CUVIER'S BEAKED WHALE AND FIN WHALE SURVEYS AT THE SOUTHERN CALIFORNIA OFFSHORE ANTI-SUBMARINE WARFARE RANGE (SOAR)

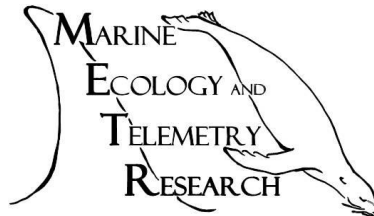## Annual Report
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14. ABSTRACT
The Southern California Tactical Training Range (SCTTR), within the Hawaii-Southern California Training and Testing Area, is one of the United States Navy's most heavily used regions, particularly for mid-frequency active sonar training. Much of the SCTTR lies within the Southern California Bight, a productive oceanographic region that hosts a wide variety of marine species. As part of ongoing studies of the distribution and demographics of several marine mammal species within the SCTTR, we conducted 24 days of survey effort from 7 January 2023 to 8 October 2023, specifically focusing on the Southern California Anti-submarine Warfare Range. The primary goal of these surveys was sighting, photographing, and collecting tissue samples from Cuvier's beaked whales (*Ziphius cavirostris*) and fin whales (*Balaenoptera physalus*). With combined effort from two ancillary projects funded by the United States Navy's Living Marine Resources program and the Office of Naval Research, we had 203 sightings of cetaceans, including 18 sightings totaling 41 Cuvier's beaked whales and 37 sightings totaling 59 fin whales. Identification photographs from these sightings were combined with opportunistic contributions from both species for this and prior years. Identification photographs from these sightings were combined with opportunistic contributions from both species for this and prior years. This yielded a total of 52 unique Cuvier's beaked whales in 2023, 15 (29%) of which had been sighted in a previous year. Two mother-calf pairs were photographed, one new to the study, the other had been seen four times prior to 2023 including as a subadult in 2010. We processed 436 new fin whale identifications through 2022, bringing that dataset to 3,620 sightings of 1,377 unique individuals. Eleven genetic samples were collected in 2023, eight from

Cuvier's beaked whales and three from common dolphins. Nine satellite tags were deployed: six SMRT tags on Cuvier's; one SMRT and two LIMPET tags on fin whales.

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Abstract

The Southern California Tactical Training Range (SCTTR), within the Hawaii-Southern California Training and Testing Area, is one of the United States Navy's most heavily used regions, particularly for mid-frequency active sonar training. Much of the SCTTR lies within the Southern California Bight, a productive oceanographic region that hosts a wide variety of marine species. As part of ongoing studies of the distribution and demographics of several marine mammal species within the SCTTR, we conducted 24 days of survey effort from 7 January 2023 to 8 October 2023, specifically focusing on the Southern California Anti-submarine Warfare Range. The primary goal of these surveys was sighting, photographing, and collecting tissue samples from Cuvier's beaked whales (*Ziphius cavirostris*) and fin whales (*Balaenoptera physalus*). With combined effort from two ancillary projects funded by the United States Navy's Living Marine Resources program and the Office of Naval Research, we had 203 sightings of cetaceans, including 18 sightings totaling 41 Cuvier's beaked whales and 37 sightings totaling 59 fin whales. Identification photographs from these sightings were combined with opportunistic contributions from both species for this and prior years. Identification photographs from these sightings were combined with opportunistic contributions from both species for this and prior years. This yielded a total of 52 unique Cuvier's beaked whales in 2023, 15 (29%) of which had been sighted in a previous year. Two mother-calf pairs were photographed, one new to the study, the other had been seen four times prior to 2023 including as a subadult in 2010. We processed 436 new fin whale identifications through 2022, bringing that dataset to 3,620 sightings of 1,377 unique individuals. Eleven genetic samples were collected in 2023, eight from Cuvier's beaked whales and three from common dolphins. Nine satellite tags were deployed: six SMRT tags on Cuvier's; one SMRT and two LIMPET tags on fin whales.

Introduction

The Southern California Tactical Training Range (SCTTR) portion of the Hawaii-Southern California Training and Testing Area is a collection of nearshore and offshore training areas that include much of the navigable water from Santa Barbara Island, California, to northern Baja California, Mexico, extending several hundred miles to the west. It is among one of the most heavily used tactical training areas in the world, and is used for a variety of aerial, surface, and subsurface exercises. The Southern California Offshore Range (SCORE) is a subset of complexes within SCTTR centered on San Clemente Island and managed via the Range Operation Center (ROC) on North Island, Coronado. It includes the Southern California Anti-submarine Warfare Range (SOAR), a focal area for exercises involving mid-frequency active sonar (MFAS) systems within the San Nicolas Basin (Figure *1*).

Through its N45 Living Marine Resources (LMR) research programs, and more recently in support of Pacific Fleet Monitoring efforts, the United States (U.S.) Navy has funded directed studies of cetacean occurrence on SOAR since 2006. Initially, the primary objective of these surveys was visual verification of acoustic marine mammal detections on the SOAR hydrophone array in conjunction with the Marine Mammal Monitoring on Navy Ranges (M3R) program. These early studies documented generally high cetacean diversity on SOAR year-round, with some seasonal fluctuations (Falcone and Schorr, 2014). As a result, photo-ID studies of both Cuvier's beaked whales (*Ziphius cavirostris*) and fin whales (*Balaenoptera physalus*) were initiated to better understand the structure of these poorly known populations that were present year-round.

The Office of Naval Research (ONR) supported a power analysis of Cuvier's beaked whale data which determined that long-term photo-ID provided the best power to detect an actual decline in the Cuvier's beaked whale population at SOAR if one were occurring (Moore et al., 2017). This work was expanded upon by Curtis et al., (2021) which used simulations to demonstrate that the probability of detecting abundance changes with the existing photo-ID data is currently low, but will greatly improve through continued effort. Booth et al. (2017) suggested that photo-ID and tissue sampling are critical tools for accurately monitoring population health, since these provide the collateral data needed to detect changes in reproductive rates before they result in actual declines.

As the surveys progressed, research expanded to incorporate the deployment of dive-reporting satellite tags to study the movements and diving behavior of both these species, and to assess any changes associated with MFAS use. Both satellite tag and photo-ID data from these studies have indicated individual site fidelity to the Southern California Bight (SCB) for several species, including Cuvier's beaked whales on SOAR (Curtis et al., 2021; Falcone et al., 2009; Schorr et al., 2014) and fin whales in the greater SCB (Falcone et al., 2022; Scales et al., 2017). Both findings were somewhat unexpected. Virtually no information was available on the stock structure of Cuvier's beaked whales, and individual Cuvier's beaked whales were not expected to preferentially use SOAR, as this is the species most frequently recorded in mass strandings associated with MFAS elsewhere (Bernaldo de Quirós et al., 2019; Cox et al., 2006; D'Amico et

al., 2009). Fin whales were believed to range broadly along the U.S. West Coast with no population substructure.

Despite a preference for the region by at least some individual Cuvier's beaked whales and fin whales, sensitivity to MFAS has been documented for both these species (DeRuiter et al., 2013; Falcone et al., 2017; Southall et al., 2023). Therefore, understanding the ecology, behavior, and population dynamics of these two populations in a region of such frequent Navy training remains critical to effective management, including realistic estimation of takes. Furthermore, there are specific inputs to Population Consequences of Disturbance (PCOD) models currently being developed for beaked whales at SOAR and other Navy ranges, which can only be derived from the individual life history data this research program supports.

Presently, the overall scientific questions addressed by the Navy's Integrated Comprehensive Monitoring Program (henceforth "Pacific Fleet Monitoring") at SOAR, in cooperation with M3R, are the following:

What is the seasonal occurrence, abundance, and density of beaked whales and Endangered Species Act-listed baleen whales within the Navy's SCTTR, and how are these metrics changing?

Does exposure to sonar or explosives impact the long-term fitness and survival of individuals or the population, species, or stocks of blue whale (Balaenoptera musculus), fin whale, humpback whale (Megaptera novaeangliae), Cuvier's beaked whale, and other regional beaked whale species?

What are the baseline population demographics, vital rates, and movement patterns for Cuvier's beaked whales and fin whales?

In addition to the detailed data collected for Cuvier's beaked whales and fin whales, the location, group size, and basic behavior is recorded for all cetacean species encountered. For those species that are data deficient, we may also collect images, tissue samples, and deploy Low Impact Minimally Percutaneous External-electronics Transmitting (LIMPET) tags (Schorr et al., 2019).

In this report, we present three components of Pacific Fleet Monitoring work:

1) *Effort and sightings from all surveys funded by Pacific Fleet Monitoring, LMR, and ONR in 2023.* Survey efforts from these projects are summarized independently but resulting sighting and photo-ID data are combined to provide the most comprehensive datasets from Navy-funded work in the region.

2) Interim results on photo-ID for Cuvier's beaked whales and fin whales, plus initial results of tags deployed during the year.

3) Finally, we provide a copy of a manuscript resulting in part from this long-term monitoring work that was published in this study year; "Using individual-based bioenergetic models to predict the aggregate effects of disturbance on populations: A case study with beaked whales and Navy Sonar" (Hin et al., 2023).

Methods

Field Data Collection

Surveys were conducted using a 6.5 to 7.5-meter (m) rigid-hulled inflatable boat (RHIB), powered by two outboard motors and equipped with a raised bow pulpit. The RHIB was launched from a shore base each morning and surveyed throughout daylight hours as conditions permitted. Surveys focused on SOAR were based at Wilson Cove on the northeast side of San Clemente Island. The RHIB was initially launched at Dana Point or Oceanside at the start of the survey period and remained moored in Wilson Cove for a period of 7 to 14 days, or until poor weather or conflicting range operations prevented further surveys at SOAR. When SOAR was available for our use, staff from the Naval Undersea Warfare Center's (NUWC) M3R program would monitor hydrophones from the ROC on North Island in San Diego and direct the RHIB via radio or satellite phone into areas where marine mammal vocalizations were detected. While the RHIB could be directed towards any vocalizations for visual verification, they were preferentially directed to those likely to be beaked whales when conditions were suitable for working with these species (typically winds at Beaufort 3 or less). In general, detections classified as other small odontocetes were bypassed in favor of those from beaked whales or baleen whales.

Effort and sighting data were collected using a custom-built Microsoft Access (Microsoft, Redmond, WA) database on a ruggedized tablet with an integrated Global Positioning System (GPS). Each time a group of cetaceans was encountered, the species, time, latitude, longitude, group size and composition, and overall behavioral state were recorded.

For encounters with beaked whales, detailed records of surfacing patterns were also collected for as long as contact with the group was maintained. Photographs were taken for confirmation of any species where the identity was uncertain, and for individual identification where this methodology is being employed by ourselves or collaborators; these include beaked, fin, blue, humpback, minke (*Balaenoptera acutorostrata*), and killer whales (*Orcinus orca*); common bottlenose (*Tursiops truncatus*) and Risso's (*Grampus griseus*) dolphins. Remote tissue samples were collected from species of interest to this study (beaked whales and fin whales) and from other species as requested by collaborators at the Southwest Fisheries Science Center (SWFSC) for use in ongoing assessments of population structure and stress hormone analyses. Samples were collected using either a crossbow or a pneumatic projector to fire arrows or darts equipped with sampling tips at distances of 5-30 m. Tip lengths were 25 millimeters for small cetaceans and 40 millimeters for large cetaceans. All biopsy darts were retrieved from the water and if a sample was successfully retained, it was processed and stored on ice for transportation to SWFSC for archiving and analysis. Additionally, a limited number of LIMPET satellite tags and SMRT

archival tags were deployed to provide additional information on distribution, behavior, and overlap with Navy activities.

Photo-Identification

All photos collected during surveys were reviewed, and image metadata were updated with sighting and individual information using ACDSee Pro image management software. Best-of-sighting identification photographs of fin whales and beaked whales from each annual sampling period were combined with opportunistic contributions from citizen science and collaborating researchers, internally reconciled, and then compared to our existing photo-ID catalogs, using methods described in (Curtis et al., 2021) and (Falcone et al., 2022) to build photographic sighting histories. Identification photos of other species were provided to curators of those catalogs at the end of each annual data collection period.

Tagging

Two types of tags were deployed as part of this work: LIMPET tags, and SMRT tags (Andrews et al., 2008; Schorr et al., 2014; Sweeney et al., 2022). Two types of LIMPET tags were deployed; the SPLASH10A which provides summarized dive data and locations generated via the Argos localization system, and the SPLASH10F which has the same features of the SPLASH10A but adds Fastloc™ GPS location estimates. LIMPET tag deployment methods and processing follow Schorr et al. (2014), while SMRT tag deployments and processing follow those outlined in Sweeney et al. (2022).

All SMRT tag audio files were manually reviewed to identify sounds emitted by the tagged whales as well as anthropogenic sounds using PAMGUARD's spectrogram module (Gillespie et al., 2009). Echolocation pulses from each tagged Cuvier's beaked whale were differentiated from those produced by nearby conspecifics or delphinids based on (1) the presence of relatively high spectral energy below 20 kHz (Johnson et al., 2009; Warren et al., 2017) and (2) relatively consistent pulse amplitudes over sequences of pulses (Zimmer et al., 2005). Dives with echolocation pulses attributed to the tagged whale were classified as "foraging dives" (Aguilar Soto et al., 2006; Alcázar-Treviño et al., 2021; DeRuiter et al., 2013; Johnson et al., 2004; Tyack et al., 2006). "Echolocation duration" was defined as the time from the first to last echolocation pulse attributed to the tagged whale within a dive. "Buzzes" are rapid series of echolocation pulses associated with close-range prey encounters and/or capture attempts; they have a lower amplitude level in the tag recording than regular pulses (Madsen et al., 2005; Jarvis et al., 2022) and can be masked by tag placement on the whale, flow noise, or electrical interference. Consequently, they cannot be as reliably or consistently detected within and across tags as well as echolocation pulses. Despite the challenges, the start time of any buzz detected was marked. The start and end times of all anthropogenic events detected were annotated and events were identified as either MFAS, echosounder, explosive, possible anthropogenic, or unknown (non-biological).

Results and Discussion

Survey Effort and Sightings

A total of 24 days of on-water surveys were conducted for this project from January to December 2023, with most survey effort occurring within SOAR (Figure 1, Table 1). Weather was particularly challenging this year; a total of 10 survey days were lost due to inclement weather, including an entire trip in December 2023 when historically large swells impacted the region. Twelve additional survey days between May–August were conducted for two ancillary projects (Figure 2, Table 2). The percentage of time by project within Navy range boundaries are presented in Table 3. During all survey effort in the region in 2023, 203 sightings of 13 cetacean species were recorded (Figure 3, Appendix 1). Species sighted were: blue whales*, common bottlenose dolphins, Bryde's whales (*Balaenoptera edeni)*, common dolphins (*Delphinus* sp.), Cuvier's beaked whales, fin whales, gray whales (*Eschrichtius robustus*), humpback whales, minke whales, Northern right whale dolphins (*Lissodelphis borealis*), Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), Risso's dolphins*, and sperm whales (*Physeter macrocephalus*).

All Cuvier's beaked whales were sighted in deep waters of the San Nicolas Basin to the west of San Clemente Island except for one sighting of a group of 5 individuals, which was sighted in the Catalina Basin. Cuvier's beaked whales were encountered during all surveys in 2023 (Figure 4, Table 4). All fin whale sightings occurred within the San Nicolas Basin with the exception of one encounter during a coastal survey out of Long Beach (Figure 4, Table 5), though fin whales were reported throughout the year, including several large aggregations, by the mainland-based whale watching organizations. We are collecting opportunistic images from these aggregations and these will be processed into long-term sighting history data in the coming year.
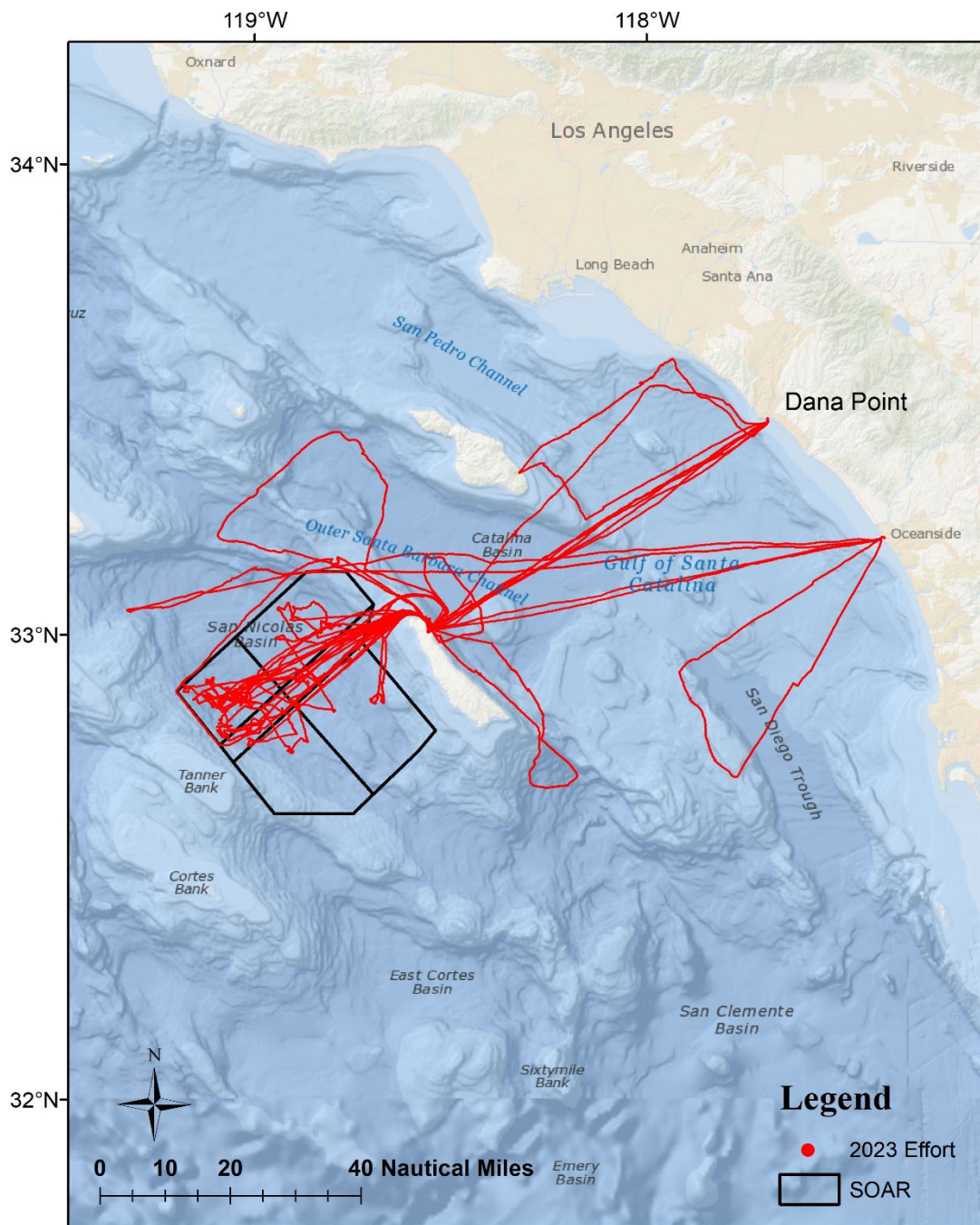
Figure 1. Vessel track lines from U.S. Pacific Fleet Monitoring surveys conducted from 7 January 2023 through 8 October 2023. SOAR = Southern California Anti-submarine Warfare Range. Prepared by B. Rone.

Figure 2. Vessel track lines from ancillary surveys conducted from 21 May 2023 through 8 August 2023. SOAR = Southern California Anti-submarine Warfare Range. Prepared by B. Rone.

Table 1. Summary of U.S. Pacific Fleet Monitoring survey effort by day from January through October 2023, with the number of cetacean sightings, tissue samples collected, and tags deployed.

Date	Survey Effort (Hrs)[1]	Survey Distance (nm)[2]	Total Sightings	Tissue Samples	Satellite Tags
1/7/2023	5.3	84.1	6	0	0
1/8/2023	6.2	85.3	6	0	0
1/12/2023	10.1	160	7	0	0
2/16/2023	2.8	52	4	0	0
2/17/2023	10.5	84.6	12	0	0
2/18/2023	10.6	102	9	0	0
2/19/2023	10.4	86.4	10	0	0
2/20/2023	5.5	40.5	4	0	0
2/21/2023	2.7	51.8	5	0	0
5/14/2023	2.9	53.7	4	0	0
5/15/2023	1.0	110	14	3	2
5/16/2023	5.5	63.5	8	0	0
5/18/2023	11.3	88.6	19	2	2
5/19/2023	11.4	97.9	13	1	1
5/22/2023	4.2	61.3	4	0	0
5/30/2023	12.1	200	1	0	0
10/1/2023	3.2	51.8	0	0	0
10/4/2023	6.6	66.2	5	0	0
10/2/2023	7.2	69.7	5	0	0
10/3/2023	7.6	93	2	0	0
10/5/2023	6.7	90.1	3	0	0
10/6/2023	7.8	66.2	2	0	0
10/7/2023	10.2	79.7	2	0	0
10/8/2023	2.9	53.1	0	0	0
Total: 24	**164.7**	**1991.5**	**145**	**6**	**5**

[1]Hrs = hours
[2]nm = nautical miles

Table 2. Summary of ancillary survey effort by day from May through October 2023, with the number of cetacean sightings, tissue samples collected, and tags deployed.

Date	Survey Effort (Hrs)[1]	Survey Distance. (nm)[2]	Total Sightings	Tissue Samples	Satellite Tags
5/21/2023	2.5	27.5	5	0	0
7/20/2023	4.3	59	3	0	0
7/21/2023	8.9	81	2	0	0
7/22/2023	10.2	77.3	3	0	0
7/23/2023	11.4	106	7	2	2
7/24/2023	11.9	104	10	0	1
7/25/2023	9.8	93	4	3	0
7/26/2023	8.1	78.8	3	0	0
7/27/2023	2.4	52	2	0	0
7/29/2023	3.2	66.4	0	0	0
7/30/2023	11.8	285	0	0	0
8/8/2023	9.5	133.8	20	0	0
Totals: 12	**94**	**1163.8**	**59**	**5**	**3**

[1]Hrs = hours
[2]nm = nautical miles

Table 3. Percentage of effort spent within U.S. Navy range boundaries by project in 2023.

	Point Mugu Sea Range	SCTTR[1] Range Complex	SOAR[2]
Pacific Fleet Monitoring	5%	97%	51%
Ancillary	16%	93%	47%

[1]SCTTR = Southern California Range Complex
[2]SOAR = Southern California Anti-submarine Warfare Range
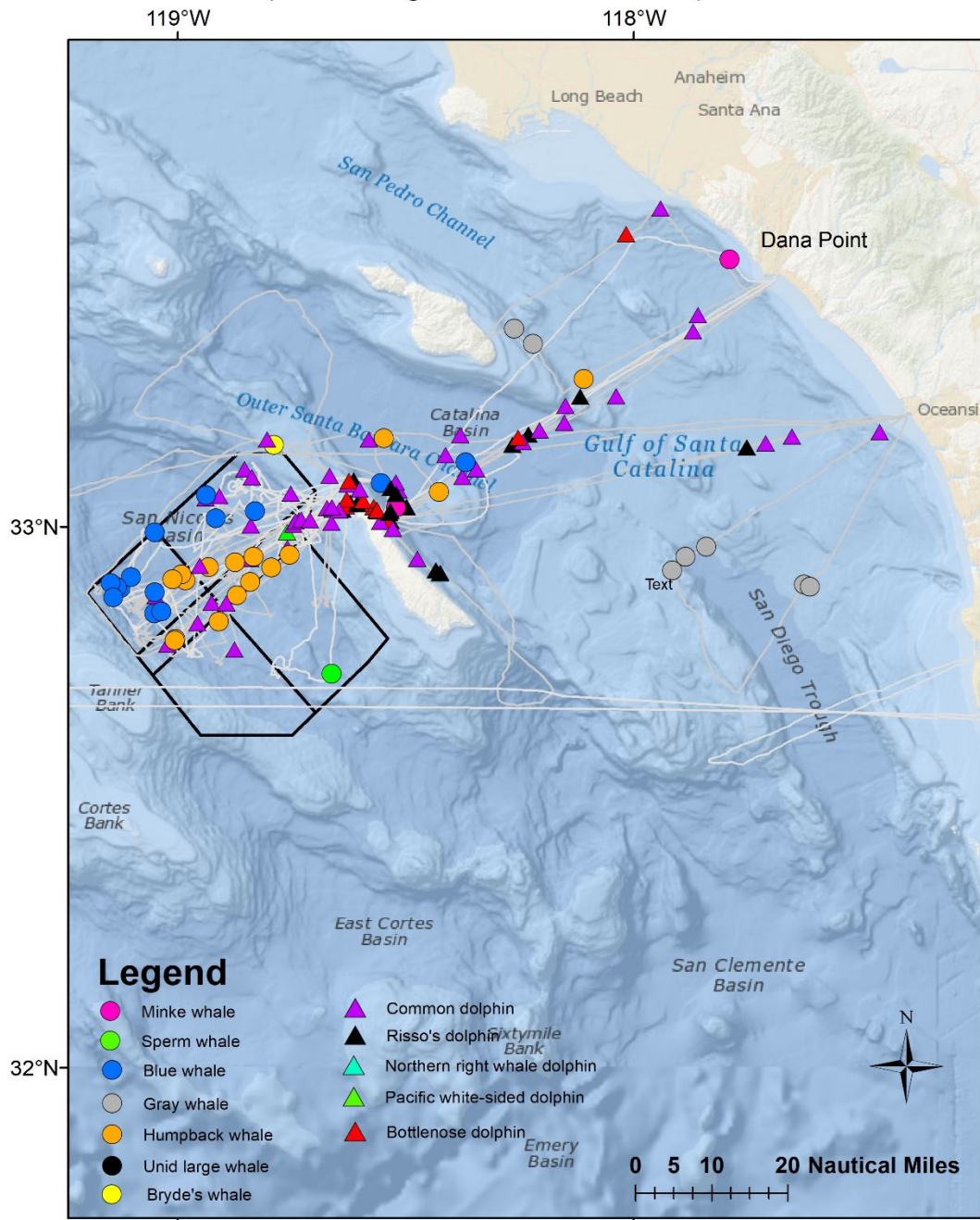
Figure 3. Sighting locations of cetaceans other than Cuvier's beaked whales and fin whales by species from surveys conducted in 2023. The Southern California Anti-submarine Warfare Range (SOAR) is outlined in black. Prepared by B. Rone.

2023 Cuvier's Beaked and Fin Whale Sightings
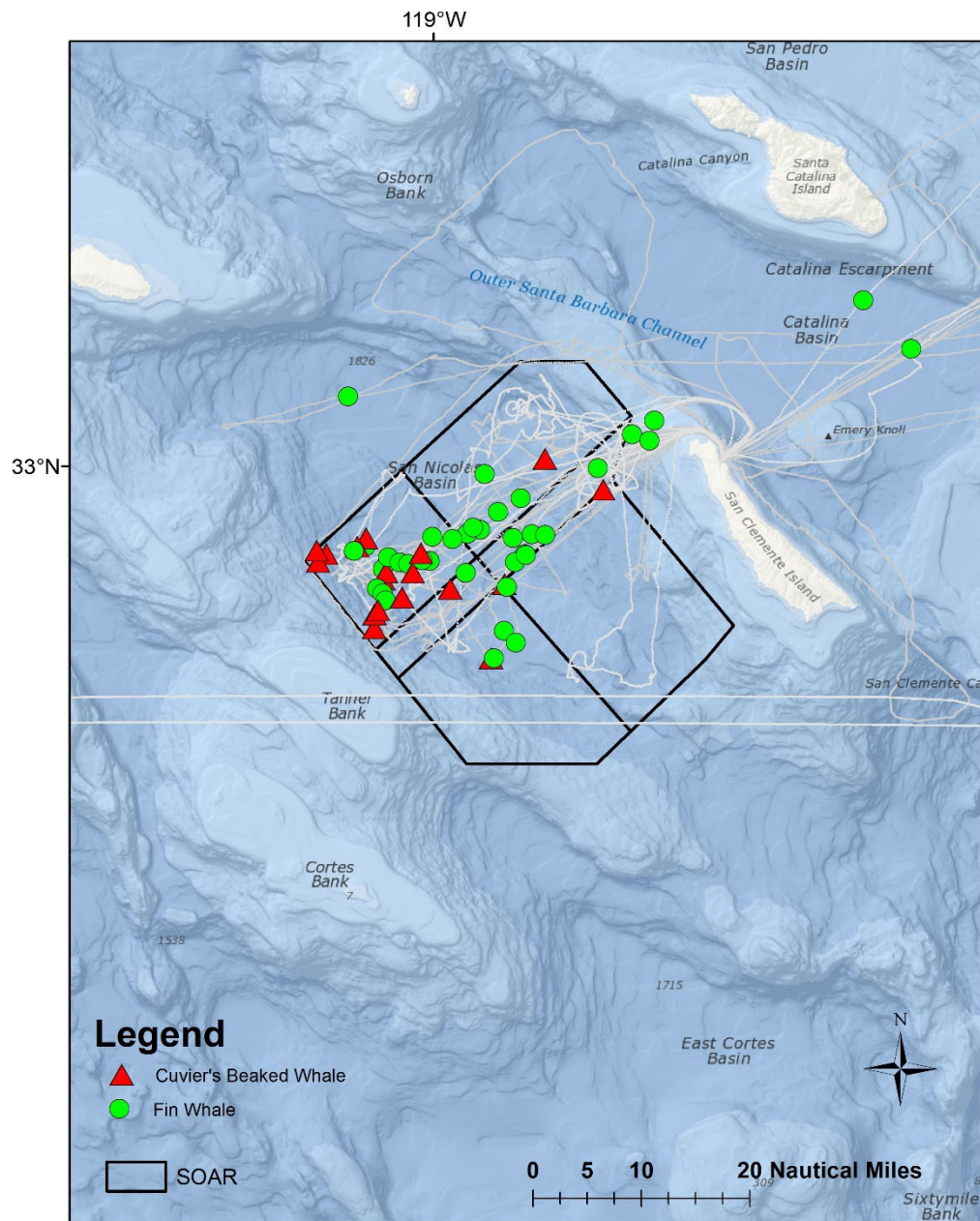
Figure 4. Cuvier's beaked whale and fin whale sightings from surveys conducted in 2023.SOAR = Southern California Anti-submarine Warfare Range. Prepared by B. Rone.

Table 4. Data collection summary for Cuvier's beaked whale sightings in 2023.

Date	Sighting	Group Size	Calves (n)	IDs	Tissue Samples	Tags
17-Feb-23	PHO-8	2	1	2	0	0
18-Feb-23	PHO-7	3	0	1	0	0
19-Feb-23	PHO-6	4	0	4	0	0
19-Feb-23	PHO-7	2	0	2	0	0
15-May-23	PHO-9	1	0	1	1	1
15-May-23	PHO-10	2	0	2	1	0
15-May-23	PHO-14	5	0	5	1	0
16-May-23	PHO-1	2	1	2	0	0
18-May-23	PHO-8	4	0	4	2	2
19-May-23	PHO-3	2	0	0	0	0
19-May-23	PHO-4	1	0	0	0	0
19-May-23	PHO-5	1	0	1	0	0
19-May-23	PHO-7	2	0	2	0	0
19-May-23	PHO-8	4	0	4	0	0
19-May-23	PHO-10	3	0	3	1	1
23-Jul-23	PHO-5	3	0	3	2	2
26-Jul-23	PHO-1	1	0	0	0	0
02-Oct-23	PHO-4	2	0	1	0	0
18 Sightings		44	2	37	8	6

Table 5. Data collection summary for fin whale sightings during Navy-funded surveys in 2023. ID totals are estimates as 2023 data are not fully processed until all contributions are received.

Date	Sighting	Group Size	Calves (n)	Est IDs	Tissue Samples	Tags
2/18/2023	PHO-8	2	0	2	0	0
5/15/2023	PHO-4	2	0	1	0	1
5/15/2023	PHO-8	1	0	0	0	0
5/15/2023	PHO-11	1	0	1	0	0
5/15/2023	PHO-13	1	0	1	0	0
5/16/2023	PHO-2	2	0	0	0	0
5/16/2023	PHO-3	2	0	0	0	0
5/16/2023	PHO-4	1	0	1	0	0
5/16/2023	PHO-5	3	0	2	0	0
5/16/2023	PHO-6	2	0	0	0	0
5/16/2023	PHO-7	1	0	1	0	0
5/18/2023	PHO-2	3	0	2	0	0
5/18/2023	PHO-4	1	0	0	0	0
5/18/2023	PHO-5	1	0	0	0	0
5/18/2023	PHO-6	1	0	0	0	0
5/18/2023	PHO-7	1	0	1	0	0
5/18/2023	PHO-9	1	0	1	0	0
5/18/2023	PHO-10	1	0	1	0	0
5/18/2023	PHO-11	1	0	2	0	0
5/18/2023	PHO-12	2	0	2	0	0
5/18/2023	PHO-13	1	0	0	0	0
5/18/2023	PHO-14	1	0	0	0	0
5/18/2023	PHO-15	3	0	2	0	0
5/18/2023	PHO-16	4	0	3	0	0
5/18/2023	PHO-17	1	0	0	0	0
5/18/2023	PHO-18	1	0	0	0	0
5/19/2023	PHO-1	2	0	2	0	0
5/19/2023	PHO-2	2	0	2	0	0
5/19/2023	PHO-6	2	0	0	0	0
5/19/2023	PHO-9	1	0	0	0	0
5/19/2023	PHO-11	1	0	1	0	0
5/19/2023	PHO-12	3	0	0	0	0
5/22/2023	PHO-3	1	0	1	0	0
5/30/2023	PHO-1	2	0	0	0	0
7/20/2023	PHO-2	2	0	2	0	1
7/21/2023	PHO-2	1	0	1	0	0
7/24/2023	PHO-7	1	0	1	0	1
37 Sightings		59	0	33	0	3

Photo-Identification and Tissue Sampling

Cuvier's Beaked Whales

Photo-IDs, tissue samples, and tags from Cuvier's beaked whales in 2023 are summarized in Table 4. Seven tissue samples were collected from the darts of archival tags, including one that failed to attach long enough to collect data. All identification photos of Cuvier's beaked whales in 2023 were internally reconciled and compared to our historical catalog. This included 41 identifications during surveys at SOAR and 24 opportunistic identifications made by whale watch boats (15 from off-range areas in Southern California in the past four years, and nine from Monterey in 2023). These identifications represented 52 unique individuals, 15 of which (29%) had been sighted in in a previous year, including two whales which were matched across years in Monterey Bay, bringing the longest sighting histories (time from first to last sighting) in our study to 15.6 years in duration (Table 6). Our catalog now totals 351 individuals.

Both identification rates and recapture rates, within and between years, were low on SOAR in 2023. This was in contrast to 2022 where 70 individuals were identified, more than half of which were previously known individuals. There were only two mother-calf pairs identified on SOAR in 2023. One mother was new to the study; the other has been sighted in four different years since she was first identified as a subadult on SOAR in 2010, though this was her first sighting with a calf. This female was also identified without a calf in an opportunistic contribution from a whale watch vessel operating out of San Diego that encountered a group of five Cuvier's beaked whales off the coast of Northern Baja California in 2021.

Though many of the opportunistic contributions we processed this year were from prior to 2023, they represent an invaluable source of data from outside our core study area. To date, opportunistic contributors have provided identifications of 43 unique individuals. Most of these whales have only been sighted once, but nine of these whales have been identified in multiple years, which is remarkable given how limited coverage is in off-range areas. Roughly half of these recaptures are whales which have been sighted on or near SOAR as well as off range. The rest are whales that have been recaptured multiple times in the same area they were opportunistically documented, including in Monterey Bay over periods up to 14 years. We are increasing our contact with tour operators that we know are increasingly heading into deep waters to ensure we get photos of Cuvier's beaked whales whenever they are collected. The data continue to underscore that small, resident populations of this species are likely to occur where conditions are consistently favorable and are also providing insights into the ranging patterns of our focal population. Understanding where whales go when they leave SOAR is one of several key inputs to PCOD models that are work is informing.

Table 6. Summarized sighting histories for 15 individual Cuvier's beaked whales that were resighted in 2023.

ID	First Date	Last Date	Year Span	Years	Total Sightings	SOAR Sightings	Off-Range Sightings	Monterey Sightings
5	23-Oct-07	15-May-23	15.57	6	8	8	0	0
8	23-Oct-07	15-May-23	15.57	5	5	5	0	0
30	26-Oct-07	23-Jul-23	15.75	4	6	6	0	0
68	15-Jun-09	14-Dec-23	14.51	2	2	0	0	2
90	29-Sep-10	16-May-23	12.64	4	4	3	1	0
132	30-Mar-13	19-May-23	10.14	7	14	14	0	0
199	11-Jan-16	19-May-23	7.36	3	6	6	0	0
231	05-Jan-18	19-May-23	5.37	3	5	5	0	0
244	20-Jul-18	23-Jul-23	5.01	2	3	3	0	0
279	11-Nov-19	18-Feb-23	3.27	3	4	4	0	0
321	13-Jan-22	19-May-23	1.35	2	4	4	0	0
324	12-Jan-22	15-May-23	1.34	2	3	3	0	0
332	28-Jan-22	05-Jul-23	1.43	2	2	0	0	2
342	21-Nov-22	19-May-23	0.49	2	3	3	0	0
344	21-Nov-22	19-May-23	0.49	2	3	3	0	0

Fin Whales

Fin whales were sighted on and near SOAR during surveys in February, May, and July 2023, but not sighted during our October effort. Our photo-ID studies of this wide-ranging species are heavily augmented by contributions from citizen scientists and collaborating researchers. These contributions can be large, and we often receive them well into the year after the photos were collected; therefore, this report contains results of fin whale photographs from 2022 and prior years that were processed into our collection in 2023. Processing of identifications from 2023, including 31 from Navy-funded surveys, is underway now.

This year we processed a total of 436 new fin whale identifications primarily from 2022, but with a small number of historical contributions from previous years (2007, 2013-2021). This annual batch brought the total number of processed fin whale identifications in our collection to 5,024, which includes 3,620 sightings of 1,377 unique individuals.

Southern California remains the focal region for our fin whale photo-ID study, with a catalog now totaling 865 individuals that have been identified there since the late 1980s, 222 (26%) of which have now been sighted in the region in multiple years. This includes individuals who have been identified in up to 13 different years, with the longest sighting histories (time from first to last sighting) now exceeding 25 years. Roughly half of the 133 fin whales identified in Southern California in 2022 have multi-year sighting histories, and as detailed in (Falcone et al., 2022), we continue to see that the whales with the longest and most detailed sighting histories are the ones that are present in summer months. Animals photographed off Southern California in other

months of the year, particularly in late fall through early spring, are much less likely to be resighted and thus believed to be migrants from the much larger west coast population that pass through the area seasonally. However, with the continued photo-ID effort, we are gradually adding resightings of these vagrants that will be useful in describing the patterns of habitat use of these apparently overlapping population segments, and potentially be able to evaluate whether animals are predominantly born into the Southern California resident population (i.e., reproductively isolated), or whether whales are recruited into it from the larger west coast population. We continue to pursue collaborative data analysis projects that would combine all available lines of evidence (photo-ID, genetics, movements of tagged individuals, and potentially toxicology) to help understand these populations and their processes. These are particularly important given the high levels of anthropogenic impacts these whales, especially the Southern California residents, are subject to.

Tagging

LIMPET and SMRT tags were deployed on Cuvier's beaked whales and fin whales in and around SOAR to collect individual movement and diving behavior data, which are being used to characterize habitat use and distribution, document time spent on the range, and assess behavior and possible behavioral changes associated with anthropogenic activity within the SCTTR (Table 7).

Table 7. Summary of tags deployed during Navy-funded efforts in 2023.

Tag ID	Species	Tag Type	Date	Transmission Duration (days)
Zica-20230515-232950	Cuvier's Beaked Whale	SMRT	5/15/2023	0.0
Bp-20230515-194279	Fin Whale	LIMPET+	5/15/2023	19.5
Zica-20230518-232950	Cuvier's Beaked Whale	SMRT	5/18/2023	0.1
Zica-20230518-233391	Cuvier's Beaked Whale	SMRT	5/18/2023	10.7
Zica-20230519-232950	Cuvier's Beaked Whale	SMRT	5/19/2023	10.4
Zica-20230723-233395*	Cuvier's Beaked Whale	SMRT	7/23/2023	2.0
Bp-20230720-242664	Fin Whale	LIMPET++	7/20/2023	12.4
Zica-20230723-233394*	Cuvier's Beaked Whale	SMRT	7/23/2023	2.6
Bp-20230724-240127*	Fin Whale	SMRT	7/24/2023	10.8

LIMPET = Low Impact Minimally Percutaneous External-electronics Transmitting
SMRT = Sound Motion Recording and Telemetry
*Deployed during a Living Marine and Office of Naval Resources-supported efforts
+SPLASH10A
++SPLASH10F

Tags deployed during Pacific Fleet Monitoring efforts will continue to be combined with those deployed during other efforts and analyzed collectively to address specific questions (e.g., Schorr et al., 2014, Falcone et al., 2017, Scales et al., 2017, Sweeney et al., 2022). Therefore, we provide a general summary of findings from 2023 deployments here.

Cuvier's Beaked Whales

Median SMRT tag duration for Cuvier's beaked whales was 2.6 days (range = 0.1–10.7 days) (Table *7*). There was direct evidence of whales removing their tags, including several that appeared to have been knocked off by other group members shortly after attachment and one that appeared to have been rubbed off on the bottom during a foraging dive. Most whales remained in the greater San Nicolas Basin region throughout their deployment with much of their activity within the boundaries of SOAR, as is most typical of whales tagged there (Figure 6, Figure 7, Figure 8, Figure 11).

The two longer duration Cuvier's beaked whale deployments in May resulted in 504.5 hours of acoustic data, which was fully processed (see methods above) (Table 8). Acoustic records from both tags were reviewed for the purpose of identifying echolocation start and end times and buzzes from the tagged whale, as well as detections of MFAS, echosounders, and explosives (collectively referred to as anthropogenic detections or events). A total of 166 foraging dives and 2,395 buzzes were identified in the dataset. One foraging dive from tag 232950 was incomplete due to the tag detaching prematurely while the whale was actively foraging. The median echolocation duration was 35.1 minutes (range = 1.7 – 61.9). There were three dives containing pulses where the echolocation duration was less than 10 minutes, with only one of those dives containing a detected anthropogenic disturbance (MFAS). More than twice as many buzzes were detected one tag than the other, but this difference could be a function of tag placement, hydrophone calibration, flow noise, or any combination thereof masking buzzes, so should be viewed with caution. MFAS, explosions (either commercial or military), echosounders, and several unknown sounds were recorded on both the tags (Table 9).

Table 8. Acoustic details from May 2023 SMRT deployments. Note that buzzes may not be equally detected between tag deployments.

Tag ID	Deployment Start (UTC)	Deployment End (UTC)	Recording Duration (hh:mm:ss)	Foraging Dives (n)	Buzzes (n)
Zica-20230519-232950	05/19/2023 23:07	05/30/2023 04:40	245:32:32	82[*]	1675
Zica-20230518-233391	05/18/2023 19:06	05/30/2023 14:04	258:58:37	84	720

[*]Includes one incomplete foraging dive where tag detached during the dive.

Table 9. Overview of anthropogenic detections on Cuvier's beaked whale SMRT tags. Note: explosive detections need additional review to attempt to identify source, as well as the identification of possible faint signals.

Tag ID	MFAS Detections (n)	Explosive Detections (n)	Echosounder Detections (n)	Unknown (n)
Zica-20230519-232950	2	21	5	12
Zica-20230518-233391	1	21	0	4

Fin Whales

Two LIMPET tags were deployed on fin whales in 2023, one in May, which transmitted for 19.5 days and another in July, which transmitted for 12.4 days. Both of these whales ranged throughout the Southern California Bight for the entire transmission period (Figure 5, Figure 9). One SMRT tag was deployed on a fin whale in July 2023 as part of an LMR-funded behavioral response project on SOAR; it remained attached for 10. 8 days, during which the whale left SOAR and traveled north along the continental shelf, ultimately shedding its tag north of Monterey Bay (Figure 10).

Figure 5. Argos satellite positions from a fin whale LIMPET tag in May 2023. Prepared by B. Rone.

Figure 6. Fastloc GPS positions from a Cuvier's beaked whale SMRT tag in May 2023. Prepared by B. Rone.

Zica-20230519-232950

Figure 7. Fastloc GPS positions from a Cuvier's beaked whale SMRT tag in May 2023. Prepared by B. Rone.

Zica-20230723-233395

Figure 8. Fastloc GPS positions from a Cuvier's beaked whale SMRT tag in July 2023. Prepared by B. Rone.

Bp-20230720-242664

Bp-20230724-240127

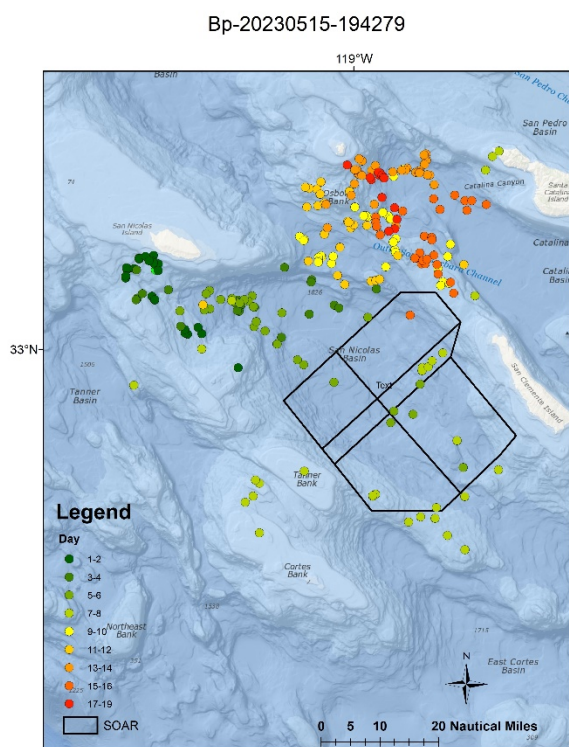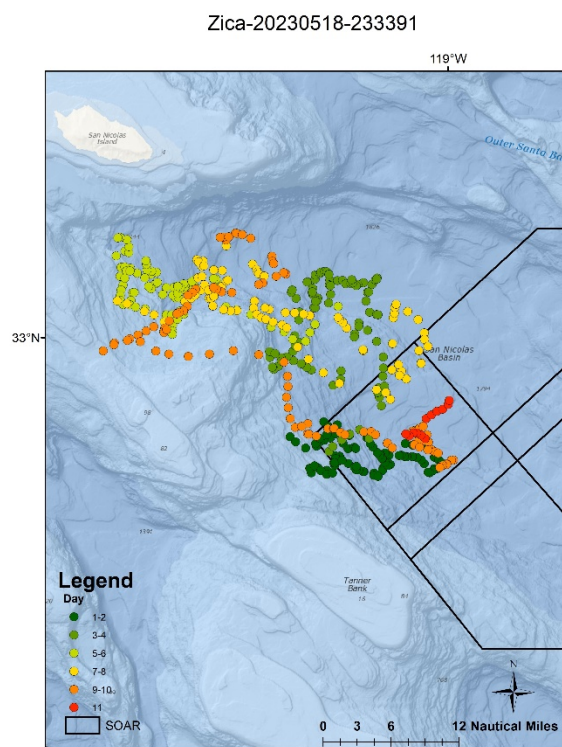Figure 9. Fastloc GPS positions from a fin whale LIMPET tag in July 2023. Prepared by B. Rone

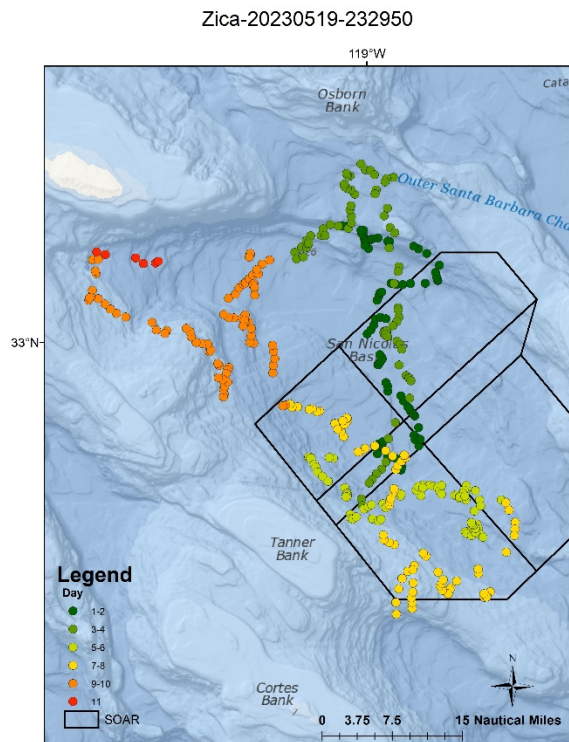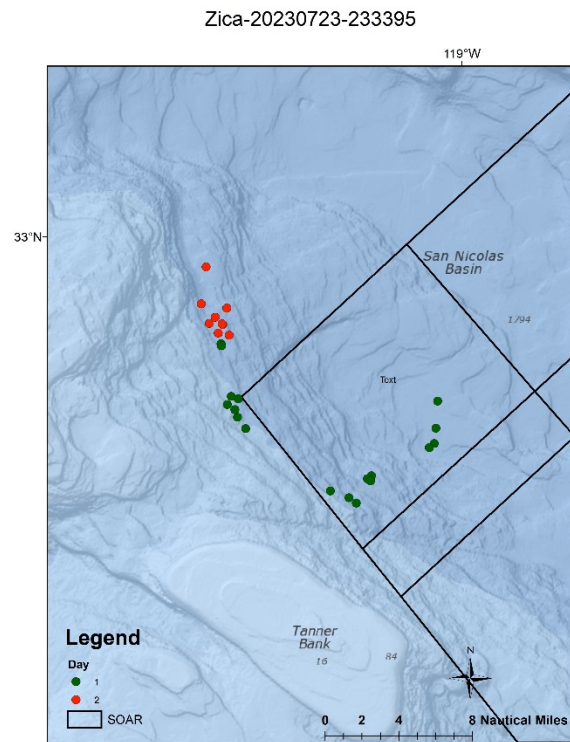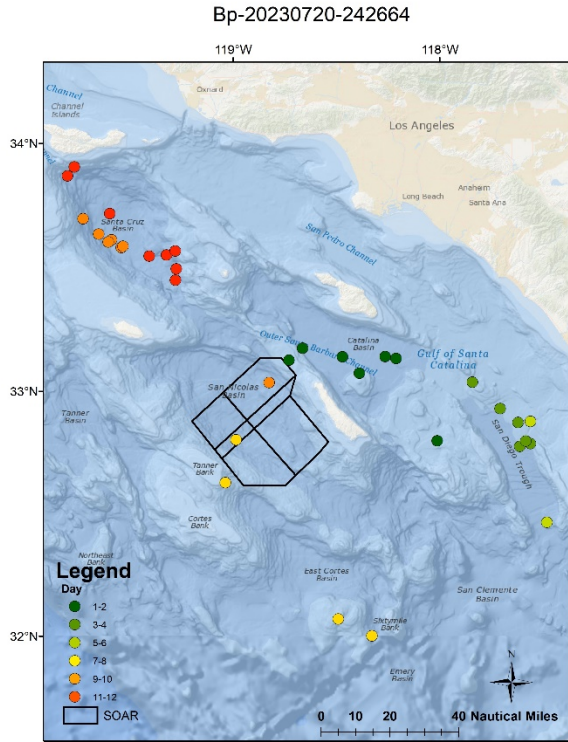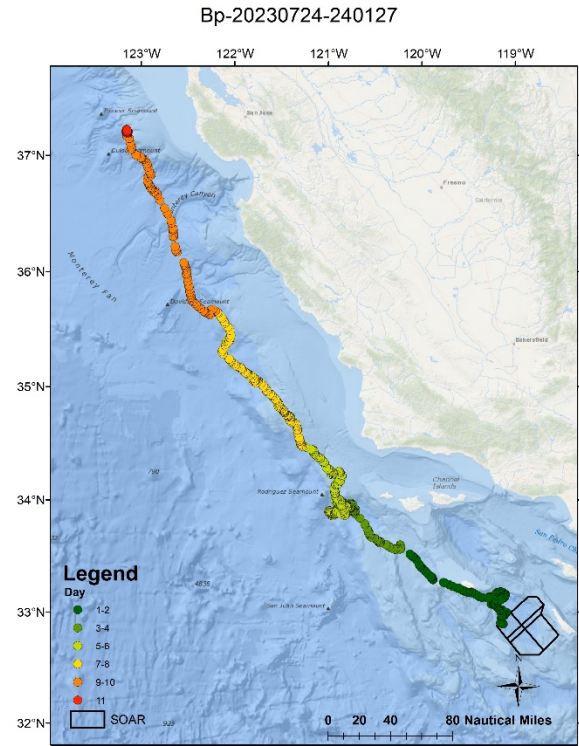Figure 10. Fastloc GPS positions from a fin whale SMRT tag in July 2023. Prepared by B. Rone.
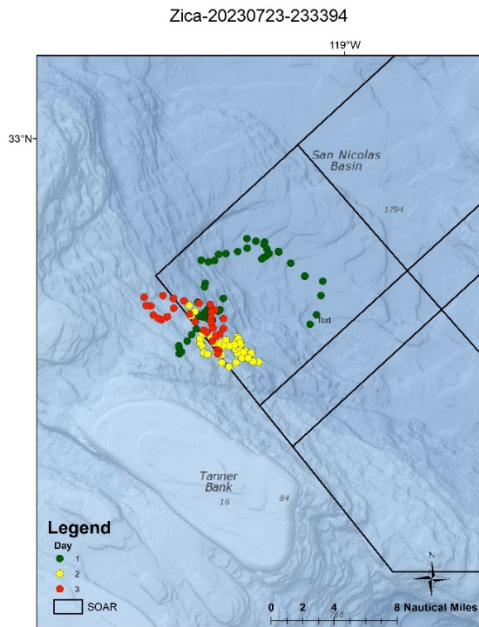
Zica-20230723-233394

Figure 11. Fastloc GPS positions from a Cuvier's beaked whale SMRT tag in July 2023. Prepared by B. Rone.

Acknowledgements

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Appendices

Appendix 1. Sighting details from all Navy-funded effort in 2023.

Date	Common Name	Latitude	Longitude	Group Size	Est IDs	Total Samples	Total Tags
1/7/2023	Common Dolphin	N33.5829	W117.9416	125	0	0	0
1/7/2023	Bottlenose Dolphin	N33.536	W118.0172	8	6	0	0
1/7/2023	Gray Whale	N33.3631	W118.263	3	0	0	0
1/7/2023	Gray Whale	N33.3354	W118.2217	3	0	0	0
1/7/2023	Humpback Whale	N33.2709	W118.1102	1	1	0	0
1/7/2023	Common Dolphin	N33.3878	W117.8597	50	0	0	0
1/8/2023	Common Dolphin	N33.1735	W117.4606	325	0	0	0
1/8/2023	Gray Whale	N32.9625	W117.8417	1	0	0	0
1/8/2023	Gray Whale	N32.9443	W117.8869	1	0	0	0
1/8/2023	Gray Whale	N32.9193	W117.9162	1	0	0	0
1/8/2023	Gray Whale	N32.8931	W117.6271	1	0	0	0
1/8/2023	Gray Whale	N32.8894	W117.6146	1	0	0	0
1/12/2023	Common Dolphin	N33.1529	W117.7106	7	0	0	0
1/12/2023	Risso's Dolphin	N33.1457	W117.7519	18	0	0	0
1/12/2023	Risso's Dolphin	N33.0105	W118.5333	65	25	0	0
1/12/2023	Bottlenose Dolphin	N33.0094	W118.5387	40	15	0	0
1/12/2023	Common Dolphin	N33.0093	W118.556	8	0	0	0
1/12/2023	Humpback Whale	N33.1622	W118.5486	1	0	0	0
1/12/2023	Common Dolphin	N33.1657	W117.653	5	0	0	0
2/16/2023	Common Dolphin	N33.2393	W118.0388	30	0	0	0
2/16/2023	Common Dolphin	N33.1903	W118.1525	500	0	0	0
2/16/2023	Bottlenose Dolphin	N33.0364	W118.4977	25	0	0	0
2/16/2023	Risso's Dolphin	N33.0356	W118.4992	40	0	0	0
2/17/2023	Risso's Dolphin	N33.0409	W118.6238	5	0	0	0
2/17/2023	Risso's Dolphin	N33.0306	W118.6384	6	0	0	0
2/17/2023	Common Dolphin	N32.9607	W118.7594	90	0	0	0
2/17/2023	Humpback Whale	N32.9478	W118.7555	1	0	0	0
2/17/2023	Humpback Whale	N32.9249	W118.7952	2	0	0	0
2/17/2023	Humpback Whale	N32.8736	W118.8705	1	0	0	0
2/17/2023	Common Dolphin	N32.8221	W118.9562	75	0	0	0
2/17/2023	Cuvier's Beaked Whale	N32.7906	W119.0913	2	2	0	0

Date	Common Name	Latitude	Longitude	Group Size	Est IDs	Total Samples	Total Tags
2/17/2023	Northern Right Whale Dolphin	N32.7831	W119.022	425	0	0	0
2/17/2023	Common Dolphin	N32.783	W119.022	30	0	0	0
2/17/2023	Humpback Whale	N32.7931	W119.0053	1	0	0	0
2/17/2023	Humpback Whale	N32.7904	W119.0066	1	0	0	0
2/18/2023	Risso's Dolphin	N33.0283	W118.5617	17	0	0	0
2/18/2023	Bottlenose Dolphin	N33.0299	W118.5635	3	0	0	0
2/18/2023	Risso's Dolphin	N33.0442	W118.6222	12	0	0	0
2/18/2023	Common Dolphin	N33.0118	W118.7345	110	0	0	0
2/18/2023	Humpback Whale	N32.9255	W118.9323	1	0	0	0
2/18/2023	Humpback Whale	N32.9007	W118.9835	1	0	0	0
2/18/2023	Cuvier's Beaked Whale	N32.8534	W119.0773	3	1	0	0
2/18/2023	Fin Whale	N32.7875	W118.8926	2	2	0	0
2/18/2023	Humpback Whale	N32.8254	W118.9101	2	0	0	0
2/19/2023	Risso's Dolphin	N33.0358	W118.5699	40	0	0	0
2/19/2023	Bottlenose Dolphin	N33.0363	W118.5706	40	0	0	0
2/19/2023	Humpback Whale	N32.9116	W118.9925	2	0	0	0
2/19/2023	Common Dolphin	N32.872	W119.0479	10	0	0	0
2/19/2023	Humpback Whale	N32.9031	W119.0116	1	0	0	0
2/19/2023	Cuvier's Beaked Whale	N32.8084	W119.0909	4	4	0	0
2/19/2023	Cuvier's Beaked Whale	N32.8624	W119.032	2	2	0	0
2/19/2023	Common Dolphin	N32.9403	W118.8404	1	0	0	0
2/19/2023	Humpback Whale	N32.9442	W118.8342	1	0	0	0
2/19/2023	Bottlenose Dolphin	N33.0376	W118.6315	3	0	0	0
2/20/2023	Bottlenose Dolphin	N33.042	W118.5999	10	0	0	0
2/20/2023	Risso's Dolphin	N33.0419	W118.6068	16	0	0	0
2/20/2023	Risso's Dolphin	N33.0306	W118.5634	35	0	0	0
2/20/2023	Bottlenose Dolphin	N33.03	W118.5633	8	0	0	0
2/21/2023	Humpback Whale	N33.0637	W118.4273	2	0	0	0
2/21/2023	Common Dolphin	N33.0913	W118.3759	20	0	0	0
2/21/2023	Common Dolphin	N33.1057	W118.3458	600	0	0	0
2/21/2023	Common Dolphin	N33.1552	W118.2433	10	0	0	0
2/21/2023	Common Dolphin	N33.1769	W118.2066	5	0	0	0
5/14/2023	Common Dolphin	N33.3581	W117.8699	15	0	0	0
5/14/2023	Common Dolphin	N33.2215	W118.1502	10	0	0	0

Date	Common Name	Latitude	Longitude	Group Size	Est IDs	Total Samples	Total Tags
5/14/2023	Bottlenose Dolphin	N33.1633	W118.2535	15	0	0	0
5/14/2023	Risso's Dolphin	N33.0371	W118.509	22	0	0	0
5/15/2023	Bottlenose Dolphin	N33.0497	W118.6295	5	0	0	0
5/15/2023	Common Dolphin	N33.0341	W118.6727	22	0	0	0
5/15/2023	Common Dolphin	N33.002	W118.8399	25	0	0	0
5/15/2023	Fin Whale	N32.9896	W118.9222	2	1	0	1
5/15/2023	Humpback Whale	N32.934	W118.8745	1	0	0	0
5/15/2023	Humpback Whale	N32.8978	W118.8411	2	0	0	0
5/15/2023	Common Dolphin	N32.8598	W118.9255	65	0	0	0
5/15/2023	Fin Whale	N32.9085	W119.0025	1	0	0	0
5/15/2023	Cuvier's Beaked Whale	N32.8876	W119.0196	1	1	1	1
5/15/2023	Cuvier's Beaked Whale	N32.7519	W118.9115	2	2	1	0
5/15/2023	Fin Whale	N32.7521	W118.9077	1	1	0	0
5/15/2023	Common Dolphin	N32.7739	W118.8753	20	0	0	0
5/15/2023	Fin Whale	N32.7718	W118.8739	1	1	0	0
5/15/2023	Cuvier's Beaked Whale	N32.8479	W118.8912	5	5	1	0
5/16/2023	Cuvier's Beaked Whale	N32.9692	W118.7397	2	2	0	0
5/16/2023	Fin Whale	N32.8861	W118.8603	2	0	0	0
5/16/2023	Fin Whale	N32.8761	W118.8755	2	0	0	0
5/16/2023	Fin Whale	N32.8441	W118.8879	1	1	0	0
5/16/2023	Fin Whale	N32.885	W118.8587	3	2	0	0
5/16/2023	Fin Whale	N32.9121	W118.8498	2	0	0	0
5/16/2023	Fin Whale	N32.911	W118.8291	1	1	0	0
5/16/2023	Common Dolphin	N33.078	W118.6271	180	0	0	0
5/18/2023	Common Dolphin	N33.0307	W118.6605	80	0	0	0
5/18/2023	Fin Whale	N32.9973	W118.7483	3	2	0	0
5/18/2023	Pacific White-sided Dolphin	N32.9899	W118.7601	12	0	0	0
5/18/2023	Fin Whale	N32.9177	W118.929	1	0	0	0
5/18/2023	Fin Whale	N32.9125	W118.9487	1	0	0	0
5/18/2023	Fin Whale	N32.9056	W118.9718	1	0	0	0
5/18/2023	Fin Whale	N32.8668	W119.0781	1	1	0	0
5/18/2023	Cuvier's Beaked Whale	N32.8633	W119.0733	4	4	2	2
5/18/2023	Fin Whale	N32.8824	W119.0703	1	1	0	0
5/18/2023	Fin Whale	N32.8758	W119.0526	1	1	0	0

Date	Common Name	Latitude	Longitude	Group Size	Est IDs	Total Samples	Total Tags
5/18/2023	Fin Whale	N32.8738	W119.0397	1	2	0	0
5/18/2023	Fin Whale	N32.8421	W119.0874	2	1	0	0
5/18/2023	Fin Whale	N32.8358	W119.0792	1	0	0	0
5/18/2023	Fin Whale	N32.8774	W119.0063	1	0	0	0
5/18/2023	Fin Whale	N32.9204	W118.9396	3	2	0	0
5/18/2023	Fin Whale	N32.9408	W118.9013	4	2	0	0
5/18/2023	Fin Whale	N32.9582	W118.8666	1	0	0	0
5/18/2023	Fin Whale	N33.0409	W118.6953	1	0	0	0
5/18/2023	Risso's Dolphin	N33.06	W118.5212	20	0	0	0
5/19/2023	Fin Whale	N33.0324	W118.6689	2	2	0	0
5/19/2023	Fin Whale	N32.8782	W119.0177	2	2	0	0
5/19/2023	Cuvier's Beaked Whale	N32.8865	W119.165	2	1	0	0
5/19/2023	Cuvier's Beaked Whale	N32.8765	W119.1778	1	1	0	0
5/19/2023	Cuvier's Beaked Whale	N32.8908	W119.1797	1	1	0	0
5/19/2023	Fin Whale	N32.8962	W119.1052	2	0	0	0
5/19/2023	Cuvier's Beaked Whale	N32.9069	W119.1042	2	2	0	0
5/19/2023	Cuvier's Beaked Whale	N32.8962	W119.1178	4	4	0	0
5/19/2023	Fin Whale	N32.8269	W119.0744	1	0	0	0
5/19/2023	Cuvier's Beaked Whale	N32.8415	W118.9743	3	3	1	1
5/19/2023	Fin Whale	N32.8622	W118.951	1	1	0	0
5/19/2023	Fin Whale	N32.907	W118.8788	3	0	0	0
5/19/2023	Common Dolphin	N33.0039	W118.7466	12	0	0	0
5/21/2023	Minke Whale	N33.0351	W118.5217	1	0	0	0
5/21/2023	Common Dolphin	N33.0671	W118.5161	150	0	0	0
5/21/2023	Common Dolphin	N33.0809	W118.5212	150	0	0	0
5/21/2023	Common Dolphin	N33.1598	W118.5808	17	0	0	0
5/21/2023	Risso's Dolphin	N33.0253	W118.5363	22	0	0	0
5/22/2023	Common Dolphin	N33.1316	W118.4132	20	0	0	0
5/22/2023	Common Dolphin	N33.1683	W118.3804	25	0	0	0
5/22/2023	Fin Whale	N33.2132	W118.34	1	1	0	0
5/22/2023	Minke Whale	N33.4897	W117.7902	1	0	0	0
5/30/2023	Fin Whale	N33.0895	W119.1318	2	0	0	0
7/20/2023	Risso's Dolphin	N33.1694	W118.2307	14	14	0	0
7/20/2023	Fin Whale	N33.1504	W118.2664	2	2	0	1

Date	Common Name	Latitude	Longitude	Group Size	Est IDs	Total Samples	Total Tags
7/20/2023	Risso's Dolphin	N33.1507	W118.266	2	0	0	0
7/21/2023	Sperm Whale	N32.7286	W118.6627	1	1	0	0
7/21/2023	Fin Whale	N33.0582	W118.6615	1	1	0	0
7/22/2023	Common Dolphin	N33.1056	W118.8535	85	0	0	0
7/22/2023	Common Dolphin	N33.091	W118.8371	300	0	0	0
7/22/2023	Blue Whale	N33.0801	W118.5546	1	1	0	0
7/23/2023	Common Dolphin	N33.0609	W118.7523	35	0	0	0
7/23/2023	Common Dolphin	N33.0558	W118.9085	300	0	0	0
7/23/2023	Blue Whale	N33.0155	W118.9166	2	2	0	0
7/23/2023	Common Dolphin	N32.9281	W118.952	25	0	0	0
7/23/2023	Blue Whale	N32.8403	W119.0519	2	0	0	0
7/23/2023	Cuvier's Beaked Whale	N32.8306	W119.0489	3	3	2	2
7/23/2023	Blue Whale	N32.8436	W119.0361	1	0	0	0
7/24/2023	Bottlenose Dolphin	N33.0477	W118.5937	16	0	0	0
7/24/2023	Blue Whale	N32.879	W119.051	1	0	0	0
7/24/2023	Blue Whale	N32.8864	W119.1256	4	2	0	0
7/24/2023	Blue Whale	N32.9071	W119.1025	1	0	0	0
7/24/2023	Blue Whale	N32.9896	W119.0509	1	0	0	0
7/24/2023	Blue Whale	N32.8887	W119.1336	2	2	0	0
7/24/2023	Fin Whale	N32.8905	W119.123	1	1	0	1
7/24/2023	Blue Whale	N32.896	W119.1474	1	1	0	0
7/24/2023	Blue Whale	N32.8695	W119.1418	4	4	0	0
7/24/2023	Risso's Dolphin	N33.0852	W118.6138	10	0	0	0
7/25/2023	Common Dolphin	N33.0096	W118.7417	22	0	3	0
7/25/2023	Risso's Dolphin	N33.06	W118.5204	35	0	0	0
7/25/2023	Bottlenose Dolphin	N33.0289	W118.5334	10	0	0	0
7/25/2023	Risso's Dolphin	N33.0288	W118.5336	60	10	0	0
7/26/2023	Cuvier's Beaked Whale	N32.8144	W119.086	1	0	0	0
7/26/2023	Bottlenose Dolphin	N33.084	W118.6245	19	0	0	0
7/26/2023	Risso's Dolphin	N33.0711	W118.5328	46	0	0	0
7/27/2023	Blue Whale	N33.118	W118.3689	1	0	0	0
7/27/2023	Risso's Dolphin	N33.2391	W118.1171	12	0	0	0
10/2/2023	Common Dolphin	N33.0302	W118.6454	1	0	0	0
10/2/2023	Common Dolphin	N33.0518	W118.9389	3	0	0	0

Date	Common Name	Latitude	Longitude	Group Size	Est IDs	Total Samples	Total Tags
10/2/2023	Blue Whale	N33.0575	W118.9382	1	0	0	0
10/2/2023	Cuvier's Beaked Whale	N33.0093	W118.829	2	1	0	0
10/2/2023	Blue Whale	N33.0283	W118.8305	1	0	0	0
10/3/2023	Bryde's Whale	N33.15	W118.7897	3	2	0	0
10/3/2023	Common Dolphin	N33.0679	W118.6008	20	0	0	0
10/4/2023	Common Dolphin	N32.9961	W118.5277	475	0	0	0
10/4/2023	Common Dolphin	N32.9409	W118.4745	250	0	0	0
10/4/2023	Risso's Dolphin	N32.9198	W118.4341	16	14	0	0
10/4/2023	Bottlenose Dolphin	N32.9153	W118.424	40	25	0	0
10/4/2023	Risso's Dolphin	N32.9146	W118.4252	4	4	0	0
10/5/2023	Common Dolphin	N33.0937	W118.6667	55	0	0	0
10/5/2023	Common Dolphin	N33.1602	W118.8037	60	0	0	0
10/5/2023	Common Dolphin	N32.859	W118.8936	300	0	0	0
10/6/2023	Common Dolphin	N33.0354	W118.6622	70	0	0	0
10/6/2023	Common Dolphin	N33.0134	W118.7297	100	0	0	0
10/7/2023	Common Dolphin	N33.0121	W118.7099	4	0	0	0
10/7/2023	Common Dolphin	N33.0071	W118.6625	55	0	0	0
8/8/2023	Humpback Whale	N36.6298	W122.0234	2	0	0	0
8/8/2023	Pacific White-sided Dolphin	N36.6108	W122.1355	12	0	0	0
8/8/2023	Common Dolphin	N36.5803	-123.0203	2	0	0	0
8/8/2023	Humpback Whale	N36.5515	W122.8956	3	0	0	0
8/8/2023	Humpback Whale	N36.4735	W122.2206	1	1	0	0
8/8/2023	Humpback Whale	N36.4766	W122.2158	2	1	0	0
8/8/2023	Humpback Whale	N36.4938	W122.2086	3	2	0	0
8/8/2023	Pacific White-sided Dolphin	N36.4986	W122.2076	12	0	0	0
8/8/2023	Humpback Whale	N36.5045	W122.2053	2	1	0	0
8/8/2023	Unidentified Large Cetacean	N36.5138	W122.2137	1	0	0	0
8/8/2023	Common Dolphin	N36.5152	W122.2124	50	0	0	0
8/8/2023	Humpback Whale	N36.5205	W122.2005	3	2	0	0
8/8/2023	Humpback Whale	N36.5276	W122.0548	1	1	0	0
8/8/2023	Humpback Whale	N36.5295	W122.0509	1	1	0	0
8/8/2023	Humpback Whale	N36.5447	W122.0231	1	1	0	0
8/8/2023	Humpback Whale	N36.5558	W122.0195	2	2	0	0
8/8/2023	Humpback Whale	N36.5563	W122.0195	3	0	0	0

Date	Common Name	Latitude	Longitude	Group Size	Est IDs	Total Samples	Total Tags
8/8/2023	Humpback Whale	N36.5891	W121.9929	4	4	0	0
8/8/2023	Humpback Whale	N36.6193	W121.9662	1	1	0	0

Appendix 2. List of Acronyms

GPS	Global Positioning System
LIMPET	Low Impact Minimally Percutaneous External-electronics Transmitting
LMR	Living Marine Resources
m	meter
M3R	Marine Mammal Monitoring on Navy Ranges
MFAS	Mid-frequency active sonar
NUWC	Naval Undersea Warfare Center
ONR	Office of Naval Research
Pacific Fleet Monitoring	Navy's Integrated Comprehensive Monitoring Program
PCOD	Population Consequences of Disturbance
ROC	Range Operation Center
RHIB	Rigid-hulled inflatable boat
SCB	Southern California Bight
SCORE	Southern California Offshore Range
SOAR	Southern California Anti-submarine Warfare Range
SMRT	Sound Motion Recording and Telemetry
SCTTR	Southern California Tactical Training Range
SWFSC	Southwest Fisheries Science Center
U.S.	United States