAR Panel concluded that the results of the assessment can be used to determine stock status and set harvest limits. Using the 2018 stock assessment conforms to the National Standard 2 of the Magnuson-Stevens Act, which requires the use of the best scientific information available for management.

The development for the 2020 – 2023 ACL, ACT and AMs for the MHI Kona crab fishery was made during the 176th Council public meetings. At its 176th meeting in March 19, 2019, the Council received the presentation from PIFSC on the benchmark assessment and accepted the SSC BSIA recommendation and directed staff to organize a working group to quantify the scientific uncertainty through the P* process and the management uncertainty through the SEEM process. Both the Council and SSC meetings were open to the public and advertised through notices in the *Federal Register* (84 FR 3760, February 13, 2019), and on the Council's website.

At its 178th meeting in June 25, 2019, the Council considered and discussed issues relevant to ACL, ACT and AM specifications for the MHI Kona crab fishery, including the ABC recommendations from the Council's SSC at its 132nd meeting held in June 18, 2019. The SSC considered and discussed the results of the P* analysis that quantified the scientific uncertainty that generated the risk of overfishing level that was used to set the ABC at 30,802 pounds(P*=38%). The Council considered and discussed the results of the SEEM analysis that quantified the social, ecological, economic and management uncertainty that was used to specify the ACL and set the ACT at 25,491 pounds (P*=20%). The Council recommended the ACT was

set 10 percent lower than the P* and SEEM analysis to provide a conservative approach as the State of Hawaii was in the process of removing regulations on no-take of females. Both the Council and SSC meetings were open to the public and advertised through notices in the *Federal Register* (84 FR 24759, May 29, 2019), and on the Council's website. The public had an opportunity to comment at the meetings on the proposed ACL and ACT specifications and AMs.

2.2 Current Task for the SSC

Setting the Acceptable Biological Catch

The SSC's current task is to specify the ABC for Kona Crab in the main Hawaiian Islands for the 2024 to 2026 fishing year. The ABC may not exceed the projected overfishing limit based on the 2019 stock assessment (Kapur et al.). the Council's ACL process is described in the FEPs, and includeds methods by which the ABC may be reduced from the OFL based on scientific uncertainties through a Risk of Overfishing Analyst (P* Analysis). Since the MHI Kona crab fishery is a Tier 1 stock, the SSC applied the P* analysis to set the ABC.

2.2.1 *ABC Options for MHI Kona Crab*

2.2.1.1 Option 1: No Action – Do not set the ABCs

Under Option 1, the SSC would not set an ABC level for NMFS to specify for Hawaii Kona crab harvested in fishing years 2024–2026. This option would not comply with the Magnuson-Stevens Act (50 CFR 665.4) or the provisions of the Hawaii FEP, which require the Council to specify an ACL for all managed stocks and stock complexes in a fishery. In order to set the ACL, an ABC is required according to the control rules. Option 1 serves as the baseline for environmental effects analyses involving other options.

2.2.1.2 Option 2: Status Quo – Set ABC based on the 2018 benchmark stock assessment at P*=38 percent equivalent to 30,802 lbs

Under Option 2, the SSC would set the ABC of 30,802 lb of MHI Kona crab for the 2024 to 2026 fishing year. Based on the probability of overfishing projections contained in the 2018 benchmark stock assessment, an ABC of 30,802 lb is associated with a 38 percent risk of overfishing. This catch level and those that follow indicate reported commercial catch, following the results of the 2018 stock assessment. These catch projections account for estimated mortality of female crabs discarded due to State regulations.

Using this new benchmark assessment information conforms with the National Standard 2 of the Magnuson-Stevens Act, which requires the use of the best scientific information available for management. This option also utilizes the information from the P* working group meeting that accounted for the scientific uncertainties following the specification process described in the Hawaii FEP.

This Option is more precautionary than the No action Option, which would not specify an ACL.

2.2.1.3 Option 3: Set ABC based on the 2018 benchmark stock assessment at P*=28 equivalent to 27,790 lbs

Under Option 3, the SSC would set the ABC of 27,970 lb for the 2024 to 2026 fishing year. Based on the probability of overfishing projections contained in the 2018 benchmark stock assessment of Kona crab in the MHI, an ABC of 27,970 lb is associated with a 28 percent risk of overfishing.

This Option is more precautionary than the No Action Option, but it is more conservative then the Status quo Option. The ABC under Option 3 is 2,832 lb lower than the ABC under the Option 3 and is associated with a probability of overfishing that is also 10 percent lower than the P* value associated with the Option 2.

This additional 10 percent buffer between Option 2 and 3 is not related to a particular scientific uncertainty issue, but provides an additional option for considering precautionary management in the event that the SSC believed that there were other unidentified factors that may add to the uncertainties in managing this stock. Additionally, this ABC allows the SSC to evaluate the effects of an ABC that is lower than Option 2, in the event the fishery requires a reduction in ABC in a subsequent fishing year.

2.2.1.4 Option 4: Set ABC based on the 2018 benchmark stock assessment at P*=18 percent equivalent to 24,783 lbs

Under Option 4, the SSC would set the ABC of 24,783 lb for the 2024 to 2063 fishing year. Based on the probability of overfishing projections contained in the 2018 benchmark stock assessment of Kona crab in the MHI, an ABC of 24,783 lb is associated with an 18 percent risk of overfishing.

This Option is more precautionary than the No action Option, but it is less conservative then the Status quo Option. The ACL under Option 5 is 6,019 lb lower than the ACL under the Status quo Option and is associated with a probability of overfishing that is also 20 percent lower than the P* value associated with the Option 2 and 10 percent lower than Option 3. Thus, this Option is more conservative than Option 2 and 3.

As with Option 3, this additional 20 percent buffer between Option 2 and 4 is not related to a particular scientific uncertainty issue, but provides an additional option for considering precautionary management in the event that the SSC believed that there were other unidentified factors that may add to the uncertainties in managing this stock. Additionally, this ABC allows the SSC to evaluate the effects of an ABC that is lower than Option 3, in the event the fishery requires a reduction in ABC in a subsequent fishing year becomes necessary.

2.3 Current Task for the Council

Specifying Annual Catch Limits

The Council's previous recommendation covered to fishing year 2020-2023. At its 195th meeting, the Council will consider specifying the ACL for the next three-year ACL starting 2023 to 2026 for MHI Kona Crab. No new scientific information will be available in the foreseeable future. The ACL can be set equal or below the SSC recommended ABC. The Council's ACL process is described in the FEPs, and includes methods by which the ACL may be reduced from the ABC based on social, economic, ecological and management uncertainty through a SEEM Analysis.

2.3.1 *ACL Options for MHI Kona Crab*

2.3.1.1 Option 1: No Action – Do not set the ABCs

Under Alternative 1, Council would not specify an ACL for the MHI Kona crab fishery for fishing year 2024-2026. This Alternative would not be consistent with the Magnuson-Stevens Act requirements (50 CFR 665.4) or the provisions of the Hawaii FEP, which require NMFS to specify an ACL and AMs for all stocks and stock complexes.

2.3.1.2 Alternative 2: Specify an ACL of 30,802 pounds and an ACT of 25,491 pounds (Status quo)

Under Alternative 2, Council would specify ACL equal to ABC at a 38 % risk of overfishing and an associated catch limit of 30,802 pounds. Council would set an ACT of 25,491 pounds of MHI Kona crab for the 2024-2026 fishing years. This ACL is identical to the ACL NMFS implemented for the fishery in fishing years 2020 through 2023 (85 FR 665), which expires on December 31, 2023. This rule was based on the probability of overfishing projections contained in the 2018 benchmark stock assessment of Kona crab in the MHI (Kapur et al. 2019), an ACT of 25,491 pounds is associated with a 20 % risk of overfishing.

Based on the 2018 benchmark stock assessment, the MSY is estimated to be at 73,069 pounds, and the OFL is estimated at 33,989 pounds. Using the benchmark assessment information conforms with National Standard 2 of the Magnuson-Stevens Act, which requires the use of the best scientific information available for management. This alternative also utilizes the information from the P* and SEEM working group meetings to account for the scientific and management uncertainties following the ACL specification process described in the Hawaii FEP.

This Alternative is more precautionary than the No action Alternative and Alternative 3, but it is less conservative then Alternative 4. The ACL is 2,833 pounds lower than the ACT under the Alternative 3 and is associated with a probability of overfishing that is also 10 % lower than the P* value associated with the Alternative 3. Thus, this Alternative is more conservative than Alternative 3.

To summarize discussion of the SSC at the 132nd meeting when the SSC set the ABC for fishing years 2020-2023, this additional 10 % buffer in the ACT from the ACL and ABC and 30 % buffer from the OFL was not related to a particular social, economic, ecological or management issue, but provides an additional option for considering precautionary management in the event that the SSC or Council believed that there were other unidentified factors that may add to the uncertainties in managing this stock.

2.3.1.3 Alternative 3: Specify an ACL at 30,802 pounds and ACT at 28,324 pounds

Under Alternative 3, Council would specify the ACL equal to ABC at a 38% risk of overfishing with an associated catch limit of 30,802 pounds and set an ACT of 28,324 pounds of MHI Kona crab for the 2024-2026 fishing year. Based on the probability of overfishing projections contained in the 2018 benchmark stock assessment of kona crab in the MHI (Kapur et al. 2019), and ACT of 28,324 pounds is associated with a 30% risk of overfishing, which is 10 percent higher than the status quo alternative.

This Alternative is more precautionary than the No action Alternative, which would not specify an ACL, but it is less conservative then Alternative 2, which would specify an ACT of 25,491 pounds. The ACT under Alternative 3 is 2,833 pounds greater than the ACL under the Alternative 2.

2.3.1.4 Alternative 4: Specify an ACL at 30,802 pounds and ACT at 21,243 pounds

Under Alternative 4, Council would specify the ACL equal to the ABC at a 38% risk of overfishing with an associated catch limit of 30,802 pounds and set an ACT of 21,243 pounds of MHI Kona crab for the 2024-2026 fishing year. Based on the probability of overfishing projections contained in the 2018 benchmark stock assessment of Kona crab in the MHI (Kapur et al. 2019), an ACT of 21,243 pounds is associated with a 10 % risk of overfishing.

This Alternative is more precautionary than the all other Alternatives. The ACT is 4,248 pounds lower than the ACT under the Alternative 2 and is associated with a probability of overfishing that is also 10 % lower than the P* value associated with the Alternative 2. Thus, this Alternative 4 is more restrictive than Alternative 2.

As with Alternative 2, the additional 10 % buffer in the ACT from the ACL and ABC and 40 % buffer from the OFL was not related to a particular social, economic, ecological or management issue, but was considered to provide an additional option for precautionary management in the event that the SSC or Council believed that there were other unidentified factors that may add to the uncertainties in managing this stock. Additionally, this ACT allows decision makers to evaluate the effects of an ACT that is lower than the Alternative 2, in the event the fishery exceeds the ACT of 25,491 pounds in a fishing year, and a reduction of the ACT and ACL in a subsequent fishing year becomes necessary.

3 Summary of New Information for the Impact Analysis

The table below summarizes the new information (if any) that can be used to evaluate the impacts of the Options on the target stocks and their surrounding environment.

Table 4. Summary of new information on impacts of various options described

New information on physical resources	There is no new information available. The action will not likely to have an adverse impact to the physical environment.

New information on biological resources	The 2018 benchmark stock assessment incorporated new information on post-release mortality for the main Hawaiian island Kona crab (Wiley and Pardee 2018). This study also indicated that the MHI Kona crab are able to regenerate broken limbs and are able to survive contrary to what was previously believed about this species.
• **Target**	No new information.
• **Non-target**	The action will not likely change the conduct of the fishery because this fishery is a selective fishery. The fishery utilizes loop net and targets mainly Kona crab. Females are being returned to the ocean.
• **Bycatch**	There is insignificant bycatch in this fishery since only Kona crab gets tangled in the loop nets.
• **Protected species**	Crustacean fisheries are not likely to adversely affect the newly listed OWT, GMR, or insular FKW critical habitat. Had previous consultation coverage for other ESA listed species.
• **Biodiversity and eco-function**	The action will not likely have an adverse effect on biodiversity and ecosystem function since the fishery has been landing well below the ACL since 2012.
New information on socio-economic setting	No new socio-economic information aside from the updated fishing participation data from the Hawaii Annual SAFE Report
New information on management setting	No new information.
• **Marine Protected Areas**	No new information and the action are not likely to adversely affect the management of MPAs. The fishery occurs outside the protected areas.
• **EFH/HAPC**	No new information.

4 References

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