2022-23 Risk Assessment: Available Data

Last updated: December 5, 2022

Contents

TRIGGERS REQUIRING MANAGEMENT ACTION

Confirmed Entanglements: §132.8(c)(1)

Data provided by: Lauren Saez and Dan Lawson (National Marine Fisheries Service)

As of November 30, 2022 there have been 16 confirmed humpback whale entanglements reported off California in 2022. Twelve of the entanglements were reported in Fishing Zone 4, two were reported in Fishing Zone 2, and one each was reported in Fishing Zones 1 and 3. Three of the humpback whale entanglements have been confirmed in California commercial Dungeness crab gear, two were confirmed in Oregon commercial Dungeness crab gear, and two were confirmed in gillnet gear (Table 1). The National Marine Fisheries Service (NMFS) has classified the remainder as occurring in unidentified pot/trap gear. There have been no confirmed entanglements of blue whales or leatherback sea turtles during this period.

Table 1. Actionable species entanglements during 2022, prepared by West Coast Region.

Actionable Species	Number Confirmed Entanglements in California Commercial Dungeness Crab Gear	Number Confirmed Entanglements in Unknown Fishing Gear Reported off California
Humpback whales	3	9
Blue whales	0	0
Leatherback sea turtles	0	0

There has been one additional confirmed entanglement of a humpback whale (20221125Mn) since the last risk assessment. The entanglement was reported by a commercial fisherman approximately 1.5 miles offshore between Santa Cruz and Davenport on November 25, 2022. The reporting party described the entanglement as "blue steel line wrapped tightly around the tail, did not see any injury but 'tangled up' in 175-180 feet of water, tail held deep and whale bobbing at the surface". Entanglement responders who were already on the water nearby responded to find multiple humpback whales. While all whales were clear of gear, without more information NMFS cannot confirm a successful self-release. CDFW has not yet assigned an Impact Score for this entanglement, or for 20221008Mn and 20221010Mn.

Table 2. Impact score calculations based on confirmed entanglements in California commercial Dungeness crab gear and confirmed entanglements in unknown fishing gear reported off California.

Actionable Species	Current Fishing Season Impact Score (2022-23)	Current Calendar Year Impact Score (2022)
Humpback whales	0	4.15 **three additional Impact Score assignments pending*
Blue whales	0	0
Leatherback sea turtles	0	0

The total calendar year impact score for 2021 was 1.89 for humpback whales and 0 for blue whales and leatherback sea turtles. The current total calendar year impact score for 2022 is 4.15 for humpback whales and 0 for blue whales and leatherback sea turtles. Beginning in 2023, CDFW will also evaluate risk based on a 3-year rolling average impact score.

Table 3. Impact score calculations based on confirmed entanglements in California commercial Dungeness crab gear and confirmed entanglements in unknown fishing gear reported off California underlying calculation of a 3-year rolling average.

Actionable Species	2021 Calendar Year Impact Score	2022 Calendar Year Impact Score	2023 Calendar Year Impact Score	3-Year Rolling Average
Humpback whales	1.89	4.15 **three additional Impact Score assignments pending*	NA	NA
Blue whales	0	0	NA	NA
Leatherback sea turtles	0	0	NA	NA

Marine Life Concentrations: §132.8(c)(2)

Data provided by: US Coast Guard, California Department of Fish and Wildlife, Karin Forney and Scott Benson (NOAA Southwest Fisheries Science Center and Upwell), Monterey Bay Whale Watch (processed by Karin Forney, NOAA Southwest Fisheries Science Center), Jon Gonzalez (California Coast Crab Association), John Calambokidis (Cascadia Research Collective, in collaboration with The Marine Mammal Center)

Table 4. Summary of available CDFW-approved survey data for marine life concentrations for each Fishing Zone, and whether the triggers established in Section 132.8(c)(2) have been met for any Fishing Zone.

Fishing Zone	CDFW-approved survey data	Triggers attained?
Zone 1	USCG/CDFW Aerial Survey	NA
Zone 2	None	NA
Zone 3	NMFS Aerial Survey, Cascadia Vessel Survey	Yes
Zone 4	NMFS Aerial Survey, MBWW, Cascadia Vessel Survey	Yes
Zone 5	CCCA/Cascadia Vessel Survey	No
Zone 6	None	Yes – No Data

USCG/CDFW Aerial Survey *(Fishing Zone 1)*

USCG and CDFW flew a joint aerial survey on November 28, 2022 between Shelter Cove and the CA/OR border, covering Fishing Zone 1 and the northern portion of Fishing Zone 2. A total of 17 humpback whales (from 4 sightings) were observed in Fishing Zone 1. No blue whales were observed in Fishing Zone 1, and no large whales were observed within the northern portion of Fishing Zone 2.

All of the humpback whales were observed off the Lost Coast, including a single sighting of 15 humpback whales in waters between 50 and 100 meters (25 to 50 fathoms). Two additional humpback whales were observed just inshore, at approximately 50 meters depth (25 fathoms).

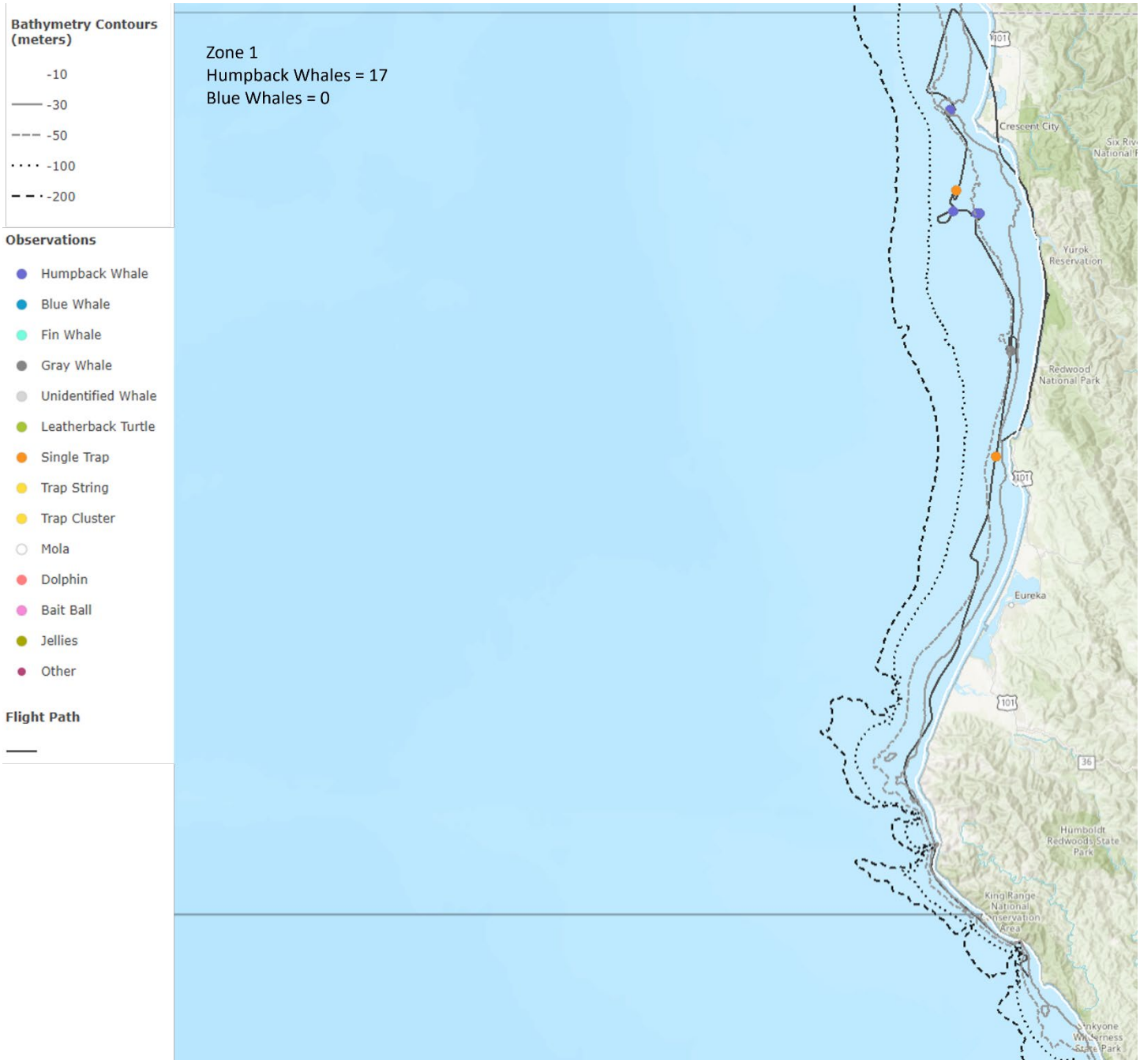


Figure 1. Map showing track lines and observations from CDFW aerial survey of Fishing Zones 1 and 2 on November 28, 2022. Survey information is overlaid onto contours showing the 10m, 30m, 50m, 100m, and 200m bathymetry lines.

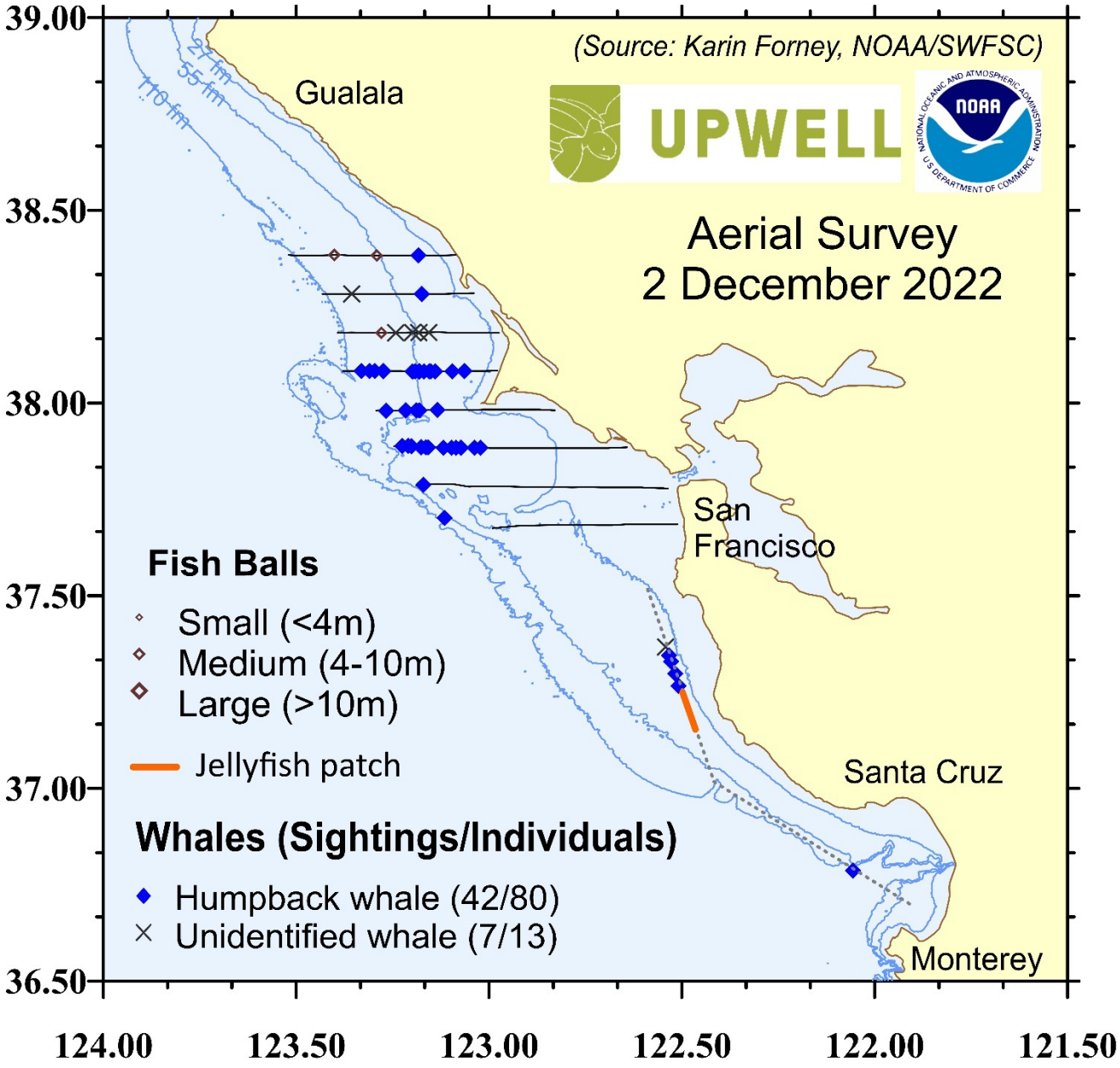
NMFS Aerial Survey *(Fishing Zones 3 and 4)*

An aerial survey was conducted on December 2, 2022 within Fishing Zone 3, covering east-west transect lines spaced 6 nmi apart from just north of Bodega Bay to about Pacifica (Figure 2). The observation team consisted of three observers (Scott Benson, Dick Ogg, and Ryan Bartling) who searched through bubble windows and a belly port, plus a data recorder (Karin Forney). Standardized line-transect survey methods that followed established NOAA methodology were used from a Partenavia P-68 Observer aircraft to record whales, turtles, and ecosystem indicator species such as forage fish, sea nettles and moon jellies (leatherback prey), and ocean sunfish (which are found in the same habitat as leatherback turtles and also feed on jellies). Weather was sunny with light to moderate winds (Beaufort sea states 2-5).

During the transit flight back to Monterey, when only Scott Benson and Karin Forney were aboard the plane, opportunistic observations of whales and jellyfish were also noted between about Half Moon Bay and Monterey (Fishing Zone 4).

A total of 80 humpback whales were observed across 42 sightings, including 41 sightings totaling 78 humpback whales in Fishing Zone 3 (during the transect surveys), and one sighting of two humpback whales in Fishing Zone 4 (during the transit back to Monterey). Thirteen additional unidentified large whales, which were probably humpback whales, were also recorded in Fishing Zone 3.

The humpback whales were concentrated in an area off Pt. Reyes (Figure 2) in water depths ranging from about 30 – 100 fathoms, and they appeared to be feeding on schooling fish (based on their co-occurrence with fish-eating seabirds).



Zone 3: 41 sightings of 78 humpback whales

Zone 4: 1 sighting of 2 humpback whales (during transit)

Figure 2. Plot for the aerial survey conducted on December 2, 2022, showing transects lines flown (black lines) and sighting locations of humpback whales, and unidentified large whales. The depth contours shown are 50 m (~27 fathoms), 100 m (~55 fathoms), and 200 m (~110 fathoms). The dotted line represents the transit flight back to Monterey airport, when a few additional opportunistic observations were made. Symbols plotted off the transect lines represent sightings made while transiting between transects.

Monterey Bay Whale Watch *(Fishing Zone 4)*

- Monterey Bay Whale Watch conducted whale-watching trips in southern Monterey Bay on six of seven days during the week of November 24-30, 2022.
- The average number of humpback whales-per-trip during the last seven days (November 24-30, 2022) was 8.9, with a peak of 33 whales observed on a single half-day trip on November 25, 2022.

- Two blue whales were observed by Monterey Bay Whale Watch on November 14, 2022, but none have been observed since that date.

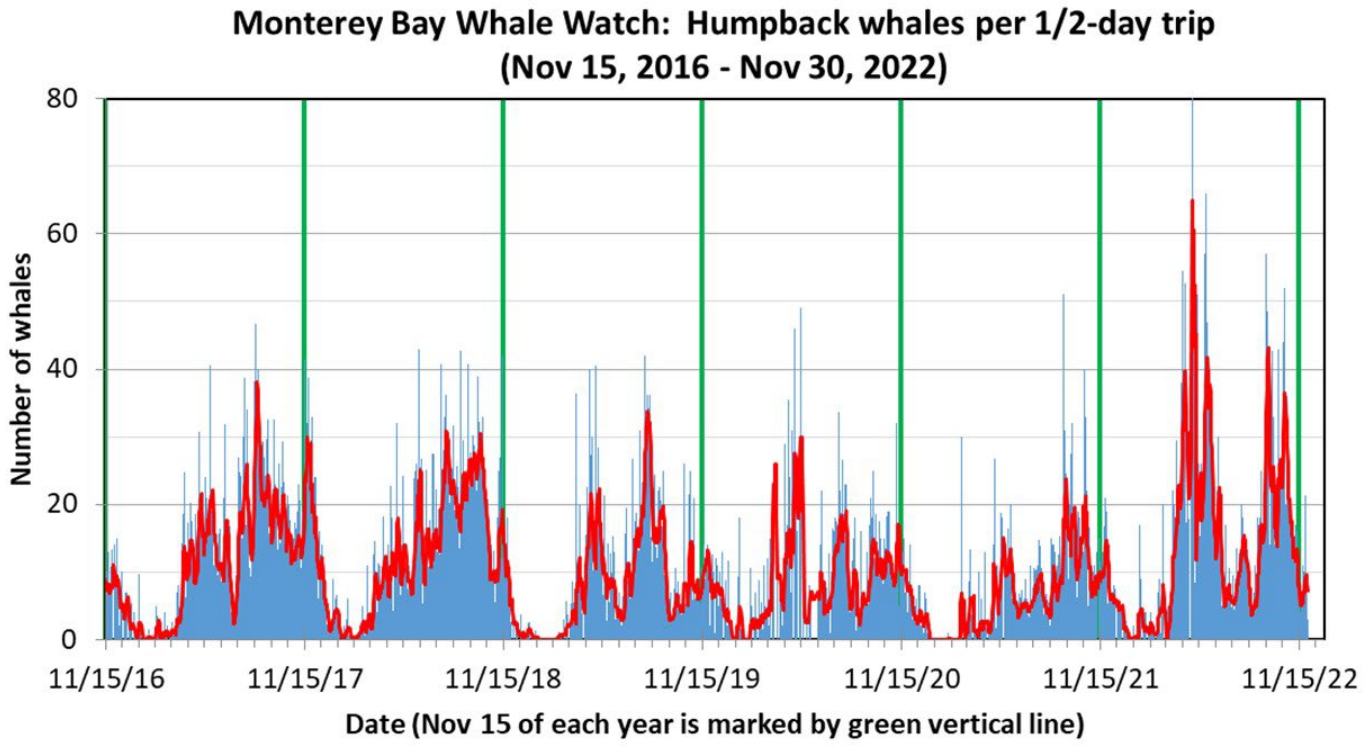


Figure 3. Standardized number of humpback whale sightings for Monterey Bay Whale Watch from 15 November 2016 – 30 November 2022. The y-axis is the number of whales per half-day trip; the thin blue bars are the average daily whale numbers, and the red line is a 7-day running average to make the patterns a bit easier to see. A vertical green line has been added on November 15 of each year for reference. Each tick mark is one month.

CCCA Small Vessel Surveys *(Fishing Zone 5)*

Three surveys were conducted off commercial fishing vessels during late November as part of industry surveys organized by the California Coast Crab Association. Two of these surveys included Cascadia Research observers and are shown in Figure 4 and described below. On November 25, 2022 F/V Brita Michelle departed from Morro Bay covering the outside southern transect (84 nmi). A Cascadia observer documented a total of five humpback whales and three unidentified large whales, all of which were traveling south. On November 30, 2022 F/V Brita Michelle departed from Morro Bay covering the northern transect (86 nmi). A Cascadia observer documented one humpback whale with good conditions throughout the day and lots of birds and fish.

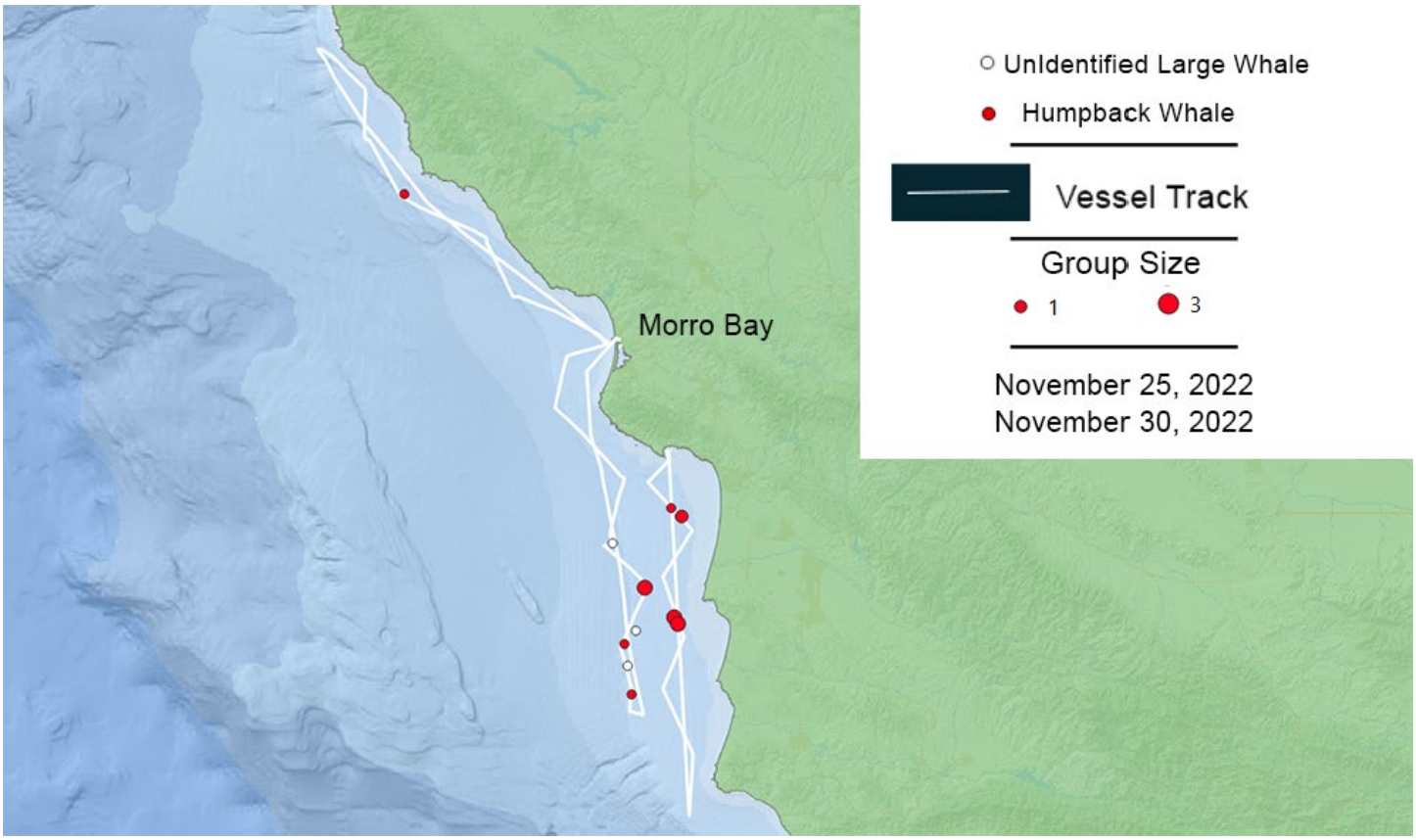


Figure 4. Image generated by Cascadia Research Collective observers showing multi day, multi-vessel surveys conducted by industry vessels coordinated by Jon Gonzalez of the California Coast Crab Association on November 25 and November 30, 2022. Note: One additional survey was conducted on November 25th covering the inside southern transect without Cascadia observers onboard, which is not reflected here.

Cascadia Small Vessel Surveys *(Fishing Zones 3-4)*

In addition to the CCCA surveys described above, three small boat surveys were conducted in the latter half of November (November 19-30, 2022) in Fishing Zones 3 and 4. Survey findings are summarized below in Table 5 and Figures 5-6. In contrast to surveys in Fishing Zone 5, which revealed low numbers of whales, those in Fishing Zones 3 and 4 each documented substantial humpback whales along the tracks surveyed with sightings along both the shallow water and shelf-edge areas.

Table 5. Summary of vessel surveys conducted late November 2022 in Fishing Zones 3 and 4 by Cascadia Research and The Marine Mammal Center. Findings from CCCA surveys in Fishing Zone 5 which included Cascadia Research observers are included in the CCCA section above.

Date	Vessel	Zone	Area	Hump. Whales (Total)	Unid. Whales (Total)	Comments
19-Nov	MUS	4	Monterey Bay & N	59	4	86 nmi, 26 IDs obtained, size meas.
20-Nov	MUS	4	Monterey Bay & N	64	2	68 nmi, 39 IDs obtained, size meas.
30-Nov	TMMC RHIB	3	Gulf of the Faral.	49	2	84 nmi

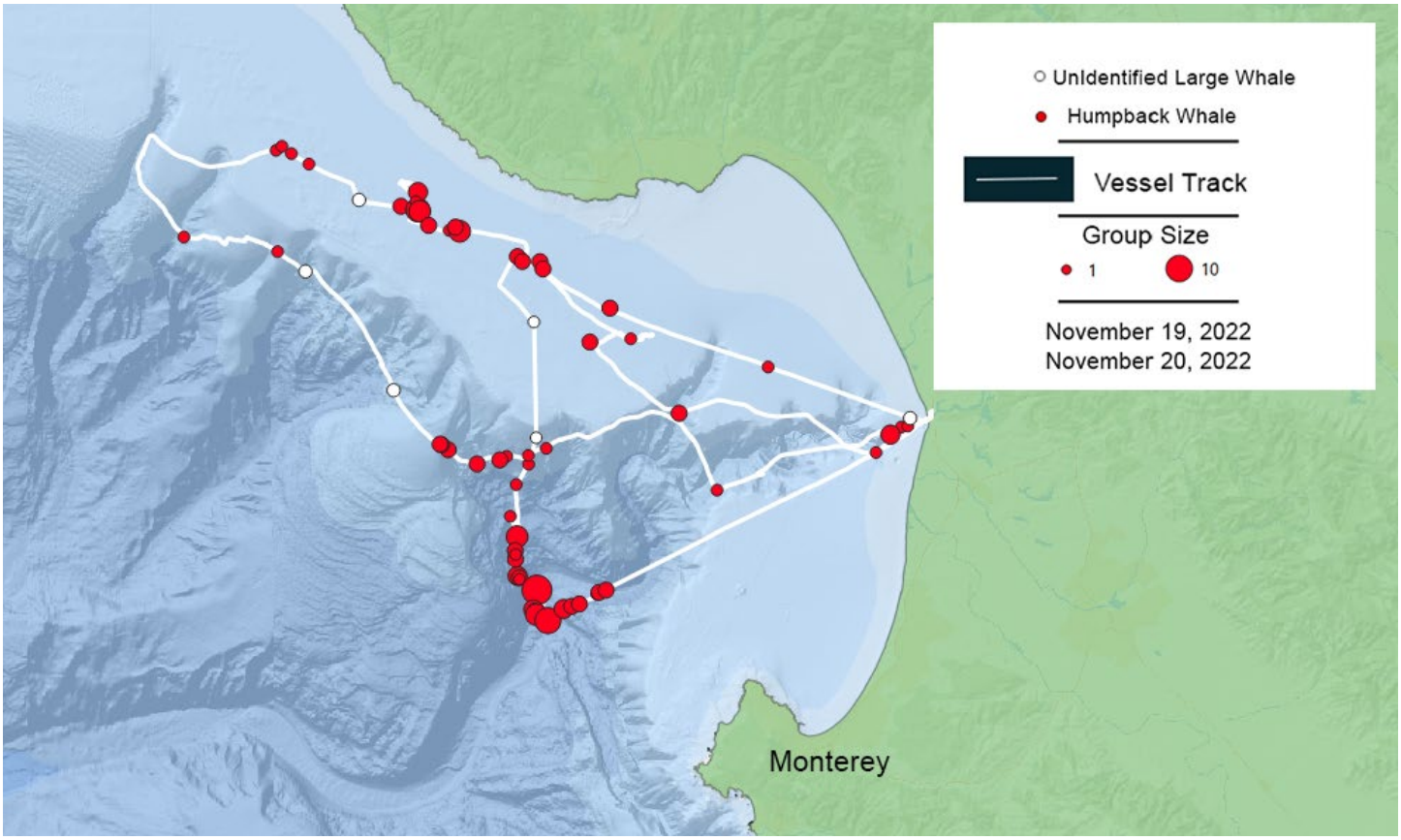


Figure 5. Track and sightings from survey by MUS in Monterey Bay area (Fishing Zone 4) on November 19-20, 2022.

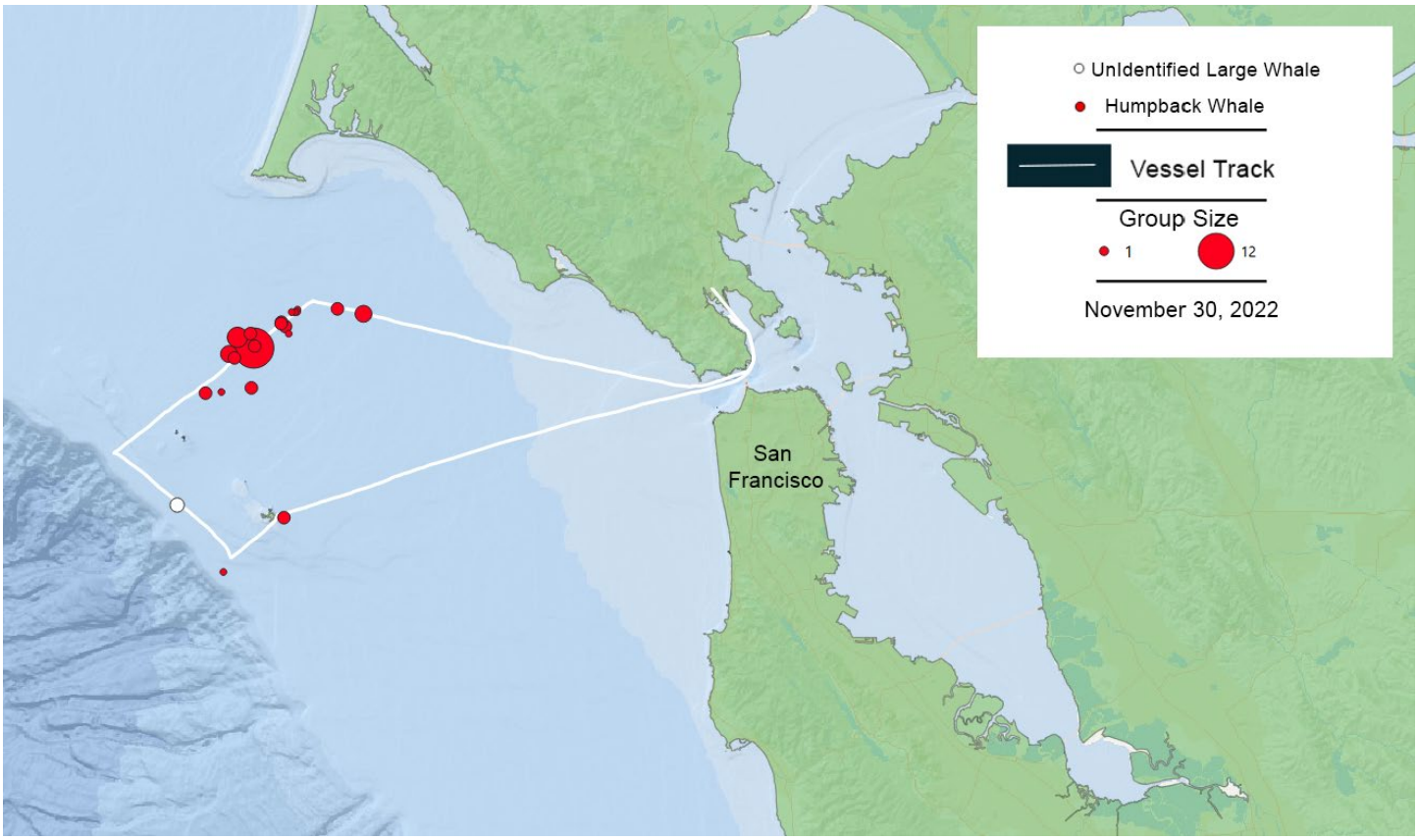


Figure 6. Track and sightings from survey by TMMC in the Gulf of the Farallones (Fishing Zone 3) on November 30, 2022.

The small boat surveys have continued to obtain photographic identifications of individual whales with an estimated 26 and 39 different individuals identified on November 19 and 20, 2022. Also, on the surveys on those two days, UAS flights were conducted to obtain vertical photographs of whales to be able to calculate size and age classes of these whales staying late into the season (Figure 7).

Figure 7. Example of UAS vertical image from surveys on November 19-20 in Monterey Bay for determining length, age class and body condition.

MANAGEMENT CONSIDERATIONS

Information from NOAA: §132.8(d)(2)

No additional information was provided for this risk assessment.

Effectiveness of management measures: §132.8(d)(3)

Data provided by: California Department of Fish and Wildlife

Given the high number of confirmed entanglements which have occurred during 2022, avoidance of any additional entanglements is a priority for CDFW. The selected management measure must limit the potential for interactions between humpback whales and commercial Dungeness crab gear, therefore issuance of a Fleet Advisory would not provide adequate protection from risk of entanglement. Foraging humpback whales often move between shallow and deep-water areas in pursuit of prey and aerial surveys documented humpback whales across a broad range of depths, so a depth constraint will not offer adequate protection as humpbacks whales leave the foraging grounds for winter breeding grounds. Opening the commercial fishery under a gear

reduction would still allow vertical lines to be deployed in areas where humpback whales are present, posing a risk of entanglement. Alternative Gear can only be authorized after April 1st. Therefore, a continued commercial fishery delay in Fishing Zones 3-6 is the most effective management action.

Actions taken in the recreational fishery are limited to a recreational trap restriction. For the reasons described above, allowing harvest with recreational crab traps poses risk of entanglement. The only effective management action is to continue the recreational trap restriction in Fishing Zones 3-6.

Total economic impact to the fleet: §132.8(d)(4)

Data provided by: California Department of Fish and Wildlife

The RAMP regulations specify that, when deciding amongst multiple management measures which would equivalently reduce entanglement risk, CDFW shall consider total economic impact to the fleet and fishing communities. CDFW has not identified any other management measure that would equivalently reduce entanglement risk.

Historic patterns and current Actionable Species migration: §132.8(d)(6) and (11)

Data provided by: Monterey Bay Whale Watch (processed by Karin Forney, NOAA Southwest Fisheries Science Center), Point Blue Conservation Science, John Calambokidis (Cascadia Research Collective)

Monterey Bay Whale Watch *(Fishing Zone 4)*

- The semi-monthly average number of humpback whales-per-half-day-trip is similar to the average historical value at this time of the year (Figure 1). The 7-day running average has increased slightly during the last two weeks, but remains below 10 whales per half-day trip (Figure 8).
- The absence of blue whales since mid-November is consistent with historical patterns for this time of the year (see the October 25, 2022 Available Data document).

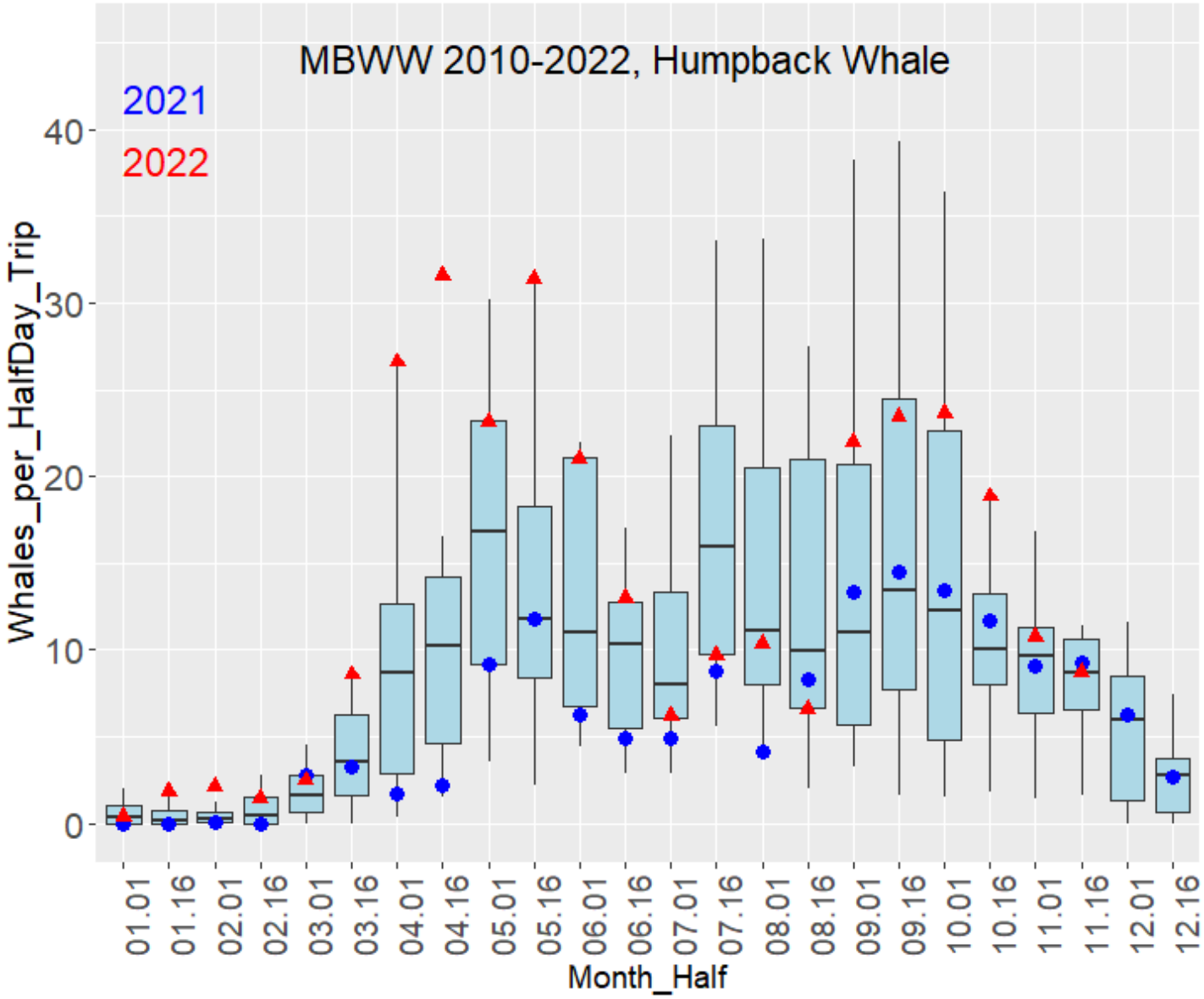


Figure 8. Historical Monterey Bay Whale Watch data for 2010-2022, summarizing the average and variation in the number of humpback whales per half-day trip on a semi-monthly basis (1st- 15th, 16th- end of month). This boxplot follows standard statistical practice in that the black horizontal line is the average number of whales; the blue box shows the 25th-75th percentiles (i.e., half of all past whale numbers are within the blue box); the vertical lines show the range of whale numbers excluding outliers, and outliers are shown as small black dots. Values for 2021 (large blue dots) and 2022 (red triangles) and are provided for reference, placing recent whale numbers in a historical context. [NOTE: To account for population growth of these recovering whale populations, the historical reference period includes only the more recent period of 2010-2022, rather than 2003-2022 as in plots provided during previous fishing seasons. This provides a more relevant comparison to the current conditions].

Cascadia Research Collective

Collaborators working with Cascadia Research in Mexico have continued to document whales arriving from California indicating the migration to wintering areas is continuing despite the sightings of whales still on feeding grounds.

Point Blue Conservation Science Data Portal *(Fishing Zones 3 and 6)*

During the seven-day period ending December 5, 2022 trained observers at the Farallon Islands did not report any blue or humpback whale sightings within Fishing Zone 3, and

trained naturalists from the Channel Islands National Marine Sanctuary and National Park Service reported four humpback whale sightings within Fishing Zone 6 (Figure 9).

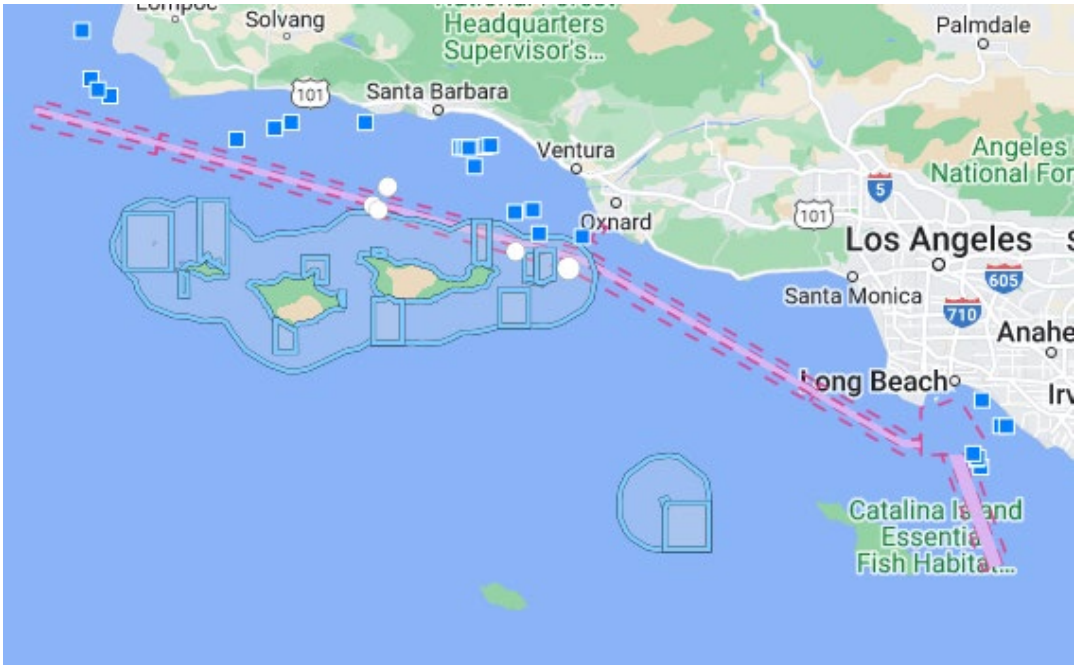


Figure 9. Locations of humpback whale sightings within Fishing Zones 3 and 6. Reporting locations are represented by white circles. A given report may or may not represent multiple individuals. Fishing Zone boundaries are represented by the dashed lines.

WhaleWatch 2.0 (*All Fishing Zones*)

Compared to predictions for November 11, 2022 (see the November 16, 2022 Available Data document), blue whale habitat predictions for December 1, 2022 indicate lower habitat suitability along most of the California coast (Figure 10). Moderate habitat suitability remains off the Channel Islands.

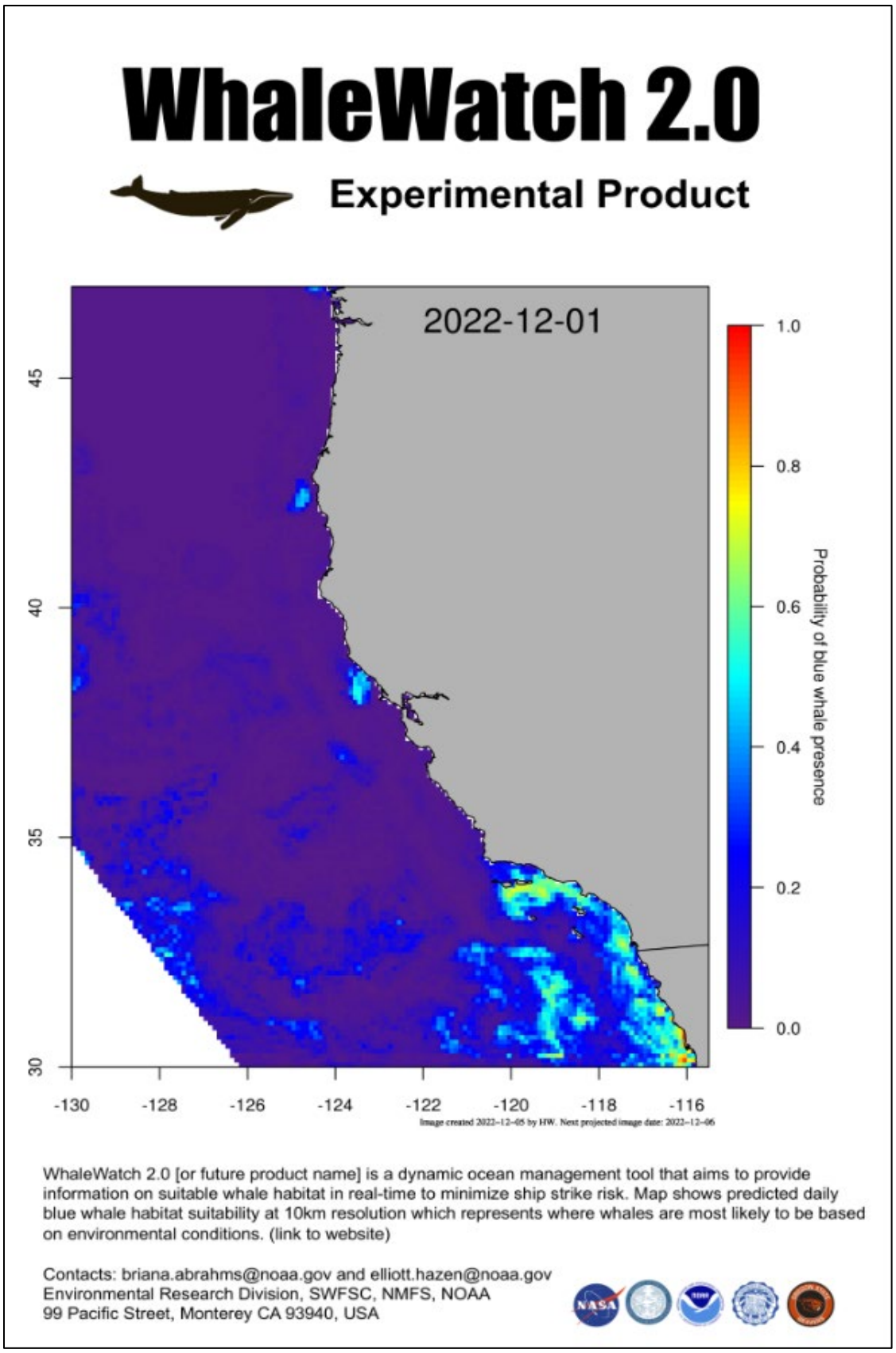


Figure 10. WhaleWatch 2.0 map for December 1, 2022. View a current map.

Fishing Season dynamics: §132.8(d)(7)

Data provided by: California Department of Fish and Wildlife

CDFW data presented in this section is preliminary and subject to revision.

Domoic Acid and Quality Testing

As of November 17, 2022, domoic acid results for all port areas indicate all crabs are below the federal action level (Figure 11). No additional domoic acid testing is planned for the 2022-23 season.

Fishing Zones 1 and 2 are currently subject to a quality delay, and will open no sooner than December 16, 2022. Samples to inform a second round of quality testing were collected on December 4 and 5, 2022. Managers from California, Oregon, and Washington will confer regarding the need for further delays under the Tri-State Agreement on December 7, 2022.

CDPH SUMMARY OF DOMOIC ACID LEVELS IN CRABS **JULY 01, 2022 - NOVEMBER 17, 2022**

PORT	COLLECTION SITE	SAMPLE COLLECTION DATE	CRAB TYPE VISCERA	INDIVIDUAL SAMPLE RESULTS (FDA ACTION LEVEL >30 PPM)						AVERAGE LEVEL (Information Only)	PERCENT OF SAMPLES EXCEEDING ACTION LEVEL
Crescent City	George Reef	10/9/2022	Dungeness Crab	<2.5	4.1	9.5	<2.5	<2.5	<2.5	2.3 ppm	0%
Crescent City	Klamath River	10/9/2022	Dungeness Crab	<2.5	<2.5	4.2	3.0	<2.5	<2.5	1.2 ppm	0%
Trinidad	Lagoons	9/11/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%
Trinidad	Trinidad Head	9/11/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%
Eureka	LP Eureka	10/9/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%
Eureka	LP Eureka	11/10/2022	Dungeness Crab	11	2.8	4.5	3.7	<2.5	<2.5	3.7 ppm	0%
Eureka	Eel River	10/9/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%
Eureka	Eel River	11/10/2022	Dungeness Crab	8.8	5.4	5.5	NA	NA	NA	6.6 ppm	0%
Fort Bragg	Usal	10/16/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%
Fort Bragg	Manchester Beach	11/4/2022	Dungeness Crab	4.4	<2.5	<2.5	<2.5	11	<2.5	2.6 ppm	0%
Bodega Bay	Salt Point	10/3/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%
Bodega Bay	Russian River	10/3/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	3.3	<2.5	0.6 ppm	0%
Bodega Bay	Bodega Head	10/3/2022	Dungeness Crab	<2.5	12	<2.5	<2.5	<2.5	<2.5	2 ppm	0%
Bodega Bay	Point Reyes	10/3/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%
Half Moon Bay/ San Francisco	Duxbury Reef	9/22/2022	Dungeness Crab	4.4	<2.5	<2.5	<2.5	<2.5	<2.5	0.7 ppm	0%
Half Moon Bay/ San Francisco	Pillar Point	9/24/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%
Half Moon Bay/ San Francisco	Pigeon Point	9/25/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%
Monterey	Monterey Bay	9/24/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	16	<2.5	2.7 ppm	0%
Monterey	Monterey Bay	9/24/2022	Rock Crab	<2.5	3.0	12	<2.5	<2.5	<2.5	2.5 ppm	0%
Morro Bay	Avila Beach	10/7/2022	Dungeness Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%
NA	CDFW Block 745	9/29/2022	Box Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%
NA	CDFW Block 745	9/29/2022	King Crab	<2.5	<2.5	<2.5	<2.5	<2.5	NA	Non-Detect	0%
NA	CDFW Block 652	9/28/2022	Rock Crab	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	Non-Detect	0%

1 SET = 6 SAMPLES

Figure 11. California Department of Public Health domoic acid test results for crab, updated November 17, 2022.

Recreational Crab Fishery

The recreational crab fishery opened statewide under a trap restriction on November 5, 2022. Use of crab traps was allowed for Fishing Zones 1 and 2 as of November 28, 2022. Use of crab traps is still prohibited in Fishing Zones 3-6.

Distribution and abundance of key forage: §132.8(d)(8)

Data provided by: Karin Forney and Scott Benson (NOAA Southwest Fisheries Science Center and Upwell), Monterey Bay Aquarium Research Institute

NMFS Aerial Survey

- A dense aggregation of jellyfish (primarily brown sea nettles but also moon jellies) was documented near Pigeon Point during the transit flight back to Monterey (see Figure 2).
- One large and one medium-sized ocean sunfish (*Mola mola*) were observed during the survey, which represents a marked decrease in the abundance of this species since October.
- A few medium-sized balls of schooling fish (likely anchovies) and several feeding flocks of fish-eating seabirds were observed near areas where humpback whales were documented.

MBARI Krill Model

Modeled zooplankton conditions for October 2022 indicate lower than expected concentrations from the CA/OR border to Point Sur, higher than expected concentrations between Point Sur and Point Conception, and average to slightly below average concentrations south of Point Conception (Figure 12).

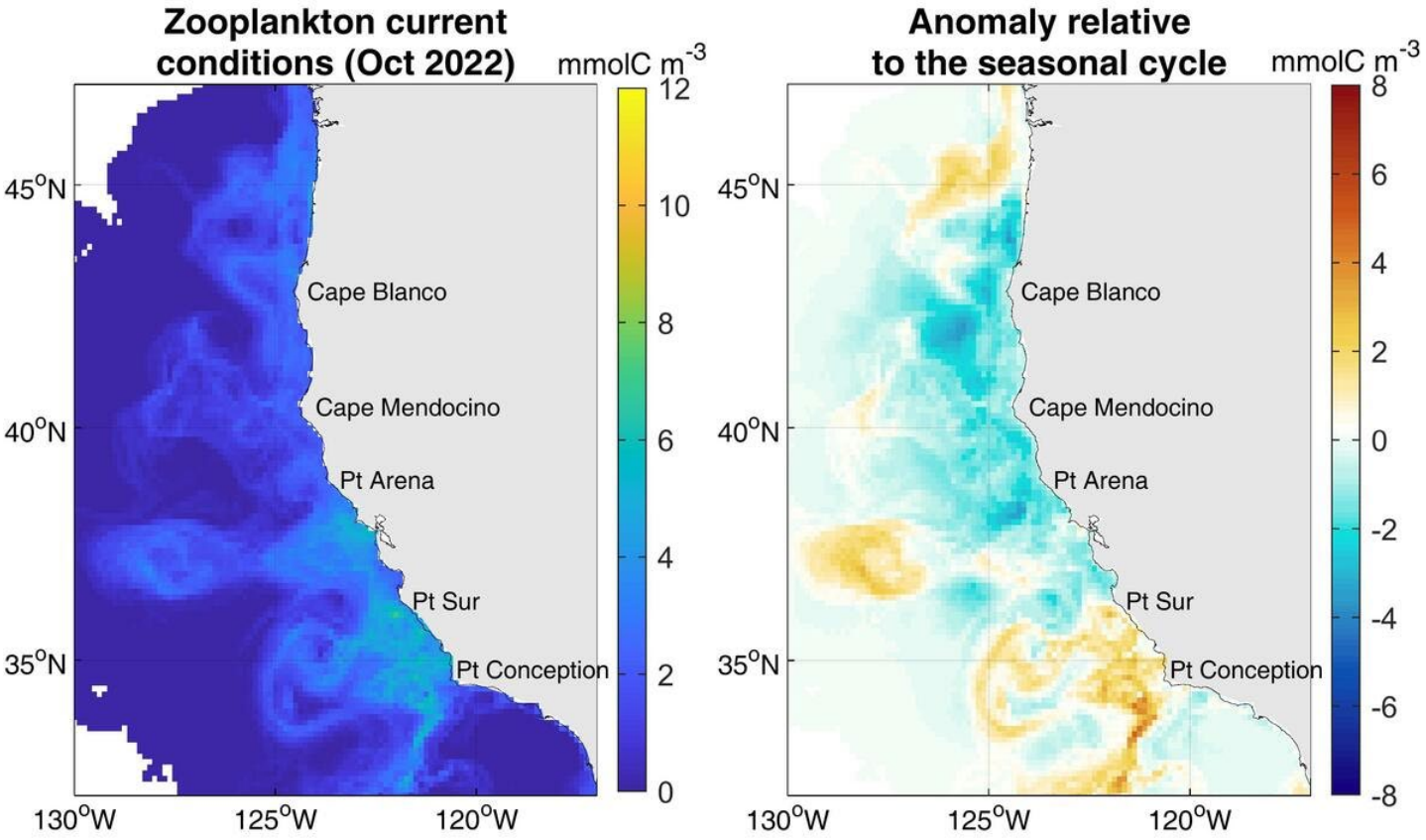


Figure 12. Latest modeled zooplankton concentrations in the California Current (left) and corresponding anomaly relative to the 1993-2018 seasonal cycle (right). Accessed from the MBARI website on December 5, 2022.

The MBARI model identified four zooplankton hotspots withing the model's spatial domain, three of which are present within California (Figure 13). 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.

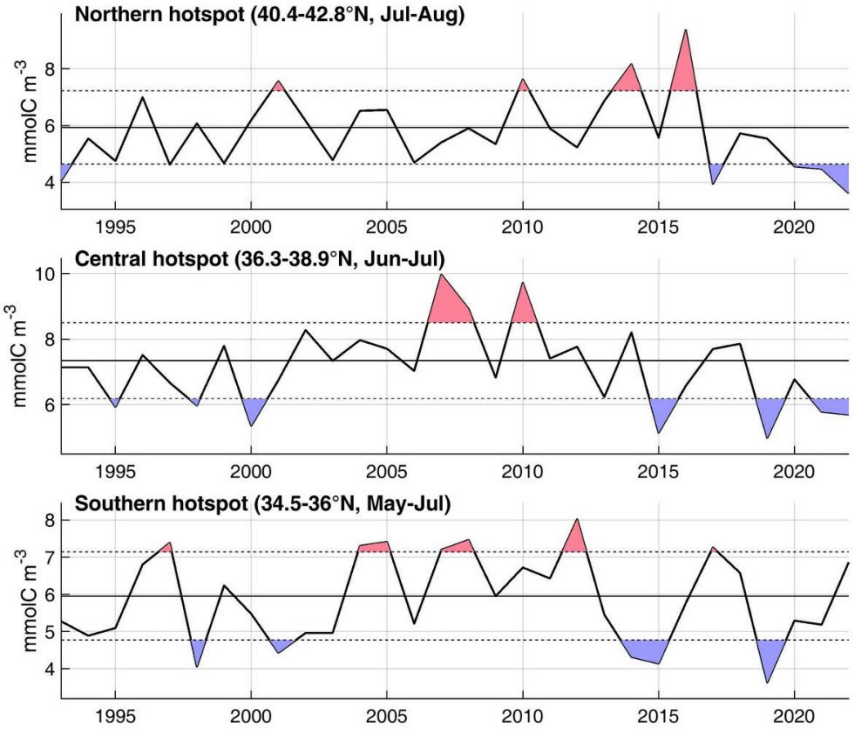


Figure 13. Time series of zooplankton concentration within three hotspots off California, averaged each year over their peak months. Horizontal lines display the mean and standard deviation over the 1993-2018 time period.

Ocean conditions: §132.8(d)(9)

Data provided by: California Current Integrated Ecosystem Assessment Program

Large Marine Heatwave Tracker

As of November 18, 2022 sea surface temperature anomalies in the Northeast Pacific indicate expansion of cool water along the coast of California, with warmer conditions persisting offshore (Figure 14).

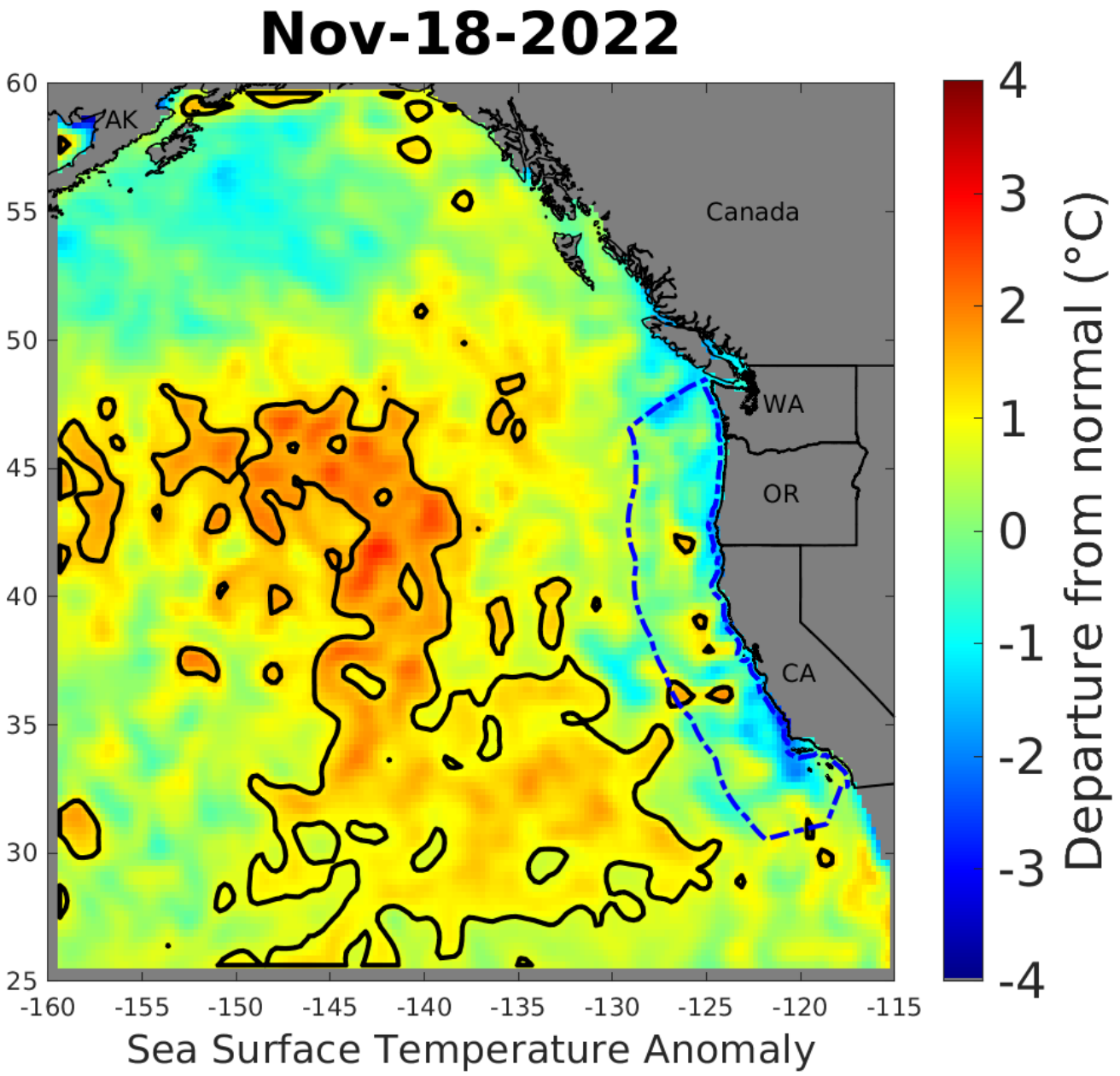


Figure 14. Science-quality (delayed 3-weeks), daily interpolated standardized sea surface temperature anomalies (SSTa) in the California Current ecosystem available for analysis of MHW presence. Dark outline shows the current extent of MHW conditions, as delineated by values of the normalized SST + 1.29 SD from normal. Blue dashed line represents the US West Coast EEZ. SST data from NOAA's Optimum interpolation Sea Surface Temperature analysis with the SST anomaly calculated using climatology from NOAA's AVHRR-only OISST dataset.

Habitat Compression Index

The most recent Habitat Compression Index values are for October 2022, when Habitat Compression was high in HCI Region 2 (which includes Northern California; Figure 15). For

the HCI Region 3 map, see the November 16, 2022 Available Data document.

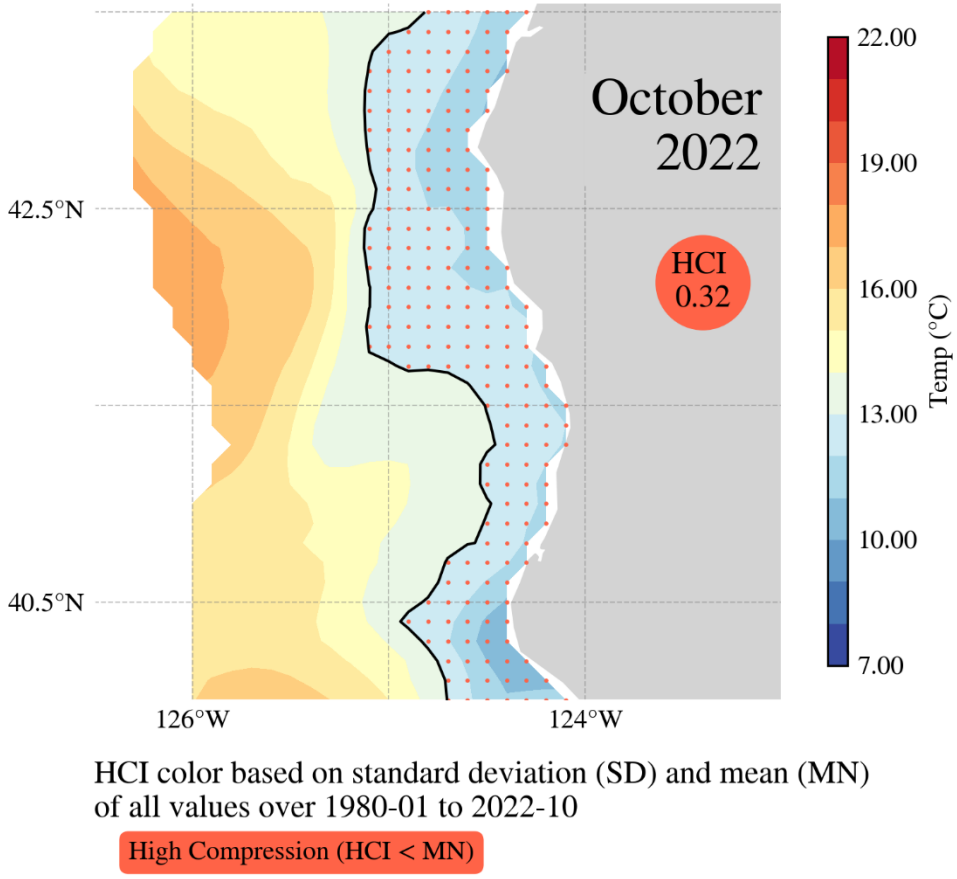


Figure 15. Map of October 2022 sea surface temperature and location of the Habitat Compression Index boundary (thin black line) for HCI Region 2.

Habitat compression has been high during December in seven of the last 10 years in HCI Region 2 (Figure 16) and eight of the last ten years in HCI Region 3 (Figure 17).

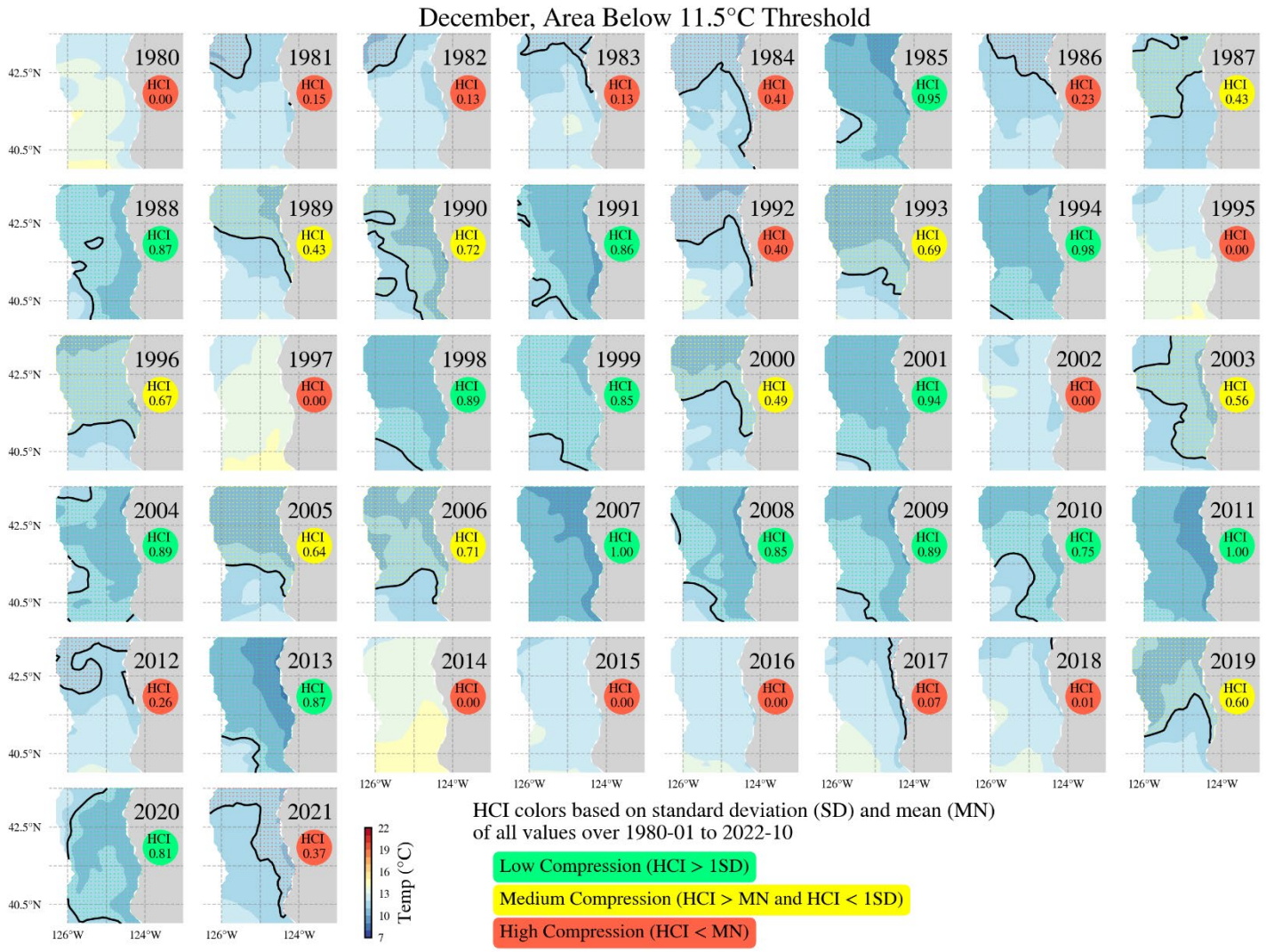


Figure 16. Maps of historical December sea surface temperature and location of the Habitat Compression Index boundary (thin black line) between 1980 and 2021 in HCI Region 2.

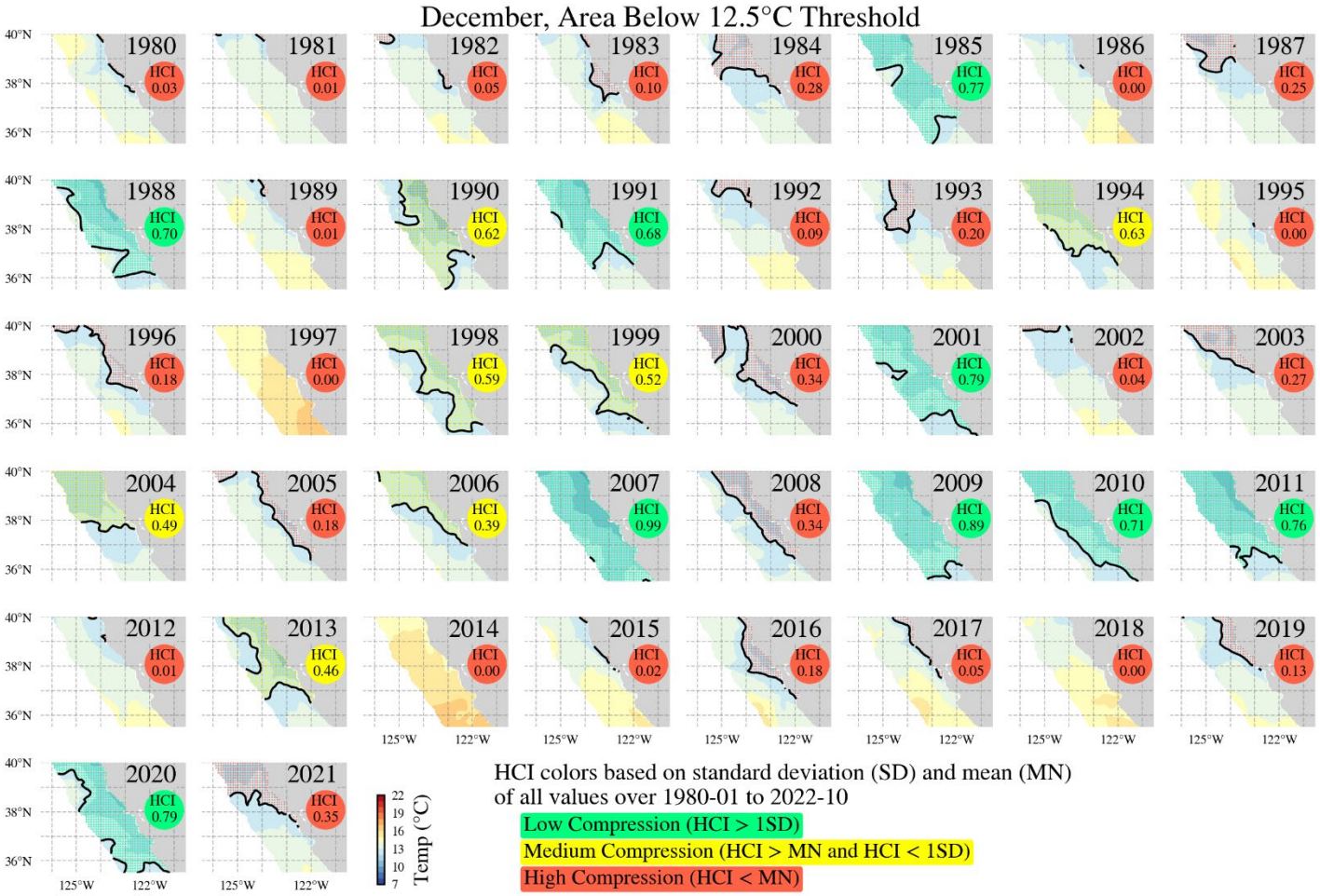


Figure 17. Maps of historical December sea surface temperature and location of the Habitat Compression Index boundary (thin black line) between 1980 and 2021 in HCI Region 3.

Current Impact Score Calculation: §132.8(d)(10)

Data provided by: California Department of Fish and Wildlife

Pursuant to the Risk Assessment and Mitigation Program (Section 132.8, Title 14, CCR), Impact Scores will be assigned beginning with the 2021 calendar year based on confirmed entanglements of Actionable Species (humpback whales, blue whales, or leatherback sea turtles) reported to CDFW by NOAA. Impact Score totals for the current fishing season (2022-23) and calendar year (2022) are provided in Table 2 above. Impact Score totals for calendar year 2021 are provided in Table 3 above.