6.D.2(2)
144th SSC

NOAA FISHERIES

Main Hawaiian Islands Insular False Killer Whale (*Pseudorca crassidens*) Distinct Population Segment

5-Year Review: Summary and Evaluation

Photo Credit: Cascadia Research Collective / Jessica Aschettino

April 2022

NOAA FISHERIES | PACIFIC ISLANDS REGIONAL OFFICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Table of Contents

5-YEAR REVIEW

Main Hawaiian Islands Insular False Killer Whale (*Pseudorca crassidens*) Distinct Population Segment

1. GENERAL INFORMATION

1.1 Reviewers

Lead Regional or Headquarters Office: Krista Graham, Pacific Islands Regional Office, (808) 725-5152

1.2 Methodology Used to Complete Review

A 5-year review is a periodic analysis of a species' status conducted to ensure that the listing classification of a species as threatened or endangered on the List of Endangered and Threatened Wildlife and Plants (List) (50 CFR 17.11–17.12) is accurate. Five-year reviews are required by section 4(c)(2) of the Endangered Species Act of 1973, as amended (ESA). This review was prepared pursuant to the joint National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service's 5-year Review Guidance and Template (USFWS and NMFS 2006). The NMFS Pacific Islands Regional Office (PIRO) conducted this 5-year review of the main Hawaiian Islands insular false killer whale (MHI IFKW) distinct population segment (DPS).

We based this 5-year review on the *Recovery Status Review for the MHI IFKW (Pseudorca crassidens) DPS*[1], completed in August 2021, which comprehensively updates the 2010 Status Review Report (Oleson et al. 2010). We also based this 5-year review on the *Final Recovery Plan for the MHI IFKW DPS*, published in November 2021, to determine whether a reclassification or delisting may be warranted (see Section 3).

1.3 FR Notice Citation Announcing Initiation of this Review

On October 16, 2020, we announced our intention to conduct a 5-year review for the MHI IFKW DPS to determine whether its classification as endangered under the ESA remains accurate (85 FR 65791). (This announcement was in conjunction with a request for public comment on the *Draft Recovery Plan* and *Recovery Implementation Strategy for the MHI IFKW DPS*). Public comments were accepted until December 15, 2020; we received six public comment letters and incorporated information as appropriate in this review.

[1] A recovery status review provides the best scientific and commercial data available on the status, threats, and conservation efforts for a listed species, including a complete ESA section 4(a)(1) five-factor analysis. It serves as the "Background" section of a recovery plan to inform management and recovery actions for the species.

2. REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment Policy

Under the ESA, the term "species" includes "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." A distinct population segment, or DPS, must be "discrete" from other populations and "significant" to the taxon (species or subspecies) to which it belongs. In the 2012 final rule to list the MHI IFKW under the ESA, we concluded that the evidence supporting discreteness and significance—based on behavioral and genetic factors, marked genetic characteristic differences, existence in a unique ecological setting, and maintenance of cultural diversity—between MHI IFKWs and their conspecifics supported a DPS designation (77 FR 70915).

Since the 2012 final listing rule, more extensive sampling of false killer whales from the main Hawaiian Islands and surrounding archipelagic waters has occurred and has further strengthened the evidence for differentiation of the MHI IFKW DPS from all other false killer whale strata, including the Northwestern Hawaiian Islands population (Martien et al. 2014a, 2014b). As such, we find that the MHI IFKW still meets the definition of a DPS. The complete DPS analysis can be found in the original 2010 Status Review Report (section 3.0; Oleson et al. 2010), the 2012 Reevaluation of the DPS Designation (Oleson et al. 2012), the final listing rule (77 FR 70915), and in the Recovery Status Review (NOAA Fisheries 2021a).

2.2 Review Summary

We used the 2021 Recovery Status Review to inform this 5-year review and incorporated information received during the public comment period, as appropriate. Below is a summary of the abundance and trends of the MHI IFKW, as well as the threats acting on the species, either individually or synergistically. We summarize the analyzed information available on the species relative to the definitions of "endangered" and "threatened" and in the context of the five ESA section 4(a)(1) listing factors. Please refer to the Recovery Status Review (NOAA Fisheries 2021a) and the Final Recovery Plan (NOAA Fisheries 2021b) for a complete discussion of the MHI IFKWs' status including biology, habitat, threats, and management and conservation efforts.

2.2.1 Population Status

Per the 2017 final Stock Assessment Report (Carretta et al. 2018), Bradford et al. (2018) used encounter data from dedicated and opportunistic surveys for MHI IFKWs from 2000 to 2015 to generate annual mark-recapture estimates of abundance over the survey period. Due to spatiotemporal biases imposed by sampling constraints, annual estimates reflect the abundance of MHI IFKWs within the surveyed area in that year, and therefore should not be considered indicative of total population size every year. The abundance estimate for 2015 was 167 (SE=23; 95% CI=128–218) animals within the surveyed area. Annual estimates over the 16-year survey period ranged from 144 to 187 animals and are similar to multi-year aggregated estimates previously reported (e.g., Oleson et al. 2010). The minimum population estimate for the MHI IFKW is calculated as the lower 20th percentile of the log-normal distribution (Barlow et al. 1995) of the 2015 abundance estimate (from Bradford et al. 2018), or 149 false killer whales (Carretta et al. 2018).

As discussed in the original Status Review Report, historical population size of the MHI IFKW is unknown. Since the range of the MHI IFKW has recently been revised (172,268 km^2; Bradford et al. 2015), and is smaller than previously thought, using methods from Oleson et al. (2010) results in a revised plausible historical abundance estimate of 655 animals (NOAA Fisheries 2021a).

Aerial survey sightings from 1989 to 2003 suggest that the MHI IFKW population declined until the early 2000s. A survey conducted on the leeward (western) sides of the main Hawaiian Islands in June and July 1989 report 14 sightings of false killer whales, including 3 large groups (group sizes of 470, 460, and 380 individuals) very close to shore off Hawaiʻi Island (Reeves et al. 2009). These large group sightings were all in an area known to be a high-density area for MHI IFKWs based on satellite tagging data (Baird et al. 2012). The largest group seen in 1989 is almost three times larger than the current best estimate of the population size. From 1993 to 2003, five systematic aerial surveys indicated declining false killer whale encounter rates, with eight groups seen in 1993, nine in 1995, one in 1998, and no false killer whales (individuals or groups) seen in 2000 and 2003 (Mobley et al. 2000, Mobley 2004). Therefore, the large group sizes observed in 1989, together with the declining encounter rates from 1993 to 2003, suggest that MHI IFKWs may have declined substantially between 1989 and 2007 (Reeves et al. 2009). Baird (2009) also reviewed the trends in sighting rates of false killer whales from these aerial surveys and concluded that sighting rates during these surveys showed a statistically significant decline that could not be attributed to any weather or methodological changes. Additionally, Silva et al. (2013) analyzed the number of sightings per hour of effort off Maui Nui across three methods of data collection (e.g., opportunistic, directed, systematic boat-based surveys). Results suggest that the encounter rate of false killer whales in leeward Maui County waters in 1995 was over five times greater than in 2011, supporting the hypothesis of a population decline.

Based on our current understanding of population structure and geographical overlap between the MHI IFKW and other nearby unlisted populations, it seems unlikely that the large group sizes of false killer whales observed in 1989 were exclusively comprised of MHI IFKWs (Baird et al. 2012). For many years, scientists assumed false killer whales observed within 40 km of shore were MHI IFKWs. More recently, the pelagic population has been observed closer to shore (as close as 5.6 km offshore; Bradford et al. 2020). However, sightings of pelagic individuals within 40 km of shore are extremely rare; in 73 false killer whale sightings over an 18-year period within 40 km of shore, only one was a pelagic group, seen 22.8 km from shore (Dr. Robin Baird, Cascadia Research Collective, pers. comm., May 2019). Despite uncertainty about the historical population size, there is high confidence in the current estimated population size of 167 MHI IFKWs within the surveyed area in 2015.

As discussed in Oleson et al. (2010), microsatellite genetic data was used to estimate the effective population size of MHI IFKWs as 45.8 individuals (95% CI=32.4 to 69.4 individuals). Due to an increased sample size of biopsies, Martien et al. (2019) have now estimated the effective population size as 57.6 individuals (95% CI=47.2–71.8). The effective population size reflects the size of an idealized population that would experience genetic drift in the same way as the actual (census) population (Chivers et al. 2010). Domestic (i.e., non-wild) animals have been shown to start displaying lethal or semi-lethal genetic traits when effective population size reaches about 50 individuals (Franklin 1980). Although negative genetic effects cannot be predicted for a group of wild individuals that are probably naturally uncommon with a strong social structure that limits genetic diversity, the low effective population size of 57.6 individuals accordingly remains a concern as it is still quite near the estimate of when individuals start displaying lethal or semi-lethal genetic traits.

Lastly, because of inter-annual variability in survey effort, it is currently unknown whether the MHI IFKW population has continued to decline, has recently stabilized, or has recently increased. The annual abundance estimates available in Bradford et al. (2018) are not appropriate for evaluating population trends, as the study area varied by year, and each annual estimate represents only the animals present in the study area within that year (Carretta et al. 2018). At a minimum, we will continue to reexamine the status of the MHI IFKW DPS once every five years—as we are doing here—to address new information available on this species.

2.2.2 Summary of Threats

Nineteen current and future threats to the MHI IFKW have been identified (NOAA Fisheries 2021a). The 3 threats of high concern and the 3 threats of moderate-to-high concern as they relate to the ESA section 4(a)(1) listing factors are summarized below; the remaining 13 threats to the MHI IFKW DPS are listed in section 2.2.2.7. Each threat is explained in greater detail in the Recovery Status Review, which also provides a summary table of threats to the species described with a variety of parameters such as:

- Major effects (e.g., compromised health, reduced foraging success, injury or mortality)
- Extent (the portion of the range over which the threat exists)
- Frequency (occurrence/regularity of the threat over time)
- Severity (magnitude or intensity of the threat)
- Trend (change in extent, frequency, or severity of the threat over time)
- Relative concern (overall perception of how the threat affects recovery relative to the other threats)
- Evidence of the threat acting on the population (confidence in the available information upon which our assessment is based)

2.2.2.1 *Incidental Take in Non-Longline Commercial and Recreational Fisheries* (Factor E: Other natural or manmade factors affecting its continued existence)

The threat of incidental take (i.e., interactions like hookings and entanglements) in non-longline commercial and recreational fisheries (e.g., troll, handline, kaka line, and shortline) in the nearshore environments around the main Hawaiian Islands is a high concern for the MHI IFKW DPS (NOAA Fisheries 2021a). Results from Baird et al. (2017) provide evidence that 1) hookings and entanglements that result in injuries to MHI IFKWs are continuing; 2) both sexes have injuries that are consistent with hookings and entanglements, although there is significant sex bias towards females; and 3) mouthline injuries suggest that at least 23% of adult MHI IFKWs depredate catch. Due to the scale and distribution of these non-longline fisheries, the prevalence of injuries associated with hookings and entanglements, along with the bias of injuries toward females, the severity of the threat of incidental take in non-longline commercial and recreational fisheries to MHI IFKWs is therefore considered high.

Although evidence is clear that these injuries are occurring, evidence of precisely how these injuries are specifically affecting MHI IFKW individuals—from the long-term health and fitness of the individual to the resulting effect to the population—is limited. However, at this time we consider it analogous to the hooking and entanglement of pelagic false killer whales from the Hawaiʻi-based commercial longline fisheries where hooking and entanglement injuries are predominantly considered a serious injury. Additionally, there are differences in injury rates between the five MHI IFKW social clusters, suggesting that different social clusters may have different habits that lead to different rates of depredation and hooking and entanglement. Certain behaviors, like depredation and following fishing vessels, may be learned behaviors that are passed down to individuals within a social cluster. These types of behaviors may affect the growth rate of the social clusters differently (Sargeant and Mann 2009, Beach 2015).

Baird et al. (2017) has shown an increasing trend in injuries consistent with fisheries interactions previously reported in earlier studies by Beach (2015). Moreover, the process of documenting fisheries-related injuries is negatively biased since many mouthline injuries are concealed below the water line and can go undetected by scientists (Beach 2015). One stranded MHI IFKW in October 2013 had five fishing hooks and line in its stomach (NOAA Fisheries Pacific Islands Region Marine Mammal Response Network, as cited in Carretta et al. 2018). These findings confirm that MHI IFKWs are interacting with nearshore hook and line fisheries, with negative consequences to their continued survival.

2.2.2.2 Inadequate Regulatory Mechanisms of Non-longline Commercial and Recreational Fisheries (Factor D: Inadequacy of existing regulatory mechanisms)

The threat of inadequate regulatory mechanisms for non-longline commercial and recreational fisheries (e.g., troll, handline, kaka line, and shortline), in the form of inadequate management and reporting requirements, is also a threat of high concern for the MHI IFKW. This is because of the evidence that interactions with MHI IFKWs are occurring, coupled with the uncertainties associated with properly assessing and analyzing the mechanisms and effects of these interactions. Specifically, the current reporting requirements for non-longline commercial and recreational fisheries are inadequate to assess the rate and type of interactions occurring with MHI IFKWs. More precisely, fishermen can fish using multiple methods (e.g., set shortlines and then fish handlines while the shortlines are soaking) but then only report just one method type (e.g., handline); thus, there is not a good way of assessing the risk for some fisheries. As such, the severity of this threat is considered high.

State of Hawaiʻi commercial fishermen are required to report their catch and other information as part of the requirements for maintaining their commercial marine license (CML); however, the reporting does not collect several types of pertinent information required to accurately characterize both the fisheries (effort detail, catch, precise location, etc.) and the prevalence of interactions with protected species, including the MHI IFKW. An analysis by Boggs et al. (2015) found that in many cases, the summary entry on predators included multiple predators that might refer to several different days, areas, or methods. Other caveats noted by the authors explain why the information about predation on catch in these forms should be treated cautiously and has limited utility for inferring interactions (i.e., depredation, hookings, or entanglements) between these fisheries and marine mammals. Moreover, there is a blurry line between commercial catch and non-commercial catch with catch often reported as both (i.e., reported as commercial in a CML report, but also reported as recreational catch in an independent survey), making it difficult to achieve reliable estimates of either one (see Hospital et al. 2011). This analysis shows that marine mammal interactions (i.e., depredation, hookings, or entanglements) occur with these fisheries, but that the information reported on the forms is not informative enough to determine effects to MHI IFKWs or to determine management strategies since there are different requirements or authorities for regulating commercial versus recreational fisheries. For example, section 118 under the Marine Mammal Protection Act and its requirements for take reduction plans do not apply to recreational fisheries. Additionally, all commercial fishermen are required to report marine mammal injuries to NOAA Fisheries (per 50 CFR 229.6), but because Category III fishermen (i.e., from troll, handline, kaka line, and shortline fisheries) are not required to register to receive an Authorization Certificate under the Marine Mammal Authorization Program (per 50 CFR 229.4), Category III fishermen rarely receive information on the reporting requirement or receive a copy of the reporting form that is typically sent with the Authorization Certification.

Even if non-longline commercial fishermen had the authorization certificate and thus information on the reporting requirement and the marine mammal reporting form, information from interactions (i.e., depredation, hookings, or entanglements) might not be submitted to NOAA Fisheries because self-reporting rates are often very low (e.g., Boggs et al. 2015). A prime example of this is in the commercial deep-set longline fishery. Given the low level of observer coverage that began in 1994 (i.e., less than 4%) compared to the more recent 20% observer coverage, the likelihood of any false killer whale takes being documented in the deep-set fishery was low prior to 2000 (Baird 2009). Additionally, there are no assurances that more recent logbook data from unobserved trips are accurate and comprehensive (e.g., Boggs et al. 2015). Therefore, interactions with protected species—especially MHI IFKWs where one or two interactions could substantially affect the fitness of the MHI IFKW DPS—are likely not noted in the logbooks from unobserved trips. This indicates that the solution is not simply to merely include reporting requirements because fishermen do not report bycaught animals at rates anywhere near what the observer data show.

2.2.2.3 *Small Population Size* (Factor E)

The threat of small population size is of high concern. Reliable trend information for the MHI IFKW is not available so it is difficult to determine whether the small population size may be an increasing, decreasing, or stable threat. The severity of the threat is considered high.

As previously mentioned, the most recent abundance estimate for MHI IFKWs is from 2015, with 167 (SE=23; 95% CI=128–218) animals in the surveyed area, and annual estimates over a 16-year survey period from 2000 to 2015 ranging from 144 to 187 animals for the portion of the range surveyed in each year (Bradford et al. 2018). The current minimum population estimate is 149 false killer whales. Significant concern exists because the current estimated number of breeding adults—57.6 individuals (95% CI=47.2–71.8; Martien et al. 2019)—is approaching levels where inbreeding depression could have increasingly negative effects on population growth rate. Other social factors (such as efficiency in group foraging and potential loss of knowledge needed to deal with unusual environmental events) may further compromise the ability of MHI IFKWs to recover to healthy levels. Considering such aspects of the MHI IFKW population—confined range, genetic isolation, social complexities, and limited abundance—the ability of the MHI IFKW population to recover is therefore concerning.

2.2.2.4 *Competition with Commercial Non-longline Fisheries* (Factor A: present or threatened destruction, modification, or curtailment of its habitat or range)

The threat of competition from the commercial non-longline fisheries (i.e., troll, handline, kaka line, and shortline) is of moderate to high concern and may be present range wide and continuously. Additionally, any current trend in the frequency of competition with commercial non-longline fisheries that may affect MHI IFKWs is unknown given a lack of clear overall trends in current catch within the habitat.

Commercial (and recreational) troll and handline fisheries in Hawaiʻi operate almost entirely within the MHI IFKWs' core nearshore habitat (<40 km from shore). Stocks of prey species are wide ranging and the amount of overlap between fishing activity and the range of the MHI IFKW is important in terms of competition for the locally-available fish. Prey of MHI IFKWs includes many of same species targeted by Hawaiʻi's commercial non-longline fisheries, especially tuna, billfish, wahoo, and mahi mahi.

The commercial troll and handline fisheries alone now harvest as much, or more than, is estimated to be consumed annually by the MHI IFKW population (WPRFMC 2017, NOAA Fisheries 2021a). The commercial troll fishery remains a very active potential competitor in the MHI IFKWs' habitat. Competition of commercial non-longline fisheries with local foraging by MHI IFKWs as indicated by the catch of the local commercial troll fishery has increased since the early 1970s, although the increase has slowed in recent decades. Competition from the commercial handline fishery would seem to have diminished compared to the late 1990s (with a recent upswing), although it, too, has increased considerably since the early 1970s. How changes in competition align with the likely decrease in MHI IFKW abundance is currently unknown. Presently, there is no direct evidence that competition is resulting in the whales being food limited, and there are no known observations of whales in reduced body condition that could be an indication of poor nutrition. However, the severity of the threat of competition with commercial non-longline fisheries is considered unknown but potentially high (NOAA Fisheries 2021a).

2.2.2.5 *Competition with Recreational Fisheries* (Factor A)

Competition with recreational fisheries is a threat that may be present range wide and continuously. Any trend in the frequency of competition from recreational fisheries that may affect MHI IFKWs is unknown, and the severity is considered unknown but potentially high. The level of concern for this threat—moderate to high relative concern—is highly uncertain because there is no reporting system in place to accurately record the level of catch or trend of target species in recreational fisheries. The best available estimate of pelagic species catch in recreational fisheries is an average of 13.5 million lbs/year for 2003 to 2014 (Ma and Ogawa 2016). Extrapolated recreational fish catch totals are many times higher than reported commercial catch totals for troll, handline, kaka line, and shortline fisheries.

The annual magnitude of prey required by the MHI IFKW population is estimated to be between 2.6 to 3.5 million lbs/year (NOAA Fisheries 2021a citing Brad Hanson, NOAA Fisheries NWFSC, pers. comm. 2016), and recreational fishing consumes almost four to five times as much fish as the entire MHI IFKW population on an annual basis. As noted earlier, there is some overlap in the catch that gets reported as commercial catch via CML reporting requirements and in catch that gets reported in a survey of non-commercial catch; this makes it difficult to tease out the separate effects of competition from these different types of fisheries (see Hospital et al. 2011, NOAA Fisheries 2021a).

2.2.2.6 Environmental Contaminants and Naturally Occurring Biotoxins

(Factor A, and Factor C: Disease or predation)

The threat of environmental contaminants and naturally occurring biotoxins is of moderate to high concern. Contaminants and biotoxins may be present range wide and continuously, and any trend in the concentration of contaminants and biotoxins that may affect MHI IFKWs is unknown.

Environmental contaminants and naturally occurring biotoxins can cause a suite of health effects to MHI IFKWs, severely limiting the potential for the DPS to recover. Exposure to environmental contaminants (e.g., persistent organic pollutants, polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethanes, polybrominated diphenyl ethers, heavy metals, and chemicals of emerging concern) and naturally occurring biotoxins (e.g., ciguatoxin, maitotoxin) is a moderate to high concern for false killer whales since their high trophic status exposes them to elevated levels of contaminants that biomagnify up through the food web. Not only is biomagnification a concern, but so is continued exposure over a long life and during vulnerable life history stages such as juveniles and much older cetaceans (NOAA Fisheries 2021a).

PCB levels exceeding 14,800 ng/g lipid weight are believed to cause adverse health effects in marine mammals (Kannan et al. 2000, Schwacke et al. 2002). Several lines of evidence show that female marine mammals can also off-load some of their contaminants, like PCBs, to their offspring during lactation (Ylitalo et al. 2009, NOAA Fisheries NWFSC unpublished data). A 2017 contaminant study of MHI IFKWs revealed that 66.7% (30 of 45) of the sampled individuals had levels of ∑PCBs ≥17,000ng/g lipid weight threshold value (NOAA Fisheries 2021a). Additional evidence from this study may suggest several females are experiencing reproductive consequences as a result of these levels.

Heavy metals have been shown to accumulate in marine mammals and, in some cases, may cause deleterious biological effects. Of greatest concern for marine mammals are mercury, lead, cadmium, and the organotins. These substances could pose risks to MHI IFKWs as they have been found in relatively high concentrations in false killer whales from other regions of the world. Currently, no data on heavy metals are available for MHI IFKWs so the risk associated with exposure to these substances is unknown. However, exposure is expected to increase as both human population growth and a demand for these substances increases. Several other emerging contaminants are also expected to increase in the future and require closer analysis of their effects on MHI IFKWs.

Lastly, biotoxins associated with harmful algal blooms (HABs) have been shown to accumulate heavily in marine mammals (Hellegraeff 1993, Trainer 2002). Marine mammals can be exposed to biotoxins through ingestion of toxin-contaminated prey or through inhalation of seawater. Exposure to these compounds can cause a variety of adverse health effects in marine mammals (Trainer 2002). Anthropogenic loading has continued to increase in the marine environment, leading to increased HABs responsible for the production of biotoxins (Sellner et al. 2003). Additionally, HABs have been shown to cause a number of marine mammal stranding events and may possibly affect MHI IFKWs (NOAA Fisheries 2021a).

2.2.2.7. *Other Threats* (Factors A, C, D, and E)

The remaining 13 threats, identified as low to moderate concern, that have been identified to affect the status and recovery of the MHI IFKWs are as follows: short and long-term climate change (ocean warming, low productivity zones, ocean acidification, and disease vectors (e.g., pathogens, fungi, worms, parasites)); anthropogenic noise (e.g., vessel traffic, sonar (military, oceanographic, fishing), alternative energy development); cumulative and synergistic effects; competition with commercial longline fisheries (i.e., deep-set and shallow-set); marine debris ingestion; intentional harm (e.g., shooting, poisoning, explosives); oil spills; predation (killer whales, tiger sharks, etc.); incidental take (hooking or entanglement) in commercial longline fisheries (i.e., deep-set and shallow-set); interactions with aquaculture facilities and other marine structures (e.g., wind farms, solar farms); vessel strikes; whale/dolphin watching and other eco-tours; and competition with marine species (marlin, sharks, etc.). For more information on these threats, please see the Recovery Status Review (NOAA Fisheries 2021a).

2.3 Synthesis

In summary, the MHI IFKW is a small and reproductively isolated DPS with a range that surrounds the main Hawaiian Islands. The most recent abundance estimate in 2015 was 167 animals within the surveyed area (Bradford et al. 2018). For reasons that are unclear, the population has likely declined until at least the early 2000s. Because of changes in survey design and effort, it is unknown whether the abundance of MHI IFKWs has continued to decline, has recently stabilized, or has recently increased (Bradford et al. 2018). Nineteen identified current and future threats (representing ESA section 4(a)(1) factors A, C, D, and E) are acting on the MHI IFKW population, either individually or synergistically.

The Final Recovery Plan and the accompanying Recovery Implementation Strategy for the MHI IFKW—both released in November 2021—identify a strategy to recover this DPS. The associated recovery goal, objectives, and criteria set standards for determining when recovery progress has been made under the ESA to the point at which the species can be downlisted to threatened and, ultimately, to the point at which the species has recovered and can be delisted because listing is no longer warranted.

This 5-Year Review concludes that the recovery criteria outlined in the Final Recovery Plan are current and meet the ESA standards of objective and measurable recovery criteria by including both biological (demographic) criteria on abundance and trends, as well as threats-based criteria that address the five factors outlined in section 4 of the ESA. However, the MHI IFKW DPS does not meet the minimum demographic criteria for productivity for reclassification from endangered to threatened (i.e., an increasing average annual population trend is not yet greater than or equal to 2% over one generation (25 years), and there are not yet, at a minimum, 248 individuals), nor does it meet the minimum threats-based criteria. Consequently, we recommend the MHI IFKW DPS remain classified as endangered.

3. RESULTS

3.1 Recommended Classification

____ **Downlist to Threatened**
____ **Uplist to Endangered**
____ **Delist** (Indicate reason for delisting per 50 CFR 424.11):

_____ *Extinction*
_____ *Species does not meet the definition of an endangered or threatened species*
_____ *Listed entity does not meet the definition of a species*

__X__ **No change is needed**

3.2 New Recovery Priority Number

Brief Rationale: The new recovery priority number—1C[2]—is based on new guidelines, which were implemented in 2019 (84 FR 18243) to prioritize limited agency resources to advance the recovery of threatened and endangered species by focusing on the immediacy of certain parameters. The priority number of 1C for the MHI IFKW indicates a high demographic or extinction risk due to low estimated abundance, uncertainty in abundance trend, and a high understanding of major threats. Additionally, a high U.S. jurisdiction, authority, or influence exists for management or protective actions to address major threats due to its circumscribed range surrounding the main Hawaiian Islands; a high certainty exists that management or protective actions will be effective because of sufficient knowledge of the threats to develop actions coupled with the United States having the jurisdiction, authority, or ability to influence implementation of such actions; and recovery of the species is in conflict with development or other forms of economic activity (e.g., fishing).

[2] The original recovery priority number—3—was based on NMFS' 1990 recovery priority system (55 FR 24296). In 2019, NMFS finalized changes to the recovery priority system (84 FR 18243; April 30, 2019). For the 2019–2020 Biennial Report to Congress, the recovery priority was reported as a 1C (NMFS 2022).

4. RECOMMENDATIONS FOR FUTURE ACTIONS

Considering the small population size, life history characteristics, and the threats affecting the MHI IFKW DPS, the overall strategy to recover this population is to do the following:

1. Increase the population size through management actions that increase survival and decrease mortality due to known threats.
2. Address threats from fisheries, including incidental take and competition with fisheries for prey.
3. Protect, maintain, and enhance habitat by identifying and minimizing environmental contaminants, biotoxins, anthropogenic noise, effects of climate change, and planning for other rare threats such as oil spills.
4. Ensure that other regulatory mechanisms such as state and federal laws and a post-delisting monitoring plan are in place to successfully manage threats and ensure that the population remains stable or increases after it is delisted.
5. Continue research and monitoring to understand secondary threats and how they interact; based on the results, improve our ability to address multiple threats acting concurrently with feasible and effective management actions.

We recognize that recovery will require a sustained effort that is adapted as new information becomes available, threats are mitigated, new threats arise, and the status of the MHI IFKW DPS changes. As such, the recovery plan is structured to address known or potential threats necessary to curb population decline and/or stabilize/increase the population first (since the current trend is unknown), and to adapt future efforts to ensure continued population growth and recovery. In the meantime, the recommendations herein are made within the context of agency resources and priorities.

Existing knowledge and data gaps for the MHI IFKW DPS make it difficult to more accurately assess the status, abundance, and trends of the population. This is partly attributed to the variability in survey locations, efforts, and methods over the years coupled with the current inability to estimate unquantified spatiotemporal biases that are imposed by necessary sampling constraints. However, more robust dedicated and opportunistic survey efforts should be designed and implemented with advanced analytical methods to further improve the accuracy of the abundance, trends, movements, and population structure of the MHI IFKW DPS. Ideally, these efforts should be conducted three times over a 1 to 1.5-year period and repeated with some regularity (i.e., occurring at least every 5 to 10 years). With robust data from this effort, we may have a higher capacity to detect trends both within the population and within social clusters. The resulting trend analysis and demographic information will influence and prioritize future research (see Action 1.1 in the Final Recovery Plan).

There is also an immediate need to better engage with fishermen to reduce the frequency and severity of false killer whale interactions as well as analyze and manage non-longline commercial and recreational fishery interactions. These high priority actions will help to ensure that we adequately address one of the most significant threats to the MHI IFKW—incidental take in fisheries. Engagement efforts could include encouraging/incentivizing fishermen to anonymously report any incidental takes of false killer whales, and working with fishermen to develop and test strategic outreach messaging, tools, and programs. These collaborative partnerships may foster innovative opportunities that benefit both fishermen and false killer whales. It can also aid in building our foundational knowledge of which non-longline gear types are interacting with the species and how/when/where interactions are occurring. This information is critical to informing management and determining if management actions are working (see Actions 2.1 and 7.3 in the Final Recovery Plan).

To see an in-depth list of all the recovery actions and stepped-down recovery activities suggested as a means of recovery, please see the Final Recovery Plan (NOAA Fisheries 2021b) and the accompanying Recovery Implementation Strategy (NOAA Fisheries 2021c).

5. REFERENCES

Baird, R.W. 2009. A review of false killer whales in Hawaiian waters: biology, status, and risk factors. Report prepared for the U.S. Marine Mammal Commission under Order No. E40475499 December 23, 2009.

Baird, R.W., M.B. Hanson, G.S. Schorr, D.L. Webster, D.J. McSweeney, A.M. Gorgone, S.D. Mahaffy, D. Holzer, E.M. Oleson, and R.D. Andrews. 2012. Range and primary habitats of Hawaiian insular false killer whales: informing determination of critical habitat. Endangered Species Research 18(1):47–61.

Baird, R.W., S.D. Mahaffy, A.M. Gorgone, K.A. Beach, T. Cullins, D.J. McSweeney, D.S. Verbeck, and D.L. Webster. 2017. Updated evidence of interactions between false killer whales and fisheries around the main Hawaiian Islands: Assessment of mouthline and dorsal fin injuries. Pacific Scientific Review Group Document. 8pp.

Barlow, J. and S. Rankin. 2007. False killer whale abundance and density: Preliminary estimates for the PICEAS study area south of Hawai‘i and new estimates for the US EEZ around Hawai‘i. Southwest Fisheries Science Center Administrative Report LJ-07-02. 15 p.

Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. marine mammal stock assessments: Guidelines for preparation, background, and a summary of the 1995 assessments. U.S. Dept. of Commerce, NOAA Technical Memorandum, NMFS-OPR-6, 73 p.

Beach, K.A. 2015. Mouthline injuries as an indicator of fisheries interactions in Hawaiian odontocetes. Master’s Thesis, Evergreen State College. June 2015. 58pp.

Boggs, C.H., D. Gonzales, and R.M. Kokubun. 2015. Marine mammals reported under catch lost to predators on fishermen's commercial catch reports to the State of Hawai‘i, 2003–2014. PIFSC Data Report DR-15-006, 14 p. doi:10.7289/V5PR7SZM

Bradford, A.L. 2018. Abundance estimates for management of endangered false killer whales in the main Hawaiian Islands. Endangered Species Research, 36: 297-313.

Bradford, A.L., E.M. Oleson, R.W. Baird, C.H. Boggs, K.A. Forney, N.C. Young. 2015. Revised stock boundaries for false killer whales (*Pseudorca crassidens*) in Hawaiian waters. U.S. Dept. of Commerce, NOAA Technical Memorandum, NOAA-TM-NMFS-PIFSC-47, 29pp. doi:10.7289/V5DF6P6J.

Bradford, A.L., E.A. Becker, E.M. Oleson, K.A. Forney, J.E. Moore, and J. Barlow. 2020. Abundance estimates of false killer whales in Hawaiian waters and the broader central Pacific. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-104, 78 p. doi:10.25923/2jjg-p807

Carretta, J.V., K.A. Forney, E.M. Oleson, D. Weller, A.R. Lang, J. Baker, M.M. Muto, B. Hanson, A.J. Orr, H. Huber, et al. 2018. U.S. Pacific marine mammal stock assessments: 2017. NOAA-TM-NMFS-SWFSC-602. La Jolla, CA: National Oceanic and Atmospheric Administration. 161 pp. https://repository.library.noaa.gov/view/noaa/18080

Chivers, S.J., R.W. Baird, K.M. Martien, B.L. Taylor, E. Archer, A.M. Gorgone, B.L. Hancock, N.M. Hedrick, D.K. Mattila, D.J. McSweeney, et al. 2010. Evidence of genetic differentiation for Hawai'i insular false killer whales (*Pseudorca crassidens*). NOAA Technical Memorandum, NOAA-TM-NMFS-SWFSC-458. 44pp.

Franklin, I.R. 1980. Evolutionary change in small populations. Conservation Biology: An Evolutionary-Ecological Perspective. M.E. Soule and B. Wilcox. Sunderland, Massachusetts, Sinauer.

Hallegraeff, G.M. 1993. A review of harmful algal blooms and their apparent global increase. Phycologia, 32(2), 79–99.

Hospital, J., S.S. Bruce, and M. Pan. 2011. Economic and social characteristics of the Hawai‘i small boat pelagic fishery. Pacific Islands Fisheries Science Center Administrative Report H-11-01. 82pp.

Kannan, K., A.L. Blankenship, P.D. Jones, and J.P. Giesy. 2000. Toxicity reference values for the toxic effects of polychlorinated biphenyls to aquatic mammals. Ecological Risk Assessment 6: 181–201.

Ma, H. and T.K. Ogawa. 2016. Hawai‘i marine recreational fishing survey: A summary of current sampling, estimation, and data analyses. NOAA Technical Memorandum NMFS-PIFSC-55. doi:10.7289/V5/TM-PIFSC-55.

Martien, K.K., S.J. Chivers, R.W. Baird, E. Archer, A.M. Gorgonne, B.L. Hancock, D. Matilla, D.J. McSweeney, E.M. Oleson, C.L. Palmer, V. Pease, K.M. Robertson, J. Robbins, G.S. Schorr, M. Schultz, D.L. Webster, B.L. Taylor. 2014a. Genetic differentiation of Hawaiian false killer whale (*Pseudorca crassidens*) discordant patterns at nuclear and mitochondrial markers suggest complex evolutionary history. Journal of Heredity doi:10.1093/jhered/esu029

Martien, K.K., S.J. Chivers, R.W. Baird, F.I. Archer, A.M. Gorgone, B.L. Hancock-Hanser, D. Mattila, D.J. McSweeney, E.M. Oleson, C. Palmer, V.L. Pease, K.M. Robertson, G.S. Schorr, M.B. Schultz, D.L. Webster, B.L. Taylor. 2014b. Nuclear and mitochondrial patterns of population structure in North Pacific false killer whales (*Pseudorca crassidens*). Journal of Heredity 105(5): 611-626. https://doi.org/10.1093/jhered/esu029

Martien, K.K., B.L. Taylor, S.J. Chivers, S.D. Mahaffy, A.M. Gorgone, and R.W. Baird. 2019. Fidelity to natal social groups and mating both within and between social groups in endangered false killer whale (*Pseudorca crassidens)* population.

Martien, K.K., B.L. Taylor, S.J. Chivers, S.D. Mahaffy, A.M. Gorgone, and R.W. Baird. 2019. Fidelity to natal social groups and mating within and between social groups in an endangered false killer whale population. Endangered Species Research, 40, pp.219-230.

Mobley, J.R. 2004. Results of marine mammal surveys on US Navy underwater ranges in Hawai‘i and Bahamas. Final report submitted to Office of Naval Research, Marine Mammal Program. Marine Mammal Research Consultants, Ltd. Honolulu, HI.

Mobley, J.R., S.S. Spitz, K.A. Forney, R. Grotefendt, and P.H. Forestell. 2000. Distribution and abundance of odontocete species in Hawaiian waters: preliminary results of 1993–1998 aerial surveys.

National Marine Fisheries Service. 2022. Recovering threatened and endangered species, FY 2019–2020 report to Congress. National Marine Fisheries Service. Silver Spring, MD. Report available online at: https://www.fisheries.noaa.gov/resource/document recovering-threatened-and-endangered-species-report-congress-fy-2019-2020

NOAA Fisheries. 2021a. Recovery status review for the main Hawaiian Islands insular false killer whale (*Pseudorca crassidens*) distinct population segment. August 2021, Version 2. NOAA Fisheries, Pacific Islands Regional Office. Honolulu, HI 96818. Available at: https://www.fisheries.noaa.gov/species/false-killer-whale#conservation-management

NOAA Fisheries. 2021b. Final Endangered Species Act recovery plan for the main Hawaiian Islands insular false killer whale (*Pseudorca crassidens*) distinct population segment. NOAA Fisheries, Pacific Islands Regional Office. Honolulu, HI 96818. Available at https://www.fisheries.noaa.gov/species/false-killer-whale#resources

NOAA Fisheries. 2021c. Endangered Species Act recovery implementation strategy for the main Hawaiian Islands insular false killer whale (*Pseudorca crassidens*) distinct population segment. September 2021, Version 1. NOAA Fisheries, Pacific Islands Regional Office, Honolulu, HI 96818. Available at: https://www.fisheries.noaa.gov/species/false-killer-whale#conservation-management

Oleson, E.M., C.H. Boggs, K.A. Forney, M.B. Hanson, D.R. Kobayashi, B.L. Taylor, P.R. Wade, and G.M. Ylitalo. 2010. Status review of Hawaiian insular false killer whales (*Pseudorca crassidens*) under the Endangered Species Act. U.S Dept. of Commerce. NOAA Tech Memo. NOAA-TM-NMFS-PIFSC-22. 140pp. + Appendices.

Oleson, E.M., C.H. Boggs, K.A. Forney, M.B. Hanson, D.R. Kobayashi, B.L. Taylor, P.R. Wade, and G.M. Ylitalo. 2012. Reevaluation of the DPS designation for Hawaiian (now main Hawaiian Islands) insular false killer whales. U.S. Dept. of Commerce. NOAA Internal Report, NOAA-PIFSC-IR-12-038. 39pp.

Reeves, R.R., S. Leatherwood, and R.W. Baird. 2009. Evidence of a possible decline since 1989 in false killer whales (*Pseudorca crassidens*) around the main Hawaiian Islands. Pacific Science 63:253-261.

Sargeant, B. L. and J. Mann. 2009. Developmental evidence for foraging traditions in wild bottlenose dolphins. Animal Behaviour, 78(3), 715-721.

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, et al. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environ Toxicol Chem 21(12):2752–2764.

Sellner, K.G., G.J. Doucette, and G.J. Kirkpatrick. 2003. Harmful algal blooms: Causes, impacts and detection. Journal of Industrial Microbiology and Biotechnology, 30(7), 383–406.

Silva, I.F., G.D. Kaufman, R.W. Rankin, and D. Maldini. 2013. Short note: Presence and distribution of Hawaiian false killer whales (*Pseudorca crassidens*) in Maui County waters: A historical perspective. Aquatic Mammals, 39(4), 409–414.

Trainer, V.L. 2002. Marine mammals as sentinels of environmental biotoxins. Handbook of Neurotoxicology. E.J. Massaro. Totowa, NJ, Humana Press Inc. I: 349–361.

USFWS and NMFS. 2006. 5-year review guidance: Procedures for conducting 5-year reviews under the Endangered Species Act. Available at: https://www.fisheries.noaa.gov/national/endangered-species-conservation/endangered-species-act-guidance-policies-and-regulations#recovery-(esa-section-4)

WPRFMC. 2017. Stock Assessment and Fishery Evaluation (SAFE) Report Pacific Island Pelagic Fisheries 2015. http://www.wpcouncil.org/wp-content/uploads/2015/04/2017-01-31_Final-2015-SAFE-Report-rev2.pdf. 396pp.

Ylitalo, G.M., R.W. Baird, G.K. Yanagida, D.L. Webster, S.J. Chivers, J.L. Bolton, G.S. Schorr and D.J. McSweeney. 2009. High levels of persistent organic pollutants measured in blubber of island-associated false killer whales (*Pseudorca crassidens*) around the main Hawaiian Islands. Marine Pollution Bulletin 58: 1932–1937.

6. APPROVAL

NATIONAL MARINE FISHERIES SERVICE
5-YEAR REVIEW
Main Hawaiian Islands Insular False Killer Whale DPS (*Pseudorca crassidens*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X_ No change is needed

Review Conducted By:

Krista Graham, NOAA Fisheries Pacific Islands Regional Office

REGIONAL OFFICE APPROVAL:

Lead Regional Administrator, NOAA Fisheries

Approve: ______________________ Date: April 12, 2022

HEADQUARTERS APPROVAL:

Assistant Administrator, NOAA Fisheries

I concur RAUCH.SAMUEL.D.III.1365850948 Digitally signed by RAUCH.SAMUEL.D.III.1365850948 Date: 2022.04.25 10:58:08 -04'00' Date___________
Signature

I do not concur_________________________________ Date___________
Signature