



**Marine
Resources**

Photo: Chris Peterson, Action Works Photography

Published August 2026

Five-year evaluation of entanglement risk reduction measures in Oregon's ocean commercial Dungeness crab fishery

Report to the Oregon Fish and Wildlife Commission

**Oregon Department of Fish and Wildlife
Marine Resources Program**

2040 SE Marine Science Drive
Newport, OR 97365
(541) 867-4741

Table of Contents

Introduction.....	4
Overview of measures.....	5
Analysis.....	6
Entanglement risk	6
Overall late-season line-days	6
Late-season line-days outside 40 fathoms.....	7
Fishery impacts	8
Compliance	15
Confirmed entanglement record	16
Conclusions.....	20
References	22

List of Acronyms

CFR: Code of Federal Regulations
CP: Conservation plan
DPS: Distinct population segment
ESA: Endangered Species Act (federal)
ITP: Incidental take permit
MMPA: Marine Mammal Protection Act
NMFS: National Marine Fisheries Service
ODFW: Oregon Department of Fish and Wildlife
OFWC: Oregon Fish and Wildlife Commission
OSP: Oregon State Police
WCR: [NMFS] West Coast Region

List of Tables

Table 1. Late-season (May through August) line-day estimates for the pre-implementation (2012-13 through 2019-20 seasons) and post-implementation (2020-21 through 2024-25 seasons) periods	7
Table 2. Crab season opening structure during the pre-implementation period (2012-13 through 2019-20 seasons, in white) and post-implementation period (2020-21 through 2024-25 seasons, in gray)	10

List of Figures

Figure 1. Average monthly percentage of crab fishery pot-pulls outside of 40 fathoms during the pre-implementation period (2012-13 through 2019-20 seasons) and first three seasons of the post-implementation period (2020-21 through 2022-23 seasons)	8
Figure 2. Average monthly (A) active permits, (B) pounds landed, and (C) ex-vessel value (in 2025 Q3 dollars) in the crab fishery during the pre-implementation period (2012-13 through 2019-20 seasons) and post-implementation period (2020-21 through 2024-25 seasons)	9
Figure 3. Average difference in late-season (A) pounds harvested and (B) ex-vessel value (in 2025 Q3 dollars) for individual permits (n=112) in the crab fishery during the post-implementation period (2020-21 through 2024-25 seasons) compared to their pre-implementation (2012-13 through 2019-20 seasons) average	12
Figure 4. Average percentage of late-season pounds landed in the crab fishery by (A) vessels in different length classes (≤ 40 feet, > 40 and ≤ 60 feet, and > 60 feet) and (B) vessels from different pot limit tiers (200, 300, and 500) during the pre-implementation period (2012-13 through 2019-20 seasons) and post-implementation period (2020-21 through 2024-25 seasons)	13
Figure 5. Average percentage of late-season pounds landed in the crab fishery by port group during the pre-implementation period (2012-13 through 2019-20 seasons) and post-implementation period (2020-21 through 2024-25 seasons)	14
Figure 6. Average number of vessels making landings per day during the pre-implementation period (2012-13 through 2019-20 seasons) and post-implementation period (2020-21 through 2024-25 seasons) in relation to days relative to May 1	15
Figure 7. Confirmed whale entanglements, by species, with Oregon commercial Dungeness crab gear from 2013-2025	17
Figure 8. Estimated depth (in fathoms) that Oregon crab gear involved in humpback whale entanglements was set at	18
Figure 9. Estimated gear set time periods for humpback whale entanglements attributed to Oregon crab gear	19

Introduction

The ocean and Columbia River commercial Dungeness crab fishery (hereafter “crab fishery”) is typically Oregon’s most valuable single-species commercial fishery, accounting for up to forty percent of the state’s combined commercial ex-vessel value each year. The fishery operates in both state (0-3 nautical miles offshore) and federal (3-200 nautical miles offshore) waters, but management authority for the U.S. West Coast fishery is delegated to the states of Washington, Oregon, and California through specific provisions of the Magnuson-Stevens Fishery Conservation and Management Act.

Sustainable management of the fishery consists primarily of restrictions on size, sex, and season of harvest, combined with a series of gear requirements and effort controls. Key management actions in recent decades include: implementation of a limited-entry permit system that restricts the number of participating vessels; the Tri-State Pre-Season Testing Protocol which provides a standardized and consistent approach for coordinating the season opening across the Tri-State area based on crab meat recovery (i.e., meat yield); and pot limits that restrict the number of crab pots each permitted vessel can fish.

More recently, several management challenges related to changing ocean conditions have emerged across the entire U.S. West Coast fishery. Among these, increased interactions between protected whale species and fishing gear have led to an elevated level of entanglement in commercial Dungeness crab gear, which the Oregon Department of Fish and Wildlife (hereafter “department”) is working to address.

Whale populations in the United States are protected, assessed, and managed by the federal government under the Marine Mammal Protection Act (MMPA) and, for threatened or endangered populations, the Endangered Species Act (ESA). Interactions with fishing gear have been documented as one of the largest contributors to human-caused serious injury and mortality of large whales on the West Coast, including some that have been attributed by the National Marine Fisheries Service (NMFS) to West Coast and Oregon commercial Dungeness crab fisheries.

Since 2019, the department has been implementing measures to reduce the risk of whale entanglements in the crab fishery. These measures are foundational to the department’s proposed conservation plan (CP) that lays out a strategy to minimize and mitigate incidental take (i.e., entanglement) of federally-protected humpback whales, blue whales, and fin whales by the crab fishery off Oregon to the maximum extent practicable. The CP is required to secure an incidental take permit (ITP) under section 10 of the federal ESA.

The Oregon Fish and Wildlife Commission (OFWC) adopted a set of measures in 2020 (described below) along with a three-year sunset provision to allow for an evaluation of their effectiveness. In 2023, those measures were evaluated based on two seasons of available data and the OFWC elected to remove the sunset provision but requested that department staff report back to the OFWC with an additional assessment once five years of

data are available. This five-year evaluation report has been prepared for the OFWC in response to that request.

Overview of measures

In 2020, the OFWC adopted a series of measures designed to reduce whale entanglement risk in the crab fishery by reducing the number of vertical lines in the water, particularly when and where ESA-listed whale species are most abundant in Oregon's coastal and offshore waters. Central to this rule package was a 20% reduction in the pot limits across all ocean Dungeness crab permits, a requirement for an additional late-season buoy tag, and a prohibition on commercial crabbing outside of 40 fathoms, all starting on May 1st each season (hereafter "late-season measures"). Two additional vertical line reduction measures were also adopted. The first eliminated the post-season gear clean-up period that historically allowed crabbers to leave unbaited gear with open release mechanisms in the water for up to 14 days following the closure of the season each year on August 14th. In doing so, crabbers now begin removing gear from the ocean earlier, significantly reducing the amount of gear in the water throughout the month of August. The second measure eliminated the allowance for crab fishery permit holders to apply for standard replacement tags for up to 10% of their pot tier limit, after the first 30 days of the season, to accommodate pot loss due to normal fishing conditions (e.g., cut-off gear, kelp, large swells, strong currents, etc.). These replacement tags were then available for use in the fishery throughout the remainder of the season. Removal of this allowance reduces the amount of gear allowed to be deployed throughout the season, and provides an incentive for participants to service, maintain, and avoid losing gear, which likely decreases the amount of derelict gear.

There is currently limited information on the quantitative relationship between co-occurrence of whales and crab gear, and the resultant entanglement risk. However, the best available information is that every line in the water has the potential to interact with marine life and, thus, poses some level of entanglement risk. Research to evaluate entanglement risk as a product of co-occurrence is ongoing; however, the co-occurrence and entanglement risk relationship has been used to examine exposure patterns in relation to various predictors (e.g., Derville et al., 2023) and as a framework for examining tradeoffs between conservation and fishery goals (e.g., Samhouri et al., 2021).

Based on this relationship, vertical line reduction is the most widely implemented means to reduce the risk of entanglements and is central to the recommendations put forth by entanglement working groups in multiple states (OEAC, 2022; WNEWG, 2018). For example, reduction of gear (fishing lines) in fixed gear fisheries has been implemented to address lobster pot gear and North Atlantic right whale entanglements on the U.S. East Coast (NMFS, 2014), and Dungeness crab pot gear and large whale entanglements on the West Coast (CDFW, 2020; ODFW, 2020; WDFW, 2020). Vertical line reduction is also central to recommendations made by the West Coast Take Reduction Team convened to address entanglement of humpback whales in the federal sablefish pot fishery (CBI, 2026), which are

expected to form the basis of a take reduction plan that is currently under development by NMFS.

Analysis

To assess the effectiveness of the risk reduction measures adopted in 2020, the department analyzed data related to entanglement risk and fishery impacts from before and after their implementation. Unless otherwise noted, data were compared from two time periods: an eight-year “pre-implementation period” from 2013-2020 (or the 2012-13 through 2019-20 seasons), and a five-year “post-implementation period” from 2021-2025 (or the 2020-2021 through 2024-25 seasons). The pre-implementation time period was selected because concerted efforts to broaden outreach about entanglement reporting and documentation since 2013 have resulted in continual improvements in the quality of documentation and evaluation of these events. The department also assessed compliance with different aspects of risk reduction measures, and explored trends in the confirmed entanglement record from 2013 through 2025.

Entanglement risk

The department uses a line-day metric, representing one vertical line deployed for one day, as a proxy for entanglement risk (by regulation, each crab pot is attached to surface buoy(s) by a single vertical line). Line-day estimates are derived from fish ticket data and crab permit pot limit allocation. First, the number of permits that made at least one landing into Oregon in each half-month period throughout the crab season is obtained. A vertical line estimate is made by multiplying the number of active permits by their associated pot limit (200, 300, or 500 pots) for each half-month period. Line-day estimates are then made by multiplying estimated vertical lines by the number of days that the season was open in each half-month period. This metric assumes that crabbers are fishing their full pot limit allotment for every day of a half-month period.

Overall late-season line-days

The late-season measures were designed to decrease co-occurrence of crab gear and whales from May through August (the crab fishery late-season) when humpback whales are present in greater abundance off Oregon. To measure effectiveness, the department’s objective was to reduce late-season line-days by at least 20% based on a five-year running average. The late-season measures performed as intended to reduce late-season line-days and their associated entanglement risk during the post-implementation period. Compared to the pre-implementation period, late-season line-days during the post-implementation period were reduced by an estimated 24.6% on average (Table 1). Across post-implementation seasons, late-season line-days varied with reductions ranging from 26-41% during four of the five post-implementation seasons. Late-season line-days during the 2022-23 season were significantly higher (around 15% higher than pre-implementation), due to very high late-season participation. The number of vessels that continued to fish into the late-season was much higher than normal and enough that, despite using 20% less

pots, the late-season line-days increased relative to the pre-implementation average. This high participation was likely due to extremely high crab volume that season and, to a lesser extent, a late season opening and reduced opportunities in other fisheries. Over 31 million pounds of crab were landed during the 2022-23 seasons, which is nearly double the 10-year average at that time.

Table 1. Late-season (May through August) line-day estimates for the pre-implementation (2012-13 through 2019-20 seasons) and post-implementation (2020-21 through 2024-25 seasons) periods. For post-implementation seasons, absolute and percent change in late-season line-days, relative to the pre-implementation average, are included. Estimates are derived from ODFW fish ticket data.

	Total	Line-day change	% line-day change
Average pre-implementation (2012-13 – 2019-20)	2,758,024		
2020-21	1,808,320	-949,704	-34.4
2021-22	1,767,280	-990,744	-35.9
2022-23	3,175,120	+417,097	15.1
2023-24	2,027,920	-730,104	-26.5
2024-25	1,623,280	-1,134,744	-41.1
Average post-implementation (2020-21 – 2024-25)	2,080,384	-677,640	-24.6

Late-season fishery effort outside 40 fathoms

The 40-fathom management line restriction beginning May 1st was intended to move late-season gear out of deeper waters where humpback whales are more commonly observed off Oregon. In isolation, this measure could have resulted in higher line densities inside 40 fathoms (through effort shift), however, by combining it with the 20% pot limit reduction, potential gear crowding inside 40 fathoms is avoided. Analysis of reported fishing depth from logbooks indicates that 4.7% of late-season fishing effort (pot-pulls) on average occurred deeper than 40 fathoms during the pre-implementation seasons (Figure 1). In the three seasons following implementation of measures (2023-24 and 2024-25 logbook data are not yet available), only 0.8% of pot-pulls on average occurred outside 40 fathoms indicating the risk of entanglement from May through August in deeper waters was significantly reduced. Pot-pulls were assessed based on fisher-reported depth information in crab logbooks, which are expected to reflect the actual depth that pots are pulled. The 40-fathom depth restriction is based on the 40-fathom management line as defined by latitude and longitude in 50 CFR § 660.71, which is an approximation of the 40-fathom depth contour. However, there are some areas inside of the 40-fathom management line that are deeper than 40 fathoms, resulting in some gear deployed deeper than 40-fathoms but still within the 40-fathom management line. This is likely the main factor contributing to

the small number of pot-pulls reported deeper than 40-fathoms in post-implementation years.

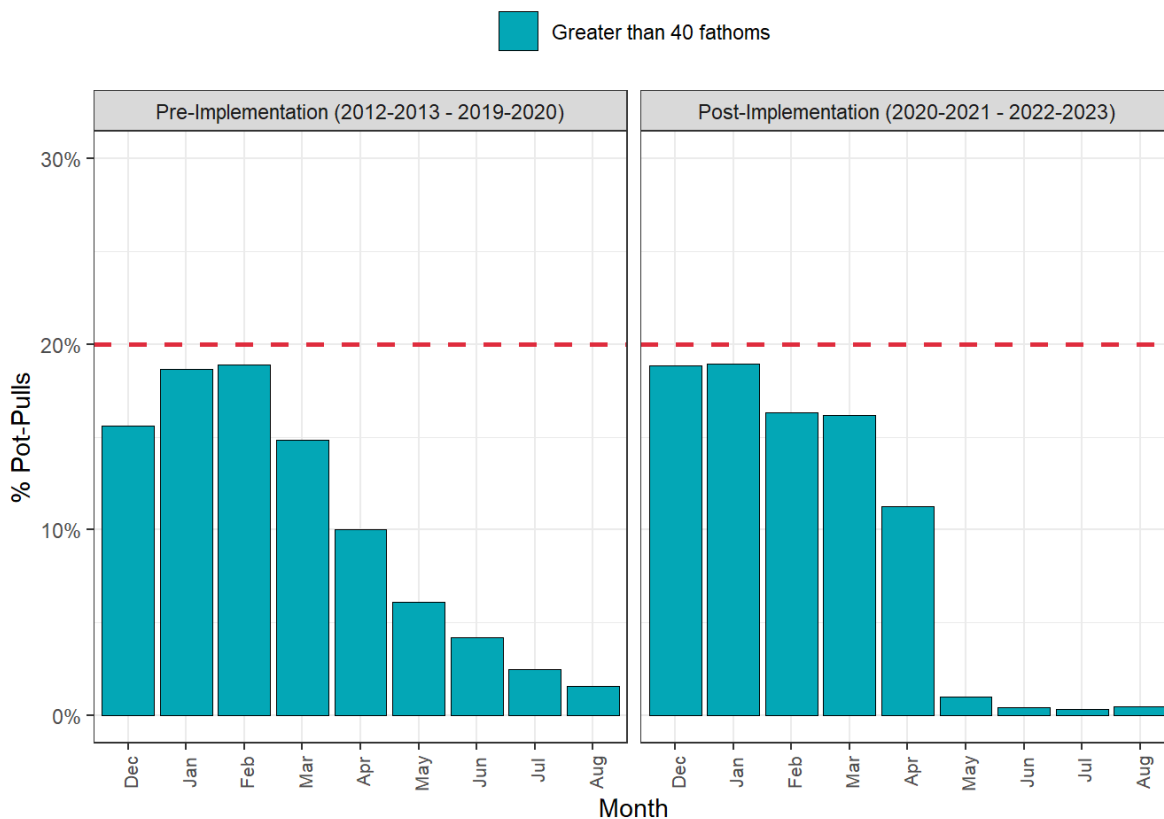


Figure 1. Average monthly percentage of crab fishery pot-pulls deeper than 40 fathoms during the pre-implementation period (2012-13 through 2019-20 seasons) and first three seasons of the post-implementation period (2020-21 through 2022-23 seasons). The red line represents 20% of pot-pulls, in reference to the 20% pot limit reduction. Data are from ODFW logbooks, currently available through the 2022-23 season.

Fishery impacts

Crab fishery economics are impacted by many biological, behavioral, and regulatory variables (e.g., crab abundance, season opening delays, crab price, operating costs), which makes it challenging to tease apart the exact economic impacts of these measures. In particular, the impacts of reduced pot limits in the late-season are difficult to predict as fishery participants may find ways to be more efficient with fewer pots (e.g., by moving their gear more often). The department primarily evaluated participation, pounds landed, and value across the entire fishery and in the late-season. The department acknowledges that these analyses do not account for potential downstream impacts on other businesses that buy and sell crab or provide services to the fleet.

To evaluate impacts at the fishery scale, the department compared the average monthly number of active permits, pounds landed, and inflation-adjusted ex-vessel value from the

pre-implementation and post-implementation periods (Figure 2). The crab fishery is most active during the winter months when nearly all active permit holders are making landings. Through the spring and summer, fishing effort greatly diminishes, which can be seen through each metric across time periods.

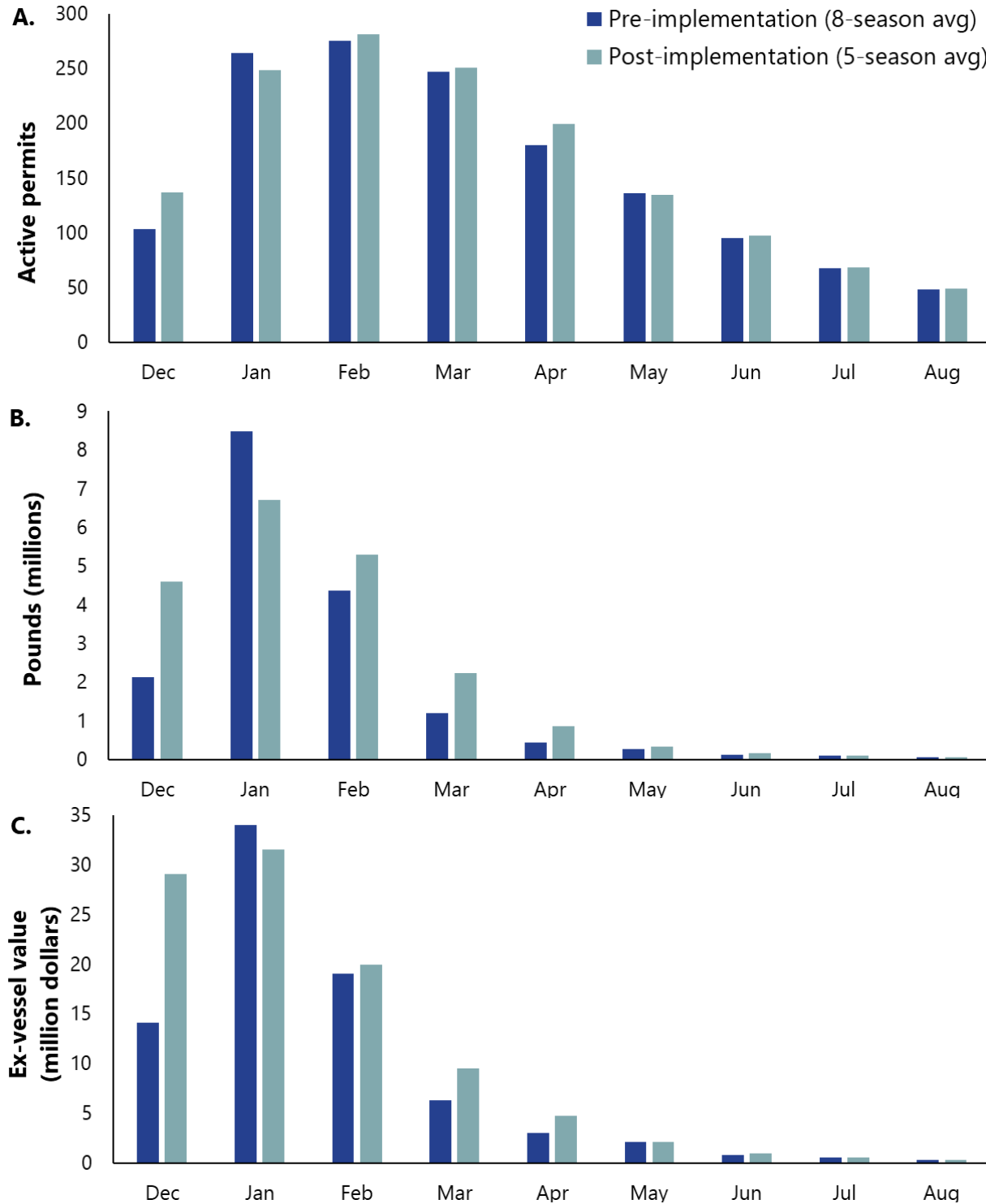


Figure 2. Average monthly (A) active permits, (B) pounds landed, and (C) ex-vessel value

(in 2025 Q3 dollars) in the crab fishery during the pre-implementation period (2012-13 through 2019-20 seasons) and post-implementation period (2020-21 through 2024-25 seasons). Data are from ODFW fish tickets. Inflation adjustment is based on gross domestic product implicit price deflator, U.S. Bureau of Economic Analysis, retrieved on June 12, 2026.

During the post-implementation period, participation, landings, and value were higher in December, lower in January, and slightly higher in February compared to the pre-implementation period. This variability is driven by different season start structures during the two time periods (Table 2). All three metrics also showed higher activity in April during the post-implementation period.

During the late-season (May through August), the number of active permits utilized in the fishery each month was nearly identical between the two time periods. This demonstrates that vessels that were participating in the late-season prior to implementation of measures have continued to participate in the late-season with the measures in place. Landings and ex-vessel value were also very similar between the two time periods. During the pre-implementation period, an average of 555,254 late-season pounds were landed each season, compared to 627,124 late-season pounds landed on average during the post-implementation period. When adjusted for inflation (in 2025 Q3 dollars), the average late-season value during the pre-implementation period was \$3.67 million, or 5.0% of the total season value. The average inflation-adjusted late-season value during the post-implementation period was \$3.89 million, or 4.3% of the total season value. Collectively, these findings illustrate that the impacts of late-season measures on overall fishery activity and value have been minimal.

Many factors other than the risk reduction measures affect the fishery's value resulting in high variability across seasons. Inflation-adjusted late-season value during the five seasons post-implementation ranged from \$2.13 million (2021-22 season) to \$9.27 million (2022-23 season), representing between 2.0% and 10.2% of the total season value, respectively. The 2021-22 season opened December 1st coastwide and saw an extraordinarily high starting price (per pound), which likely contributed to less overall value from the late-season. The 2022-23 season, on the other hand, was delayed through at least mid-January (into February for some portions of the coast) and saw exceptionally high crab volume that likely led to high participation into the late-season.

Table 2. Crab season opening structure during the pre-implementation period (2012-13 through 2019-20 seasons, in white) and post-implementation period (2020-21 through 2024-25 seasons, in gray). Most seasons experienced a delayed or split opening due to low meat yield, elevated domoic acid levels in crab viscera, or a combination of both.

Crab season	Regulatory		Reason for delay
	opening date	Fishing zone	
2012-13	December 31	Coastwide	Low meat yield
2013-14	December 16	Coastwide	Low meat yield

2014-15	December 1	Coastwide	
2015-16	January 4	Coastwide	Elevated domoic acid
2016-17	December 18	South of Cape Blanco	Elevated domoic acid
	January 1	North of Cape Blanco	Elevated domoic acid
2017-18	January 15	North of Cape Blanco	Low meat yield
	February 7	South of Cape Blanco	Low meat yield + elevated domoic acid
2018-19	January 4	North of Cape Arago	Low meat yield
	February 1	South of Cape Arago	Low meat yield + elevated domoic acid
2019-20	December 31	Coastwide	Low meat yield
2020-21	December 16	South of Cape Falcon	Low meat yield
	February 15	North of Cape Falcon	Low meat yield + elevated domoic acid
2021-22	December 1	Coastwide	
2022-23	January 15	Cape Falcon to Cape Arago	Low meat yield
	February 1	North of Cape Falcon	Low meat yield
	February 4	South of Cape Arago	Low meat yield + elevated domoic acid
2023-24	December 16	South of Cape Foulweather	Low meat yield
	December 31	Cape Foulweather to Cape Falcon	Low meat yield
	February 1	North of Cape Falcon	Low meat yield
2024-25	December 16	South of Cape Falcon	Low meat yield + elevated domoic acid
	January 15	North of Cape Falcon	Low meat yield

To evaluate impacts of risk reduction measures to late-season participants at the individual permit level, staff examined 112 crab permits that participated in the late-season in three or more pre-implementation seasons and three or more post-implementation seasons. The average difference in late-season pounds and value at the permit level during the two periods is compared in Figure 3. Over half of the permits (n=64) landed less crab on average during the post-implementation period, compared to the pre-implementation period. The average difference in landings between the two time periods ranged from 8,116 pounds less to 8,627 pounds more, though the majority (n=66) experienced a loss or gain of 2,000 pounds or less on average. In terms of value, roughly half the permits earned less (n=58) and half earned more (n=54) in the late-season relative to their pre-implementation averages. The average difference in ex-vessel value, when adjusted for inflation (in 2025 Q3 dollars), ranged from \$57,551 less to \$58,467 more, with roughly half (n=57) experiencing a loss or gain of \$10,000 or less on average. Importantly, this analysis only considers the late-season portion of each permit's landings and earnings. It does not factor in whether those same permits landed or earned more or less earlier in the season, prior to May. It also does not account for permit transfers, which could affect fishing activity depending on permit ownership.

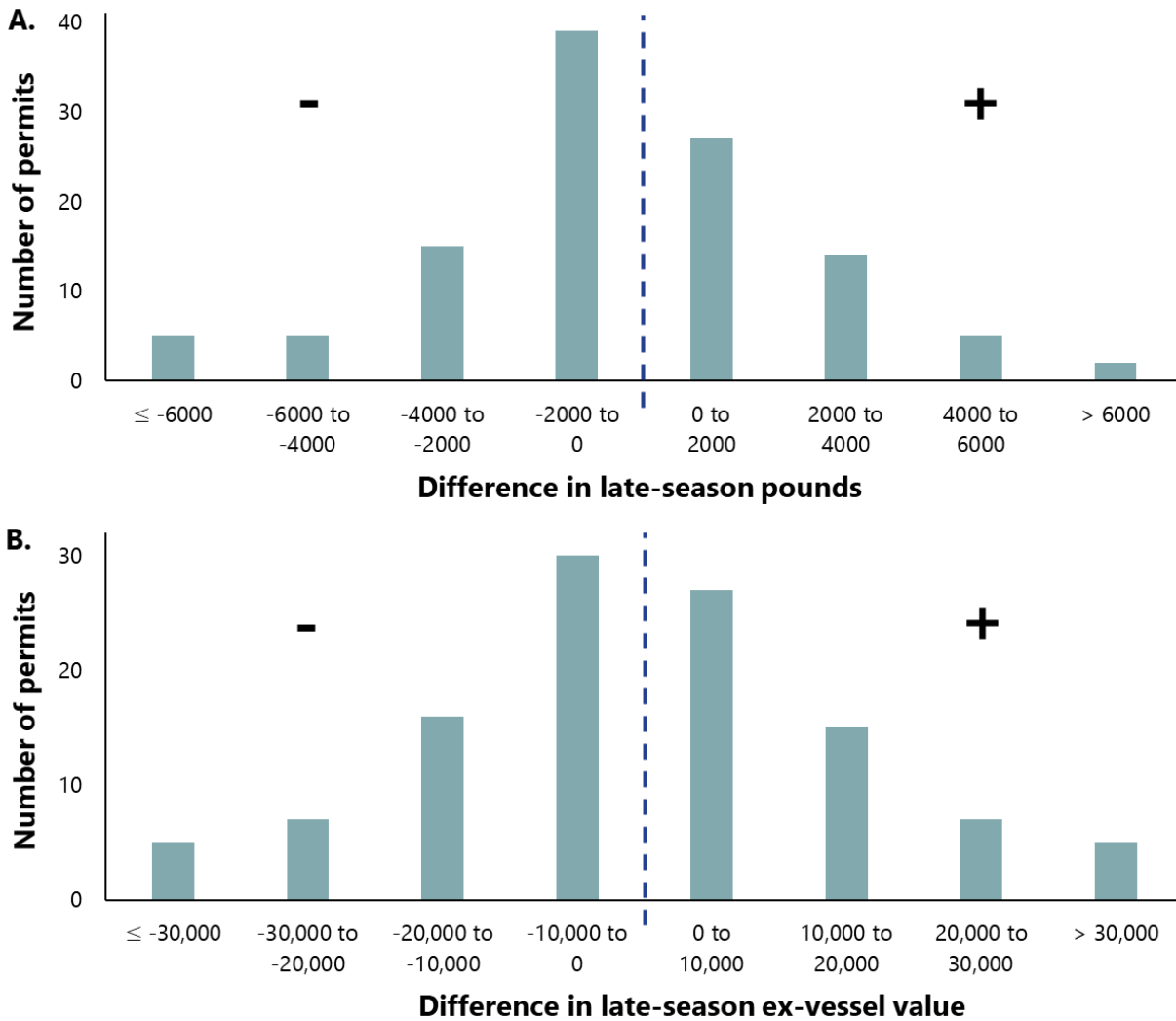


Figure 3. Average difference in late-season (A) pounds harvested and (B) ex-vessel value (in 2025 Q3 dollars) for individual permits (n=112) in the crab fishery during the post-implementation period (2020-21 through 2024-25 seasons) compared to their pre-implementation (2012-13 through 2019-20 seasons) average. Data are from ODFW fish tickets. Inflation adjustment based on gross domestic product implicit price deflator, U.S. Bureau of Economic Analysis, retrieved on June 17, 2026.

The Oregon crab fleet is diverse, with vessels ranging from small boats that fish for several hours and hold less than 1,000 pounds of crab, to those that spend days or weeks at sea and return with over 100,000 pounds of crab. To investigate any disproportionate impacts on different sectors of the fleet, staff evaluated the average percentage of late-season pounds landed by different vessel length classes and pot limit tiers between the two periods (Figure 4). This evaluation showed that different vessel lengths harvested nearly the same percentage of late-season pounds before and after implementation of risk reduction measures. Different pot tiers also harvested similar percentages of late-season pounds

across both time periods, although slightly more was harvested by 300 pot tier vessels and slightly less was harvested by 500 pot tier vessels during the post-implementation period.

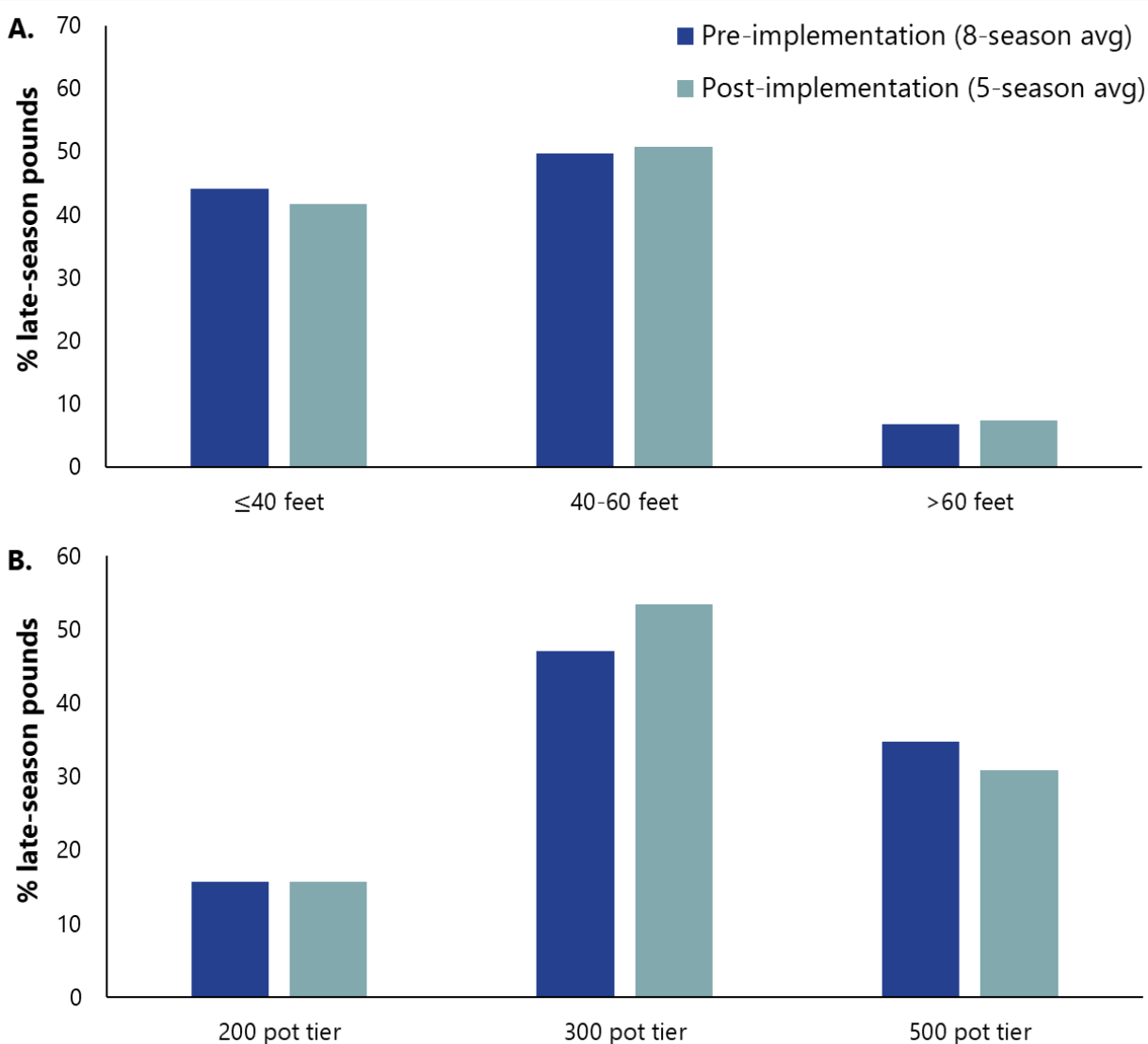


Figure 4. Average percentage of late-season pounds landed in the crab fishery by (A) vessels in different length classes (≤40 feet, >40 and ≤60 feet, and >60 feet) and (B) vessels from different pot limit tiers (200, 300, and 500) during the pre-implementation period (2012-13 through 2019-20 seasons) and post-implementation period (2020-21 through 2024-25 seasons). Data are from ODFW fish tickets.

To investigate fishery impacts at the port level, the average percentage of late-season pounds landed into major crabbing port groups was compared between the pre- and post-implementation periods (Figure 5). Compared to the pre-implementation period, a higher percentage of late-season pounds was landed into more northern ports and a lower

percentage of late-season pounds was landed into more southern ports (especially Gold Beach/Brookings) during the post-implementation period. Port-level activity is influenced by a number of factors. For example, buying and processing capacity issues in Brookings have likely led to more landings that were historically made into Brookings being made into other ports. Additionally, season opening dynamics impact spatial fishing activity and may lead to differences in where fishing effort is more likely to extend into the late-season. During the post-implementation period, the season was delayed 22 days longer on average in Astoria compared to the pre-implementation period. Conversely, the season was delayed 10 days less in Port Orford and Gold Beach/Brookings during the post-implementation period. Staff also evaluated the percentage of pounds landed from December through May, as well as across the full season, by port group and found similar trends (a higher percentage landed in more northern ports and lower percentage landed in more southern ports), though differences were less pronounced than for the late-season alone, indicating factors other than late-season measures may be driving these changes.

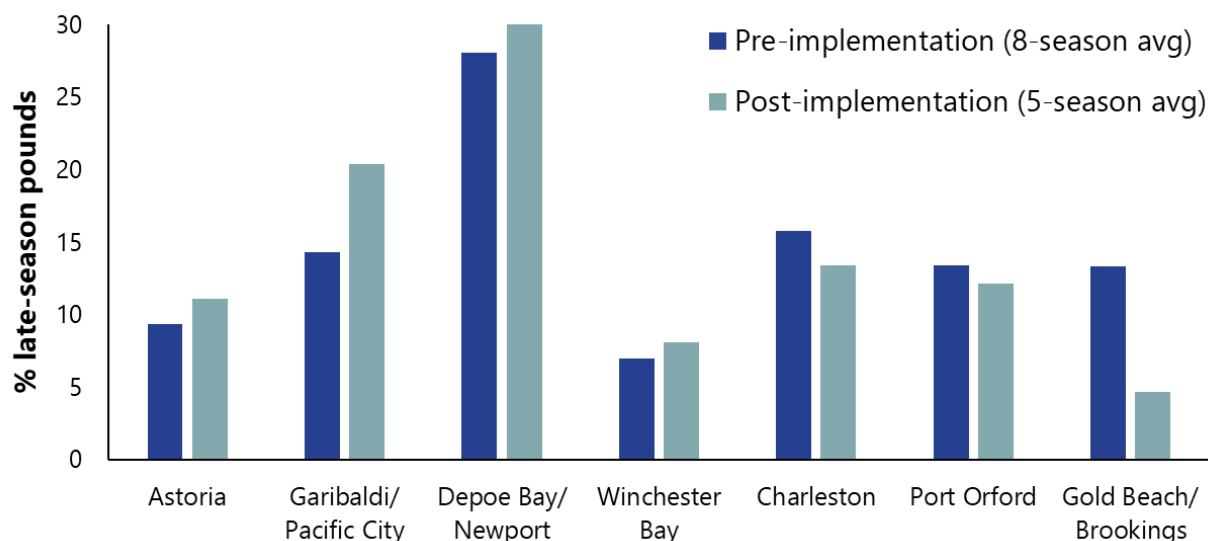


Figure 5. Average percentage of late-season pounds landed in the crab fishery by port group during the pre-implementation period (2012-13 through 2019-20 seasons) and post-implementation period (2020-21 through 2024-25 seasons). Data are from ODFW fish tickets.

Finally, to explore how risk reduction measures may have influenced fleet behavior, average daily participation in the two months before and after May 1st was compared between the pre- and post-implementation periods (Figure 6). At the statewide level, approximately five fewer vessels per day made landings after May 1st during the post-implementation period. At the port scale, this reduction corresponds to about one fewer vessel making landings per day. Prior to implementation, participation trends before and after May 1st were generally aligned. After implementation, however, the post-May period shows a slight downward shift in average daily vessel activity. These results indicate that the reduced number of pots likely

led to reduced day-to-day activity, even though total late-season pounds landed did not decline. Given there is no evidence of reduced permit activity, vessels may be adapting by leaving pots to soak longer between making landings.

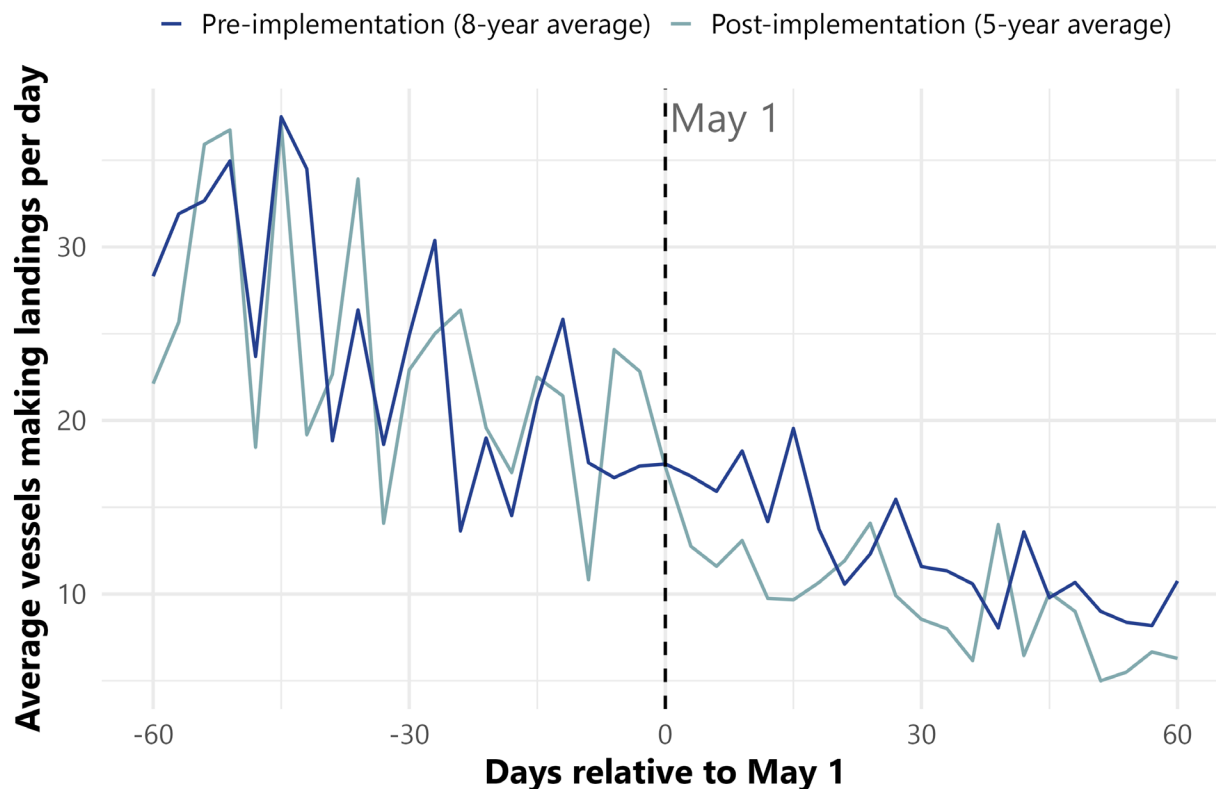


Figure 6. Average number of vessels making landings per day during the pre-implementation period (2012-13 through 2019-20 seasons) and post-implementation period (2020-21 through 2024-25 seasons) in relation to days relative to May 1. Data are from ODFW fish tickets.

Compliance

Overall, Oregon State Police (OSP) report good compliance with the different aspects of late-season measures. There has recently been a reduction in aerial support related to enforcement of late-season regulations, which increases the need for enforcement to be on the water. Over the post-implementation period, there was only enforcement action taken on three vessels regarding crab gear set outside the 40-fathom management line after April 30th.

Enforcing compliance with the late-season tag requirement is challenging due to the time-consuming nature of searching for illegal gear amongst legally tagged gear. OSP estimates enforcing the late-season tag requirement consumes 95% of all commercial crab enforcement efforts during the first two weeks of implementation. Weather and availability

of enforcement personnel have hampered enforcement efforts in some ports. Over the post-implementation period, enforcement action was limited to 42 vessels for non-compliance with late-season tags and four vessels that landed crab after April 30th without purchasing late-season tags.

Confirmed whale entanglement record

When an entanglement is observed and reported, the reporting party provides information and documentation to NMFS. NMFS then uses reported information, any submitted documents, follow-up sightings, and entanglement response information to evaluate specific criteria in order to identify unique instances of entanglement, eliminate redundant or spurious reports, and maintain accuracy. NMFS is able to “confirm” the majority of entanglement reports (~84% on average) based on the following criteria (Saez et al., 2021):

- Photos/videos of the animal with entangling gear;
- Direct visual observation by NMFS staff;
- The report is from a trusted source (i.e., trained or professional reporting party);
- A NMFS expert or experienced partner from the West Coast Marine Mammal Stranding Network interviews the reporting party and receives information that is detailed and specific enough to confirm; and/or
- Corroborated, independent, and multiple sources provide reports with detailed descriptions of the animal and entanglement.

A large whale entanglement database for the West Coast region was most recently provided to the department by NMFS for CP development in January 2026. All whale entanglement data discussed throughout this report are from this database. All information related to the specific type, fishery, or state of origin of gear involved in entanglements is based on attributions made by the NMFS West Coast Region (WCR).

In this section, the confirmed entanglement record is explored to provide insight on entanglement trends and characteristics of entanglements attributed to Oregon crab gear from 2013 through 2025. It is important to note that the management measures implemented in 2020 were intended to reduce entanglement risk. Entanglements themselves are relatively rare events (zero to four per year attributed to Oregon crab gear since 2013) making them challenging to analyze in relation to entanglement risk (millions of line-days per season). The rarity of entanglements and the influence of numerous uncontrolled factors (e.g., whale population growth, improved awareness and reporting, and improved gear identification) mean that pre- and post-implementation comparisons are not valid indicators of management effectiveness. For these reasons, this section presents information to better understand overall entanglement trends and is not tied directly to management measure effectiveness.

Confirmed entanglements attributed to Oregon crab gear from 2013 through 2025 are shown in Figure 7. During this period, 20 entanglements were documented, involving 17 humpback whales, one gray whale, one minke whale, and one fin whale. The number of

entanglements involving Oregon crab gear each year has generally increased since 2013, driven primarily by interactions with humpback whales. The increase has likely been the result of a combination of ecological and human factors. First, overall humpback whale abundance off the West Coast has been increasing by about 8.2% annually since 1989 (Calambokidis and Barlow, 2020). This coastwide growth trend increases co-occurrence with crab gear, likely increasing entanglement risk despite multiple management measures that strategically decrease fishery effort to reduce interactions. It is worth noting, however, that the best available information at the time of writing suggests that this increase is being driven largely by an increasing Mainland Mexico – CA-OR-WA stock (which includes animals from the threatened Mexico distinct population segment, or DPS), while the Central America/Southern Mexico – CA-OR-WA stock (which includes all animals from the endangered Central America DPS) is likely stable but not increasing. Second, concerted efforts to raise awareness with ocean users about entanglement reporting has likely led to more frequent reports and improved documentation in recent years. Additionally, improvements in gear marking have likely increased the number of entanglements able to be attributed to a specific fishery. Finally, changing ocean conditions may be increasing overlap between gear and whales, through regional changes in prey distribution and abundance, or changes in the spatial distribution of crab and fishery effort.

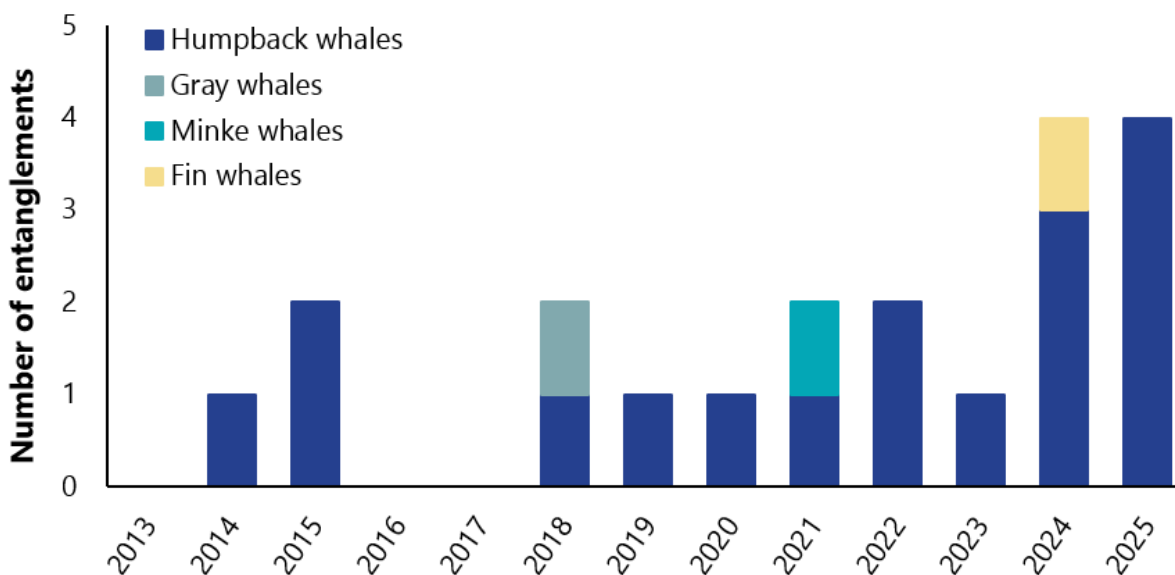


Figure 7. Confirmed whale entanglements, by species, with Oregon commercial Dungeness crab gear from 2013-2025. Data provided by NMFS WCR, January 2026.

During this period, four humpback whale entanglements (one in 2015, one in 2021, and two in 2025) were suspected to involve derelict gear. For all other cases, the entanglement was reported during or shortly after the season from which the gear originated. There is sufficient evidence in at least two cases to determine that the gear was being actively

fished; however, it is unclear in the remaining cases whether the animal interacted with active gear and then carried it for weeks or months, or if the gear was lost and then the animal encountered it. This underscores the importance of reducing entanglement risk posed by both active and derelict gear.

It is difficult to determine the timing, location, or depth where an entanglement originates but, in some cases, a range can be estimated from information about when and where the gear was being fished. The estimated gear set depth range for humpback whale entanglements attributed to Oregon crab gear are shown in Figure 8. The level of available information varies widely across cases, resulting in high variability in gear set depths. Throughout this period, entanglements involved gear set inside, outside, and spanning across 40 fathoms; however, there were generally more cases involving gear set in deeper waters. Of the cases with a set depth estimate, three involved gear set at 40 fathoms or shallower, five involved gear set at 40 fathoms or deeper, and four involved gear that could have been set shallower or deeper than 40 fathoms. The gear set depth range (as well as timing and region below) could not be estimated for cases involving derelict gear, or where the gear owner could not be identified. For context, the average percentage of crab fishery pot-pulls deeper than 40 fathoms from December through April ranged from 10.0 to 18.9% during the 2012-13 through 2022-23 seasons (Figure 1). Crab gear is commonly moved into shallower waters as the season progresses. Prior to implementation of the late-season depth restriction, the average percentage of pot-pulls outside of 40 fathoms declined from 6.1% in May to 1.6% in August.

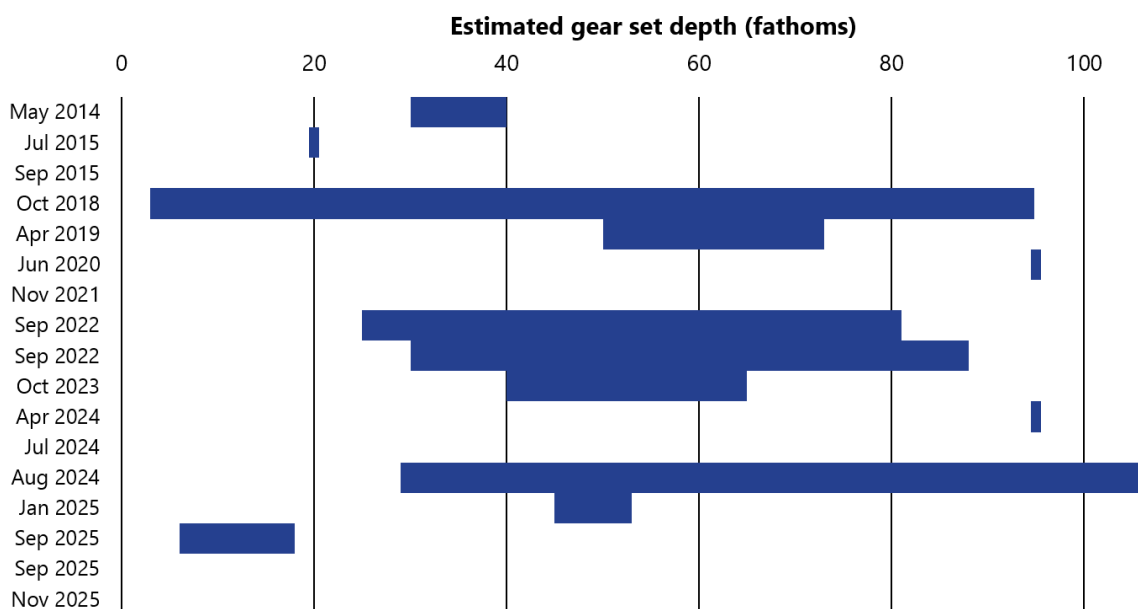


Figure 8. Estimated depth range (in fathoms) that Oregon crab gear involved in humpback whale entanglements was set at. Each row represents an individual humpback whale entanglement attributed to Oregon crab gear, and the date indicates when the entanglement was reported (which may differ from when the entanglement originated).

Depth was estimated from interviews with gear owners and ODFW logbook data. Rows with no estimated gear set depth represent cases where this could not be estimated.

The estimated gear set time periods for humpback whale entanglements attributed to Oregon crab gear are shown in Figure 9. As with depth, there is high variability in the estimated gear set time periods and many could not be narrowed down beyond a broad range of months over which the gear owner was fishing. For context, the crab fishery is most active during the winter months when nearly all active permit holders are making landings. Fishery effort, in terms of both participation and landings, starts to significantly decline by April, and continues to decline through the end of the season (August 14th), as shown by the number of active permits being utilized in the fishery and pounds landed (Figure 2).

It is worth noting that the late-season measures adopted in 2020 included a requirement for an additional late-season buoy tag. Since implementation of that measure, no entanglements attributed to Oregon crab gear have been documented with late-season tags and so the estimated gear set time periods end May 1st for those cases. The lack of late-season tags indicates that recent entanglements have originated from gear set outside of the late-season (May – August) timeframe. Prior to the 2020-21 season, this information tool was not available to refine estimated gear set time periods.

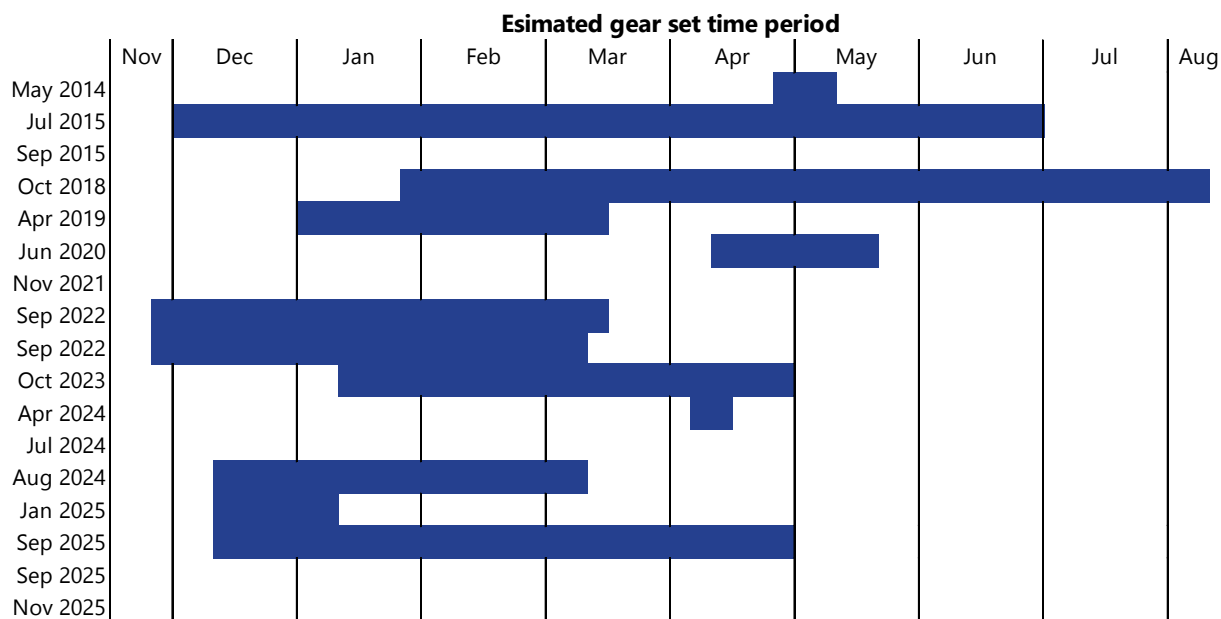


Figure 9. Estimated gear set time periods for humpback whale entanglements attributed to Oregon crab gear. Each row represents an individual humpback whale entanglement attributed to Oregon crab gear, and the date indicates when the entanglement was reported (which may differ from when the entanglement originated). Time period was estimated from interviews with gear owners and ODFW logbook data, with initial set time

adjusted based on soak time to reflect total time gear was deployed. Beginning with the 2020-21 season, time period estimates end May 1st due to the absence of late-season tags. Rows with no estimated gear set time period represent cases where this could not be estimated.

Finally, the estimated gear set region for humpback whale entanglements attributed to Oregon crab gear was explored. Throughout this period, entanglements involved gear set at crabbing grounds spanning the coast. Of the cases for which the gear set region could be estimated, three involved gear set off northern Oregon, one involved gear set off either northern or central Oregon, seven involved gear set off central Oregon, and one involved gear set off southern Oregon. As with depth and timing, there was not a clear pattern to where the gear involved in humpback whale entanglements was set; however, entanglements most commonly involved gear set on the central Oregon coast and only a single entanglement (in 2025) likely involved gear set off southern Oregon.

Conclusions

The department conducted this evaluation to assess the effectiveness and impacts of entanglement risk reduction measures implemented in the crab fishery beginning with the 2020-21 season. Based on the results, the department concludes that the risk of entanglement to ESA-listed species in waters off Oregon has been reduced during the late-season as intended by these measures. Overall late-season line-days have been reduced by around 25% on average since implementation, as well as being reduced to near-negligible levels outside of 40 fathoms where humpback whales are present off Oregon in highest abundance.

The economic impact of these measures is difficult to ascertain for multiple reasons; however, overall fishery participation, landings, and value have been minimally impacted. Variability in these metrics appears to be driven more by factors like season start structure, crab volume, and price. An analysis of permits that participated in the late-season during both time periods demonstrates that some businesses have seen increased landings and value since implementation of measures, while others have experienced losses. Minimal differences were also noted in the percentage of late-season landings made by different vessel length classes or pot limit tiers. Finally, while more late-season landings have been made into more northern ports and less in more southern ports since implementation of measures, it seems unlikely that this pattern is due to changes brought on by entanglement risk reduction measures. Instead, it likely reflects other port-level dynamics such as buying and processing capacity and the influence of split season openings.

From this evaluation, the department concludes that the risk reduction measures adopted by the OFWC successfully reduced late-season effort and entanglement risk without substantial fishery impacts. This occurred, however, during a time period when the total number of entanglements involving Oregon crab gear increased. Several factors have likely

contributed to this increase in entanglements including a growing coastwide humpback whale population, changing ocean conditions that increase overlap between whales and crab gear, and better entanglement reporting and documentation.

Through its proposed CP, the department has developed a strategy for ongoing monitoring and evaluation of these measures, as well as implementation of adaptive management if needed. The CP's proposed adaptive management strategy clearly defines a process that will be used to ensure objectives and permit conditions are met. This process includes specific triggers based on entanglement risk (line-days) and confirmed entanglements, designed to keep entanglement levels below what is authorized under an ITP and ensure successful conservation outcomes.

References

Calambokidis, J., and Barlow, J. 2020. Updated abundance estimates for blue and humpback whales along the U.S. West Coast using data through 2018. National Marine Fisheries Service, Southwest Fisheries Science Center, NOAA-TM-NMFS-SWFSC-634, 20 pp.

California Department of Fish and Wildlife (CDFW). 2020. Risk Assessment Mitigation Program Regulations. Approved by Office of Administrative Law, October 19, 2020. Available at <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=184189&inline>

Consensus Building Institute (CBI). 2026. West Coast Take Reduction Team March 20 – April 2, 2026 meeting summary. Supplemental Informational Report 6, prepared for the Pacific Fishery Management Council, June 2026. Available at <https://www.pcouncil.org/documents/2026/06/supplemental-informational-report-6-west-coast-take-reduction-team-march-30-april-2-2026-meeting-summary.pdf/>

Derville, S., Buell, T. V., Corbett, K. C., Hayslip, C., and Torres, L. G. 2023. Exposure of whales to entanglement risk in Dungeness crab fishing gear in Oregon, USA, reveals distinctive spatio-temporal and climatic patterns. *Biological Conservation*, 281: 1- 10.

National Marine Fisheries Service (NMFS). 2014. Final Environmental Impact Statement for amending the Atlantic Large Whale Take Reduction Plan: vertical line rule. Volume I of II. 1258 pp.

Oregon Department of Fish and Wildlife (ODFW). 2020. Reducing risk of whale entanglement in commercial crab fishing gear. Oregon Fish and Wildlife Commission, 11 September 2020, Exhibit C. Agenda Item Summary. Marine Resources Program, 19 pp.

Oregon Entanglement Advisory Committee (OEAC). 2022. Oregon commercial Dungeness crab fishing directive to minimize marine life entanglement risk. 2 pp.

Samhouri, J. F., Feist, B. E., Fisher, M. C., Liu, O., Woodman, S. M., Abrahms, B., Forney, K. A., *et al.* 2021. Marine heatwave challenges solutions to human-wildlife conflict. *Proceedings of the Royal Society B*, 288: 1–10.

Washington Department of Fish and Wildlife (WDFW). 2020. Coastal Dungeness crab whale entanglement (decision). Summary Sheet. Washington Fish and Wildlife Commission, 17 January 2020. 25 pp.

Washington Whale Entanglement Working Group (WWEWG). 2018. Washington commercial Dungeness crab fishing 2018-2019 directive to minimize whale entanglement risk. 2 pp.