ACTION PLAN TEAM WORKING DRAFT

Amendment 6 to the Fishery Ecosystem Plan for the Hawaii Archipelago Including a Fishery Impact Statement

Establishment of Status Determination Criteria for Main Hawaiian Islands Kona Crab

Regulatory Identification Number (RIN) 0648-XXXX

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Cover Page

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Abstract

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) authorizes the National Oceanic and Atmospheric Administration (NOAA), the National Marine Fisheries Service (NMFS), Western Pacific Regional Fishery Management Council (Council) to manage crustacean management unit species (CMUS) in the United States (U.S.) Exclusive Economic Zone (EEZ) of the western Pacific. NMFS proposes to implement status determination criteria (SDC) for Kona crab, *Ranina ranina*, in the Fishery Ecosystem Plan for the Hawaii Archipelago (Hawaii FEP) as recommended by the Council.

Despite active federal management of Kona crab through annual catch limits (ACLs) and periodic stock assessments, there exists no SDC by which NMFS can make a stock status determination for the fishery and transmit it to Congress. NMFS and the Council manage the Kona crab fishery in the Main Hawaiian Islands (MHI) through the Hawaii FEP that was developed by the Council and implemented by NMFS, and the Magnuson-Stevens Act requires the specification of SDC in the FEP for all managed species. To fill the regulatory gap for Kona crab in the Hawaii FEP, the Council recommended amending the FEP to establish SDC for the MHI Kona crab fishery to align with provisions of the Magnuson-Stevens Act's National Standards.

Establishing the proposed SDC for Kona crab is intended to bring the Hawaii FEP into compliance with the National Standard 1 and allow for the determination and reporting of stock status as mandated by the Magnuson-Stevens Act. The nature of the proposed SDC would allow status determination for the species based on the results of the previous stock assessment and would similarly be applied to the results of forthcoming assessments. Without specifying these

SDC, the Hawaii FEP would remain out of compliance with the Magnuson-Stevens Act and preclude the use of results of previous or subsequent stock assessments for status determination.

This amendment evaluates the potential impacts of the three alternatives:

1. No Action
2. Establish SDC for MHI Kona crab, consistent with the most recent Kona crab stock assessment
3. Establish SDC for MHI Kona crab based on SDC for other crab fisheries

How to Comment

Instructions on how to comment on this document and the associated proposed rule can be found by searching on RIN 0648-XXXX at www.regulations.gov or by contacting the responsible official or Council at the above address. Comments are due on the date specified in the instructions.

ACRONYMS AND ABBREVIATIONS

ABC – Acceptable Biological Catch
ACL – Annual Catch Limit
AM – Accountability Measure
β – Critical Biomass Threshold
B – Biomass
B_{FLAG} – Warning reference point to trigger management action prior to biomass reaching MSST
B_{MSY} – Biomass at MSY
BSIA – Best Scientific Information Available
CBSAC – Chesapeake Bay Stock Assessment Committee
CE – Categorical Exclusion
CFR – Code of Federal Regulations
CIE – Center for Independent Experts
Council – Western Pacific Fishery Management Council (also WPFMC)
CML – Commercial Marine License
CMUS – Crustacean Management Unit Species
CPUE – Catch Per Unit Effort
DLNR – Hawaii Department of Land and Natural Resources
EEZ – Exclusive Economic Zone
EFH – Essential Fish Habitat
F – Fishing Mortality
F_{MSY} – Fishing Mortality at MSY
F_{OFL} – Fishing Mortality used to calculate OFL
FEP – Fishery Ecosystem Plan
FIS – Fishery Impact Statement
FMP – Fishery Management Plan
FR – *Federal Register*
HAPC – Habitat Areas of Particular Concern
Hawaii FEP – Fishery Ecosystem Plan for the Hawaii Archipelago
HDAR – Hawaii Division of Aquatic Resources
LOF – List of Fisheries
MHI – Main Hawaiian Islands
Magnuson-Stevens Act – Magnuson-Stevens Fishery Conservation and Management Act
MFMT – Maximum Fishing Mortality Threshold
MMB – Mature Male Biomass
MSST – Minimum Stock Size Threshold
MSY – Maximum Sustainable Yield
MUS – Management Unit Species
N – Abundance
NEFMC – New England Regional Fishery Management Council
NEPA – National Environmental Policy Act
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
NPFMC – North Pacific Regional Fishery Management Council
NWHI – Northwestern Hawaiian Islands
OFL – Overfishing Limit

OY – Optimum Yield
PIFSC – NMFS Pacific Islands Fisheries Science Center
PIFSC-SAP – NMFS Pacific Islands Fisheries Science Center Stock Assessment Program
PIRO – NMFS Pacific Islands Regional Office
RA – NMFS Regional Administrator
sCPUE – Commercial Standardized Catch Per Unit Effort
SDC – Status Determination Criteria
sFIS – Standardized Fishery-Independent Survey data
SIS – NMFS Species Information System
SSC – Scientific and Statistical Committee
TACC – Total Allowable Commercial Catch
U – Exploitation Rate
U.S. – United States
WPacFIN – Western Pacific Fisheries Information Network
WPFMC – Western Pacific Fishery Management Council (also Council)
WPSAR – Western Pacific Stock Assessment Review

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1 INTRODUCTION

1.1 Background Information

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) established the Western Pacific Fishery Management Council (WPFMC, or the Council) in 1976 to develop management plans for fisheries within the United States Fishery Conservation Zone around Hawaii, U.S. Pacific territories, commonwealth, and possessions of the United States in the Pacific Ocean (16 U.S.C. § 1801 *et seq.*). Crustacean fisheries in the Main Hawaiian Islands (MHI) harvest federally managed crustacean management unit species (CMUS), inclusive of the Kona crab, *Ranina ranina* (Linnaeus 1767), also referred to as the "spanner crab" or "frog crab."

The Council and the National Marine Fisheries Service (NMFS) manage the MHI Kona crab fishery in federal waters (i.e., the U.S. Exclusive Economic Zone, or EEZ, 3 to 200 nm from shore) around the MHI in accordance with the Fishery Ecosystem Plan (FEP) for the Hawaii Archipelago (Hawaii FEP; WPFMC 2009), the Magnuson-Stevens Act, and implementing regulations at 50 CFR 665. The State of Hawaii manages the Kona crab fishery in State waters (i.e., generally 0 to 3 nm from shore) that are not part of the Hawaii FEP management area, though the State of Hawaii and NMFS collaborate to implement complementary management for some federal fisheries.

Previously, the Council's Crustaceans Fishery Management Plan (FMP), implemented in 1983, considered Kona crab as a management unit species (MUS) since it was incidentally caught in the now-dormant Northwestern Hawaiian Islands (NWHI) spiny lobster fishery, but overfishing definitions were never developed for Kona crab because catch was considered to be negligible in federal waters (WPFMC 1981). When the Council's species-based FMPs transitioned into spatially oriented FEPs (75 FR 2198, January 14, 2010), the MUS status for Kona crab was retained without overfishing definitions despite the fishery participation beginning to grow in federal waters (e.g., around Penguin Banks in the MHI). Subsequently, after Amendment 3 to the Hawaii Archipelago FEP (76 FR 37285, June 27, 2011), the Council and NMFS began to implement annual catch limits (ACLs) and conduct stock assessments for the species.

The Council's Hawaii FEP does not specify status determination criteria (SDC) for the Kona crab MUS. Thus, while the 2019 stock assessment indicated that the MHI Kona crab stock is not overfished nor experiencing overfishing (Kapur et al. 2019), NMFS was not able for formally determine stock status. Accordingly, the stock status of MHI Kona crab is reported as "unknown" in the NMFS Species Information System (SIS), a national database that serves as the repository for stock assessment and status determination results. Additionally, due to the lack of MHI Kona crab SDC, the FEP currently does not meet the requirements of National Standard 1 of the Magnuson-Stevens Act and does not allow for the determination and reporting of stock status consistent with section 304(e) of the Magnuson-Stevens Act.

1.1.1 Magnuson-Stevens Act Provisions on SDC

The Magnuson-Stevens Act requires the Council's FMPs (or FEPs) to evaluate and describe several items to manage federal fisheries that harvest stocks that require conservation and management. These include maximum sustainable yield (MSY), SDC, control rules, and other items associated with specifying ACLs and accountability measures (AMs; 50 CFR 600.310(c)). A stock's MSY is the largest long-term average catch that can be taken from a stock under prevailing conditions, based on the best scientific information available (BSIA). The MSY

fishing mortality rate (F_{MSY}) is the fishing mortality rate that would result in MSY over the long term, and the MSY biomass (B_{MSY}) is the long-term average size of the stock that would be achieved by fishing at F_{MSY}.

The Hawaii FEP established an MSY control rule that specifies the relationship of fishing mortality to biomass under an MSY harvest policy, which is useful for specifying SDC to identify when the fishery is overfished (WPFMC 2009). National Standard guidelines (74 FR 3178, January 16, 2009) require that SDC include two limit reference points or thresholds, one for fishing mortality to identify when overfishing is occurring and another for biomass to indicate when the stock is overfished (WPFMC 2009).

SDC refer to measurable and objective factors that are used to determine if overfishing has occurred or if the stock is overfished, which can include the maximum fishing mortality threshold (MFMT), overfishing limit (OFL), minimum stock size threshold (MSST), or associated proxies. The Magnuson-Stevens Act defines both 'overfishing' and 'overfished' to mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the MSY on a continuing basis. The term 'overfished' usually refers to the biomass of the stock, while 'overfishing' is associated with a rate or level of removal from a stock (50 CFR 600.310(e)(2)). Thus, the MFMT is the level of fishing mortality on an annual basis above which overfishing is occurring, the OFL is the annual amount of catch that corresponds to the MFMT estimate applied to a stock's abundance, and the MSST is the level of biomass below which a stock is considered overfished. A stock is considered to be approaching an overfished condition when it is projected that there is greater than a 50% chance that the stock's biomass will decline below MSST within two years. These parameter definitions were retained in the Hawaii FEP (WPFMC 2009). Whenever the MFMT and MSST thresholds are breached, the Council must develop and NMFS must implement a rebuilding plan to sufficiently constrain fishing mortality to allow the stock to rebuild within an acceptable timeframe in accordance with Section 304(e) of the Magnuson-Stevens Act.

Each FMP (or FEP) must describe how SDCs will be established, and SDCs are often based on fishing rates or biomass levels associated with MSY or MSY proxies. In specifying SDC, a Council must provide an analysis of how the SDC were chosen and how they relate to the reproductive potential of stocks of fish within the fishery (50 CFR 600.310(e)(2)). To use SDC to determine the overfishing status of a stock, the Council may specify the fishing mortality rate exceeding MFMT or catch exceeding the OFL. In using SDC to determine the overfished status of a stock, the MSST should be expressed in terms of spawning biomass, or other measures of reproductive potential, between $0.5*B_{MSY}$ and B_{MSY}.

In the example in Figure **1** for NWHI lobster stocks, the MSY control rule in the Hawaii FEP sets the MFMT constant at F_{MSY} for biomass greater than the MSST and decreases the MFMT linearly with biomass for values less than the MSST. Additionally, the MSST should equal whichever of the following is greater: one-half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock were exploited at the MFMT. The MSST in Figure **1** is indicated by a vertical line at a biomass level somewhat less than B_{MSY}. Lastly, the FEP describes a warning reference point, B_{FLAG}, that provides an indication that biomass or fishing mortality are approaching their respective thresholds. The Figure **1** example shows that B_{FLAG} is specified at some point above MSST.

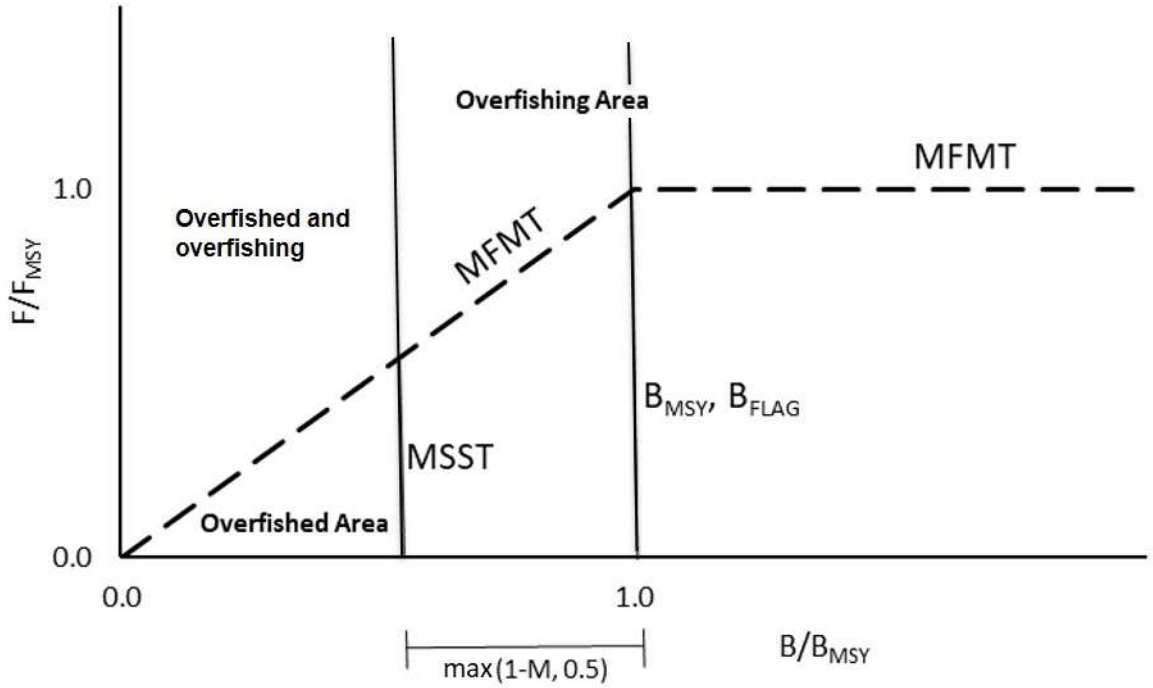

Figure 1**. Depiction of MSY control rule and reference points for NWHI lobster stocks.**

1.1.2 Current Crustacean SDC in the Hawaii FEP

SDC, overfishing criteria, and control rules are specified and applied to MUS to ensure that fishing mortality does not exceed a level that would result in excessive depletion of that species. Though NWHI lobster stocks are no longer considered MUS under the FEP, the established SDC for the stock remains. The MSY control rule is used as the MFMT. While the MSST is specified based on the recommendations of Restrepo et al. (1998), the MFMT is more conservative than the default recommendation as the threshold would be based on a higher level of B (i.e., B_{MSY} rather than some level less than B_{MSY}; WPFMC 2009). Both MFMT and MSST are dependent on the natural mortality rate (M) that is occasionally re-estimated using BSIA. In addition to the thresholds MFMT and MSST, a warning reference point, B_{FLAG}, is specified at some point above the MSST to provide a trigger for consideration of management action prior to reaching the threshold (WPFMC 2009; WPFMC 2022). The MFMT, MSST, and B_{FLAG} for NWHI lobster stocks, which are the only crustacean MUS in the Western Pacific region with established SDC in the FEP, are specified in Table 1. Figure **1** illustrates the MSY control rule and reference points for NWHI lobster stocks as specified in the Hawaii Archipelago FEP (WPFMC 2009).

Table 1. Overfishing threshold specifications for NWHI lobster stocks in the Hawaii FEP

MFMT	MSST	B_{FLAG}
$F(B) = \frac{F_{MSY}B}{B_{MSY}}$ for $B \leq B_{MSY}$ $F(B) = F_{MSY}$ for $B > B_{MSY}$	$c\ B_{MSY}$	B_{MSY}
Where c = max(1-M, 0.5)		

Source: WPFMC (2009).

1.1.3 Description of the fishery

Kona crab is the only species within its genus and is commercially harvested over much of its range in the tropical and subtropical Pacific Ocean. 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). Wiley and Pardee (2018) reported females up to 5 inches (12.7 cm) and males up to 6 inches (15.2 cm). Fishing for Kona crab occurs in both State and Federal waters around the MHI. Fishers target crabs 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 from 10-12 m in length (Brown 1985). The net frames are built from ½ cm wire approximately 1 m across. 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 and the nets reset. See Section 3.1 for additional background information on the fishery.

1.2 Proposed Action

The Council proposes to establish SDC in the Hawaii FEP for Kona crab based on either: 1) technical guidance provided by Restrepo et al. (1998), the previous stock assessment for the fishery (Kapur et al. 2019), and SDC applied to other Council-managed insular fisheries; or 2) SDC from other fisheries for crab species, consistent with Magnuson-Stevens Act section 303(a) and implementing regulations at 50 CFR 600.310(e)(2). Pursuant to applicable fishery management regulations found at 50 CFR 600.310, when applying the SDC established in the Hawaii FEP, the Secretary of Commerce (i.e., NMFS) determines if overfishing is occurring and whether the MHI Kona crab stock is overfished based on BSIA.

1.3 Purpose and Need

The purpose of this proposed action is to establish SDC for the Kona crab stock in the MHI as an MUS under the Hawaii Archipelago FEP. The need for this action is to allow for the determination and reporting of stock status to support the sustainable management of the Kona crab fishery in the MHI. This action is consistent with the requirements of section 303(a) of the Magnuson-Stevens Act and implementing regulations at 50 CFR 600.310(e)(2).

1.4 Action Area

The action area is the State and federal waters throughout the MHI where fishing for Kona crab occurs. Kona crab fishing occurs over sandy substrate at depths up to 400 m. Waters around the

NWHI are not part of the action area because commercial fishing is prohibited in Papahānaumokuākea Marine National Monument (50 CFR 404.6).

1.5 Decision(s) to be Made

This FEP amendment and the associated CE will support a decision by the Regional Administrator (RA) of the NMFS Pacific Island Region, on behalf of the Secretary of Commerce, whether to approve, disapprove, or partially approve the Council's recommendation.

1.6 Public Involvement

1.6.1 Council and SSC Meetings

NMFS and the Council provided several opportunities to the public to provide input on specifying appropriate SDC for the MHI Kona crab fishery. The development of the Council's recommendations for Kona crab SDC in the Hawaii FEP took place during over the course of several Council and SSC meetings. Relevant meetings where the Council and its SSC discussed Kona crab SDC are provided in Table 2. These meetings were announced in the *Federal Register* and on the Council's website, and all meetings were open to the public with time set aside on their agendas for public comment. The public had an opportunity comment on the proposed SDC for MHI Kona crab at these meetings, and no public comment addressed this action at any of the listed meetings.

Table 2. Meetings of the Council and its SSC during which the Council discussed the proposed action to establish Kona crab SDC allowed the public to submit comments

Meeting	Date(s)	*Federal Register* Notice	Summary of Discussion and Recommendations
145th SSC	Sept. 13-15, 2022	87 FR 53732	The SSC recommended that the Council should consider deferring action until its Fishery Ecosystem Plan Team (Plan Team) has a chance to review the action. Additional details about SSC deliberations that occurred on this topic at this meeting can be found on the Council's website.
192nd Council	Sept. 20-22, 2022	87 FR 53732	The Council recommended that staff convene an action team comprised of PIRO and PIFSC staff as well as NOAA General Counsel to develop the Hawaii FEP amendment and related environmental impact analyses as needed for initial action in March 2023 after Plan Team review. Additional details about SSC deliberations that occurred on this topic at this meeting can be found on the Council's website.

1.7 List of Preparers

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Reviewers
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2 DESCRIPTION OF ALTERNATIVES CONSIDERED

2.1 Development of the Alternatives

This FEP amendment and its alternatives were developed in conjunction with the Categorical Exclusion (CE) document for the proposed action based on comments from the Council, its advisory bodies, and the public. The alternatives served as a basis for discussion at meetings where the proposed action was discussed and comments were received. The exact structure and components of the alternatives were developed by the Council, NMFS PIRO, and NMFS PIFSC following initial presentations to the Council and its advisory bodies associated with the 192nd Council meeting held on September 20 through 22, 2022, in Honolulu, Hawaii.

2.2 Description of the Alternatives

The alternatives considered in this document were developed by the Council and NMFS in response to the Council's request for Secretarial action. We developed three alternatives to evaluate a range of management options: a baseline of no Federal action (Alternative 1), basing SDC on the criteria used in the previous stock assessment (Alternative 2), and implementing SDC utilized in other crab fisheries (Alternatives 3a through 3d). These alternatives are described in detail and evaluated below.

2.2.1 Alternative 1: No Action (Status Quo)

Under Alternative 1, the Council and NMFS would not establish SDC for MHI Kona crab, and the Hawaii FEP would remain as it currently exists without SDC for the species.

Expected Fishery Outcomes

Under the status quo, the Council and NMFS expect that the MHI Kona crab fishery would continue to operate as it has in recent years with no changes to the management framework. No technical correction would be applied to the Hawaii FEP such that stock status could be officially determined and transmitted to Congress. This alternative would not comply with Magnuson-Stevens Act requirements under National Standard 1 for the Hawaii FEP to specify methods used to determine the overfishing and overfished status for each federally managed stock (50 CFR 600.310(e)(2)). Additionally, because no SDC would be established that would allow for stock status determinations for the fishery, the Council and NMFS would not be able to require a rebuilding plan if a future stock assessment indicates that stock biomass is depleted.

The recent stock assessment that analyzed Kona crab in the MHI (Kapur et al. 2019) would remain the BSIA under Alternative 1 until the next stock assessment is completed for the fishery. However, future assessments would have no established SDC to allow for a stock status determination to be made. Thus, under the status quo alternative, the Kona crab stock status would remain as "unknown" under the NMFS SIS regardless of the results of the recent or upcoming stock assessments as it has through the present.

2.2.2 Alternative 2: Establish SDC for MHI Kona crab, consistent with the most recent Kona crab stock assessment

Under Alternative 2, the Council and NMFS would amend the Hawaii FEP to establish SDC for MHI Kona crab identical to those used in the most recent stock assessment (Kapur et al. 2019), which are based on guidance provided by Restrepo et al. (1998) and consistent with the specified

SDC for other federal insular fisheries under the Council's authority. The SDC that the Council and NMFS would specify in the Hawaii FEP are provided in Table 3. Thus, the proposed SDC for MHI Kona crab would be identical to the SDC specified for NWHI lobsters in the Hawaii FEP (Table 1). Additionally, control rules would be included in the specification of SDC such that a rebuilding plan would be implemented if the MSST threshold would be breached, and management action would be considered if B_{FLAG} would be reached (Table 3). In addition, action to end overfishing would also be taken if the MFMT was reached. No other changes would be made to the management structure for MHI Kona crab under the Hawaii FEP.

Table 3. Proposed SDC for MHI Kona crab under Alternative 2

MFMT	**MSST**	**B_{FLAG}**
$F(B) = \frac{F_{MSY}B}{B_{MSY}}$ for B ≤ B_{MSY} $F(B) = F_{MSY}$ for B > B_{MSY} **Remedy if threshold exceeded**: Rebuilding Plan	c B_{MSY} **Remedy if threshold exceeded**: Rebuilding Plan	B_{MSY} **Remedy if threshold exceeded**: Consideration of management action prior to B reaching MSST
Where c = max(1-M, 0.5)		

Expected Fishery Outcomes

The Council and NMFS do not expect the proposed action to result in any changes or adverse effects to the MHI Kona crab fishery, including on fishing location, gear, catch, effort, participation, intensity, seasonality, timing, the number of sets or trips, changes in target or non-target species, permits required, or other salient features. The proposed action is a technical correction to the Hawaii FEP to ensure requisite regulations are in place for the management framework to comply with the provisions of the Magnuson-Stevens Act. Because the Council and NMFS do not anticipate that implementing protocols for stock status determination in the form of SDC would result in any change to fishery operations, we believe it is unlikely that the proposed action would result in any significant impacts to the fishery, its participants, and the related fishing community.

This alternative would serve to fill a management gap in the Hawaii FEP for Kona crab by establishing SDC that are required under the Magnuson-Stevens Act and, thus, the SDC provided under Alternative 2 would bring the Hawaii FEP into compliance with federal law. Because the SDC would be identical to those applied in the most recent benchmark stock assessment for MHI Kona crab (Kapur et al. 2019), stock status could be officially determined using the results of that assessment immediately after establishing the SDC. Thus, stock status would be changed from "unknown" in the NMFS SIS to reflect the results of the 2019 stock assessment, which concluded the stock is not overfished nor experiencing overfishing. This alternative would not differ from the criteria in the most recent stock assessment that used the proposed SDC for stock status determination. Future stock assessments completed by PIFSC-Stock Assessment Program (SAP) could be conducted utilizing the same SDC as the 2019 benchmark stock assessment.

Because this alternative would only establish SDC for the fishery and change no other management provisions, it is not likely that this alternative would result in any direct impacts to the MHI Kona crab fishery or its operations. Thus, NMFS expects that fishery operations would continue as they would under the status quo. Furthermore, because the SDC established under

Alternative 2 would result in the stock being classified as not overfished nor experiencing overfishing based on the most recent stock assessment, the current management framework at the time of SDC establishment would not trigger of the rebuilding provisions of Section 304(e) of the Magnuson-Stevens Act or other management measures.

2.2.3 Alternative 3: Establish SDC for MHI Kona crab based on SDC for other crab fisheries

Alternative 3 generally considers the incorporation of SDC from other crab fisheries, both domestic and international, to the MHI Kona crab fishery.. Examples of establishing SDC consistent with other U.S.-based crab fisheries are provided in Alternatives 3a through 3c, and Alternative 3d provides an example of implementing SDC based on an international fishery for Kona crab.

2.2.3.1 Alternative 3a: Establish SDC for MHI Kona crab based on SDC for Chesapeake Bay blue crab

Under Alternative 3a, the Council and NMFS would establish SDC for the MHI Kona crab fishery consistent with the coordinated management of the Chesapeake Bay blue crab (*Callinectes sapidus*) by the State of Maryland, the Commonwealth of Virginia, and the Potomac River Fisheries Commission by the Chesapeake Bay Stock Assessment Committee (CBSAC) under the coordination of the NOAA Chesapeake Bay Office. The most recent benchmark stock assessment for the species was conducted in 2011 and recommended biomass and exploitation reference points based on MSY for females only (Miller et al. 2011). As of the start of the 2022 crabbing season, the CBSAC determined that the Chesapeake Bay blue crab stock is not depleted and overfishing is not occurring (CBSAC 2022).

Under the current management framework for Chesapeake Bay blue crab, there are targets and limits for female crab abundance that are based on stock size to produce MSY and the target is the abundance that would be produced by fishing at 75% of F_{MSY}. The abundance of mature female crabs (age 1+) is estimated from the annual, bay-wide Winter Dredge Survey conducted by the State of Maryland and the Virginia Institute of Marine Science. Relatedly, annual estimates of exploitation (U) are calculated as the annual harvest of female crabs in a given year (not inclusive of bycatch, discards, or unreported losses) divided by the total number of female crabs (age 0+) estimated in the population at the beginning of the season (CBSAC 2020). The overfishing limit for the fishery is the exploitation rate of age 0+ female crabs that coincides with MSY (i.e., U_{MSY}), and the overfished abundance threshold is estimated by $0.5*N_{MSY}$, where N is abundance (Miller et al. 2011). Empirical estimates of exploitation rate are compared with target and threshold reference points derived from the model of the benchmark stock assessment in 2011 (Miller at al. 2011) and the subsequent stock assessment update in 2017 (see Table 4). The blue crab fishery should ideally operate to meet the target values, never exceed the exploitation rate threshold, and never fall below the abundance threshold. The target exploitation rate is set at $0.75*U_{MSY}$, while the target abundance is established as $N_{0.75*U_{MSY}}$ (Miller et al. 2011).

Thus, under this alternative, the Council and NMFS would establish SDC for the MHI Kona crab fishery consistent with those under the CBSAC management framework for Chesapeake Bay blue crab. The MSST would be set as specified in Table 8 at a target of $0.75*U_{MSY}$ with a threshold of $0.5*N_{MSY}$, where U represents exploitation rate and N represents abundance. The MFMT would be set at a target and threshold of $0.75*U_{MSY}$ and U_{MSY}, respectively.

Table 4. Biological reference points generated by the 2011 benchmark stock assessment and the 2017 stock assessment update for Chesapeake Bay blue crab

Stock Assessment	Female Abundance (Age 1+) in millions		Female Exploitation Rate (Age 0+) per year	
	Target	Threshold	Target	Threshold
2011	215	70	25.5%	34%
2017	196	72.5	28%	37%

Source: CBSAC (2022).

2.2.3.2 Alternative 3b: Establish SDC for MHI Kona crab based on SDC for Atlantic deep-sea red crab

Under Alternative 3b, the Council and NMFS would establish SDC consistent with the management provisions specified by the New England Fishery Management Council (NEFMC) for the Atlantic Deep-Sea Red Crab FMP (NEFMC 2002). The fishery for Atlantic deep-sea red crab (*Chaceon quinquedens*) operates year round with trap/pot gears over 400 to 800 m depth (NMFS 2022). The stock is considered data-poor, so the OFL is unknown while the ACL was set at 4.41 million lb for 2020 to 2023 (87 FR 3697, January 25, 2022).

MSY for the red crab resource is estimated to be 6.24 million lb based on the biomass of male crabs (i.e., the primary fishery target) and assuming a natural mortality rate of 0.15; optimum yield (OY) is specified based on 95% of MSY (NEFMC 2002). The overfished and overfishing definitions were designed based on Restrepo et al. (1998) to utilize BSIA and offer the most flexibility to the NEFMC and NMFS when making a status determination. The overfishing definition for Atlantic red crab is any rate of exploitation such that the ratio of current exploitation to an ideal exploitation under MSY condition exceeds a value of 1.0 (NEFMC 2002). Estimates of exploitation rate are calculated using proxies, such as F/F_{MSY}, which may be calculated as the ratio of landings (L) to CPUE against MSY to $CPUE_{MSY}$. Otherwise, landings divided by MSY may be used as a proxy if data are not available to implement the above indicators (see Table 5). The stock is considered overfished if any of the following three conditions are met:

1) The current biomass of the stock is below $0.5*B_{MSY}$ in the NEFMC management area;
2) The annual fleet average CPUE (in number of crabs landed per haul) continues to decline below a baseline level for three or more consecutive years; or
3) The annual fleet average CPUE falls below a minimum threshold level in any year (NEFMC 2002).

Thus, under this alternative, the Council and NMFS would establish SDC for the MHI Kona crab fishery identical to those under the NEFMC's management framework for Atlantic red crab. The MSST would be set as specified in Table 5 at $0.5*B_{MSY}$ with additional qualifiers monitoring CPUE declines over time spans of one and three years. The MFMT would simply be when F is greater than F_{MSY}, but there would be allowable proxies for the MFMT using current landings, CPUE, and MSY information.

Table 5. SDC and reference points for Atlantic deep-sea red crab

Status	Criteria	Reference Point	Proxy	Remedy if Threshold Exceeded
Overfishing	F	$F/F_{MSY} > 1.0$	$\frac{L}{CPUE}:\frac{MSY}{CPUE_{MSY}}$	Reduce landings
			$\frac{L}{MSY}$	Reduce landings
Overfished	B	$B < 0.5*B_{MSY}$	None	Rebuilding Plan
	CPUE	$CPUE < 0.5*CPUE_0$	N/A	Rebuilding Plan
		$CPUE < 0.25*CPUE_0$	N/A	Rebuilding Plan

Source: NEFMC (2002).

2.2.3.3 Alternative 3c: Establish SDC for MHI Kona crab based on SDC for Eastern Bering Sea snow crab

Under Alternative 3d, the Council and NMFS would establish SDC for the MHI Kona crab fishery consistent with the management provisions for Eastern Bering Sea snow crab (*Chionoecetes opilio*). This species is managed by the State of Alaska under the Bering Sea/Aleutian Islands King and Tanner Crab FMP (NPFMC 2021) developed by the North Pacific Fishery Management Council (NPFMC). The commercial fishery for Alaska snow crabs is lucrative, with more than 36.6 million pounds landed in 2020, valued over $101.7 million. The most recent stock assessment for the fishery determined that Alaska snow crabs are overfished but not experiencing overfishing based on 2020 data (Szuwalski 2021).

North Pacific crab fisheries operate based on a five-tier system for setting overfishing OFLs and acceptable biological catches (ABCs; see Table 6). Generally, for North Pacific crab fisheries, a stock is determined to be overfished by comparing annual biomass estimates to the MSST, which is defined as $0.5*B_{MSY}$. Overfishing is determined by comparing the OFL, which is set equal to MSY, with catch estimates in a given year. The instantaneous fishing mortality from the fishery used to calculate the overfishing limit (F_{OFL}) has a maximum value of F_{MSY} when $B > B_{MSY}$. Proxies for F_{MSY} are frequently used, such as $F_{x\%}$, which is the F that results in x% of the equilibrium spawning per recruit relative to the unfished value; $F_{35\%}$ is specified for use for Tier 3 stocks such as the snow crab (Table 6). In the 2021 stock assessment, morphometrically mature male biomass (MMB) is used to determine stock status since the fishery primarily targets and captures large males. The OFL was calculated using proxies for biomass and fishing mortality reference points from spawner-per-recruit methods (i.e., $F_{35\%}$ and $B_{35\%}$; Szuwalski 2021). While studies have found the assumption $F_{MSY} = F_{35\%}$ to be reasonable, changes in recruitment over time may impact the estimation of B_{MSY} (Punt et al. 2014).

Thus, under this alternative, the Council and NMFS would establish SDC for the MHI Kona crab fishery identical to the Tier 3 F_{OFL} calculations done by the NPFMC based on stock status level for the Eastern Bering Sea snow crab fishery. The MSST would be set at $0.5*B_{MSY}$, and the MFMT would be set as specified in Table 6 for the three possible stock status conditions. After the implementation of these SDC, the Council's SSC could convene to discuss and potentially revise the 35% level utilized in $B_{35\%}$ and $F_{35\%}$. At the Council's discretion, the Hawaii FEP could incorporate a single tier or the entirety of the five-tier system for the MHI Kona crab fishery.

Table 6. Five-tier system of setting OFL for crab stocks in the NPFMC management area

Information available	Tier	Stock status level	F_{OFL}
B, B_{MSY}, F_{MSY}, and pdf of F_{MSY}	1	a. $\frac{B}{B_{msy}} > 1$	$F_{OFL} = \mu_A$ =arithmetic mean of the pdf
		b. $\beta < \frac{B}{B_{msy}} \leq 1$	$F_{OFL} = \mu_A \frac{B/B_{msy} - \alpha}{1-\alpha}$
		c. $\frac{B}{B_{msy}} \leq \beta$	*Directed fishery F = 0* $F_{OFL} \leq F_{MSY}$†
B, B_{MSY}, F_{MSY}	2	a. $\frac{B}{B_{msy}} > 1$	$F_{OFL} = F_{msy}$
		b. $\beta < \frac{B}{B_{msy}} \leq 1$	$F_{OFL} = F_{msy} \frac{B/B_{msy} - \alpha}{1-\alpha}$
		c. $\frac{B}{B_{msy}} \leq \beta$	*Directed fishery F = 0* $F_{OFL} \leq F_{MSY}$†
B, $F_{35\%}$*, $B_{35\%}$*	3	a. $\frac{B}{B_{35\%}*} > 1$	$F_{OFL} = F_{35\%}*$
		b. $\beta < \frac{B}{B_{35\%}*} \leq 1$	$F_{OFL} = F^*_{35\%} \frac{\frac{B}{B^*_{35\%}} - \alpha}{1-\alpha}$
		c. $\frac{B}{B_{35\%}*} \leq \beta$	*Directed fishery F = 0* $F_{OFL} \leq F_{MSY}$†
B, M, $B_{msy^{prox}}$	4	a. $\frac{B}{B_{msy^{prox}}} > 1$	$F_{OFL} = \gamma M$
		b. $\beta < \frac{B}{B_{msy^{prox}}} \leq 1$	$F_{OFL} = \gamma M \frac{B/B_{msy^{prox}} - \alpha}{1-\alpha}$
		c. $\frac{B}{B_{msy^{prox}}} \leq \beta$	*Directed fishery F = 0* $F_{OFL} \leq F_{MSY}$†
Stocks with no reliable estimates of biomass or M.	5		OFL = average catch from a time period to be determined, unless the SSC recommends an alternative value based on the best available scientific information.

*35% is the default value unless the SSC recommends a different value based on the best available scientific information.

† An $F_{OFL} \leq F_{MSY}$ will be determined in the development of the rebuilding plan for that stock.

Source: NPFMC (2021).

2.2.3.4 Alternative 3d: Establish SDC for MHI Kona crab based on SDC from the Australian spanner crab fishery

Under Alternative 3d, the Council and NMFS would adopt the same SDC for MHI Kona crab as under the management framework for the east coast Australia spanner crab fishery. Spanner crabs, as Kona crab is referred to in Australia, has a single biological stock along the east coast off of New South Wales and Queensland, though Queensland accounts for roughly 80% of harvest (Roelofs et al. 2021). Despite the lack of a stock assessment, the East Coast spanner crab stock is officially classified as a sustainable stock due to reduced catches relative to the total allowable commercial catch (TACC) level (Roelofs et al. 2021).

Because there is no stock assessment for East Coast spanner crabs, commercial standardized CPUE (sCPUE) and standardized fishery-independent survey (sFIS) data are used as performance indicators to infer the status of the stocks using established decision rules (State of Queensland 2020). The harvest strategy and associated decision rules for East Coast spanner crabs currently focus on setting the TACC to rebuild the stock from its stock status of "depleting." The target reference point for spanner crabs is based on the average of sCPUE and sFIS catch rates from 2006 to 2010, which represents a time of operational efficiency for the commercial fishery, while the lower limit reference point is set at a commercial index value of 0.5 kg per dilly lift (i.e., a proxy for approximately 20% biomass in the fishery; Table 7). These limit reference points are likely to reduce the chance of a fishery closure according to a management strategy evaluation (State of Queensland 2020).

Thus, under this alternative, the Council and NMFS would specify ACLs for the MHI Kona crab fishery consistent with how TACCs are specified for the Australian spanner crab fishery after determining an appropriate time period that could represent a span of operational efficiency for the commercial MHI Kona crab fishery. Additionally, limit reference points would be established consistent with the mechanism utilized in the Australian fishery such that the Australian spanner crab fishery has no reference points associated with fishing mortality and, thus, no MFMT could be established under this alternative; this alternative would not suffice to bring the Hawaii FEP into compliance with the provisions of the Magnuson-Stevens Act and its National Standards.

Table 7. Performance indicators and reference points for the Australian spanner crab fishery

Performance Indicator	Reference Point/Buffer	Reference Level
Standardized commercial catch rate of spanner crabs in kilogram per dilly lift (sCPUE)	Target reference point proxy for 60% biomass	95% of the 2006-2010 average standardized catch rate
Catch rate of spanner crabs from the standardized fishery independent survey in legal crabs per ground line (sFIS)	Target reference point proxy for 60% biomass	95% of the 2006-2010 average standardized catch rate
sCPUE of spanner crabs averaged over two conservative years	Limit reference point proxy for 20% biomass	0.5 kg per dilly lift
Pooled index – average of the sCPUE and sFIS	Target reference point	1
TACC	Upper limit	1,300 mt

Performance Indicator	Reference Point/Buffer	Reference Level
TACC	Lower limit	300 mt
TACC change	Minimum change buffer	50 mt
TACC change	Maximum change buffer	200 mt

Expected Fishery Outcomes

Under Alternative 3, the Council and NMFS do not expect any adverse effects to the MHI Kona crab fishery, similar to Alternative 2. Establishing any of the SDC under Alternative 3 in the Hawaii FEP, except under Alternative 3d, would bring it into compliance with the National Standard 1 guidelines under the Magnuson-Stevens Act. Implementing the SDC described under the sub-alternatives, or comparable SDC, would not directly impact fishery operations, but rather the action would revise the metrics by which the MHI Kona crab stock are evaluated using the best available data during stock assessments conducted by the PIFSC-SAP. However, because the proposed SDC would differ from those applied in the most recent benchmark stock assessment for MHI Kona crab (Kapur et al. 2019), stock status could not be officially determined immediately after establishing the SDC using the results of that assessment. Thus, the status of Kona crab would remain "unknown" until the next stock assessment is completed, and the subsequent stock assessment conducted by PIFSC-SAP would need to be a benchmark in order to apply any of the SDC under Alternative 3, as a stock assessment update would be constrained by the SDC used in the previous assessment.

It is possible that establishing SDC could have indirect impacts to the fishery in the future. The SDC implemented by the Council and NMFS would be used after subsequent stock assessments conducted by the PIFSC-SAP to determine stock status (i.e., if the fishery resource is overfished and/or experiencing overfishing) and, thus, could impact status determination for the fishery if notably different from stock status procedures in the past. In this case, the results of the stock assessments would remain unaffected by the proposed action, but the SDC applied to those results may lead to different stock status determinations depending on the SDC. It is possible, for example, that some SDC would indicate a healthy fishery while others would suggest an overfished or experiencing overfishing condition for the resource. If the implemented SDC indicate the fishery is overfished or experiencing overfishing, fishery operations could be impacted by the consequent rebuilding plan that would be implemented by the Council for the fishery such that the ACL could be reduced there may be associated negative consequences for the participating fishers or related fishing communities.

Under Alternatives 3a through 3c, which represent different approaches to establishing SDC for the MHI Kona crab fishery based on the SDC for other U.S.-based crab fisheries, the SDC from other U.S. crab fisheries may not be directly applicable to the MHI Kona crab fishery, as the life histories and historical harvests of other crab species may be reflected in their management approaches. For example, under Alternative 3c, the current level of information available for MHI Kona crab, specifically regarding recruitment, may not be available in a sufficient amount to be able to apply the provisions associated with $F_{35\%}$. Thus, the Council could utilize different tiers of the NPFMC's management framework to apply the SDC most appropriate for the available fishery information. However, this would require more intensive monitoring and assessment by the Council and its SSC following each stock assessment.

Similarly, SDC from international fisheries may result in compatibility issues if they are applied MHI Kona crab fishery. Under Alternative 3d, though international crustacean fisheries may be

harvesting the same species, the associated management frameworks may not be adaptable to the Pacific Island Region. Crab fisheries operate differently in each region in which they occur, and related management provisions are highly habitat- and gear-dependent. For example, the east coast Australian spanner crab fishery operates in habitats that are much vaster and utilizes different gear types (i.e., dilly pots) than the Hawaii Kona crab fishery (i.e., loop nets). Further, the shift in type of management provisions for the fishery (i.e., utilizing sCPUE proxies from a fishery with different gear types, habitats, and life histories for target species) may directly impact allowable harvest and impact fishery operations. Additionally, because the Council and NMFS would not be able to establish an MFMT under Alternative 3d, this alternative would not bring the Hawaii FEP into compliance with the provisions of the Magnuson-Stevens Act.

Table 8. Comparison of Features of the Alternatives

Alt.	MSST	MFMT	Complies with Magnuson-Stevens?
1	N/A	N/A	No
2	c * B_{MSY}	$F(B) = \frac{F_{MSY}B}{B_{MSY}}$ for $B \leq B_{MSY}$ $F(B) = F_{MSY}$ for $B > B_{MSY}$	Yes
3a	Target: $N_{0.75*U_{MSY}}$ Threshold: 0.5 * N_{MSY}	Target: 0.75 * U_{MSY} Threshold: U_{MSY}	Yes
3b	0.5 * B_{MSY}, or $CPUE < 0.5 * CPUE_0$ (if CPUE below this level for 3+ years), or $CPUE < 0.25 * CPUE_0$ (if CPUE below this level for a single year)	$\frac{F}{F_{MSY}} > 1$, or $\frac{F}{F_{MSY}} = \frac{L}{CPUE} : \frac{MSY}{CPUE_{MSY}} > 1$ (proxy), or $\frac{F}{F_{MSY}} = \frac{L}{MSY} > 1$ (proxy)	Yes
3c	0.5 * B_{MSY}	$F_{OFL} = F_{35\%}$ for $\frac{B}{B_{35\%}} > 1$ $F_{OFL} = F_{35\%} \frac{\frac{B}{B_{35\%}} - \alpha}{1-\alpha}$ for $\beta < \frac{B}{B_{35\%}} \leq 1$ $F = 0$ for $\frac{B}{B_{35\%}} \leq \beta$	Yes
3d	Set reference level at 2-year average sCPUE as a proxy for 20% biomass	N/A	No

Note: For Alternative 2, c = max(1-M, 0.5). For Alternative 3a, N represents abundance and U represents exploitation rate. For Alternative 3b, L represents the current landings. For Alternative 3c, $0 \leq \alpha \leq \beta$, and default α = 0.1 as recommended by the NPFMC SSC; $0 \leq \beta < 1$, and default β =0.25.

3 FISHERY IMPACT STATEMENT

The Magnuson-Stevens Act requires that a fishery impact statement (FIS) be prepared for all amendments to FMPs (i.e., and FEPs). The FIS contains: 1) background information on the target species and fishery; 2) an assessment of the likely biological/conservation, economic, and social effects of the conservation and management measures on fishery participants and their communities; 3) an assessment of any effects on participants in the fisheries conducted in adjacent areas under the authority of another Fishery Management Council; and 4) the safety of human life at sea. Detailed discussion of the expected effects for all alternatives considered is provided in Section 2.2.

3.1 Background Information

3.1.1 Overview of Kona Crab Biology and Habitat

Kona crab is a commercially harvested species throughout its ecological range in the tropical and subtropical Indo-Pacific region, where it is widely considered a delicacy (Wiley et al. 2020). The species displays sexual dimorphism, with males growing to a much larger size than females (Uchida 1986). In Hawaii, males reach maturity at 2.9 inch carapace length, and the majority of females reach sexual maturity at 2.6 inch carapace length (Fielding and Haley 1976; Onizuka 1972). Fishers can easily differentiate the sexes of adult crabs based on morphology (NMFS 2020; Figure 1). The sex composition in catches of Kona crabs in the MHI is approximately 49% male and 51% female (Wiley and Pardee 2018; Wiley et al. 2020).

Figure 2. Dorsal view of male and female individuals of Kona crab.
Source: State of Hawaii Division of Aquatic Resources (HDAR).

Kona crabs bury themselves in sandy substrates from 2 to 200 m depths (Wiley et al. 2020), emerging only to scavenge (Onizuka 1972; Fielding and Haley 1976). The crabs spend 22 hours per day buried in the sand on average, and females tend to be buried longer than males (Skinner and Hill 1986). Feeding rates and emergence time (i.e., time spent not buried in the sand) for females are associated with their reproductive cycle (Kennelly and Watkins 1994). From February to May, when ovarian growth for female Kona crabs tends to occur, feeding rates

increase for female individuals (Fielding and Haley 1976). Egg-bearing (i.e., berried) females are less likely to emerge from the sand but most frequently do so between June and July (Onizuka 1972). Males must be large enough to successfully dig female crabs out of the sand in order to reproduce (Skinner and Hill 1986; Minagawa 1993). Many of these known life history traits for Kona crab in the MHI actively influence the directed fishery and associated regulations for this species.

3.1.2 Overview of the Kona Crab Fishery and its Management

Kona crabs are a prized food species in Hawaii that are harvested for consumption at social gatherings, graduations, weddings, and holidays (NMFS 2020; Wiley et al. 2020). Fishers target the species by setting strings of baited, circular tangle-nets over sandy bottom areas for an average of one hour (Kennelly and Craig 1989). Individuals emerge from the sand and become entangled in the mesh of the nets as they walk across it to eat the bait.

Fishing for Kona crab occurs in both State and federal waters around the MHI, and the fishing year runs from January 1 through December 31 annually. Fishing for Kona crab occurs in State waters to a greater extent than in federal waters, which is reflected in the proportion of catch harvested in State waters versus federal waters. Over the past five years, about 85% of Kona crab catch came from State waters, and this proportion has been generally increasing over the past two decades (e.g., over the past 20 years, about 60% of Kona crab catch came from State waters (HDAR data request)). In federal waters, fishing for Kona crab primarily occurs at Penguin Bank, an area west of Molokai. Though fishing trips for Kona crab at Penguin Bank account for a fraction of all trips, a previous study found that fishing in this area tends to result in a higher catch CPUE and the harvest of larger individuals (Thomas 2011). However, Thomas (2011) used trips as a measure of effort instead of gear units because the number of gears was not reported by fishers until 2002 and there is some uncertainty as to how fishers reported the number of gears they used. Available fishery data suggest that the CPUE for the harvest of Kona crab are relatively similar in State and federal waters (HDAR data request).

The MHI Kona crab fishery is tightly regulated by both State and federal management. Under the Magnuson-Stevens Act, the Council and NMFS must implement and monitor the fishery against an ACL and AMs to ensure the stock remains sustainable. The FEP management regime prohibits the use of non-selective and destructive gear (e.g., bottom trawls, bottom-set nets, explosives, and poisons) to harvest Kona crab. The State of Hawaii has also implemented a suite of management regulations intended to conserve Kona crab resources, including a prohibition on taking of female Kona crab (Hawaii Revised Statutes [HRS] §188-58.5), a minimum size for male crabs of 4 inches carapace length, seasonal closures from May to August for breeding (Hawaii Administrative Rules [HAR] §13-95), and gear restrictions (e.g., no spearfishing and a minimum net mesh size; HAR §13-95-51). Based on the size regulations, it takes an average of 4.3 years for male crabs and 6.3 years for female crabs to reach the legal size in Hawaii (Kapur et al. 2019). These management provisions result in a high number of regulatory discards for the fishery due to size and sex restrictions on harvested individuals.

Due to the high rate of undersized and female discards for Kona crab, stock assessments and management regimes must consider the post-release mortality for the species, in consideration of injuries sustained during net disentanglement and predation, to better understand total mortality (Wiley et al. 2020). Recent studies show that post-release mortality of female crabs in Hawaii is just over 10% (Wiley 2017; Wiley and Pardee 2018). A study also found the total mortality of

uninjured crabs to be around 4.5% (Wiley et al. 2020), in contrast with previous studies indicating higher rates (Onizuka 1972; Kennelly et al. 1990; Kirkwood and Brown 1998). The same study calculated the annual fishing mortality for Kona crabs in the Hawaii fishery to be 1.4 times that of the reported landed crabs due to death after release associated with injury or stresses of fishing pressure and corresponding with an unaccounted mortality rate (i.e., the combined rates of post-release mortality and total predation) of 10.9% (Wiley et al. 2020). While the loss of an entire limb has notable impacts on Kona crab post-release survival rates, the mortality rate greatly decreased when the limb was cut cleanly at the base rather than pulled off (Wiley et al. 2020). Hawaii Kona crabs can seal wounds and regenerate lost limbs from injuries associated with fishing or predation, but breakage caused by fishing and associated blood loss sustained likely affects their survival rates and growth rates after molting (Wiley et al. 2020).

The State of Hawaii is currently considering repealing regulations on sex-specific harvest for this fishery such that females could be caught and kept. The rationale for removing these regulations is that it has become uneconomical for commercial fishers to release over half of their catch due to sex. The statute (HRS §188.58-5) prohibiting the no-take of females was removed in 2021 by the State of Hawaii legislature, but the administrative rule (HAR §13-95-51) must still be repealed (Sakoda, pers. comm.).The production model of the previous stock assessment (Kapur et al. 2019) considers both male and female crabs and, thus, such a regulatory change would not impact the biomass projections or management of the current fishery.

In addition to gear, size, and sex regulatory restrictions, the State of Hawaii requires that fishers have a Commercial Marine License (CML) to harvest Kona crab for commercial purposes and report catch on a monthly basis. Over the past 20 years, the annual number of CML holders, trips taken, catch, and CPUE generally trended downward before reaching all-time lows in 2016 for each metric except for the number of CML holders (Table 1; Figure 3). Since 2016, participation and effort have had relatively consistent trends despite interannual variability, while catch and CPUE generally increased despite a slight reduction in 2021 (Table 1; Figure 3). Considering the commercial sector of the MHI Kona crab fishery, trends in adjusted annual revenue and pounds sold tend to closely track with total estimated catch (Table 2; Figure 4). Despite the decline of values through 2016, average adjusted price per pound of Kona crab has continued to trend upward (Table 2; Figure 4).

Federally, according to the NMFS 2022 List of Fisheries (LOF), the MHI Kona crab loop net fishery consists of approximately 20 vessels and/or fishers harvesting the species (87 FR 23133, April 19, 2022), down from 33 vessels/persons in the 2021 LOF (86 FR 3028, January 14, 2021).

Table 9. Time series data for the Main Hawaiian Islands Kona crab loop net fishery

Fishing Year	# CML Holders Reporting Catch	# Trips	Catch (lb)	CPUE (lb/trip)
2002	63	196	12,830	65.46
2003	49	158	11,841	74.94
2004	48	167	12,164	72.84
2005	46	161	9,937	61.72
2006	35	128	6,749	52.73
2007	31	188	9,773	51.98
2008	36	201	10,940	54.43

Fishing Year	# CML Holders Reporting Catch	# Trips	Catch (lb)	CPUE (lb/trip)
2009	41	191	9,097	47.63
2010	46	178	9,913	55.69
2011	46	172	10,876	63.23
2012	35	121	7,980	65.95
2013	33	83	7,330	88.31
2014	24	59	2,029	34.39
2015	26	62	2,902	46.81
2016	16	25	745	29.80
2017	19	53	2,753	51.94
2018	20	52	2,769	53.25
2019	24	71	5,688	80.11
2020	12	42	4,201	100.02
2021	17	45	3,822	84.93
5-yr avg.	**18**	**53**	**3,847**	**74**
10-yr avg.	**23**	**61**	**4,022**	**64**
20-yr avg.	**33**	**118**	**7,217**	**62**

Source: WPFMC (2022).

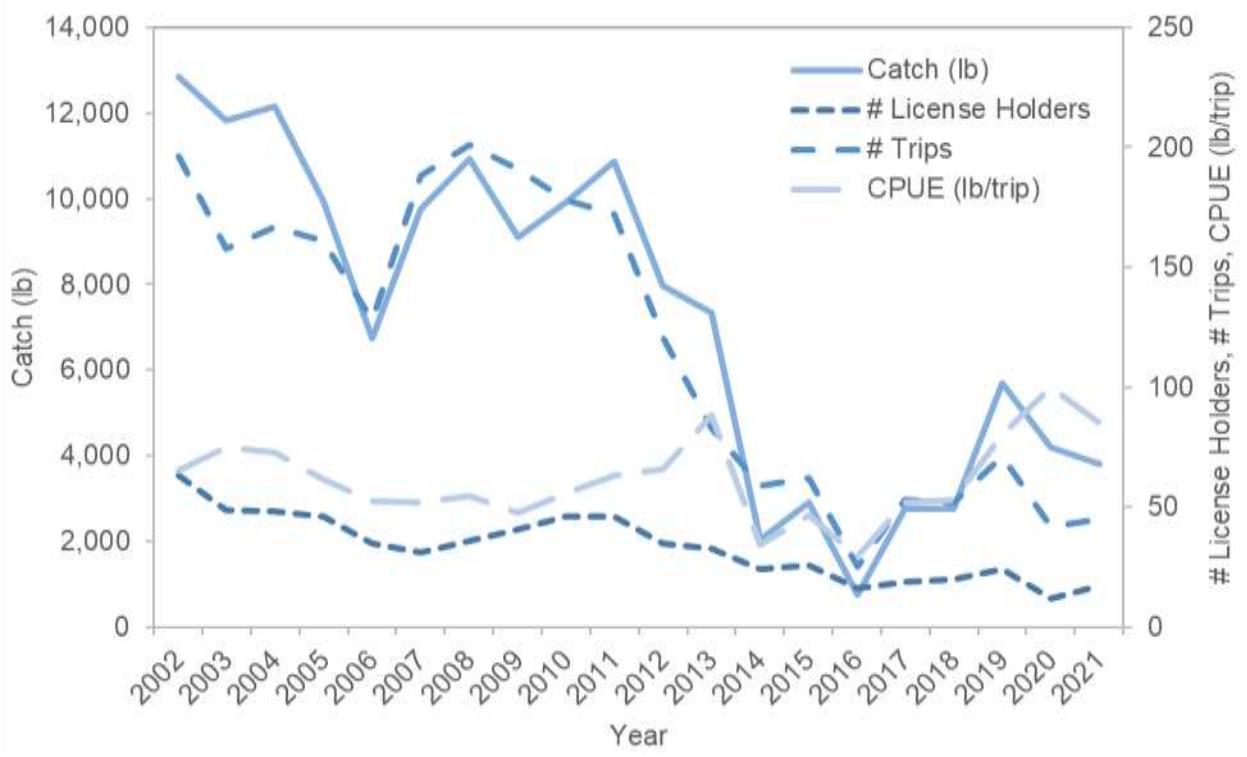

Figure 3. Visualization of time series data for the Main Hawaiian Islands Kona crab loop net fishery

Source: WPFMC (2022).

Table 10. Commercial time series data for the Main Hawaiian Islands Kona crab fishery

Fishing Year	# Dealers	Pounds Sold	Revenue ($)	Adjusted Revenue ($)	Price per Pound ($)	Adjusted Price per Pound ($)
2002	22	7,925	38,188	62,857	4.82	7.93
2003	18	8,868	38,910	62,606	4.39	7.06
2004	22	9,912	41,911	65,255	4.23	6.59
2005	12	5,259	21,312	31,989	4.05	6.08
2006	7	3,899	17,263	24,462	4.43	6.28
2007	5	8,216	34,292	46,363	4.17	5.64
2008	9	8,868	36,887	47,842	4.16	5.40
2009	12	6,228	26,948	34,763	4.33	5.59
2010	12	6,403	27,342	34,560	4.27	5.40
2011	15	6,561	32,823	39,978	5.00	6.09
2012	10	7,161	36,655	43,619	5.12	6.09
2013	9	4,563	25,989	30,381	5.70	6.66
2014	8	602	3,708	4,272	6.16	7.10
2015	6	966	5,389	6,149	5.58	6.37
2016	4	177	1,059	1,185	6.00	6.71
2017	5	876	5,477	5,975	6.26	6.83
2018	4	1,530	10,713	11,474	7.00	7.50
2019	4	2,471	18,336	19,326	7.42	7.82
2020	5	2,656	21,329	22,140	8.03	8.34
2021	7	2,537	21,653	21,653	8.54	8.54
5-yr avg.	**5**	**2,014**	**15,502**	**16,113.6**	**7.45**	**7.81**
10-yr avg.	**6**	**2,354**	**15,031**	**16,617.4**	**6.58**	**7.20**
20-yr avg.	**10**	**4,784**	**23,309**	**30,843**	**5.48**	**6.70**

Source: Western Pacific Fisheries Information Network (WPacFIN) data request.

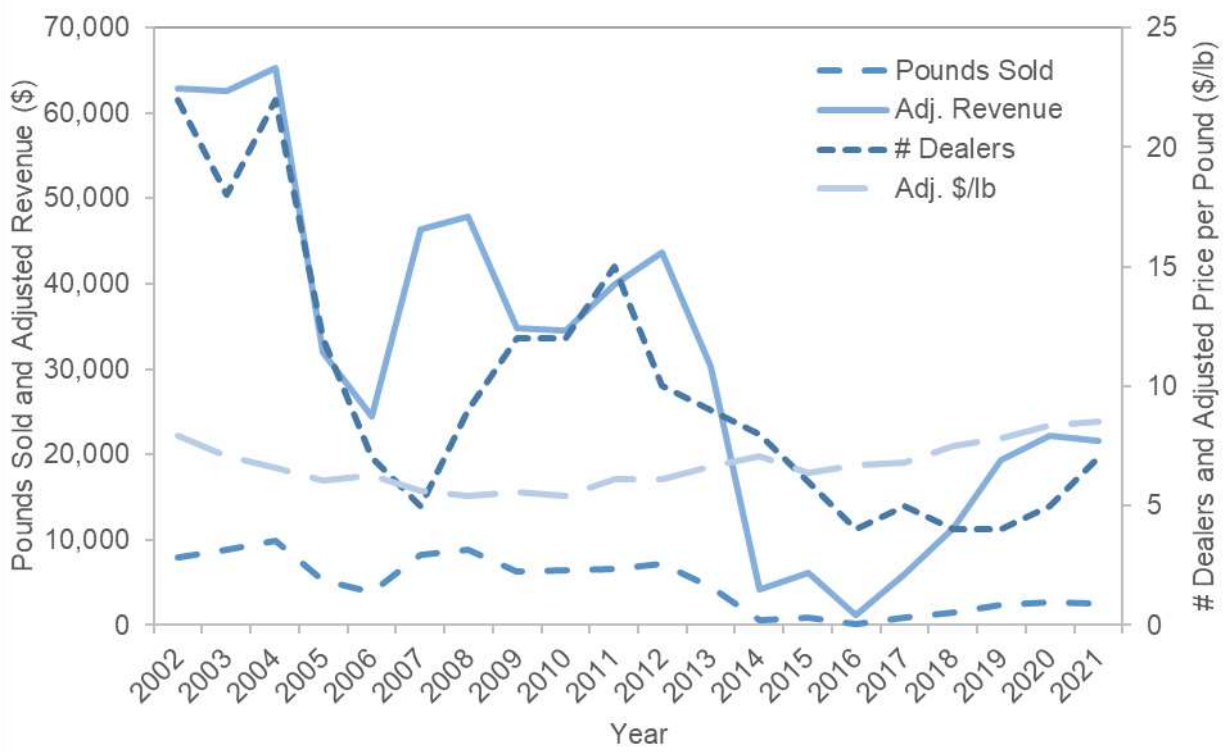

Figure 4. Visualization of commercial time series data for all gear types in the Main Hawaiian Islands Kona crab fishery.
Source: WPacFIN data request.

3.1.3 MHI Kona Crab Stock Status

The most recent stock assessment was a benchmark conducted by PIFSC (Kapur et al. 2019), which was peer reviewed through the Western Pacific Stock Assessment Review (WPSAR) process in Honolulu, Hawaii on September 10 to 14, 2018, and finalized in February 2019.

The benchmark stock assessment indicated that the MHI Kona crab stock was not overfished or experiencing overfishing (Table 11) borrowing reference points specified in the FEP for NWHI lobster stocks (Kapur et al. 2019). At its 131st meeting, held in Honolulu, Hawaii on March 12, 2019, the Council's Scientific and Statistical Committee discussed the benchmark stock assessment and considered it BSIA. Subsequently, at its 176th meeting, held in Honolulu, Hawaii on March 19, 2019, the Council accepted the SSC BSIA recommendation, and on September 24, 2019, the PIFSC also determined the stock assessment to be BSIA (NMFS 2020).

Table 11. Stock assessment parameters for the Main Hawaiian Islands Kona crab stock

Parameter	Value	Status
MSY for total catch	73,069 lb	
MSY for reported catch	25,870 lb	
H_{2016}	0.0081	
H_{MSY}	0.114	
H/H_{MSY}	0.0714	No overfishing occurring
B_{2016}	885,057 lb	

Parameter	Value	Status
B_{MSY}	640,489 lb	
B_{2016}/B_{MSY}	1.3977	Not overfished

Source: Kapur et al. (2019).
Note: "H" refers to harvest rate and is used instead of fishing mortality in this instance. The PIFSC SAP utilized H over F because the effective rate of fishing mortality from a biomass dynamic model is generally given as H and the FEP is not explicit about the use of instantaneous fishing mortality (i.e., F) as the measure of effective fishing effort.

3.2 Potential Effects of the Alternatives

NMFS will provide NEPA documentation of environmental impacts for the proposed action through a categorial exclusion (CE). The action is consistent with the type of activities described under NAO 216-6A Companion Manual, Appendix E, NOAA Trust Resource Management Actions, CE Reference Number A1, which applies to "an action that is a technical correction or a change to a fishery management action or regulation, which does not result in a substantial change in any of the following: fishing location, timing, effort, authorized gear types, or harvest levels." There are no direct or indirect effects expected from the proposed action on fishery operations, biology and conservation of the resource, socioeconomics, or safety at sea. Thus, adverse impacts to the fishery, its participants, and the related fishing community are unlikely. Similarly, we do not anticipate effects to the associated natural environment. While there would not be indirect impacts associated with establishing SDC or consequences from a subsequent stock status determination under Alternative 2, the implementation of SDC under Alternatives 3a through 3d may result in indirect effects to fishery operations, economics, and social impacts if the new SDC were to cause an abrupt change in stock status determination for MHI Kona crab to that of an overfished or overfishing status.

Cumulative impacts are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes those actions. Past and present effects on the Kona crab stock would result from past and current management of the Kona crab fishery, as described throughout this document and in the previous NMFS and Council actions to specify an ACL and AMs for 2020 to 2023 for the stock (NMFS 2020). This action resulted in a Finding of No Significant Impact by NMFS. Besides the previous and forthcoming ACL and AM specifications, NMFS does not have any other reasonably foreseeable management actions that are likely to affect the MHI Kona crab fishery, cause a change in the biological conditions of the resource, or change the review of environmental impacts.

Numerous activities take place in Federal, State, and territorial waters including military and maritime uses, wind and tidal power, communication uses, and conservation activities. These activities do not present foreseeable future activities that would have impacts on the assessment or status determination of the MHI Kona crab stock because they are not connected to the stock assessment and stock status determination process. Additionally, there is no information that any of these types of activities are planned where the MHI Kona crab fishery occurs.

The potential forthcoming repeal on regulations by the State of Hawaii prohibiting the harvest and retention of female Kona crab (see Section 3.1), considered in combination with the proposed action, is not likely to result in adverse impacts to the fishery, its resource, or its fishing communities. While the regulatory change may alter the landscape of the fishery due to the

potential for increased catches, participation, or effort due to the newly allowed retention of female individuals, the model used in the most recent benchmark stock assessment (Kapur et al. 2019) provided projections inclusive of female Kona crab such that increased catches from the retention of females would not result in unexpected impacts. The Council and NMFS expect that the proposed SDC could be established in the FEP and applied to the results of the subsequent benchmark stock assessment regardless of potential State regulatory changes.

With respect to cumulative effects on the physical environment, the MHI Kona crab fishery is not known to have adverse effects on air quality, noise, water quality, view planes, or terrestrial resources, and management of the fishery using the SDC under Alternative 2 would not change effects on the physical environment (see Section 2.2.2). Similarly, the proposed action under Alternative 2 would not have any impact on the biological environment since the same SDC as the 2019 assessment to be established in the Hawaii FEP would be applied to determine stock status. Further, protected species would remain unaffected because the fishery would continue to be authorized and conducted in accordance with Section 7 of the Endangered Species Act and the Marine Mammal Protection Act, as the MHI Kona crab fishery is not likely to have significant effects on the survival or recovery of any listed species, due to the low levels of interactions the fishery has with these listed species.

In consideration of potential cumulative effects on habitat and vulnerable ecosystems from the proposed action, there are no identified impacts to marine biodiversity, resources, or ecosystem function from the continued operation and management of the MHI Kona crab fishery, and Kona crab fishing is not known to be a potential vector for introducing or spreading new alien species since none of the vessels are known to fish outside of Hawaii State waters. For these reasons, the proposed action to establish SDC for MHI Kona crab in the Hawaii FEP is not expected to result in effects to the physical or biological environment.

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