Application for an Individual Incidental Take Permit Under the Endangered Species Act of 1973

Draft Conservation Plan for California's Commercial Dungeness Crab Fishery

January 2024 Interim Draft

California Department of Fish and Wildlife
715 P Street, Sacramento, CA 95814
T: (916) 445-0411

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Acronym Glossary

Acronym	Definition
ARS	Area Restricted Search
BIA	Biologically Important Area
Cal. Code Regs.	California Code of Regulations
California APA	California Administrative Procedure Act
CCIEA	California Current Integrated Ecosystem Assessment
CCS	California Current System
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
CEQA	California Environmental Quality Act
CMA	Central Management Area
CNP	Central North Pacific
CP	Conservation Plan
CPFV	Commercial Passenger Fishing Vessel
DCTF	Dungeness Crab Task Force
DGN	Drift Gillnet
DIP	Demographically Independent Population
DPS	Distinct Population Segment
DTD	CDFW Data and Technology Division

Acronym	Definition
EEZ	Exclusive Economic Zone
EFP	Experimental Fishing Permit
ENP	Eastern North Pacific
ENSO	El Niño Southern Oscillation
ESA	Endangered Species Act
Federal APA	Federal Administrative Procedure Act
FGC	California Fish and Game Commission
Fish & G. Code	California Fish and Game Code
FR	Federal Register
HAB	Harmful Algal Bloom
ITP	Incidental Take Permit
LED	CDFW Law Enforcement Division
LLRP	Local Limit Reference Point
LMH	Large Marine Heatwave
M&SI	Mortality and Serious Injury
MLMA	Marine Life Management Act
MLPA	Marine Life Protection Act
MMPA	Marine Mammal Protection Act
MR	Marine Region

Acronym	Definition
NEPA	National Environmental Protection Act
NHPA	National Historic Preservation Act
NMA	Northern Management Area
NMFS	National Marine Fisheries Service
NPGO	North Pacific Gyre Oscillation
NPH	North Pacific High
OCEO	CDFW Office of Communications, Education, and Outreach
OGC	CDFW Office of General Counsel
ONI	Oceanic Niño Index
OPC	Ocean Protection Council
PBR	Potential Biological Removal
PCFG	Pacific Coast Feeding Group
PDO	Pacific Decadal Oscillation
PRD	NMFS Protected Resources Division
PSMFC	Pacific States Marine Fisheries Commission
RAMP	Risk Assessment and Mitigation Program
RU	CDFW Regulations Unit
SCB	Southern California Bight
SDM	Species Distribution Models

Acronym	Definition
SST	Sea Surface Temperature
SWFSC	Southwest Fisheries Science Center
TSD	Temperature-Dependent Sex Determination
US	United States
VMS	Vessel Monitoring System
WCRO	West Coast Regional Office
Working Group	California Dungeness Crab Fishing Gear Working Group

Executive Summary

The California Department of Fish and Wildlife (CDFW) has prepared this draft Conservation Plan (CP) to support an application for an Incidental Take Permit (ITP) from the National Marine Fisheries Service (NMFS) under Section 10(a)(1)(B) of the federal Endangered Species Act (ESA). The ESA generally prohibits "take" of endangered or threatened species, which includes activities that "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect". However, Section 10 of the ESA allows NMFS to issue an ITP authorizing take of endangered or threatened species when incidental to otherwise lawful activities, such as commercial fisheries. An ITP applicant must develop a CP which discusses:

- The impact which will likely result from such taking
- What steps the applicant will take to minimize and mitigate such impacts, and the funding that will be available to implement such steps
- What alternative actions to such taking the applicant considered and the reasons why such alternatives are not being utilized
- Such other measures that NMFS may require as being necessary or appropriate for purposes of the plan

The California commercial Dungeness crab fishery, which is managed by CDFW, is known to entangle endangered large whales and sea turtles. Entanglements are considered a form of "take" under the federal ESA and are generally prohibited without authorization under an ITP. The requested ITP would provide authorization for limited incidental take of the specified Covered Species (blue whales, humpback whales, and leatherback sea turtles) by the California commercial Dungeness crab fishery.

CDFW is seeking a 15-year ITP which would allow for continued operation of the California commercial Dungeness crab fishery ("Covered Activities"), while avoiding and minimizing entanglements to the maximum extent practicable. During the permit term, continued implementation of the Risk Assessment and Mitigation Program (RAMP) and focused efforts to prevent gear loss and remove lost or abandoned gear would limit overlap between the Covered Activities and the Covered Species. These "avoidance" Conservation Measures are designed to prevent entanglements from occurring. CDFW would also implement Conservation Measures to minimize the impact of any entanglements that do occur, including development and adoption of gear modifications, supporting development and use of safe handling procedures for entangled leatherback sea turtles, and bolstering entanglement response efforts.

Throughout the permit term, CDFW will conduct monitoring to quantify the number of entanglements occurring as a result of the Covered Activities, periodically review the effectiveness of the Conservation Measures, and implement needed changes through an adaptive management process. The proposed Conservation Measures would apply throughout the Plan Area, which

is defined as the portion of the United States (US) Exclusive Economic Zone (EEZ) off California.

CHAPTER 1. INTRODUCTION AND BACKGROUND

1.1 Background

The California Department of Fish and Wildlife (CDFW) is a state agency within California's executive branch (specifically, the California Natural Resources Agency) and is the state trustee agency for fish and wildlife resources. CDFW has prepared this Conservation Plan (CP) to support its application for an Incidental Take Permit (ITP) under Section 10 of the federal Endangered Species Act (ESA). The ITP would provide authorization for limited incidental take of the specified Covered Species by the California commercial Dungeness crab fishery. This CP describes a comprehensive strategy to monitor, avoid, and minimize entanglements of certain ESA-listed whales and sea turtles in commercial Dungeness crab fishing gear off the coast of California.

The California Ocean Protection Council (OPC) also falls within the California Natural Resources Agency and has been charged by the California Legislature with coordinating agency activities related to the protection and conservation of coastal and ocean ecosystems, including those of CDFW (Public Resources Code § 35615). As such, OPC's policies and their corresponding strategic plan serve to inform the broader context of this CP. That vision, in turn, is to ultimately move towards zero annual mortality and serious injury (M&SI) from entanglement by all state managed fisheries, as described in Target 3.3.5 in OPC's 2020-2025 Strategic Plan (OPC 2020). While meeting this target is not an explicit goal of this CP, it underpins many of the precautionary elements detailed in this document. Minimizing bycatch (entanglements) is also consistent with the Marine Life Management Act (AB1241, Keely, 1998) which guides management of California fisheries.

Whale and sea turtle entanglements are reported to the National Marine Fisheries Service (NMFS) through either the West Coast Regional Office (WCRO) or the Southwest Fisheries Science Center (SWFSC). WCRO receives and confirms reports of large whale entanglements and tracks a variety of metrics associated with each large whale entanglement including location, gear type, timing, and response efforts. SWFSC is responsible for receiving and confirming reports of human interactions with sea turtles, which include but are not limited to entanglements. CDFW considers these confirmed reports to be the best available information regarding historical large whale entanglements and sea turtle interactions, since unconfirmed reports may lead to double counting (i.e., multiple reports of the same whale) or may not in fact be entanglements (e.g., kelp or other debris which resembles fishing gear). NMFS has confirmed 573 entanglements of large whales in fishing gear of various types off the United States West Coast (West Coast) between 1982 and 2022 (NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023) and 67 sea turtle fishery interactions between 1980 and 2022 (NMFS SWFSC Sea Turtle Stranding Database, shared March 8, 2023). Entanglements in fixed gear (i.e., trap and gillnet fisheries) have been confirmed for blue whales (*Balaenoptera musculus*), fin whales (*B. physalus*), gray whales (*Eschrichtius robustus*), humpback whales

(*Megaptera novaeangliae)*, killer whales (*Orcinus orca*), minke whales (*B. acutorostrata*), and sperm whales (*Physeter macrocephalus*) as well as leatherback sea turtles (*Dermochelys coriacea*). Fishery interactions have also been documented for green turtles (*Chelonia mydas*), loggerhead turtles (*Caretta caretta*), hawksbill turtles (*Eretmochelys imbricata*), and olive ridley turtles (*Lepidochelys olivacea*). Blue whales, fin whales, sperm whales, leatherback sea turtles, green turtles, loggerhead turtles, hawksbill turtles, and olive ridley turtles are protected under ESA throughout their range. Certain Distinct Population Segments (DPS) of humpback whales, killer whales, and gray whales are also protected under ESA (see Section 1.3.1).

The number of confirmed large whale entanglements off the West Coast (across all gear types) increased sharply in 2014, from an average of 8.2 per year from 1982–2013 to an average of 34.2 per year from 2014-2022 (NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023; Figure 1-1). While the number of confirmed entanglements has decreased from the highs of 53 and 56 in 2015 and 2016, respectively, entanglements in recent years still remain above pre-2014 levels (2019, n = 25; 2020, n = 17; 2021, n = 27; 2022, n = 29). The increased number of entanglements is likely due to a combination of factors, including changes in the abundance and distribution of whales and forage, shifting patterns of human activities, and increased public awareness and reporting.

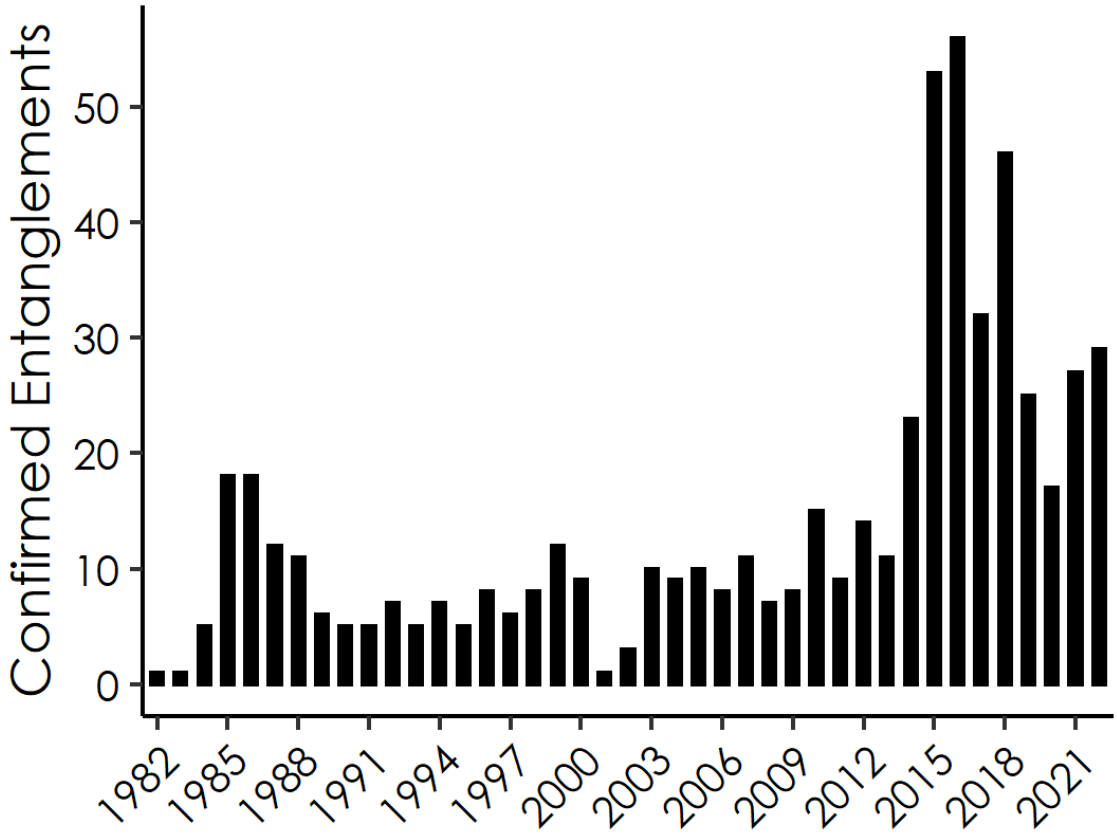

Figure 1-1. Annual number of confirmed large whale entanglement reports off the West Coast, 1982-2022. Created with NMFS WCRO Whale Entanglement Response Database (shared January 6, 2023).

Reports of sea turtle interactions with fishing gear also increased during this period (Figure 1-2). Between 1980 and 2015, zero to three fishery interactions were reported each year. Reported interactions increased to eight in 2016, followed by seven in 2017 and eight in 2018. However, the cause of this increase is not well understood. Reports declined during 2019 (n = 3) but increased again in 2020 (n = 7), with no fishery interactions reported in 2021 and two reported in 2022.

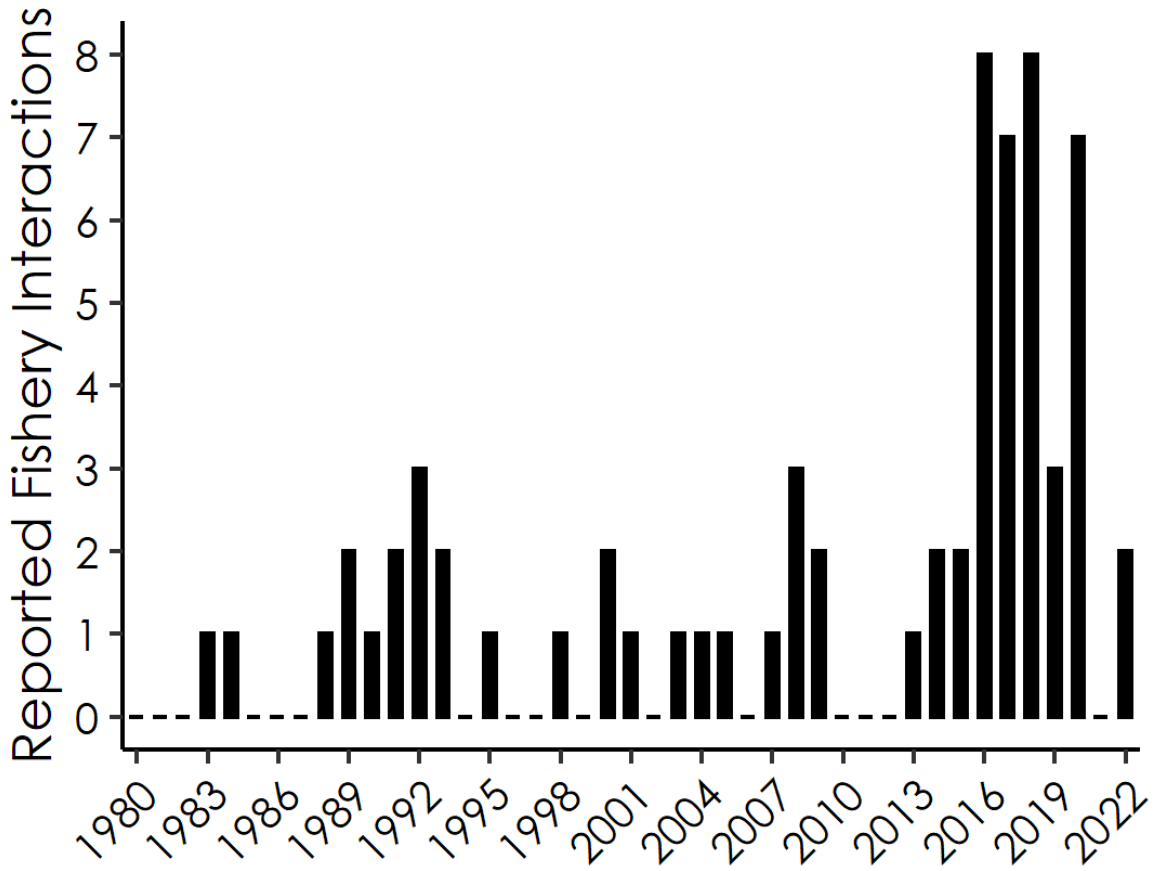

Figure 1-2. Annual number of reported fishery interactions with sea turtles off the West Coast, 1980-2022. Created with information from the NMFS SWFSC Sea Turtle Stranding Database (shared March 8, 2023).

Nearly half (n = 259, 45%) of confirmed West Coast large whale entanglements between 1982 and 2022 involved unidentified gear (NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023). Of the instances where gear can be identified (n = 314), about a third (n = 104, 33%) involved gillnet. Gillnet gear is used in multiple fisheries including state managed, federally managed, and international fisheries adjacent to U.S. waters. In terms of gear which can be identified to a specific fishery, commercial Dungeness crab gear was the most common (n = 112, 36%), of which 57% (n = 63) involved gear set in California.

Compared to large whales, available information regarding fishery attribution is much more limited for sea turtles. Of the 67 reported fishery interactions between 1980 and 2022, 64% (n = 43) involved line gear (e.g., monofilament, braided line, and hook and line), 13% (n = 9) involved pot/trap gear, 12% (n = 8) involved netting (including one instance of both line and netting), and 10% (n = 7) don't have enough information to specify the type of gear. Of the five sea turtle interactions attributed to specific fisheries, three were leatherback sea turtles with one in California rock crab gear (found dead), one in groundfish pot/trap gear (found dead), and one in California commercial Dungeness crab gear

(released alive by the reporting fisherman). There was also a green sea turtle in beach seine gear targeting sharks/rays (released alive) and a loggerhead turtle entangled in drift gillnet (DGN) gear (found dead).

1.2 ITP Applicant

CDFW personnel and functions are spread amongst a variety of offices, branches, divisions, programs, and regions which report to the CDFW Director. Key units within CDFW whose scope of work includes state fishery management, including marine life entanglement issues, are briefly described below.

CDFW's Marine Region (MR) is responsible for protecting, maintaining, enhancing, and restoring California's marine ecosystems for their ecological values and their use and enjoyment by the public through good science and effective communication. Within the MR, the Invertebrate Management Program oversees development and implementation of scientific and regulatory programs to assess and manage fisheries targeting invertebrate species (including Dungeness crab) and their associated ecosystem impacts. The MR's Pelagic Fisheries and Ecosystem Program oversees management issues related to sea turtles, including listings under the California Endangered Species Act (CESA). Because of the direct link to the Dungeness crab fishery, overseeing implementation of the CP will be one of the Invertebrate Management Program's primary responsibilities.

CDFW's Law Enforcement Division (LED) enforces regulations adopted by CDFW or the California Fish and Game Commission (FGC), as well as statutory mandates from the California Legislature. The Office of General Counsel (OGC) advises and reports to the Director on legal matters and provides in-house legal services to CDFW divisions and regions for, among other things, a variety of resource management and conservation issues. The Regulations Unit (RU) assists staff throughout CDFW with developing new and amended regulations in support of broader program goals. The Data and Technology Division (DTD) maintains CDFW's webpages and electronic databases, oversees IT equipment and software acquisitions, and manages CDFW's biogeographic data resources. The License and Revenue Branch (LRB) issues licenses and permits for recreational and commercial fishing activities, aquaculture, and scientific collection in support of educational and research projects. The Office of Communications, Education, and Outreach (OCEO) prepares and distributes press releases and other official CDFW communications regarding important actions by CDFW, including those affecting operations of commercial fisheries. Furthermore, administrative staff within each CDFW unit provide strategic support for essential functions such as procurement, contracts, and personnel management.

1.3 Regulatory Framework

Even though ESA establishes the fundamental regulatory framework for this CP, additional state and federal laws are also relevant. These laws include CESA, the Marine Mammal Protection Act (MMPA), the National Environmental Policy Act

(NEPA), the California Environmental Quality Act (CEQA), various provisions of the California Fish and Game Code (Fish & G. Code) and California Code of Regulations (Cal. Code Regs.), the Marine Life Management Act (MLMA), the California Administrative Procedure Act (California APA), the Federal Administrative Procedure Act (Federal APA), and the National Historic Preservation Act (NHPA).

1.3.1 Endangered Species Act

ESA is the primary federal law that protects living resources at risk of extinction. The statute requires federal agencies to prevent additional declines in, and support recovery of, species that are listed under the act as either in danger of extinction throughout all or a significant portion of their range ("endangered") or as likely to become endangered in the foreseeable future ("threatened"). ESA defines species to include "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" (Title 16, US Code (USC) §1532 subdivision (subd.) 16).

Under Section 4 of ESA, NMFS is responsible for listing and designating critical habitat for most marine species. NMFS is also responsible for monitoring and evaluating the status of listed species, as well as developing and implementing recovery plans for them. Section 9 includes a broad prohibition on take of listed species, which is defined to include activities which "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" a member of a species (16 USC § 1538).

For some species, such as blue whales, the entire species may be listed as endangered or threatened throughout its range under ESA. Other times, however, a subspecies or "distinct population segment (DPS)" of a species may be listed (16 USC § 1532 subd. 16), as is the case with humpback whale, where only certain DPS are listed as threatened or endangered. A DPS designation is guided by the distinctness and significance of a population, as well as whether the population's status warrants listing under the standards of the statute (61 Federal Register (FR) 4722). Once a DPS has been listed as endangered or threatened, it is afforded the same protection as other listed species.

Section 10 provides a process to permit take of listed species incidental to otherwise lawful activities, such as commercial fisheries (16 USC § 1539 subd. (a)(1)(B)). To issue such a permit, NMFS requires a Section 10(a)(1)(B) application and a CP for the impacted species (16 USC § 1539 subd. (a)(2)). A CP must discuss the following:

- The impact which will likely result from such taking
- What steps the applicant will take to minimize and mitigate such impacts, and the funding that will be available to implement such steps
- What alternative actions to such taking the applicant considered and the reasons why such alternatives are not being utilized

- Such other measures that NMFS may require as being necessary or appropriate for purposes of the plan

Before issuing an ITP under Section 10, NMFS must comply with the consultation requirements in Section 7 (16 USC § 1536 subds. (a) and (b)) to ensure issuing the permit is not likely to jeopardize the continued existence of the listed species or result in the destruction or adverse modification of any designated critical habitat. NMFS must also conduct a public review and make the following findings in accordance with 16 USC §1539 subd. (a)(2)(B):

- The taking will be incidental
- The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking
- The applicant will ensure that adequate funding for the plan will be provided
- The taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild
- The measures, if any, required under subparagraph (A)(iv) will be met

In the case of marine mammals, the Secretary of Commerce must also make findings pursuant to the MMPA, including whether the taking is authorized under Section 101(a)(5) of the MMPA (16 USC § 1371 subd. (a)(5)) and identifying any measures necessary to ensure such compliance (16 USC § 1536 subd. (b)(4)(C)). Further details about the MMPA are provided in Section 1.3.3.

1.3.2 California Endangered Species Act

CESA is the California counterpart to the federal ESA. CESA operates similarly to ESA by prohibiting the import, export, take, possession, purchase, and sale of species that are listed under the act as threatened or endangered (Fish & G. Code § 2080). CESA contains provisions that allow CDFW to permit incidental take of listed species if certain conditions are met (Fish & G. Code § 2081 subd. (b)), as well as take for scientific, educational, or management purposes (Fish & G. Code § 2081 subd. (a)). In October 2021, the FGC listed the leatherback sea turtle, which forages in California state waters, as an endangered species under CESA.

1.3.3 Marine Mammal Protection Act

MMPA establishes a national policy of preventing marine mammal species and populations from diminishing, as a result of human activities, to the extent they cease to be significant functioning elements of their ecosystems. Under MMPA, NMFS is responsible for evaluating the status of marine mammal species and developing conservation plans for species or stocks designated as depleted (16 USC § 1383 subd. (b)), developing stock assessment reports to evaluate stock status (16 USC § 1386), coordinating responses to marine mammal strandings and entanglements (16 USC §§ 1421 and 1421 subd. (b)), assessing M&SI of incidental anthropogenic interactions with marine mammals arising from

commercial fisheries (16 USC § 1387), and issuing permits and authorizations for take of marine mammals (16 USC §§ 1373 and 1374).

MMPA generally prohibits "take" of marine mammals in US waters, which is defined as activities which "harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal" (16 USC § 1362). The law also provides limited exemptions to the take prohibition by authorizing several types of take permits. Section 101(a)(5)(E) allows NMFS to permit incidental take of certain stocks listed under ESA by commercial fishing vessels (16 USC § 1371 subd. (a)(5)(E)). To issue such a permit, the Secretary of Commerce must find, among other things, that the incidental M&SI from the permitted commercial fishing activity will have a "negligible impact" on protected marine mammals (16 USC § 1371 subd. (a)(5)(E)). Guidelines for making such determinations are provided in NMFS Procedure 02-204-02.

1.3.4 National Environmental Policy Act and California Environmental Quality Act

NEPA requires every federal agency to use all practicable means and measures to protect environmental values and makes environmental protection a part of its mandate (42 USC §§ 4321-4370 subd. (m-12)). The statute requires every federal agency to prepare a detailed statement for any major federal action significantly affecting the quality of the human environment that includes, among other things, the environmental impact of the proposed action (42 USC § 4332).

CEQA is the California counterpart to NEPA. CEQA generally requires state and local government agencies to inform decision makers and the public about the potential environmental impacts of proposed projects. CEQA also requires those agencies to reduce potentially significant impacts to a less than significant level, unless such mitigation or alternatives are infeasible (California Public Resources Code §§ 21000-21189.3). Information regarding the CEQA analysis for this CP will be made available on CDFW's Whale Safe Fisheries webpage.

1.3.5 California Fish and Game Code and California Code of Regulations

Primary management authority for the commercial Dungeness crab fishery rests with the California Legislature, which has enacted several statutes constraining allowable fishing activity. Certain statutes have expressly delegated authority over fishery management to CDFW, which has then adopted implementing regulations. Therefore, legislative statutes (codified in Fish & G. Code) and CDFW regulations (codified in Cal. Code Regs, Title 14 (Tit. 14)) jointly provide the management framework for this fishery.

The commercial Dungeness crab fishery in California is mainly regulated by Fish & G. Code §§ 8275 *et seq* and implementing regulations in Cal. Code Regs., Tit. 14 §§ 132.1-132.8. These provisions address season dates, trap limits, delays of the fishery due to crab meat quality, and permitting structure. Some specific statutes

and regulations that provide relevant authority to CDFW and important context for understanding the construction of this CP are:

- Fish & G. Code § 5523 authorizes CDFW to restrict the commercial take of Dungeness crab due to human health risks.
- Fish & G. Code § 8276.1 authorizes CDFW to restrict the commercial take of Dungeness crab due to the risk of marine life entanglement; with implementing regulations found in Cal. Code Regs., Tit. 14, § 132.8.
- Fish & G. Code § 8276.2 allows CDFW to delay the commercial Dungeness crab season in specified fishing districts when the quality of crab is poor.
- Fish & G. Code § 8276.5 prescribes the trap limits for commercial Dungeness crab vessel permit holders and allows for replacement of lost tags; with implementing regulations found in Cal. Code Regs., Tit. 14, §§ 132.1, 132.2 and 132.4
- Fish & G. Code § 8279.1 prohibits commercial Dungeness crab fishery participants from fishing in areas where openings are delayed due to human health risks, poor crab meat quality, or entanglement risk for 30 days if these participants have already fished in other areas.
- Fish & G. Code § 9002.5 requires CDFW to develop a program that facilitates retrieval of lost or abandoned commercial Dungeness crab traps following the end of the fishing season; with implementing regulations found in Cal. Code Regs., Tit. 14, § 132.7.
- Fish & G. Code § 9004 describes gear servicing requirements, specifically that each trap shall be raised, cleaned, and serviced at intervals not to exceed 96 hours and that no trap shall be abandoned in the waters of the state.
- Fish & G. Code § 9005 requires every commercial fishing trap to be marked with a buoy.

1.3.6 California Marine Life Management Act

The MLMA establishes the importance of California's marine resources (Fish & G. Code §7050 subd. (a)) and ensures the conservation, sustainable use, and restoration of California's marine living resources (Fish & G. Code § 7050 subd. (b)). The MLMA emphasizes the importance of fishery sustainability and the need for a comprehensive ecosystem-based approach (Fish & G. Code §7050 subd. (b((1)). To achieve these overarching goals, the MLMA outlines several basic tools including use of best available science, constituent involvement, creation of fishery management plans, and use of adaptive management. In addition, the MLMA also highlights the importance of recreational, sport, and commercial fisheries as a benefit to the citizens of California (Fish & G. Code § 7050 subd. (b)(3)-(4)). This includes ensuring the growth of commercial fisheries (Fish & G. Code § 7055 subd. (d)), supporting management for sport use (Fish & G. Code 7055 subd. (c)), and recognizing the importance of recreational ocean activities such as fishing (Fish & G. Code § 7050 subd. (b)(3)).

The MLMA requires that fishery management be adaptive and defines adaptive management as a "scientific policy that seeks to improve management of

biological resources, particularly in areas of scientific uncertainty, by viewing program actions as tools for learning. Actions shall be designed so that even if they fail, they will provide useful information for future actions. Monitoring and evaluation shall be emphasized so that the interaction of different elements within the system can be better understood" (Fish & G. Code § 90.1). The MLMA stipulates that management systems should be proactive and respond quickly to changing environmental conditions (Fish & G. Code § 7056 subd. (l)).

Adaptive management is a continuous and flexible process that aids in decision making under uncertainty. It begins by defining the problem, identifying objectives and evaluation criteria, implementing a monitoring program, and finally adapting management actions or decisions based on findings (Figure 1-3). Several elements of this Conservation Plan incorporate the principle of adaptive management, as described further in Chapter 7.

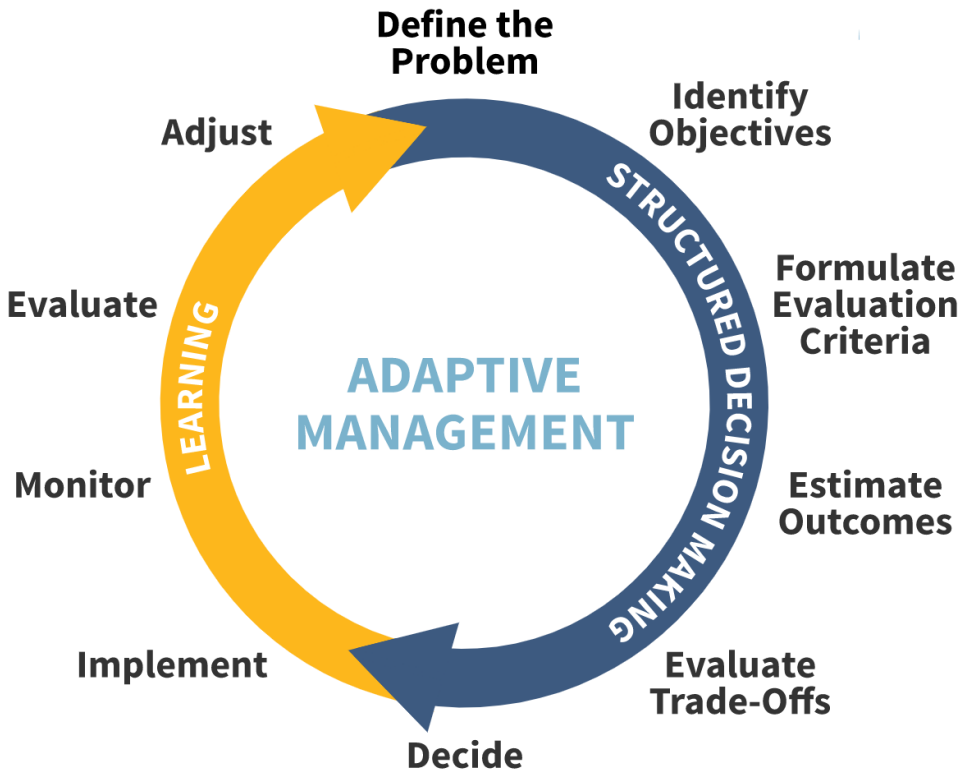

Figure 1-3. A generalized view of the adaptive management cycle. The blue arrow represents the systematic identification of the problem, objectives, and the associated decision-making. The yellow arrow represents the learning associated with implementation (adapted from Birgé et al. 2016).

1.3.7 California Administrative Procedure Act and Federal Administrative Procedure Act

The California APA (Government Code §§ 11340-11365) establishes rulemaking procedures and standards for California state agencies. Unless otherwise exempt, the adoption of every regulation must comply with the requirements of the California APA. The law is designed to provide the public with a meaningful

opportunity to participate in the adoption of state regulations and to ensure that regulations are clear, necessary, and legally valid. State regulations must also be adopted in compliance with relevant regulations implementing the California APA (Cal. Code Regs., Tit. 1, §§ 1-280).

Federal agencies are also subject to statutorily prescribed administrative requirements through the Federal APA (5 USC §§ 500 *et seq.*). While most rulemaking and rule implementation described in this CP fall under state jurisdiction, and are thus managed pursuant to the California APA, the CP, ITP, and accompanying NEPA documents are subject to review and approval by NMFS. These approval decisions are in turn required to meet the decision-making standards described in the Federal APA and are subject to judicial review (see 5 USC §§ 701-706).

1.3.8 National Historic Preservation Act

The NHPA (54 USC §§ 300301 *et seq.*) was signed into law in 1966 to help preserve historic properties in the United States. As part of issuing an ITP, NMFS is required to consult with state and tribal stakeholders and to avoid, minimize, or mitigate any adverse effects on any historical property listed under the National Register of Historic Places (36 Code of Federal Regulations (CFR) §§ 800.3 *et seq.*). While there are properties registered under NHPA located within the proposed Permit Area for this CP (see Section 2.1), most notably the Farallon Islands (National Register # 77000332), the activities governed by this CP are not expected to impact the wildlife, tribal artifacts, or historical buildings located on and around the Islands. The state of California is committed to continuously engaging with tribal communities through both requirements under CEQA and CDFW's own Tribal Consultation Policy. CDFW will also provide a liaison or any information necessary for NMFS to satisfy NHPA consultation requirements.

1.4 Covered Species

1.4.1 Species Proposed for Coverage

Trap gear from the California, Oregon, Washington and tribal commercial Dungeness crab fisheries are known to interact with blue whales, gray whales, humpback whales, killer whales, and minke whales, as well as leatherback sea turtles (NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023 and NMFS SWFSC Sea Turtle Stranding Database, shared March 8, 2023). Between 1982 and 2022, there were 76 humpback whale, 27 gray whale, three blue whale, three killer whale, one minke whale, and one leatherback sea turtle interactions with commercial Dungeness crab gear. CDFW requests take coverage for the following ESA-listed species under this ITP (Covered Species):

- Humpback whale – Central America DPS and Mexico DPS
- Blue whale
- Leatherback sea turtle

The humpback whale was originally listed under ESA in June 1970, and in April 2015 NMFS proposed revising the listing status to designate 14 DPS units. On September 8, 2016, the Central America DPS and Mexico DPS, both of which are known to occur along the California coast (see Chapter 3) were listed as endangered and threatened, respectively (81 FR 62260). Multiple interactions have also been documented with blue whales, which was listed as endangered on July 30, 1970 (35 FR 18319). The leatherback sea turtle was listed as endangered on June 2, 1970 (35 FR 8491). While only one leatherback sea turtle interaction has been documented in this fishery, the species is included as a Covered Species due to extremely low population abundance and potential for interactions with California commercial Dungeness crab fishing gear.

1.4.2 Species Not Proposed for Coverage

The following species are known to interact with commercial Dungeness crab gear and/or are listed as endangered and known to occur within the Plan Area (see Section 2.1). However, they are not proposed for coverage under this ITP, as detailed further in the following sections:

- Gray whale – Western North Pacific DPS
- Killer whale – Southern Resident DPS
- Fin whale
- North Pacific right whale
- Sei whale
- Sperm whale
- California sea otter
- Green sea turtle – East Pacific DPS
- Loggerhead turtle – North Pacific Ocean DPS
- Olive ridley turtle
- Minke whale

1.4.2.1 Threatened and Endangered Mammals Occurring Within the Plan Area

1.4.2.1.1 Gray Whale

The gray whale was originally listed in December 1970, but in 1994 NMFS de-listed the Eastern North Pacific DPS (59 FR 31094). The Western North Pacific DPS, which occurs primarily off Russia and Japan, remains endangered. However, the likelihood of these individuals interacting with California commercial Dungeness crab gear is low. Over the 41-year period from 1982-2022, a total of 27 gray whales have been confirmed as entangled in commercial Dungeness crab gear, of which nine were confirmed as California commercial Dungeness crab gear. On average, this translates to 0.22 gray whales entangled in California commercial Dungeness crab gear each year. The latest stock assessment suggests that the Western North Pacific DPS has at most 290 individuals, which is much lower than the Eastern North Pacific DPS abundance estimate of 26,960 individuals (Carretta et al. 2023), although an updated abundance estimate from Eguchi et al. (2022) indicates a decline to 16,650 individuals in the Eastern North Pacific DPS due to recent unusual mortality events. Moore and Weller

(2018) report that at least 37% of the Western North Pacific population migrates along the West Coast. Even with a conservative assumption that each member of the Western North Pacific DPS was present within the Eastern North Pacific at the time an entanglement occurred results in an estimate that 1.7% [290/(16,650+290)] of the gray whales encountered within the Plan Area would be Western North Pacific gray whales. Combining these two estimates (0.22 gray whales entangled in California commercial Dungeness crab gear each year and 1.7% of gray whales within the Plan Area originating from the Western North Pacific DPS) results in an annual take estimate of 0.004 Western North Pacific gray whales. Even over a 15-year permit term (see Section 2.3), this would result in take of less than 0.1 gray whales from the Western North Pacific DPS.

While not identified as a DPS under ESA, the most recent gray whale stock assessment report signals future action to consider specifying the Pacific Coast Feeding Group (PCFG) as a distinct stock under MMPA (Carretta et al. 2023). Although this does not necessarily mean the current DPS designations would be revised, CDFW considered whether potential impacts to the PCFG might warrant including the Eastern North Pacific DPS as a Covered Species, despite its delisted status. Harris et al. (2022) estimates the 2020 PCFG abundance as 212 individuals. Using the same analysis as above regarding likelihood of interactions with Western North Pacific gray whales, CDFW estimates an annual take of 0.003 PCFG gray whales in California commercial Dungeness crab gear (212/16,650 = 1.3% of gray whales encountered within the Plan Area from the PCFG * 0.22 gray whales entangled within the Plan Area). This is despite the fact that the highest PCFG habitat utilization within the Plan Area is in Northern California, making it unlikely that entanglements which occur in other portions of the Plan Area would involve members of the PCFG.

Given the low likelihood of interactions between the California commercial Dungeness crab fishery and the endangered Western North Pacific DPS or the Eastern North Pacific DPS PCFG, as well as the de-listed status of the Eastern North Pacific DPS, gray whales are not included as a Covered Species under this CP.

1.4.2.1.2 Killer Whale

Of the eight killer whale stocks in the Pacific currently recognized under MMPA, three have members that are known to visit California waters: Eastern North Pacific Offshore, Eastern North Pacific Southern Resident, and West Coast Transient (Carretta et al. 2023; Young et al. 2023). Under ESA the Southern Resident DPS, which consists of the same individuals as the Eastern North Pacific Southern Resident stock under MMPA, is listed as endangered (70 FR 69903). There have been two confirmed killer whale entanglements in California commercial Dungeness crab trap gear since 1982; one each in 2015 and 2016 (NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023). However, there is no indication that these entanglements involved members of the Southern Resident population (Carretta et al. 2023). With a minimum population size of 74 individuals, compared to a minimum population of 276 individuals in the Eastern North Pacific Offshore stock and 349 individuals

from the West Coast Transient stock, animals from this population are the rarest killer whales found off California. The 2023 stock assessment for the Southern Resident stock puts the known total M&SI for the stock at zero (Carretta et al. 2023). Because of the lack of evidence suggesting any entanglement of this ESA-listed DPS by the fishery, killer whales are not included as a Covered Species under this CP.

1.4.2.1.3 Fin Whale

Ten fin whale entanglements have been documented off the West Coast since 1982, and none of them have been confirmed as California commercial Dungeness crab gear (NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023). Of these entanglements, one was confirmed as DGN gear and nine were categorized as unidentified gear. Due to the rarity of these entanglements, and lack of documented entanglements with California commercial Dungeness crab gear, fin whales are not included as a Covered Species under this CP.

1.4.2.1.4 North Pacific Right Whale

Although recent sightings of the North Pacific right whale Eastern North Pacific stock are most common in the central North Pacific and Bering Sea (https://www.fisheries.noaa.gov/species/north-pacific-right-whale#overview, accessed February 27, 2023), the historical distribution of this stock does include the Plan Area (Young et al. 2023) and there was a confirmed sighting of a North Pacific right whale within Monterey Bay on March 5, 2023. While there is potential for overlap with the Covered Activity, there have been no confirmed entanglements of North Pacific right whales in any gear type since 1982 (NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023). Given the lack of documented entanglements, and its rarity within the Plan Area, North Pacific right whales are not included as a Covered Species under this CP.

1.4.2.1.5 Sei Whale

Sei whales are rare within the California Current Ecosystem, although occasional sightings have been documented within the offshore portions of the Plan Area (Carretta et al. 2023). While there is potential for overlap with the Covered Activity, there have been no confirmed entanglements of sei whales in any gear type since 1982 (NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023). Given the lack of documented entanglements, sei whales are not included as a Covered Species under this CP.

1.4.2.1.6 Sperm Whale

Sperm whales are regularly observed within the Plan Area (Carretta et al. 2023), and there have been 15 entanglements since 1982; however, none of these entanglements have involved trap gear (NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023). Of these entanglements, 10 were confirmed as DGN gear, four were confirmed in gillnet gear, and one was categorized as unidentified gear. Given the lack of documented entanglements

with trap gear, sperm whales are not included as a Covered Species under this CP.

1.4.2.1.7 California Sea Otter

California sea otters are listed under ESA and listed as depleted under MMPA. California sea otters are also fully protected under California state law (Fish & G. Code § 4700). M&SI due to interactions with trap gear is rare, with five mortalities known to have occurred in California since the mid-1970s (Hatfield et al. 2011, USFWS 2021). Of these mortalities, one was confirmed in rock crab gear, two in lobster gear, and two in suspected sablefish gear. These mortalities were due to drowning when the otter entered the trap, rather than entanglement in the line or buoys. There is no direct evidence of mortality or serious injury from the commercial Dungeness crab fishery, and sea otters are not included as a Covered Species under this CP.

1.4.2.2 Threatened and Endangered Turtles Occurring Within the Plan Area

Loggerhead sea turtles (*Caretta caretta*), Olive ridley turtles (*Lepidochelys olivacea*), and green sea turtles were listed under the ESA on July 28, 1978 (43 FR 32800). Loggerhead sea turtles were initially listed as threatened, and the North Pacific Ocean DPS was listed as endangered in September 2011 (76 FR 58868). While no DPS are designated for olive ridley turtles, two categories of populations are identified, with breeding colony populations on the Pacific coast of Mexico listed as endangered, and all other populations listed as threatened. Similarly, green sea turtle breeding populations in Florida and along the Pacific coast of Mexico were originally listed as endangered, and all other populations listed as threatened. In May 2016, NMFS and the USFWS revised the green sea turtle listing status to establish 11 DPS units, with the East Pacific DPS listed as threatened (81 FR 20057).

The range of the loggerhead sea turtle North Pacific DPS spans the entire North Pacific Ocean between 0 and 60°N and therefore includes the Plan Area. Olive ridley sea turtles are known to occur between Southern California and Northern Chile (https://www.fisheries.noaa.gov/species/olive-ridley-turtle#overview, accessed November 2, 2022), overlapping with the southern portion of the Plan Area. The range of the green sea turtle East Pacific DPS extends from 41°N southward along the Pacific Coast of the Americas to central Chile (40° S) and westward to 142° W (at the northern end) and 96° W (at the southern end), therefore overlapping with all but the very northern portion of the Plan Area. While both live sightings and strandings of these three species have occurred north of Point Conception, they are considered relatively rare, likely due to low tolerance of the cooler waters common north of Point Conception (personal communication, Jeffrey Seminoff, NMFS SWFSC, November 3, 2022).

More specifically, as of November 2022 unpublished NMFS data indicates there have been a total of 25 live hardshell turtle sightings (since 1974) and 259 hardshell turtle strandings (since 1981) north of Point Conception. This includes sightings in Oregon, Washington, and Alaska. In terms of live sightings off

California (n = 15), the three species are observed in similar quantities (five olive ridley turtles, four green sea turtles, and four loggerhead sea turtles, as well as six unidentified sea turtles). In terms of stranded turtles reported in California (n = 100), olive ridley turtles are by far the most common (n = 56), followed by green sea turtles (n = 37) and loggerhead sea turtles (n = 6), with one unidentified hardshell turtle. On an annual basis, no more than 10 turtles total are reported stranded in California, and no more than four live turtles have been sighted off California.

There have been no documented interactions of loggerhead, olive ridley, or green sea turtles with pot/trap gear off the West Coast, and recent status reviews for these species have identified bycatch issues in the Eastern Pacific only with other gear types: longlines, drift nets, set nets, and trawls for green sea turtles (Seminoff et al. 2015); gillnet and longline for loggerhead turtles (NMFS and USFWS 2020a); and trawl, longline, purse seine, and gillnet fisheries for olive ridley turtles (NMFS and USFWS 2014). Given the limited presence of these species in the portion of the Plan Area north of Point Conception (where the Covered Activities take place) and the absence of documented interactions between these species and pot/trap gear, CDFW considers take of these species by the commercial Dungeness crab fishery to be unlikely. Therefore loggerhead, olive ridley, and green sea turtles are not included as Covered Species under this CP.

1.4.2.3 Species Not Currently Endangered

There has been a single documented interaction of minke whales with commercial Dungeness crab gear, however the species is not listed under the ESA or considered a strategic stock under MMPA. Given the low estimates of human-caused M&SI for this species, as well as their current stable population trend (Carretta et al. 2023), CDFW considers it unlikely that minke whales will become ESA listed during the permit term, and therefore does not include them as a Covered Species.

1.5 Tribal Governments

On December 23, 2019 CDFW provided formal notice to California tribal governments regarding the development of this CP and associated regulations. CDFW requested preliminary input by February 1, 2020. CDFW staff also provided a brief update during the January 17, 2020 FGC Tribal Committee meeting in Los Alamitos, California.

CDFW provided a second formal notice to California tribal governments on July 26, 2021 which included an update on preparation of the CP. The notice invited tribal governments to request consultation or to contact CDFW staff for questions related to CP development by September 1, 2021. Pursuant to CEQA CDFW provided a third formal notice to tribal governments regarding preparation of the CP, associated regulations, and analyses on August 29, 2022. CDFW will provide an additional formal notice to tribal governments when submitting the ITP application to NMFS.

1.6 Stakeholder Involvement

1.6.1 California Dungeness Crab Fishing Gear Working Group

CDFW, OPC, and NMFS first convened the California Dungeness Crab Fishing Gear Working Group (Working Group) in 2015. The group's charge is to address marine life entanglements from the California Dungeness crab fishery and consists of a broad cross-section of key stakeholders, including fishermen, agencies, and environmental organizations. In dealing with a problem as uncertain and dynamic as marine life entanglements, the Working Group provides critical transparency and the input necessary for CDFW to establish and implement effective programs.

The Working Group has been instrumental in making recommendations to state management agencies and the California Legislature regarding actions to reduce entanglement risk. Its most significant achievement to date has been testing and development of the Risk Assessment and Mitigation Program (the RAMP; see Section 5.1). CDFW has provided routine updates to, and solicited feedback from, the Working Group during development of this CP and the associated regulations implementing the RAMP. The Working Group provided feedback on key aspects of this CP, including triggers for management action and the avoidance and minimization measures, prior to submission of a preliminary draft CP to NMFS in May 2020. CDFW conducted additional targeted outreach with this group prior to submission of the ITP application. The Working Group's role in implementing this CP is discussed further in Chapters 5-7.

1.6.2 Other Outreach

In March 2019, CDFW created a dedicated Whale Safe Fisheries webpage where updates about the ITP process were posted. CDFW also created a listserv where the interested public could sign up for updates regarding development of the CP, and a dedicated email account where individuals could send comments regarding CDFW's Whale Safe Fisheries efforts. As of December 4, 2023, 2,839 individuals are subscribed to this list.

CDFW notified commercial fishery participants of this CP's development and invited their comments in outreach newsletters mailed in October of 2019 – 2023. Updates were also provided at public meetings of the Dungeness Crab Task Force (DCTF) in October of 2019-2022 and November 2023, and the California Legislature's Joint Committee on Fisheries and Aquaculture in November 2019, March 2020, November 2021, and October 2022.

CDFW conducted a webinar meeting in March 2020 during which staff provided a pre-notice preview of the proposed RAMP regulations and provided updates regarding the overall ITP process. Invitations were broadly distributed to commercial and recreational Dungeness crab fishery participants, harbormasters, the Working Group, and environmental interest groups. Around 80 individuals attended, including several Working Group members.

CDFW made two public drafts of the CP available prior to submission of the ITP application, one in May 2020 and another in December 2021. CDFW solicited comments from the Working Group and the public on both drafts, and integrated the comments received as appropriate. CDFW held a public meeting on January 7, 2022 to provide further information about the December 2021 public draft and answer clarifying questions. CDFW also hosted a Q&A session with the Working Group on January 14, 2022.

CDFW will provide public notice via the Whale Safe Fisheries email listserv when submitting the ITP application to NMFS.

CHAPTER 2. PROJECT DESCRIPTION AND ACTIVITIES COVERED BY THE PERMIT

This Chapter describes the Plan and Permit Area (Section 2.1), provides an overview of the Covered Activities (Section 2.2), and identifies CDFW's requested permit term (Section 2.3). Covered Activities are further described in Chapters 4, 5 and 6.

2.1 Plan and Permit Area

Commercial Dungeness crab fishing depths are dependent on multiple factors, including fishing location, time of year, and vessel type. Fishing locations are dependent on the time of year, home port, and access to processing facilities. In practice, traps are rarely if ever deployed in waters deeper than 750 feet (125 fathoms), with average maximum fishing depths reported of 180 feet (30 fathoms) reported to CDFW. Additionally, the fishery occurs almost exclusively north of Point Conception (CDFW 2020a). However, individual fishermen may decide to set gear in other areas, and gear could be moved by ocean currents, other vessels, or entangled marine life beyond the typical fishing grounds. CDFW jurisdiction over the fishery extends throughout the entire US Exclusive Economic Zone (EEZ) off California (16 USC § 1856 note). Therefore, CDFW has defined the Plan and Permit Area as encompassing the entirety of the EEZ south of the California/Oregon border (Figure 2-1).

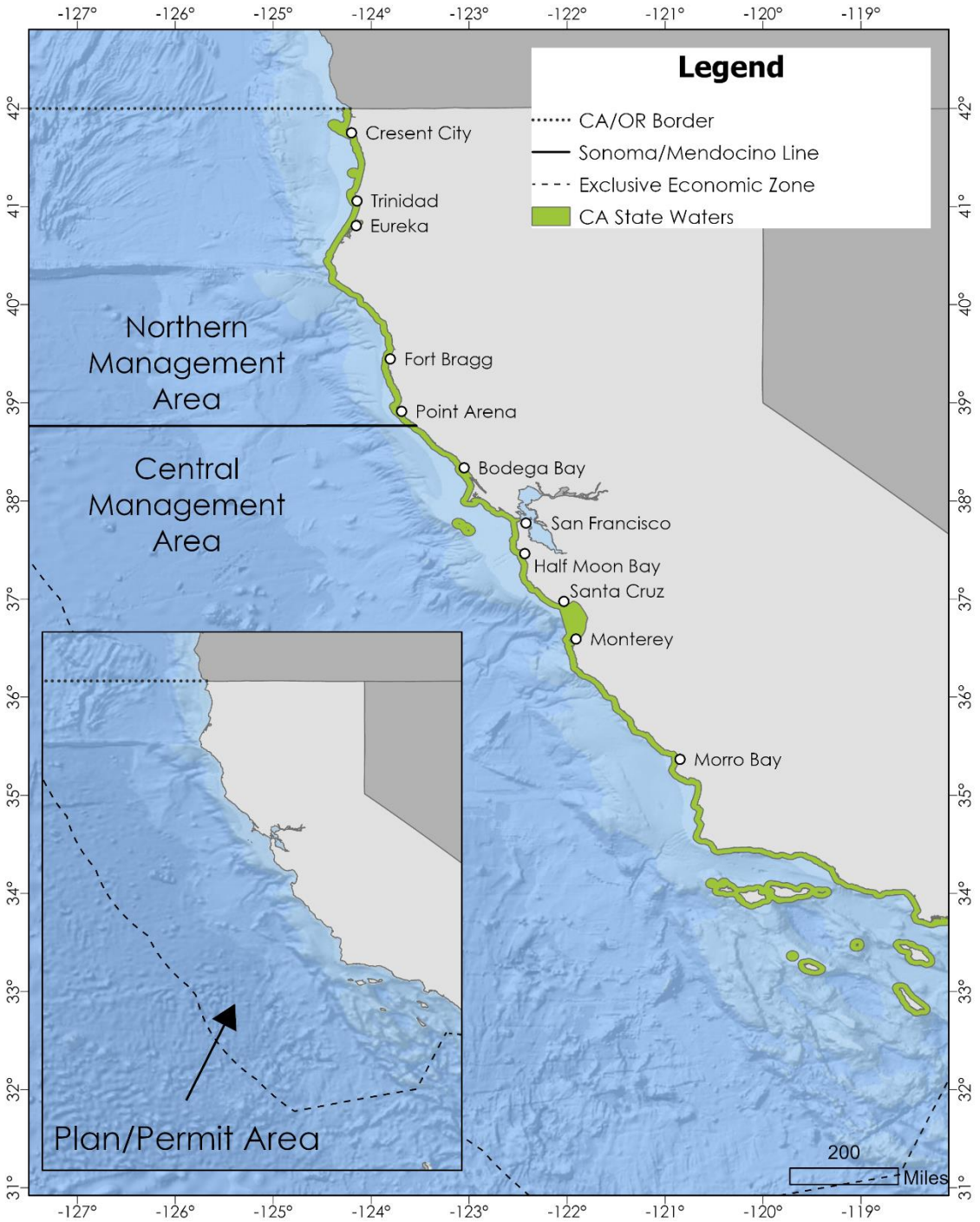

Figure 2-1. Northern and Central Management Areas within the Plan and Permit Area, along with key landmarks. California state waters, shown in green, generally extend to 3 nautical miles offshore but extend farther in some areas (e.g., Monterey Bay).

2.2 Covered Activities

The Covered Activity to which this CP applies is the operation of the California commercial Dungeness crab fishery. The California commercial Dungeness crab fishery began in the mid-1800s and over time has developed into one of the most valuable commercial fisheries in the state (Wild and Tasto 1983). Crab is the most important species group by both revenue and number of active vessels for Crescent City and Eureka and is among the highest contributors for other ports in northern and central California (Harvey et al. 2022). While multiple crab species are harvested in California, Dungeness crab constitutes the highest percentage of both landings and ex-vessel value. Among ports in California, Bodega Bay is particularly reliant upon this fishery (Magel et al. 2020). Since 2010, the fishery has regularly exceeded $50 million in ex-vessel value each season (CDFW 2020a). Landings then enter the larger California seafood economy, which generated over $26 billion in sales and supported nearly 130,000 jobs in 2020 (NMFS 2023).

The following subsections provide additional details regarding the Covered Activities, including targeted species, gear configuration, permitting and associated trap limits, methods of monitoring fishing activity, and spatial and temporal patterns of fishing activity.

2.2.1 Targeted Species

Adult Dungeness crab (*Metacarcinus magister*) prefer sandy to silty substrates shallower than 300 feet (50 fathoms; CDFW 2020a), and fishing activity is concentrated within this habitat type. These highly productive crustaceans take about three to five years to reach the minimum legal size of 6.25 inches. Seasonal landings are dependent on crab production cycles with decadal variability, resulting in large fluctuations from year to year.

2.2.2 Gear Used

The fishery uses trap gear, which is generally composed of three elements: a weighted trap, surface gear, and a vertical line connecting the trap to the surface gear. The trap is constructed from two circular iron frames, three to 3.5 feet in diameter, connected by spokes on the outer edges (Figure 2-2) and generally weighs between 40 and 50 pounds. The frame is wrapped with strips of rubber and the entire frame is covered with stainless steel wire mesh. When gear is deployed, the weighted trap sinks to the seafloor and generally remains in place until the trap is hauled, limiting the spatial footprint of the associated benthic disturbance.

Figure 2-2. Stacked commercial Dungeness crab gear. Photo by Morgan Ivens-Duran (CDFW).

The surface gear is composed of one or more buoyant buoys connected to the vertical line by a short length of rope and generally floats at the surface when the gear is deployed. Fish & G. Code § 9005 requires every trap or string of traps be marked with a buoy, and the operator of a Dungeness crab trap must also mark the buoy with their commercial fishing license number (Fish & G. Code § 9006). Additional trailer buoys may be used, depending on the participant's need for added buoyancy to facilitate recovering trap gear. Current regulatory requirements regarding allowable surface gear are described in Section 4.2.

Fish & G. Code § 9012 prohibits connecting multiple traps with a common line in Districts 6, 7, 8, and 9 (north of the Sonoma/Mendocino county line). Requiring each trap to be individually buoyed helps CDFW enforce its trap limit program. However, this requirement prevents the use of multi-trap "trawls" which are common in East Coast trap fisheries (Figure 2-3).

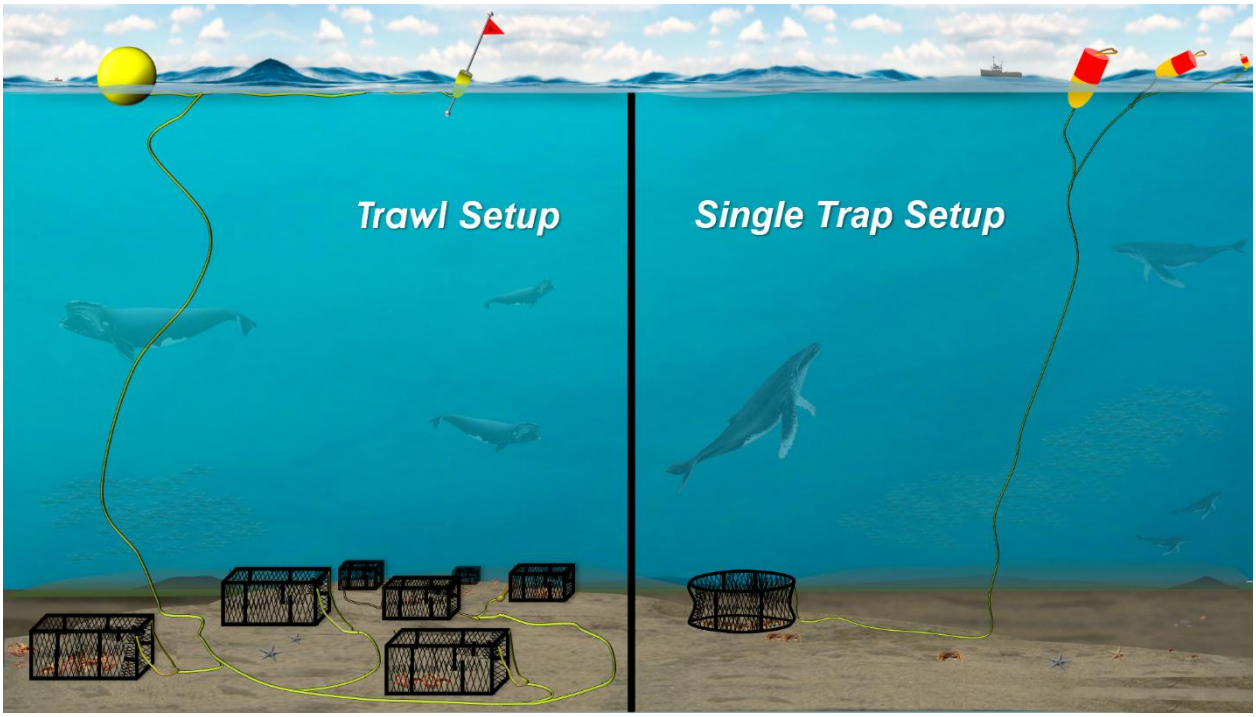

Figure 2-3. Side-by-side comparison of trawl and single trap set up. Whale images courtesy of NMFS.

The amount of vertical line which connects the trap and the surface gear is dictated by the depth where the trap will be deployed, with additional scope to compensate for tidal changes, swell, and currents. The fleet typically uses blue steel-type line, also known as "floating line", but more recently participants have been switching to neutral buoyancy lines.

In general, trap gear has low to medium impacts on the benthic environment, especially when compared to mobile gears such as dredges or trawls (Chuenpagdee et al. 2002, Kopp et al. 2010). Higher impacts can be seen if traps are set in areas with complex biogenic structures (e.g., deep water corals) or submerged aquatic vegetation such as eelgrass or kelp (PFMC 2019); these habitats are not favorable for Dungeness crab and typically aren't targeted by the fishery (see Section 2.2.1). Habitat impacts from trap gear include disruption of the sediment or damage to emergent epifauna and can occur when the trap settles to the seafloor, during deployment if the trap is moved by vessel traffic or currents, and during retrieval (especially when multi-trap trawls are set). Organisms may also be impacted through "ecological distraction" if they lay eggs on trap gear which are removed prior to hatching (Stevens et al. 2021).

2.2.3 Fishing Vessel Permits and Trap Limits

The California Legislature first implemented a restricted access program in 1995, capping the fishery at 681 permits (AB 3337, Hauser, 1994). A trap limit program to further control effort was established in 2013 (SB 369, Evans, 2011). Dungeness crab vessel permitholders were divided into seven tiers based on their total California Dungeness crab landings from the 2003-04 through 2007-08 seasons.

Those in the highest tier (Tier 1) were allotted 500 traps, and those in the lowest tier (Tier 7) were allotted 175 traps. Trap allotments are enforced with biennial buoy tags marked with the permit number. Originally implemented due to concerns about overcapacity and latent permits, the unique gear marking has allowed commercial Dungeness crab gear to be more easily identified when involved in a marine life entanglement. As of the 2022-23 fishing season, 534 permits were renewed across the seven tiers (Table 2-1).

Table 2-1. Number of Dungeness Crab Permits Renewed in 2022 by Trap Tier (CDFW Automated License Data System February 13, 2023).

Tier	Trap Number	Number of Permits
1	500	57
2	450	53
3	400	56
4	350	55
5	300	52
6	250	156
7	175	105

2.2.4 Monitoring Landings

All catch taken under a California commercial fishing license must be reported on a commercial landing receipt (commonly called a "fish ticket"; Fish & G. Code § 8043). These landing receipts include vessel and commercial fishing license information, pounds caught by species, unit price, catch location, port of landing, and fish business information. These documents are then submitted by the commercial fish business to CDFW via an electronic platform (eTix, maintained by the Pacific States Marine Fisheries Commission (PSMFC)) within three business days of the landing, allowing managers to have access to near-real time information on fishing activity.

2.2.4.1 Trap Estimates

Landing receipts require identification of the fishing vessel, which can be combined with permitting information from the state's Automated License Data System to identify the vessel's permit tier and trap allotment. However, the number of deployed traps is not reported on landing receipts. Historically, this has made it difficult for CDFW to quantify the amount of gear used in the fishery.

CDFW has three methods to quantify gear usage. The first method is to identify the total number of issued permits and sum the associated trap limits to estimate the maximum amount of gear that could be fished. The second method is to identify which vessels participated in the fishery (i.e., "active" vessels that made landings) and sum the associated trap limits to estimate the maximum amount of deployed gear. The third method relies on a new requirement for fishery participants to self-report trap usage (see Section 5.1.6.6) to estimate the number of deployed traps. Because not all vessels with active permits participate in the

fishery, and participating vessels do not always fish their full trap allotment, the first two methods likely overestimate the amount of actual gear in the water. Because there is not yet full compliance with the new reporting requirement, the third method likely underestimates the amount of deployed gear. However, CDFW has developed a method to correct for non-compliance, as further described in Section 5.2.

2.2.4.2 Location of Catch

Catch location, which is assumed to correlate with where gear is deployed, is reported by selecting the CDFW fishing block where the majority of catch occurred (see Figures 2-4 and 2-5). The size of these reporting blocks varies, with smaller blocks nearshore and larger blocks offshore, but in all instances provides a coarse understanding of where gear is deployed.

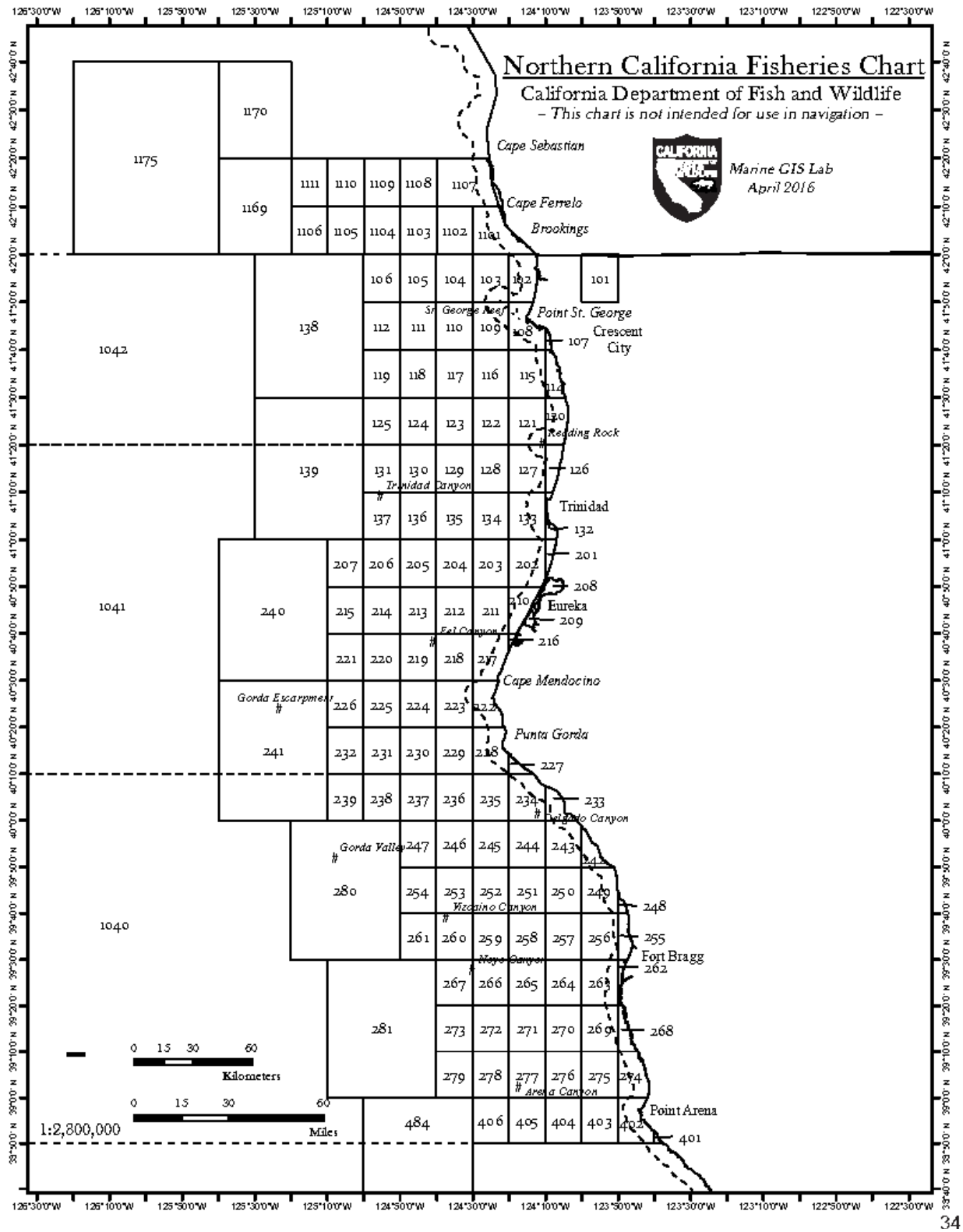

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Figure 2-4. CDFW Fishing Blocks, Northern California.

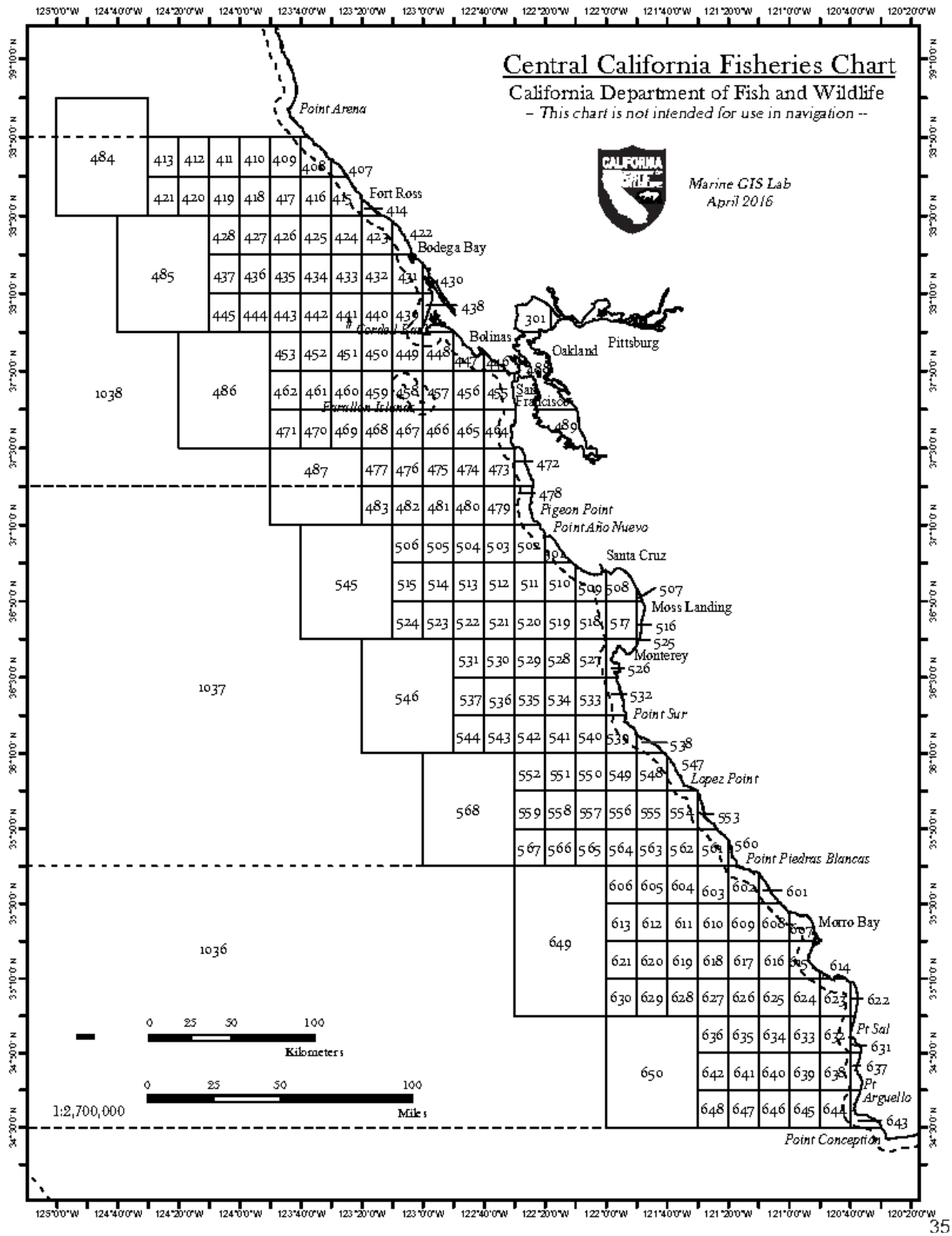

Figure 2-5. CDFW Fishing Blocks, central California.

2.2.4.3 Fishery Management Areas and Timing

Historically, the fishery has been divided into two areas at the Sonoma/Mendocino county line. The Northern Management Area (NMA) extends from the Sonoma/Mendocino county line to Oregon, and the Central Management Area (CMA) extends from the Sonoma/Mendocino county line to Mexico (Figure 2-1). The scheduled season start date is preceded in both management areas by a designated "pre-soak" period during which baited gear can be deployed but Dungeness crab cannot yet be harvested. Historically, there was a 64-hour pre-soak period for the NMA and an 18-hour pre-soak period for the CMA. SB 80 (McGuire, 2021) amended Fish & G. Code § 8283 to establish a uniform 64-hour pre-soak period for both management areas, which has been in effect since the 2021-22 season.

The scheduled season runs from December 1 to July 15 in the NMA, and from November 15 to June 30 in the CMA (Fish & G. Code § 8276). However, the Director of CDFW may delay the season opening for part or all of the NMA due to low crab meat quality (Fish & G. Code § 8276.2), close any area due to biotoxin risk (Fish & G. Code § 5523), and (more recently) restrict fishing activity in any area due to elevated marine life entanglement risk (Fish & G. Code § 8276.1 and Cal. Code Regs., Tit. 14 § 132.8). With the exception of low crab meat quality, the same actions may be implemented in the CMA. The interactions between these three provisions (quality, biotoxin risk, and entanglement risk) generate uncertainty regarding the timing and duration of the fishing season (Figure 2-6).

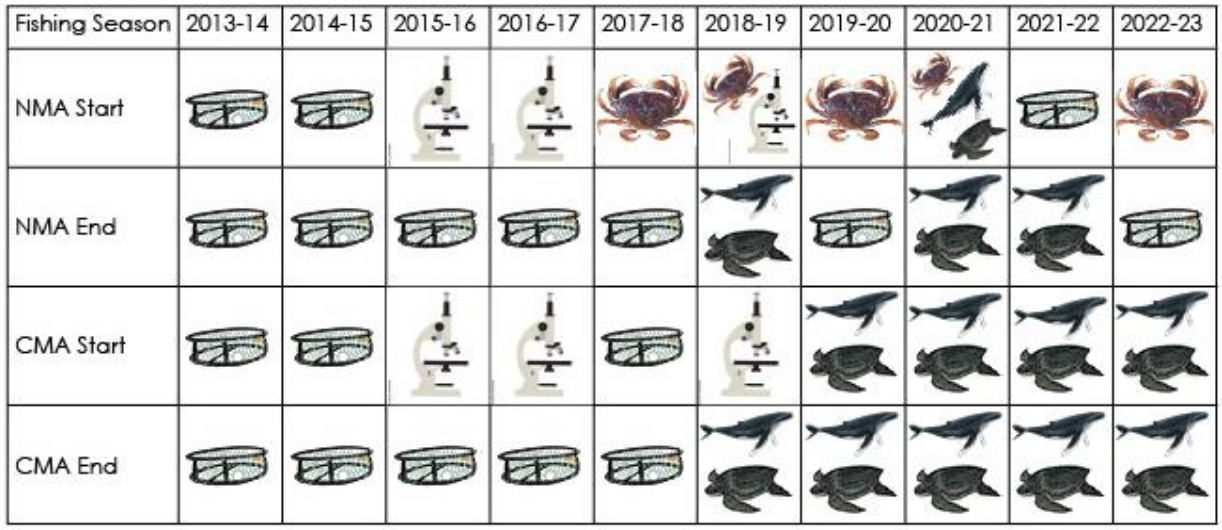

Figure 2-6. Summary of Dungeness crab season timing during the 2013-14 through 2022-23 fishing seasons. On time openings and closures are represented with a crab trap. Delays or early closures are represented with a humpback whale and leatherback sea turtle (marine life entanglement risk), Dungeness crab (low meat quality), or a microscope (elevated levels of domoic acid). Whale and sea turtle images courtesy of NMFS.

Regardless of the actual start date, a majority of landings occur within the first two months of a given season (Figure 2-7).

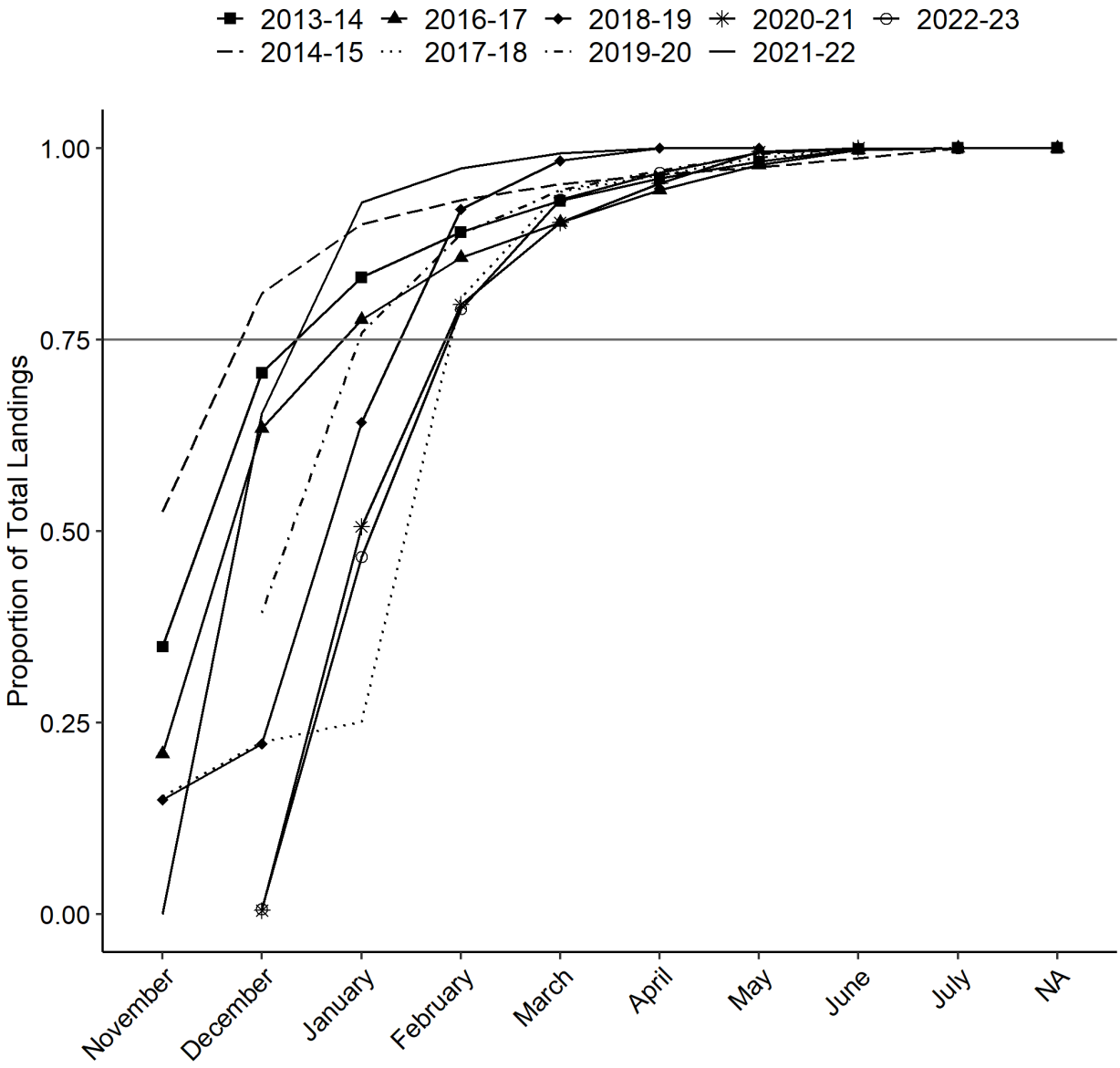

Figure 2-7. Proportion of cumulative pounds of Dungeness crab landed by month between 2013-14 and 2022-23 (not including the 2015-16 disaster season). Source: CDFW Marine Landings Data System.

Fish & G. Code § 8276 subd. (d) requires all Dungeness crab traps to be removed from the water by 11:59pm on the last day of the Dungeness crab season, and neither Fish & G. Code nor Cal. Code Regs., Title 14 provide any post-season buffer period during which gear may remain at sea.

2.2.5 Spatial Trends in Fishing Activity

The relative importance of an individual port or management area during any given Dungeness crab fishing season is largely driven by the interannual variability in crab production within nearby fishing grounds, although a small number of vessels will transit a substantial distance between the area where

crab was harvested and the port of landing. Historical CDFW Dungeness crab landings data are available beginning with the 1915-16 fishing season. Since the mid-1940s, the bulk of Dungeness crab landings have been made into ports within the NMA, although during the last decade there has been an increase in the proportion of landings made into CMA ports (Figure 2-8), which may reflect the five-fold increase in pre-season Dungeness crab abundance before and after 2000 (Richerson et al. 2020).

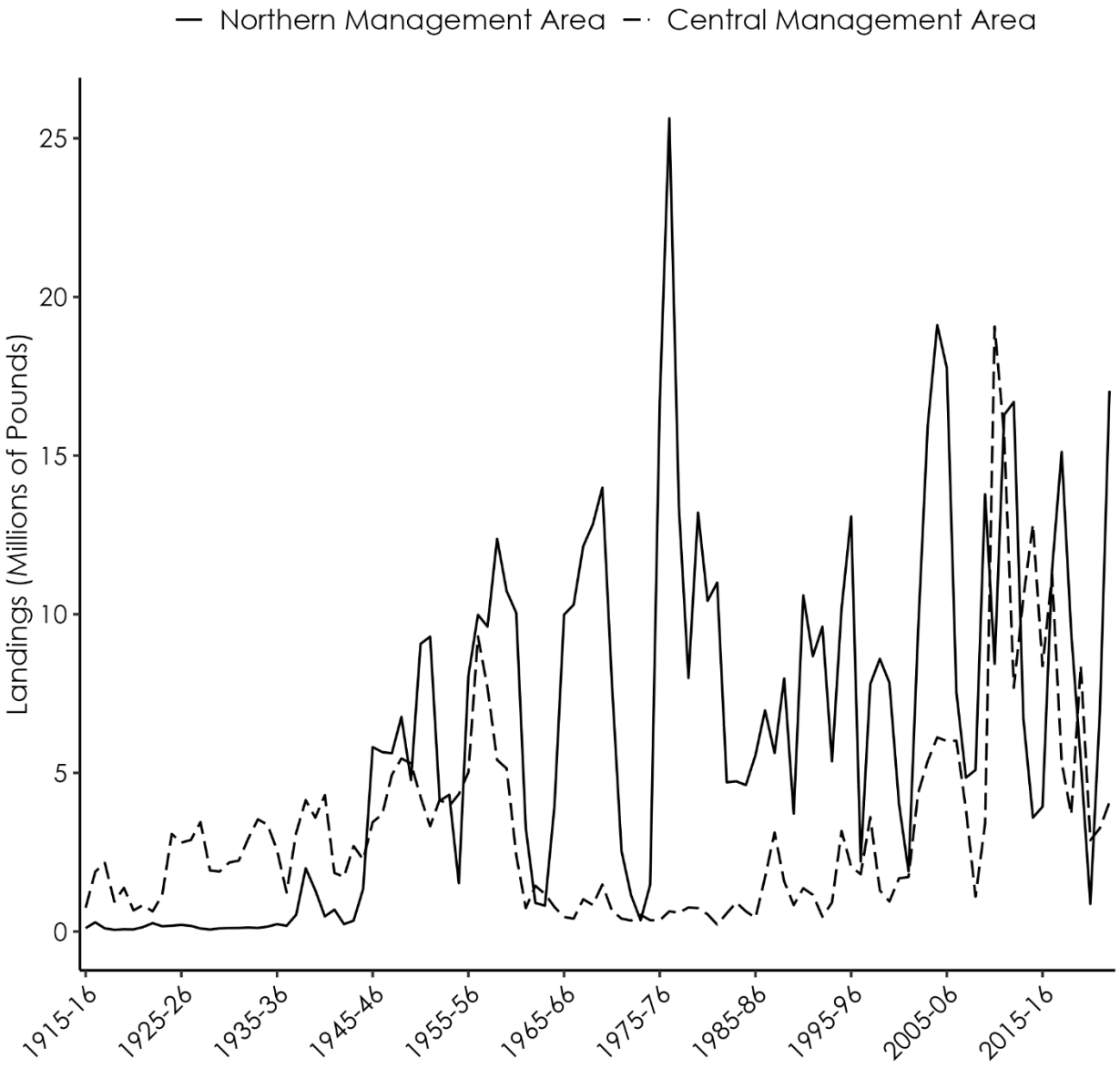

Figure 2-8. California Dungeness crab landings in millions of pounds from the 1915-16 to the 2022-23 fishing seasons within the NMA (solid line) and CMA (dashed line).

In addition to crab landings volume, examining the number of permitted vessels which make landings into each port (active vessels) during January and February and their associated trap limits provides another method for evaluating fishing activity. Focusing on January and February captures the period with the

most vessel activity while reducing overlap of vessels which transit to more than one port area over the course of the fishing season.

The relative contribution of landings by port region to the total number of active vessels between the 2016-17 and 2022-23 fishing seasons is shown in Figure 2-9, with about a third to half of active vessels landing in the ports of Crescent City, Trinidad, and Eureka within the NMA, and a similar proportion landing in Bodega Bay, San Francisco and Half Moon Bay within the CMA. This is in contrast to ports in Mendocino County (e.g., Fort Bragg and Point Arena) and from Monterey Bay south that have a smaller proportion of active vessels (≤10%).

Figure 2-9 also displays the maximum number of traps those vessels may have deployed during each fishing season. While the trap estimates are based on port of landing rather than catch area, CDFW anticipates these traps would mostly be found near these ports and inside the 100-fathom depth contour.

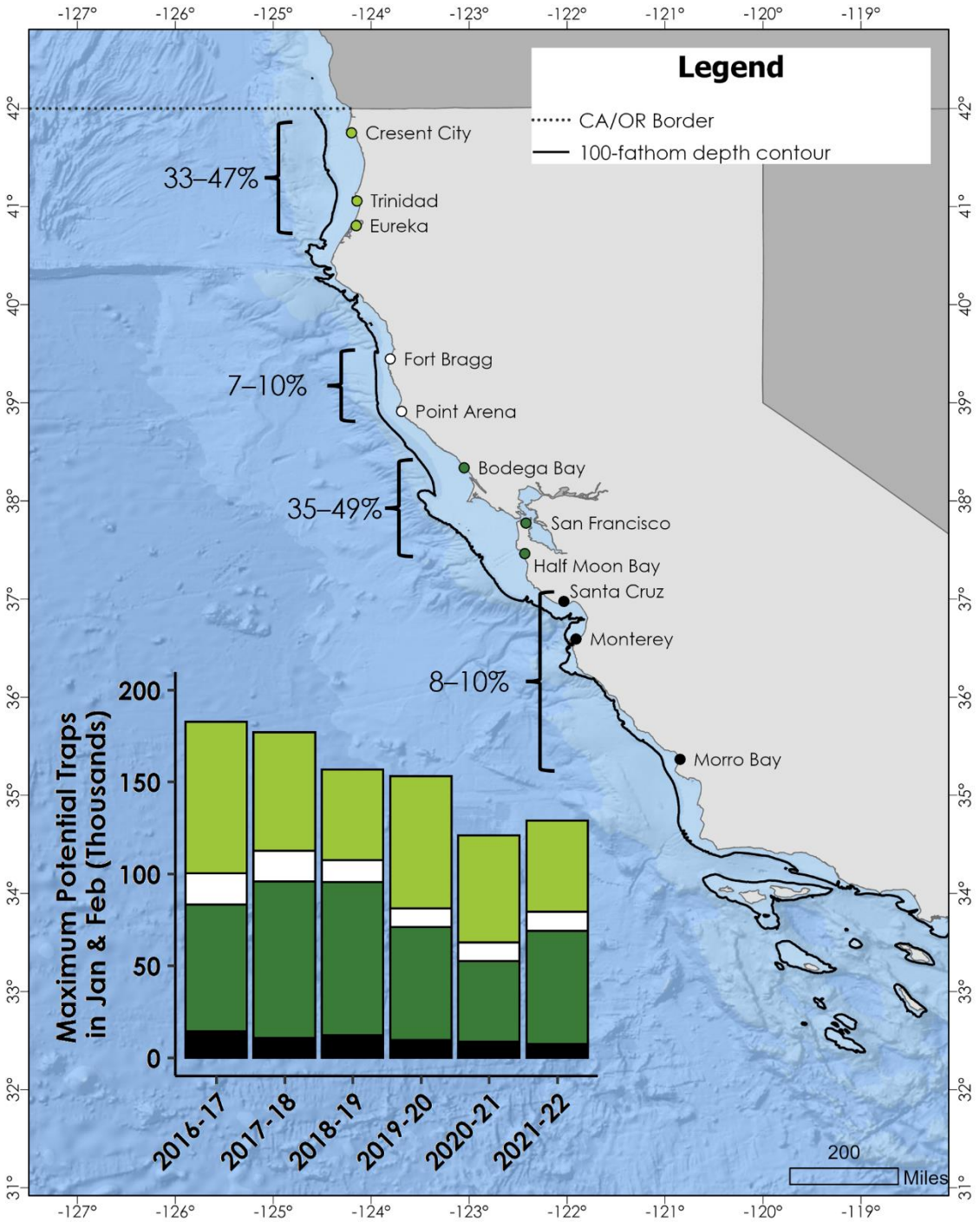

Figure 2-9. Map of California showing 100-fathom depth contour (black line) along port regions. Numbers adjacent to each port region show the range in percent of the active fleet that made at least one landing in the port region during January and February over the past seven fishing seasons (2016-17 to 2022-23). The stacked bar graph in lower left shows the estimated maximum potential traps by fishing season that the active vessel permits represent during the same time period, color coded by port region (from top to bottom: Northern, North-Central, Central, and Southern).

2.3 Permit Duration

CDFW is requesting a 15-year renewable ITP. This permit term offers a balanced approach between providing stability for fishery participants and accounting for the advances in best available science and fundamental changes in fishing practices anticipated during the permit term. Further details are provided in Chapters 6 and 7.

During the requested permit term, CDFW anticipates changes in Covered Species abundance which may warrant changes to the Conservation Measures described in Chapters 5 and 6. While the current population trend for blue whales is stable (Carretta et al. 2023), both the Central America and Mexico DPS of humpback whales appear to be increasing, although there is high uncertainty regarding the rate of increase for the Central America DPS and a stock-specific population trend is not yet available for the Mexico DPS (Carretta et al. 2023). In contrast, the population of Western North Pacific leatherback sea turtles is declining (see Section 3.4). As populations of Covered Species change, both the potential for take (driven by changes in the timing and degree of co-occurrence with the Covered Activities) and the relative impact of that take (whereby a given number of entanglements impacts a different proportion of the overall population) will also change. For humpback whales, this may be compounded by an improved understanding of the relative proportions of Central America and Mexico DPS within the Plan Area.

As described further in Section 3.1, oceanographic conditions within the Plan Area are highly dynamic, and large-scale shifts in oceanographic regimes have been directly linked to episodic fluctuations in entanglement frequency (Santora et al. 2020). Multiple years of observation regarding the spatiotemporal distribution of both Covered Species and the Covered Activities will be needed to evaluate the effectiveness of this CP's Conservation Measures within distinct oceanographic contexts. Should the measures prove to be robust to this environmental variation, CDFW will consider asking for a longer permit term during the renewal process. If the measures are less effective during certain environmental regimes, the backstop measures described in Section 6.8 will ensure take remains within allowable levels.

CDFW also anticipates changes to fishery operations over the requested permit term which may prompt reconsideration of the Conservation Measures. Since the Working Group was first convened in September 2015, CDFW has received a variety of proposals from fishery participants regarding management changes that would be equally protective of the Covered Species while maintaining (or even enhancing) economic viability of the fishery. Some of these approaches are highlighted in Chapter 7. Should the fishery as a whole move towards these practices, the Conservation Measures proposed here may no longer be required in their current form.

CDFW has outlined a process for adaptive management in Chapter 7, however appropriate changes to the approach outlined in this CP become more difficult to forecast as the permit term increases. Taken together, these factors (likelihood

of new information regarding the impacts of the Covered Activities on the Covered Species; potential for environmental variation that may reduce effectiveness of the Conservation Measures; probability of the fleet undertaking actions beyond those currently required by CDFW) supports the requested permit term.

CHAPTER 3. ENVIRONMENTAL SETTING AND BIOLOGICAL RESOURCES

This Chapter briefly summarizes available information regarding the oceanographic and ecological conditions of waters off California (Section 3.1) as well as the biology, migratory patterns, and foraging activity of blue whales (Section 3.2), humpback whales (Section 3.3), and leatherback sea turtles (Section 3.4). Should updated best available science become available prior to permit issuance, CDFW will consult with NMFS regarding integration of those findings into this Chapter.

3.1 Seasonal and Interannual Dynamics of the California Current System

The waters off California are part of the California Current System (CCS), a highly productive coastal ecosystem spanning the West Coast of North America from British Columbia to Baja California (Talley et al. 2011). The dynamics of the CCS have been described in detail by several sources (e.g., Huyer 1983; Lynn and Simpson 1987; Hickey 1979; Marchesiello et al. 2003; Checkley and Barth 2009) and are briefly summarized here.

The CCS is comprised of the California Current, the California Undercurrent, the Davidson Current, and the Southern California Countercurrent (Hickey 1979). Like other eastern boundary current systems, the CCS experiences significant, sustained upwelling events driven by large-scale wind and circulation patterns (Carr and Kearns 2003; Talley et al. 2011). Upwelling occurs when warmer surface water is pushed offshore and replaced by deeper, nutrient-rich water. This influx of nutrients into the euphotic zone fuels high levels of biological production, particularly in shelf and shelf-break habitats, supporting high densities of migratory seabirds and marine mammals as well as resident fish species including groundfish, salmon, sardine, and mackerel (Carr and Kearns 2003; Field et al. 2006).

The California Current Integrated Ecosystem Assessment (CCIEA) identifies three basin-scale oceanographic phenomena which influence dynamics of the CCS: El Niño Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO), and North Pacific Gyre Oscillation (NPGO; Harvey et al. 2023). ENSO has three states: neutral, El Niño, and La Niña. During ENSO neutral years, a low atmospheric pressure center forms over Northern Australia and Indonesia and a high-pressure center forms over Peru (https://www.whoi.edu/know-your-ocean/ocean-topics/ocean-circulation/el-nio-other-oscillations/, accessed May 14, 2021). The resulting trade winds move warm surface waters from the eastern Pacific to the western Pacific, driving upwelling along the coast of South America. During El Niño, the high-pressure system over the western Pacific weakens, allowing warm surface waters to move from the western Pacific towards South America, reducing upwelling and productivity in the eastern Pacific. During La Niña, trade winds strengthen, intensifying upwelling in the eastern Pacific. The CCIEA tracks ENSO conditions via the Oceanic Niño Index (ONI), which is a 3-month running mean of sea surface temperature (SST) anomalies in the Nino 3.4 region (120°-150° W. longitude and 5° N. latitude-5° S. latitude). ONI values above 0.5° Celsius (C) indicate El Niño conditions (i.e., lower primary production and weaker

upwelling) and values below -0.5°C indicate La Niña conditions (i.e., higher primary production and stronger upwelling). The cycling between El Niño, La Niña, and ENSO-neutral conditions is variable in both periodicity and intensity, but typically recurs every two to 10 years.

The PDO also reflects anomalies in SST, with positive values (warmer temperatures) indicating lower productivity and lower values (colder temperatures) reflecting higher productivity conditions (Harvey et al. 2023). Cycling between the warm and cool phases of the PDO occurs on longer timescales than ENSO, typically on 20-30 year intervals (https://www.whoi.edu/know-your-ocean/ocean-topics/ocean-circulation/el-nio-other-oscillations/, accessed May 14, 2021).

The NPGO is an index of sea surface height, indicating basin-scale circulation patterns. Positive NPGO values are associated with higher flows of nutrient-rich subarctic waters towards the equator, supporting more productive coastal ecosystems, and negative NPGO values are associated with decreased contributions of subarctic waters and lower productivity (Harvey et al. 2023).

Skogsberg (1936) defined three distinct oceanographic periods in Monterey Bay: (1) a spring/summer "upwelling season", (2) a summer/fall "oceanic season", and (3) a winter "Davidson Current season", and suggested these trends apply to the CCS more broadly. Subsequent investigations have documented latitudinal trends in upwelling phenology (onset, duration, and intensity) within the CCS as well as substantial interannual variation (Bograd et al. 2009; Brady et al. 2017). Persistent, low-magnitude upwelling occurs nearly year-round below Point Conception, and the upwelling season shortens with increasing latitude. Between Point Conception and Cape Mendocino, relatively consistent upwelling of a moderate magnitude occurs from March to October. The highest magnitude upwelling is seen north of Cape Mendocino between April and October, with a peak in July. Complex coastal topography (e.g., capes, points, and peninsulas) and bathymetry (e.g., banks, and canyons) can alter upwelling patterns and associated productivity (Huyer 1983; Marchesiello et al. 2003; Checkley and Barth, 2009). Upwelling phenology is also impacted by basin-scale changes in oceanographic circulation, including ENSO and PDO (Bograd et al. 2009; Santora et al. 2011). Specifically, increased advection of southern source water associated with El Niño events can result in dramatic declines in productivity and shifts in community structure, while during the cold phases of ENSO the coastal ecosystem is characterized by intensified transport of nutrient-rich northern waters and increased productivity (Checkley and Barth 2009).

Variations in large-scale atmospheric forcing can also influence upwelling dynamics and ecosystem productivity in the CCS. The North Pacific High (NPH) is a semi-permanent area of high pressure (> 1020 Pascals) in the North Pacific Ocean, and variation in both the size and location of the NPH affects the timing and strength of coastal upwelling off California (Schroeder et al. 2013). Winter NPH values (January – February mean) provide an early indication of likely

upwelling conditions and resulting biological productivity during the following spring and summer.

Climate change may alter historical upwelling dynamics. Brady et al. (2017) anticipate that in the latter half of the 21st century, seasonal upwelling in the CCS will be characterized by a more intense spring transition (shift from downwelling to upwelling) and a reduction in total seasonal upwelling. These changes could lead to higher, rather than lower, productivity if more moderate levels of upwelling recalibrate the balance between advection and available nutrients. Additionally, CCIEA researchers have recently documented decoupling of basin-scale indices from local-scale oceanographic conditions, e.g. ONI from observed SST within the central and southern portions of the CCLME (Harvey et al. 2022); PDO and ONI values from observed SST and primary production (Harvey et al. 2023). This trend is likely due, at least in part, to climate change resulting in breakdowns between longstanding correlative relationships (Harvey et al. 2023). Should this trend continue, basin-scale indices will become increasingly ineffective at predicting local physical conditions and associated ecosystem responses, limiting the ability of CDFW and other resource managers to rely on seasonal forecasts.

Between 2014 and 2016, typical seasonal dynamics in the Northeast Pacific were disrupted by a Large Marine Heatwave (LMH) event colloquially known as "The Blob." Driven by changes in sea level pressure (Bond et al. 2015), this LMH event had profound impacts on ocean circulation patterns which cascaded throughout the ecosystems of the CCS. Upwelling in 2014 was dramatically delayed and was among the weakest and shortest since the 1990s (Peterson et al. 2015), decreasing primary productivity and impacting the abundance, species richness, and distribution of key prey species such as copepods and krill (reviewed by Cavole et al. 2016).

Warm SST caused by the LMH, northward transport of *Pseudo-nitzchia australis*, and the onset of seasonal upwelling in spring 2015 led to a Harmful Algal Bloom (HAB), a rapid proliferation of microalgae with detrimental effects (Guang et al. 2021). The HAB caused a large scale, unprecedented domoic acid event along the entire West Coast of North America (Cavole et al. 2016; McCabe et al. 2016). Fishery-dependent coastal communities in California, Oregon, and Washington experienced broad financial and socioeconomic impacts. The Dungeness crab, rock crab, anchovy, sardine, mussel, and razor clam fisheries all experienced closures which resulted in millions in lost revenue, mass reductions in fishery-related employment, and reduced sustenance and recreational fishing (Moore et al. 2019; Moore et al. 2020). The West Coast commercial Dungeness crab fishery experienced a $97.5 million loss in revenue (Moore et al. 2020) and $48.3 million was from California alone (NMFS 2016a). The federal Department of Commerce provided nearly $26 million in disaster assistance relief funds to California Dungeness crab fishermen.

Due to health risks from consumption of domoic acid, the 2015-16 season opening of the California commercial Dungeness crab fishery was delayed until

March 26, 2016 in the CMA, and the NMA did not fully open until May 26, 2016. As discussed in Section 2.2.4.3, in a typical fishing season the vast majority of Dungeness crab landings are made within the first eight weeks of the season opening, with declining landings thereafter. During the 2015-16 season, a majority of landings (presumably accompanied by the highest amount of deployed trap gear) did not occur until April, May and June (Figure 3-1).

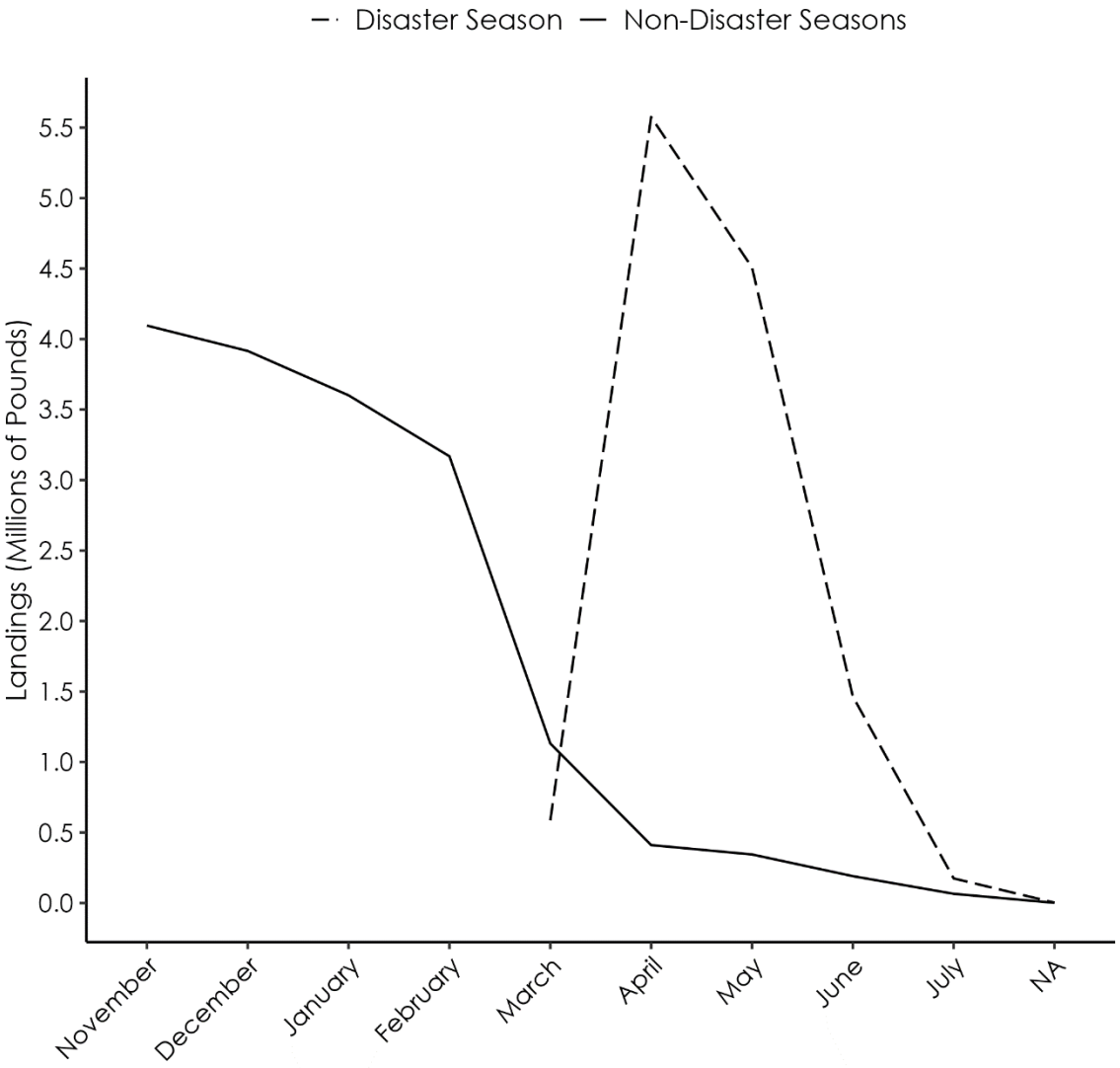

Figure 3-1. Monthly landings during the 2015-16 "Disaster Fishing Season" (dashed line) as compared to average monthly landings during the "Non-Disaster Fishing Seasons" of 2013-14 to 2014-15 and 2016-17 to 2022-23 (solid line).

Restricted upwelling in the 2015-16 period also compressed available forage into a relatively narrow band along the coast (Santora et al. 2020). When large whales arrived off the California coast, their distribution was similarly compressed into nearshore areas where active Dungeness crab fishing was occurring. The convergence of these factors likely contributed to the record number of

confirmed large whale entanglements along the West Coast in 2016 (n = 56), 22 (39%) of which involved California commercial Dungeness crab gear.

Jacox et al. (2018) suggest that while the 2014-16 LMH was primarily driven by a confluence of complementary natural processes, these were exacerbated by long-term trends of anthropogenic warming. Guang et al. (2020), Oliver et al. (2018) and Moore et al. (2019) analyzed historical trends in LMHs and HABs and concluded both have increased in intensity and frequency. Several additional heatwave events have followed the 2014-16 LMH in the CCS (Harvey et al. 2021, Harvey et al. 2022, Harvey et al. 2023). A study of global annual LMHs found the frequency and duration have increased by 34% and 17% from 1925 to 2016, respectively (Oliver et al. 2018). Moore et al. (2019) examined 17 fishing communities and found one-third of the communities were affected by HABs each year. In addition, future projections from Brady et al. (2017), Guang et al. (2020), and Oliver et al. (2018) indicate that climate change will continue to increase LMHs, the intensity of upwelling in the CCS, and SST. Guang et al. (2020) anticipates HABs will increase along with these factors. While the geographic scale, intensity, and duration of the 2014-16 LMH was unprecedented, best available science suggests these types of warm water events will continue to occur, and should be considered as part of the environmental context for this CP.

3.2 Blue Whales

Blue whales are broadly distributed amongst the world's ocean and are listed at the species level under ESA. The Society for Marine Mammalogy currently recognizes five subspecies of blue whale: *B. m. musculus* in the North Atlantic and North Pacific Oceans; *B. m. intermedia* in the Antarctic; *B. m. brevica* in the sub-Antarctic southern Indian Ocean and southwestern Pacific Ocean; *B. m. indica* in the northern Indian Ocean; and an un-named subspecies in the southeastern Pacific Ocean (NMFS 2020a). For purposes of management under the MMPA, NMFS divides the North Pacific population of *B. m. musculus* into Eastern North Pacific (ENP) and Central North Pacific (CNP) stocks (Carretta et al. 2023). Carretta et al. (2023) identifies the mark-recapture analysis by Calambokidis and Barlow (2020) as the best available abundance estimate of the ENP stock, resulting in a current estimate of 1,898 individuals and a minimum population estimate of 1,767 individuals.

Blue whales undertake seasonal migrations between breeding and foraging grounds and are generally more abundant off California during the summer months (Reilly et al. 1990; Mate et al. 1999; Forney and Barlow 1998; Bailey et al. 2009; Abrahms et al. 2019a; NMFS 2020a). Models of blue whale presence (Hazen et al. 2016) and suitable habitat (Abrahms et al. 2019b) support this finding, with limited presence or suitable habitat during the winter and early spring, an increase within the Southern California Bight (SCB) during April, May and June, and northwards expansion during the late summer and early fall before retracting southwards towards the SCB. Hazen et al. (2016) found the highest predicted blue whale densities in the SCB and between Monterey and Humboldt

Bay within 300 km of shore, and Abrahms et al. (2019b) found hotspots of suitable habitat within the SCB, Monterey Bay, Gulf of the Farallones, Cape Mendocino, and Cape Blanco.

Blue whales depart summer foraging areas in December and follow the continental margin until they reach one of three wintering areas: the southern tip of Baja, the Gulf of California, or the area west of the Costa Rica Dome (Bailey et al. 2009). During the northward migration, which begins in March or April, blue whales make extended stops off Baja before arriving off California in June. Area Restricted Search (ARS) behaviors indicate the Gulf of the Farallones, SCB, northern Coast of Baja, and off the tip of Baja are key foraging areas. Palacios et al. (2019) also documented a key foraging area between Cape Mendocino and Cape Blanco, and that ARS behavior decreased within these foraging areas during warm phases of the PDO.

Even during years with lower productivity, blue whales still exhibit strong site fidelity (Palacios et al. 2019), consistent with recent findings indicating blue whale migration is driven by a combination of memory and environmental cues. Abrahms et al. (2019a) found that blue whale migratory movements in the Northeastern Pacific were significantly correlated with 10-year average values of peak chlorophyll-a, indicating blue whales target areas with predictably high-quality prey resources rather than those with the highest contemporaneous productivity. This memory-driven focus on long-term average trends in resource availability may be detrimental as climate change drives shifts in phenology, latitudinal range, and vertical distribution of prey species. Szesciorka et al. (2020) found a combination of ocean conditions and memory drove timing of blue whale movements between the winter breeding and summer foraging grounds. Blue whales arrived in the SCB earlier if conditions during the prior year were cooler and arrived later if conditions had been warmer than average.

Calambokidis et al. (2015) identified nine Biologically Important Areas (BIAs) off the West Coast where blue whale foraging is common (Figure 3-2). Together, the nine BIAs represent 2% of the waters off the West Coast while encompassing 87% of blue whale sightings between 1986 and 2011. All of these BIAs are located off California and six are located within the SCB, which underscores the importance of the Plan Area for this species. Three BIAs north of Point Conception (Monterey Bay to Pescadero, Gulf of the Farallones, Point Area to Fort Bragg) overlap with Dungeness crab fishing grounds. Based on available sightings information, Calambokidis et al. (2015) concluded blue whales generally arrive in these areas in July or August and depart in October or November. However, near-daily shore-based observations between 1993 and 2016 indicate a trend of earlier arrivals and increased residence time at the Farallon Islands (Ingman et al. 2021). The initial arrival of blue whales has shifted from early September to mid-May. While blue whales are also departing earlier (in early rather than mid-October), the extended residency of blue whales overlaps to a greater extent with the commercial Dungeness crab season, contributing to increased entanglement risk.

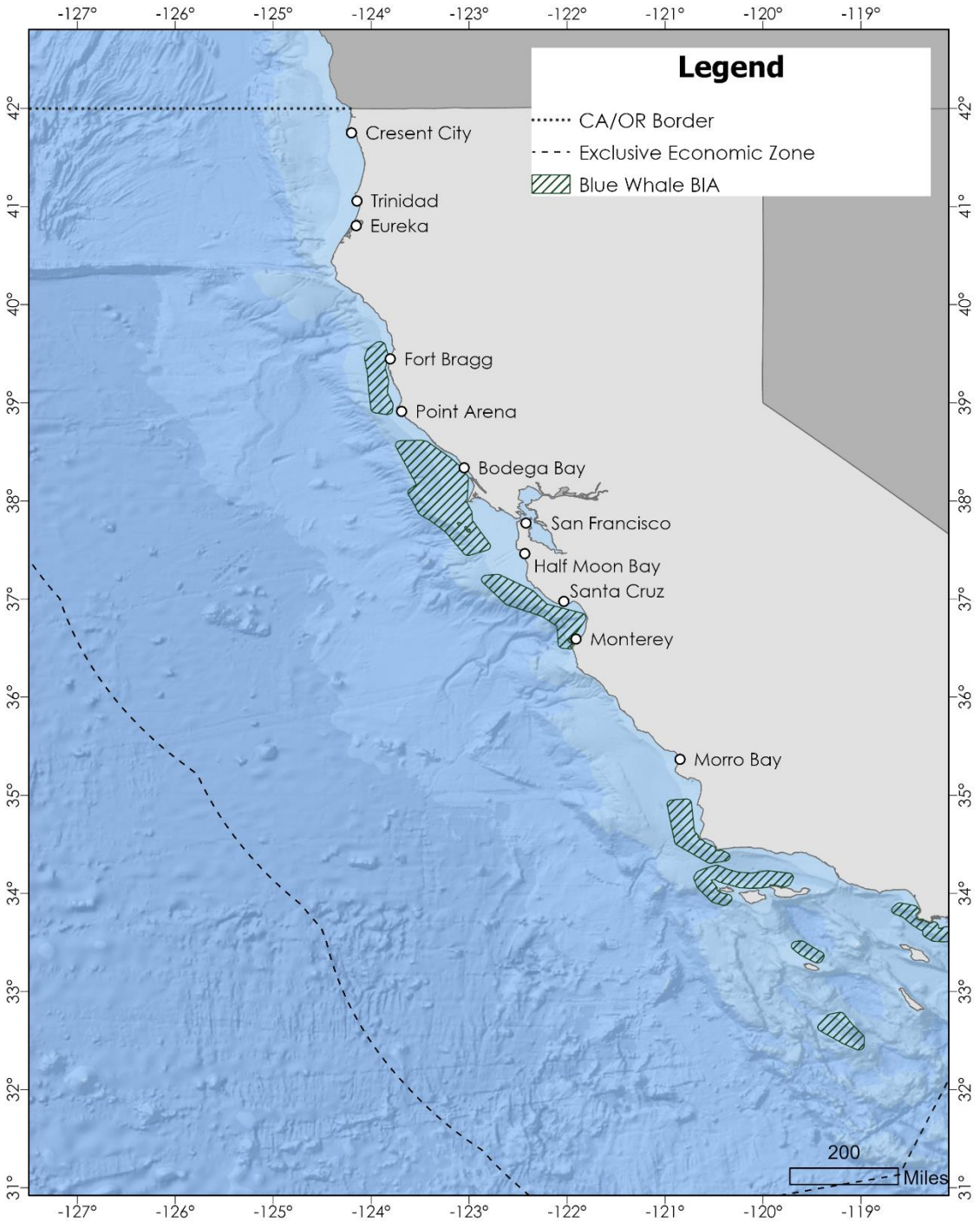

Figure 3-2. BIAs for blue whales off the West Coast, as described in Calambokidis et al. 2015 (downloaded from https://oceannoise.noaa.gov/biologically-important-areas, November 10, 2022).

Krill species are a foundational component of CCS trophic structure, with substantial interannual variation in abundance. Field et al. (2006) estimated that much of the energy flow between primary producers and tertiary consumers in the northern CCS is filtered through krill. This is certainly true for blue whales,

which exclusively consume these small euphausiids. In particular, blue whales forage selectively on high-density patches of large *Thysanoessa spinifera* and *Euphausia pacifica*, even when other size classes or species are more abundant (Croll et al. 2005).

Blue whales can conduct multiple feeding lunges at depths exceeding 200m before returning to the surface (Croll et al. 2001; Calambokidis et al. 2007). Blue whales shift from deeper foraging dives during daylight hours to shallower dives at night, tracking the vertical migration of their prey (Fiedler et al. 1998; Croll et al. 2001; Calambokidis et al. 2007).

The stretch of coast between the California-Oregon border and Point Sur generally experiences the strongest upwelling within the CCS, as well as the most variability from year to year (Bograd et al. 2009). On average, the area south of Point Sur experiences less upwelling than the area immediately to the north, but upwelling tends to last longer and is more consistent (Bograd et al. 2009). As upwelling strength increases, nutrient availability and abundance of phytoplankton species upon which krill feed also increases (Croll et al. 2005). However, stronger upwelling also increases the likelihood of advection, with krill being transported away from favorable habitat. Santora et al. (2011) found hotspots of high krill abundance during May and June in areas of moderate upwelling, particularly between Point Reyes and Point Conception (Figure 3-3).

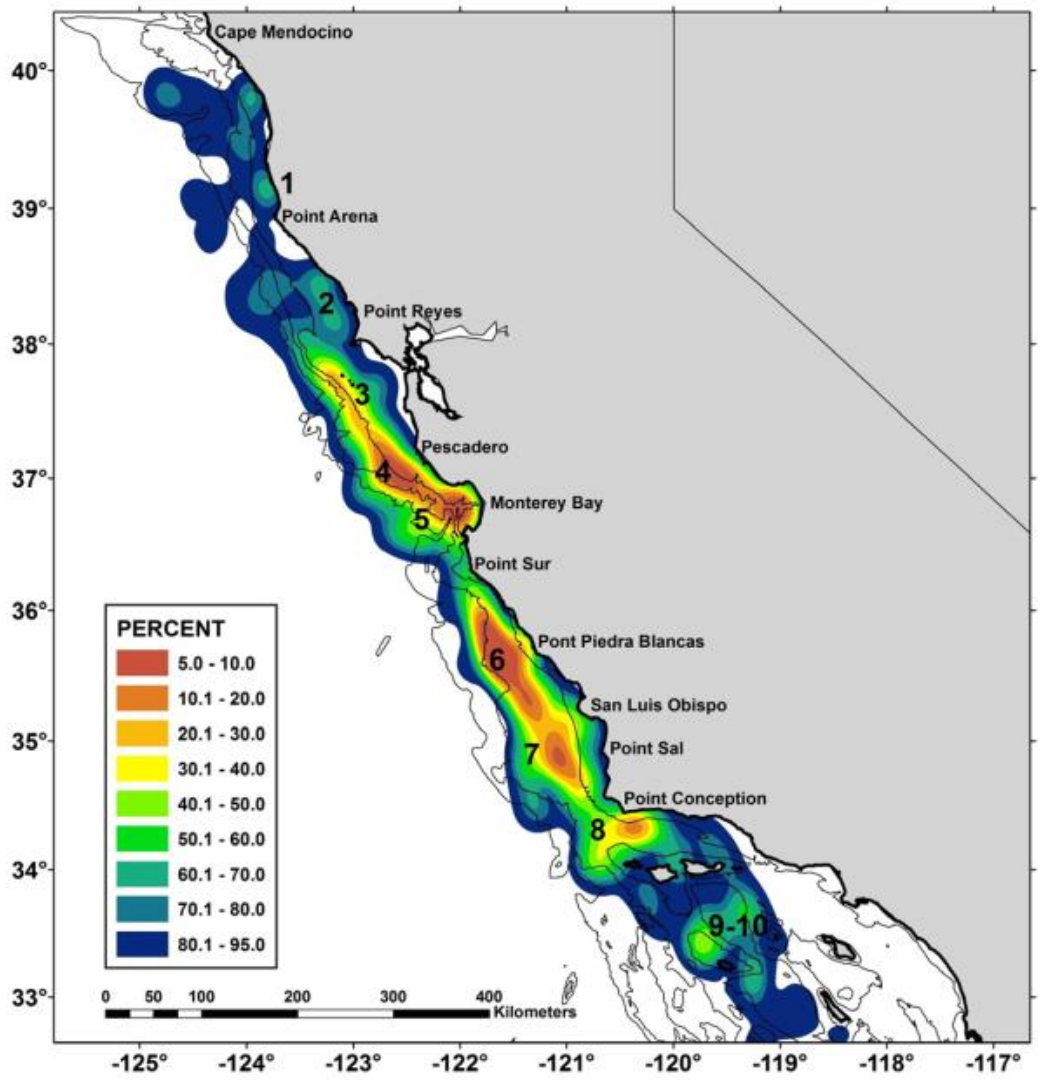

Figure 3-3. Krill hotspots along the California coast during May-June from 2004-2009, with depth contours denoting the 200m, 1000m, and 2000m isobaths. Percent value denotes the relative krill abundance of an area as a percentile within all sampled areas, with areas in the 5th to 20th percentiles considered "high," and areas in the 20th to 40th percentile considered "medium". From Santora et al. (2011).

More recently, Messié et al. (2022) identified three main krill hotspots off California. The southernmost hotspot (north of Point Conception, 34.5 to 36° N) is most productive between May and July. The central hotspot (which extends from Point Sur to Point Arena, 36.3 to 38.9° N) is most productive during June and July, and the northern hotspot (which extends from Cape Mendocino to Cape Blanco, 40.4 to 42.8° N) is most productive during July and August. Krill concentrations are consistently elevated within the central hotspot, with the southern and northern hotspots subject to greater interannual variability. On average, krill concentrations are highest between Point Conception and Point Arena, although hotspots appear to be shifting northward and occurring progressively earlier in the year. Near-real time mesoscale predictions of krill concentrations within the California Current are updated on a monthly basis and

available on a dedicated page hosted by the Monterey Bay Aquarium Research Institute, which can be used to support protected species management.

3.3 Humpback Whales

Humpback whales are broadly distributed amongst the world's oceans. Best available science from Jackson et al. (2014) identifies three subspecies (North Pacific, Atlantic, and Southern Hemisphere) based on restricted gene flow between the major ocean basins. The North Pacific subspecies is found throughout the Pacific ocean basin, with summering areas spanning the waters between Russia and California, and wintering areas in both the eastern and western portions of the North Pacific (Figure 3-4).

NMFS (2016b) states that whenever possible, stocks should comprise a demographically independent population (DIP). Therefore, in order to determine how the four North Pacific DPS designated under ESA (Western North Pacific, Hawaii, Mexico, and Central America) should be considered for purposes of management under the MMPA, NMFS evaluated whether each DPS unit contains one or more DIPs. Those findings are summarized in Figure 3-4 and explained in further detail below.

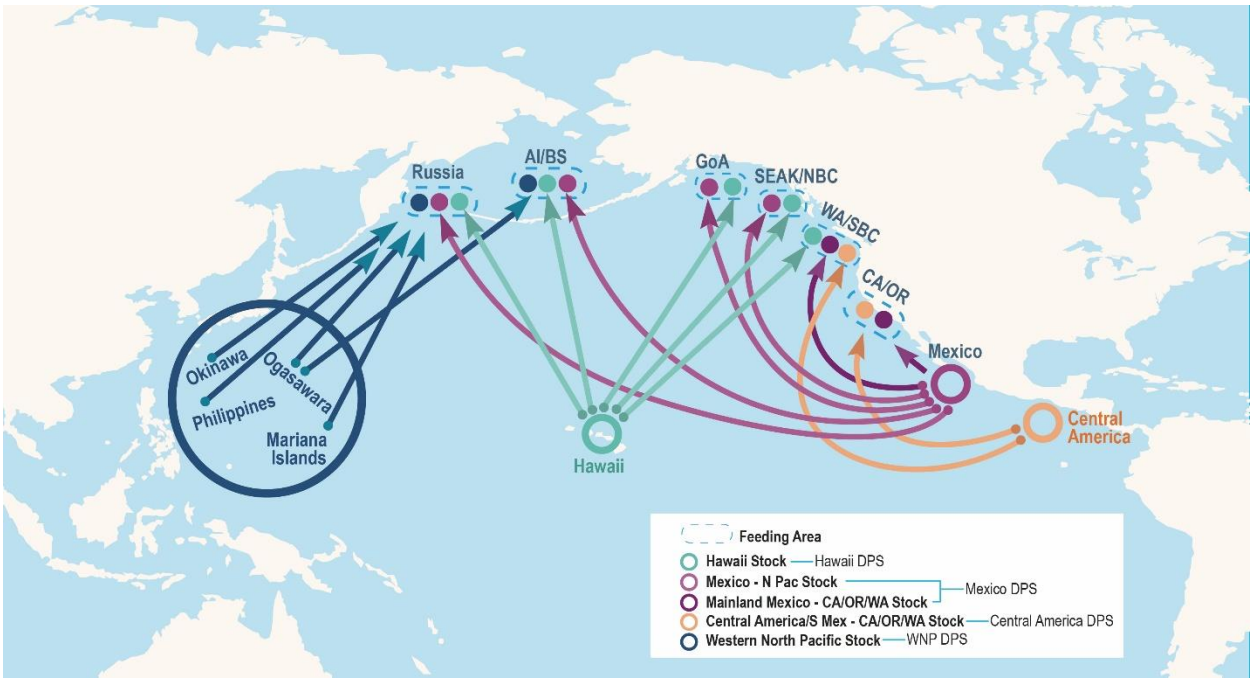

Figure 3-4. Pacific basin map showing wintering areas of five humpback whale stocks mentioned in the 2022 U.S. Pacific Marine Mammal Stock Assessments. Also shown are the following summer feeding areas: Russia, Aleutian Islands / Bering Sea (AI/BS), Gulf of Alaska (GoA), Southeast Alaska / Northern British Columbia (SEAK/NBC), Washington / Southern British Columbia (WA/SBC), and California / Oregon (CA/OR). From Carretta et al. (2023).

Only two DPS (Central America and Mexico) forage within the Plan Area (NMFS 2020b), and jointly constitute the Covered Species for the purposes of this CP.

The Central America DPS breeds along the Pacific coasts of Costa Rica, Panama, Guatemala, El Salvador, Honduras, and Nicaragua and feeds almost exclusively off California and Oregon (81 FR 62260), although more recent data indicates the wintering area extends northwards into southern Mexico (Taylor et al. 2021). The Mexico DPS breeds along the Pacific coast of mainland Mexico and the Revillagigedo Islands, and feeds along a broad swath of the Northeastern Pacific Ocean from Central California to the Aleutian Islands (81 FR 62260).

NMFS has determined that the Central America DPS is comprised of a single DIP (the Central America – CA/OR/WA DIP), which is also designated as a single stock (the Central America/Southern Mexico – CA/OR/WA stock; Carretta et al. 2023). In contrast, there is insufficient evidence to fully resolve the Mexico DPS into its component DIPs (Martien et al. 2021). In the interim, NMFS has determined the Mexico DPS includes a single DIP (the Mainland Mexico – CA/OR/WA DIP), with the remaining individuals constituting the Mexico – North Pacific unit (Carretta et al. 2023). NMFS has therefore designated the Mainland Mexico – CA/OR/WA DIP as the Mainland Mexico – CA/OR/WA stock and separately designated the Mexico – North Pacific unit as the Mexico – North Pacific stock. Best available science therefore indicates the following humpback whales utilize the Plan Area:

- Central America – CA/OR/WA DIP and Central America/Southern Mexico – CA/OR/WA stock
- Mainland Mexico – CA/OR/WA DIP and Mainland Mexico – CA/OR/WA stock

Using spatial capture-recapture methods and photographs collected between 2019 and 2021, Curtis et al. (2022) estimated the abundance of the Central America/Southern Mexico – CA/OR/WA stock as 1,494 individuals, with a minimum population estimate of 1,284 individuals, and an estimated annual growth rate of 1.6%. However, there is high uncertainty (SD = 2.3%) in the Curtis et al. (2022) estimate, and Carretta et al. (2023) relies upon the 8.2% growth rate estimated by Calambokidis and Barlow (2020) for all whales summering off California and Oregon, i.e. the Central America/Southern Mexico – CA/OR/WA stock and Mainland Mexico – CA/OR/WA stock, when calculating Potential Biological Removal (PBR) levels pursuant to the MMPA.

NMFS has determined the best abundance estimate for the Mainland Mexico – CA/OR/WA stock is the difference between the Calambokidis and Barlow (2020) abundance estimate for humpback whales off the West Coast (4,973 individuals) and the Curtis et al. (2022) estimate for the Central America/Southern Mexico – CA/OR/WA stock (1,494 individuals), resulting in an estimated abundance of 3,479 individuals and a minimum population estimate of 3,185 individuals (Carretta et al. 2023). A stock-specific population trend is not yet available, however Carretta et al. 2023 applies the same 8.2% growth rate selected for the Central America/Southern Mexico – CA/OR/WA stock when calculating PBR for the Mainland Mexico – CA/OR/WA stock.

While these DPS and stocks differ in their breeding and foraging areas, CDFW is not aware of any evidence which suggests they differ with respect to habitat preferences, prey species, foraging behavior, or other aspects of their ecology. Therefore, the remainder of this section describes best available science regarding humpback whales in general.

Humpback whales rarely feed while on the breeding grounds and rely on seasonal foraging in temperate latitudes to replenish the energy stores needed to support migration and successful breeding (NMFS 2020b). Historical whaling records from Monterey and Trinidad in the early 20th century indicate mean body condition was lowest in March, increased through the summer, and peaked in October (Clapham et al. 1997). Humpback whales require high-density prey patches to build sufficient energy reserves (Friedlander et al. 2009; Hazen et al. 2009). The high energetic costs of lunge feeding compared to swimming at constant speed drive humpback whale foraging behavior (Goldbogen et al. 2008). Humpback whales can complete multiple foraging lunges at depth during a single dive event, although as the number of lunges and dive duration increases, so does the subsequent surface interval (Kieckhefer 1992; Goldbogen et al. 2008). Humpback whales target the upper boundary of dense prey aggregations, possibly to minimize the energy costs from diving and searching at depth, and will alter their dive profiles to repeatedly sample high-quality prey patches before returning to the surface (Goldbogen et al. 2008).

Their main prey targets are euphausiids (particularly *E. pacifica* and *T. spinifera*) and small pelagic fish such as northern anchovy, Pacific herring, and Pacific sardine (Kieckhefer 1992; Clapham et al. 1997; Fleming et al. 2016; NMFS 2020b). The distribution and abundance of both krill and small pelagic fish are impacted by basin-scale and local oceanographic conditions and vary from year to year (Chavez et al. 2003). Acoustic and trawl surveys conducted during the spring and summer in the CCS show both interannual and seasonal variability in the distribution and abundance of these fish species, although anchovy exhibited higher geographic affinity and were consistently caught close to shore off the Columbia River mouth and Monterey Bay (Zwolinski et al. 2012, 2016, 2017). Fluctuations in upwelling can also modulate fine-scale distribution of prey species, with smaller, more discrete aggregations of krill and anchovy found during strong upwelling and more diffuse distribution during relaxation of upwelling conditions (Benoit-Bird et al. 2019). Anchovy and sardine spawning habitat also varies between years, although in general anchovy eggs are found closer to shore and concentrated within the Southern California Bight while sardine eggs are more abundant offshore and north of Point Conception (Reiss et al. 2008).

Unlike blue whales, humpback whales are generalist predators, switching between prey species depending on their relative abundance and quality (Clapham et al. 1997; Fleming et al. 2016; Santora et al. 2020). Humpback whale diets are dominated by krill during years with low SST, positive NPGO, and high upwelling, which results in elevated nutrient levels and higher krill abundance.

Conversely, anchovy and sardine are more prevalent during years with higher SST, negative NPGO, and delayed upwelling.

Humpback whales are most common in relatively cool waters over the continental shelf and slope, remaining largely nearshore during the summer and fall and extending farther offshore during the winter and spring (Becker et al. 2017). Calambokidis et al. (2015) identified seven BIAs where humpback whales are commonly seen feeding (Figure 3-5). Together, the seven BIAs represent 3% of EEZ waters off the West Coast, while encompassing 89% of the humpback whale sightings between 1986 and 2011. Four of the BIAs are located off California (Fort Bragg to Point Arena, Gulf of the Farallones to Monterey Bay, Morro Bay to Point Sal, and the Santa Barbara Channel to San Miguel Island), underscoring the importance of the Plan Area for this species. There is also substantial overlap between these BIAs and traditional Dungeness crab fishing grounds.

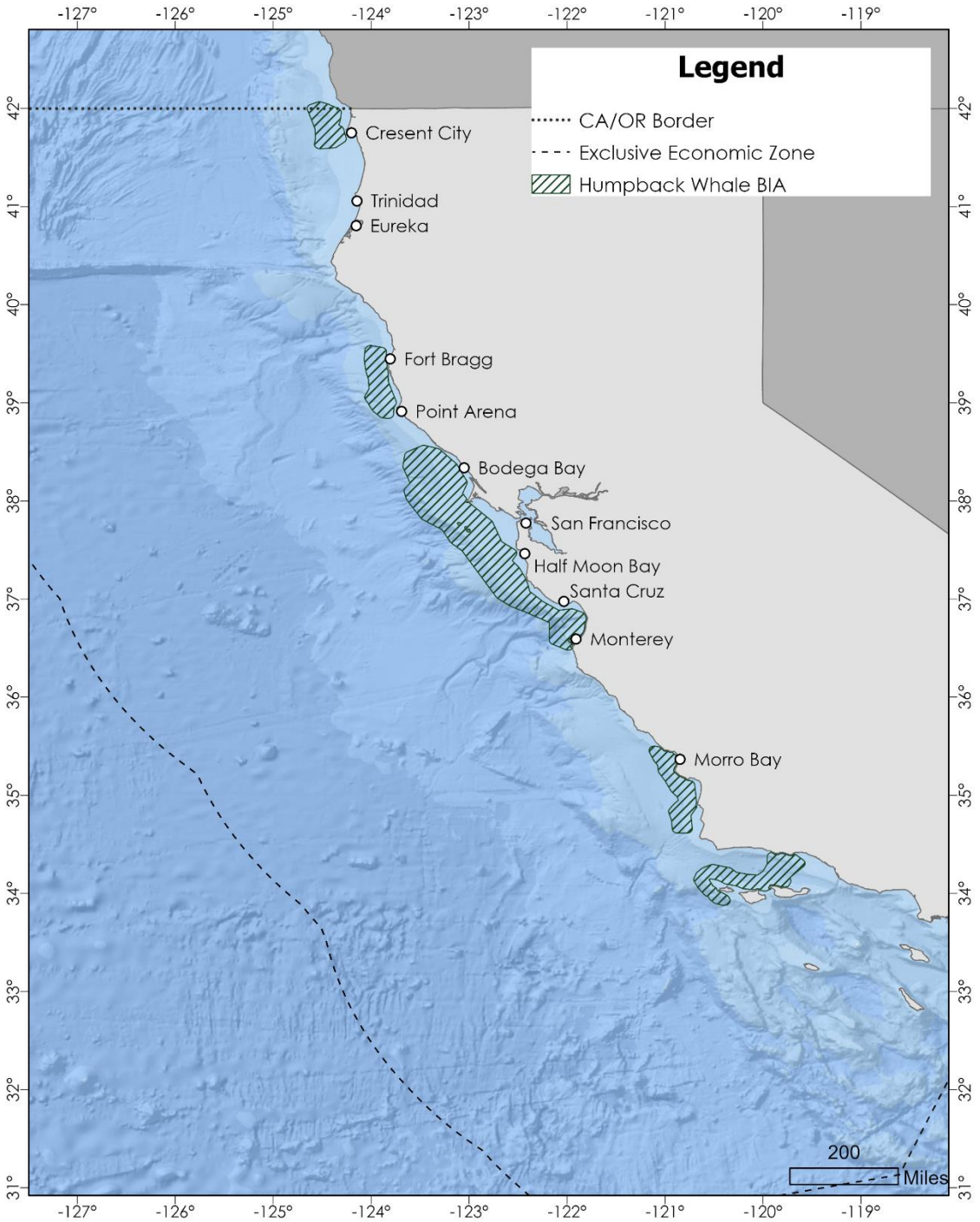

Figure 3-5. BIAs for humpback whales off the West Coast, as described in Calambokidis et al. 2015 (downloaded from https://oceannoise.noaa.gov/biologically-important-areas, 11/10/2022).

Based on available sightings information, Calambokidis et al. (2015) concluded humpback whales were most common from July to November between Fort Bragg and Monterey Bay, April to November between Morro Bay and Point Sal, and March to September from the Santa Barbara Channel to San Miguel Island.

There is limited overlap between these periods and the scheduled timing of the commercial Dungeness crab season (see Section 2.2.4.3), although Forney and Barlow (1998) have documented some presence of humpback whales off California year-round. However, basin-scale oceanographic conditions may modify seasonal occurrence patterns. Daily observations at the Farallon Islands indicate humpback whales arrive earlier during years characterized by cool-phase PDO values and depart later during years with neutral or high NPGO values (Ingman et al. 2021). Additionally, similar to the trend for blue whales, Ingman et al. (2021) has documented a shift in the initial arrival of humpback whales from early October in 1993 to early June in 2016. The extended residency of humpback whales overlaps to a greater extent with the commercial Dungeness crab season, contributing to increased entanglement risk.

Beginning in 2020, there have been multiple studies focused specifically on evaluating humpback and/or blue whale entanglement risk in the California commercial Dungeness crab fishery. Santora et al. (2020) and Feist et al. (2021) found that the high number of humpback whale entanglements during the LMH resulted from a combination of humpback whales moving into areas used by the fishery (as a result of habitat compression driving altered forage availability) and the presence of gear within those areas later into the spring and summer (following an unprecedented delay of the 2015-16 Dungeness crab season). Samhouri et al. (2021) and Free et al. (in press) used retrospective analyses to evaluate the hypothetical impacts of particular management actions (both static and dynamic) on entanglement risk and fishery outcomes both during and following the LMH. Direct comparison of their findings is difficult due to differences in methodology, however both papers concluded management actions which displace, rather than reduce, gear presence can have counterproductive outcomes. Free et al. (in press) also found that static management actions generally outperform dynamic responses, largely due to shifts in the risk landscape prior to management action implementation. Taken together, these four studies indicate that management actions which directly constrain overlap of vertical lines with the Covered Species will provide the greatest reduction in entanglement risk and highlight the importance of incorporating proactive risk predictions (such as the near-real time forecasts of whale distributions described in Section 5.1.6.5 and 6.2.1.3).

3.4 Leatherback Sea Turtles

Leatherback sea turtles are the largest and most widely distributed sea turtle species in the world. Of the sea turtles found north of Mexico, they have the most northern distribution and are frequently sighted between Northern Baja and Oregon, with occasional sightings off Washington, Canada, and Alaska (Stinson 1984). A recent status review of the leatherback sea turtle identified seven potential DPS units (Northwest Atlantic, Southwest Atlantic, Southeast Atlantic, Southwest Indian, Northeast Indian, West Pacific, and East Pacific), although no DPS have been formally designated under ESA (NMFS and USFWS 2020b). Of the two populations within the Pacific Ocean Basin only the West Pacific population

is known to forage within the CCS (Benson et al. 2011; Benson et al. 2020; NMFS and USFWS 2020b), and is the primary focus of this CP.

The West Pacific population primarily nests on beaches along the north coast of the Bird's Head Peninsula in Indonesia, although nesting has also been documented in Papua New Guinea, Vanuatu, and the Solomon Islands (Benson et al. 2011; NMFS and USFWS 2020b). The two main nesting beaches are Jamursba Medi and Wermon (Benson et al. 2011; Tapilatu et al. 2013). A large-scale satellite telemetry tagging effort by Benson et al. (2011) showed that while leatherback sea turtles utilize broad swaths of the Pacific Ocean basin, only those turtles nesting during the summer at West Papua, Indonesia forage within the CCS. Of the leatherback sea turtles in the study, approximately 62% of the leatherback sea turtles nesting in West Papua moved towards the North Pacific after nesting, with 27% eventually reaching the CCS. Of the leatherback sea turtles tagged within CCS foraging grounds, 97% eventually moved towards the Eastern Equatorial Pacific, from which they either continued moving towards nesting beaches in the Western Pacific (28%) or returned to the CCS after a two-to-three-month overwintering period (72%).

Leatherback sea turtles first enter the CCS via the SCB in the spring, after which they travel through nearshore waters to foraging areas in central California (Benson et al. 2011). South of Point Conception, leatherback sea turtles first appear during May and June and are most common during the July – September "turtle season" (Stinson 1984). North of Point Conception, 87% of sightings are within this turtle season. Leatherback sea turtle abundance is positively correlated with Northern Oscillation Index values, and the timing of their arrival in California foraging areas is associated with upwelling (Benson et al. 2007; Eguchi et al. 2016). Leatherback sea turtle sightings are also associated with surface drifts of jellies, as well as concentrations of albacore and bluefin tuna (Stinson 1984). Individuals begin to depart the CCS in October and November when water temperature begins to drop and productivity decreases (Thomas and Strub 2001; Benson et al. 2011). Approximately two-thirds (67.5%) of the leatherback sea turtles which forage off California are female (Benson et al. 2007) and they exhibit strong fidelity to foraging sites, with individuals returning to the CCS in subsequent years (Benson et al. 2011).

Within the CCS the primary leatherback sea turtle foraging area lies between Monterey Bay and Point Arena (Benson et al. 2011; Benson et al. 2020; Figure 3-6), where they have been observed feeding on *Chrysaora fuscescens, C. colorata,* and *Aurelia sp.* (Benson et al. 2007). This region is characterized by 14-16°C waters over the continental shelf (< 200m) with high levels of chlorophyll and low physical energy, supporting high concentrations of gelatinous prey within northern Monterey Bay, the Gulf of the Farallones, and Point Reyes (Lenarz et al. 1995; Graham et al. 2001; Benson et al. 2011).

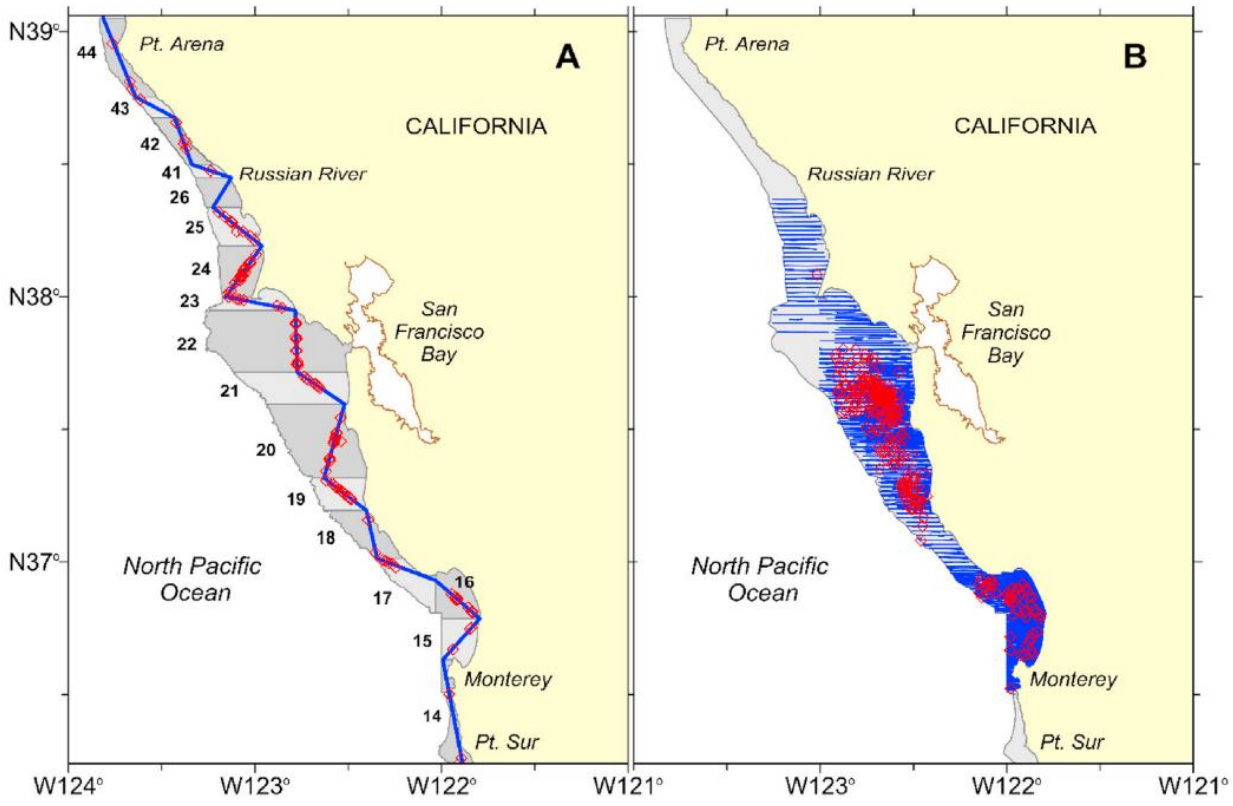

Figure 3-6. Aerial survey coverage (A) along harbor porpoise transects, 1990-2017 and (B) along adaptive fine-scale surveys that primarily covered waters from Monterey Bay to San Francisco, 2000-2017. Blue lines show transects; red diamonds show leatherback sea turtle sightings. Analysis strata are shown in alternating light and medium gray shading in panel (A), with stratum/transect numbers shown alongside. From Benson et al. (2020).

Studies of foraging leatherback sea turtles in the Atlantic Ocean indicate they are efficient and successful predators which consume 96 times their body weight in jellies each year, with higher proportions for juveniles and lower proportions for adults (Heaslip et al. 2012; Jones et al. 2012). Within Monterey Bay, between 1986 and 1991 the highest number of leatherback sea turtle sightings were during August and correlated with high SST (Starbird et al. 1993). While leatherback sea turtle sightings occur seasonally regardless of ocean temperatures, during warmer years they are reported in greater numbers and over a longer period north of Point Conception (Stinson 1984).

Within the CCS, leatherback sea turtle abundance has declined by 5.6% annually between 1990 and 2017, with a total decline of 80% over that period (Benson et al. 2020). Benson et al. (2020) found no evidence for declines in habitat quality or prey availability within the CCS, although this decline is closely correlated with declines observed at the Jamursba Medi and Wermon nesting beaches by Tapilatu et al. (2013). The most recent estimate of West Pacific nesting female abundance is 1,277 individuals; however, this estimate relies on surveys from a subset of nesting beaches and should be viewed as an index rather than the total abundance of nesting females (NMFS and USFWS 2020b).

CHAPTER 4. BASELINE PERIOD (2014-2018)

This Chapter describes how CDFW selected an appropriate baseline for evaluating take (Section 4.1) and the Conservation Measures implemented during the baseline period (Section 4.2). Section 4.3 describes how CDFW defines take for purposes of this CP, including allocation of humpback whale take between the Mexico and Central America DPS. Section 4.4 presents evaluations of existing take levels.

4.1 Baseline Selection

Unlike a development project, in which a new source of take is proposed, this CP and associated ITP application seeks coverage for ongoing Covered Activities with a documented history of Covered Species take. Therefore, there is no clear starting point for evaluating take from the Covered Activities. Additionally, recent changes in entanglement reporting specificity, variable ecosystem conditions, and modifications and improvements to management approaches prior to submission of the ITP application (Figure 4-1) make it unlikely that prior take levels properly reflect the anticipated future take by the fishery, as further detailed below.

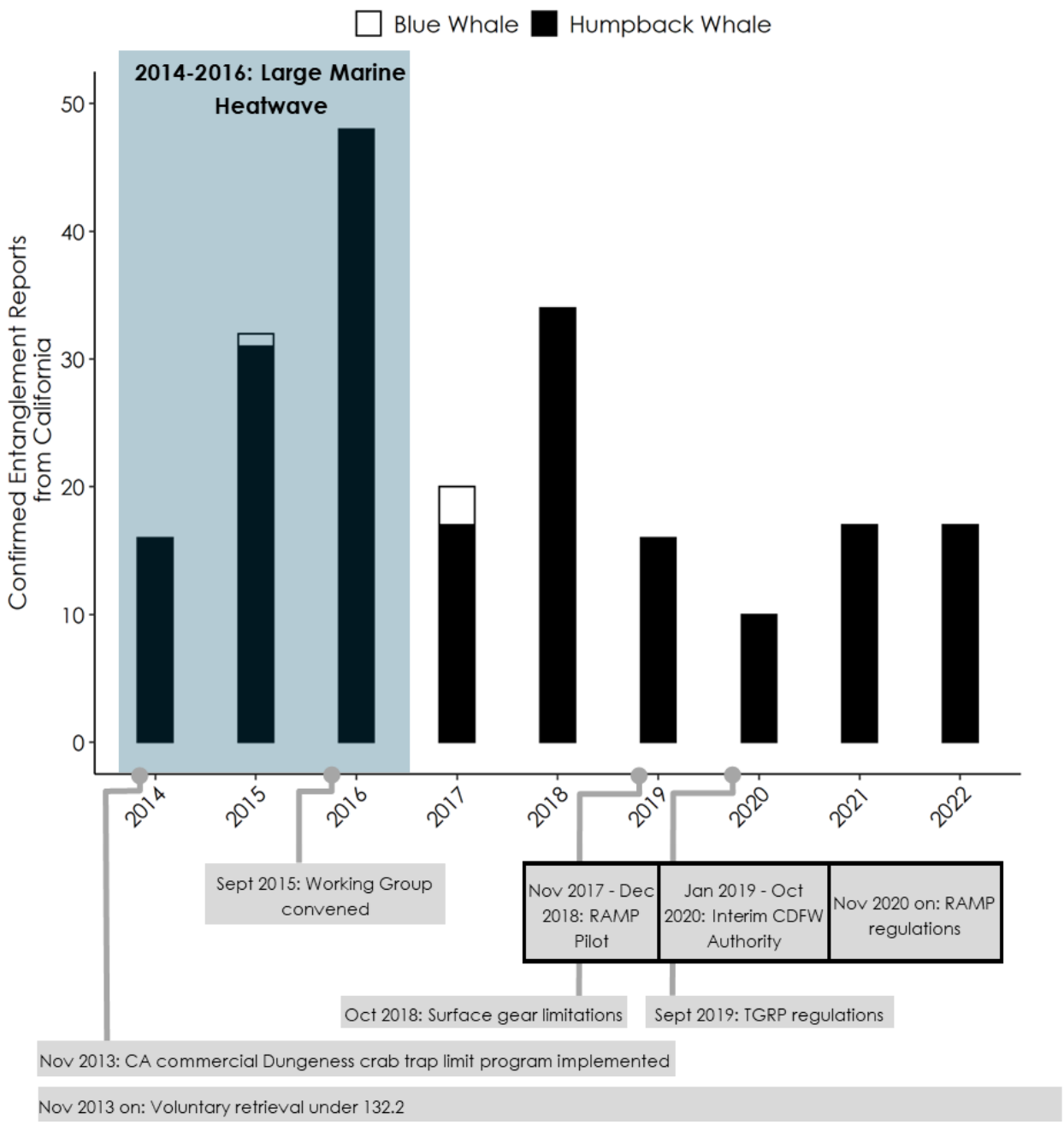

Figure 4-1. Annual confirmed entanglements of blue and humpback whales reported off California, all gear types, 2014-2022, with notes regarding ecosystem conditions, gear detectability, and key changes in Dungeness crab fishery management.

CDFW considered multiple factors to identify the period that best captures baseline take levels. While sea turtle stranding records are available from 1981 on, and large whale entanglement records are available from 1982 on, NMFS has characterized 2013 as the beginning of the "modern era of entanglements" based on increased availability and quality of documentation for entanglement reports (Saez et al. 2021). Sea turtle stranding data began receiving additional scrutiny in 2015, with an increased focus on attributing leatherback sea turtle entanglements to specific fisheries, as is done for large whales (personal

communication, Dan Lawson, NMFS WCRO, June 4, 2021). Additionally, requirements to mark California commercial Dungeness crab gear with a unique buoy tag went into effect beginning with the 2013-14 season. When the main buoy is visible, or the gear can be retrieved by an entanglement response team, this unique tag makes it easier to attribute an entanglement to the commercial Dungeness crab fishery. Each state uses different colors and shapes for their fishery's tags (Figure 4-2), allowing managers to attribute commercial Dungeness crab entanglements to either the California, Oregon, or Washington fishery. To account for the increased detectability of California commercial Dungeness crab gear involved in entanglements, CDFW uses the 2014 calendar year as the starting point to assess baseline take levels.

Figure 4-2. From left to right: Examples of California, Oregon, and Washington commercial Dungeness crab buoy tags (tier specific and replacements). Color (for all three states) and shapes (for Washington) vary between seasons. Photos provided by Lauren Saez, NMFS WCRO.

CDFW also deliberated potential end points for this baseline and considered relying on the entanglement record through 2018 (the last year prior to active in-season management) or 2022 (the last full year with available data at the time this CP was submitted to NMFS for consideration). After reviewing all of the available information and considering the factors for delineating a reasonable and appropriate baseline period, CDFW decided to use data through 2018 as the baseline period. The 2019-2022 period is considered separately (see Chapter 5).

4.2 Baseline Conservation Measures

During the baseline period, CDFW undertook several actions to address take of the Covered Species in California commercial Dungeness crab gear. Early on, the Working Group identified that real-time information on the spatiotemporal distribution of fishing effort would improve evaluation of entanglement risk and enable more effective management of the fishery. The Working Group conducted preliminary testing of three electronic monitoring systems and a paper logbook during the 2016-17 commercial fishing season. One specific model of solar-powered vessel tracking systems (solar loggers) tested by Working Group members showed promise due to its automated operations, easy installation, and ability to report vessel location every few seconds, providing tracking data with a high degree of spatial resolution (Figure 4-3). Further testing during the 2017-18 fishing season highlighted the potential for solar loggers to

provide high-quality, real-time information on vessel activity. In October 2018, OPC provided funding to cover equipment, data storage, and processing costs for pilot program participants. Additional details regarding the OPC-funded pilot program are provided in Section 5.1.6.6.

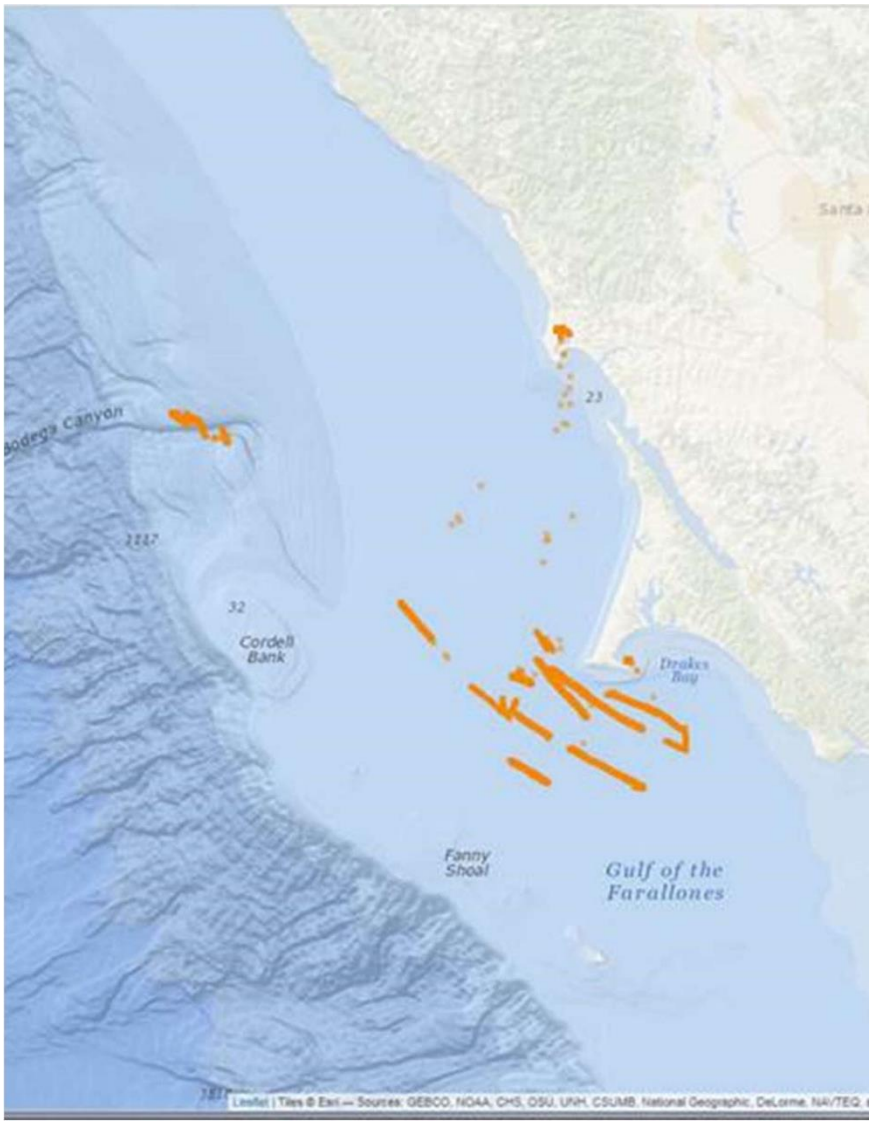

Figure 4-3. Solar logger vessel tracks example, courtesy of Aileen Smith (PSMFC).

The Working Group piloted a real-time approach to evaluating entanglement risk during the 2017-18 fishing season. When conducting these risk assessments, the Working Group scored risk across four factors (confirmed entanglements, marine life concentrations, ocean and forage conditions, and fleet dynamics) as low, medium, or high. During the 2017-18 season, the full Working Group conducted a pre-season risk assessment across two meetings in late October/early November, a mid-season risk assessment in mid-March, and a post-season risk assessment in mid-July. A subset of Working Group members (operating as a rapid-response Evaluation Team) conducted supplemental reviews of available information regarding the four factors in late November,

early January, and early June. Findings from these risk assessments were circulated with an interested parties list, including fishing leadership and port/harbor representatives, and posted on the Working Group's webpage. A similar approach was taken at the start of the 2018-19 season, however as noted in Section 4.1 new CDFW authority as of January 1, 2019 marked a transition away from voluntary actions under the pilot program to the active in-season management characterizing the phased implementation period.

As part of the regulations implementing the trap limit program (Cal. Code Regs., Tit. 14 § 132.2), CDFW specified that no more than six traps could be on a vessel without a buoy tag assigned to that vessel, although an unlimited number are allowed from July 16 - October 31 (during the closed season). This allowance was intended to facilitate good-faith efforts by Dungeness crab vessel permitholders to retrieve lost or abandoned gear, while ensuring CDFW would still be able to enforce the trap limit program. In several ports, local non-profit organizations and fishing organizations have worked with commercial Dungeness crab fishermen to conduct coordinated gear retrieval operations under this authority. Between 2014 and implementation of the formal CDFW program in 2019 (see Section 5.2), these operations removed over 2,000 traps (personal communications: Jennifer Renzullo, Sea Doc Society, August 10, 2015; Oliviya Wyse, Monterey Bay Fisheries Trust, November 26, 2019; Jenn Humberstone, The Nature Conservancy, March 6, 2020).

In response to marine life entanglement issues, CDFW adopted regulations in October 2018 restricting the amount of line and buoys that can be attached to each trap (Cal. Code Regs., Tit. 14 § 132.6). Fishermen commonly use trailer buoys to provide additional flotation in high current locations and to increase gear visibility. This rule stipulates no more than two trailer buoys may be used, and the distance from the front end of the main buoy to the tail end of the last trailer buoy cannot exceed 24 feet when a trap is fished in depths less than or equal to 35 fathoms, or 36 feet when fishing in depths greater than 35 fathoms (Figure 4-4). Regular LED patrol activity indicates high compliance with this requirement.

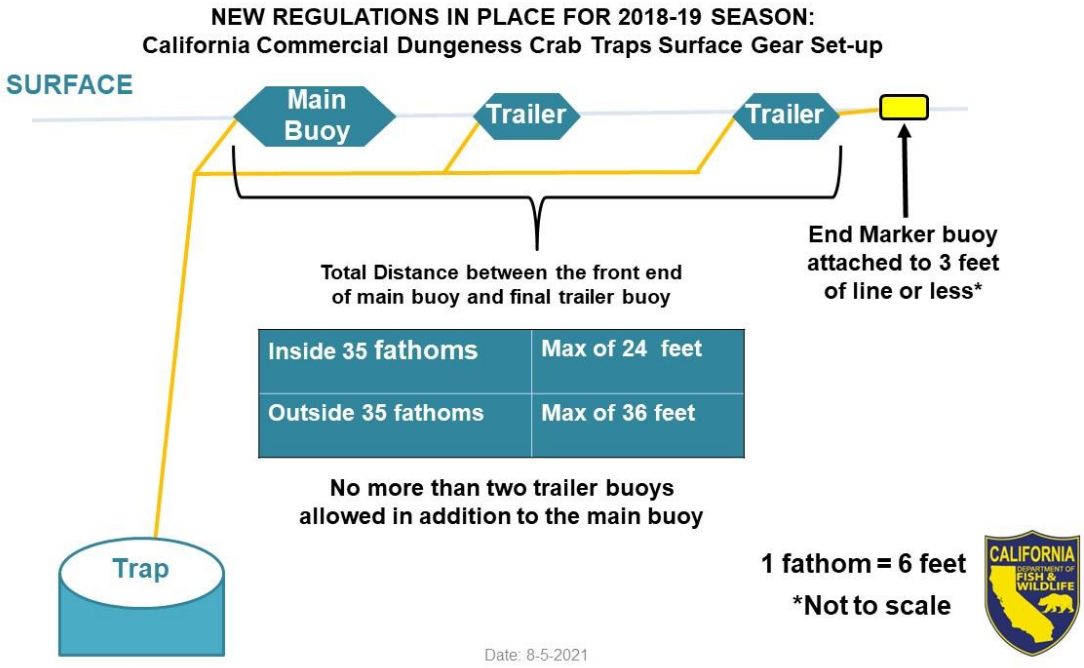

Figure 4-4. Schematic showing surface gear restrictions in place as of October 2018.

4.3 Defining and Allocating Take

This CP addresses take of Covered Species which results from entanglements in commercial Dungeness crab trap gear deployed within the Plan Area. While entanglements are only one activity that would be considered take under the definitions in ESA and MMPA (see Chapter 1), this CP's focus is the impact of Covered Activities on Covered Species resulting from entanglements in commercial Dungeness crab trap gear. CDFW notes that not all entanglements result in removal of the entangled individual animal from the population. Therefore, this CP uses the term "take" when discussing entanglements and "removal" when discussing entanglements which are known or expected to result in M&SI.

As described in Section 3.3, humpback whales in the Plan Area may originate from either the Central America DPS (which is equivalent to Central America/Southern Mexico – CA/OR/WA stock) or the Mexico DPS (a portion of which comprises the Mainland Mexico – CA/OR/WA stock). Identifying individuals and their source DPS or stock is rarely possible in real time during an entanglement response or during post-hoc forensic review (personal communication, Pieter Folkens, May 1, 2020). Genetic tissue sample collection is not always possible due to the hazard of approaching an entangled whale and safety considerations for the response team. Furthermore, very few individuals on the West Coast are currently authorized through the West Coast Large Whale Entanglement Response Program to collect tissue samples allowing for genetic analysis. High-quality photographs of the flukes or dorsal fins can be compared to identification databases but can be difficult to acquire with available equipment or if the entanglement configuration restricts movement. Due to

these difficulties, Carretta et al. (2023) determines stock-specific take by applying proration factors to the total M&SI values reported from CA, OR, and WA. Specifically, Carretta et al. (2023) considers each take of a humpback whale to constitute take of 0.42 humpback whales from the Central America DPS (and the Central America/Southern Mexico – CA/OR/WA stock) and 0.7 humpback whales from the Mexico DPS (specifically the Mainland Mexico – CA/OR/WA stock). CDFW has used these same proration factors to apportion baseline take to the Central America and Mexico DPS in the following subsections, as well as evaluating take during the phased implementation period (see Section 5.6) and developing anticipated and requested take levels under an ITP (see Sections 6.5 and 6.6).

4.4 Take of Covered Species: 2014-2018

Historically, NMFS has relied on opportunistic reporting of entanglements to assess the prevalence of fishery interactions. A portion of these reports are confirmed by NMFS staff and affiliates and represent the best source of information regarding entanglements (see Section 1.1). However, while the availability and quality of documentation has increased since 2013 (Saez et al. 2021), NMFS is unable to identify a responsible fishery or gear type for approximately 50% of confirmed large whale entanglements reported off the West Coast, making it difficult to estimate total take by any given fishery. Therefore, relying on the opportunistic reports which comprise the NMFS entanglement record likely underestimates overall entanglement counts, and there is uncertainty regarding the amount of take which occurs in any given fishery. Nevertheless, the NMFS entanglement record currently represents the best available information regarding take of the Covered Species, and CDFW will rely on this record for the analyses presented in this section, as well as Sections 5.6 and 6.5.

4.4.1 Take of Covered Species, All Fisheries and Reporting Areas, 2014-2018

Of the 210 confirmed large whale entanglements reported off the West Coast between 2014 and 2018, slightly more than half (51%, n = 107) involved unidentified gear (Table 4-1). Of those where the gear could be identified (n = 103), 61% (n = 63) involved commercial Dungeness crab gear.

Looking specifically at the Covered Species (Table 4-1), of the seven confirmed blue whale entanglements reported off the West Coast between 2014 and 2018 four (57%) occurred in unidentified fishing gear and the other three (43%) occurred in commercial Dungeness crab gear. Of the 146 confirmed humpback whale entanglements reported off the West Coast during this period, 47% (n = 68) occurred in unidentified fishing gear. Of the 78 confirmed humpback whale entanglements where the gear could be identified, 64% (n = 50) were in commercial or tribal Dungeness crab gear, with the remainder occurring in netting (including gillnet) or other types of commercial (lobster, sablefish, spot prawn) and recreational (Dungeness crab, spot prawn) trap gear.

Table 4-1. Fishery gear type for confirmed West Coast Region entanglement records by large whale species, 2014 – 2018, all reporting locations (created with NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023).

Fishery Type	Blue	Humpback	Other/Unidentified	Total
Dungeness crab commercial	3	50	10	63
Dungeness crab recreational	0	2	0	2
Gillnet	0	7	12	19
Lobster trap	0	1	0	1
Net	0	4	0	4
Other	0	1	0	1
Sablefish pot	0	4	0	4
Commercial spot prawn pot	0	8	0	8
Recreational spot prawn pot	0	1	0	1
Unknown	4	68	35	107
Grand Total	7	146	57	210
Annual Average	1.4	29.2	11.4	42

Of the 210 total large whale entanglements reported during this period, 81 had known gear set locations (Table 4-2). Of these, 66 (81%) were set within the state where the entanglement was reported. For gear known to have been set in California (n = 60), 54 (90%) were reported within the Plan Area, with five (8.3%) reported in Mexico and one (1.7%) reported in British Columbia. For entanglements with known gear origins reported within California (n = 58), 93% of those occurred with gear set in the Plan Area, 5% (n = 3) were with gear set in Oregon, and 2% (n = 1) were with gear set in Washington. These patterns suggest entanglements which occurred in the Plan Area are highly likely to be reported within the Plan Area, and entanglements which are reported within the Plan Area are highly likely to have occurred within the Plan Area. Implications of these findings are discussed further in Chapter 6.

Table 4-2. Large whale entanglement report locations for gear with known origins, 2014-2018. Created with NMFS WCRO Whale Entanglement Response Database (shared January 6, 2023). Shaded cells reflect entanglement reports originating from the same state as the gear origin.

Reported In	California Gear	Oregon Gear	Washington Gear
British Columbia	1	0	1
California	54	3	1
Mexico	5	0	1
Oregon	0	2	1
Washington	0	2	10

For sea turtles, data from the SWFSC stranding database indicate the vast majority (85%) of the 27 fishery interactions between 2014 and 2018 were with green sea turtles. For leatherback sea turtles during this period, one of the fishery interactions was with commercial Dungeness crab gear and one was with unidentified pot/trap gear (Table 4-3).

Table 4-3. Gear descriptions for confirmed West Coast fishery interactions by sea turtle species, 2014-2018. Created from NMFS SWFSC Sea Turtle Stranding Database (shared March 8, 2023) and unpublished data from NMFS WCRO (shared June 4, 2021). "Line" includes interaction descriptions which reference hook and line gear, monofilament line, or braided line. "Netting" includes interaction descriptions which reference gillnet, drift gillnet, or beach seine, as well as instances where both line and netting were reported. "Unspecified" includes interaction descriptions with insufficient information was provided to assign the incident to either a specific fishery or one of the other broad categories (line, netting, or pot/trap).

Gear Description	Leatherback	Other/Unidentified	Total
Commercial Dungeness crab, CA	1	0	1
Line	0	23	23
Netting	0	2	2
Pot/trap	1	0	1
Grand Total	2	25	27
Annual Average	0.4	5	5.4

4.4.2 Take of Covered Species in the California Commercial Dungeness Crab Fishery, 2014-2018

Between 2014 and 2018 there were 38 known humpback whale, three known blue whale, and one known leatherback sea turtle entanglements in California commercial Dungeness crab gear (Table 4-4). All three of the blue whale reports originated within the Plan Area, as did 33 (87%) of the humpback whale reports.

Table 4-4. Confirmed entanglements in California commercial Dungeness crab gear by year for each Covered Species, 2014-2018. Created with NMFS WCRO Whale Entanglement Response Database (shared January 6, 2023) and NMFS SWFSC Sea Turtle Stranding Database (shared March 8, 2023).

Year	Blue Whale	Humpback Whale	Leatherback Sea Turtle
2014	0	2	0
2015	0	7	0
2016	2	19	1
2017	1	3	0
2018	0	7	0
Grand Total	3	38	1
Annual Average	0.6	7.6	0.2

While there has been documented take of all three Covered Species in California commercial Dungeness crab gear, by far the highest number of entanglements have been of humpback whales. Of the 38 humpback whale entanglements in California commercial Dungeness crab gear, 28 (74%) occurred during the 2014-16 LMH. As noted in Chapter 3, this unprecedented LMH event led to an extended delay in the 2015-16 fishing season. Santora et al. (2020) directly connects the heatwave's impacts on fishery operations and Covered Species distributions with the dramatic increase in large whale entanglements documented off California in 2015 and 2016 (Figure 4-5). While the annual number of entanglements has since declined, the entanglements

documented during this LMH were the impetus for CDFW's increasingly active management of the Dungeness crab fishery and request for an ITP.

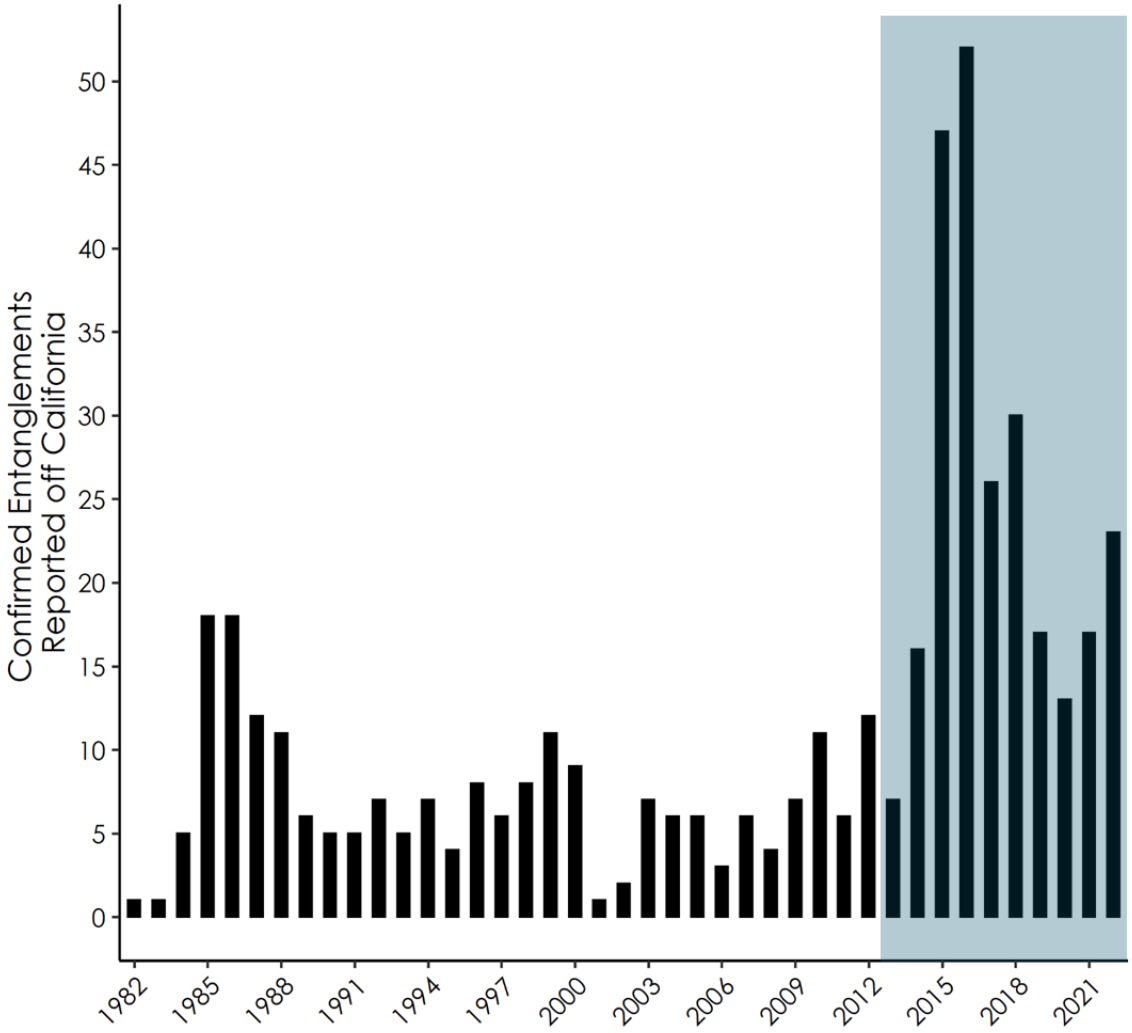

Figure 4-5. Confirmed large whale entanglements reported off California, all species and gear types, 1982 – 2022. Blue shading represents the modern era of entanglements, which began in 2013.

4.4.3 Take of Covered Species in Unidentified Pot/Trap Gear, 2014-2018

Between 2014 and 2018 there were 68 known humpback whale, four known blue whale, and one known leatherback sea turtle entanglements in unidentified gear (Table 4-5). The "unidentified gear" category excludes entanglements which are confirmed in netting, and those which are attributed to non-fishery sources. Generally, entanglements in "unidentified gear" can be considered entanglements in "unidentified pot/trap gear" (personal communication, Lauren Saez, NMFS WCRO, July 26, 2022). Therefore, the summaries in this Section, as well as Section 5.6.3, consider "unidentified gear" to be equivalent to "unidentified pot/trap gear".

All of the blue whales, 61 (90%) of the humpback whales, and the single (100%) leatherback sea turtle entangled in unidentified pot/trap gear were reported within the Plan Area. On average, there were 0.8 confirmed blue whale, 12.2 confirmed humpback whale, and 0.2 confirmed leatherback sea turtle entanglements reported within the Plan Area in unidentified pot/trap gear each year.

Table 4-5. Confirmed entanglements in unidentified pot/trap gear by year for each Covered Species, 2014-2018. For each species, "In" refers to entanglements reported within the Plan Area, and "Out" refers to entanglements reported outside of the Plan Area (e.g. off Oregon, Washington, or Mexico). Created with NMFS WCRO Whale Entanglement Response Database (shared January 6, 2023) and NMFS SWFSC Sea Turtle Stranding Database (shared March 8, 2023).

Year	Blue Whale (In)	Blue Whale (Out)	Humpback Whale (In)	Humpback Whale (Out)	Leatherback Sea Turtle (In)	Leatherback Sea Turtle (Out)
2014	0	0	4	2	0	0
2015	1	0	16	0	1	0
2016	1	0	22	0	0	0
2017	2	0	7	1	0	0
2018	0	0	12	4	0	0
Grand Total	4	0	61	7	1	0
Annual Avg.	0.8	0	12.2	1.4	0.2	0

As described in Section 4.4.1, distinguishing between entanglements reported either inside or outside the Plan Area is meaningful because CDFW considers reports from the Plan Area to generally reflect take occurring within the Plan Area.

CHAPTER 5. PHASED IMPLEMENTATION PERIOD (2019-2022)

Following an uptick in large whale entanglements during 2014 and 2015 (see Figure 4-1), CDFW began taking actions to better understand and address entanglement risk from the Covered Activities. These actions relied upon voluntary compliance by fishery participants until January 1, 2019, when Fish & G. Code § 8276.1 granted the Director authority to implement mandatory in-season management measures to respond to entanglement risk in the commercial Dungeness crab fishery. This authority marked the transition between the baseline period (2014-2018, described in Chapter 4) and the phased implementation period (2019-2022, described further in this Chapter). Based on available information at the time this CP was prepared, CDFW defined the phased implementation period as extending through either 2022 (the last calendar year with a complete entanglement record) or the 2022-23 fishing season (the last complete fishing season).

The phased implementation period follows CDFW's notice of intent to apply for an ITP, which was transmitted to NMFS on November 26, 2018. Shortly thereafter, CDFW began developing a draft CP and implementing active in-season management to reduce marine life entanglements in the commercial Dungeness crab fishery. CDFW's proactive response during the phased implementation period, rather than waiting to implement such actions as required under an issued ITP, demonstrates a durable and focused commitment to curtailing marine life entanglements. The Conservation Program proposed in Chapter 6 builds and expands upon the measures described in this Chapter. Therefore, a full and complete evaluation of CDFW's proposed Conservation Program requires accounting for progress and conservation efforts during the phased implementation period as well as the enhanced commitments described in Chapter 6.

The phased implementation period has been affected by litigation. In early 2019 CDFW, the Center for Biological Diversity, and the Pacific Coast Federation of Fishermen's Associations reached a settlement agreement (*Center for Biological Diversity* v. *Bonham*, Settlement Agreement, Case No. 3:17-cv-05685-MMC (Mar. 26, 2019)) which includes multiple provisions to evaluate and minimize risk of entanglement for the Covered Species until an ITP is issued. That agreement requires implementation of specific actions when certain thresholds are reached, thereby affecting management during the phased implementation period.

This chapter describes management actions and take associated with the Covered Activities during the phased implementation period. Section 5.1 describes the RAMP, an inherently adaptive approach to in-season management of the Covered Activities designed to avoid take of the Covered Species. Section 5.2 describes efforts to better quantify gear loss, as well as remove lost or abandoned gear. Section 5.3 describes work to develop and implement best practices, and Section 5.4 describes improvements to entanglement reporting and documentation. Section 5.5 describes outcomes

from the 2020-21 through 2022-23 fishing seasons, during which several components of the proposed Conservation Program were implemented. Lastly, Section 5.6 reviews take levels during the phased implementation period.

5.1 Risk Assessment and Mitigation Program

5.1.1 Enabling Statute and Regulatory Framework

As described in Section 4.2, the Working Group first piloted a version of the RAMP during the 2017-18 fishing season. Initially, any changes in fishery operations due to elevated entanglement risk were made voluntarily by the fishing fleet, with no metrics for CDFW to directly assess industry adherence to Working Group guidance.

In addition to granting interim authority to implement in-season management measures, Fish & G. Code § 8276.1 directed CDFW, in consultation with the Working Group, to adopt regulations formalizing the RAMP. CDFW released proposed regulations (Cal. Code Regs., Tit. 14 § 132.8) for public comment on May 15, 2020, and subsequently adopted the final language on October 19, 2020 with an effective date of November 1, 2020. These regulations began governing fishing operations at the start of the 2020-21 fishing season, providing CDFW broad authority to implement the take avoidance measures that are a key element of this CP. Figure 5-1 provides an overview of the RAMP process, as further described in the remainder of Section 5.1.

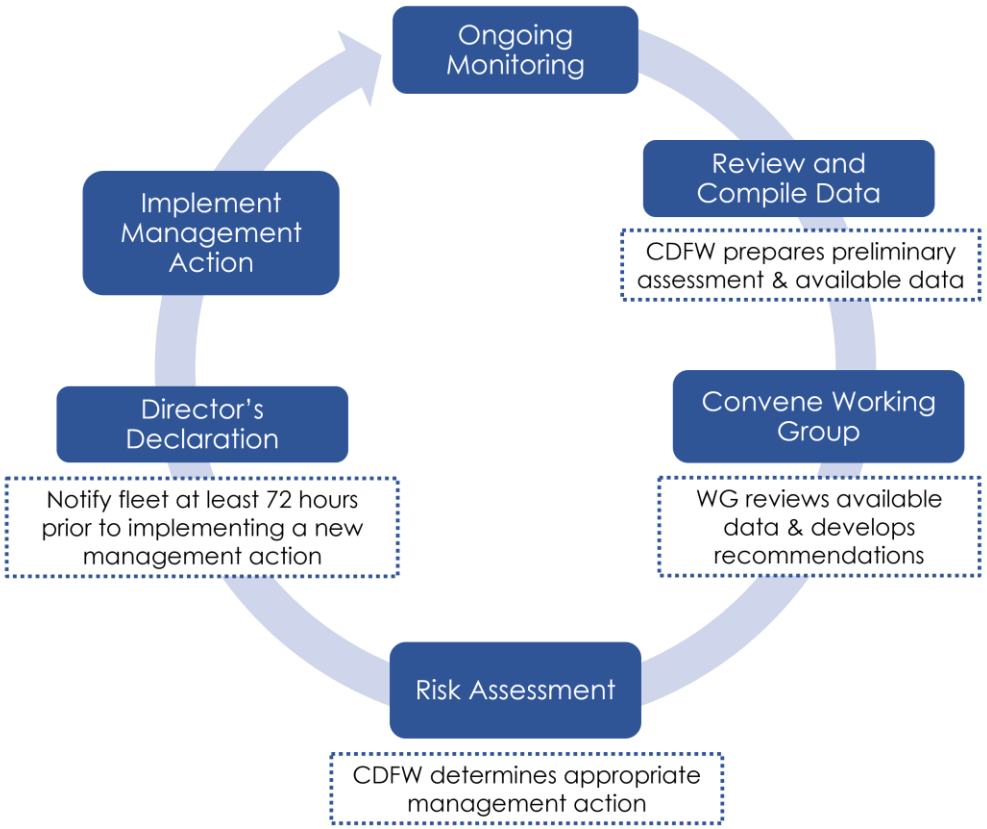

Figure 5-1. Phases of the RAMP cycle: Ongoing Monitoring, Review and Compile Data, Convene Working Group, Risk Assessment, Director's Declaration, Implement Management Action.

The RAMP establishes quantitative thresholds for determining if entanglement risk is elevated; specifies potential management actions; and requires consideration of the best available science and outreach to stakeholders when determining appropriate management actions. Under the 2018 MLMA Master Plan, CDFW has defined best available science as that which is relevant, inclusive, objective, open, and timely. CDFW will use these standards when determining whether information should be considered as best available science. The Working Group plays a key role in RAMP implementation by independently evaluating available data and recommending management actions to the CDFW Director based on the Working Group members' relevant expertise.

The structure of the RAMP incorporates several elements of the adaptive management cycle described in Section 1.3.6 by providing a structured way to respond to changing conditions within and outside the Plan Area. While adaptive management steps and processes can vary, CDFW has followed many of the steps outlined in Figure 1-3 which include defining the problem, identifying objectives, formulating evaluation criteria, estimating outcomes, evaluating trade-offs, decision making, implementation, monitoring, evaluation, and adjustment. The following sections will outline the RAMP process in more detail; however, a high-level outline of how the RAMP is an example of adaptive management in action follows:

- As described in Section 1.1, an increase in the number of entanglements led to the establishment of the RAMP which aims to reduce entanglement risk in the Dungeness crab fishery by limiting deployment of gear when Covered Species are present. This process of defining the problem and outlining objectives represents the first step in an adaptive management approach.
- RAMP establishes quantitative thresholds to determine if entanglement risk is elevated. This represents the second step in many adaptive management processes, formulating evaluation criterion with which to make informed decisions.
- RAMP takes into account various management considerations, including input from the Working Group (Section 5.1.6.1) when evaluating potential management actions (Section 5.1.5). This represents a phase of adaptive management where tradeoffs are evaluated, and management actions are selected based on the tradeoff analysis.
- Once a management action is selected, CDFW continues to monitor and evaluate the fishery based on a set schedule (Section 5.1.2) to determine if a management adjustment is needed. This ensures that management is proactive and can respond to changing conditions.

Specifically, subsections (a) – (f) of the RAMP regulations define key terms, specify the frequency and process for conducting risk assessments (see Section 5.1.2) and receiving input from the Working Group (see Section 5.1.6.1), specify triggers for management actions (see Sections 5.1.3 and 5.1.4), specify potential management actions (see Section 5.1.5) and the considerations which guide selection of an appropriate management action (see Section 5.1.6), and describe the process by which CDFW will notify fishery participants of management actions taken pursuant to these regulations. This portion of the RAMP regulations also establishes Fishing Zones with the following latitudinal boundaries:

- Zone 1: From the California/Oregon border (42° N. latitude) to Cape Mendocino (40° 10' N. latitude).
- Zone 2: From Cape Mendocino to the Sonoma/Mendocino county line (38° 46.125' N. latitude).
- Zone 3: From Sonoma/Mendocino county line to Pigeon Point (37° 11' N. latitude)
- Zone 4: From Pigeon Point to Lopez Point (36° N. latitude)
- Zone 5: From Lopez Point to Point Conception (34° 27' N. latitude)
- Zone 6: From Point Conception to the U.S./Mexico border (32° 32' N. latitude)

An additional Fishing Zone (Fishing Zone 7) is defined as the "Pacific Leatherback Sea Turtle Foraging Area" and extends from Point Arena (38° 57.5' N. latitude) to Point Pinos (36° 38.314' N. latitude).

5.1.2 Risk Assessment Schedule

Beginning in the late fall, CDFW evaluates marine life entanglement risk and any needed modifications to the scheduled opener of the commercial fishery (see Section 2.2.4.3) in each Fishing Zone. In general, four risk assessments are conducted between October and December at approximately two-to-three-week intervals. Once a given Fishing Zone is open, the timing of each subsequent risk assessment is guided by available data, but conducted at least monthly until the closure of that Fishing Zone. Providing a set schedule of risk assessments aids in an adaptive management approach by providing opportunities to monitor and adjust if needed.

During the 2022-23 fishing season, CDFW piloted the following milestones approach for the season opener:

- On or before November 1, evaluate risk and implement management actions regarding the scheduled November 15 opener in Fishing Zones 3-5
    - If a management action is implemented for one or more of these Fishing Zones, the management action will be in place until at least December 1
- On or before November 22, evaluate risk and implement management actions regarding the scheduled December 1 opener in Fishing Zones 1-2. Additionally, evaluate risk and determine whether to maintain, modify, or lift any management action currently in place for Fishing Zones 3, 4, and/or 5 beyond December 1.
    - If a management action is implemented for one or more of these Fishing Zones, the management action will be in place until at least December 16
- On or before December 7, evaluate risk and determine whether to maintain, modify, or lift any management action currently in place for any Fishing Zone
    - If a management action is implemented for one or more of these Fishing Zones, the management action will be in place until at least December 31
- On or before December 22, evaluate risk and determine whether to maintain, modify, or lift any management action currently in place for any Fishing Zone
    - If a management action is implemented for one or more of these Fishing Zones, the management action duration will be selected on a case-by-case basis

Further details are provided in Section 5.5.

5.1.3 Evaluating Risk: Presence, Distribution and Abundance of Covered Species

CDFW evaluates entanglement risk, and the need for management action, based on separate abundance thresholds for each Covered Species and for two periods, fall (November 1 – December 31) and spring (March 1 until fishery closure). Two distinct time periods are identified because information collected during these periods has different implications for management based on

anticipated presence of Covered Species and their respective historical migration patterns. Covered Species migration status (whether they are anticipated to be moving into or out of the fishing grounds) in conjunction with the status of the fishing season (open or closed) and associated overlap between Covered Species and Covered Activities warrants identification of distinct triggers and management actions for each period due to differences in potential co-occurrence. Additionally, these pre-determined thresholds and triggers provide structured decision making under an adaptive management approach.

During the fall risk evaluation period, CDFW does not open the season in each Fishing Zone until sufficient data are available to inform the risk assessment process. This precautionary approach reflects that the absence of current information on Covered Species presence does not mean there is no entanglement risk.

If data are available and counts of humpback whales are greater than or equal to 20 or there is a running average of five or more animals over a one-week period within a single Fishing Zone (excluding Fishing Zone 7), the Director must implement a management action to restrict the Covered Activities. The same applies when counts of blue whales are greater than or equal to three or there is a running average of three or more blue whales over a one-week period within a single Fishing Zone (excluding Fishing Zone 7). For leatherback sea turtles a management action will be implemented for any Fishing Zone where a leatherback sea turtle is present (including Fishing Zone 7).

During January and February (i.e., the interval between the fall and spring risk evaluation periods), CDFW scales back data collection efforts. Low abundance of Covered Species within the Plan Area during this interim period (see Sections 3.2-3.4) is associated with low marine life entanglement risk, making intensive data collection efforts less important. CDFW still conducts risk assessments as described in Section 5.1.2 in order to (a) further increase understanding of entanglement risk dynamics and seasonality and (b) ensure actions can be taken if a given fishing season deviates from historical norms.

The spring risk evaluation period begins on March 1 and continues through June 30 (or the end of the fishing season). If data are unavailable for a given Fishing Zone by March 15, the Director must implement a management action to restrict Covered Activities. As during the fall, the absence of current information does not mean there is no entanglement risk. Therefore, if data are available and the number of humpback whales is greater than or equal to 10 or there is a running average of five or more animals over a one-week period within a single Fishing Zone (excluding Fishing Zone 7), risk is deemed to be elevated and the Director will implement a management action. The same applies when there are three or more blue whales or a running average of three or more blue whales over a one-week period within a single Fishing Zone (excluding Fishing Zone 7). For leatherback sea turtles, a management action will be implemented for any Fishing Zone (including Fishing Zone 7) where a leatherback sea turtle is present.

The threshold values established in regulation for humpback and blue whales are based on trends observed for Fishing Zone 4 in a long-term data series collected by Monterey Bay Whale Watch and standardized by NMFS SWFSC. The values are used as robust indicators of seasonal humpback and blue whale migration status within the Monterey Bay region. In the fall, abundances below these values indicate migration out of the Monterey Bay region is largely complete. Conversely, abundances above these values in the spring indicate migration into the Monterey Bay region has commenced. In the absence of robust alternatives, CDFW uses the Monterey Bay Whale Watch values as indicators of relative entanglement risk for humpback and blue whales in all Fishing Zones.

Given the population status of leatherback sea turtles, avoiding any interactions with the Covered Activities is critical. Therefore, management actions must be implemented if surveys or satellite telemetry information indicate one or more leatherback sea turtles are present within a given Fishing Zone.

CDFW uses multiple, complementary methods to evaluate and consider presence, distribution, and abundance of Covered Species (collectively described as "Marine Life Concentrations"), as detailed in the following subsections. This supports an adaptive management approach by relying on monitoring information to make management decisions. The following monitoring methods contribute to CDFW's goal of reducing take in commercial Dungeness crab trap gear to the maximum extent practicable.

5.1.3.1 Aerial Surveys

Aerial surveys provide high-resolution information regarding distribution of Covered Species, forage (e.g., bait balls, *Chrysaora* patches), and observed trap gear. Historically, systematic surveys designed to provide quantitative estimates of the abundance and distribution of Covered Species and trap gear have been conducted three to four times per year by NMFS SWFSC scientists, contingent upon available funding and suitable weather windows. Reconnaissance surveys intended to provide a qualitative assessment of Covered Species and trap gear co-occurrence have been conducted opportunistically prior to fishing season openings and during periods of elevated risk in the spring. Beginning with the 2019-20 season, CDFW has placed an increased emphasis on conducting reconnaissance flights. Beginning with the 2020-21 fishing season, the U.S. Coast Guard has also conducted focused surveys in support of their Living Marine Resources mandates and opportunistically recorded information during other types of flight operations.

5.1.3.2 Vessel Surveys

Vessel-based surveys are another option for collecting fine-scale information on the presence, distribution, and abundance of Covered Species. Unlike aerial surveys, vessel-based surveys cover far less area per unit time, and an individual survey is unable to provide a snapshot of conditions over a large area. However, vessel-based surveys place observers in closer proximity to observed individuals, enabling collection of genetic samples and high-resolution photographs

(enabling assignment of individuals to specific DPS units, see Section 3.3), attachment of satellite tags (see Section 5.1.3.3), and other supplemental research activities.

CDFW has historically relied upon external partners to conduct these surveys, although surveys can also be conducted during routine vessel-based enforcement patrols by LED. NMFS has several ongoing vessel-based research and monitoring efforts that collect information on the distribution and abundance of marine species off California either as their primary mission or as ancillary data. Examples include the Rockfish Recruitment and Ecosystem Assessment Survey, Applied California Current Ecosystem Studies, and Coastal Pelagic Species surveys. Location and timing vary between surveys and years, however data are often collected during the spring and summer months when Covered Species are abundant off California.

Beginning in summer 2019, Cascadia Research Collective has conducted vessel surveys to support the assessment of real-time large whale distributions. In June 2020 and June 2021, OPC awarded funding to continue this work through the 2022-23 season. Transects typically follow both a shallower (e.g., 70m) and deeper (e.g., 200m) depth contour to assess the spatial distribution of large whales across multiple depths. All sightings of humpback and blue whales are recorded, as well as sightings of unidentified whales and other species of interest. In addition to sightings information, researchers document prey species when animals are observed foraging at the surface. Photographs are taken to allow for identification of individual humpback whales and assignment to a specific DPS. Photographs also support estimates of minimum and overall abundance by allowing researchers to document sighting histories for a given individual. Satellite telemetry tags are opportunistically deployed, allowing tracking of individual animal movements and inference of foraging behavior.

The California Coast Crab Association and The Nature Conservancy have collaborated to develop an industry-led vessel survey which utilizes commercial fishing vessels and crew to document whale presence. Fishing Zones are systematically surveyed to document the distribution and abundance of large whales. Working closely with Working Group Advisors, surveys were conducted beginning in Fall 2020 to evaluate the feasibility of, and protocols for, fishing vessel-based surveys for Covered Species. Further details regarding their current status are provided in Section 6.2.1.3.

Monterey Bay Whale Watch conducts routine whale watching and natural history tours within Monterey Bay, and reports sightings of Covered Species on a publicly accessible website. NOAA SWFSC scientists compile new postings into a database which contains reported sightings from 2003 to present. Sightings information from trips (which vary in length) is then standardized as half-day trips. While data collected on these trips is not generated by formal surveys, observations are made by trained naturalists and are conducted on a near-daily basis, providing a long running, high-resolution timeseries of Covered Species abundance within a key foraging area.

5.1.3.3 Tagging

Ongoing satellite tagging programs targeting blue whales and leatherback sea turtles provide information regarding their presence and distribution. Unlike aerial or vessel surveys, which quantify presence within a given area and time, tagging data provide long-term tracks of individual animal movements. For species with known migratory patterns, these index individuals provide a general understanding of when populations begin to arrive in or depart from the Plan Area. Deployment of satellite tags requires scientists to locate and then closely approach an individual animal; for cryptic species which spend limited time at the surface (e.g., blue whales) and are difficult to observe even when on the surface (e.g., leatherback sea turtles), this often results in small sample sizes. Additionally, due to limited battery life, tag loss, or individual mortality, satellite tags generally report for weeks to months after deployment. Therefore, understanding multi-year trends requires routine tagging operations.

Funding permitting, researchers with the NMFS SWFSC Marine Turtle Ecology and Assessment Program conduct routine leatherback tagging operations within the Plan Area during the late summer and early fall. Successful deployment of satellite transmitters is dependent on available aerial and vessel platforms, the presence of sufficient leatherback sea turtles, calm sea conditions (Beaufort 0-2), and relatively clear sky conditions. As of June 2023, during the phased implementation period a total of 39 days of at-sea effort has been conducted within the Plan Area, as well as 53 days of aerial survey effort (27 of which were dedicated to transect surveys and 26 of which directly supported capture and tagging operations). A total of 31 turtles were observed off California during this period, with 10 successful satellite tag deployments. No operations were conducted in 2020 due to the COVID-19 pandemic.

5.1.4 Evaluating Risk: Confirmed Entanglements

During the phased implementation period, any entanglement of a Covered Species confirmed in California commercial Dungeness crab gear (reported from any location) or Unknown Fishing Gear (reported within the Plan Area) was considered an indicator of elevated risk. Entanglements reported in unidentified gear were classified as Unknown Fishing Gear if available documentation indicated the gear could have originated from the California commercial Dungeness crab fishery. Unlike thresholds related Marine Life Concentrations, which forecast future risk based on potential overlap with the Covered Activities, confirmed entanglements in California commercial Dungeness crab gear indicate overlap has occurred and management actions are needed to prevent additional entanglements.

CDFW therefore assigned the following Impact Scores, with pre-determined measures taken following attainment of specified cumulative total Impact Scores:

- Humpback whales

    - Confirmed entanglement in California commercial Dungeness crab gear = 0.75
    - Confirmed entanglement in California commercial Dungeness crab gear, deceased = 1
    - Confirmed entanglement in Unknown Fishing Gear = 0.38
    - Confirmed entanglement in Unknown Fishing Gear, deceased = 0.5
- Blue whales and leatherback sea turtles
    - Confirmed entanglement in California commercial Dungeness crab gear = 1
    - Confirmed entanglement in Unknown Fishing Gear = 0.5

As further described in Chapter 6, under the proposed Conservation Program CDFW will substantially revise how confirmed entanglements are evaluated, and further details regarding their consideration during the phased implementation period are not presented here.

5.1.5 Management Actions

Once risk is determined to be elevated as described in Sections 5.1.2 and 5.1.3, including when current data regarding Marine Life Concentrations are not available, the Director implements a management action to reduce marine life entanglement risk. The default action when a trigger is reached is closure of one or more Fishing Zones to traditional Dungeness crab trap gear. In most cases, however, the Director selects from several alternatives based on the best available science related to the management considerations described in Section 5.1.6. This ability to adjust depending on best available science within varying degrees of risk and uncertainty highlight RAMP's adaptive management approach.

Management responses are limited to issuance of a Fleet Advisory, depth constraint, vertical line/gear reduction, Fishing Zone closure, and authorizing deployment of Alternative Gear (Cal. Code Regs., Tit. 14 § 132.8 subd. (e)). Having a bounded range of options allows management responses to be both flexible and predictable. Should the best available science be insufficient to support alternative management responses, the default of a partial or statewide closure of the fishing grounds ensures protective actions to minimize entanglement risk.

The amount of time which elapses between confirming a trigger has been reached and fully effectuating a management action will depend on the time of year and which action is being implemented. First, CDFW must gather and evaluate available data and provide at least 48-hours notice to the Working Group and public (Cal. Code Regs., Tit. 14 § 132.8 subd. (b)(2)). Sharing findings and soliciting feedback from the Working Group provides the opportunity and information necessary to adaptively manage the Covered Activities. CDFW determined a 48-hour period provides transparency to the affected public; ensures all interested parties have access to the information currently under consideration by CDFW; and creates an opportunity for potential collaborators

to provide additional information to CDFW, ensuring decisions will be made using best available science. Following review of the Working Group's recommendation (Cal. Code Regs., Tit. 14 § 132.8 subd. (d)(1)), the Director must then issue a determination and provide at least 72-hours notice to the fleet before requiring adherence to the management action (Cal. Code Regs., Tit. 14 § 132.8 subd. (f)(2)). Consultation with the Working Group and other stakeholders indicated 72-hours was a reasonable time period for fishery participants to understand and respond to management changes. This interval is also consistent with notification requirements for public health advisories (Fish & G. Code § 5523). However, in practice, once gear is in the water CDFW has generally given at least one week's notice, and generally two to three weeks when weather or crew availability constrain the fleet's ability to rapidly remove gear.

5.1.5.1 Fleet Advisory

The Director may issue an advisory to the fleet to encourage voluntary efforts if risk is elevated or expected to increase but a more restrictive management response is not necessary. These advisories raise awareness and encourage vessel operators to avoid areas where entanglement risk may be elevated due to recent observations or other management considerations as described in RAMP. Voluntary actions encouraged by the Working Group have included implementation of Best Practices, as detailed in the Best Practices Guide, regarding gear configuration (e.g., reducing slack line and minimizing surface gear) and placement (e.g., avoiding areas with high concentrations of forage or where Covered Species have been sighted). In some instances, a trigger may be reached but management action to reduce entanglement risk is not warranted. For example, if a trigger is hit late in the spring when fishing effort is decreasing rapidly and expected to be at negligible levels prior to Covered Species entering the fishing grounds in large numbers, additional mandates to remove gear may not be needed.

5.1.5.2 Depth Constraint

A depth constraint may be implemented to limit co-occurrence of Covered Species and Covered Activities. Depth constraints have particular value when paired with a vertical line/gear reduction, in order to avoid increasing entanglement risk due to effort displacement into the areas which remain open (Samhouri et al. 2021). Depth constraints are based on waypoints as defined in federal regulation (50 CFR §§ 660.71-660.72). The use of waypoints to define depth contours is routine in the federal groundfish fishery and is familiar to Dungeness crab fishermen because many individuals participate in both fisheries. As discussed in Chapter 3, available forage for Covered Species is in part tied to the depth contour off the coast. If the best available scientific information indicates that certain depths carry a higher risk of entanglement, the Director could implement a depth constraint over the fishing grounds or within specific Fishing Zones. Given the flexible foraging strategies of humpback whales (see Section 3.3) and the potential for humpback whales to rapidly shift across a range of depths in pursuit of prey, CDFW will consider the use of depth constraints on a case-by-case basis. This management action may be used

more routinely when the species of concern are leatherback sea turtles or blue whales. For example, prohibiting take of Dungeness crab seaward (deeper) of the 45-fathom line could protect leatherback sea turtles by excluding gear from their primary foraging area. Prohibiting take of Dungeness crab seaward of the 50-fathom line could reduce interactions with blue whales, which are primarily found in deeper depths over the continental shelf. CDFW will consider the best available science when determining appropriate depth-based closures.

5.1.5.3 Vertical Line/Gear Reduction

If survey data indicate Covered Species (or their prey) are widely distributed across a broad range of depths, reducing the number of vertical lines in the water is another method to reduce entanglement risk. Given the current requirements for each Dungeness crab trap to be individually marked with a buoy (see Section 2.2.2), vertical line reductions are implemented as gear reductions. Based on the availability of Marine Life Concentrations data, CDFW could implement a vertical line reduction to lower the overall risk of entanglement within a given Fishing Zone. For example, if data collected prior to the season opening indicated the southward migration of Covered Species had begun but was not yet complete, a vertical line reduction during the early weeks of the fishing season would allow the fishery to commence while reducing entanglement risk for the Covered Species. Alternatively, if data collected in the early spring indicated the northward migration of Covered Species had begun, but abundances only marginally exceed the thresholds described in Section 5.1.3, allowing remaining participants to continue fishing with a reduced amount of gear would allow for continued fishing opportunity while still reducing marine life entanglement risk. Furthermore, by requiring removal of a portion of the gear, fishery participants would need less time to comply with subsequent management actions (e.g., additional vertical line reductions or fishery closure).

The RAMP regulations specify trap reductions are effectuated through requiring excess tags to be present onboard the vessel, rather than affixed to traps. Any deployed gear without the required buoy tags would be non-compliant.

5.1.5.4 Closures

Spatiotemporal closures are a key management measure in the spring months when historical migration patterns, surveys, and/or models indicate that Covered Species have begun to arrive in the fishing grounds, and during the fall if Covered Species have not yet left. In these instances, the scheduled season opening can be delayed, or the scheduled season closure advanced. When real-time information on Marine Life Concentrations, trap gear, and co-occurrence is available, spatiotemporal closures can also be used to selectively close areas with elevated entanglement risk. Cal. Code Regs., Tit. 14 § 132.8 specifies that closures can occur by Fishing Zone or statewide. Once a closure is in effect, LED can take appropriate enforcement action against owners of Dungeness crab traps found inside closed Fishing Zones.

5.1.5.5 Alternative Gear

As noted above in Section 5.1.5.4, spatiotemporal closures are an effective tool for reducing co-occurrence between Covered Species and the Covered Activity, and therefore reducing associated take. However, such closures will have economic impacts on some fishery participants. Developing innovative gear types which pose lower entanglement risk could ameliorate those impacts and is an area of substantial interest for CDFW.

In 2019, CDFW began actively engaging with gear manufacturers and other stakeholders to better understand the current limitations of, and potential solutions for, design and adoption of innovative gear types in the Dungeness crab fishery. Both the Working Group and CDFW have produced guidance for gear developers regarding design considerations and options for testing. A current version of CDFW's guidance is available on CDFW's Whale Safe Fisheries webpage, and copies of each CDFW and Working Group version are included as Appendix A.

Several types of gear innovations are being explored by gear developers, fishermen, and members of the Working Group. These include but are not limited to "pop-up" gear (sometimes referred to as "ropeless gear"). There are two main categories of pop-up gear: on-demand and timed release. In general, on-demand gear involves a coil of rope, acoustic receiver, and buoy attached to the trap. An acoustic signal is sent from the fishing vessel to the receiver, triggering the release of the rope and buoys. Once the buoy "pops up" to the surface of the water, the fisherman can retrieve the gear using the same methods as they would for traditional gear. Other companies have entirely replaced the rope and buoys, and the acoustic release instead triggers compressed gas canisters to fill large lift bags which bring the entire trap to the surface for retrieval. In contrast, timed-release gear relies on a chemical reaction (for galvanic releases) or elapsed time (for electronic releases) to release the rope and buoys. All of these approaches share the common element of minimizing the amount of time vertical lines are present in the water column and gear is at the surface, thereby decreasing entanglement risk.

Preliminary testing of pop-up gear off California prior to the phased implementation period had highlighted economic and reliability concerns from fishery participants and CDFW concerns regarding gear conflict, gear loss, and enforceability of trap limits, gear configuration, Marine Protected Areas, and other regulations. Recognizing ongoing development efforts in this area, the RAMP establishes a process for CDFW certification of innovative gear types as Alternative Gear. This process includes performance standards such as being detectable by CDFW, having a reliable means of retrieval, being easily identifiable, and providing a tangible benefit by reducing entanglement risk or severity. CDFW has identified specific concerns related to these performance standards which must be addressed prior to certification (see Section 6.2.1.4.2 for further details). Additionally, given the heightened potential for gear conflict during the fall and winter (when the majority of fishing activity occurs; see

Section 2.2.4.3) use of Alternative Gear is limited to specified closures on or after April 1.

CDFW notes this certification process is distinct from, and serves a different role than, issuance of Experimental Fishing Permits (EFPs) by the FGC pursuant to Cal. Code Regs., Tit. 14 § 91. EFPs are a mechanism by which testing of innovative gear could occur, thereby generating the information required to request CDFW certification as Alternative Gear. However, upon certification, Alternative Gear would become legal commercial fishing gear and could be used by all participants (not just those who received an EFP).

5.1.6 Management Considerations

As described in Section 5.1.5, CDFW implements management actions which reduce marine life entanglement risk within portions of the fishing grounds where Covered Species presence exceeds the thresholds defined in Section 5.1.3 and 5.1.4. However, evaluating marine life entanglement risk requires a dynamic, flexible approach rather than relying on historical patterns alone. Furthermore, CDFW's intention with implementation of the RAMP is to reduce entanglement risk for all Covered Species across the entire Plan Area, which requires considering how curtailing effort in one area might increase effort, and associated entanglement risk, in another.

Therefore, following attainment of a Marine Life Concentration trigger (and in most cases, following attainment of a Confirmed Entanglement trigger), the Director implements a management response based on the best available science and will, to the maximum extent possible, rely on relevant and publicly available information. The types of information that can be considered include a Working Group recommendation, information from NMFS, management measure effectiveness, total economic impacts, historical migration patterns, fishing season dynamics, forage, ocean conditions, and cumulative confirmed entanglements. This process follows an adaptive management approach, where decisions are made based on predetermined management actions and thresholds. Adaptive management also requires effective stakeholder engagement, which CDFW specifically accounts for through consideration of a Working Group recommendation. Further details regarding the management considerations are provided in the following sections.

5.1.6.1 Working Group Recommendation

The Working Group and its Advisors are comprised of individuals who have expertise regarding the Covered Activities, oceanography, and Covered Species. As such, their input is critical to informing the Director when selecting and implementing appropriate management actions. Once CDFW determines a trigger has been met, at least 48-hours' notice is provided to the Working Group and public prior to the Director's final determination. CDFW then convenes the Working Group to discuss available data and solicit its management recommendation(s). Soliciting feedback from the Working Group provides an opportunity to reflect on management strategies, share findings, and modify

management recommendations as necessary. The specific process by which the Working Group arrives at its recommendation(s) is specified in its most recent charter, available on CDFW's Whale Safe Fisheries webpage, and not described in detail here. However, the Working Group generally strives to make recommendations by consensus that reflect expert input from its Advisors as well as the full range of stakeholders represented on the Working Group. All Working Group recommendations are carefully evaluated by the Director, particularly those which are made by consensus and firmly grounded in best available science related to the other management considerations described below.

During the 2020-21 through 2022-23 fishing seasons, CDFW prepared and shared interim documents which conveyed MR staff's initial evaluation of entanglement risk and preliminary recommendation regarding appropriate management actions prior to meeting with the Working Group. The intention of producing this document was to increase transparency and focus the Working Group's discussion and recommendations on suitable options, as well as provide more meaningful opportunities for public input. Following the Working Group's meeting, CDFW prepared an additional interim document which conveyed MR staff's final evaluation of entanglement risk and recommendation regarding appropriate management actions. This document was an opportunity for MR staff to convey updated thinking and additional information which would inform the Director's decision. In the event the Working Group elected not to produce a formal recommendation memo, this document also provided a way to capture Working Group input for the Director's consideration. The process of soliciting input from the Working Group represents a key step in an adaptive management – sharing recommendations and modifying management actions if necessary.

5.1.6.2 Information from NOAA

CDFW may consult with NOAA to determine the need for or effectiveness of a specific management action, given their subject matter expertise regarding Covered Species and management authority under the ESA and MMPA. Consultation will occur with WCRO, Protected Resources Division (PRD), or other units within NOAA as appropriate. Any recommendations will be considered when selecting a management action.

5.1.6.3 Management Measure Effectiveness

The RAMP regulations require CDFW to consider the effectiveness of a given management measure, but do not specify a particular method for doing so. This allows CDFW to continually review and incorporate the best available science related to this aspect of the RAMP.

A basic premise of the measures described in both Chapters 5 and 6, including the RAMP, is that co-occurrence of vertical lines and Covered Species is an appropriate measure of, and proportional to, entanglement risk. Given this assumption, when evaluating management measure effectiveness, the fundamental question is whether it will meaningfully reduce co-occurrence. This

is expected to vary based on the time of year, progression of the fishing season, ocean conditions, and gear configuration. For example, a depth restriction may be more effective if the distribution of Covered Species and available forage is constrained to a certain depth range. If the distribution of Covered Species or available forage is more widespread across a range of depths within a particular Fishing Zone, a season delay/closure or vertical line reduction may be more effective. This consideration is evaluated based on expert input from the Working Group and its Advisors, as well as any other information made available to CDFW through the RAMP process.

Another aspect of effectiveness is the degree to which this type of management measure has been successfully implemented during prior periods. Was there high compliance by the fleet the last time this management measure was implemented? Are there known enforcement challenges that would require dedicated resources to effectively implement this management measure? This is evaluated based on routine compliance checks by CDFW. Additionally, reviewing historical compliance of various management measures provides CDFW an opportunity to adaptively manage the fishery to effectively minimize co-occurrence.

5.1.6.4 Economic Impact

CDFW also considers total economic impact on the fleet and fishing communities. The regulations do not specify a particular method for determining the relative amount of economic impact for a given management measure, although they do reflect the fact that for the fleet, the number of vessels impacted is higher for delays in the fall than for early closures in the spring (CDFW 2020b). Historical landings data also indicate that total landings and economic value are similar for seasons with and without fall delays. However, an early closure during the spring will have different impacts on fleet sectors depending on their reliance on the fishery throughout the season. Operators who have completed Dungeness crab fishing activities for the season and transitioned to other fisheries may experience less of an impact.

Seary et al. (2022) conducted a retrospective analysis to estimate revenue losses during the 2018-19 and 2019-2020 fishing seasons due to actions under the RAMP pilot program and CDFW's interim authority under Fish and G. Code § 8276.1 (see Sections 4.2 and 5.1.1), as well as closures due to low crab quality or domoic acid. Losses during the 2019-20 season also reflect market impacts of the COVID-19 pandemic, which were estimated as roughly 4.1% of overall revenue losses. While the magnitude of out-of-sample prediction errors indicates high uncertainty, and the proportion of predicted losses directly attributable to actions under RAMP cannot be determined, CDFW briefly describes key findings below.

For both seasons, both total and proportional predicted revenue losses were higher for the CMA – $9.37 million (38%) for the 2018-19 season and $14.43 million (38%) for the 2019-20 season – than the NMA – $0.28 million (0.9%) for the 2018-19 season and $3.87 million (18%) for the 2019-20 season. At the vessel level,

estimated losses were higher during the 2019-20 season (as compared to the 2018-19 season) and for the CMA (as compared to the NMA). As a proportion of mean historical revenues (2010-11 through 2017-2018 seasons, with the exception of 2015-16), impacts were greater for small (< 40 ft) vessels as compared to large vessels (≥ 40 ft). However, the high variability at the per-vessel level cannot be explained by vessel size alone, and CDFW posits the analysis would be improved by considering a broad range of factors in a discriminate analysis such as that used by Davis et al. (2017) to identify five distinct subsectors within the Oregon crab fishery.

Seary et al. (2022) note the complex interplay between price, pre-season crab abundance and distribution, crab catchability, fisher behavior, and latent factors such as fuel price and market demand complicate their revenue predictions. The authors also note that a behavioral choice model and use of counterfactual synthetic controls could provide additional insights regarding socioeconomic impacts.

Generating additional information regarding economic impacts from management actions implemented under the RAMP is a priority for CDFW. Potential methods are described further in Section 6.2.1.5.2.

5.1.6.5 Historical Migration Patterns

Given the challenges associated with collecting Marine Life Concentrations data, robust, real-time survey or tagging information to evaluate against the triggers described in Section 5.1.3 are not always available for each Covered Species across all Fishing Zones. Even if a substantial amount of information is available, relying on these snapshots of abundance and distribution alone fails to take advantage of multi-year (and even decadal) perspectives regarding what these point-in-time abundances suggest about broad-scale entanglement risk. Are Covered Species migrating into the fishing grounds in the spring and summer, with entanglement risk expected to continue increasing? Or are Covered Species migrating out of the fishing grounds in the fall, with entanglement risk expected to decline? In either case, how quickly might abundances change?

Evaluating current survey information in the context of historical migration patterns can address these questions and allows CDFW to consider the degree to which Marine Life Concentrations data collected in one Fishing Zone may, or may not, be indicative of Covered Species presence and distribution within another Fishing Zone. During years when contemporaneous data was collected in multiple Fishing Zones, were similar levels of abundance or patterns of distribution observed? Do declining (or increasing) trends in one Fishing Zone forecast (or lag) trends in another Fishing Zone?

However, the availability of historical migration information will not negate the need for protective management actions in the absence of current Marine Life Concentration survey information (see Section 5.1.3). That survey information can be bolstered by review and consideration of other sources of Marine Life

Concentrations data. This includes systematic shore-based visual surveys conducted by Point Blue Conservation Science staff and trained volunteer biologists from the Farallon Island lighthouse and opportunistic surveys by the Channel Island Naturalist Corps aboard multiple vessel platforms transiting the Santa Barbara Channel including whale watch tours, natural history tours, and island landings (Jahncke and Howar 2022). CDFW also considers findings from Species Distribution Models (SDMs), including an experimental blue whale SDM which predicts daily suitable blue whale habitat throughout the Plan Area (WhaleWatch 2.0) hosted on the NOAA CoastWatch website.

5.1.6.6 Fishing Season Dynamics

As noted above, understanding the distribution of commercial Dungeness crab trap gear is an essential element of evaluating entanglement risk. Prior to implementation of the RAMP regulations in November 2020, the best available information regarding fishing effort was based on landing receipts, and CDFW analyses of fishing season dynamics assumed that a given vessel utilized their full trap allocation (see Section 2.2.4.1). This allowed CDFW to estimate a maximum number of deployed traps by adding up the trap allotments for each permitted vessel making landings into California which reported catch locations within the Plan Area. These estimates could be further refined by only including vessels that made landings in a given season, port complex, or other spatiotemporal unit. However, this approach created the opportunity for both overestimation (since not every vessel consistently utilizes their full trap allotment) and underestimation (since vessels may have gear deployed without making a landing during a given period). While this is less of a concern for analyses at the fishing season level, it was a limiting factor when conducting analyses at the weekly or monthly level to support in-season assessment of risk. CDFW therefore incorporated mandatory reporting requirements into the RAMP.

As part of the RAMP regulations, all fishery participants are required to submit bi-weekly reports to CDFW. These reports include vessel permit number, Fishing Zone, the Fishing Zone where gear is currently deployed, and the number and depth range of currently deployed traps. This formalizes and expands on a previous voluntary effort by fishery participants to provide estimates of current fishing effort for risk assessments during the 2019-20 fishing season. Submitting these reports every two weeks allows CDFW and the Working Group to consider recent information during the risk assessment process. While data are still self-reported, these reports nevertheless greatly improve CDFW's ability to quantify near real-time fishing effort and gear deployment. The bi-weekly reports are also the only way to identify vessels which are harvesting crab from (and therefore have gear deployed in) the Plan Area but are making landings into other states, allowing CDFW to more accurately quantify maximum potential trap deployments.

Starting with the 2020-21 fishing season, the RAMP regulations also require electronic vessel location monitoring for all Dungeness crab vessels using Alternative Gear (see Section 5.1.5.5) or operating under a depth restriction (see

Section 5.1.5.2). While CDFW does not specify the type of vessel monitoring systems that must be used, systems must meet the specified minimum ping rate of once per minute and data must be available to CDFW upon request for up to 60 days. This information can be compared with the bi-weekly reports to verify accuracy, and will allow for closer monitoring (i.e., higher spatial resolution information) for compliance with depth restrictions or fishery closures, as well as tracking Alternative Gear deployment. This requirement was expanded to all vessels starting with the 2023-24 season, as described further in Section 6.2.1.5.4.

During the phased implementation period, an OPC-funded pilot program to test solar loggers (see Section 4.2) provided additional information regarding fishing activity. A total of 47 solar loggers were used by fishing vessels during the pilot program, which spanned the 2018-19 through 2021-22 fishing seasons, and participation increased substantially after the electronic vessel location monitoring requirements described above went into place in November 2020 (personal communication, Kathi George, September 7, 2022).

Another form of electronic vessel location monitoring currently required for participation in certain federally managed fisheries is a Vessel Monitoring System (VMS; see 50 CFR § 660.14 for requirements applicable to West Coast groundfish fisheries). A mobile transceiver unit detects the vessel's location and transmits it via satellite to a communication service provider, which then provides the information to the NOAA Office of Law Enforcement. Both the transceiver unit and the service provider must be approved by NMFS. The unit must be operational 24/7 and transmit location information at least four times per hour. While Dungeness crab is a state managed fishery, some Dungeness crab vessels participate in federally managed fisheries where VMS is required. Around 35% of total annual Dungeness crab landings are made from vessels with VMS, and about 30% of vessels that participate in the fishery have VMS (Feist et al. 2021). When combined with landings data, VMS tracks can indicate where Dungeness crab fishing activity occurred. While VMS data are only available for a portion of the Dungeness crab fleet and have lower resolution than the CDFW-required systems, this information provides a valuable resource for hindcast analyses. VMS data are available to select NMFS staff in near-real time, however CDFW's inability to access and utilize these data for state managed fisheries prevents their use for in-season management at this time.

Aerial and vessel surveys (see Sections 5.1.3.1 and 5.3.1.2) can also provide information on trap gear distribution, and potentially be used to validate self-reported information on landing receipts and through bi-weekly reports. However, particularly for aerial surveys, while the number and color of buoys attached to the trap gear may be recorded, observers generally cannot attribute gear to a particular fishery or distinguish between actively fished and lost or abandoned gear.

When combined, available data described above (landing receipts, bi-weekly reports, electronic vessel location monitoring, and surveys) allow CDFW to consider the concentration and geographic location of fishing effort, amount of

gear deployed, and progression of the fishing season when determining appropriate management actions. Fishing pressure (number of vessels and amount of gear deployed) is greatest in fall when the fishery opens and declines substantially during the spring months (see Section 2.2.4.3). Historical migration patterns indicate fewer Covered Species are in the fishing grounds in late fall and early winter as opposed to spring. Therefore, an on-time (November 15 or December 1, depending on location) or slightly delayed fishery opening is associated with lower entanglement risk than an opening late in the fishing season (February-April). Historical landings data suggests that more than 80% of commercial Dungeness crab landings occur within the first eight weeks of the season (Figure 2-8). The scheduled season openings mean this high level of effort, and large amount of deployed gear, occur when Marine Life Concentrations are decreasing in the fishing grounds, and entanglement risk is therefore declining.

In contrast, if the fishery does not open until late winter or spring, the high effort period is more likely to overlap with a period of increasing Covered Species presence as whales and turtles return to the fishing grounds. Additionally, during a compressed fishing season, fishing effort would likely be higher than normal during the latter part of the season as individuals try to make up for lost fishing opportunities. This would increase the likelihood of co-occurrence between gear and Covered Species, resulting in increased entanglement risk.

The location of the fleet in relation to Covered Species presence (i.e., co-occurrence) will therefore be an important consideration when assessing appropriate management responses. If Covered Species are observed towards the end of a fishing season in locations where fishing activity is decreasing, the Director may choose to implement a less restrictive management action. Conversely, if there is a risk of substantial overlap of fishing activity and Covered Species the Director may choose a more restrictive measure to enhance protections.

5.1.6.7 Available Forage

Distribution and abundance of forage can have a profound impact on movement patterns and concentrations of Covered Species (Santora et al. 2020). While specific thresholds have not yet been defined, CDFW considers available information regarding forage species presence in the Plan Area when assessing relative risk of marine life entanglement. Relative abundance of krill and anchovy are assessed during the annual NMFS SWFSC Rockfish Recruitment and Ecosystem Assessment Surveys. Midwater trawls are deployed during the spring and early summer at defined sampling stations which cover both coastal and offshore waters. Data for central California are available from 1990 on, allowing for comparison of current values with historical conditions and trends.

Higher coastal abundance of forage species increases entanglement risk by increasing the probability that large whales will congregate in nearshore areas and overlap with fishing activity. Conversely, abundant offshore or widespread foraging opportunities are associated with reduced entanglement risk.

5.1.6.8 Ocean Conditions

A variety of oceanographic conditions influence the distribution of key prey species (see Chapter 3), with direct consequences for co-occurrence between Covered Species and fishing gear. During the 2019-20 through 2022-23 fishing seasons, CDFW considered available information regarding habitat compression, coastal upwelling, NPH, ONI, and LMH events to predict distributions of Covered Species. Additionally, conditions at sea such as high winds or strong currents strongly influence fishing behavior and responsiveness of the fleet. High winds and swell events can affect the fleet's ability to detect and retrieve gear or be responsive to a management directive.

5.1.6.9 Confirmed Entanglements and Cumulative Take

At the time the RAMP regulations were developed, CDFW anticipated take levels of up to six humpback whales (with no apportionment to the Mexico and Central America DPS), up to two blue whales, and up to two leatherback sea turtles every three years. Since the specific levels authorized under a future permit had not yet been determined, CDFW relied upon informal consultation with NMFS WCRO to set the following targets:

- Average total annual Impact Score Calculation during the previous two calendar years and the current calendar year exceeds:
    - Two humpback whales
    - One blue whale
    - One leatherback sea turtle

As the number of confirmed entanglements approaches the above levels, CDFW implements increasingly precautionary management actions. The higher levels for humpback whales provide CDFW the opportunity to transition from less restrictive to more restrictive actions with each additional confirmed entanglement. For example, if the management considerations identified above suggest a gear reduction is the best approach to reduce entanglement risk and the cumulative total number of entanglements during the current three-year period is three, CDFW might implement a 25% gear reduction. Should additional entanglements occur during that same season, CDFW might implement a 50% or 75% gear reduction, and ultimately consider closure of one or more Fishing Zones. Given the low limits for blue whales and leatherback sea turtles, CDFW would implement a restrictive management action following a single confirmed entanglement of these species. For example, if the entanglement is confirmed during the open fishing season, CDFW might close one or more Fishing Zones for the remainder of the season to prevent continued co-occurrence.

In all instances, CDFW considers the potential for unintended consequences when implementing a management action which could displace, rather than remove, fishing effort. Given differences in migration patterns, habitat utilization, and forage needs of the Covered Species (see Chapter 3), it is possible that management actions taken in response to elevated risk for one species could lead to increased take of another species. Therefore, CDFW selects the type,

spatial extent, and temporal duration of any management action to minimize take of each Covered Species.

5.2 Gear Loss

The best available information regarding causes of gear loss is from the between-season requests for replacement buoy tags which are processed by LRB. The DFW 1302 form (Rev 05/25/2022) requires Dungeness crab vessel permitholders to "describe the factual circumstances surrounding the loss of the buoy tags". Based on the descriptions provided on the between-season request affidavits submitted in 2014, 2016, and 2018, gear loss was most frequently caused by other boats (55.2%), weather (27%), and kelp (16.3%), followed by wear and tear (5.7%), debris (2%), the operator's boat (1.5%), or silt (1%). Nearly half (48%) of gear loss incidents didn't include sufficient details to assign a cause of gear loss.

Entanglement reports, including information collected during a response effort, rarely include sufficient details to evaluate whether the entanglement occurred in lost (rather than actively fished) gear. Of the 246 confirmed large whale entanglements between 2013 and 2020, only three are known to have occurred in lost or abandoned gear, and another 11 had "indications" of lost gear but could not be confirmed as such (personal communication, Lauren Saez, NMFS WCRO, August 29, 2022). Despite this, CDFW considers lost or abandoned gear as a substantial source of marine life entanglement risk. As the abundance of Covered Species within an area increases the likelihood of an interaction with a given vertical line also increases. Vertical lines which persist in the Plan Area during the spring, summer, and early fall months when Covered Species are foraging within the Plan Area therefore pose a disproportionate risk of entanglement. Given the actions described in Section 5.1, the gear most likely to be present at those times would be lost or abandoned, rather than actively fished. CDFW has therefore taken actions to both reduce the amount of gear which becomes lost or abandoned and to remove lost or abandoned gear, further minimizing entanglement risk from the Covered Activity.

Prior to implementation of Cal. Code Regs., Tit. 14 § 132.8, CDFW had no specific mechanism to assess gear loss, however requests for replacement buoy tags allow CDFW to estimate gear loss for the 2013-14 to 2018-19 fishing seasons. Replacement tag requests can be submitted both in-season and between the two seasons of each biennial period and are assumed to reflect gear loss, other than instances where the request form included sufficient details to determine that only tags (and no gear) were lost or that the loss occurred on land rather than at sea. Inferred gear loss is contextualized by calculating maximum potential traps, which reflects the cumulative total trap allotments for all vessels participating in the fishery as determined by landing receipts or (beginning with the 2020-21 season) both landing receipts and bi-weekly reports. Dividing replacement tag requests by maximum potential traps estimates the percentage of deployed gear which was lost each season. While there are a variety of limitations with this approach (e.g., lost tags do not necessarily equate

to lost traps at sea), it is a particularly inadequate mechanism for assessing lost gear for the second season of each biennial period, since each permitholder will receive a complete set of tags prior to the start of the next biennial period and therefore would not submit a between season replacement request.

Beginning with the 2020-21 fishing season, the bi-weekly Fishing Activity Reports under Cal. Code Regs., Tit. 14 § 132.8 subd. (g)(1) require fishery participants to annually report the number of lost traps. These self-reported gear loss values can be compared to gear deployments from those same reports as an alternative method for calculating gear loss. As discussed in Section 2.2.4.1, due to compliance issues with this new reporting requirement, CDFW considers the number of reported lost traps and reported deployed traps to be a lower bound, although it's unclear whether this would also negatively bias the associated gear loss percentage. To correct for vessels which harvested Dungeness crab from the Plan Area but did not provide bi-weekly reports, and vessels whose bi-weekly reports did not include the number of lost traps, CDFW relied on the following assumptions when correcting reported totals:

- Total lost traps are calculated by summing the lost traps documented on bi-weekly reports. For those vessels which harvested crab in California but did not provide a lost trap total, trap loss was estimated by calculating tier-specific averages for those vessels which did submit lost trap totals (rounded to the nearest whole number).
- Total deployed traps are calculated by summing each permit's maximum reported trap number. For those vessels which harvested crab in California but did not provide bi-weekly reports, the permit was assumed to have deployed their full trap allotment.

Bi-weekly reports also allow for a more holistic evaluation of the maximum potential traps deployed within the Plan Area, as described in Section 5.1.6.6.

For the 2020-21 season, a total of 358 permits operated within the Plan Area. Of these, 324 permits provided at least one bi-weekly report (324/358 = 91% compliance) and 34 permits did not submit any reports. After correcting for non-compliance, CDFW estimates a total of 105,327 traps were deployed within the Plan Area that season. 296 permits provided a lost trap number (296/358 = 83% compliance), and 62 permits did not. After correcting for non-compliance, CDFW estimates a total of 1,772 traps were lost within the Plan Area that season.

For the 2021-22 season, a total of 374 permits operated within the Plan Area. Of these, 363 permits provided at least one bi-weekly report (363/374 = 97% compliance) and 11 permits did not submit any reports. After correcting for non-compliance, CDFW estimates a total of 112,540 traps were deployed within the Plan Area that season. 320 permits provided a lost trap number (320/374 = 86% compliance), and 54 permits did not. After correcting for non-compliance, CDFW estimates a total of 3,923 traps were lost within the Plan Area that season.

For the 2022-23 season, a total of 359 permits operated within the Plan Area. Of these, 348 permits provided at least one bi-weekly report (344/359 = 97% compliance) and 15 permits did not submit any reports. After correcting for non-compliance, CDFW estimates that a total of 106,006 traps were deployed within the Plan Area that season. 278 permits provided a lost trap number (278/359 = 77% compliance), and 54 permits did not. After correcting for non-compliance, CDFW estimates a total of 3,438 traps were lost within the Plan Area that season.

Despite the compliance issues, bi-weekly reports remedy many of the limitations associated with relying on tag replacement request affidavits, and with continued implementation of the RAMP program (including higher compliance with the reporting requirement), CDFW will be able to phase out use of correction factors and more accurately quantify annual gear loss.

Table 5-1. Estimates of gear deployment and loss for the 2013-14 through 2022-23 commercial Dungeness crab seasons. Percent loss values for the 2013-14 through 2018-19 fishing seasons are calculated by dividing *Tag Replacement Requests* by *Maximum Potential Traps*, as described above. Asterisks indicate years when only the In Season process was in effect. Percent loss values for the 2019-20 through 2022-23 fishing seasons are calculated by dividing corrected values of *Bi-Weekly Lost Traps* by *Maximum Reported Traps*, as described above.

Season	Tag Replacement Requests	Maximum Potential Traps	Bi-Weekly Lost Traps	Maximum Reported Traps	% Loss
2013-14	10,207	148,325	NA	NA	6.9%
2014-15	1,280*	149,250	NA	NA	0.9%*
2015-16	5,432	134,000	NA	NA	4.1%
2016-17	1,599*	150,375	NA	NA	1.1%*
2017-18	8,176	147,900	NA	NA	5.5%
2018-19	671*	142,375	NA	NA	0.5%*
2019-20	Not tabulated	139,450	NA	NA	Not tabulated
2020-21	Not tabulated	117,250	1,772	105,327	1.7%
2021-22	Not tabulated	123,100	3,923	112,540	3.5%
2022-23	Not tabulated	120,600	3,438	106,006	3.2%

Building on the pilot efforts described in Section 4.2, CDFW adopted regulations (Cal. Code Regs., Tit. 14 § 132.7) in September 2019 implementing a formal lost or abandoned commercial Dungeness crab trap gear retrieval program (Trap Gear Retrieval Program). Under the terms of the program, qualified entities (sport or commercial fishing associations with a board and/or charter, non-profits, and local government agencies or harbor districts) work with commercial trap fishermen to conduct on-the-water retrieval operations from two weeks after the scheduled season closure (Fish & G. Code § 8276) to September 30. The Director can authorize retrieval to begin sooner as part of a closure under the RAMP. All retrieved traps are documented on a logbook, which is submitted to CDFW each year. Compensation for retrieval activities is provided either by the Dungeness crab vessel permitholder, in exchange for the retrieved trap, or by CDFW. The guaranteed compensation is one key difference between the formal program and the informal retrieval activities conducted under Cal. Code Regs., Tit. 14 § 132.2. CDFW has conducted extensive outreach to potential Retrieval

Permittees to encourage their participation, as well as notifying commercial fishery participants of the program's implications. Outcomes from the program during the phased implementation period are described in Section 5.5.

5.3 Outreach and Best Practices

The first Best Practices Guide was developed in fall 2015 by the Working Group, with input and support from OPC, NMFS, and CDFW. The Best Practices Guide was updated on an annual basis prior to the start of the 2016-17 through 2020-21 seasons. As of the 2021-22 fishing season, the Best Practices Guide is updated on an as-needed basis to incorporate new recommendations from the Working Group, Working Group Advisors, and agencies. Copies are given to Working Group members for distribution, posted online, and shared through various listservs. The Best Practices Guide is available at CDFW license counters that fall within the range of the Dungeness crab fishery and is also distributed by CDFW staff during recreational fishery sampling and at outreach events.

CDFW prepares and distributes an annual pre-season newsletter which includes updates regarding development and implementation of Conservation Measures to address marine life entanglements and any new regulatory requirements for the commercial fishery. The newsletter is mailed to all Dungeness crab vessel permitholders.

CDFW also holds at least one public meeting prior to the start of each fishing season. The goal of these meetings is to increase awareness of marine life entanglement issues and management actions by the fleet and general public. CDFW provides updates regarding implementation of the Conservation Program and identifies areas where industry collaboration and involvement is needed to increase effectiveness.

CDFW also generates press releases, sends updates via a dedicated listserv, and regularly updates the Whale Safe Fisheries webpage with new developments related to the Conservation Measures described in this CP. These outreach efforts are an important aspect of adaptive management, which aims to incorporate and facilitate effective stakeholder engagement.

5.4 Improving Reporting and Documentation

Recognizing the importance of reducing the proportion of entanglements in unidentified fishing gear, the California Legislature, FGC, and CDFW have advanced proposals to enhance gear marking requirements for multiple fisheries operating within the Plan Area. Updates to Fish & G. Code § 9005 in 2018 required CDFW to adopt regulations requiring standardized gear marking in state-managed commercial trap fisheries by January 1, 2020. CDFW undertook a rulemaking process to adopt Cal. Code Regs., Tit. 14 § 180.5 to establish a standardized framework for marking commercial fishing gear used in the spiny lobster, rock crab, tanner crab, spot prawn, coonstripe shrimp, and nearshore finfish fisheries. The updated regulations:

- require each buoy to be marked with a fishery-specific identification letter (see Table 5-2)
- require at least one buoy marking a given trap, or string of traps, to be marked by a specified identification number (see Table 5-2)
- prescribe minimum height and thickness of the identification letters
- specify where markings must be present
- specify markings must be in a color that contrasts with the buoy and maintained so they are visible and legible

Table 5-2. Specified identification letters and numbers for state-managed commercial trap fisheries, as defined in Cal. Code Regs., Tit. 14 § 180.5.

Fishery and Gear Type	Identification Letter	Identification Number
Lobster Trap	P	operator's commercial fishing license identification number
Rock Crab Trap	X	operator's commercial fishing license identification number
Tanner Crab Trap	T	vessel's commercial boat registration number
Spot Prawn Trap	S	operator's commercial fishing license identification number
Coonstripe Shrimp Trap	C	operator's commercial fishing license identification number
Nearshore Finfish Trap	Z	operator's commercial fishing license identification number

The regulations were effective as of October 28, 2019, with a compliance date of May 1, 2020.

In December 2020, the FGC adopted updated regulations governing activities of the recreational crab fishery which were effective as of November 1, 2021. Among other changes, the updated regulations:

- require each crab trap to be marked only with a main buoy and a marker buoy
- specify minimum sizes for main buoys
- specify a required color and minimum size for marker buoys
- specify a maximum distance between the main and marker buoys

In addition, during the phased implementation period CDFW formalized a previously ad-hoc approach to conducting follow up interviews with California-permitted fishermen whose gear is involved in marine life entanglements. When buoy markings indicate the gear may have originated from a California fishery and traced back to an individual, CDFW searches license and permitting records for vessel, permit, or fishermen identification numbers documented on entangling gear. If this search indicates California-permitted gear was responsible for the entanglement, CDFW conducts a follow up interview with the permitted individual to learn about gear set location, gear configuration, last

known servicing and any other relevant information that will support entanglement response and forensic review, and shares those findings with NMFS.

5.5 Conservation Program in Action: 2020-21 through 2022-23 Seasons

As described in the preceding sections, several of the Conservation Measures which comprise the proposed Conservation Program in Chapter 6 were at least partially implemented during the 2019-2022 phased implementation period. The 2020-21, 2021-22, and 2022-23 seasons can therefore be treated as a case study for how the Conservation Program will function during the permit term. While the 2019-20 season falls within the phased implementation period, it was conducted under CDFW's interim authority granted by Fish and G. Code § 8276.5 rather than the RAMP regulations and is less meaningful in this context.

Additionally, while this CP is limited to the commercial Dungeness crab fishery, CDFW has also taken actions to address entanglement risk in the recreational crab fishery through regulations approved by the FGC and effective as of November 1, 2021 (Cal. Code Regs., Tit 14 § 29.85). As of the 2021-22 fishing season, when Marine Life Concentration triggers have been met CDFW can prohibit deployment of recreational crab traps until risk is of entanglement is no longer elevated.

The 2020 Trap Gear Retrieval Program began on May 22 in the CMA (Fishing Zones 3-6) and began on July 30 in the NMA (Fishing Zones 1-2). CDFW issued permits to qualified entities based in seven ports: Crescent City, Eureka, Trinidad, Bodega Bay, San Francisco, Half Moon Bay, and Monterey Bay. Gear was recovered under six of these permits (all but Bodega Bay), with a total of 13 active Designated Retrievers conducting 47 retrieval trips and collecting 521 Dungeness crab traps. Recovered gear was traced to 130 unique Dungeness crab vessels, with an average of four traps per vessel. In addition to gear recovered under CDFW-issued Retrieval Permits, CDFW received reports of an additional 112 Dungeness crab traps recovered near Trinidad, for a total of 633 traps recovered during 2020.

During September and October 2020, CDFW collaborated with NMFS, OPC, and Working Group members to develop an updated Best Practices Guide for the 2020-21 season. In October 2020, CDFW mailed a pre-season newsletter and copies of the Best Practices Guide to all commercial Dungeness crab vessel permitholders.

CDFW conducted the first pre-season risk assessment on November 4, 2020 (Table 5-3). Marine Life Concentrations in Fishing Zones 3 and 4 required implementation of a management action, and the Director delayed the scheduled November 15, 2020 season opening in Fishing Zones 3-6. During the second risk assessment on November 24, 2020, Marine Life Concentrations in Fishing Zones 3 and 4 again exceeded the threshold for management action, and the Director further delayed the season opening in Fishing Zones 3-6. Additionally, the scheduled December 1, 2020 opening in Fishing Zones 1 and 2

was delayed due to low crab quality. On December 7, 2020 Tri-State fishery managers determined further crab quality delays of Fishing Zones 1 and 2 were not required. A third risk assessment on December 11, 2020 indicated Marine Life Concentrations in Fishing Zone 4 still exceeded the threshold for management action. The Director delayed the season opening in Fishing Zones 1-6 until December 23, 2020 and issued a Fleet Advisory requesting fishery participants to avoid setting gear at the edges of the Monterey Canyon (where krill and blue whales were sighted), as well as near Point Reyes and around the Farallon Islands (known hotspots for humpback and blue whales). The Fleet Advisory also requested fishery participants to employ best practices in all waters.

During the January 14, 2021 and February 11, 2021 risk assessments, no triggers were reached and management action was not required. During the March 12, 2021 risk assessment, Marine Life Concentrations in Fishing Zone 4 and a lack of CDFW-approved survey data in Fishing Zones 1, 5 and 6 required implementation of a management action. The Director issued a Fleet Advisory for Fishing Zones 1-6 which requested fishery participants employ best practices and immediately remove all gear once the operator was done fishing for the season. The Fleet Advisory specifically encouraged vessels in Fishing Zone 4 to pay attention to the location of set gear and foraging whales. During the April 1, 2021 risk assessment, a lack of CDFW-approved survey data for Fishing Zones 5 and 6 required implementation of a management action. The Director issued a second Fleet Advisory for Fishing Zones 1-6 which requested fishery participants employ best practices and immediately remove all gear once the operator was done fishing for the season. The Fleet Advisory specifically encouraged vessels in Fishing Zones 3 and 4 to pay attention to the location of set gear and foraging whales. During the April 14, 2021 risk assessment, a lack of CDFW-approved survey data for Fishing Zones 1, 2, 5 and 6 required implementation of a management action, and the Director issued a third Fleet Advisory.

During the May 3, 2021 risk assessment, a lack of CDFW-approved survey data for Fishing Zones 1, 2, 5 and 6 required implementation of a management action. The Director issued a fourth Fleet Advisory. In addition, in response to large aggregations of humpback whales observed between 30 and 45 fathoms in Fishing Zones 1 and 2, the Director implemented a depth constraint restricting the fishery to waters shallower than 30 fathoms in Fishing Zones 1 and 2 as of May 10, 2021. Available humpback whale survey data indicated foraging was occurring in waters deeper than 30 fathoms, entanglement risk was likely elevated in those areas, and constraining remaining gear to inshore waters would provide adequate reductions in co-occurrence between foraging humpback whales and remaining gear. This management action also aligned with a long-standing practice in these Fishing Zones, whereby participants move their gear into nearshore waters during the latter portion of the season. Paired with the customary gear reductions observed during the spring, as fishermen pull gear and transition to other fisheries, this action provided a balanced approach between avoiding entanglement risk and providing continued fishing opportunity.

During the May 18, 2021 risk assessment, Marine Life Concentrations in Fishing Zones 1 and 4 and a lack of CDFW-approved survey data in Fishing Zones 2, 3, 5 and 6 required implementation of a management action. The Director closed the fishery statewide (all Fishing Zones) beginning at noon on June 1, 2021 and authorized operations under the Trap Gear Retrieval Program beginning at 6:00 am on June 7, 2021.

As part of each risk assessment during the 2020-21 fishing season, CDFW convened the Working Group and solicited their recommendation(s) regarding appropriate management actions. The Working Group provided formal recommendations for the November 4, November 24, December 11, May 3, and May 18 risk assessments.

Table 5-3. Risk Assessment recommendations and outcomes during the 2020-21 fishing season. Each risk assessment where a management action was implemented or modified is included on a separate row. Risk Assessments which did not result in management changes are not included. The date of the risk assessment, the substance of either consensus or majority/minority Working Group recommendations, CDFW's selected management action, and accompanying rationale are provided.

Risk Assessment	WG Recommendation	Management Action	Rationale
11/4/2020	Delay Zones 3-6 until at least Dec 1	Delay CMA opener	Humpback whale values exceed triggers for Zones 3 and 4, no approved survey data for Zone 6. Humpback whales observed foraging across a broad range of depths. Season delay will ensure no gear is deployed, removing any entanglement risk. Allowing Zone 5 to open would inhibit an orderly start to the fishery.
11/24/2020	Delay Zones 3-6 until Dec 16	Delay CMA opener	Zones 1-2 already delayed due to low quality. Humpback whale values exceed triggers for Zones 3 and 4, no approved survey data for Zones 5 and 6. High anchovy abundance and high habitat compression increases nearshore concentrations of humpback whales. Season delay will ensure no gear is deployed, removing any entanglement risk.
12/11/2020	Majority: Delay statewide until Dec 31. Minority: Delay statewide until Dec 16 with a Fleet Advisory in Zone 4. Minority: Delay opener until Dec 16 with a statewide Fleet Advisory.	Delay statewide opener until Dec 23, issue Fleet Advisory	Humpback and blue whale values exceed triggers for Zone 4, although trends indicate migration has commenced. Remaining whales concentrated on the shelf break and over deep-water canyons, at the outer edges of traditional fishing grounds. Quality delay will lift for Zones 1-2 on Dec 16. Statewide opener under a Fleet Advisory will distribute gear throughout open Zones and encourage best practices, further reducing entanglement risk.
1/15/2021	NA	Lifted Fleet Advisory	No triggers met, fall migration has occurred.

Risk Assessment	WG Recommendation	Management Action	Rationale
3/18/2021	NA	Fleet Advisory	Humpback whale values marginally exceed triggers for Zone 4, no approved survey data for Zones 1, 5, 6. Some humpback whales have departed winter areas. Declining fishing activity across the state and low habitat compression.
4/1/2021	NA	Maintain Fleet Advisory	No approved survey data for Zones 1 and 5, low sightings of humpback and blue whales in other Zones. Observed humpback whales foraging on large krill patches along 200-m (100-fa) contour. Continued declines in fishing activity and low spatial overlap between remaining activity (inshore of 80-fa) and foraging humpback whales.
5/3/2021	Majority: Fleet Advisory for Zones 3-6 and depth constraint for Zones 1-2. Minority: Fleet Advisory and voluntary depth constraint for Zones 1-2.	Depth constraint for Zones 1 and 2; maintain Fleet Advisory	No approved survey data for Zones 1, 2, 5, and 6. Low presence in Zones 3, 4, and 5. Continued declines in fishing activity and limited spatial overlap between remaining activity (generally less than 31 fa) and humpback whales in Zones 1-2 (generally 30-45 fa). Depth constraint will further constrain potential co-occurrence. In Zones 3-4, Fleet Advisory sufficient due to low spatial overlap between remaining activity (generally less than 40 fa) and humpback whales in Zones 3-4 (primarily along the 200-m/100-fa contour).
5/18/2021	Majority: Depth constraint in Zones 1-5, close Zone 6. Minority: Close statewide on June 1.	Close statewide on June 1	No approved survey data for Zones 2, 3, 5, and 6. Humpback whale values exceed triggers for Zones 1 and 4. Despite continued declines in overall fishing activity, substantial amounts of gear deployed in Zones 1 and 3. With humpback whale presence expected to increase over the coming weeks, remaining gear will pose increasing entanglement risk.

NMFS WCRO did not confirm any entanglements of either blue whales or leatherback sea turtles between August 2020 and July 2021. During this period, NMFS identified two humpback whale entanglements which might meet CDFW's criteria for triggering a management action. One humpback whale entanglement was reported on April 3, 2021 in Fishing Zone 6. Based on the available documentation (photos showing a dark line, with no visible surface gear), NMFS was unable to attribute the entanglement to a gear type or specific fishery and classified the entanglement as occurring in unidentified gear. CDFW solicited input from Working Group members and Advisors during multiple meetings. Despite robust discussion, CDFW was unable to rule out California commercial Dungeness crab as a potential gear type, and therefore classified the entanglement as occurring in Unknown Fishing Gear. Given its potential to have originated from the commercial Dungeness crab fishery, the entanglement

was considered during subsequent risk assessments as an indicator of elevated entanglement risk. The second humpback whale entanglement was reported on June 9, 2021 off Los Cabos, Mexico and confirmed by NMFS as occurring in California commercial Dungeness crab gear. As the fishery had already closed, CDFW did not implement any additional management actions.

The 2021 Trap Gear Retrieval Program began on June 7 in all Fishing Zones. CDFW issued six permits to qualified entities based in five ports: Crescent City, Bodega Bay, San Francisco, Half Moon Bay, and Monterey Bay. Gear was recovered under five of these permits (all except one of the two permits in Monterey Bay), with a total of 12 active Designated Retrievers conducting 21 retrieval trips and collecting 244 Dungeness crab traps. Recovered gear was traced to 66 unique Dungeness crab vessels, with an average of 3.7 traps per vessel. In addition to gear recovered under CDFW-issued Retrieval Permits, CDFW received reports of an additional six Dungeness crab traps recovered near Trinidad, for a total of 250 traps recovered during 2021.

In September 2021, NMFS WCRO notified CDFW and the Working Group of two additional confirmed entanglements in unidentified fishing gear reported off California. Both were reported in Fishing Zone 6, one on July 13, 2021 and the other on August 28, 2021. During the February 17, 2022 risk assessment, CDFW classified both entanglements as occurring in Unknown Fishing Gear.

During September 2021, CDFW collaborated with NMFS, OPC, and Working Group members to develop an updated Best Practices Guide for the 2021-22 season. In October 2021, CDFW mailed a pre-season newsletter and copies of the Best Practices Guide to all commercial Dungeness crab vessel permitholders.

CDFW conducted the first pre-season risk assessment on November 1, 2021 (Table 5-4). Marine Life Concentration values in Fishing Zones 3 and 4 required implementation of a management action, and the Director delayed the opening of the commercial Dungeness crab fishery in those zones. During the second risk assessment on November 19, 2021, Marine Life Concentration values in Fishing Zones 3 and 4 again exceeded the RAMP thresholds, and the season opener was further delayed in those zones. A Fleet Advisory was also issued for Fishing Zones 1, 2, 5 and 6 which directed fishery participants to avoid setting gear in areas where whales are transiting or foraging. During the third risk assessment on December 9, 2021, Marine Life Concentration values in Fishing Zones 3 and 4 remained above the RAMP thresholds. The Director implemented a further delay of the season opener in Fishing Zone 3, and determined Fishing Zone 4 would open on December 13, 2021 under a Depth Constraint prohibiting trap gear from being set seaward of the 40-fathom contour line. The Fleet Advisory currently in place for Fishing Zones 1, 2, 5, and 6 was extended to include Fishing Zone 4. During the fourth risk assessment on December 15, 2021, Marine Life Concentration values in Fishing Zone 3 again exceeded the RAMP thresholds, and the Director implemented a final delay of the season opener in Fishing Zone 3 until December 29, 2021 and announced the Depth Constraint in Fishing Zone 4 would lift on December 26, 2021. The Director also continued the

Fleet Advisory for all Fishing Zones, with an emphasis on avoiding setting gear in deep water areas of Fishing Zone 4 and in waters between 50 and 100 fathoms off Pigeon Point.

No triggers were met during the January 18, 2022 risk assessment, and the Director lifted the Fleet Advisory for all Fishing Zones. On January 27, 2022 a humpback whale entanglement in unidentified gear was reported in Fishing Zone 4, which CDFW classified as occurring in Unknown Fishing Gear. During the next risk assessment on February 17, 2022, the Director implemented a Fleet Advisory for all Fishing Zones which encouraged all fishery participants to report any observed entanglements and to implement best practices throughout the remainder of the season.

During the March 14, 2022 risk assessment, a lack of approved survey data for Fishing Zones 5 and 6 required implementation of a management action and the Director continued the Fleet Advisory currently in place for all zones. On March 11, 2022 a confirmed humpback whale entanglement in California commercial Dungeness crab gear was reported in Fishing Zone 3, and a second confirmed humpback whale entanglement in California commercial Dungeness crab gear was reported on March 19, 2022 in Fishing Zone 4. The Director conducted a risk assessment on March 25, 2022. Based on these two entanglements, and a continued lack of available data for Fishing Zones 5 and 6, the Director closed the remainder of the fishing season in Fishing Zones 3-6 beginning at noon on April 8, 2022 and authorized retrieval operations under the Trap Gear Retrieval Program in those zones beginning at noon on April 15, 2022. At the time, there were no certified Alternative Gears, but in anticipation of the fact that one or more gear types could become authorized prior to the statutory closure date, the Director authorized use of any certified Alternative Gears following the closure of Fishing Zones 3-6. The Director also continued the Fleet Advisory in place for Fishing Zones 1-2.

Two additional entanglements were confirmed on March 30, 2022. A humpback whale reported from Fishing Zone 3 on March 28, 2022 was confirmed to be entangled in California commercial Dungeness crab gear, and a humpback whale reported from Fishing Zone 4 on March 21, 2022 was confirmed to be entangled in unidentified gear. CDFW classified the March 21, 2022 entanglement as occurring in Unknown Fishing Gear. Taken together, cumulative Impact Scores for these five confirmed humpback whale entanglements required closure of the fishing season statewide. Following the April 6, 2022 risk assessment the Director closed the fishing season in Fishing Zones 1 and 2 at noon on April 20, 2022 and authorized retrieval operations under the Trap Gear Retrieval Program in those zones beginning at noon on April 27, 2022. In anticipation of the fact that one or more gear types could become authorized prior to the statutory closure date, the Director authorized use of any certified Alternative Gears following the closure of Fishing Zones 1-2.

As part of each risk assessment during the 2021-22 fishing season, CDFW convened the Working Group and solicited their recommendation(s) regarding

appropriate management actions. The Working Group provided formal recommendations for the November 1, November 19, December 9, and December 15 risk assessments.

Table 5-4. Risk Assessment recommendations and outcomes during the 2021-22 fishing season. Each risk assessment where a management action was implemented or modified is included on a separate row. Risk Assessments which did not result in management changes are not included. The date of the risk assessment, the substance of either consensus or majority/minority Working Group recommendations, CDFW's selected management action, and accompanying rationale are provided.

Risk Assessment	WG Recommendation	Management Action	Rationale
11/1/2021	Open Zones 1 and 2 on Dec 1; Delay Zones 3 and 4 until Nov 19 and open under a Fleet Advisory; Open Zones 5 and 6 on Nov 15 under a Fleet Advisory	Delay Zone 3 and 4 openers	Humpback whale values exceed triggers for Zones 3 and 4, and leatherback sea turtles are present in Zones 3 and 4. Season delay will ensure no gear is deployed, removing any entanglement risk. No action needed for Zones 5 and 6 due to low presence of humpback whales and no documented presence of leatherback sea turtles.
11/19/2021	Open Zones 1 and 2 on Dec 1; Delay Zones 3 and 4	Delay Zone 3 and 4; Fleet Advisory for Zones 1-2, 5-6	Humpback whale values exceed triggers for Zones 3 and 4 and are broadly distributed across a range of depths. Leatherback turtles are present in Zone 4, and foraging opportunities remain in Zone 3. Season delay of Zones 3 and 4 will ensure no gear is deployed, removing any entanglement risk. Fleet Advisory sufficient for Zones 1, 2, 5 and 6 due to low presence of humpback whales and no documented presence of leatherback sea turtles.
12/9/2021	Open Zones 3 and 4 under Fleet Advisory on Dec 20	Delay Zone 3; Delay Zone 4 until Dec 13 under a depth constraint; continue Fleet Advisory and include Zone 4	Humpback whale values exceed triggers for Zones 3 and are broadly distributed across a range of depths. In Zone 4, humpback whale values are declining but still exceed specified triggers, and humpback whales are generally located in waters deeper than 50-fa. A depth constraint in Zone 4 will limit potential co-occurrence. Fleet Advisory sufficient for Zones 1, 2, 5 and 6 due to low presence of humpback whales.

Risk Assessment	WG Recommendation	Management Action	Rationale
12/15/2021	Majority: Lift depth constraint for Zone 4 when Zone 3 opens. Minority: Postpone Zone 3 opener until Jan 1.	Delay Zone 3 until Dec 29; lift Zone 4 depth constraint on Dec 26; continue Fleet Advisory for all Zones	Humpback whale values are declining in Zones 3 and 4, but still exceed triggers for Zone 3. Remaining whales are concentrated along deep-water canyons, at the outer edges of traditional fishing grounds, and as additional whales commence their southbound migration potential co-occurrence will continue to decline. A Fleet Advisory for all open Zones will encourage best practices, further reducing entanglement risk.
1/18/2022	Lift Fleet Advisory	Lift Fleet Advisory	No triggers met, fall migration has occurred.
2/17/2022	NA	Fleet Advisory for all Zones	Confirmed entanglement in unidentified gear reported in Zone 4. Fleet Advisory to encourage best practices will reduce entanglement risk, and prompt reporting of any entanglements will allow for additional information gathering and intervention by an entanglement response team.
3/25/2022	NA	Close Zones 3-6 on April 8; continue Fleet Advisory for Zone 1-2	Despite low presence of humpback whales and declining fishing activity, two confirmed entanglements in California commercial Dungeness crab gear, one reported in Zone 3 and one reported in Zone 4. Low abundance of humpback whales precludes identification of an appropriate depth-based closure. Removing all gear from Zones 3-6 and authorizing early gear retrieval will limit co-occurrence, which would otherwise increase as humpback whales begin migrating into the fishing grounds. Fleet Advisory sufficient for Zones 1 and 2 due to low presence of humpback whales and lack of any confirmed entanglements from those areas.
4/6/2022	NA	Close Zones 1-2 on April 20	Despite low presence of humpback whales and declining fishing activity, one additional confirmed entanglement in California

Risk Assessment	WG Recommendation	Management Action	Rationale
			commercial Dungeness crab gear (reported in Zone 3) and one in unidentified gear (reported from Zone 4). Cumulative Impact Score Calculation exceeds regulatory threshold and requires a statewide fishery closure.

NMFS WCRO did not confirm any entanglements of either blue whales or leatherback sea turtles between August 2021 and July 2022. During this period, NMFS identified nine humpback whale entanglements which might meet CDFW's criteria for triggering a management action. As described above, three of the entanglements were confirmed in California commercial Dungeness crab gear and six were confirmed as occurring in unidentified gear. After review of available documentation and consultation with the Working Group, CDFW was able to rule out California commercial Dungeness crab as a potential gear type for only one entanglement, and therefore classified the remaining five unidentified gear entanglements as occurring in Unknown Fishing Gear. On February 23, 2023 CDFW became aware of an additional confirmed entanglement in California commercial Dungeness crab gear originally documented on February 13, 2022, after a photograph of the entanglement was featured in a CNN underwater photography contest. CDFW retroactively added this report to the entanglement record for 2022, bringing the total to four confirmed entanglements in California commercial Dungeness crab gear.

The 2022 Trap Gear Retrieval Program began on April 8 in Fishing Zones 3-6 and April 27 in Fishing Zones 1-2. CDFW issued five permits to qualified entities based in the following ports: Crescent City, Trinidad, San Francisco, Half Moon Bay, and Monterey Bay. Gear was recovered under four of these permits (all except Crescent City), with a total of nine active Designated Retrievers conducting 30 retrieval trips and collecting 584 Dungeness crab traps. Recovered gear was traced to 109 unique Dungeness crab vessels, with an average of 5.3 traps per Dungeness crab vessel. In addition to gear recovered under CDFW-issued Retrieval Permits, CDFW received reports of an additional 215 Dungeness crab traps recovered near Trinidad, for a total of nearly 800 traps recovered during 2022.

During October 2022, CDFW mailed a pre-season newsletter and copies of the current Best Practices Guide to all commercial Dungeness crab vessel permitholders.

During the first pre-season risk assessment on October 28, 2022 Marine Life Concentration values in Fishing Zones 1-5 and an absence of approved survey data for Fishing Zone 6 required implementation of a management action, and the Director delayed the scheduled November 15, 2022 opening of the commercial Dungeness crab fishery in Fishing Zones 3-6 until at least December 1

(Table 5-5). During the second risk assessment on November 21, 2022 Marine Life Concentration values in Fishing Zones 3 and 4 again exceeded the RAMP thresholds and insufficient information was available for Fishing Zones 5 and 6, and the Director further delayed the season opener for Fishing Zones 3-6 until at least December 15, 2022. During this risk assessment, CDFW determined there was no need to delay the scheduled December 1, 2022 season opener for Fishing Zones 1-2 under RAMP, however the opener was delayed due to low crab quality.

During the third risk assessment on December 7, 2022 Marine Life Concentration values in Fishing Zones 3-6 remained above the RAMP thresholds and no approved survey data was available for Fishing Zone 6, and CDFW further delayed the season opener until at least December 31, 2022. During the fourth risk assessment on December 22, 2022, Marine Life Concentration values in Fishing Zone 3 again exceeded RAMP thresholds, however current values indicated declining presence and that the southbound migration out of the Plan Area was underway. The Director announced the season would open in Fishing Zones 3-6 on December 31, 2022 under both a 50% trap reduction and Fleet Advisory which emphasized not setting gear near Point Reyes or the Farallon Islands. Quality test results also allowed the opening of Fishing Zones 1 and 2 as of December 31, 2022.

During the January 11, 2023, February 15, 2023, March 15, 2023, and March 30, 2023 risk assessments, Marine Life Concentration values remained below RAMP thresholds. However, given the exceedance of the 3-year running average Impact Score threshold, CDFW maintained the current Fleet Advisory. Additionally, while Marine Life Concentration values remained low during the March 30, 2023 risk assessment, based on historical migration patterns and the importance of avoiding any additional entanglements, CDFW closed the remainder of the fishing season in Fishing Zones 3-6 beginning at noon on April 15, 2023 and authorized retrieval operations under the Trap Gear Retrieval Program in those zones beginning at 6:00 am on April 21, 2023. In anticipation of the fact that one or more gear types could become authorized prior to the statutory closure date, the Director authorized use of any certified Alternative Gears following the closure of Fishing Zones 3-6.

On April 17, 2023 a confirmed humpback whale entanglement in unidentified gear was reported in Monterey Bay (Fishing Zone 4). A separate confirmed humpback whale entanglement was reported in unidentified gear in Monterey Bay on April 20, 2023. Based on available information, CDFW was unable to rule out California commercial Dungeness crab as a potential gear type, and therefore classified both unidentified gear entanglements as occurring in Unknown Fishing Gear.

During the May 2, 2023 risk assessment, Marine Life Concentration values were exceeded in Fishing Zone 1 and the Director continued the Fleet Advisory as well as implementing a depth constraint for Fishing Zones 1-2. On May 12, 2023 there was a confirmed humpback whale entanglement in unidentified gear reported

from Monterey Bay (Fishing Zone 4). After review of available information, CDFW determined the line material was inconsistent with that used in the commercial Dungeness crab fishery and did not classify it as occurring in Unknown Fishing Gear or assign an Impact Score.

During the May 31, 2023 risk assessment, Marine Life Concentration values were exceeded in Fishing Zone 1. Humpback whales were observed foraging in deep waters (along shelf and canyon edges), and the Director continued the Fleet Advisory and depth constraint currently in place to limit overlap between humpback whales and commercial gear. On June 11, 2023, a confirmed humpback whale entanglement was reported in California commercial Dungeness crab gear from Monterey Bay (Fishing Zone 4). As the fishery had already closed in this area, no further action was taken. During the June 22, 2023 risk assessment, Marine Life Concentration values were again exceeded in Fishing Zone 1 and the Director announced a final continuation of the Fleet Advisory and depth constraint through the end of the statutory season on July 15, 2023. On July 19, 2023 an additional confirmed humpback whale entanglement was reported in California commercial Dungeness crab gear from Monterey Bay (Fishing Zone 4). As the fishery was already closed statewide, no further action was taken.

As part of each risk assessment during the 2022-23 fishing season, CDFW convened the Working Group and solicited their recommendation(s) regarding appropriate management actions. The Working Group provided formal recommendations for the December 7, December 22, January 11, March 30, and May 2 risk assessments.

Table 5-5. Risk Assessment recommendations and outcomes during the 2022-23 fishing season. Each risk assessment where a management action was implemented or modified is included on a separate row. Risk Assessments which did not result in management changes are not included. The date of the risk assessment, the substance of either consensus or majority/minority Working Group recommendations, CDFW's selected management action, and accompanying rationale are provided.

Risk Assessment	WG Recommendation	Management Action	Rationale
10/28/2022	NA	Delay Zone 3-6 opener	Blue whale values exceed triggers for Zone 1; Humpback whale values exceed triggers for Zones 2-5; no approved survey data available for Zone 6. Humpback whales broadly distributed across a range of depths. Season delay will ensure no gear is deployed, removing any entanglement risk.
11/21/2022	Only addressed actions for recreational sector	Delay Zone 3-6 opener	Humpback whale values exceed triggers for Zones 3-4; no approved survey data available for Zones 5-6. Season delay will ensure no gear is

Risk Assessment	WG Recommendation	Management Action	Rationale
			deployed, removing any entanglement risk.
12/7/2022	Broad support for staff recommendation	Delay Zone 3-6 opener	Humpback whale values exceed triggers for Zones 3-4; no approved survey data available for Zone 6. Humpback whale abundance could increase in Zone 5 as whales from Zones 3-4 migrate south. Cumulative Impact Score warrants a precautionary approach. Season delay will ensure no gear is deployed, removing any entanglement risk.
12/22/2022	Two options with mixed support: open Zones 3-6 Dec 31 under 50% vertical line reduction; continue delay of Zones 3-6	Open Zones 3-6 on De 31, 2022 under a 50% gear reduction and Fleet Advisory	Humpback whale values exceed triggers for Zone 3, but at lower levels than prior risk assessments indicating southbound migration is underway. Opening under gear reduction and Fleet Advisory allows fishing opportunity while minimizing entanglement risk.
1/11/2023	Lift 50% gear reduction ASAP	Lift 50% gear reduction on Jan 15, 2023; continue Fleet Advisory for Zones 3-6	No Marine Life Concentration triggers met, fall migration has occurred. Running three-year average Impact Score exceeds specified threshold and requires management action.
3/30/2023	Multiple options with mixed support: close Zones 3-6 on April 15; close Zones 3-6 on April 30 with an interim management action (vertical line reduction or depth constraint) in mid-April; maintain status quo	Continue Fleet Advisory statewide; close Zones 3-6 on April 15, 2023	No Marine Life Concentration triggers met, although historical migration patterns indicate humpback whales typically return to the Plan Area in April and entanglement risk is expected to increase over the coming weeks. Precautionary closure is warranted given exceedance of running three-year average Impact Score.
5/2/2023	Majority: 30-fathom depth constraint in Zones 1-2. Minority: Close Zones 1-2 by May 15, 2023.	30-fathom depth constraint in Zones 1-2 and continue Fleet Advisory	Humpback whale values exceeded triggers for Zone 1.

NMFS WCRO did not confirm any entanglements of either blue whales or leatherback sea turtles between August 2022 and July 2023. During this period, NMFS identified four humpback whale entanglements which met CDFW's criteria for triggering a management action. Two of these were confirmed in California commercial Dungeness crab gear, while two others were classified as occurring in Unknown Fishing Gear.

All documents related to the risk assessments, including available data compilations, MR staff recommendations, Working Group recommendations, and declarations by the Director are available on CDFW's Whale Safe Fisheries webpage, and are included as Appendix B to this CP.

The low number of confirmed Covered Species entanglements in either California commercial Dungeness crab gear or Unknown Fishing Gear during the 2020-21 season provides an early indication that even partial implementation of the Conservation Program described in this Chapter will be effective at limiting take of Covered Species below permitted take limits. The rapid accumulation of confirmed entanglements during March 2022, despite Marine Life Concentration values remaining below the values which would have required management action, highlights ongoing uncertainty regarding the best methods for evaluating entanglement risk and reducing take, and the importance of the adaptive management framework described in Chapter 7. Despite this, CDFW was able to leverage RAMP's adaptive management framework and quickly implement closures. No additional confirmed entanglements in California commercial Dungeness crab gear were reported between the statewide closure implemented on April 20, 2022 and the start of the 2022-23 commercial Dungeness crab fishing season. Furthermore, the high number of entanglements required CDFW to take a precautionary approach during the 2022-23 fishing season, during which there were only two confirmed entanglements in California commercial Dungeness crab gear. Taken together, these findings suggest that the precautionary approach outlined in Chapters 5 and 6 will enable to CDFW to avoid and minimize take, and that the backstop measures described in Section 6.8 will enable CDFW to avoid exceeding take limits in an issued ITP.

5.6 Take of Covered Species: 2019-2022

5.6.1 Take of Covered Species, All Fisheries and Reporting Areas, 2019-2022

Between 2019 and 2022, there have been 98 confirmed large whale entanglements reported off the West Coast. Over half of these (n = 55; 56%) have involved unidentified gear. Of those where the gear could be identified (n = 43), 53% (n = 23) involved commercial Dungeness crab gear.

Looking specifically at the Covered Species, there have been no blue whale entanglements during this period. Of the 60 humpback whale entanglements, 50% (n = 30) occurred in unidentified gear. Of those where the gear could be identified (n = 30), 60% (n = 18) involved commercial Dungeness crab gear, with the remainder occurring in gillnet, other types of commercial trap gear (spot

prawn, rock crab, experimental box crab, lobster), and recreational Dungeness crab trap gear (Table 5-6).

Table 5-6. Fishery gear type for confirmed West Coast Region entanglement records by large whale species, 2019 – 2022, all reporting locations (created with NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023).

Fishery Type	Blue	Humpback	Other/Unidentified	Total
Dungeness crab commercial	0	17	5	22
Dungeness crab commercial + rock crab	0	1	0	1
Dungeness crab recreational	0	1	0	1
Drift gillnet	0	2	0	2
Experimental box crab	0	1	0	1
Gillnet	0	5	5	10
Lobster trap	0	1	0	1
Monofilament	0	0	2	2
Other	0	0	1	1
Commercial spot prawn pot	0	2	0	2
Unknown	0	30	25	55
Grand Total	0	60	38	98
Annual Average	0	15	9.5	24.5

Of the 98 large whale entanglements reported during this period, 30 had known gear set locations. Of these, 18 (60%) were set within the state where the entanglement was reported (Table 5-7). For gear known to have been set in California (n = 15), 14 (93.3%) were reported within the Plan Area, with one (6.7%) reported in Mexico. For entanglements with known gear origins reported within California (n = 20), 70% occurred with gear set in the Plan Area, 20% (n = 4) was with gear set in Oregon, and 10% (n = 2) was with gear set in Washington. This is consistent with the overall trends noted in Section 4.4.1.

Table 5-7. Large whale entanglement report locations for gear with known origins, 2019-2022 (created with NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023). Shaded cells reflect entanglement reports originating from the same state as the gear origin.

Reporting Location	California Gear	Oregon Gear	Washington Gear
Alaska	0	0	1
California	14	4	2
Mexico	1	2	2
Washington	0	0	4

For sea turtles, data from the SWFSC stranding database indicate the majority (n = 9; 75%) of the 12 fishery interactions between 2019 and 2022 were with green sea turtles. For leatherback turtles during this period, the single fishery interaction was with commercial rock crab gear (Table 5-8).

Table 5-8. Gear descriptions for confirmed West Coast fishery interactions by sea turtle species, 2019-2022. Created from NMFS SWFSC Sea Turtle Stranding Database (shared March 8, 2023) and unpublished data from NMFS WCRO (shared June 4, 2021). "Line" includes interaction descriptions which reference hook and line gear, monofilament line, or braided line. "Netting" includes interaction descriptions which reference gillnet, drift gillnet, or beach seine, as well as instances where both line and netting were reported. "Unspecified" includes interaction descriptions with insufficient information was provided to assign the incident to either a specific fishery or one of the other broad categories (line, netting, or pot/trap).

Fishery Type	Leatherback	Other/Unidentified	Total
Line	0	10	10
Netting	0	1	1
Rock crab, CA	1	0	1
Grand Total	1	11	12
Annual Average	0.25	2.75	3

5.6.2 Take of Covered Species in the California Commercial Dungeness Crab Fishery, 2019-2022

During 2019-2022, nine humpback whales, zero blue whales, and zero leatherback sea turtles were entangled in California commercial Dungeness crab gear (Table 5-9). As expected, the annual average number of humpback whale entanglements is substantially lower during this more recent period as compared to the 2014-2018 baseline (2.25 vs 7.6 per year; 70% decline). As with the baseline period, this includes reports which originated both inside and outside of the Plan Area.

Table 5-9. Confirmed entanglements in California commercial Dungeness crab gear by year for each Covered Species, 2019-2022. Created with NMFS WCRO Whale Entanglement Response Database (shared January 6, 2023) and NMFS SWFSC Sea Turtle Stranding Database (shared March 8, 2023). The table also includes an additional humpback whale entanglement reported in February 2023 but documented in 2022 (see Section 5.5 for further details).

Year	Blue Whale	Humpback Whale	Leatherback
2019	0	3	0
2020	0	1	0
2021	0	1	0
2022	0	4	0
Grand Total	0	9	0
Annual Average	0	2.25	0

5.6.3 Take of Covered Species in Unidentified Pot/Trap Gear, 2019-2022

Between 2019 and 2022 there were 30 known humpback whale, 0 known blue whale, and 0 known leatherback sea turtle entanglements in unidentified pot/trap gear (Table 5-10). Three quarters (n = 23; 76.7%) of the humpback whales were reported from within the Plan Area. On average, there were 5.75 humpback whale entanglements reported within the Plan Area in unidentified pot/trap gear each year. As expected, this represents a substantial decrease from the 2014-2018 baseline (12.2 per year; 52.9% decline).

Table 5-10. Confirmed entanglements in unidentified pot/trap gear by year for each Covered Species, 2019-2022. For each species, "In" refers to entanglements reported within the Plan Area, and "Out" refers to entanglements reported outside of the Plan Area (e.g. off Oregon, Washington, or Mexico). Created with NMFS WCRO Whale Entanglement Response Database (shared January 6, 2023) and NMFS SWFSC Sea Turtle Stranding Database (shared March 8, 2023).

Year	Blue Whale (In)	Blue Whale (Out)	Humpback Whale (In)	Humpback Whale (Out)	Leatherback (In)	Leatherback (Out)
2019	0	0	7	2	0	0
2020	0	0	3	2	0	0
2021	0	0	4	3	0	0
2022	0	0	9	0	0	0
Grand Total	0	0	23	7	0	0
Annual Average	0	0	5.75	1.75	0	0

As described in Section 4.4.1, the classification of these entanglements as being reported either inside or outside the Plan Area is meaningful because CDFW considers reports from the Plan Area to generally reflect take occurring within the Plan Area.

CHAPTER 6. PROPOSED CONSERVATION PROGRAM AND REQUESTED TAKE

Note: Regulations will be revised prior to permit issuance consistent with the final content of this Chapter.

This chapter describes the biological goals and objectives for the Covered Species (Section 6.1) and the Conservation Program CDFW will implement to achieve those goals and objectives (Sections 6.2-6.3). Section 6.4 describes CDFW's planned outreach efforts and approach to collaborating with key partners to ensure full CP implementation over the permit term. Sections 6.5 and 6.6 describe the basis for the take amounts CDFW is requesting pursuant to an ITP. This Chapter also describes how CDFW will account for take under an issued ITP (Section 6.7) and actions CDFW will take to avoid exceedance of permitted take levels (Section 6.8). Lastly, this Chapter describes anticipated impacts of the requested take on the Covered Species and their habitat (Section 6.9) and cumulative effects and impacts of anthropogenic take (Section 6.10).

In developing this CP, CDFW was guided by the dual goals of avoiding and minimizing take of Covered Species to the maximum extent practicable and maintaining a viable commercial Dungeness crab fishery which supports fishermen and dependent communities. CDFW is also guided by the MLMA (see Section 1.3.6), which requires CDFW to consider the long-term interests of people dependent on fishing for food, livelihood, or recreation, and to minimize the adverse impacts of fishery management on small-scale fisheries, coastal communities, and local economies (Fish & G. Code § 7055). As described in Chapter 2, the commercial Dungeness crab fishery is one of the most valuable fisheries in California and constitutes one of the most important economic sectors for coastal communities in central and northern California. Economic viability can be assessed by looking at the long-term, statewide stability of the fishery with regard to landings, value, and participation level. An economically viable fishery should include diverse business plans and operations which can adapt to market fluctuations, season modifications, product availability and climate uncertainty. CDFW will continue to work with stakeholders to identify additional methods for evaluating economic viability and to reduce economic impacts on affected individuals, communities, and industries from implementation of the Conservation Program described in this Chapter, primarily through the adaptive management process described in Chapter 7.

6.1 Biological Goal and Objectives

The biological goals and objectives are the broad, guiding principles for this CP. Collectively, they describe a desired future condition for the Covered Species and specific actions CDFW will undertake to help achieve it. These actions are more fully described in the remainder of this Chapter.

In developing these goals and objectives, CDFW reviewed and considered the 1991 Humpback Whale Recovery Plan (particularly Objective 2; NMFS 1991), the 2020 Blue Whale Recovery Plan (particularly Recovery Action 5.4; NMFS 2020c),

and the 1998 Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle (particularly Recovery Actions 2.1.3.3 and 2.1.4.2; NMFS and USFWS 1998).

The Humpback Whale Recovery Plan states that the main method for increasing population growth is to optimize natural fecundity by providing adequate feeding opportunities and by reducing death or injury caused by human activities. Through regulations promulgated by NMFS, the Pacific Fishery Management Council has prohibited harvest of krill within the West Coast EEZ (50 CFR § 660.502 and 660.505(o)); prohibited development of directed commercial fisheries for a variety of small pelagic fish and squid, krill and copepods, gelatinous zooplankton, and other essential forage species designated as "Ecosystem Component Species" (50 CFR § 660.5-660.6); and actively manages fisheries for northern anchovy and Pacific sardine under the Coastal Pelagic Species Fishery Management Plan. The FGC adopted a forage species policy in 2012 which recognizes the significant ecological role of forage species, and prevents development of new or expanded forage fisheries until sufficient information is available to ensure sustainability (https://fgc.ca.gov/About/Policies/Fisheries#Forage, accessed September 1, 2022). The only state-managed fishery targeting forage species is the Pacific herring fishery, which is managed under a Fishery Management Plan that recognizes its importance as an ecosystem component species and specifies an annual catch allotment based on spawning stock biomass (CDFW 2019). CDFW considers these protections adequate to ensure continued provision of sufficient forage for the Covered Species, and has therefore chosen to focus this CP on reducing death or injury caused by the Covered Activity. This is also consistent with the Blue Whale Recovery Plan, which identifies managing or eliminating significant anthropogenic threats as the main method by which to increase blue whale resiliency.

The 1998 Recovery Plan for Pacific Populations of the Leatherback Turtle reviews a broad suite of both on-land and in-water threats, and states that the primary threat within waters off the West Coast is incidental take in fisheries. More recently, the 2020 ESA Status Review (NMFS and USFWS 2020b) and Species in the Spotlight 2021-2025 Priority Actions for the Pacific Leatherback Sea Turtle (NMFS 2021a) identifies bycatch in foraging areas, migratory corridors, and off nesting beaches as the most significant threat to leatherback sea turtles. NMFS (2021a) predicts further declines in the West Pacific population without "intensive international conservation efforts". Since terrestrial and many of the in-water threats occur outside the Plan Area, CDFW has focused its goal on actions which fall within the agency's authority to manage the commercial Dungeness crab fishery across the Plan Area.

In alignment with federal priorities described above, CDFW has developed the following goal:

Goal: Support recovery of humpback whale, blue whale, and leatherback sea turtle populations by reducing take in commercial Dungeness crab trap gear to the maximum extent practicable.

CDFW has developed five objectives in support of this goal, which can be categorized as either avoidance measures or minimization measures. As described in Section 2.2.2, traditional commercial Dungeness crab gear is constructed with a weighted trap, a vertical line running from the trap (on the sea floor) to the surface, and a shorter, buoyed length of line at the surface. CDFW believes the vertical line running between the trap and the surface poses the greatest risk of entanglement. For take to occur, there must be both spatial and temporal overlap between these vertical lines and the Covered Species. Therefore, removing vertical lines from areas where Covered Species are present will limit potential for take. This concept of reducing co-occurrence underlies the following strategies to avoid take:

Objective 1: Throughout the Plan Area, reduce co-occurrence of humpback whales, blue whales, and leatherback sea turtles with the Covered Activity by restricting presence of actively fished vertical lines when one or more of the following Marine Life Concentration thresholds within any Fishing Zone are met:

- Between November 1 and December 31, 20 or more humpback whales observed on a single survey or a running average of five or more humpback whales over a one-week period
- Between November 1 and December 31, three or more blue whales observed on a single survey or a running average of three or more blue whales over a one-week period
- Between March 1 and the end of the statutory fishing season (on or before June 30 or July 15), 10 or more humpback whales observed on a single survey or a running average of five or more humpback whales over a one-week period
- Between March 1 and the end of the statutory fishing season (on or before June 30 or July 15), three or more blue whales observed on a single survey or a running average of three or more blue whales over a one-week period
- At any time during the statutory fishing season (November 15 to June 30 or December 1 to July 15), one or more leatherback sea turtles are present

Objective 2: Through implementation of the Trap Gear Retrieval Program specified in Cal. Code Regs., Tit. 14 § 132.7, other gear recovery efforts, and improved fishing practices which result in less gear loss, reduce co-occurrence of humpback whales, blue whales, and leatherback sea turtles with lost or abandoned California commercial Dungeness crab gear throughout the Plan Area. Beginning with the first year of permit issuance, on an annual basis at least one of the following targets will be attained:

- No more than 3% of the maximum number of traps reported as deployed on bi-weekly Fishing Activity Reports will be reported as lost at the end of the season
- At least 15% of gear reported as lost during a given fishing season will be removed from the Plan Area prior to the start of the next fishing season

As further described in Sections 6.2.1 and 6.2.2, these actions will reduce opportunities for take of the Covered Species in commercial Dungeness crab gear. However, CDFW anticipates some take may still occur. CDFW has therefore developed additional objectives which aim to minimize the severity of any entanglements on the individual animal, and therefore reduce the impacts of the Covered Activity on the Covered Species as a whole. Further details are provided in Section 6.3.

Objective 3: Develop, evaluate, and require use of gear modifications which reduce severity if humpback or blue whales become entangled in commercial Dungeness crab gear (e.g., weak links, line cutters, decreased use of knots). By year seven of the permit term, at least one additional gear modification will be required when using gear with persistent vertical lines.

Objective 4: Jointly develop with NMFS safe handling procedures for leatherback sea turtles which become entangled in pot/trap gear. Upon approval by NMFS PRD, conduct annual outreach efforts encouraging their adoption by fishery participants.

Objective 5: Support rapid entanglement response efforts which minimize the severity of entanglements in gear from the Covered Activities through annual educational efforts for the fleet and consistently supporting NMFS efforts to identify the origin of gear involved in any large whale or sea turtle entanglement.

For the purpose of implementing the above objectives, CDFW will not differentiate between humpback whales belonging to the Central America or Mexico DPS.

6.1.1 Climate Change Impacts on Biological Goals and Objectives

While the specific timing, location, and magnitude of impacts are impossible to predict, climate change will likely result in physical changes to foraging grounds within the CCS as well as other ocean habitats where Covered Species transit, forage, and breed. These changes, which may include increased water temperatures and changes in upwelling patterns, may in turn affect ocean productivity, timing and biomass of spring phytoplankton blooms, and the abundance and distribution of forage species such as anchovy, krill, and brown sea nettles. Both physical and biological phenological cues are likely to affect the timing of spring and fall Covered Species migrations, and their movement patterns when present within the CCS.

The same physical and biological signals described above may also alter the timing of Dungeness crab molting and reproduction, affecting crab meat quality. Fish & G. Code § 8276.2 specifies the NMA opening cannot be delayed beyond January 15 due to low crab quality. However, if low crab quality conditions routinely persist beyond this date in the future, that requirement may change. Domoic acid events that delay the season opening, as was seen during the 2014-16 LMH event (see Section 3.1), could have similar impacts (McCabe et

al. 2016; McKibben et al. 2017). However, delays due to domoic acid should be diminished following the passage of SB80 (McGuire, 2021), which authorized a process for allowing the fishery to open under an evisceration order when only the viscera (and not the meat) have domoic acid concentrations exceeding federal alert levels. Climate change may also affect crab distribution, as warmer nearshore ocean temperatures may drive adult Dungeness crabs to seek deeper-water habitats. These changes would incentivize fishermen to move their gear into deeper water, which may alter the degree of co-occurrence between Covered Species and Covered Activities. Lastly, new research (Bednaršek et al. 2020) suggests ocean acidification is already having measurable impacts on crab larval survival and shell formation, which may reduce crab availability and have a profound effect on the future viability of the fishery.

Together, these changes will have a direct impact on co-occurrence of Covered Species with actively fished Dungeness crab gear. Given the uncertainty regarding future co-occurrence dynamics, CDFW will conduct routine assessments of marine life entanglement risk based on robust, real-time information rather than relying on static closures based on historical patterns. Recovery of lost or abandoned gear will further limit co-occurrence, even if increased frequency or severity of storms increases the overall amount of lost or abandoned gear. CDFW will also implement actions designed to minimize the impact of any entanglements which do occur.

6.2 Avoidance Measures

Avoidance measures include the actions taken in support of Objectives 1 and 2 and are designed to decrease take of the Covered Species to the maximum extent practicable by reducing the prevalence of both actively fished (Objective 1) and lost or abandoned (Objective 2) vertical lines which could entangle Covered Species within the Plan Area during times when Covered Species are known, or likely, to be present. Additional details regarding CDFW's approach to implementing these Objectives are provided in the following sections.

6.2.1 Objective 1: Risk Assessment and Mitigation Program

As described in Chapter 3, there are well-established seasonal patterns to the presence of Covered Species within the Plan Area. Humpback whales, blue whales, and leatherback sea turtles arrive during the spring or summer, and depart in the fall. Historically, this seasonality has limited overlap with the Covered Activity, and thus potential for take from entanglements in commercial Dungeness crab gear. However, research by Ingman et al. (2021) has documented increased residency of both blue and humpback whales within the Plan Area, which overlaps to a greater degree with the commercial Dungeness crab season as defined in Fish & G. Code § 8276. Additionally, as humpback whale populations increase, increasing numbers of humpback whales may persist within the Plan Area over the winter rather than migrating to southern latitudes.

To reduce co-occurrence of Covered Species and the Covered Activities, CDFW will implement the dynamic RAMP management framework. Details of this program as implemented during the phased implementation period are provided in Section 5.1; in general, CDFW will continue implementing the program as described therein. Planned changes to specific elements are described in the following subsections.

6.2.1.1 Spatial Management

During the phased implementation period, CDFW had defined seven Fishing Zones; six of which collectively comprised the Plan Area and a seventh Fishing Zone designated as the "Pacific Leatherback Sea Turtle Foraging Area" which encompassed the southern portion of Fishing Zone 2, the entirety of Fishing Zone 3, and the northern portion of Fishing Zone 4. Marine Life Concentrations were evaluated for each Fishing Zone, including Fishing Zone 6 (south of Point Conception), even though the Covered Activities occur north of Point Conception.

CDFW will use a modified spatial management approach when implementing RAMP during the permit term by establishing five Fishing Zones with the following latitudinal boundaries (see Figure 6-1):

- Zone 1: From the California/Oregon border (42° N. latitude) to Cape Mendocino (40° 10' N. latitude).
- Zone 2: From Cape Mendocino to the Sonoma/Mendocino county line (38° 46.125' N. latitude).
- Zone 3: From Sonoma/Mendocino county line to Pigeon Point (37° 11' N. latitude)
- Zone 4: From Pigeon Point to Lopez Point (36° N. latitude)
- Zone 5: From Lopez Point to Point Conception (34° 27' N. latitude)

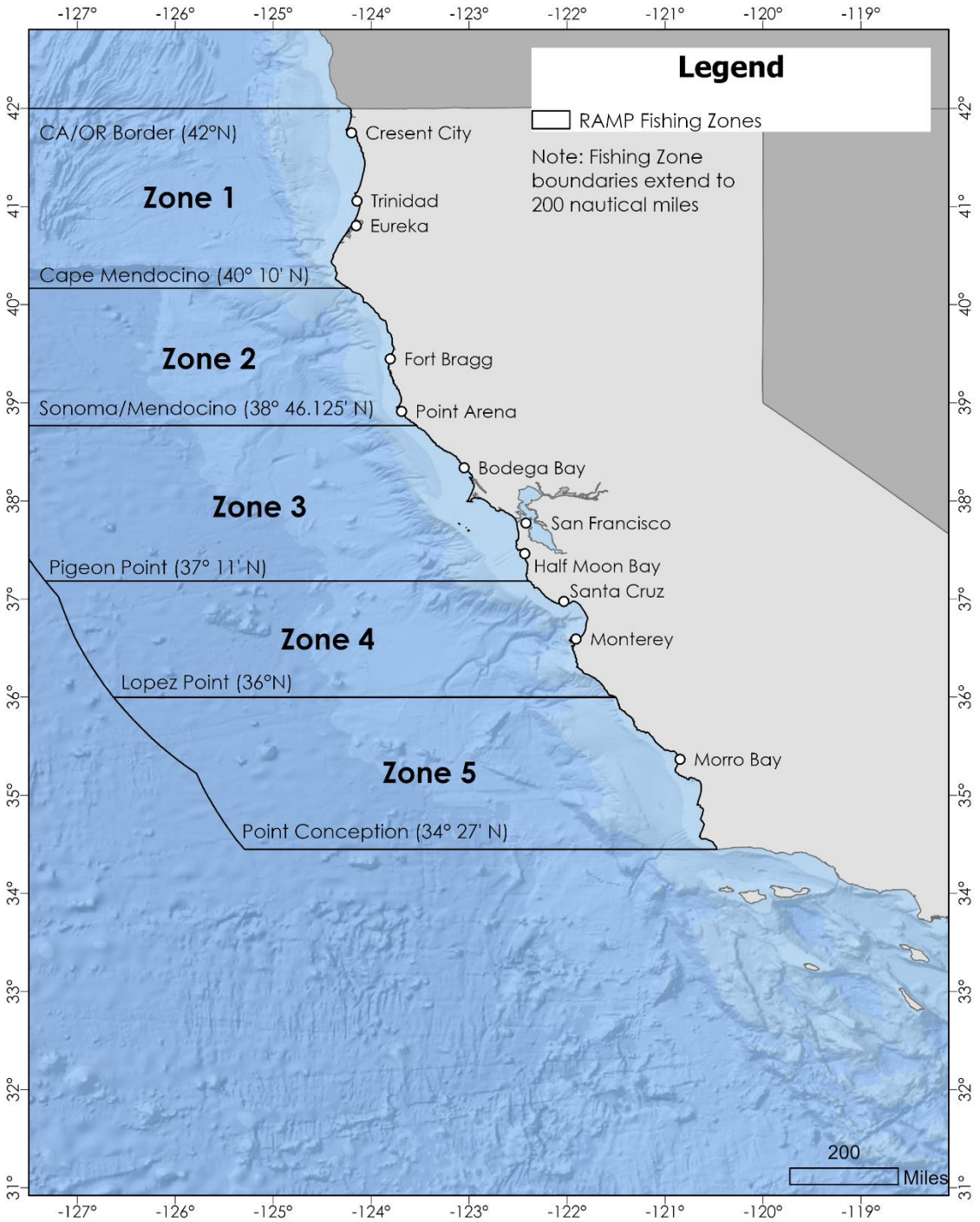

Figure 6-1. RAMP Fishing Zones boundaries. Created by CDFW MR.

Instead of defining a specific Fishing Zone focused on leatherback sea turtles, CDFW will separately define the "Pacific Leatherback Sea Turtle Foraging Area" as the area from Point Arena (38° 57. 5' N. latitude) to Point Pinos (36° 38.314' N. latitude). CDFW will utilize this area when implementing management actions designed to protect leatherback sea turtles under the RAMP, as well as the backstop measures described in Section 6.8.

Marine Life Concentrations will be evaluated within the portions of Fishing Zones 1-5 between shore and 100 fathoms (as defined in 50 CFR §§ 660.71-660.72). Further details regarding how this modified spatial management structure will be used when evaluating entanglement risk and implementing management actions are provided in Sections 6.2.1.3 and 6.2.1.4.1.

6.2.1.2 Risk Assessment Schedule

As described in Section 5.1.2, during the 2022-23 fishing season CDFW piloted a milestones-based approach to conducting risk assessments to inform the season opener in each Fishing Zone. CDFW will use a similar approach throughout the permit term. Prior to the start of each fishing season, CDFW will announce a risk assessment schedule to guide the season opener which includes the dates of each risk assessment and the duration of any associated management actions. The number and timing of risk assessments may vary between years, but will generally adhere to the process described below and illustrated in Figure 6-2:

- First risk assessment to determine whether Fishing Zones 3-5 will open as scheduled (November 15) and if so, under what conditions
    - If a management action is implemented, it will be in place until after the second risk assessment has occurred
- Second risk assessment to determine whether Fishing Zones 1-2 will open as scheduled (December 1) and if so, under what conditions; whether to maintain, modify, or lift any management actions currently in place for Fishing Zones 3-5
    - If a management action is implemented for any Fishing Zone, it will be in place until after the third risk assessment has occurred
- Third risk assessment to determine whether management actions currently in place should be maintained, modified, or lifted
    - If a management action is implemented for any Fishing Zone, it will be in place until either a specified date or after the fourth risk assessment has occurred
- Subsequent risk assessments would occur on an as-needed basis

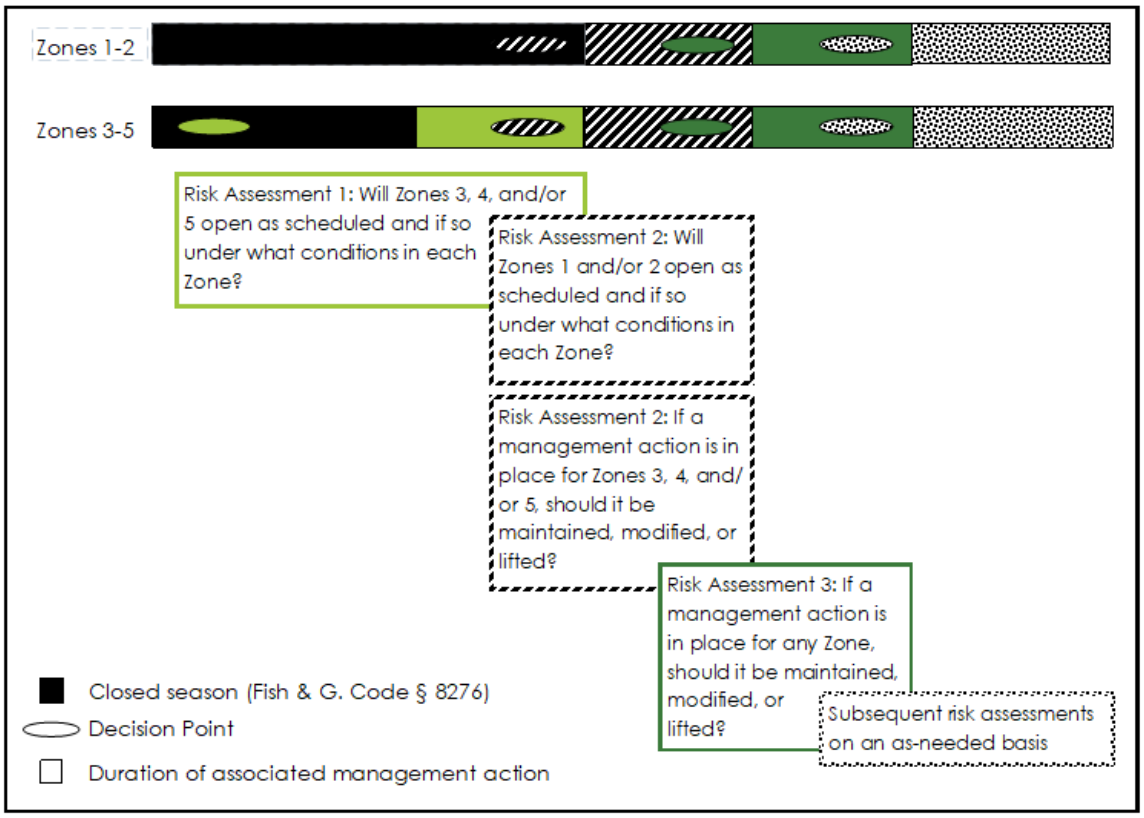

Figure 6-2. Milestones approach to the season opener. The closed season (as defined by F & G. Code § 8276) extends to November 15 for Fishing Zones 3-5 and December 1 for Fishing Zones 1-2, and is signified by a black bar. Each risk assessment consists of a decision point (during which CDFW will determine whether a management action is necessary) and the time period during which the associated management action would be in place. Decision points are signified by ovals and the timing and duration of the associated management action are signified by horizontal bars. Within a given risk assessment, the color and pattern of each shape are consistent.

6.2.1.3 Marine Life Concentration Thresholds and Data Sources

As described in Sections 5.1.3 and 5.1.6.5, during the phased implementation period CDFW relied upon a combination of aerial surveys, vessel surveys, and satellite tagging information to evaluate Marine Life Concentrations against specified thresholds for management action, and considered other types of information (including outputs from SDMs) within the context of historical migration patterns.

During the permit term, CDFW will conduct surveys from aerial and/or vessel platforms between shore and 100 fathoms in Fishing Zones 1-5 to evaluate the abundance and distribution of Covered Species. Surveys will be conducted on a monthly basis from October until the end of the Fishing Season, and during the summer and early fall as resources allow. CDFW will continue working closely with NMFS SWFSC scientists to develop data collection tools and staff training modules which would allow CDFW reconnaissance flights to more closely

replicate the systematic (distance sampling) line transect surveys conducted by NMFS.

Weather or mechanical issues may occasionally prevent CDFW from conducting these surveys. In such instances, CDFW will review and consider sources of current information regarding Marine Life Concentrations, including aerial or vessel surveys conducted by other partners. Of particular interest at the time this CP was prepared was a pilot effort by the California Coast Crab Association and The Nature Conservancy during the phased implementation period (see Section 5.1.3.2). Initial findings show promise, however further work is needed to further refine a workflow to ensure reliable data collection and data transmission to CDFW.

When conducting surveys, or considering information contributed by outside partners, CDFW will separately evaluate whether the survey covered a sufficient latitudinal and depth range of each Fishing Zone as to be a useful and reliable indicator of Covered Species presence, whether the survey used design-based transects or followed one or more depth contours, and the spacing between each transect. CDFW will also consider whether standardized methods were used, platform type, the number and placement of observers (including distance above the sea surface), observer experience level, observer affiliation (i.e., whether they are independent or whether sightings were recorded by fishery participants), transit speed, and weather conditions (e.g., swell, wind, and fog) which may have limited detection. If sufficient information is not available, CDFW will implement management actions to restrict the presence of vertical lines, as described further in Sections 5.1.5 and 6.2.1.4.

At the outset of the permit term, CDFW will generally continue the approach specified in Section 5.1.3 when determining risk based upon Marine Life Concentrations. One key change, as described in Section 6.2.1.1, is that CDFW will only evaluate Marine Life Concentrations within the portions of each Fishing Zone between shore and 100 fathoms. This will focus available resources on evaluating Covered Species distribution and presence within the areas where Covered Activities occur. However, management actions could be applied to one or more Fishing Zones (including the portions outside of 100 fathoms) as well as other portions of the Plan Area, i.e. waters south of Point Conception.

Additionally, management actions will be implemented for any Fishing Zone where a leatherback sea turtle is present as well as within the Pacific Leatherback Sea Turtle Foraging Area. Based on historical tagging and sightings data, CDFW anticipates leatherback sea turtles are most likely to be observed within this area, which encompasses all of Fishing Zone 3 and portions of Fishing Zones 2 and 4. Implementing management actions in both this area and the Fishing Zone where the leatherback sea turtle was sighted will ensure entanglement risk is abated throughout the area where leatherback sea turtles are likely to forage when present within the Plan Area.

At this time, CDFW does not plan to undertake tagging operations during the permit term. CDFW will consider any tagging information provided by NMFS and explore collaborative funding opportunities with NMFS researchers. Additionally, CDFW will explore partnership opportunities with research organizations and institutions that conduct tagging operations on Covered Species, which could allow CDFW access to real-time tagging information.

6.2.1.4 Management Actions

In alignment with Objective 1, CDFW will limit management actions to those which restrict the presence of actively fished vertical lines. Therefore, CDFW has removed issuance of a Fleet Advisory from the options specified in in Cal. Code Regs., Tit. 14 § 132.8 subd. (d). During the permit term, management actions will be limited to a depth constraint, vertical line/gear reduction, closures, and authorization of Alternative Gear. These actions will generally be implemented as described in Sections 5.1.5.2-5, except as described below.

6.2.1.4.1 Temporal and Spatial Extent

Management actions may be applied to one or more Fishing Zones, as well as other portions of the Plan Area.

Moving gear from one area to another (with a Fishing Zone closure or depth constraint) or removing a portion of fished gear (with a vertical line reduction) will require less time than fully removing all deployed gear (with closure of multiple Fishing Zones). When implementing a closure of one or more Fishing Zones, CDFW strives to fully implement a management action within three weeks of attaining a trigger. CDFW anticipates that line reductions or depth constraints could be implemented more quickly.

The Fishing Zones described in Section 6.2.1.1 were selected based on a combination of ecological and fishery characteristics and the anticipated scale of available information. As additional sources of information regarding fishing activity and distribution of Covered Species become available, CDFW may determine closures providing equivalent protections for Covered Species could be implemented on smaller spatial scales, which Welch et al. (in prep) indicates could reduce economic impacts on fishery participants.

6.2.1.4.2: Vertical Line Reductions and Alternative Gear

During the phased implementation period, CDFW specified that vertical line reductions would be accomplished by reducing the number of traps individual fishermen can deploy. In addition to requiring excess tags to be on board the vessel (see Section 5.1.5.3), CDFW has identified two potential alternatives by which gear reductions could be implemented:

- Issuance of required buoy tags in multiple colors. During periods of reduced trap use, only specified colors could be used.

- Gear check in. During periods of reduced trap use, fishermen would be required to bring the specified amount of gear ashore, where it is checked in by CDFW.

While not currently feasible, these two alternatives provide another means to enact vertical line reductions. Should these alternatives be deemed easier to implement or otherwise preferable by the fleet or CDFW than the method already in place, changes can be made using the adaptive management process outlined in Section 7.4. CDFW would evaluate the effectiveness of these changes through the holistic review process and would then initiate a rulemaking to amend the regulations (see Section 7.6.3).

Two alternative methods for reducing vertical lines which would not necessarily require reducing the amount of deployed gear are (1) replacing the traditional vertical line and surface gear with a "pop-up" system and (2) transitioning from traditional single-trap configurations to multi-trap trawls (where multiple pots are connected by a common ground line and only a subset of those traps have a vertical line attached; see Figure 2-3). At this time, CDFW anticipates these methods could be authorized under the Alternative Gear framework, as further described in Section 5.1.5.5.

Review of requests for Alternative Gear certification, the EFP review and issuance process, and ongoing conversations with East Coast collaborators have identified specific concerns related to the RAMP performance standards, which require gear be detectable, reliable, identifiable, beneficial, and enforceable (Cal. Code Regs., Tit 14 § 132.8 subd. (h)(1)(B)). These concerns must be addressed prior to certification of novel gear types (which lack persistent vertical lines) as Alternative Gear.

Detectable Criteria

- Concerns
    - Virtual gear marks only available on specific devices and through designated applications
    - Other ocean users required to identify, (in some cases) purchase, and use designated applications in order to view virtual gear marks
    - Virtual gear marking applications are designed for use with a single manufacturer's gear type, without interoperability
    - Gear operators able to adjust gear mark visibility radius, potentially preventing other ocean users from viewing the gear's location
    - Placement of gear marks is discretionary; gear operators may not place location marks in order to prevent others (including enforcement) from "seeing" their gear, or may place location marks in areas where gear isn't deployed to discourage others from fishing in a given area

    - If currents, wave action, or other vessels move gear after deployment, gear location marks set at the time of gear deployment may not reflect the gear's current position
- Options to address
    - Make software freely available on all platforms and open source
    - Develop single interoperable back-end database which contains virtual gear marks from manufacturer-specific applications
    - Allow manufacturer-specific applications to display virtual gear marks from all gear types
    - Create universal application which displays virtual gear marks from all gear types
    - Develop chart-plotter integrations for virtual gear marking applications
    - Gear location marks are generated automatically once gear leaves the vessel, without requiring user input (e.g., through scanning of an RFID geotag)
    - Condition authorization to prohibit vessels from transiting closed areas
    - Require fisher to be in close proximity of both the gear and the location mark prior to transmitting an acoustic release command
    - Integrate methods for gear location marks to automatically update when gear is moved

Reliable Criteria

- Concerns
    - Adequate number of trials to prove reliability of the release mechanism
    - Substantial testing with representative vessels under "real world" Dungeness crab fishery conditions
    - Need for extensive training prior to successful gear use
- Options to address
    - All tests conducted to date reflect a minimum 95% success release rate
    - Conduct trials throughout the statutory Dungeness crab season (November – July), including during winter storm conditions and swell events, with reliable gear recovery
    - Conduct trials throughout the Fishing Grounds, including in soft-bottomed habitats and in depths up to 100 fathoms
    - Conduct trials on board commercial Dungeness crab vessels of varying sizes and deck configurations

  - Gear is simple with easy-to-follow instructions regarding set up and use, which minimizes potential for operator error

Identifiable Criteria

- Concerns
  - Ability for CDFW to identify gear owner, gear operator, and permitting information when no surface gear is present
- Options to address
  - Agency-level access of virtual gear location marking application includes all identifying information required to be present on deployed gear, i.e. commercial fishing license number of gear operator; name and contact information for trap owner; and the Dungeness crab vessel permit number as well as the biennial period and sequence number of the issued Dungeness crab tag

Beneficial Criteria

- Concerns
  - For gear which does not rely on pop-up technology (thereby reducing the amount of time when vertical lines are present in the water column compared to traditional gear), no clear method for evaluating how the gear would reduce probability of entanglements
  - For gear with pre-set release times or when recovering on-demand gear via a back-up timed release method, proportion of time vertical lines are present in the water column compared to traditional gear will vary depending on individual fisher practices
  - The acoustic signals used to communicate with the gear could negatively impact protected species, particularly if multiple units are deployed in close proximity
- Options to address
  - Provide scientifically defensible rationale for how proposed gear would meaningfully reduce potential for entanglements to occur
  - Quantify portion of gear deployment interval where vertical lines are not present in the water column when using innovative as compared to standard gear; e.g.,
    - Switching to a lift bag inflated system without any vertical lines = 100% reduction in entanglement risk.
    - For pop-up systems which include vertical lines, any amount of time the vertical line isn't present in the water represents an improvement over baseline (traditional gear with persistent vertical lines)

  - Conduct or review scientific studies documenting low (or no) impacts of the acoustic signals used on marine mammals known to occur within the Fishing Grounds, particularly the Covered Species

Enforceable Criteria

- Concerns
  - Standardized approaches for enforcement to release and redeploy on-demand gear do not yet exist
  - CDFW patrol vessels would need to purchase technology required to release and redeploy each authorized on-demand gear type
  - Smaller CDFW patrol vessels may not have capability to retrieve and inspect gear, especially if configured in multi-trap trawls
  - LED officers would need extensive training on how to release and redeploy each authorized gear type
  - CDFW would only be able to inspect timed-release gear dockside or once the gear has surfaced
  - Current methods for ensuring gear tending as required by Fish & G. Code § 9004 are not well-suited for pop-up gear
  - User-defined gear location marks may not reflect actual gear locations, complicating enforcement of both permanent (e.g., Marine Protected Areas) and temporary (e.g., domoic acid, quality, or RAMP) closed areas
  - If currents, wave action, or other vessels move gear after deployment, gear location marks may not reflect the current gear position, preventing CDFW from accessing the gear
- Options to address
  - Generate universal access codes that allow CDFW to retrieve and re-deploy all on-demand gear
  - Technology and materials to retrieve and redeploy authorized gear are low cost, readily available, and easy to use and install
  - Develop efficient methods for dockside gear inspections prior to deployment, and require operator compliance
  - Gear location marking system maintains an automatically-generated history of gear deployments and recoveries which cannot be modified by the fisher
  - High-resolution electronic vessel location monitoring systems are in place
  - Gear location marks are placed automatically, and fisher must be in close proximity of both the gear and the location mark prior to transmitting an acoustic release command

- Recalling acoustic-release gear requires use of gear location marking application
- Integrate methods for gear location marks to update when gear is moved

During the permit term, CDFW will continue engaging in conversations with gear manufacturers and other stakeholders to better understand the current limitations of, and potential solutions for, design and adoption of novel gear types in the Dungeness crab fishery. CDFW will also routinely review and update publicly available guidance regarding appropriate methods and approaches for testing different types of innovative trap gears.

Multi-trap trawls (see Figure 2-3) are another potential method for reducing vertical lines during periods of high risk, although any entanglements which then occur may be more severe than an entanglement with a single trap. At this time, Fish & G. Code § 9012 specifically prohibits the use of multi-trap trawls in the NMA. Legislative bill analysis of AB 3337 (Hauser, 1994) indicates there were concerns about overcapitalization and excessive early-season fishing effort. More recently, Working Group members and some fishery participants have described gear conflict, gear loss, and human safety as additional reasons for prohibiting the use of multi-trap trawls in certain areas. The FGC approved an EFP testing multi-trap trawl configurations in the commercial Dungeness crab fishery in February 2023, and in the box crab fishery in June 2023. After effectiveness testing of multi-trap trawl configurations under multiple EFPs, CDFW and the California Legislature could consider future actions to authorize the use of multi-trap trawls.

As findings from EFPs and other testing efforts become available, CDFW anticipates the above concerns will be remedied, allowing CDFW to certify one or more types of Alternative Gear. If available information warrants, CDFW could issue a conditional authorization which limits use of the Alternative Gear to certain Fishing Zone(s), certain depths, or a maximum number of traps. Authorization conditions could also include notification requirements prior to gear deployment, or other conditions needed to ensure gear use is consistent with the standards and requirements of Cal. Code Regs., Tit. 14 § 132.8 subd. (h). Conditional authorizations could also specify whether gear could be used while one or more of the backstop measures described in Section 6.8 are in place. CDFW may also consider revising the RAMP regulations to expand the portion of the season where Alternative Gear can be used, including when the scheduled season opener is delayed.

6.2.1.5 Management Considerations

CDFW is committed to implementing management actions which restrict the presence of actively fished vertical lines within portions of the Fishing Grounds where Covered Species presence exceeds the thresholds defined in Section 6.2.1.3. However, experiences over the last several fishing seasons have highlighted the fact that evaluating marine life entanglement risk requires a

dynamic, flexible approach rather than relying on historical patterns alone. Furthermore, CDFW's obligation is ultimately to avoid take for all Covered Species across the entire Plan Area, and must consider how curtailing effort in one area might increase effort, and associated entanglement risk, in another.

CDFW will continue relying on the management considerations specified in Cal. Code Regs., Tit. 14 § 132.8 subd. (d) when selecting appropriate management actions. Planned modifications to the approach taken during the phased implementation period are detailed below.

6.2.1.5.1 Working Group Recommendation

During the phased implementation period CDFW supported development of Working Group recommendations by producing additional documents which exceed the requirements of the RAMP regulations (see Section 5.1.6.1). On an ongoing basis, and at least annually, CDFW will consider whether production of such documents provides a tangible benefit and may discontinue or modify such efforts at any time.

6.2.1.5.2 Economic Impact

By definition, the retrospective approach taken by Seary et al. (2022) can only be used in a post-season capacity, and is not well suited to the real-time analysis required when selecting management actions under RAMP. However, the trends indicated by such analyses (described in Section 5.1.6.4) highlight the scale of potential impacts and the need to develop specific metrics which are suited to in-season evaluation.

During the permit term, CDFW will improve the ability to conduct assessments of economic impact through utilizing the full range of management action options described in Sections 5.1.5 and 6.2.1.4, as appropriate; establishing and monitoring metrics which more fully characterize economic viability of the fleet and relevant sectors; and integrating outcomes from decision-support tools such as trade-off analyses and management strategy evaluations (see Section 7.4.1). CDFW will work closely with the Working Group and its Advisors, industry organizations, economists, social scientists, and other individuals with relevant expertise to identify additional metrics. These metrics should enhance CDFW's ability to assess impacts on the fleet as a whole, as well as on different sectors within the fishery.

6.2.1.5.3 Ocean Conditions

While specific thresholds indicating elevated risk related to the oceanographic factors described in Section 5.1.6.8 have not yet been incorporated into regulation, ongoing research efforts may allow CDFW to establish precautionary triggers in the future. Until that time, CDFW will consider historical trends when forecasting entanglement risk.

6.2.1.5.4 Fishing Season Dynamics

The fleetwide electronic vessel position monitoring required as of the 2023-24 fishing season (see Section 5.1.6.6) will greatly enhance available information regarding fishing activity and likely gear hotspots. CDFW will continue coast-wide coordination efforts with the Washington and Oregon Departments of Fish and Wildlife and PSMFC on both technical and operational aspects of electronic monitoring. When paired with Species Distribution Models (see Section 7.2.2), information gathered from electronic vessel location monitoring will support CDFW's eventual transition to evaluating risk based on explicit measures of co-occurrence (see Chapter 7). Improved evaluations of co-occurrence could also allow targeted evaluations of management measure effectiveness, as seen in Free et al. (in press) and Samhouri et al. (2021).

6.2.2 Objective 2: Gear loss

Recognizing that minimizing entanglement risk from lost or abandoned gear can be achieved through both enhanced removal efforts and decreased loss or abandonment, CDFW has included two distinct targets within Objective 2; (1) that no more than 3% of the maximum number of traps reported as deployed on bi-weekly Fishing Activity Reports will be reported as lost at the end of the season or (2) that at least 15% of the gear reported as lost during a given fishing season will be removed from the Plan Area prior to the start of the next fishing season.

The first target focuses on reducing the amount of gear lost or abandoned at sea. CDFW will implement a broad array of actions to achieve this target including continued education, continued enforcement of gear tending requirements, improved best practices, support for gear innovation, and electronic monitoring.

CDFW will continue to regularly communicate with fishery participants regarding the importance of reducing gear loss and avoiding gear abandonment. Current communication efforts include an annual pre-season newsletter mailed to all Dungeness crab vessel permitholders, as well as distributed electronically through CDFW's Marine Management News blog and posted on CDFW's Whale Safe Fisheries webpage. CDFW will also emphasize this during public meetings held prior to the start of each fishing season and in press releases and other public-facing communication efforts. Since implementation of the RAMP CDFW has noted a substantial increase in awareness regarding marine life entanglement issues amongst the fleet, media, and members of the public. CDFW believes continued education regarding the role of lost or abandoned gear in marine life entanglements is one method for making progress on this target.

As described in Section 1.3.5, Fish & G. Code § 9004 requires each trap to be raised, cleaned, and serviced at intervals not to exceed 96 hours (weather conditions at sea permitting) and that no trap shall be abandoned in the waters of the state. As with all regulations pertaining to the Covered Activity, this requirement is actively enforced by the Marine Enforcement District. CDFW will

maintain or exceed baseline levels of enforcement throughout the permit term to ensure compliance with gear tending requirements.

Adoption of pop-up gear should reduce gear loss. Because the vertical line is contained near the trap for some (or all) of the time the trap is deployed at sea, currents are less likely to move the gear away from its deployment location, increasing the likelihood that fishery participants will be able to locate the gear when they return. Use of trawls is anticipated to have a similar effect, since the heavier gear is less mobile. Certain methods of virtual gear marking, such as self-localization or use of GPS-enabled buoys, would also decrease gear loss by allowing fishers to locate their gear even if it does move from the deployment location.

Fleet-wide use of electronic vessel position monitoring (see Sections 5.1.6.6 and 6.2.1.5.4) will improve the ability of fishery participants to account for their gear during the course of the season, and will also support target 2 by allowing CDFW, Trap Gear Retrieval Program participants, and others to conduct targeted removal efforts.

CDFW will determine whether the second target has been met based on bi-weekly Fishing Activity Reports, logbooks submitted under the Trap Gear Retrieval Program, voluntary submission of documentation regarding retrieval under Cal. Code Regs., Tit. 14 § 132.2, and any documentation provided regarding retrieval activities conducted under other authorities (e.g., salvage permits issued by the NOAA Office of National Marine Sanctuaries).

Following the 2020-21 season, CDFW received documentation substantiating retrieval of 250 lost or abandoned commercial Dungeness crab traps. This represents 14% of the corrected total number of lost traps in Table 5-1 (n = 1,772). 799 traps were retrieved following the 2021-22 season, which represents 20% of the corrected total number of lost traps in Table 5-1 (n = 3,923). Gear recovery following the 2022-23 season was underway at the time of drafting, and totals are not yet available.

The numeric values selected for each target are based on what CDFW has been able to achieve during the 2020-21 and 2021-22 seasons. CDFW does not anticipate being able to substantially improve upon the gear loss or gear recovery percentages presented in Table 5-1. Given the extent of the Plan Area, and limited capacity for on-the-water retrieval operations, CDFW is largely dependent on actions taken by external parties with respect to gear tending and recovery. Selecting targets which exceed what CDFW has been able to accomplish during the past two seasons would therefore jeopardize CDFW's ability to achieve this objective.

CDFW considered, but rejected, eliminating tag replacements as an additional measure to reduce gear loss. Cal. Code Regs., Tit. 14 § 132.4 establishes three options for requesting tag replacements: in-season, between-season, and catastrophic loss. Starting 30 days after the season opener, Dungeness crab

permitholders may request replacement of up to 10% of their tier allotment at a cost of $1 per tag by submitting an In-Season Replacement Dungeness Crab Buoy Tag Affidavit (FG1303) to LRB. In-season replacement tags must be returned to CDFW prior to the start of the next fishing season. Dungeness crab permitholders can request replacement of any number of tags (up to their full tier allotment) through submission of a Between-season Replacement Dungeness Crab Buoy Tag Affidavit (FG1302) to LRB at a cost of $1 per tag. In instances of catastrophic loss, CDFW can issue replacement of any number of tags at no cost to the Dungeness crab permitholder.

Presumably, eliminating issuance of replacement tags could incentivize fishery participants to oversee deployed gear more closely and disincentivize gear abandonment. CDFW is aware fishery managers in Oregon and Washington have included this measure into their draft CPs. However, this is not a practicable option for CDFW. While these procedures and costs are specified through implementing regulations in Cal. Code Regs., Tit. 14 and could be amended through CDFW rulemaking actions, the ability of Dungeness crab permitholders to replace lost tags in some form is provided by statute (F. & G. Code § 8276.5 subd. (a)(7)). Entirely eliminating tag replacements is therefore outside the scope of CDFW's authority at this time.

6.3 Minimization Measures

Despite efforts to avoid take (see Section 6.2), CDFW anticipates some level of take will continue to occur as a result of the Covered Activities. This anticipated take is the reason CDFW is seeking an ITP. CDFW is committed to minimizing the impacts of this residual take to the maximum extent practicable, by ensuring that entanglements which do occur are less severe for the individual animal as compared to those during the 2014-2018 baseline period. CDFW anticipates that by reducing severity of entanglements at the individual level, continued operations of the Covered Activities will have decreased impacts to the associated DPS and stock.

CDFW will undertake actions in support of three objectives designed to minimize impacts of entanglements for the Covered Species – improvements in baseline fishing practices (Objective 3), supporting development and use of safe handling procedures for leatherback sea turtles (Objective 4), and support for entanglement response efforts (Objective 5).

6.3.1 Objective 3: Gear modifications

Once testing and enforcement challenges are addressed certification of Alternative Gear (see Sections 5.1.5.5 and 6.2.1.4.2) will allow for continued fishing activity during periods of elevated entanglement risk. This is an important method for providing fishing opportunity while maintaining protections for Covered Species. However, Alternative Gear is limited in the times and areas it can be deployed. Therefore, CDFW will also undertake efforts to develop and require changes to baseline fishing practices which reduce entanglement

severity. Incorporation of these modifications will reduce entanglement risk across the fishery as a whole.

Much of our understanding regarding the relationships between specific gear configurations and entanglement severity comes from forensic reviews. In 2018, PSMFC and NMFS hosted a focused workshop with fishermen, Large Whale Entanglement Response Network members, scientists, managers, and gear experts to review available forensic data and improve understanding of how a given entanglement occurs. The report generated after the workshop and reflections shared by the Working Group members in attendance have provided valuable insights. Subsequent conversations with the Working Group have highlighted potential gear modifications which are anticipated to reduce entanglement severity, including incorporation of weak links or line cutters, replacing knots with smooth splices, ensuring taut lines, and eliminating surface gear.

The "South Shore sleeve" is a method of splicing rope together where the two butt ends of the rope meet in the middle of the sleeve (Figure 6-3). This sleeve then acts as a weak link. The sleeves were designed by the South Shore Lobster Fishermen's Association and further developed and manufactured by Novabraid. On the East Coast, these sleeves are manufactured with a 1,700-pound breaking strength, the minimum breaking strength of ropes which have persisted on entangled North Atlantic right whales. The average breaking strength of ropes which have persisted on adult and juvenile humpback whales is significantly lower (Knowlton et al. 2016), indicating even weaker ropes might be needed for the California commercial Dungeness crab fishery so that whales are able to self-release by breaking the rope. Similar research has not yet been conducted for blue whales, although Arthur et al. (2015) estimated the force output for large individuals as approximately 60 kN (13.5k pounds of force). In addition to serving as weak links, connecting gear with South Shore sleeves instead of knots or splices means the rope lacks binding points which can get caught up in baleen (PSMFC 2018), increasing the likelihood an entangled whale can self-release. Due to their smaller size, the benefits for leatherback sea turtles are unknown but self-release is unlikely.

Figure 6-3. Novabraid South Shore sleeve, courtesy of Fran Recht (PSMFC).

Another potential modification is automatic line cutting devices attached to the vertical line connecting the pot and surface buoys. If it detects sustained pressures which exceed the duration or force of typical fishing operations, the device would cut the line. While the entanglement might persist, without the trap's weight the entanglement may be less severe.

A third potential modification is integrating mechanisms at either the top or bottom of the vertical line which would ensure lines remain taut within the water column. This would substantially decrease the potential for an entanglement to occur, since whales which come in contact with tight vertical lines presumably cannot get wrapped up in the line, although in-mouth entanglements could still occur if a large whale encountered the line while engaged in foraging behavior (personal communication, Pieter Folkens, September 7, 2022). One potential method for achieving taut vertical lines was developed through a 2022 University of California Santa Barbara Mechanical Engineering Capstone Project in collaboration with the Channel Islands National Marine Sanctuary. The "TightLines" proposal relies on a counterweight pulley system which automatically adjusts for swell, movement of the trap along the bottom, or other factors which would affect the amount of slack in the line and involves minor modifications to traditional commercial Dungeness crab gear (Figure 6-4). A standard vertical line is attached to the crab pot on one end and a 5-lb counterweight on the other. The pulley is created by passing the line through a stainless steel O-ring, and traditional surface gear is replaced by two buoys attached to the O-ring. The buoys are connected by a swivel which allows rotation of the lower buoy and prevents tangling of the counterweighted line with the portion of the line connected to the trap. Gear set and hauling practices are nearly identical to those used with traditional gear (Figure 6-5).

Figure 6-4. TightLines set up, courtesy of Sean Hastings (Channel Islands National Marine Sanctuary) and the University of California Santa Barbara TightLines capstone team (Connie Berdan, Connell Trainor, Daniel Tafoya, Jordan Pink, Justin Law).

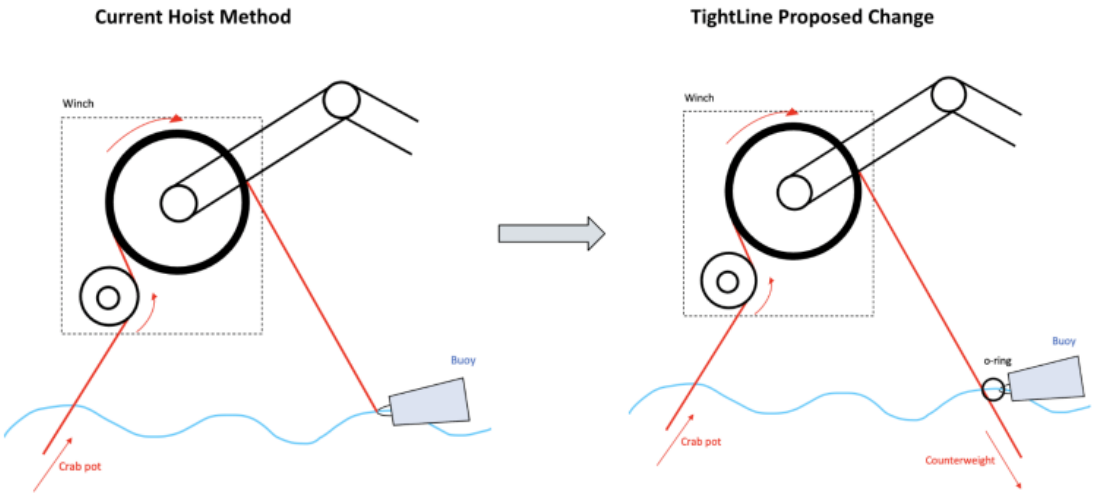

Figure 6-5. Diagram comparing hoist methods for traditional gear (left) and the TightLines modification (right). Courtesy of Sean Hastings (Channel Islands National Marine Sanctuary) and the University of California Santa Barbara TightLines capstone team (Connie Berdan, Connell Trainor, Daniel Tafoya, Jordan Pink, Justin Law).

A fourth potential modification involves eliminating surface gear by only allowing the main buoy. This would build upon restrictions already in place for the fishery, which limit fishers to two trailer buoys and include depth-dependent limitations on the amount of line between the main buoy and the last trailer buoy (see Section 2.2.2 and Figure 4-4). Trailer buoys are an important element of current fishing practices. The presence of trailer buoys is important when fishing in

deeper water or areas with strong currents, where the additional flotation is needed to ensure at least one buoy is present at the surface for retrieval. Additionally, surface gear is needed to allow larger vessels to pull the gear onboard when servicing the traps due to the height of the vessel. Given this, CDFW is unlikely to entirely prohibit the use of surface gear. However, conversations with the DCTF and other fishery participants have highlighted the fact that Dungeness crab gear can be fished reliably with a single buoy under some circumstances. Further testing may identify particular areas of the coast or portions of the fishing season which CDFW could designate as "main buoy only".

Prior to requiring fleet-wide use of gear modifications, CDFW would evaluate findings from on-the-water testing, modeling, or expert input which indicate these changes will meaningfully reduce entanglement severity. It will also be important for such findings to demonstrate these changes can be integrated across all fishery sectors (e.g. both small and large vessels) and do not increase risks to human life and safety. The options discussed above are promising, and CDFW anticipates additional ideas will come from future forensic review or gear innovation workshops. CDFW will continue to convene and participate in relevant meetings or workshops during the permit term, such as the workshop held in Sausalito during August 2022 in conjunction with the National Marine Sanctuary Foundation and OPC (NMSF 2022). Specifically, CDFW will convene or participate in at least two meetings or workshops focused on forensic review or gear innovations during the first five years of permit issuance. By the sixth year of the permit term, CDFW anticipates several potential gear modifications will have been identified and evaluation efforts will be underway.

Once a potential gear modification has been identified, it needs to be developed and tested to ensure it meets both the "effective" (i.e., meaningfully reduces entanglement severity) and "fishable" (i.e., practical and efficient across a range of sectors, and able to harvest crab) standards. Testing could occur through a variety of methods, including the EFP process described in Section 5.1.5.5. CDFW will work with interested parties to develop EFP applications related to gear modifications for the Covered Activity and, if appropriate, recommend approval by the FGC.

Once sufficient evidence accumulates that a particular gear modification is both effective and fishable, CDFW will evaluate whether requiring its use as part of baseline fishing practices can be accomplished through a CDFW-led rulemaking, whether it requires a FGC-led rulemaking, or whether it requires changes to statutory requirements. If the change requires an FGC-led rulemaking or changes to statute, CDFW will work with appropriate parties (e.g., FGC, Working Group, DCTF) to implement the change. Regardless of the method, the new requirements would likely include a compliance date which is later than the effective date of the rulemaking (e.g., the rulemaking may be effective April 1, 2028 with compliance required as of October 1, 2029). CDFW has used this approach with other rulemakings, such as the standardized trap marking regulations, in order to allow the fleet sufficient time to source the necessary equipment or materials and reconfigure their gear. In the interim,

CDFW will work with the Working Group, NMFS, OPC, and fishery participants to incorporate the proposed changes into an updated version of the Best Practices Guide (see Section 5.3).

CDFW has established a target that by year seven of the permit term, at least one additional gear modification will be required when using gear with persistent vertical lines. This encompasses changes to gear requirements in effect at the conclusion of the 2018-19 fishing season (i.e., the end of the baseline period). CDFW selected this target after considering the need to identify, develop, evaluate, and fully implement changes to baseline fishing practices. As an example, CDFW adopted regulations in October 2018 restricting the amount of line and buoys that can be attached to each trap (Cal. Code Regs., Tit. 14 § 132.6). Early on the Working Group identified excess surface gear as an issue for the fishery and the first Best Practices Guide (developed prior to the 2015-16 season) included several strategies for addressing this (e.g., adjustment of line when changing depth to minimize scope and floating line at surface). Beginning with the 2016-17 version, the Best Practices Guide featured a gear diagram with optimal trailer buoy line lengths. In spring 2018, after several seasons of voluntary best practices shared with the fleet, CDFW conducted scoping with the Working Group regarding how to best translate these recommendations into regulatory requirements. Largely informed by the trailer buoy gear diagram, the regulation added a new requirement regarding maximum allowable lengths of trailer line dependent on the depth the trap gear was deployed. The formal rulemaking process began in late spring 2018 and the regulations were finalized in October 2018, prior to the 2018-19 season. Given implementing the surface gear restrictions into regulation took over three years, the timelines involved for the EFP program, the need for thorough vetting of additional gear modifications, delayed compliance deadlines, and anticipated staff capacity, CDFW is confident at least one gear modification can be implemented by year seven of the permit term. CDFW will pursue additional changes as available information warrants and CDFW resources allow.

6.3.2 Objective 4: Safe handling procedures

Given that the only documented leatherback sea turtle entanglement in California commercial Dungeness crab gear was released alive by the reporting party, developing and promoting utilization of safe handling procedures would offer additional benefits in the unlikely event of future leatherback sea turtle entanglements. NMFS regulations and technical memoranda prepared for the Pacific Islands and Southeast Regions highlight the value of such procedures for mitigating take in longline, gillnet, trawl, and hook and line fisheries.

The 2019 NMFS Biological Opinion regarding continued authorization of the Hawaii Pelagic Shallow Set Longline Fishery anticipates up to 21 interactions with leatherback sea turtles each year (NMFS 2019a). In accordance with Reasonable and Prudent Measure Number 3 from this Biological Opinion, operators and owners of pelagic longline vessels which are active within the Pacific Islands Region are required to annually attend a NMFS protected species

workshop (50 CFR § 665.814). Furthermore, pelagic longline vessels are required to have specific mitigation gear onboard and implement safe handling procedures for any entangled turtle (50 CFR 665.812). Protected species workshops are required every three years for owners and operators of vessels which fish with longline or gillnet gear for pelagic sharks and swordfish within the Atlantic region (50 CFR § 635.8), and the Southeast Fisheries Science Center has prepared a technical memorandum detailing release protocols for turtles entangled in trawl, gillnet, fixed gear, and hook and line (including longline) fisheries (NMFS 2019b). While specific actions to release the turtle are suggested in most instances, for entanglements in fixed gear parties are advised that disentanglement should only be attempted by trained experts, and intervention should be limited to prompt notification of the appropriate regional stranding hotline.

The appropriate expertise needed to develop meaningful and beneficial safe handling procedures for leatherback sea turtles entangled in pot/trap gear lies with NMFS PRD. Therefore, CDFW will work closely with NMFS to jointly develop these procedures. Once approved by NMFS, CDFW will educate the fleet regarding these procedures and encourage their adoption on an annual basis. Should this collaborative process confirm that direct intervention by fishery participants is unlikely to benefit entangled leatherback sea turtles, CDFW will discontinue efforts to develop safe handling procedures, and instead focus on implementing Objective 5.

6.3.3 Objective 5: Entanglement response

Another way to reduce entanglement severity is through improved entanglement response efforts. Having reporting parties promptly report entanglements, document pertinent information regarding the entanglement, and monitor the entanglement until a Large Whale Entanglement Response Network team can arrive on site makes it more likely responders will be able to re-locate the entangled animal and mount a successful response. Unlike on the East Coast, where there is a designated Sea Turtle Stranding and Salvage Network which responds to sea turtle entanglements, in California members of the Large Whale Entanglement Response Network handle response efforts for both large whales and sea turtles.

Removing some or all of the entangling gear is associated with decreased rates of M&SI for humpback whales (NMFS 2020d). While this same trend has not been observed for blue whales, this may be due to a limited sample size. Additionally, the size and strength of blue whales may increase the likelihood of self-release from less severe or complicated entanglements, resulting in an observational bias towards detecting only the more severe entanglements.

Documentation collected by the initial reporting party or during an entanglement response can also support forensic reviews, which can identify best practices (see Section 6.3.1) and improve the general state of knowledge regarding gear configuration, environmental conditions, and other

circumstances which could result in entanglements. Contacting fishers whose gear is involved in entanglements therefore provides a crucial source of information for both CDFW and NMFS. CDFW will continue the follow-up actions described in Section 5.4, i.e. searching license and permitting records and conducting interviews with fishermen, for the duration of the permit.

The State of California has previously provided direct financial support to the Large Whale Entanglement Response Network. The 2015-16 and 2016-17 state budgets each included $100,000 grants to California Whale Rescue/Oceanic Society administered through the UC Davis Wildlife Health Center. In 2020 OPC appropriated $110,000 to The Marine Mammal Center. Between May 2020 and December 2022, this funding was used to reimburse vessel expenses from 48 response efforts, repair or replace specialized equipment, purchase personal protective equipment for responders, and reimburse travel costs for responders assisting with entanglement response efforts outside their home area. OPC also granted $59,101 to the National Marine Sanctuary Foundation to host Large Whale Entanglement Response trainings. While initially scheduled for summer 2020, the trainings were delayed due to the COVID-19 pandemic. In late 2022, the OPC funding was used to support trainings at both the Channel Islands and Monterey Bay National Marine Sanctuaries, with 42 and 35 participants respectively. The trainings included hands-on skill improvement for Level 2-4 responders; refreshers regarding safety protocols, operations and roles, and risk assessment; and development and discussion of Incident Action Plans for both regions. Throughout the permit term CDFW will work with OPC and the California Legislature to identify other opportunities to support operations of the Large Whale Entanglement Response Network.

Additional actions to improve reporting and documentation are described in Section 6.7.1.

6.4 Outreach, Coordination and Key Partners

Outreach to fishery participants is a crucial component of this CP. CDFW will continue routinely engaging key stakeholders on the Working Group and DCTF, as well as encouraging them to share information with the constituents they represent.

CDFW will annually distribute a pre-season newsletter which includes updates regarding implementation of this CP and any new regulatory requirements for the commercial fishery. The most recent Best Practices Guide will also be included. The newsletter will be mailed to all Dungeness crab vessel permitholders. The newsletter will also be distributed electronically through CDFW's Marine Management News blog and posted on CDFW's Whale Safe Fisheries webpage.

CDFW will hold at least one public meeting prior to the start of each fishing season. The goal of these meetings is to increase awareness of marine life entanglement issues and management actions by the fleet and broader public. CDFW will provide updates regarding implementation of the Conservation

Program and identify areas where industry collaboration and involvement is needed to increase effectiveness.

CDFW will also generate press releases, send updates via a dedicated listserv, and regularly update the Whale Safe Fisheries webpage with new developments related to implementation of the CP.

Specific efforts to coordinate with key partners are further described below.

6.4.1 NMFS

Successful implementation of this CP will require continued coordination and collaboration between CDFW and NMFS staff within the WCRO, PRD, and the Fisheries Science Centers. CDFW will continue relying on NMFS to review and confirm reported entanglements and to provide any available information regarding the appropriate attribution of those entanglements (i.e., which gear type was involved). CDFW will consider any information provided to support the in-season risk assessment and management action selection process under the RAMP, including real-time marine life concentrations information from surveys or satellite tagging operations (see Sections 5.1.3 and 6.2.1.3), analysis of historical patterns (see Section 5.1.6.5), and insights regarding ocean conditions and forage availability (see Sections 5.1.6.7 and 5.1.6.8). CDFW will work closely with NMFS to jointly develop safe handling procedures for leatherback sea turtles (see Section 6.3.2).

CDFW will also engage NMFS when conducting holistic reviews of the Conservation Plan, and when considering potential amendments to this CP and associated regulations, as described in Sections 7.4 and 7.6.

6.4.2 Tribal Governments

CDFW is committed to consulting with tribes about the potential impact of activities on tribal interests and providing meaningful opportunities to participate in decision-making processes regarding those activities. Throughout the term of the permit, CDFW will conduct consultation with tribal governments in accordance with the CDFW Tribal Communication and Consultation Policy.

6.4.3 California Ocean Protection Council

As described in Section 1.1, as the lead agency for California ocean policy OPC strategic plans and policies provide crucial guidance for the ocean conservation activities of state agencies. Of particular relevance to this CP are elements of the current OPC Strategic Plan (OPC 2020) which discuss sustainable fisheries and anthropogenic impacts on marine life, including entanglements. OPC's goal of zero annual M&SI provides overarching context for the design and implementation of this CP. OPC also provides financial resources (from bond funds and legislative appropriations) to state agencies and external parties that enhance the quality and quantity of scientific information upon which state management decisions are made. Further details are provided in Chapter 8.

Along with CDFW and NMFS, OPC was instrumental in organizing the initial public meeting on marine life entanglements in August 2015 and convening the Working Group in September 2015. Since the Working Group's inception, OPC has provided financial support for Working Group operations, strategic guidance regarding Working Group activities, and staff resources to organize meetings and document outcomes of Working Group discussions. CDFW intends to continue this collaborative relationship with OPC when implementing this CP.

6.4.4 Tri-State

Washington and Oregon have indicated that they plan to submit applications for ITPs providing coverage for their commercial Dungeness crab fisheries. While differences in each state's regulatory environment and fishery operations will be reflected in their respective CPs, California will continue routine information and data-sharing with the other two states, particularly with regard to forensic review of entanglements, gear marking and innovations, and emerging science. California will also continue participating in the Tri-State Agreement overseen by PSMFC, through which the three states routinely discuss and coordinate management actions regarding domoic acid and Dungeness crab quality as well as marine life entanglement efforts undertaken by each state's Working Group, industry, and management agency.

6.4.5 State Advisory Bodies

The expertise of Working Group members and Advisors is crucial to gathering and reviewing available information and making management recommendations to the Director under the RAMP (Section 5.1.6.1). The Working Group also provides a forum for conducting and evaluating trials of innovative gear that may reduce entanglement risk, which may be authorized as Alternative Gear (Sections 5.1.5.5 and 6.2.1.4.2) or incorporated into baseline fishing practices (Sections 5.3 and 6.3.1). A substantial amount of the Working Group's value is vested in its composition. At the time this CP was prepared, Working Group members included commercial and recreational fishermen and industry representatives, environmental organization representatives, members of the Large Whale Entanglement Response Network, and agency staff. Working Group members are appointed by the MR manager, and CDFW will undertake reasonable efforts to ensure continued representation across a diverse range of interests throughout the permit term.

While not exclusively focused on entanglement issues, the DCTF is charged with making recommendations to the California Legislature, FGC, CDFW, and other state institutions regarding the need for changes in management of the Dungeness crab fishery. As such, CDFW will keep the DCTF informed regarding implementation of this CP and may request DCTF review of adaptive management measures under consideration.

6.4.6 Fishing and Port Associations

As described earlier in this Chapter, CDFW recognizes implementation of the Conservation Measures described in this Chapter will have short-term economic impacts on the commercial Dungeness crab fishery, related industries, and coastal communities throughout central and northern California. Feedback from fishing and port associations on proposed regulations, the draft CP, and the in-season RAMP process has provided crucial insights into industry perspectives. CDFW will continue collaborating with fishing and port associations through, and in parallel to, the cross-interest Working Group process. In particular, CDFW will work with fishing and port associations to develop more detailed metrics and approaches for assessing economic impact of management actions implemented under the RAMP (Section 6.2.1.5.2); design and implementation of industry-led surveys for detecting entanglements and documenting presence, abundance, and distribution of Covered Species (Section 6.2.1.3); developing innovative gear and evaluating best practices (Sections 5.1.5.5, 5.3, and 6.3.1); and promoting recovery and reporting of lost or abandoned gear through the Trap Gear Retrieval Program and other regulatory provisions (Sections 5.2 and 6.2.2).

Additionally, CDFW will welcome continued strategic investments and other support provided by fishing and port associations to bolster implementation of the various Conservation Measures described in this Chapter, as well as broader updates to the Conservation Program through the holistic review process described in Section 7.4.

6.4.7 Environmental Organizations

During the early years of the Working Group and initial development of the various Conservation Measures described in this Chapter, conservation-oriented environmental organizations have provided valuable input. CDFW will continue collaborating with environmental organizations through, and in parallel to, the cross-interest Working Group process. In particular, CDFW anticipates environmental organizations will continue to support the development and testing of gear innovations (Section 5.1.5.5); evaluating best practices (Sections 5.3 and 6.3.1); highlighting advances in the best available science to inform the RAMP (Section 6.2.1); and promoting recovery and reporting of lost or abandoned gear through the Trap Gear Retrieval Program and other regulatory provisions (Sections 5.2 and 6.2.2).

Additionally, CDFW will welcome continued strategic investments and other support provided by environmental organizations to bolster implementation of the various Conservation Measures described in this Chapter, as well as broader updates to the Conservation Program through the holistic review process described in Section 7.4.

6.4.8 External Researchers

As highlighted throughout this CP, and particularly in this Chapter, CDFW is committed to relying upon the best available science when implementing and

evaluating the Conservation Measures which comprise this Conservation Program. CDFW will undertake targeted research efforts as resources allow, but to a large extent will rely on findings from studies conducted and funded by other parties. CDFW will encourage interested researchers to focus their efforts on implementation of the RAMP (Section 6.2.1) and developing actionable approaches to the alternative management strategies described in Chapter 7. CDFW will also highlight critical information gaps in external-focused documents such as the Science Action Strategy, which was in development at the time this CP was prepared.

CDFW has established robust working relationships with researchers at the NMFS Fisheries Science Centers and outside organizations such as Point Blue Conservation Science and Cascadia Research Collective, who serve as Working Group members and Advisors. Throughout the permit term, CDFW will build on existing relationships and explore opportunities to establish new relationships with other individual, institutional, and agency researchers focused on marine life entanglement issues in both East and West Coast contexts.

6.5 Anticipated Take During Requested Permit Term

CDFW began active in-season management to reduce marine life entanglements in the commercial Dungeness crab fishery in January 2019. The management measures implemented during the 2019-2022 period are similar to those described in this Chapter, and allow CDFW to forecast anticipated take under a fully implemented CP.

As highlighted in Sections 4.4 and 5.6, entanglements in unidentified pot/trap gear comprise approximately 50% of confirmed large whale entanglements. CDFW expects the enhanced gear marking requirements described in Section 6.7.2, as well as those implemented in Oregon and Washington, will reduce the proportion of entanglements in unidentified pot/trap gear during the permit term and increase the number of entanglements identified to specific fisheries, including California commercial Dungeness crab. Therefore, anticipating future take levels under a fully implemented CP requires CDFW to consider not only those entanglements confirmed in California commercial Dungeness crab gear, but also those entanglements which were classified as unidentified pot/trap gear during the baseline and phased implementation periods.

To better understand the percentage of unidentified gear entanglements which may have resulted from the Covered Activity, CDFW staff reviewed available information regarding active participants, number of fishable days, number of deployed traps, and gear configuration to estimate the vertical line day contributions of pot/trap fisheries operating within the Plan Area for the 2014-2022 period. As further described in Appendix C, the vertical line days metric reflects cumulative entanglement risk during a given calendar year. Analysis included the following fisheries: commercial Dungeness crab, recreational Dungeness crab (commercial passenger fishing vessel (CPFV) sector), commercial California spiny lobster, commercial rock crab, commercial coonstripe shrimp, commercial hagfish, and commercial spot prawn. Based on

available information, CDFW has determined gear deployed in the California commercial Dungeness crab fishery comprised 67.8% of vertical line days during the baseline period (2014-2018), 56.9% of vertical line days during the phased implementation period (2019-2022), and 64.2% averaged across 2014-2022.

The above proportions overestimate the contributions of the California commercial Dungeness crab fishery, as CDFW was unable to obtain sufficient information to include contributions from several other pot/trap fisheries operating within the Plan Area (see Appendix C for further details). As necessary information becomes available, CDFW will incorporate these fisheries into this analysis and refine estimates of total vertical line days as well as the relative contribution of the Covered Activity.

CDFW has selected a conservative apportionment level of 57%, which reflects the contribution of the Covered Activity to total vertical line days during the phased implementation period. CDFW has applied this apportionment to confirmed entanglements in unidentified pot/trap gear reported within the Plan Area only, rather than coastwide reports. As described in Sections 4.4.1 and 5.6.1, for entanglements with known origin locations there is a high correlation between the state where the gear was originally set and the state where the entanglement is first reported. CDFW has therefore determined it is reasonable to limit apportionment of unidentified gear entanglements to those which were first reported within the Plan Area.

Applying this 57% apportionment to the recent take levels in unidentified pot/trap gear described in Section 5.6.3 results in 13.11 additional humpback whale entanglements attributable to the California commercial Dungeness crab fishery between 2019 and 2022. Combined with the nine confirmed humpback whale entanglements in California commercial Dungeness crab gear during the same period (see Section 5.6.2), this results in an average annual total of 5.53 humpback whale takes. After applying the pro-ration factors described in Carretta et al. (2023), whereby each take of a humpback whale constitutes take of 0.42 humpback whales from the Central America DPS (and the Central America/Southern Mexico – CA/OR/WA stock) and 0.7 humpback whales from the Mexico DPS (specifically the Mainland Mexico – CA/OR/WA stock), CDFW anticipates take of 34.80 humpback whales from the Central America DPS and 58.05 humpback whales from the Mexico DPS over the requested 15-year permit term (2.32 Central America DPS humpback whales and 3.87 Mexico DPS humpback whales annually * 15 years).

There have been no confirmed entanglements of blue whales or leatherback sea turtles in California commercial Dungeness crab gear or reported off California in unidentified pot/trap gear during 2019-2022. CDFW therefore relied upon data from both the 2014-2018 baseline and the 2019-2022 phased implementation period when determining anticipated take levels.

Over the 2014-2022 period, there were four blue whale entanglements reported within the Plan Area in unidentified pot/trap gear, for a pro-rated average

annual take of 0.25 blue whales (4 blue whales * 57% apportionment / 9 years). Combined with the average annual take in California commercial Dungeness crab gear (3 blue whales / 9 years = 0.33 blue whales), this results in a total annual average take of 0.59. CDFW anticipates take of 8.85 blue whales over the requested 15-year permit term.

Over the 2014-2022 period, there was one leatherback sea turtle entanglement reported within the Plan Area in unidentified pot/trap gear, for a pro-rated average annual take of 0.06 (1 leatherback turtle * 57% apportionment / 9 years). Combined with the average annual take in California commercial Dungeness crab gear (1 leatherback sea turtle / 9 years = 0.11 leatherback sea turtles), this results in a total annual average take of 0.17. CDFW anticipates take of 2.55 leatherback sea turtles over the requested 15-year permit term.

As described further in Sections 4.1 and 6.7.2, updated and expanded gear marking for both the commercial Dungeness crab fishery and other state-managed pot and trap fisheries operating within the Plan Area are expected to improve the ability of CDFW and NMFS to attribute entanglements to their fisheries of origin. This will not only increase certainty regarding the actual amount of incidental take by the Covered Activities, but also the severity of those takes. With an increasing proportion of confirmed entanglements attributed to a given fishery, CDFW may discover the impacts of the Covered Activity are either higher or lower than currently anticipated.

6.6 Requested Allowable Take of Covered Species

CDFW is requesting the following allowable take levels of Covered Species by the California commercial Dungeness crab fishery over the permit term: 58 humpback whales from the Mexico DPS, 34 humpback whales from the Central America DPS, eight blue whales, and two leatherback sea turtles.

As shown in Section 5.6, the Conservation Measures implemented during the phased implementation period (2019-2022) have substantially reduced take of the Covered Species. Full implementation of the Conservation Program described in this Chapter may further reduce the amount of take from the Covered Activities. However, there remains uncertainty regarding the amount of take currently classified as unidentified pot/trap gear which is actually a result of the Covered Activities and the amount of take from the Covered Activities which is not currently being reported (or able to be confirmed). The restrictions described in this CP are the maximum CDFW can practicably implement to avoid take of the Covered Species and minimize the impacts of that taking. More stringent limitations are either outside the scope of CDFW's authority or would excessively impede continued operations of the California commercial Dungeness crab fishery.

For purposes of determining whether these take thresholds have been reached, CDFW will consider each confirmed entanglement of a blue whale or leatherback sea turtle in California commercial Dungeness crab gear to constitute take of an individual. In alignment with NMFS Directive 02-204-01,

when evaluating take of humpback whales relative to take limits for the Central America and Mexico DPS, CDFW will apply a two-phase approach. If sufficient documentation exists to definitively identify a source DPS for the entangled humpback whale, CDFW will assign that take to the appropriate DPS. If there is insufficient information to make a DPS determination, CDFW will use the proration factors from Caretta et al. (2023) unless improvements in best available science indicate alternative proration factors are warranted. Further details regarding assignment of humpback whale takes to the relevant DPS are provided in Section 6.7. Confirmed entanglements of Actionable Species in California commercial Dungeness crab gear will be considered take regardless of the reporting location (i.e., inside or outside of the Plan Area) or time of year (i.e., whether the fishery is currently open or closed).

CDFW's take request is framed as entanglements in gear from the Covered Activity because there is no additional take anticipated as a result of the monitoring activities described in Section 6.7. Preliminary consultations with NMFS indicated that the Conservation Program as proposed does not contain any activities which would be considered mitigation. Activities which are designed to minimize the impacts of the taking (Section 6.3) would not result in any additional take beyond those caused by the Covered Activities themselves. Implementation of gear modifications will not result in any additional take beyond that caused by the entanglement itself. Utilizing safe handling procedures would require fishers to interact with entangled leatherback sea turtles, which would expand the scope of the take but not the number of turtles taken as a result of the Covered Activity. Entanglement response activities are conducted under existing Marine Mammal Health and Stranding Permits, and CDFW involvement would not result in any additional take.

6.7 Accounting for Take Under an Issued ITP

Due to the nature of how the Dungeness crab fishery is prosecuted (i.e., fishermen set and periodically return to check gear), entanglement events are presumed to occur while gear is unattended. Unattended gear is of particular concern for cetaceans because the entangled animal is likely to swim away with the gear. This is a key distinction between the Dungeness crab fishery and other fisheries where gear is more actively tended (e.g., North Carolina gillnet fishery, Hawaii shallow set longline fishery) and take of protected species can be documented in real time, or when gear is retrieved, by fishermen or independent observers.

Therefore, during the permit term there will necessarily be some degree of uncertainty regarding the amount of take which results from the Covered Activity. However, pursuant to 50 CFR § 222.307 subd. (b)(5)(iii), CDFW must specify steps to monitor impact to the Covered Species, and 50 CFR § 222.301 subd. (i) allows NMFS to require ITP permitholders provide complete and accurate records of taking Covered Species. During pre-application consultations with NMFS, CDFW clarified that the monitoring program must both (1) increase the detection and reporting of Covered Species entanglements and

(2) require sufficient gear marking to enable identification of entanglements which occur in California commercial Dungeness crab gear.

CDFW has therefore developed a two-fold monitoring program which will improve the reporting and documentation of entanglements and improve the ability of NMFS and CDFW to identify the origins of reported entanglements. In combination, these two components will allow CDFW and NMFS to quantify incidental take of the Covered Species which occurs as a result of the Covered Activity.

6.7.1 Improving Reporting and Documentation

While the current model of opportunistic reporting does not constitute a sufficient monitoring program on its own, the more individuals who spend time on the water are aware of entanglement response procedures, the more useful these opportunistic reports will be. NMFS has developed a free online Level 1 U.S. Whale Entanglement Response training, which takes approximately one hour to complete and covers the essential elements of how to report and document marine life entanglements. CDFW will work with four groups of on-the-water users to improve reporting and documentation: CDFW staff, individuals seeking EFPs from the FGC, commercial Dungeness crab fishery participants, and other commercial or recreational ocean users.

CDFW routinely conducts at-sea research and enforcement operations throughout the Plan Area, with over 2,000 on-the-water hours each year. Prior to permit issuance, CDFW will ensure that all MR and LED staff who are conducting on-the-water research or enforcement activities have taken the Level 1 entanglement response training and immediately report any observed entanglement. Furthermore, unless it interferes with mission critical functions or poses substantial risks to human safety, CDFW vessels will standby an observed entanglement until additional trained personnel from the Large Whale Entanglement Response Network arrive on site and can initiate an entanglement response effort.

MR staff conduct technical reviews of applications for EFPs (see Section 5.1.5.5). While the FGC ultimately determines the terms and conditions which are attached to these permits, for any applications which seek to use trap gear MR staff will recommend including a requirement to take the Level 1 entanglement response training prior to commencing EFP activities. Unlike MR and LED personnel and assets, which are under the direct control of CDFW, EFP recipients are independent entities, and the FGC cannot direct the use of EFP participant's vessels and time by requiring they standby observed entanglements. However, while they are operating under the auspices of an EFP, and receiving a privilege not afforded to other members of the fishing community, it is appropriate and reasonable to ensure they have the necessary information to effectively contribute to entanglement reporting and documentation efforts within the Plan Area.

On an annual basis CDFW will provide all commercial Dungeness crab fishery participants with information regarding proper entanglement reporting procedures. Dissemination of outreach materials, and increasing the proportion of the fleet who are Level 1 responders, will ensure individuals engaged in the Covered Activities can take swift and effective actions when entanglements are observed. However, requiring fishery participants to take the Level 1 training is currently outside the scope of CDFW's delegated authority to manage the fishery.

As a public agency, CDFW oversees a broad array of communications to various commercial and recreational ocean user groups. While CDFW cannot compel action, incorporating reminders regarding proper entanglement reporting and documentation procedures into these communications will increase awareness amongst a broad swath of the ocean-going public. CDFW will work in close collaboration with NMFS WCR and PRD to develop appropriate content for inclusion in both print and electronic mailings (Table 6-1).

Table 6-1. Inventory of routine electronic and print communications distributed by CDFW to commercial and recreational ocean users.

Name	Communication Type	Description	Audience/Reach	Frequency
Commercial Fishing Digest	PDF (Posted online)	Regulations for commercial fishing in California	The commercial fishing industry and general public (CDFW sold approximately 5,600 commercial fishing licenses in 2022)	Once annually (April 1st)
Ocean Sport Fishing Regulations	PDF (Posted online)	Regulations for recreational ocean fishing in California	Recreational fishermen and general public (CDFW sold 1.6 million sport fishing licenses in 2022)	Once annually (March 1st)
Recreational Angler Update	Email	Informational email sent from CDFW that contains various fishing topics, seasons, regulatory changes, etc.	All recreational fishing license holders in California who provide their email address to CDFW (as of 8/21/2023, approximately 785,000 individuals)	Monthly
Marine Management News	Blogsite/email	A blogsite that contains a collection of marine fisheries-related blog posts, written by CDFW staff	"Blog Update" emails with links to the latest blog posts are sent to all interested parties who have signed up for the CDFW MR News Service (as of 8/16/2023, approximately 4,900 individuals)	Sporadically, as the need arises

6.7.2 Improving Gear Identification

Historically, CDFW has relied on NMFS to attribute confirmed entanglements to specific fisheries (e.g., California commercial Dungeness crab) or gear types (e.g., other trap gear). While the availability and quality of documentation has increased since 2013 (Saez et al. 2021), NMFS is unable to identify a responsible fishery or gear type for approximately 50% of confirmed entanglements reported off the West Coast. The trap limit program implemented in 2013 has made California commercial Dungeness crab gear more readily identifiable by requiring the use of buoy tags (see Sections 2.2 and 4.1). Prior to permit issuance,

CDFW will amend current buoy marking requirements for commercial Dungeness crab in alignment with those implemented for other state-managed commercial fisheries (see Section 5.4).

Establishing a line marking schema will further improve the ability of CDFW and NMFS to identify a fishery of origin for marine life entanglements. Between 2013 and 2020, approximately 47% of confirmed entanglements of unknown origin had high quality imagery which could have allowed for the detection of line marks (NMFS 2022). CDFW will coordinate with the Oregon and Washington Departments of Fish and Wildlife to implement line marking for each state's commercial Dungeness crab fishery, and consider implementation for other fisheries, prior to permit issuance. Between 2014 and 2022, 36% of humpback and blue whale entanglements reported in the Plan Area were from gear set within the Plan Area, five percent were from gear set elsewhere, and 59% were from an unknown area (NMFS WCRO Whale Entanglement Response Database as of January 6, 2023). Therefore, pursuing a coordinated, coast-wide approach to line marking is essential to appropriately attributing Covered Species take to each state's commercial Dungeness crab fishery.

Over time, CDFW anticipates these expanded marking requirements will increase the proportion of confirmed entanglements which can be attributed to a given fishery, supporting CDFW and NMFS' abilities to attribute take of the Covered Species to the appropriate fisheries, and NMFS' ability to make negligible impact determinations under the MMPA.

In addition, CDFW will develop a reference catalog of gear types commonly used in each fishery operating within the Plan Area. Currently, the best available information regarding gear used in West Coast fixed gear fisheries is NMFS 2014, although an updated version is under development (personal communication, Wendy Piniak, NMFS PRD, December 13, 2022). Should the updated NMFS product not meet CDFW's needs, CDFW will update and expand the 2014 version to account for recent changes in gear marking requirements and include additional photos and descriptions of common surface gear configurations for each fishery. An initial version of the catalog will be completed prior to permit issuance, and it will be routinely updated based on input from state and federal fishery managers, as well as gear configurations documented both dockside and at sea by MR, LED, and federal agency staff.

6.7.3 Entanglements Which Are Not Considered Take by the Covered Activity

There are several categories of entanglements which CDFW does not consider take attributable to the Covered Activity. These include unconfirmed entanglements, confirmed entanglements of unidentified species, confirmed entanglements in gear from other fisheries, confirmed entanglements in unidentified gear, and unreported entanglements. Unconfirmed entanglements are not considered for reasons described in Chapter 1 (i.e., to avoid double counting when multiple reports are received for the same entanglement, and to

ensure the entanglement involves fishing gear rather than kelp or other marine debris).

Confirmed entanglements with unidentified large whale species are relatively rare occurrences, representing just 4% (n = 21) of the 573 total confirmed entanglements between 1982 and 2022 (NMFS WCRO Whale Entanglement Response Database, shared January 6, 2023). Only two of those entanglements were confirmed in commercial Dungeness crab gear, one in 2007 and one in 2008. At this time, CDFW considers the available data too speculative to include confirmed entanglements of unidentified species when evaluating take of Covered Species. However, as with other changes to the proposed Conservation Program, should new information indicate such triggers are warranted, CDFW will consider updating this element of the CP through the adaptive management process described in Chapter 7.

Confirmed entanglements in gear from other fisheries do not reflect take from the Covered Activities, and are outside the scope of this CP. This includes confirmed entanglements reported within the Plan Area which are attributed to other state's commercial (or tribal) Dungeness crab fishery and confirmed entanglements reported within the Plan Area which are attributed to any other fishery (even if the gear originated within the Plan Area).

While CDFW considered confirmed entanglements in unidentified pot/trap gear when selecting requested take levels (see Sections 5.6.3 and 6.5), CDFW will not implement restrictions for the California commercial Dungeness crab fishery in response to confirmed entanglements which are categorized as unidentified pot/trap gear. While CDFW does consider it likely that a portion the unidentified pot/trap gear entanglements which occurred during the baseline and phased-implementation periods originated from the Covered Activities, pre-consultation discussions with NMFS indicate that the expanded gear marking which will be in place prior to permit issuance (see Section 6.7.2) is sufficient to enable reliable identification of confirmed entanglements which occur in California commercial Dungeness crab gear. Furthermore, as seen in recent analyses for the West Coast sablefish pot fishery, NMFS practice is to limit evaluation of fishery-specific take to instances where the fishery is specifically identified (86 FR 69627). Assigning a portion of the residual take in unidentified pot/trap gear to the Covered Activity would therefore be inconsistent with past practice, and is not proposed for this CP.

Regarding unreported entanglements, the entanglement reports received by NMFS represent an unknown subset of the total number of entanglements which occur. CDFW will undertake efforts to improve reporting, as described in Section 6.7.1.

6.8 Actions to Avoid Exceedance of Permitted Take Thresholds

Under the RAMP regulations, CDFW must take a management action informed by the best available science following a single confirmed entanglement of a humpback whale, blue whale, or leatherback sea turtle in California commercial

Dungeness crab gear (reported from any location). The Conservation Measures described in Section 6.2 (particularly the RAMP) are intended to avoid take resulting from co-occurrence between Covered Species and the Covered Activities. Therefore, when an entanglement does occur, CDFW will implement a management action designed to further restrict the presence of actively fished vertical lines and prevent additional entanglements.

The default management action in this instance is a Fishing Zone closure. The specific Fishing Zone(s) closed will depend on whether available information is limited to the reporting location, or also includes the location where the entanglement occurred. Regardless, the Director retains discretion to select an alternative management action after review of the most current information related to the management considerations identified in Sections 5.1.6 and 6.2.1.5. CDFW discretion is needed due to the potential for distinct risk profiles for each Covered Species and the dynamic nature of both the Covered Species and Covered Activities. For example, even when entanglements are ultimately traced to the point of origin, this may occur weeks or months later, at which point a predetermined management response may be ineffective. Alternatively, if closing particular areas in response to a humpback whale entanglement would concentrate gear in areas suitable for blue whales or leatherback sea turtles, this action could increase opportunities for take of the other Covered Species.

Furthermore, a recent analysis by Saez et al. (2022) indicates that for the 53 confirmed humpback whale entanglements reported within the Plan Area in commercial Dungeness crab gear between 2014 and 2022, 30% (n = 16) were with gear set within the same Fishing Zone as where the entanglement was reported and 34% were with gear set within either a different Fishing Zone or different state. Nearly a third of the entanglements (30%, n = 16) were known to have occurred within the Plan Area but a specific Fishing Zone could not be identified. When only the entanglement reporting location is known, there is a reasonable probability that closing the Fishing Zone where the report originated may not meaningfully address entanglement risk in the Fishing Zone where that entanglement occurred. By working through the RAMP process, CDFW can consider the full suite of available information and select an action which is appropriately informed by these complexities.

However, pre-determined management responses are necessary when the current trajectory of take indicates permitted take levels would be exceeded. Exceedance of permitted take levels could lead to NMFS formally addressing permit noncompliance by initiating an action to suspend or revoke CDFW's ITP pursuant to 50 CFR § 222.306 subd. (e). Furthermore, NMFS must conduct internal consultation every three years to determine whether the CP, as implemented, satisfies the requirements for authorization under the MMPA. If take of humpback or blue whales no longer meets the negligible impact standard, NMFS could revoke the MMPA 101(a)(5)(E) permit. CDFW has therefore identified species-specific backstop measures which will apply to traditional trap gear with persistent vertical lines, as further detailed below.

Following a cumulative total of two or more leatherback sea turtle entanglements confirmed in California commercial Dungeness crab gear (reported from any location) during the permit term, CDFW would close the remainder of the season statewide. For the remainder of the permit term, CDFW would delay the season opener until January 1 and close the season no later than June 1 within the Pacific Leatherback Sea Turtle Foraging Area (as defined in Section 6.2.1.1). As described in Section 3.4, leatherback sea turtles are most common within the Plan Area during the spring, summer, and early fall, and are rarely documented outside of the Pacific Leatherback Sea Turtle Foraging Area. Based on these migratory patterns, CDFW considers take in actively fished vertical lines could occur at both the beginning and the end of the statutory fishing season. Restricting the Covered Activities to a period during which leatherback sea turtles are rarely, if ever, present within this area (January 1 – May 31) should therefore prevent overlap between leatherback sea turtles and actively fished vertical lines. By selecting a closure date of May 31, CDFW has created a buffer period during which gear recovery efforts can remove lost or abandoned gear (see Sections 5.2 and 6.2.2), further reducing the potential for additional take to occur during the remainder of the permit term.

Following a cumulative total of two or more blue whale entanglements confirmed in California commercial Dungeness crab gear (reported from any location) during a given five-year period of the permit term, CDFW would close the remainder of the season statewide. For the remainder of the five-year period (i.e., Years 1-5, Years 6-10, or Years 11-15), CDFW would close the season statewide no later than April 1. As described in Section 3.2, while historical patterns suggest blue whales begin utilizing BIAs within the Plan Area in July and depart in October or November, recent research indicates blue whales have begun arriving at the Farallon Islands (Fishing Zone 3) in mid-May and departing in early October. Blue whales were infrequently observed on CDFW aerial surveys conducted during the 2020-21 through 2022-23 seasons (n = 19), with nearly all sightings (n = 15) during the months of October and June. Based on these migratory patterns, CDFW considers take in actively fished vertical lines to be unlikely at the beginning of the fishing season, and would not mandate actions to restrict their presence during that period. Take is more likely at the end of the fishing season during the spring and early summer. Closing the season prior to their expected arrival in the Plan Area should therefore prevent overlap between blue whales and actively fished vertical lines. By selecting a closure date of April 1, CDFW has created a buffer period during which gear recovery efforts can remove lost or abandoned gear (see Sections 5.2 and 6.2.2), further reducing the potential for additional take to occur. At the beginning of the next five-year period of the permit term, the Covered Activities would again be managed as described in Sections 6.2 and 6.3.

The presence of two humpback whale DPS units within the Plan Area complicates actions to prevent exceedance of permitted take thresholds. Section 6.6 describes the approach by which CDFW will work with NMFS to assign takes to the appropriate DPS, but as described in Section 4.3 such assignments are unlikely to be done in real time. Given the lower requested take limit for the

Central America DPS, CDFW will therefore implement backstop measures as though each confirmed take constitutes take of a humpback whale from the Central America DPS. This highly precautionary approach will only be used to allow for timely implementation of backstop measures.

Following a cumulative total of eleven or more humpback whale entanglements confirmed in California commercial Dungeness crab gear (reported from any location) during a given five-year period of the permit term, CDFW would close the remainder of the season statewide. For the remainder of the five-year period, CDFW would delay the season opener until at least January 1 in each Fishing Zone and close statewide on March 1. As described in Section 3.3, historical patterns suggest humpback whales begin utilizing BIAs within the Plan Area in March and depart in November. Humpback whales were frequently observed on CDFW aerial surveys conducted during the 2020-21 through 2022-23 seasons (n = 547), with the vast majority observed during October and November (n = 405, 74%), and more limited numbers in December (n = 42, 8%). Delaying the season opener to January 1 should therefore prevent most overlap between humpback whales and actively fished vertical lines from the Covered Activity during the fall period. CDFW aerial survey coverage has been more limited during the spring period, however humpback whale BIA usage suggests they are commonly observed within the Fishing Grounds (Fishing Zones 1-5) beginning in April. Closing the season prior to their expected arrival in the Plan Area should therefore prevent overlap between humpback whales and actively fished vertical lines. By selecting a closure date of March 1, CDFW has created a buffer period during which gear recovery efforts can remove lost or abandoned gear (see Sections 5.2 and 6.2.2), further reducing the potential for additional take to occur. At the beginning of the next five-year period of the permit term, the Covered Activities would again be managed as described in Sections 6.2 and 6.3.

In all instances, the season delays and early closures would apply to traditional trap gear which is fished with persistent vertical lines. CDFW anticipates certain types of Alternative Gear could be fished in a manner which poses little to no risk of entanglements. For such gear types, the conditional authorization would specify the manner in which the gear could be fished while a backstop measure is in place.

These backstop measures ensure CDFW will be responsive to entanglements which are reported or confirmed after the close of the season by constraining the Covered Activities to lower risk times and areas during future fishing seasons. This is particularly important given the potential for days, weeks, or even months to pass between when an entanglement occurs and when it is reported and confirmed. As described in Section 5.2, the vast majority of confirmed large whale entanglements are presumed to occur in actively fished gear. Therefore, CDFW presumes that in general, entanglements which are reported after the end of the season occurred in actively fished gear with a lag between entanglement occurrence and reporting. As noted in Section 5.6.2, there have been nine confirmed entanglements of Covered Species in California

commercial Dungeness crab gear during the phased implementation period (2019-2022), four of which were reported when the fishery was closed statewide (August 1, 2019; August 7, 2019; October 23, 2019; June 9, 2021) and four of which were reported when the fishery was open in one of more Fishing Zones (May 16, 2020, March 11, 2022, March 19, 2022, March 28, 2022). The last entanglement was documented on February 13, 2022 (while the fishery was open in one or more Fishing Zones) but was not reported until February 23, 2023 (well after the close of 2021-22 fishing season).

These backstop measures are not codified in regulation. However, Cal. Code Regs., Tit. 14 § 132.8 subd. (c)(1)(B) specifies CDFW will take action following each confirmed entanglement of a Covered Species and Cal. Code Regs., Tit. 14 § 132.8 subd. (d)(9) specifies CDFW will consider the magnitude and accumulation trend for confirmed entanglements when selecting an appropriate management action. Taken together, these two provisions grant CDFW the management authority necessary to implement the backstop measures described above.

The interval over which the backstop measures would apply differs between leatherback sea turtles and large whales. For leatherback sea turtles, the requested take limit (two) is so low that measures would need to be in place over the remainder of the permit term. CDFW is requesting higher take limits for blue and humpback whales, and measures would be in place over the remainder of a given five-year period. For these species, the backstop measures prevent take from accumulating too quickly. CDFW would then undertake a holistic review of the Conservation Program to identify appropriate changes to status quo management which should be implemented prior to the start of the next five-year period (see Figure 7-1 and Section 7.4).

6.9 Anticipated Impacts of Taking

Pursuant to ESA, an ITP can only be issued if the proposed activities will not jeopardize the continued existence of any listed species (16 USC § 1536 subd. (a)(2)), among other requirements. Jeopardy exists when an agency action reasonably would be expected, directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild (50 CFR § 402.02). For humpback and blue whales, the requested take must also satisfy requirements of the MMPA.

In the following sections, CDFW describes anticipated impacts of the requested take on each Covered Species, including effects on their designated critical habitat.

6.9.1 Anticipated Impacts of Taking Blue and Humpback Whales

Large whale entanglements in pot/trap fishing gear, including commercial Dungeness crab, can have a variety of outcomes ranging from little or no impact to mortality. NMFS (2012) highlights this fact and describes the process for evaluating fishery impacts for the purpose of evaluations under the MMPA,

which involves categorizing a given entanglement as resulting in either non-serious injury, serious injury, or morality. Injuries in the latter categories are often grouped together and referred to as M&SI.

As described in NMFS (2012), entanglements involving constricting wraps (L2) can cause lacerations, partial or complete fin amputation, organ damage, or muscle damage and interfere with mobility, feeding, and breathing. In addition, constricting wraps trigger a stress response, and elevated cortisol levels could tax the immune system and make the whale susceptible to infection. L2 entanglements are therefore considered a serious injury. Entanglements which consist of a lose wrap (L3) can result in tissue damage but do not elicit the same immune response, and are considered a non-serious injury.

Even for L3 entanglements, or L2 entanglements with successful self-release or human intervention which enables removal of some or all of the gear, it is reasonable to conclude the whale has suffered some degree of harm. While there is limited information focused on humpback or blue whales, the question of sublethal impacts from entanglements has been well studied in the North Atlantic right whale. Given plausible differences in morphology, physiology (including immune response), locomotion, and other biological aspects, it is imprudent to assume humpback and blue whales respond to stressors in an identical manner as North Atlantic right whales. However, this well-studied species is the closest proxy available, and the general principles deducted from this research likely apply to other large whales.

The most severe outcome from a given entanglement event is mortality. Cassoff et al. (2011) conducted an extensive review of mortality reports for four baleen whale species, including both North Atlantic right whales and humpback whales. Among stranded carcasses with evidence of entanglement, causes of death included asphyxia, starvation, systemic infection, hemorrhage, and debilitating tissue damage. Cassoff et al. (2011) concluded asphyxia is more likely in smaller whales (e.g. juveniles), but is possible in whales of any body size if the extent, weight, and strength of entangling gear are sufficient. Drowning is more likely for complex entanglements, where gear is affixed to multiple body parts. Starvation can occur either as a result of impaired locomotion or the direct disruption of feeding mechanics when gear is present in or around the mouth. Systemic infection can be caused by the loss of epithelial protection or chronic stress levels which weaken the immune system. Gear induced wounds may be up to 20 cm deep, cutting through blubber, tissue, and even into bone.

For entanglements which do not result in mortality, the outcomes are more variable. From a biomechanical perspective, sublethal entanglements subject whales to additional drag forces, increasing the amount of energy required to propel an individual through the water (van der Hoop et al. 2017). Over time, overcoming these increased drag forces can consume the same amount of energy as is needed to complete seasonal migrations, and (for females) nearly as much as is required to gestate and wean a calf. The specific health impacts of a given entanglement are affected by the timing relative to available energy

reserves. Van der Hoop et al. (2017) also found that the duration of an entanglement, more than the amount of drag imposed by the entanglement configuration, had stronger health effects and was a better predictor of post-entanglement survival; i.e., more rapid human intervention or self-release led to higher survival. These increased energetic costs can also result in thermal stress associated with blubber loss (Lysiak et al. 2018).

Increased energetic demands associated with entanglements can also impair reproduction. With increasing entanglement severity, whales spend a greater proportion of time with body condition below that required for calving, and have an increasing likelihood of mortality (i.e., lower survivorship). Knowlton et al. (2022) also found that for a given level of injury severity, females had lower survival than males. Entanglement in fishing gear is associated with decreased body length of both entangled individuals and (if present) their dependent calves (Stewart et al. 2021). Because shorter whales also display decreased reproductive output (Stewart et al. 2022), the impact of a given entanglement can cascade across generations.

NMFS 2020d calculates an average M&SI rate of 0.76 for humpback whales entangled in California commercial Dungeness crab gear (where gear was not removed through human intervention), and an average M&SI rate of 0.92 for blue whales entangled in Dungeness crab gear. Therefore, the requested take (see Section 6.6), would equate to removal of 25.84 humpback whales from the Central America DPS and 44.08 from Mexico DPS, with the remaining entanglements resulting in non-serious injury. Similarly, the requested take of eight blue whales over the permit term would equate to removal of 7.36 whales. These removals represent a marginal proportion of the minimum population estimates (see Sections 3.2-3.3 and Table 6-3 below).

Table 6-2. Anticipated impacts of the requested take for blue and humpback whales. N_{min} reflects the minimum population estimates from Carretta et al. (2023). Requested Take is as described in Section 6.6. To calculate Anticipated Removals, CDFW multiplied Requested Take by the average M&SI values described above. Proportional Impact of Anticipated Removals is calculated by dividing Anticipated Removals by N_{min}.

Species – DPS	N_{min}	Requested Take	Anticipated Removals	Proportional Impact of Anticipated Removals
Blue whale	1,767	8	7.36	0.42%
Central America/Southern Mexico – CA/OR/WA stock	1,284	34	25.84	2.02%
Mainland Mexico – CA/OR/WA stock	3,185	58	44.08	1.38%

However, as detailed above, even instances of entanglement deemed to be a non-serious injury can trigger stress responses and potentially impact growth and reproduction of not only the entangled individual but, for entangled females, any subsequent offspring. Therefore, a full accounting of the impacts of the taking for these species must consider not only entanglements which result in M&SI but also those which result in non-serious injuries.

6.9.2 Anticipated Impacts of Taking Leatherback Sea Turtles

CDFW's requested take level is two individuals over the 15-year permit term, and CDFW anticipates that each sea turtle interaction will result in removal from the population. This is a conservative assumption, given that the single known instance of a leatherback sea turtle entangled in Dungeness crab trap gear was released alive; however, given the poor stock status for this species, CDFW is taking a precautionary approach. CDFW evaluated the impact of the removal of two individuals by examining what percentage of the female and adult nesting population of leatherback sea turtles the individuals represented. CDFW used recent population estimates from NFMS and USFWS (2020b) and the annual decline in Martin et al. (2020a) to estimate the total and adult nesting populations, then divided the requested take by the predicted populations to determine what percentage it represented.

CDFW chose to examine the impact of take on the female and adult nesting populations of West Pacific leatherback sea turtles based on past surveys of the Plan Area and life history knowledge. Aerial and vessel surveys of the CCS, conducted since the 1990s, have never recorded juveniles (personal communication, Scott Benson, NMFS SWFSC, March 21, 2023; Benson et al. 2020). Thus, any leatherback sea turtles taken in the Plan Area will likely be adults or sub-adults. West Pacific leatherback sea turtle mating strategies make females the greatest determiner of future fecundity. Male West Pacific leatherback sea turtles are capable of fertilizing multiple clutches of eggs and females can have multiple clutches per season (NMFS and USFWS 2020b). West Pacific leatherback sea turtles also exhibit female skewed temperature-dependent sex determination (TSD). Tomillo and Spotila (2020) suggests that TSD developed as an adaptation to increase future fecundity (by producing more females) and species resilience in warming climates. Tomillo et al. (2015) notes that as climate change intensifies a significant reduction in the male population would render this adaptation ineffective. However, best available science suggests female West Pacific leatherback sea turtles are the limiting factor in reproduction.

NFMS and USFWS (2020b) recently estimated an adult nesting female population of 1,277 from Jamursba-Medi and Wermon, Papua Barat, Indonesia, based on nesting surveys and long-term modeling. In contrast, Martin et al. (2020a) estimated a smaller adult female population of 666 to 942 (95% CI) based on the same nesting surveys and Bayesian state-space model analyses. Unlike NFMS and USFWS (2020b), Martin et al. (2020a) calculated estimates for months with no surveys through predictive modeling, and CDFW determined the Martin et al. (2020a) estimates represent best available science for the purposes of this analysis. Jamursba-Medi and Wermon are the main two beaches utilized by nesting adults (Benson et al. 2011), and estimates suggest that they host 50-75% of the West Pacific DPS (NFMS and USFWS 2020b; Tapilatu et al. 2013). CDFW applied this proportion to the most conservative female nesting population estimate from Martin et al. (2020a), 666, resulting in a total West Pacific female nesting population between 888 and 1,332. Benson et al. (2011) and the IUCN (Tapilatu and Tiwari 2007) tagged nesting individuals and conducted mark-

recapture studies, concluding that the population sampled showed a 3:1 female-to-male ratio. Adults and sub-adults foraging in the temperate waters off the West Coast of North America were recorded to have the same 3:1 female-to-male ratio (Benson et al. 2011). CDFW applied this ratio to nesting female abundance to estimate an adult male population between 296 and 444 individuals. Combining these estimates results in a total population of adult nesting West Pacific leatherback sea turtles of 1,184 to 1,776 individuals for 2020. (Table 6-3).

Table 6-3. West Pacific leatherback sea turtle population estimates for 2020.

Year	Female leatherback sea turtle estimated population size range (median)	Total adult leatherback sea turtle estimated population size range (median)
2020	735-1103 (914)	1,184-1,776 (1,480)

With regards to the current population trajectory, NMFS conducted a Population Viability Analysis (PVA) for West Pacific leatherback sea turtles which simulated the annual rate of decline of nesting adults for a 100-year projection with or without fishery related take from the Hawaii shallow-set longline, Hawaii deep-set longline, and American Samoa longline fisheries (Martin et al. 2020a, 2020b). The PVA indicated that in 2020 the population of adult nesting leatherback sea turtles was declining at a rate of 6.1% per year (95% CI: - 23.8% to 12.2%). Tapilatu et al. (2013) and Benson et al. (2020) had similar results, estimating an annual decline at the two Indonesian beaches of 5.9% and 5.6%. The NMFS PVA also indicated a shift in population trajectories before and after 46 years (95% CI: 13 to 95), Before this threshold, there was no significant difference in population trajectories between models which included fishery-related take and those which did not include fishery-related take. CDFW therefore considers it unlikely that the requested take will exacerbate the current trajectory of population decline, and that the 6.1% population decline can be reasonably used to estimate expected declines over the permit term.

CDFW applied the 6.1% decline rate to the current adult nesting and female nesting population estimates to calculate future population estimates in 2025 (anticipated timing for permit issuance) and 2040 (anticipated end of the permit term; Table 6-4).

Table 6-4. West Pacific leatherback sea turtle population estimates for 2025 (anticipated permit issuance) and 2040 (anticipated end of the permit term).

Year	Female leatherback sea turtle estimated population size range (median)	Total adult leatherback sea turtle estimated population size range (median)
2025	648-972 (806)	864-1296 (1,080)
2040	252-378 (314)	336-504 (336)

Even when considering the lowest population estimates, the removal of two individual leatherback sea turtles would represent less than 0.8% of the adult and female nesting West Pacific leatherback sea turtle population (Table 6-5). CDFW's requested take of two animals represents a negligible percentage; given this, the current status of the species, and the cumulative impacts described in Section 6.10.2, the requested take will not significantly alter the recovery, or survival of the species.

Table 6-5. The estimated percentage of the adult and female nesting populations that the proposed take of two leatherback sea turtles represents.

Year	Percentage of Female Nesting Population	Percentage of Adult Nesting Population
2025	0.21% - 0.31% (0.25%)	0.15% - 0.23% (0.19%)
2040	0.53% - 0.80% (0.64%)	0.40%- 0.60% (0.48%)

CDFW considered and rejected an alternative approach that utilized Local Limit Refence Points (LLRPs), which are analogous to PBR for marine mammals to evaluate impact. While PBR is only calculated for marine mammals, Curtis et al. (2015) adapted the PBR concept to leatherback sea turtles by calculating LLRPs. The LLRP approach estimates the maximum amount of anthropogenic mortality along the West Coast which would still allow for recovery of this species. LLRPs were calculated for three distinct conservation outcomes: (1) allowing the population to rebuild to the maximum net productivity level, (2) limiting delay of, or expediting, population rebuilding, and (3) preventing further population decline. At that time, Curtis et al. (2015) noted estimated abundance was approximately 10% the size prior to anthropogenic impact. While more recent publications do not provide a directly comparable value, there is evidence of continued decline in nesting females (NMFS and USFWS 2020b) as well as animals foraging off California (Benson et al. 2020).

While Curtis et al. (2015) provides specific thresholds against which CDFW could evaluate requested take, NMFS has not yet adopted any of these values or provided guidance on their applicability to analyzing impacts under ESA. The Curtis et al. (2015) LLRPs apply to take from all sources (similar to PBR) rather than to take from a given activity (as is typical for ITPs). Furthermore, both Curtis et al.

(2015) and more recent USFWS and NMFS documents acknowledge the outsized influence of anthropogenic pressures occurring outside of the Plan Area (particularly those affecting nesting beaches) on the continued decline of this species (NMFS and USFWS 2020b; NMFS 2021a). Even if all take within the EEZ were kept below these LLRP values, without substantive actions at the international level to promote recovery, Benson et al. (2020) and the recent ESA status review (NMFS and USFWS 2020b) forecast declines in this population. CDFW has therefore decided against directly evaluating requested take of leatherback sea turtles against the Curtis et al. (2015) LLRP values when considering potential impacts.

6.9.3 Effects on Covered Species Habitat

Specific areas of particular importance for each Covered Species are reviewed in Sections 3.2-3.4. Additionally, critical habitat has been designated for humpback whales (see Section 6.9.3.2) and leatherback sea turtles (see Section 6.9.3.3).

6.9.3.1 Blue Whales

The Covered Activities are not anticipated to impact blue whale habitat. Use of the gear may damage the benthic environment (see Section 2.2.2), however blue whale habitat is generally considered to include the pelagic portions of the water column. Trap gear is not an effective means of harvesting blue whale prey species, and is not deployed at densities which would prevent movement through the Plan Area.

NMFS has neither proposed nor adopted critical habitat designations for blue whales, and CDFW is unable to assess the impact of the Covered Activities on blue whale critical habitat. However, the current recovery plan (NMFS 2020c) highlights the importance of additional research to document important habitat through satellite tagging, surveys, and environmental modeling.

6.9.3.2 Humpback Whales – Central America DPS and Mexico DPS

NMFS designated critical habitat for three DPS units of humpback whales (Western North Pacific, Mexico, Central America) on April 21, 2021 (86 FR 21082). Critical habitat for the Mexico and Central America DPS includes most waters off California, with nearshore boundaries defined by the 15, 30 or 50-meter isobath and the offshore boundaries defined by the 2,000, 3,000 or 3,700-meter isobath (Figure 6-6). Presence of key prey species within known humpback whale feeding areas of sufficient quality, abundance, and accessibility to support feeding and population growth is an essential feature of this designation. CDFW is unaware of any direct evidence that the Covered Activities will affect the quality, density, or accessibility of humpback whale prey. Therefore, CDFW concludes the Dungeness crab fishery is unlikely to negatively impact critical habitat for humpback whales.

The Covered Activities are not anticipated to impact other aspects of humpback whale habitat. Use of the gear may damage the benthic

environment (see Section 2.2.2), however humpback whale habitat is generally considered to include the pelagic portions of the water column. Trap gear is not deployed at densities which would prevent movement through the Plan Area.

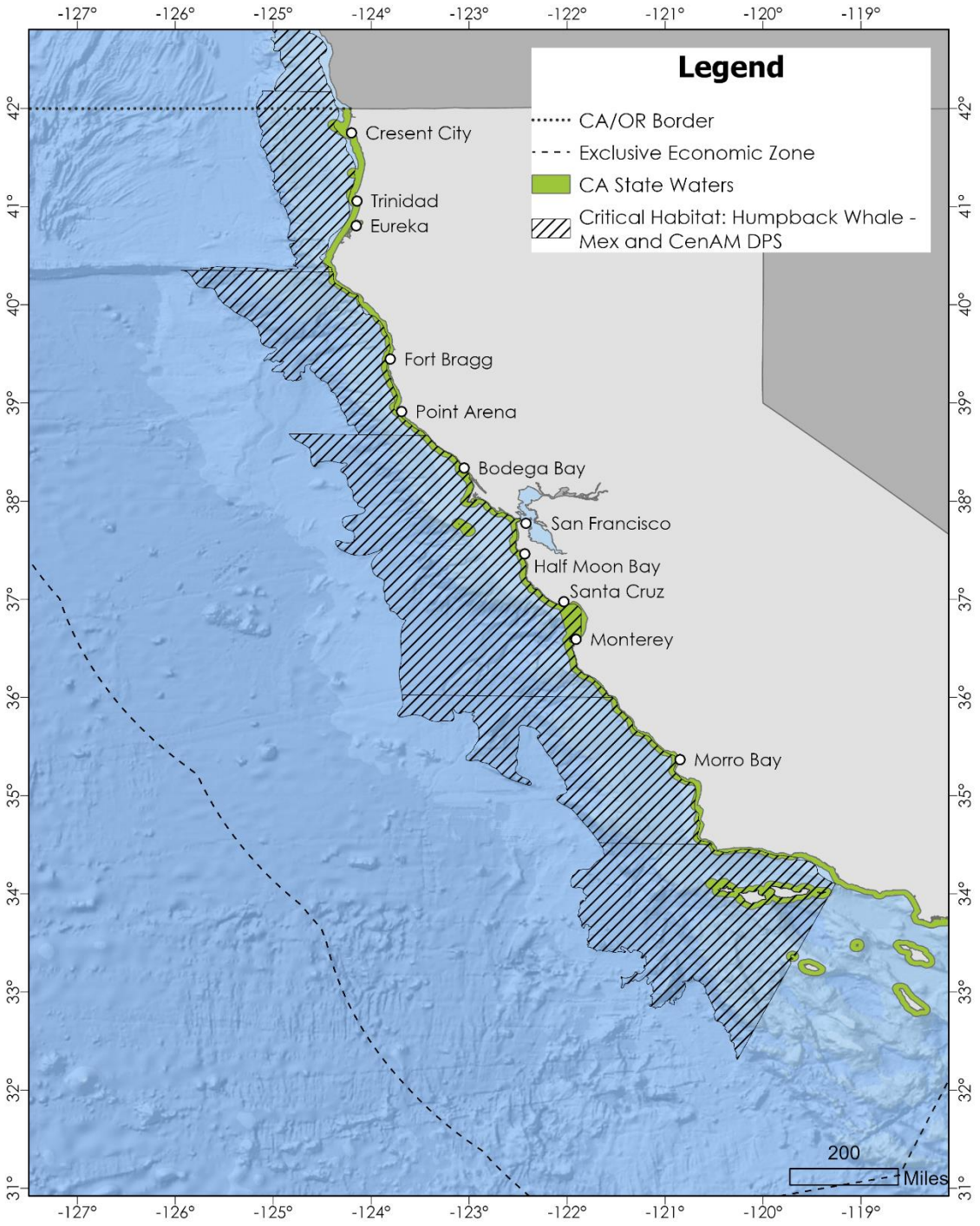

Figure 6-6. Designated critical habitat for the Mexico DPS and Central America DPS of humpback whales off California.

6.9.3.3 Leatherback Sea Turtles

Leatherback sea turtle critical habitat (Figure 6-7) was most recently revised on January 26, 2012 (77 FR 4169). The portion off California includes ocean waters east of the 3,000-meter depth contour from Point Arena to Point Arguello. Critical habitat has also been designated off Oregon and Washington. Oceanographic features which provide consistent foraging areas with sufficient density of preferred prey (brown sea nettles) were the primary driver of this designation. CDFW is unaware of any direct evidence that the Covered Activities will affect the quality or density of leatherback sea turtle prey. Therefore, CDFW concludes the Dungeness crab fishery is unlikely to negatively impact critical habitat for leatherback sea turtles.

The Covered Activities are not anticipated to impact other aspects of leatherback sea turtle habitat. Use of the gear may damage the benthic environment (see Section 2.2.2), however leatherback sea turtle habitat is generally considered to include the pelagic portions of the water column. Trap gear is not deployed at densities which would prevent movement through the Plan Area.

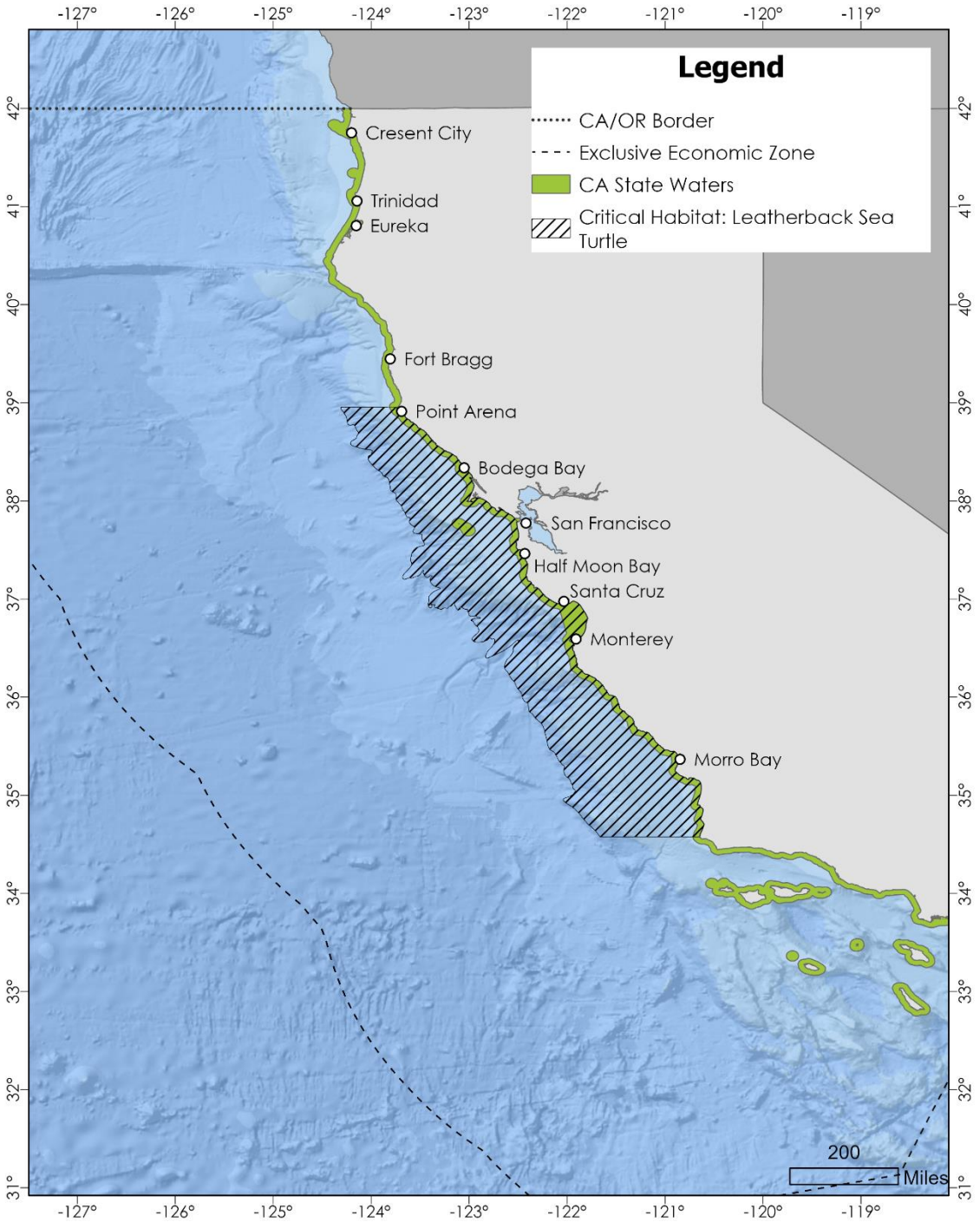

Figure 6-7. Designated critical habitat for leatherback sea turtles off California.

6.10 Cumulative Effects and Impacts

Under Section 7 of ESA, NMFS is required to consider cumulative effects of future, non-federal activities which are reasonably certain to occur within the action area of the Federal action (i.e., issuance of the requested permit) subject to consultation (50 CFR 402.02 and 402.17 subd. (a)). This is distinct from the NEPA requirement to consider cumulative impacts on the environment which result

from the incremental impact of the action when added to other past, present, and reasonably foreseeable future federal and non-federal actions (40 CFR 1508.7). Analyses of cumulative impacts (under ESA) and cumulative effects (under NEPA) fall within the purview of NMFS and are not required elements of a CP developed pursuant to Section 10(a)(1)(B) of ESA. Here, CDFW briefly reviews anticipated future activities within the Plan Area which NMFS may incorporate into their analyses of cumulative impacts or cumulative effects.

CDFW anticipates both new and ongoing activities will contribute to climate change effects within the Plan Area. However, differentiating between impacts caused by baseline global climate change and those which result from specific future actions is not feasible. Therefore, CDFW has included an overview of potential climate change impacts on Covered Species within the Plan Area in Chapter 3, and on the goals and objectives for this CP in Section 6.1.1.

6.10.1 Cumulative Effects and Impacts on Blue and Humpback Whales

Pursuant to MMPA, NMFS routinely prepares stock assessment reports for marine mammals under their jurisdiction, including large whales. These reports reflect the best available information regarding past and present anthropogenic impacts within US waters that are known to cause M&SI to members of a given stock. Carretta et al. (2023) identifies vessel strikes and entanglements in fishing gear as sources of M&SI for blue and humpback whales (Table 6-6). Mean annual M&SI is estimated as 13 for blue whales, 13.4 for Central America DPS humpback whales, and 22.1 for Mexico DPS humpback whales.

Table 6-6. Known sources of anthropogenic mortality for blue and humpback whales between 2016 and 2020, adapted from the 2022 U.S. Pacific Marine Mammal Stock Assessments (Carretta et al. 2023) and Carretta et al. (2022). Commercial and tribal pot/trap fisheries includes Dungeness crab, sablefish, and spot prawn. Recreational trap/pot includes Dungeness crab and spot prawn. Unidentified fisheries includes unidentified pot/trap fisheries. Mean annual M&SI numbers may differ slightly from those presented in Carretta et al. (2023) due to rounding.

Sector	Total (Mean Annual) M&SI: Blue Whales	Total (Mean Annual) M&SI: Humpback Whales – CenAm DPS	Total (Mean Annual) M&SI: Humpback Whales – Mex DPS
Commercial and Tribal Pot/Trap Fisheries	3 (0.6)	22.7 (4.5)	37.8 (7.6)
Commercial and Tribal Gillnet Fisheries	0 (0)	3.8 (0.8)	6.3 (1.3)
Hook & Line Fishery	0 (0)	0.4 (0.1)	0.7 (0.1)
Non-Fishery Entanglement	0 (0)	0.4 (0.1)	0.7 (0.1)
Recreational Pot/Trap	0 (0)	1.3 (0.3)	2.1 (0.4)
Unidentified Fishery	6 (1.2)	29.8 (6)	49.7 (9.9)
Ship Strikes	4 (0.8)	5.9 (1.2)	9.8 (2)
Unidentified whales, pro-rated	Unknown	2 (0.4)	3.3 (0.7)
Total	13 (2.6)	65.9 (13.4)	110.4 (22.1)

Carretta et al. (2023) notes that the M&SI values above likely underestimate total impacts from both ship strikes and fishery interactions due to incomplete detection. Rockwood et al. (2017) used an encounter theory model to estimate annual ship strike mortality as 18 blue whales and 22 humpbacks. Applying the DPS pro-ration factors results in an annual M&SI estimate of 9.2 Central America DPS humpback whales and 15.4 Mexico DPS humpback whales, far higher than the estimates in Table 6-6. Although standardized observer programs allow for more precise estimates in certain fisheries (e.g., sablefish pot, drift gillnet), in general estimates of M&SI from fishery interactions rely upon opportunistic reports. There is no method currently available to correct for this negative bias (Carretta et al. 2023). Therefore, the totals in Table 6-6 should be considered minimum values.

Unidentified whales represent approximately 15% of West Coast entanglement cases (Carretta 2018). If excluded from further consideration, this can also negatively bias estimates of species-specific entanglement rates and associated M&SI. Carretta et. al (2023) uses a cross-validated species identification model to estimate additional M&SI of two Central America DPS humpback whales and 3.3 Mexico DPS humpback whales. CDFW has included these values in Table 6-6. The most recent value available for blue whales (0.04 mean annual M&SI) is from the 2021 U.S. Pacific Marine Mammal Stock Assessments and reflects entanglements from 2015-2019. Since a comparable value for the 2016-2020 period is not available, CDFW has not included additional M&SI of unidentified whales which were likely blue whales in Table 6-6.

Carretta et al. (2023) also notes increasing levels of anthropogenic sound as an additional impact to blue and humpback whales. Low- and mid-frequency sounds, including those produced by shipping traffic and used in active sonar military exercises, can cause harm by impacting communication between individuals and can cause lethal or sublethal injuries to individuals. Noise-related injuries are not included in injury determinations due to the challenges of detecting them in live animals (NMFS 2012).

Additional activities which may occur within the Plan Area and affect blue and humpback whales include aquaculture projects, offshore energy development (e.g., wind farms), changes to vessel traffic separation schemes, and modifications of National Marine Sanctuary or state Marine Protected Area boundaries. These types of changes in ocean use policies are highly uncertain and subject to change as available resources and state and federal priorities shift. Given the federal nexus of these activities, while they could be considered under NEPA as contributing to cumulative impacts they would not be considered under ESA as a component of cumulative effects, which are limited to non-federal actions.

6.10.2 Cumulative Effects and Impacts on Leatherback Sea Turtles

While anthropogenic impacts on leatherback sea turtles are not quantified in the same way as for marine mammals (i.e., through Stock Assessment Reports), there are multiple known threats to this species that are responsible for the population's decline. Internationally, threats include bycatch in fisheries, direct harvest of eggs and adults, destruction of nesting habitat, and climate change (NMFS and USWFS 2020b; NMFS 2021a).

International fisheries bycatch remains a threat to West Pacific leatherback sea turtle populations. The foraging range and migratory routes of the population overlap with the coastal and pelagic fisheries of many nations, including the US, Japan, Philippines, Malaysia, Korea, China, and Taiwan (Benson et al. 2011). A study by Lewison et al. in 2004 estimated 1,000 to 3,200 leatherback sea turtle mortalities occurred in the Pacific Ocean in 2000 as a result of pelagic longlining. A revised estimate by Beverly and Chapman (2007), which incorporated additional bycatch data, calculated approximately 200 to 640 annual leatherback sea turtle mortalities in the Pacific. However, it is important to note that few studies accurately quantify mortality from international fishery interactions due to inconsistent reporting and lack of information on small scale coastal fisheries. Annual interaction and mortality rates of leatherback sea turtles are only reliably available for US fisheries, where regulations regarding leatherback sea turtle interactions are adequately enforced (NMFS and USFWS 2020b).

The harvest of adult leatherback sea turtles and eggs continues to be a significant threat to the population. While the number of leatherback sea turtles removed from the population via harvest is unquantified, there is significant evidence that legal and illegal take occurs in all four nations where the West

Pacific populations nests, despite regulatory protections (NMFS and USFWS 2020b). In Indonesia, poaching at Jamursba-Medi and Wermon has largely been eliminated since the enactment of a beach monitoring program in 1993, though recent surveys show leatherback sea turtles and eggs are still harvested from other beaches (NMFS and USFWS 2020b). Approximately three to five adults are killed at Buru Island, Indonesia and up to 100 adults at the Kei Islands, annually (NMFS and USFWS 2020b; Kinan 2005). In Vangunu Island, Solomon Islands, an estimated 10-20 nesting females are taken annually (Jino et al. 2018). Similar reports of harvest have been documented in Papua New Guinea and Vanuatu (NMFS and USFWS 2020b). The illegal poaching and legal harvest of leatherback sea turtles and eggs, combined with predation of eggs by local fauna, is unsustainable and considered a major threat to the population (NMFS and USFWS 2020b).

The destruction of nesting habitat is another threat to the West Pacific leatherback sea turtle population and difficult to quantify. Nesting beaches of this population are subject to beach erosion and ocean inundation (NMFS and USFWS 2020b). In West Papua, Indonesia, where leatherback sea turtles foraging in the CCS primarily nest, beach erosion and ocean inundation destroyed 80 percent and 23 percent of nests at Jamursba-Medi during the 2003-04 nesting season and at Wermon during the 2004-05 nesting season, respectively (NMFS and USFWS 2020b). While the West Pacific leatherback sea turtle population can sustain natural (but unquantified) loss of nests, the increased frequency and severity of storms and other high energy events, perhaps due to climate change, may lead to an unsustainable loss of nests (NMFS and USFWS 2020b).

In addition to the destruction of nesting habitat, climate change is also likely to impact hatching success and hatchling sex ratios. Studies have documented decreased hatching success and a female skewed sex ratio at warmer nesting sites (NMFS and USFWS 2020b; Tapilatu and Tiwari 2007). Increased global temperatures can increase sand temperatures, potentially creating lethal incubation temperatures or changes in hatchling sex ratios as sea turtles exhibit TSD (NMFS and USFWS 2020b). The majority of the threats described above, particularly those affecting nesting beaches in the Western Pacific, occur in areas outside of US jurisdiction. Within US waters, incidental take in fisheries, particularly those using longline and gillnet, remains a threat to the West Pacific leatherback sea turtle population and is described in further detail below.

Longline fishing is prohibited within the Plan Area, and not considered further. The best available bycatch rates for the California DGN fishery are computed by the SWFSC using Bayesian regression trees (PFMC 2017). Estimates are produced with a two-year lag; the most recent estimates available when this CP was prepared were through 2021. Leatherback sea turtle bycatch rates dropped significantly after 2001 upon implementation of the Pacific Leatherback Conservation Area (Eguchi et al. 2016). Estimated annual M&SI values from 2014 to 2021 ranged from 0.1 to 0.899, with a total of 1.829 over this period (Carretta 2022). Neither observer data nor logbook data for state-managed gillnet fisheries indicates historical take of leatherback sea turtles.

CDFW also considered potential impacts from the Deep-Set Buoy Gear (which, like DGN, targets swordfish) and West Coast groundfish fisheries. There have been no reported interactions with leatherback sea turtles during the experimental phase of the Deep-Set Buoy Gear Fishery (2015-2020; NMFS 2021b). Between 2002 and 2019 there was a single observed leatherback sea turtle mortality in the groundfish fishery, however no take has been observed since 2008 (PFMC 2021).

An additional source of information regarding anthropogenic take of leatherback sea turtles is the SWFSC stranding database. Of the 10 leatherback sea turtle takes documented between 2014 and 2022, four were of unknown origin and one involved handling only (to remove kelp wrapped around the animal). Of the other five takes associated with human interactions, three involved fishing gear (one in rock crab gear, one in California commercial Dungeness crab gear, one in unspecified fishing gear), one involved ingested plastic, and one was due to unspecified trauma.

Based on available information, there appears to be limited anthropogenic take of leatherback sea turtles within the Plan Area and waters off the West Coast. Additional activities which may occur within the Plan Area and affect leatherback sea turtles include aquaculture projects, offshore energy development (e.g., wind farms), changes to vessel traffic separation schemes, and modifications of National Marine Sanctuary or state Marine Protected Area boundaries. These types of changes in ocean use policies are highly uncertain and subject to change as available resources and state and federal priorities shift. Given the federal nexus of these activities, while they could be considered under NEPA as contributing to cumulative impacts they would not be considered under ESA as a component of cumulative effects, which are limited to non-federal actions.

CHAPTER 7. FUTURE ADAPTATION OF THE CONSERVATION PLAN

This Chapter reviews the adaptive management components of the Conservation Program described in Chapters 5 and 6, specifies planned improvements to the Conservation Program, and describes how both planned and unplanned changes to the Conservation Program will be evaluated and implemented. A high-level summary of the adaptive management approach is provided in Figure 7-1, and further described in the remainder of this Chapter.

As mentioned in Section 1.3.6, the MLMA requires management actions to follow the principle of adaptive management. Adaptive management is a continuous and flexible process that aids in decision-making due to uncertainty. Adaptive management as a concept is present throughout many aspects of the Conservation Plan such as the RAMP process (see Section 5.1.1), and the built-in backstop measures when approaching take limits (see Section 6.8). In addition to these approaches CDFW will outline the overarching adaptive management plan, and potential future adaptive management approaches.

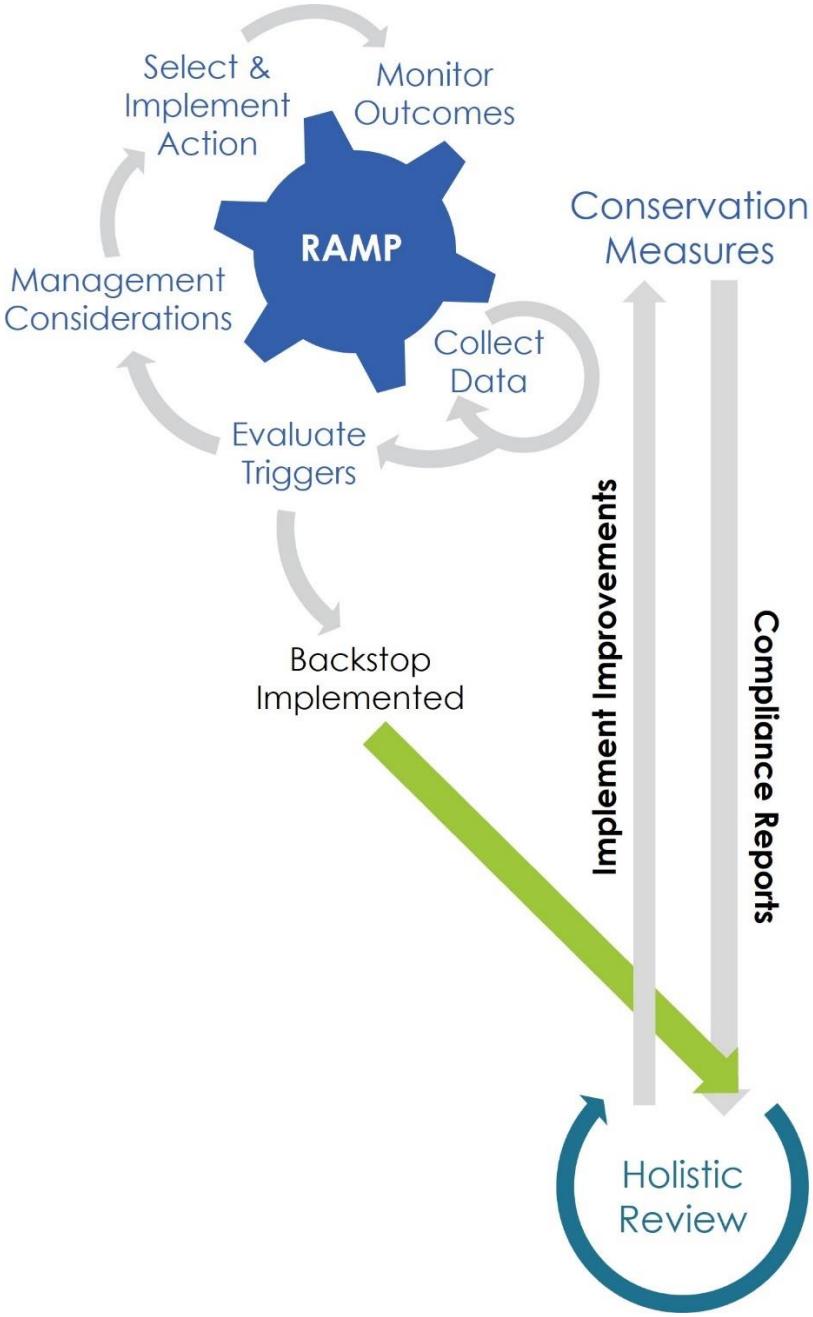

Figure 7-1. Overview of CDFW's adaptive management approach. Ongoing implementation of the Conservation Measures, including the inherently adaptive RAMP process, is documented through annual Compliance Reports (Section 7.3), which feed into the 5-year holistic review process (Section 7.4). CDFW then implements identified improvements to the Conservation Measures. CDFW routinely collects information and periodically evaluates available data against specified triggers through the RAMP process, which may prompt implementation of backstops described in Section 6.8. While the backstops are in place, CDFW initiates a holistic review to identify and implement improvements prior to expiration of the backstop measure.

7.1 Existing Adaptive Management Actions

As further described in Section 5.1.1, the RAMP is an example of adaptive management that works to balance changing conditions and data availability to make management decisions. Currently, the RAMP is one of the primary management tools that CDFW uses to manage entanglement risk in the Dungeness crab fishery. RAMP is an example of how CDFW is already utilizing an adaptive approach.

In addition to the RAMP, CDFW has instituted backstop measures to avoid exceedance of permitted take, as further described in Section 6.8. These backstop measures will ensure that CDFW is responsive to entanglements and provide built in check points to evaluate take levels and appropriate management actions. This process is adaptive in that it identifies predetermined time frames to incorporate new information, evaluate current progress, and potentially change management actions to address conservation goals.

7.2 Planned Adaptive Management Improvements

Both the RAMP and backstop measures rely on CDFW's current understanding of Marine Life Concentrations, existing monitoring practices, and regulatory authority. Currently, CDFW management actions consider overlap between the Covered Activities and Covered Species, but do not explicitly calculate or use metrics of co-occurrence. However, moving forward CDFW anticipates incorporating more real time information based on co-occurrence to evaluate risk from the Covered Activity. This will improve both in-season management and the ability to conduct post-hoc evaluations of effectiveness.

To effectively utilize co-occurrence modeling, CDFW needs detailed data on both species' distribution and gear location. With the incorporation of vessel data from electronic monitoring and updated SDMs, CDFW will be able to calculate co-occurrence values for discrete spatiotemporal units to inform management decisions. Additionally, as technology and data inputs improve CDFW will be able to quantify and evaluate areas with historically high co-occurrence, which will provide a stronger basis for management actions.

7.2.1 Electronic Monitoring

As described in Sections 5.1.6.6 and 6.2.1.5.4, electronic vessel position monitoring was required for all participants in the California commercial Dungeness crab fishery as of the 2023-24 fishing season. This requirement will provide near real-time information on fleet dynamics and allow CDFW to track fleet-wide trends, identify hot spots of gear usage and vessel activity, observe individual vessel trajectories, and verify harvest location by matching vessel tracks to landing receipts. This comprehensive, fine-scale information will be an essential input into spatiotemporal analyses of co-occurrence, supporting both real-time decision making and retrospective evaluations of management effectiveness. At this time, electronic monitoring will be limited to vessel position information, however CDFW will consider the value of additional equipment such

as hydraulic or rotational sensors, allowing a more precise estimate of the number of pots hauled and evaluation of when fishing activity begins and ends.

Electronic monitoring data could also be paired with an electronic logbook where GPS data is automatically collected and matched to landing receipts, bi-weekly Fishing Activity Reports, or other documentation regarding vessel activity.

As described in Section 5.1.6.6, all vessels participating in the California commercial Dungeness crab fishery are required to submit a bi-weekly Fishing Activity Report via text or email to WhaleSafeFisheries@wildlife.ca.gov. During the phased implementation period, CDFW continued its work to improve compliance rates across the fleet. Submission of the reports can be burdensome for fishery participants, and the workload for CDFW staff to review and enter the Fishing Activity Report is substantial. Collection of electronic vessel position monitoring data could allow automatic generation and submission of the Fishing Activity Reports, ensuring compliance and providing more robust data to inform CDFW's analyses of fleet dynamics, efforts to quantify co-occurrence, and the management decision process.

Fleet-wide deployment of electronic monitoring equipment will also enable more holistic evaluations of co-occurrence than were possible during the phased implementation period. In the absence of fine-scale spatial data regarding vessel activity or gear deployment, prior analyses by Feist et al. (2021), Samhouri et al. (2021), and Welch et al. (in prep) relied on VMS-informed landing receipt data. While valuable, the analyses and conclusions reflect activity from a subset of the fleet, and VMS data lags limit their utility for real-time management. The availability of vessel position and gear deployment information for the entire Dungeness crab fleet will allow for more robust and meaningful analyses which better quantify the spatiotemporal distribution of fishing effort and associated co-occurrence with Covered Species. Additionally, looking ahead this technology will give CDFW more data with which to evaluate the effectiveness of the CP as a whole, as described further in Section 7.4.

7.2.2 Marine Life Concentration Thresholds and Data Sources

As described in Section 6.2.1.3, the RAMP relies on routine evaluation of information regarding the distribution and abundance of Covered Species. As described in Section 5.1.3, during the phased implementation period CDFW relied on a long-term data series collected by Monterey Bay Whale Watch and processed by NMFS scientists when evaluating entanglement risk in all Fishing Zones and across a suite of aerial and vessel-based surveys. During the permit term, CDFW will refine the Marine Life Concentration thresholds currently specified in regulation to incorporate improved best available science. Potential improvements are described further below and include SDMs; predicted arrival dates based on environmental factors and lagged responses to abundance trends in other areas; and incorporating Effective Strip Widths for aerial and vessel surveys to calculate density rather than straight counts. CDFW will also specify distinct trigger values for each Fishing Zone.

The blue whale SDM described in Section 5.1.6.5 and a similar model currently under development for humpback whales provide near real-time predictions of habitat suitability and presence, respectively, throughout the Plan Area. Outputs from these models will be particularly valuable when environmental conditions or available resources constrain the ability of CDFW and partners to conduct routine surveys. The outputs from these SDMs are either density or probability of suitable habitat and cannot be evaluated against the survey-style triggers used during the phased implementation period. Once final versions of both models are available, CDFW will work with model developers, Working Group Advisors, and NMFS to identify thresholds which indicate elevated entanglement risk.

Survey speed, altitude, and arrangement of observers can all affect detection of the Covered Species during aerial and vessel surveys. Collecting and reporting this metadata, as well as the linear distance surveyed, would allow for calculation of an Effective Strip Width and relative density for each survey. CDFW could then adjust the Marine Life Concentration triggers from straight counts to relative density values, allowing for meaningful comparisons of findings from surveys with different protocols. By the 2029-30 season, CDFW will collaborate with survey partners and Working Group Advisors to identify and develop appropriate thresholds which indicate elevated entanglement risk.

OPC-funded research has recently produced models which forecast the arrival and departure of humpback and blue whales from key areas in Fishing Zones 3, 4, and 6 and identified lagged relationships in monthly abundances between these areas. These models would allow CDFW to take precautionary actions based on predicted arrival dates, however additional evaluation is needed to validate these findings and operationalize the models within the RAMP process. Once complete, CDFW will collaborate with external researchers, NMFS, and Working Group Advisors to revise the RAMP regulations as needed.

CDFW relied upon best available science, including input from Working Group Advisors, when developing the current Marine Life Concentration thresholds. CDFW determined that lower thresholds would excessively limit fishing activity, while higher thresholds would be insufficiently protective of Covered Species. However, as improvements in best available science indicate that revised values are warranted, CDFW will undertake the needed amendment processes described in Section 7.6.

7.3 Annual Assessment: Compliance Monitoring

To ensure that CDFW is fulfilling the commitments outlined in this CP, CDFW will submit an annual report to NMFS by October 1 of each year beginning the first year after permit issuance. Each report will capture the period immediately preceding, during, and immediately following each fishing season by tracking an August-July reporting period (i.e., a report submitted in 2026 would cover activities between August 1, 2025 and July 31, 2026). The primary purpose of these reports is to document CDFW's ongoing implementation of the Conservation Program, support adaptive management approaches, and to

meet CDFW's obligations under 50 CFR 222.301 subd. (h); i.e., to support compliance monitoring.

In Chapter 6, CDFW outlines five objectives that support CDFW's goal to assist in the recovery of humpback whale, blue whale, and leatherback sea turtle populations. CDFW makes commitments throughout the CP to support this goal and, more specifically, support each objective. In the annual reports, CDFW will summarize actions and accomplishments related to each objective. Specifically, each report will include the following:

Objective 1. Reduce co-occurrence of Covered Species with actively fished vertical lines:

- Summary of how the RAMP functioned during the season, including dates and outcomes of each risk assessment and the dates each Fishing Zone opened and closed.
- Summary of CDFW and partner surveys for Covered Species, including the number of surveys conducted in each Fishing Zone and any procedural changes to CDFW surveys, such as the protocol improvements described in Section 6.2.1.3.
- Any improvements in best available science regarding the RAMP management considerations, including explicit calculations of co-occurrence and evaluating economic impact.
- Updates regarding certification of innovative gear types as Alternative Gear, including copies of updated guidance for testing and development produced by CDFW or the Working Group.
- The number of issued EFPs which include testing of novel pot/trap gear types or innovative gear configurations (e.g., trawls).

Objective 2. Reduce co-occurrence of Covered Species with lost or abandoned California commercial Dungeness crab gear:

- The amount of gear reported as lost as compared to the reported amount of deployed gear during the prior season.
- Summary of CDFW's work to minimize gear loss through enforcement of gear tending requirements, education and communication with fishery participants, and electronic monitoring.
- The amount of lost or abandoned gear recovered as compared to gear reported lost during the prior season.
- Summary of lost or abandoned Dungeness crab gear retrieval efforts during the prior calendar year from the Trap Gear Retrieval Program, voluntary efforts under Cal. Code Regs., Tit. 14 §132.2, and salvage efforts.

Objective 3. Reduce the severity of entanglements through gear modifications:

- During the first five years of the permit term, dates, locations, and outcomes from meetings or workshops focused on gear innovations.
- Updates regarding regulatory or statutory changes to require use of gear modifications.
- Updated Best Practices Guide, if available.

Objective 4. Reduce leatherback sea turtle entanglement severity through safe handling procedures:

- Summary of progress in jointly developing safe handling procedures for leatherback sea turtles that have become entangled in pot/trap gear, including dates and outcomes from any meetings with NMFS personnel or other relevant experts.
- After NMFS's final approval, a summary of the outreach efforts and materials provided to fishery participants encouraging adoption of the safe handling procedures.

Objective 5. Reduce the severity of entanglements by supporting entanglement response education and supporting efforts to identify unidentified gear's origin:

- Summary of the work completed with NMFS towards creating a gear reference catalog, as described in Section 6.7.2, and a copy of the gear reference catalog once finalized.
- Summary of any updates to vertical line analysis described in Appendix C, and any relevant conclusions from these updates.
- Summary of the collaborative efforts of the California, Oregon, and Washington Departments of Fish and Wildlife to minimize unidentified gear through new gear marking requirements (including new gear marking regulations, data sharing, forensic review of entanglements, gear innovations, and emerging science).
- Copies of any new outreach materials developed collaboratively with NMFS WCR and PRD regarding entanglement reporting procedures, and a summary of education efforts with the Dungeness crab fishery participants including dates and the number of participants for any in-person or virtual meetings.
- Summary of CDFW engagement with fishery participants involved in entangling events and support provided to the Large Whale Entanglement Response Network.
- The current number of MR and LED staff who have taken the Level 1 Entanglement Response Training.
- Number and associated records of any entanglements observed or reported by CDFW.

- Number of EFPs for which CDFW has recommended including a requirement for EFP participants to take the Level 1 entanglement response training, and whether the FGC included that stipulation in the approved Terms and Conditions for the permit.
- Number of Dungeness crab permitholders who have self-reported to CDFW they have completed the Level 1 entanglement response training.

CDFW will make these reports available to the public on CDFW's Whale Safe Fisheries webpage for a period of five years and provide access to archived documents for the duration of the permit. The same public accessibility protocols will be applied to any information on entanglements, Marine Life Concentrations, and any other non-confidential information relied upon by the Working Group or Director during decision-making; risk assessment and management recommendation memos produced by the Working Group; and CDFW staff recommendations transmitted to the Director. All information will be provided and archived in accordance with CDFW's Scientific Integrity Policy (CDFW 2017).

7.4 Holistic Review

An important aspect of adaptive management is monitoring whether the management actions and activities are achieving the stated goals and objectives. In this case, CDFW aims to support the recovery of humpback whale, blue whale, and leatherback sea turtle populations by reducing take in commercial Dungeness crab trap gear to the maximum extent practicable. CDFW will therefore implement a holistic review of the Conservation Plan and Covered Activities every five years. This holistic review will provide an opportunity to reflect, evaluate the CP as a whole, and potentially introduce changes as needed.

Building upon the annual compliance report, CDFW will engage in collaborative conversations in the form of discussions, workshops, or meetings with Working Group members and Advisors, NMFS, and other stakeholders. This holistic review may take the form of a best available science roundup (e.g., series of presentations and discussion in a public forum), engaging in structured conversations with the Working Group, or other collaborative processes. An important aspect in many adaptive management approaches is providing opportunities for input and feedback. As such, this collaborative approach will encourage engagement and provide opportunities for learning and potential adjustment of the Conservation Program to better support the biological goals and objectives identified in Section 6.1.

The holistic review, with support from the annual compliance reports, will provide CDFW with an opportunity to address unforeseen changes over the duration of the permit term. Some of these changes may include, but are not limited to, addressing new legislation or regulations, environmental changes or significant climatic events, or potential technological improvements. During this holistic review period, CDFW may also consider use of decision support tools, which

could provide greater consistency, structure, and analytical sophistication for the holistic review process.

7.4.1 Decision Support Tools

During preparation of this CP, CDFW consulted with the developers for two specific decision support tools. One of the tools takes a hindcasting approach to anticipate tradeoffs (Samhouri et al. 2021). The other uses a management strategy evaluation to create a simulation of the entire fishery, guided by historical data, to weigh tradeoffs among alterative management strategies in relation to pre-defined performance metrics (Free et al. in press). Both tools rely on a similar conceptual model that evaluates co-occurrence of Covered Species and Covered Activities by relating habitat suitability models developed for large whales (e.g., Abrahms et al. 2019b) and fishery-dependent data from landing receipts and VMS. However, the tools then use different methodologies to translate this co-occurrence into entanglement risk. CDFW will continue to engage with decision support tool developers to assess utility of such approaches within the adaptive management framework of this CP and to support evaluations of economic impact from a given RAMP management action (see Section 6.2.1.5.2).

7.4.2 Five Year Cycle

The adaptive management framework is centered around a five-year review cycle. The five-year timeframe is designed to give CDFW sufficient opportunity to assess program effectiveness prior to making management or regulatory changes, while also ensuring routine review of the Conservation Program. While some changes could be administrative in nature, many will likely involve formal rulemaking action by CDFW and/or formal amendment of the CP. As this will require a substantial investment of staff resources, conducting a focused effort once every five years will reduce workload for CDFW and NMFS staff. In addition, a shorter timeframe is unlikely to provide time to conduct meaningful analyses due to the relative rarity of entanglements. The five-year timeframe also provides some certainty for industry, whose livelihoods will be directly impacted by any substantive changes to the Conservation Program.

Additionally, the five-year review cycle mimics the backstop measures that CDFW has implemented for large whales (see Section 6.8). If backstop measures are hit before the five-year period has concluded, CDFW will conduct a holistic review during the interval when the backstop measures are in place. This will allow CDFW, NMFS, the Working Group, and other partners to determine whether changes are needed prior to resuming status quo management.

7.4.3 Performance Standards

While CDFW's compliance with the terms of an issued permit will be demonstrated through the annual report described above, the overall effectiveness of the Conservation Program is ultimately measured by whether

implementation of the objectives specified in Section 6.1 are sufficient to attain the associated goal. To that end, CDFW will undertake targeted effectiveness monitoring efforts. These monitoring efforts are tied to three performance standards which evaluate whether the number and severity of Covered Species entanglements in Dungeness crab trap gear is declining and CDFW's ability to accurately predict co-occurrence of the Covered Species and Covered Activities. Outcomes regarding each performance standard will be evaluated during each holistic review.

Standard 1: CDFW will calculate the number of reported entanglements of Covered Species in California commercial Dungeness crab gear. CDFW will evaluate whether the number of entanglements is increasing, decreasing or remaining stable and whether CDFW is approaching permitted take levels. CDFW will also consider observation effort and other factors affecting entanglement detection. If confirmed entanglements are increasing rather than decreasing or stabilizing CDFW will identify and implement appropriate changes to the Conservation Program.

Standard 2: CDFW will review the M&SI values for each Covered Species entanglement in California commercial Dungeness crab gear, as documented in the NMFS Serious Injury and Mortality Determination reports. CDFW will evaluate the M&SI values released during the five-year review period to determine whether the average scores indicate stable, declining, or increasing entanglement severity. By the end of the permit term, CDFW anticipates declining average M&SI values when compared to values during the baseline period (2014-2018), which would indicate reductions in severity of entanglements resulting from the Covered Activities. If the M&SI values are not trending downward CDFW will identify and implement changes to the Conservation Program.

Standard 3: CDFW will also evaluate effectiveness of avoidance measures (i.e., RAMP and lost gear recovery) to reduce co-occurrence by conducting retrospective evaluations of Covered Species movement patterns relative to management actions. CDFW will compare the predicted and actual timing of Covered Species arrival and departure to determine whether the selected management actions effectively reduced co-occurrence beyond what would have been present without management intervention. Such evaluations will also identify instances where actions may have been unnecessarily precautionary in timing or spatial extent. CDFW will undertake complementary evaluations of the timing, location, and magnitude of lost gear recovery efforts as compared to the timing, distribution, and abundance of Covered Species to determine whether lost gear recovery efforts meaningfully reduced co-occurrence with lost or abandoned gear from the Covered Activities. Particularly given variable entanglement detection rates, quantifying the impact of these Conservation Measures on co-occurrence rather than looking at entanglements alone will provide greater confidence that the Conservation Program is achieving CDFW's intentions.

As described in Chapter 6, CDFW is guided by the dual goals of minimizing take of Covered Species and maintaining an economically viable commercial Dungeness crab fishery. If available information indicates that the Conservation Program as implemented is not adequately meeting the biological goal and objectives of this CP, CDFW must implement changes. If the biological goal and objectives are being met, then CDFW will evaluate whether there are improvements that could reduce economic impacts on the fishery and resources needed to implement the program, without compromising the protection of Covered Species. CDFW will determine the appropriate course of action based on the best available science and in consultation with stakeholders.

Following the holistic review, necessary changes can be implemented by amending existing components of the Conservation Program, creating new components, or establishing new methods for Conservation Program implementation. For example, CDFW may identify a promising new management tool or action that can be built into the RAMP regulations, an optimal management action for a specific set of circumstances under the RAMP, or a new regulatory program independent from RAMP. Regulatory changes and CP amendments will follow the processes described in Section 7.6.

7.5 Fleet Adoption of Alternatives

While developing the Conservation Program described in Chapters 5 and 6, CDFW considered multiple potential Conservation Measures. CDFW identified two potential Conservation Measures which are not currently practicable: fixed season dates, capacity reductions, and active tending. CDFW is aware that there is interest in further exploring these options from certain segments of the fleet. CDFW has not included these measures into the Conservation Program due to statutory authority, anticipated economic impacts to the fleet, or other challenges associated with implementation. However, should the fleet (likely in collaboration with the DCTF and California Legislature) show interest in advancing these options, CDFW would work to incorporate these measures into the CP.

7.5.1 Fixed Season Dates

The management program described in Chapters 5 and 6 creates uncertainty for fishery participants. Restricting fishery operations to periods of extremely low entanglement risk, as defined by historical patterns, would require significantly fewer resources for CDFW to implement and enforce, reduce CDFW's reliance on data collection efforts by outside partners, and may provide greater market stability. CDFW considered modifying the season to a historically low-risk period (e.g., January through March). Given the dynamic nature of the CCS and potential for climate change impacts on spatiotemporal dynamics of co-occurrence (see Sections 3.1 and 6.1.1), fixed season dates may not provide the necessary protections to Covered Species over the full permit term. Further analysis is also needed to better understand the potential socioeconomic costs of this alternative to the fleet and fishing communities.

It should be noted that California fishery operations would also no longer be aligned with Oregon and Washington, as prescribed under the Tri-State Agreement. It should be noted that while season delays and early closures under the RAMP may shorten some fishing seasons, adopting a fixed season approach would greatly reduce fishing opportunity during otherwise low risk years. A delayed start to the season could mean fishery participants would no longer provide crab for holiday markets, reducing economic viability for some segments of the fishery. An early end to the season would also disproportionately impact vessels that traditionally harvest through the spring and early summer months (see Section 5.1.6.4). While an economic analysis prepared during the RAMP rulemaking process (CDFW 2020b) indicates the fishery as a whole could achieve similar levels of harvest and Ex-Vessel Value despite a fishing season delay or early closure, the impacts are likely disproportionately felt by specific sectors of the fleet. Permanently restricting the fishery to a shorter period would likely have more substantial effects on the economic viability and composition of the fleet than those contemplated during the RAMP rulemaking. CDFW anticipates this alternative would be more impactful to smaller, artisanal operators who rely on being able to fish for a greater proportion of the season. Restricting operations to a two or three-month period would also likely compound any negative impacts resulting from HABs, trade disputes, or other external pressures.

Given the uncertainty regarding the degree of protection offered to Covered Species, as well as the potential for substantial economic impacts on certain sectors of the fishery, CDFW decided against implementing fixed season dates at this time.

7.5.2 Permanent Capacity Reduction

As described in Section 6.1, the Conservation Program in this CP is primarily focused on reducing co-occurrence between Covered Species and Covered Activities. As a result, CDFW considered multiple methods for implementing permanent reductions in fishery capacity (i.e., amount of fished gear) to further limit entanglement risk due to co-occurrence. Capacity reductions can be targeted at decreasing the number of participating vessels in the fishery, the amount of gear being fished by those vessels, or both. To be meaningful the reduction must apply to active rather than latent effort. Three common methods of achieving capacity reductions within a limited entry fishery are a permit buy-back, permit stacking, and reduced gear (e.g., trap) allotments.

Based on the considerations detailed below for each of these methods, CDFW did not seek a permanent capacity reduction for the fishery. However, acknowledging the importance of reduced capacity as a tool to manage entanglement risk, CDFW has included temporary vertical line reductions as a potential management action under the RAMP (see Sections 5.1.5.3 and 6.2.1.4.2), which can achieve a similar result on an as-needed basis when implemented by the Director.

7.5.2.1 Permit Buy-Back

Implementing a successful permit buy-back program can be costly, must remove a meaningful portion of active effort from the fishery, and is ultimately driven by the interest of fishery participants. CDFW recently implemented a buy-back program for the DGN fishery pursuant to SB 1017 (Allen, 2018), which offered active permitholders $110,000 and inactive permitholders $10,000 for surrendering their permit and nets. Currently, a total of $3.3 million has been invested in the buy-back program, of which $2.3 million is from state funding, and CDFW anticipates buying back 44 permits. During 2018, the last year before the buyout program began, there were 69 total DGN permits of which 28 (41%) were active. In contrast, as described in Chapter 2, the California commercial Dungeness crab fishery has approximately 550 permitted vessels; on average, 80% were active during the 2017-18 through 2019-20 seasons. Additionally, mean Ex-Vessel Value during the 2017-18 through 2019-20 seasons for a given Dungeness crab permit ($120,000) was substantially higher than that for a DGN permit ($34,357) during calendar year 2018. Both the percentage of active vessels and mean per-permit Ex-Vessel Value make it likely that substantially greater funding would be needed to implement a similar degree of capacity reduction in the commercial Dungeness crab fishery. Without a direct appropriation from the California Legislature, or commitments from outside entities, CDFW lacks both the necessary funding and statutory authority to implement a permit buy-back program.

CDFW would need to develop meaningful targets for the buy-back program that correspond to a sufficient decrease in entanglement risk. Furthermore, given the derby nature of this fishery, any reduction in the amount of gear may alter typical fishing season dynamics. If it takes longer for the fleet to harvest the same amount of crab, remaining vessels may fish their full trap allocation for a longer period. This could have the unintended effect of increasing the amount of trap gear present during the spring or summer months, when Covered Species are likely to be returning to the Fishing Grounds. Recent discussions by the DCTF highlighted a variety of industry concerns around cost, equity, harm to local communities, and other unintended side effects of a permit buy-back program (DCTF 2020). At this time, CDFW does not anticipate gaining authority to establish a buy-back program without broad support from the DCTF and other partners.

7.5.2.2 Permit Stacking

Dungeness crab permits are assigned to specific vessels, and each vessel may only fish a single permit (Fish & G. Code 8280.2 subds. (b) and (d)). Permit stacking would allow multiple Dungeness crab permits, and therefore more gear, to be fished by a given vessel. If paired with a stacked permit trap reduction, whereby the vessel could fish the full trap tier for the first permit but only a portion of the trap tier (e.g., 50%) for subsequent permits, permit stacking would reduce the maximum amount of gear that could be deployed in the fishery. However, as highlighted in Section 2.2.4.1, the maximum amount of gear that could be fished doesn't necessarily reflect the amount of trap gear that is actually deployed at any given time. Furthermore, if permits that are not currently being

fished are stacked onto a vessel that does participate in the fishery, permit stacking could actually result in re-activation of latent effort and increase the amount of trap gear being fished, which would be contrary to the intent. CDFW anticipates permit stacking would differentially impact the diverse business models currently employed by fishery participants and could fundamentally change the nature of the Covered Activities, resulting in fishery consolidation. Finally, authorization for permit stacking would require a legislative change. Due to the lack of appropriate targets, the potential for increased rather than decreased fishing effort, potential impacts on the economic viability of the fishery, and lack of authority, CDFW did not select this alternative for inclusion in the CP.

7.5.2.3 Reduced Gear Allotments

As described in Section 2.2.3, the number of traps a given vessel can deploy is specified by the tier level of the Dungeness crab vessel permit. The existing tiers were established following extensive negotiation with the fleet. Modifying the trap tiers could reduce the maximum amount of gear that could be deployed in the fishery. While some of the limitations from Section 7.5.2.2 apply, the conservation benefit would be more predictable as this method would implement a reduction across the entire fleet, rather than phasing in reductions through permit stacking as individual operators decide to purchase additional permits. This could be done by a proportional reduction across all tiers, or by some differential reduction. For example, all tiers could be limited to 75% of their current trap allotment, or a set number of traps (e.g., 25) could be subtracted from each tier's current allotment.

As described in Chapter 4, prior to implementation of the RAMP regulations, CDFW had limited available information regarding the number of deployed traps on either a fishery-wide or per-permit basis. Without this information, it is not possible to calculate the appropriate reduction in the number of permitted traps that would translate to a reduction from baseline levels of fishing activity. It is also unclear what impact adjusting the permit tiers would have on the economic viability of the fishery. Furthermore, Fish & G. Code § 8276.5 subd. (d) requires that any changes to the existing permit tiers be supported by the DCTF, so CDFW cannot unilaterally implement modifications.

Given the potential for adverse economic impacts on the fishery CDFW decided against implementing this alternative.

7.5.3 Active Tending Requirement

CDFW has considered transitioning to a more actively tended approach which requires fishermen to remain in close proximity to the trap gear and tend it more regularly. Close monitoring of deployed gear could provide benefits for both take minimization and entanglement reporting. However, shortening this interval would require a modification of current fishing practices.

The current statute restricting the trap service interval includes the condition "weather conditions at sea permitting," allowing for longer service intervals based an individual vessel's capacity to safely service traps under prevailing weather and ocean conditions. Mandating a shorter service interval may increase risks to human health and safety. Furthermore, even in ideal conditions, fishermen report minimum pot handling times of 90 seconds. For a Tier 1 permitted vessel, this equates to 12.5 hours of handling time when fishing their full trap allotment. Combined with transit to and from the Fishing Grounds, as well as transit between deployed gear, it would be impossible to service their full set of gear on time frames shorter than 24 hours.

However, shorter service intervals would be more feasible if participants were using a subset of their allocated traps. When implementing a vertical line reduction under RAMP (see Sections 5.1.5.3 and 6.2.1.4.2), CDFW will consider imposing an active tending requirement to further enhance protections for Covered Species. Further exploration of active tending may identify it's suitability for incorporation into baseline fishing practices. CDFW would then engage in further discussion with the Working Group, DCTF, and Legislature to discuss modifications to Fish & G. Code § 9004 or other statutory requirements, as appropriate.

7.6 Amendments

The following sections describe the process by which CDFW will amend the CP and promulgate new or amended state regulations, should the holistic review process described above identify needed changes to the Conservation Program.

7.6.1 Minor Amendments to the CP/ITP

Minor amendments may be made by mutual agreement between CDFW and NMFS without any prior public notice or comment period, provided NMFS determines they otherwise satisfy the requirements of applicable federal statutes and regulations, do not result in an increase in levels of incidental take, and the activity does not change in ways that were not analyzed in applicable analyses under NEPA and ESA Section 7. The following changes are considered minor amendments, unless they change the intended purpose of the amended text:

- Correction of typographical, grammatical, and similar editing errors
- Correction of maps, numbers, and similar substantive errors that deviate from the references they are pulled from
- Minor changes to survey, monitoring, reporting, or analytical protocols

For every minor amendment, the proposing agency shall provide a written statement describing its effect on the Covered Species, rationale for the amendment, and its effect on CP implementation. Amendments must be approved in writing by both parties, and both parties will endeavor to reach agreement within 45 days of the proposed amendment's initial transmittal.

Following this agreement, the amended document(s) will be posted on CDFW's Whale Safe Fisheries webpage.

7.6.2 Major Amendments to the CP/ITP

An amendment is considered a major amendment if it is not a minor amendment. In general, any amendment which affects the take level of a Covered Species, modifies the scope of this CP, or otherwise changes the Conservation Program in a way not analyzed by this CP or associated environmental review documents (e.g., NEPA) will be considered a major amendment. These amendments must also satisfy federal statutory and regulatory requirements.

As with minor amendments, either CDFW or NMFS may initiate a major amendment to the CP or the ITP. The proposing agency will provide a written statement describing the amendment's effect on Covered Species, the rationale for the amendment, and its effect on CP implementation. CDFW shall provide notice of any major amendment under consideration on its Whale Safe Fisheries webpage with a 45-day public comment period. Both CDFW and NMFS shall review and consider all public comments prior to taking final action on the proposed amendment. The proposed amendment will be adopted following written approval from both CDFW and NMFS, after which CDFW will post the amended document(s) on the Whale Safe Fisheries webpage.

7.6.3 Amendments to State Regulations

Fish & G. Code § 8276.1 provides CDFW with the authority to develop and amend regulations implementing RAMP and other necessary measures to reduce marine life entanglement risk. The amendment process for any of the regulations underlying the Conservation Program described in Chapter 6 will adhere to the California APA (see Section 1.3.7). At a minimum, this requires CDFW to provide a notice to the public through the California Notice Register that includes the amended text of the regulations and a statement of reasons providing rationale for the proposed changes. The public must be afforded at least 45 calendar days to provide comments before the amendment can be adopted.

Given public interest in marine life entanglement issues, CDFW has historically conducted additional outreach with key stakeholders prior to commencing the formal rulemaking process, including adoption of regulations establishing the Trap Gear Retrieval Program, RAMP, and standardized gear marking requirements. CDFW will continue to proactively engage with stakeholders throughout the term of the ITP when contemplating changes to these and other regulations relevant to this CP.

7.7 Renewal, Suspension/Revocation, and Cancellation

As noted in Section 2.3, CDFW requests NMFS issue a renewable ITP. CDFW will submit its renewal request at least 30 days before the permit's expiration. ITP renewal shall follow the terms of federal regulation (50 CFR 222.304).

NMFS may suspend or revoke the permit if CDFW fails to implement the CP in accordance with the terms and conditions of the permit or if suspension or revocation is otherwise required by federal law. Suspension or revocation of a Section 10(a)(1)(B) permit, in whole or in part, must be in accordance with the process provided in federal statutes and regulations.

If the Conservation Measures prescribed by this CP are no longer required due to improved stock status or decreased risk of entanglement from Covered Activities, CDFW will request a cancellation of the ITP. Cancellation will follow the terms of federal regulation (50 CFR 222.306).

7.8 Changed Circumstances

As part of this CP, CDFW must contemplate changed circumstances affecting the Covered Species that may necessitate additional conservation and mitigation measures and can be reasonably anticipated (50 CFR 222.307 subd. (g)). Changed circumstances include relatively predictable, but unplanned, events. NMFS will not require CDFW to implement measures beyond the Conservation Program described in Chapter 6 unless the changed circumstance is provided for in the following sections.

7.8.1 Covered Activity Take of Newly Listed Species

In the event a new species that may be affected by Covered Activities is listed under ESA during the permit term, NMFS will determine whether current Conservation Measures in the CP are sufficient to avoid take of the newly listed species. If not, NMFS will work with CDFW to identify appropriate measures.

7.8.2 De-listing of Covered Species

In the event a Covered Species is delisted during the permit term, CDFW will continue to include assessments of take and removals in the annual report to NMFS for the duration of the permit. CDFW will also evaluate whether changes to the Conservation Program are appropriate and consider initiating a major amendment process and associated updates to state regulations.

7.8.3 Change in Covered Species Status Under ESA

In the event ESA classification of a Covered Species (endangered vs threatened) changes during the permit term, during the next holistic review CDFW will consider whether changes to the Conservation Program are appropriate.

7.8.4 Designation or Revision of Critical Habitat; Changes to Stock Abundance, Distribution, or DPS structure

As described in Section 6.9.3, CDFW does not anticipate trap gear will significantly impact currently designated critical habitat for humpback whales or leatherback sea turtles. Should additional or revised critical habitat be designated for Covered Species, CDFW will evaluate whether a major or minor amendment and associated changes to state regulations are warranted.

CDFW anticipates changes in the abundance, distribution, and DPS/stock structure of Covered Species over the term of the permit. As part of the holistic review process, and more often as warranted, CDFW will consider the best available science and determine whether amendments to the CP and associated state regulations are warranted.

7.9 Unforeseen Circumstances

Unforeseen circumstances are changes in circumstances affecting the Covered Species that could not reasonably have been anticipated by CDFW and NMFS at the time of the CP's development, and that result in a substantial and adverse change in the status of the Covered Species (50 CFR 222.102). Such events by their very nature cannot be reasonably predicted and considered in the proposed Conservation Program. Under terms of federal regulation (50 CFR 222.307 subd. (g)(3)), NMFS may require additional management measures from CDFW, provided that they are within the current scope of this CP. NMFS bears the burden of demonstrating that unforeseen circumstances exist, and it will not require additional measures and resource commitment from CDFW without CDFW's consent. Should unforeseen circumstances arise, CDFW will work with NMFS to redirect existing resources and evaluate additional actions as appropriate.

CHAPTER 8. FUNDING ASSURANCES

CDFW is responsible for implementation of this CP and ongoing management and monitoring during the permit term. Section 10(a)(2)(A)(ii) of the ESA and NMFS implementing regulations at 50 CFR § 222.307 subd. (b)(5) require ITP applicants to demonstrate sufficient funding is available to implement the measures described in their CP, including changed circumstances and any future CP amendments.

This following chapter describes the state resources that will support implementation of the CP (Section 8.1), anticipated participation from various non-state entities (Section 8.2), and the role of grant funding (Section 8.3).

8.1 State Funding

CDFW is primarily funded through an annual budget cycle (July 1 – June 30) and is subject to state agency funding rules and processes. Funding sources include general funds from California income taxes, permit and licensing fees, dedicated accounts funded by other assessments, and federal grants. The California Legislature appropriates and allocates funding to all state agencies, including CDFW. Typically, CDFW receives funding to cover staffing and operating expenses for existing programs. In addition, either the Executive Branch or the Legislature can propose budget changes to cover costs for new or expanded programs. During the 2022-23 fiscal year, CDFW had over 3,000 employees and a budget of $1.321 billion (Table 8-1).

Table 8-1. CDFW budget for the 2013-14 through 2022-23 fiscal years in millions of dollars, as provided

Fiscal Year	CDFW Budget
13-14	$455
14-15	$550
15-16	$563
16-17	$576
17-18	$601
18-19	$620
19-20	$636
20-21	$641
21-22	$1,040
22-23	$1,321

CDFW cannot guarantee the amount of funding that will be available over the permit term because of the annual budgeting process and the prioritization that occurs based on available state funding. However, CDFW will work to ensure staffing and operating resources are sufficient to fully implement the CP. Budget allocations over the last 10 years (Table 8-1), policy statements by the California Legislature (e.g., AB 1241, Keeley, 1998; SB 1309, McGuire, 2018), OPC (e.g., OPC 2020), and other potential funding partners indicate reducing marine life entanglements is a priority for the State of California. Given this, CDFW does not

expect any reduction in funding that would impact its ability to fulfill obligations under an issued permit. If such circumstances arise, CDFW will notify NMFS and work with NMFS to prioritize CP obligations to maximize benefits to Covered Species during any period of reduced resources. Such changes to CP operations may be considered a major amendment and would then follow the process described in Section 7.6.2.

Both CDFW and OPC began allocating staff time to marine life entanglement issues in fall 2015. Initially, these efforts were absorbed as part of general management for the commercial Dungeness crab fishery. Recognizing the importance of, and increased workload associated with, addressing marine life entanglements, the Budget Act of 2018 included dedicated staffing and funding for CDFW. The Budget Act of 2018 also included a one-time general fund allocation of $7.5 million to the OPC to address marine life entanglement risk. Of this, $1 million was directed to support sea lion stranding response and $1 million was directed to the Drift Gillnet Transition Program mandated by Fish & G. Code § 8583. At the November 13, 2019 meeting OPC approved an investment strategy to guide investment of the remaining funds, which must be spent by July 1, 2025 (OPC 2019). This funding is available to support a variety of projects, including development of predictive models to inform real-time assessment of entanglement risk and testing of gear innovations. As of March 2023, OPC has provided nearly $4 million to fund projects consistent with the 2019 investment strategy that advance entanglement science and reduce the risk of whale and sea turtle entanglement in fishing gear. Of these, the largest allocation was $2 million to PSMFC to fund and administer projects that develop, align, or improve information to reduce entanglement risk and minimize impacts on the fishing industry. In total, OPC has approved 11 projects that support the strategy's goals of advancing collaborative partnerships, improving the best available science, promoting gear innovation, enhancing entanglement response, and improving outreach. The Budget Act of 2022 also included additional staffing and funding for CDFW, including approximately $100,000 which was used to purchase electronic monitoring equipment. CDFW worked closely with PSMFC to secure additional funding so that the entire active commercial Dungeness crab fleet could be outfitted with required electronic vessel position monitoring equipment.

As described in Section 1.2, primary responsibility for implementation of the CP falls within the MR, whose budget has steadily increased since the 2013-14 fiscal year (Table 8-2). The Budget Act of 2018 included funding for two full time MR staff within the Invertebrate Management Program dedicated to marine life entanglement issues. Staff capacity was further augmented through the Budget Act of 2022, which included funding for three additional dedicated MR staff. Upon issuance of the ITP, their primary duties will include implementation of the CP, including the underlying RAMP regulations. Within the Invertebrate Management Program, additional staff who actively manage the Dungeness crab fishery will support CP implementation. Outreach and education staff, administrative staff, and managers within MR will also provide support.

Table 8-2. MR budget for the 2012-13 through 2022-23 fiscal years in millions of dollars.

Fiscal Year	MR Budget
13-14	$18.9
14-15	$19.0
15-16	$19.8
16-17	$20.7
17-18	$20.5
18-19	$25.3
19-20	$26.2
20-21	$25.7
21-22	$29.2
22-23	$31.1

Specifically, MR staff duties will include:

- Participation in, and oversight of, constituent groups (e.g., Working Group, DCTF)
- Routine monitoring of available data streams
- Research and development to improve RAMP performance
- Compilation and synthesis of available data to inform RAMP risk assessments
- Administering the Trap Gear Retrieval Program and supporting other lost gear recovery efforts
- Supporting entanglement response activities
- Supporting NMFS forensic reviews, including conducting interviews with California fishermen whose gear was involved in an entanglement
- Coordination with Oregon and Washington regarding entanglement avoidance, minimization, and monitoring efforts
- Oversight and coordination of Alternative Gear development and testing
- Outreach to Dungeness crab fishery participants and other trap fisheries

CDFW has numerous staff and operational resources from several other functions, including LED, OGC, DTD, OCEO, the RU, LRB, and Executive who will assist with CP implementation. Table 8-3 provides an overview of which function areas will be involved in each of the CP commitments.

Table 8-3. Summary of CDFW commitments and involved function areas.

CDFW Commitment	Function Area
RAMP risk assessments and management measures	MR, LED, OGC, OCEO, Executive
Procedural improvements to RAMP	MR, LED, OGC, RU, Executive
Management measure compliance	MR, LED
Electronic vessel location monitoring	MR, LED, DTD, LRB
Authorization of Alternative Gear	MR, LED, OGC
Lost or abandoned gear retrieval	MR, LED, LRB
Improvements to baseline fishing practices	MR, LED
Safe handling procedures for leatherback sea turtles	MR
Entanglement response and gear identification	MR, LED
Outreach to fleet	MR, OCEO, LRB
Holistic review of Conservation Program	MR, LED, OGC, Executive
Implementation of needed regulatory changes, preparing minor or major CP amendments	MR, LED, OGC, RU, Executive

LED staff and equipment (e.g., vessels, aircraft) will support the surveys to assess Covered Species presence. If available information triggers management action under the RAMP, LED will help select appropriate management measures and inform implementation timelines. LED will also evaluate fleet compliance with implemented management measures as well as reporting requirements and take appropriate enforcement actions when violations occur. LED will provide input regarding the design and function of electronic vessel location monitoring systems, as well as review available information from those systems. LED will work with MR staff to review available documentation from confirmed entanglements and identify those which occurred in California commercial Dungeness crab gear. LED will also work with MR staff to review requests for authorization of innovative gear types as Alternative Gear. LED will conduct inspections of gear retrieval operations, including those of the Trap Gear Retrieval Program, on an as-needed basis. LED will also participate in research and development to improve RAMP performance, 5-year reviews of the Conservation Program, and developing new or amended state regulations and preparing CP amendments.

OGC will be instrumental in reviewing available information to ensure CDFW selects management actions which align with the RAMP regulations and obligations arising out of the 2019 settlement agreement, as well as preparing management action declarations. OGC will also participate in research and development to support improvements to RAMP performance, 5-year reviews of the Conservation Program, developing new or amended state regulations and preparing CP amendments.

DTD maintains CDFW webpages and electronic databases, as well as biogeographic data resources and software applications. DTD will provide technical support to LED and MR staff for technological aspects of authorized Alternative Gear and electronic vessel location monitoring data. OCEO will

support the development of press releases and other external communications regarding the RAMP risk assessments and management measures. The RU will oversee internal and public-facing processes for promulgation of new or amended state regulations, as required throughout the term of the permit. LRB will issue Trap Gear Retrieval Permits and collect associated fees. LRB is also responsible for issuing commercial fishing licenses, commercial Dungeness crab permits, and vessel registrations, and therefore routinely engages with fishery participants. LRB will work with MR to identify and distribute appropriate outreach materials to fishery participants.

Executive staff, specifically the Director, hold decision-making authority regarding implementation of Conservation Measures, including actions taken under the RAMP. As such, Executive staff will provide high-level policy guidance regarding CDFW actions and priorities throughout the term of the permit. Executive staff will also develop requests for any needed budget and staffing augmentations and redirect existing staff to support CP implementation, as appropriate.

Taken together, direct allocations to both OPC and CDFW's MR, as well as dedicated staffing within the Invertebrate Management Program reflect a portion of the state funding available to support CP implementation over the requested permit term (Table 8-4). However, these values substantially underestimate CDFW's anticipated investment, as they do not reflect all operating expenses or CDFW staff time directly tasked with supporting CP implementation, specifically the activities of other CDFW functions discussed above as well as other staff within MR. Existing funding for other functions mentioned above is expected to continue throughout the permit term and adequately support CDFW's obligations under the CP.

Table 8-4. Minimum amount of state funding available to support CP implementation. MR staff costs include salary, benefits, and operating expenses for 3 Range C Environmental Scientists, 1 Range A Senior Environmental Scientist Specialist, and 1 Range A Senior Environmental Scientist Supervisor. Amounts are as currently allocated, and not adjusted for inflation.

Category	Annual Cost	Over 15-Year Permit Term
OPC General Fund Allocation	NA	$5,400,000
Dedicated MR Staff	$811,063	$12,165,952
Total	$811,063	$17,565,952

In addition, enabling legislation for the Trap Gear Retrieval Program described in Sections 5.2 and 6.2.2 (Fish & G. Code § 9002.5) includes a requirement for CDFW to fully recover reasonable costs of administering and implementing the program. As other methods of gear recovery will be conducted entirely by external parties, CDFW anticipates this Conservation Measure will be cost-neutral over the term of the permit.

8.2 Anticipated Non-State CP Implementation Partners

While CDFW anticipates the available state funding discussed above will be sufficient to fulfill state obligations under the CP, CDFW also recognizes the importance of working with outside entities in CP implementation. There are several non-state entities which have been involved in funding recent projects or activities related to reducing the risk of marine life entanglements, and who may be reasonably expected to continue doing so throughout the permit term.

As highlighted in Sections 1.6.1 and 6.4.5, the Working Group has been an essential partner in developing key elements of this CP. Between September 2015 and March 2023, the Working Group held over 140 meetings. While many of these meetings were virtual, others were held in-person in Santa Rosa, and required travel from as far away as San Luis Obispo and Crescent City. CDFW anticipates the Working Group will participate in at least 10 meetings a year throughout the term of the permit. CDFW anticipates the Working Group will remain engaged throughout the permit term and considers their time and travel expenses to be an in-kind contribution towards CP implementation.

Implementation of the Conservation Measures described in Chapters 5 and 6 will create additional operating costs for individuals participating in the Covered Activities. As described in Section 8.1, while electronic vessel position monitoring equipment is being provided at no cost to active fishery participants, ongoing service and data transmission costs will be borne by industry. Conducting surveys to evaluate marine life concentrations are particularly costly, yet also critical to implementation of the CP. While CDFW anticipates state resources will support some level of survey activity, it will also facilitate participation of commercial fishing vessels. During the phased implementation period, commercial vessel participation in surveys provided data to inform the RAMP process (see Section 5.1.3.2). Given past participation and the importance to the fleet of maximizing fishing opportunity, CDFW anticipates continued industry involvement in these surveys.

PSMFC is an interstate compact agency that promotes and supports policies and actions to conserve, develop, and manage fishery resources in a five-state member region (California, Oregon, Washington, Idaho and Alaska). Through this forum, CDFW works with other resource agencies and the fishing industry to determine how both federal and non-federal funds can be directed to address regional needs, including marine life entanglements in the commercial Dungeness crab fishery. Since 2017, PSMFC has helped convene three regional workshops to facilitate information sharing, improve collective knowledge about whale entanglements, review forensic data provided by gear removed from entangled whales, and develop recommendations for gear innovations and other options to reduce entanglement risk. PSMFC staff are also active participants in the Working Group. Furthermore, PSMFC has a stated policy resolution to continue to work on marine life entanglements issues (PSMFC 2019). Based on these commitments and examples of past funding and participation on this issue, CDFW reasonably expects to continue to work with and/or pursue

funding from PSMFC to support activities related to CP implementation over the term of the permit.

8.3 Grants

As a state wildlife management agency, CDFW is eligible to apply for federal, state, and non-governmental organization funds to support CP tasks. CDFW will evaluate future grant opportunities and consider applying for funding, however implementation of this CP is not dependent upon external grant funds. This, however, does not preclude future grant applications if the situation warrants it.

CHAPTER 9. ALTERNATIVES

Issuance of an ITP requires the applicant to avoid, minimize, and mitigate take of the Covered Species to the maximum extent practicable. In the course of developing this CP, CDFW considered a variety of Conservation Measures, the degree to which they would reduce take of Covered Species, and the feasibility of implementation. CDFW ultimately selected the Conservation Program described in Chapters 5 and 6. CDFW did not select the alternatives described in this Chapter due to limited information regarding their effectiveness in reducing take of Covered Species; anticipated economic impacts on the Covered Activity, rendering their adoption impracticable; and/or the lack of necessary management authority.

9.1 Required Use of Multi-Trap Trawls

Under the Conservation Program detailed in Chapters 5 and 6, a transition from single traps to multi-trap trawls is one potential method of achieving vertical line reductions and could be authorized as Alternative Gear (see Section 6.2.1.4.2). However, as noted in Sections 5.1.5.5 and 6.2.1.4.2, there is potential for gear conflict and safety issues. There is also uncertainty regarding the benefit to Covered Species, as multi-trap trawls would reduce encounter rates but any entanglements which did occur would involve heavier gear. Fishing with multi-trap trawls poses substantial safety concerns for smaller vessels, which have less available deck space and capacity to handle the gear. Only requiring vertical lines on a subset of fished traps also poses concerns similar to those highlighted in Section 6.2.1.4.2 regarding CDFW's ability to enforce trap limits and closed areas. At the time this CP was prepared, CDFW determined there was insufficient evidence to appropriately weigh the relative costs and benefits of widespread use of multi-trap trawls and instead identified it as one potential management response in instances of elevated entanglement risk. For similar reasons, CDFW ultimately decided against requiring the use of multi-trap trawls as a baseline fishing practice.

9.2 Require Use of Pop-Up ("Ropeless") Gear

As described in Sections 5.1.5.5 and 6.2.1.4.2, there is increasing interest in replacing standard trap configurations (which include persistent vertical lines) with pop-up gear. CDFW received numerous public comments regarding use of pop-up gear during the rulemaking process to adopt Cal. Code Regs., Tit. 14 § 132.8. In February 2021, a bill (AB 534, Bonta) was introduced that would have required all commercial and recreational trap fisheries to use "ropeless" fishing gear within National Marine Sanctuary waters by 2025. CDFW considered requiring the use of pop-up gear throughout the fishing season, rather than limiting its use to certain closures after April 1. Ultimately, CDFW decided against this alternative due to concerns about gear conflict, enforceability, implementation costs, and compatibility with fishery operations.

As described in Appendix 1 of the Final Statement of Reasons (CDFW 2020c) and Section 5.1.5.5, CDFW chose to prohibit the use of pop-up gear in an open

Fishing Zone due to concerns about gear conflicts with traditional Dungeness crab trap gear, other trap fisheries, and commercial trawl fisheries. Furthermore, the greatest need for Alternative Gear is during spring closures, when entanglement risk is expected to continue increasing through the end of the fishing season as Covered Species return to the Fishing Grounds. Allowing the use of pop-up gear in these situations allows for continued harvest of Dungeness crab in a manner that poses a lower risk of entanglement, mitigating economic impacts of such closures. Since traditional commercial Dungeness crab gear will not be deployed in those areas for the remainder of the fishing season, the potential for within-fishery gear conflict is reduced. During the fall and winter months, when Covered Species are either absent from or present in low numbers within the Fishing Grounds, the additional protective benefit from the use of pop-up gear is outweighed by concerns regarding gear conflict. Several methods for addressing gear conflict are identified in Section 6.2.1.4.2.

Should CDFW require the entire fishery to transition to pop-up gear, each vertical line would need to be replaced with a pop-up unit and (for on-demand releases) each vessel would also need an on-deck or hull-mounted unit to locate the gear and transmit the release signal. Calculating the cost for each participant to purchase, install, and operate the required gear is difficult, as it depends on whether a single pop-up unit would be attached to each trap or whether they could be deployed onto multi-trap trawls (see Figure 2-3). Additionally, given the number of traps used in the fishery, this sort of fleet-wide transition to pop-up gear could drive down production costs. However, 2021 equipment acquisition costs for a National Marine Sanctuary Foundation gear innovations testing project provide some insight into potential costs. Galvanic timed-release devices were by far the lowest cost option ($225/unit), although one component would need to be replaced at a cost of $1 each time the trap was re-deployed. Electronic timed-release devices were slightly more expensive ($300/unit). Of the four acoustic-triggered release devices, per-unit costs ranged from $1,700 - $11,000. In contrast, a traditional Dungeness crab trap, rope, and buoys typically costs $275. It is unclear at this time how the additional costs of transitioning to pop-up gear would impact economic viability of the fishery.

After consideration of the potential harm from gear conflicts and the anticipated economic impacts on the fishery, CDFW found this to be an impracticable alternative at this time.

9.3 Alternative Approaches to Quantify Take

As described in Section 6.7, CDFW has proposed a three-pronged approach to accounting for take from the Covered Activities. CDFW considered, but ultimately rejected, an alternative method relying on GPS gear tracking.

Broad scale deployment of GPS trackers on commercial Dungeness crab trap gear would provide specific, real-time information on trap location. Through a combination of machine-learning algorithms and manual (human) review, CDFW could detect gear movement patterns consistent with gear being pulled by a large whale. These probable detections could then be verified with

deployment of CDFW aerial or vessel assets, or an entanglement response team. In addition to providing greater certainty regarding the amount of take resulting from the Covered Activity, this approach would also have benefits for entanglement response efforts.

Each large whale entanglement response is dictated by environmental conditions, available equipment and personnel, behavior of the entangled whale, and nature of the entanglement (personal communication, Justin Greenman, NMFS WCRO, August 2, 2021). One common element of successful responses is the response team's ability to locate and track the whale's movements. This can be done either through ongoing monitoring of the entangled whale from vessel or aerial platforms, or through deployment of a GPS tracker on the entangling gear. Continuous observation from vessel or aerial platforms is resource intensive, can be hindered by weather and sea conditions, and is very difficult at night. Deployment of a GPS tracker is often a preferrable method; however this is a delicate operation that can only be done by trained members of the Large Whale Entanglement Response Network. In some cases, by the time the response team arrives on site, the whale is no longer visible, precluding any further actions. In other instances, the response team may lose sight of the animal due to weather or sea conditions, or the specific gear configuration or behavior of the whale may preclude attachment of a telemetry buoy. Of the 289 confirmed large whale entanglements off the West Coast between 2014 and 2022 where the whale was alive at the time of initial reporting, 241 (83%) either had no response or a response that resulted in only partial removal of the gear. In these instances, if the entangling gear already had a GPS tracker, response teams would be far more likely to locate the whale and mount a successful response.

However, to reliably monitor for potential entanglements each individual trap (or string of traps) would need to be outfitted with a GPS gear tracker. This would entail one-time hardware costs as well as recurring data subscription fees. Preliminary scoping with one manufacturer has indicated fleetwide costs would depend on whether gear was fished as single buoys or trawls (and therefore the total number of buoys required), as well as the spacing between each buoy (which determines the ratio of lower-cost radio buoys to higher-cost satellite buoys). CDFW will continue to track developments in this space, and may later identify a feasible path forward for implementation.

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Appendices