

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

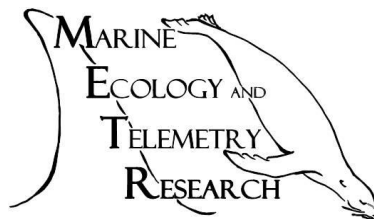
Annual Report N66604-22-D-F200

Gregory S. Schorr¹, Erin A. Falcone¹, Brenda K. Rone¹, Erin L. Keene¹, David A. Sweeney¹, Shannon N. Coates¹, Alexandra Carroll², Karin Dolan², Lauren Moniz², Nancy DiMarzio², Susan Jarvis², and Ronald Morrissey²

¹Marine Ecology and Telemetry Research (MarEcoTel)
2468 Camp McKenzie Tr NW
Seabeck, WA 98380
(206) 931-4638
gschorr@marecotel.org

² Marine Mammal Monitoring on Navy Ranges (M3R)
Naval Undersea Warfare Center (NUWC), Division Newport
1176 Howell St
Newport, RI 02841

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14. ABSTRACT This document represents a brief annual summary on work completed between January 1st, 2024 to December 15th, 2024, under award N66604-22-D-F200, which is part of a broad project to monitor the populations of goose-beaked whales (<i>Ziphius cavirostris</i>) and fin whales (<i>Balaenoptera physalus</i>) in the Southern California Testing and Training Range (SCTTR).		

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Summary statement

This document represents a brief annual summary on work completed between January 1st, 2024 to December 15th, 2024, under award N66604-22-D-F200, which is part of a broad project to monitor the populations of goose-beaked whales (*Ziphius cavirostris*) and fin whales (*Balaenoptera physalus*) in the Southern California Testing and Training Range (SCTTR).

1. Field Efforts

1.1 MarEcoTel Field Data Summary

Surveys were conducted in February, March, November, and December in 2024. Surveys were conducted on 19 calendar days, with some field days having two boats running concurrently, representing a total of 28 boat days, with 203 hours of effort covering 2618 nautical miles (Table 1, Figure 1). An additional 12 field days of ancillary effort were completed in June, November, and December 2024 representing 128 hours of effort covering 1342 nautical miles (Table 1, Figure 2). The percentage of time by project within Navy range boundaries are presented in Table 3. The June effort at SOAR was shifted to coastal work and multiple days within field efforts were cancelled due to inclement weather conditions. One hundred ninety total sightings of 12 different species were documented (Table 4). Fin whale sightings increased compared to the previous year, with thirty-four sightings of sixty including one calf documented in December (Figures 3, 4). A total of 29 sightings of an estimated 80 individual goose-beaked whales were documented, with all but two within the boundaries of the Southern California Anti-submarine Warfare Range (SOAR); one sighting occurred within Catalina Basin and the other was just outside the southern border of SOAR (Figures 3,4). Non-focal species sighted across the SCTTR consisted mainly of blue, gray, and humpback whales, small delphinids (Figure 5). Risso's dolphins were sighted consistently on the east side of San Clemente Island, mainly in the vicinity of Wilson Cove for the entirety of the November and December effort.

Two SMRT tags were deployed on goose-beaked whales during the February field effort and three during the November/December effort. Tag durations ranged from 3.6 -11.8 days (Figures 6-9). Two tissue samples were collected from goose-beaked whales.

Photogrammetry data was collected for the first time at SOAR under an ancillary ONR project using an unmanned aircraft system (Astro Freefly) on both goose-beaked and fin whales.

Table 1. U.S. Pacific Fleet Monitoring effort details for each day a survey was conducted.

*Indicate days with two boats on the water.

Date	Hrs On Effort	Distance (nmi)
2/22/2024*	10.2	124.1
2/23/2024*	20.0	193.8
2/24/2024*	21.2	189.8
2/25/2024*	11.7	107.4
2/26/2024*	12.0	198.2
2/27/2024*	21.7	186.3
2/28/2024*	18.8	172.4
2/29/2024*	9.5	102
3/1/2024*	7.6	139.9
3/5/2024	10.1	173
3/8/2024	3.2	37.6
3/9/2024	7.8	163
11/21/2024	4.6	63
11/27/2024	4.6	119
11/29/2024	10.0	90.5
12/1/2024	7.4	74.3
12/07/204	7.7	165
12/08/2024	7.2	152
12/15/2024	8.0	167
Total	203.3	2618.3

Table 2. Ancillary effort details for each day a survey was conducted. * Indicate days with two boats on the water.

Date	Hrs On Effort	Distance (nmi)
6/26/2024	4.6	36.5
6/27/2024	5.8	49.3
6/29/2024	6.9	93.7
6/30/2024	8.7	127
11/21/2024	4.0	53
11/23/2024*	15.9	144.8
11/24/2024*	16.1	156.6
11/25/2024*	20.2	184.7
11/26/2024*	21.5	154.5
11/28/2024	8.1	138
11/30/2024	11	91
12/02/2024*	4.4	112.9
Total	127.2	1342

Table 3. Percentage of effort spent within U.S. Navy range boundaries. Note that SOAR is a sub-range within the bounds of the SOCAL Range Complex.

	Point Mugu Sea Range	SOCAL¹ Range Complex	SOAR²
Pacific Fleet Monitoring	0%	97%	57%
Ancillary	4%	95%	51%

¹SOCAL = Southern California Range Complex

²SOAR = Southern California Anti-submarine Warfare Range

2024 U.S. Pacific Fleet Monitoring Effort (February-December)

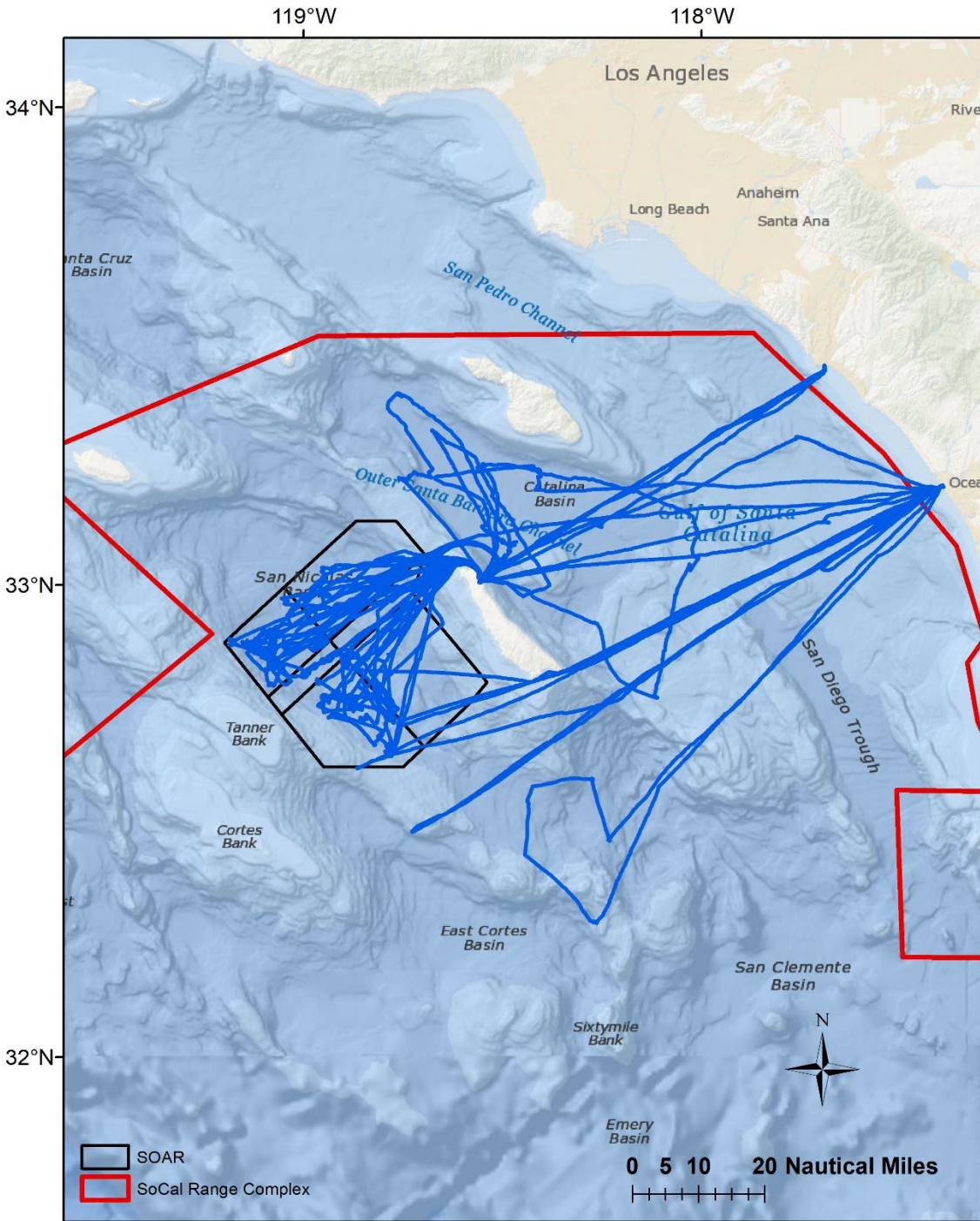


Figure 1. Map showing vessel tracklines associated with U.S. Pacific Fleet monitoring surveys and tag recoveries conducted during this project period.

2024 Ancillary Effort (June-December)

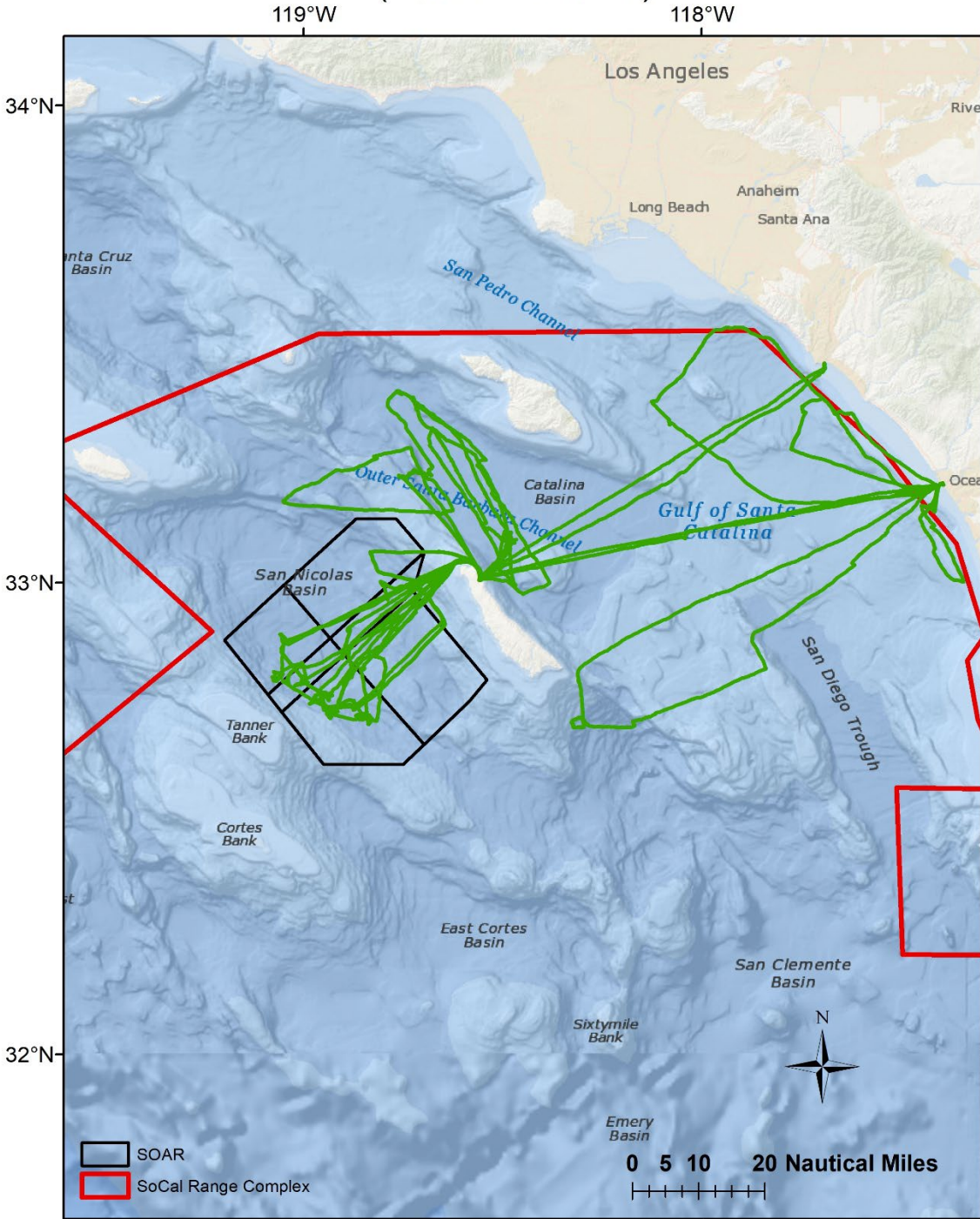


Figure 2. Map showing vessel tracklines associated with ancillary surveys conducted during this project period.

Table 4. Sighting details, by species. Number of individuals represents the sum of the best group estimate size for each encounter.

Species	No. sightings	No. individuals	No. estimated IDs
Blue whale	2	2	1
Fin whale	34	60	38
Long-beaked common dolphin	4	212	0
Short-beaked common dolphin	26	4135	0
Delphinus sp.	14	1204	0
Gray whale	17	50	14
Risso's dolphin	27	618	208
Northern right whale dolphin	1	45	0
Pacific white-sided dolphin	4	95	0
Humpback whale	25	59	25
Dall's porpoise	1	3	0
Bottlenose dolphin	6	44	2
Goose-beaked whale	29	80	37
Total	190	6607	325

2024 Seasonal Goose-beaked and Fin Whale Sightings

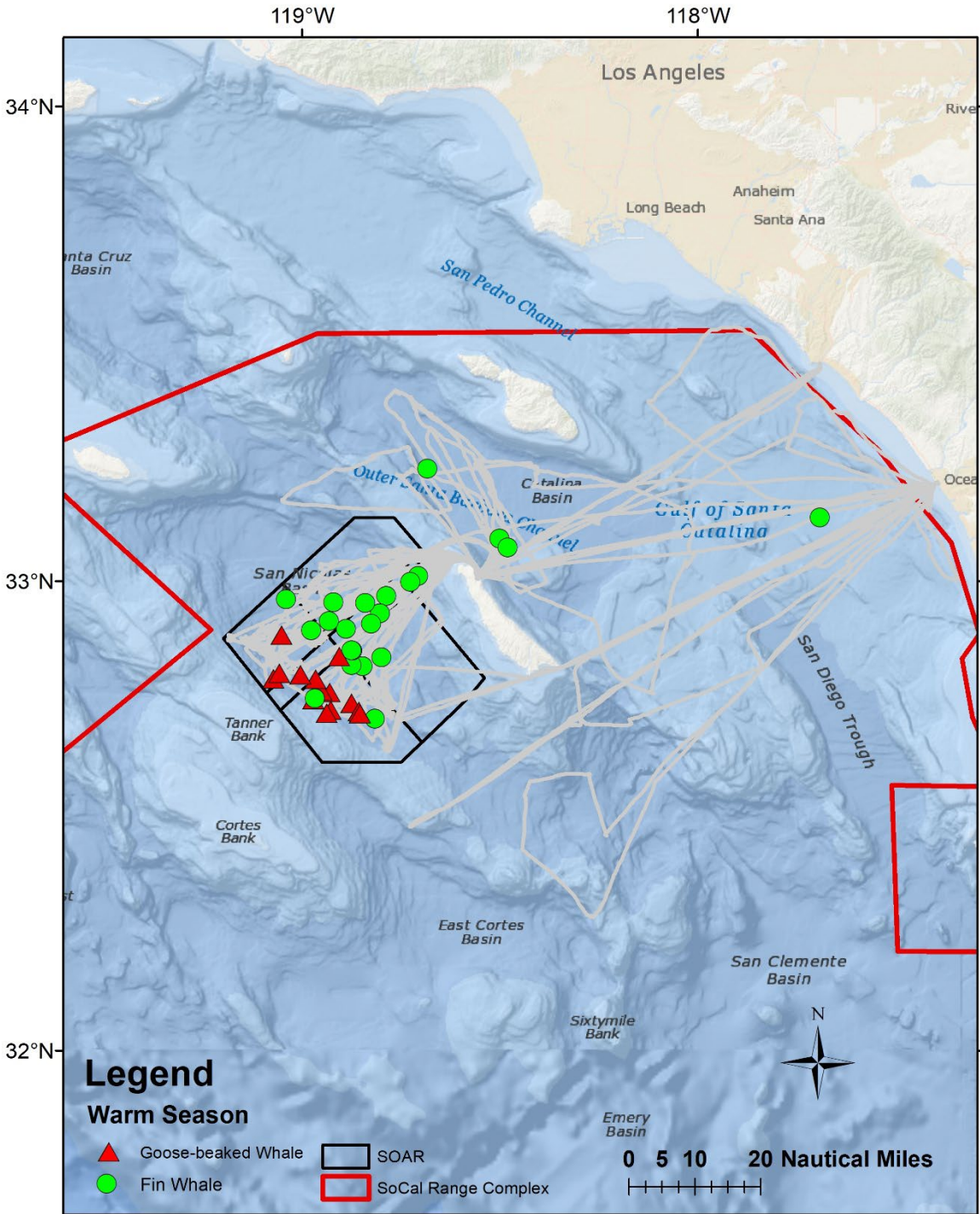


Figure 3. Map showing seasonal sighting locations for goose-beaked and fin whales sighted during field efforts, June-November.

2024 Seasonal Goose-beaked and Fin Whale Sightings

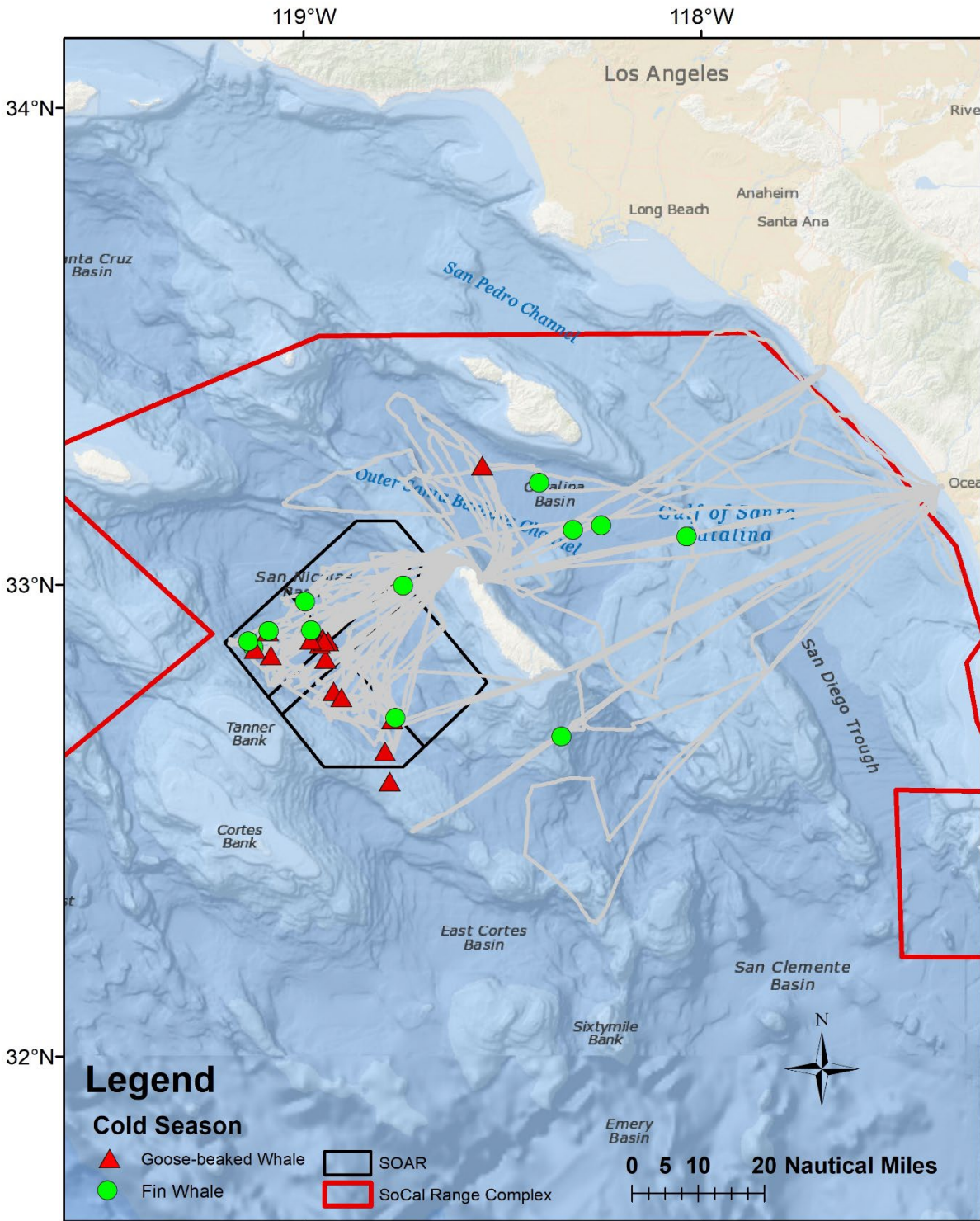


Figure 4. Map showing seasonal sighting locations for goose-beaked and fin whales sighted during field efforts, December-May.

2024 Cetacean Sightings (excluding goose-beaked and fins)

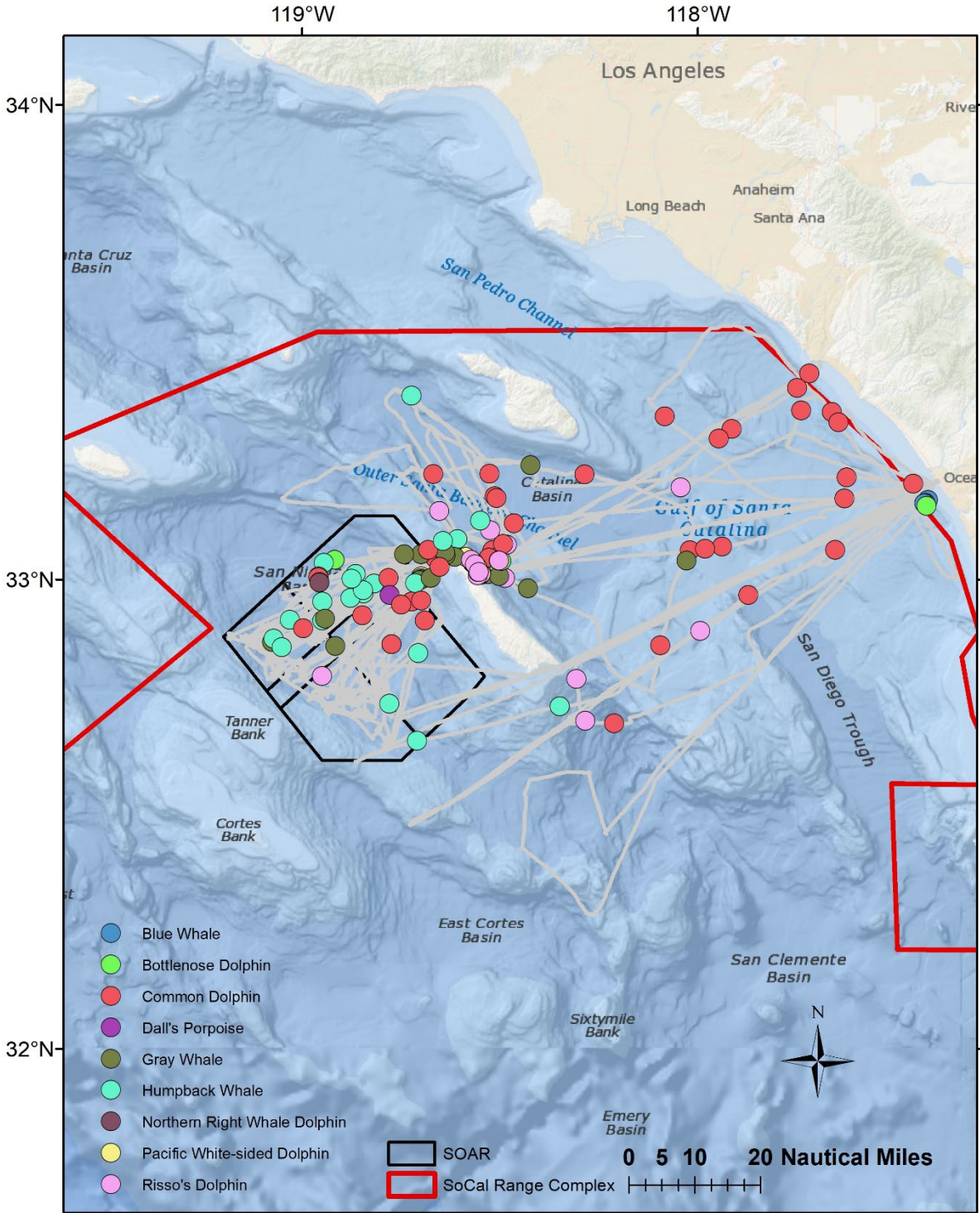


Figure 5. Sighting locations for all species other than goose-beaked and fin whales.

Zica-20240227-233396

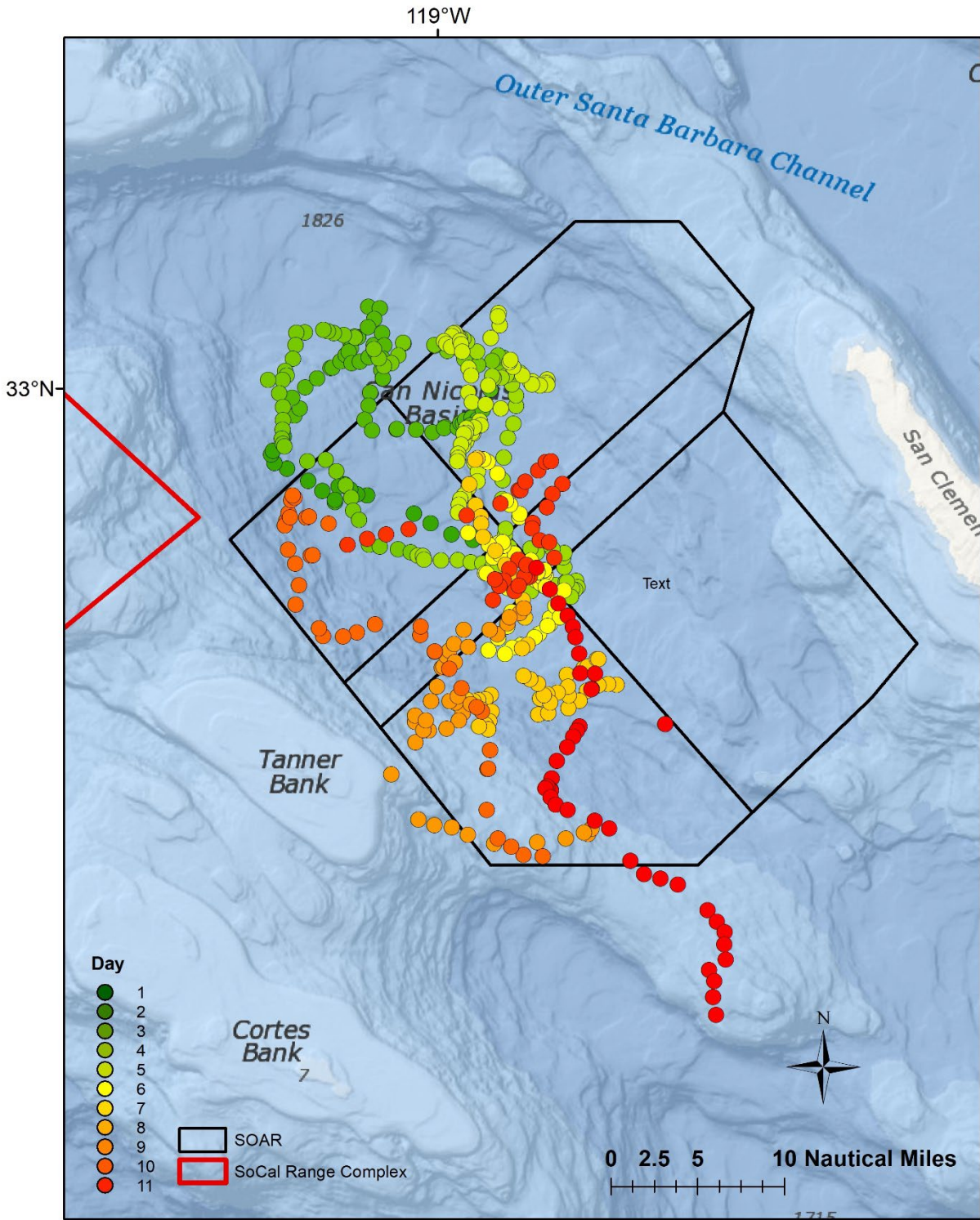


Figure 6. SMRT deployment on a goose-beaked whale (tag ID Zica-20240227-233396) tagged under U.S. Fleet monitoring effort in 2024.

Zica-20240227-240128

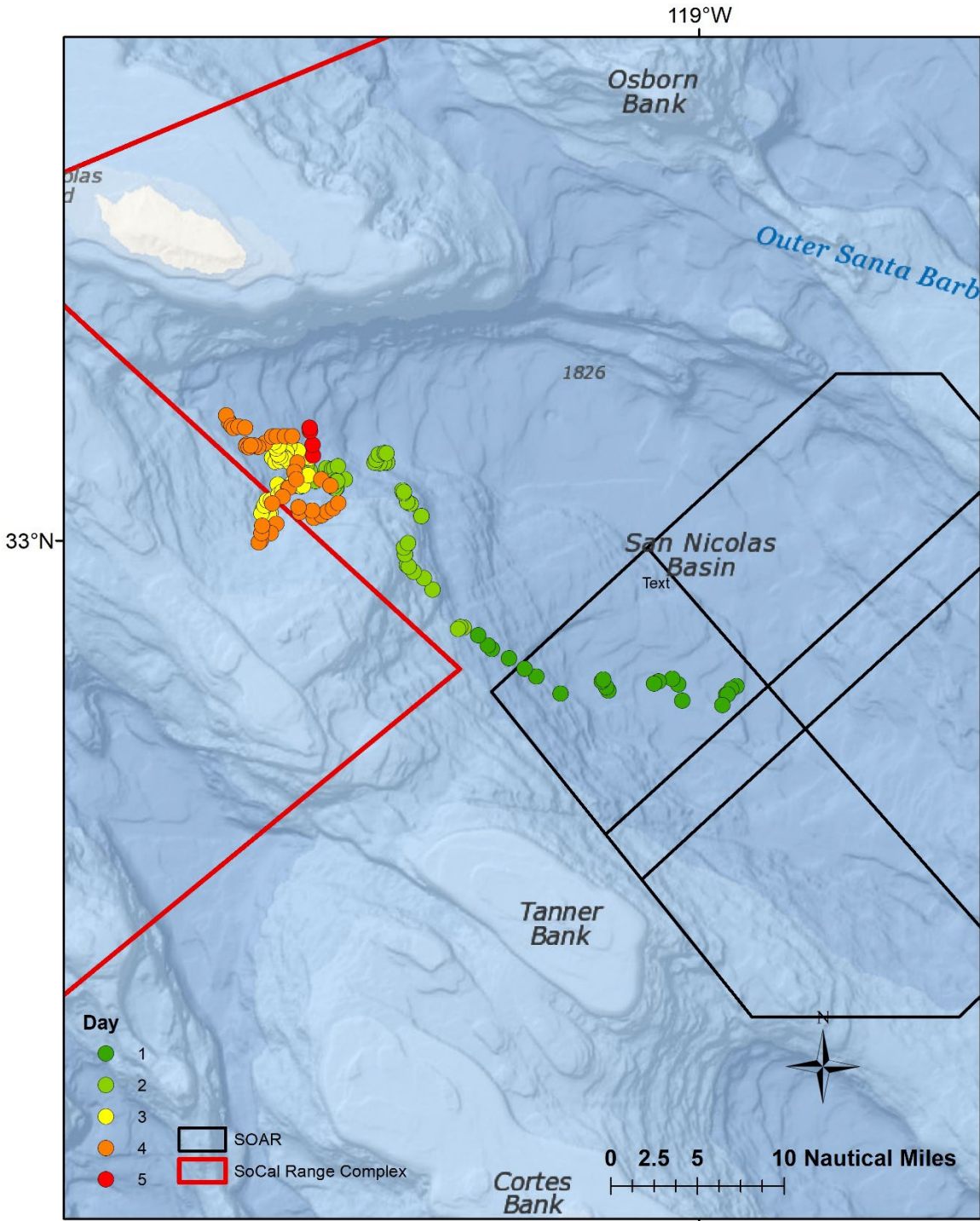


Figure 7. SMRT deployment on a goose-beaked whale (tag ID Zica-20240227-240128) tagged under U.S. Fleet monitoring effort in 2024.

Zica-20241201-260685

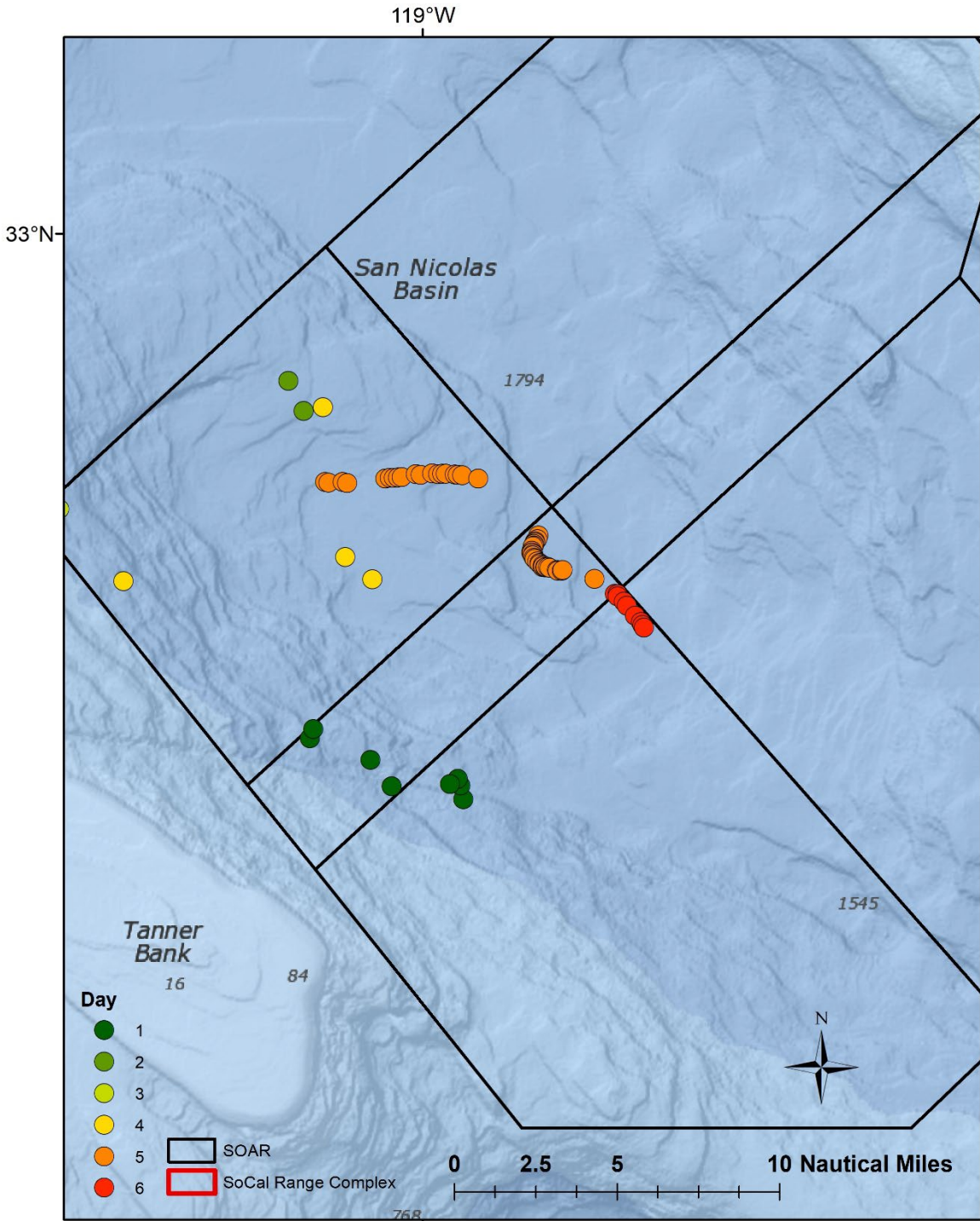


Figure 8. SMRT deployment on a goose-beaked whale (tag ID Zica-20241201-260685) tagged under U.S. Fleet monitoring effort in 2024.

1.2 M3R Field Data Summary

The Marine Mammal Monitoring on Navy Ranges (M3R) program provided real-time acoustic monitoring for target species to the on-water MarEcoTel crews for each survey by utilizing the M3R system at SOAR, which continuously runs algorithms to passively detect, classify and localize marine mammals year-round (Jarvis et al. 2014). The locations of animals were generated automatically by the M3R system localization code. These localizations indicate a level of confidence for each position. M3R personnel use both these automated outputs and real-time review of binary spectrograms to identify relevant species and to determine the best locations to communicate. Manual localization is also employed when necessary. Raven Pro Sound Analysis Software (Cornell University, Ithaca, NY) has been modified to stream M3R data in real-time, allowing M3R personnel to view non-binary spectrograms (i.e. spectrograms with complete magnitude information) on individual hydrophones on demand, which assists with species identification. Table 5 lists the marine mammal species acoustically identified using the M3R system during the two field surveys completed between January 1st – December 15th, 2024.

Table 5. Species acoustically identified with the M3R system at SOAR in 2024. Data are extracted from field test logs for February 20 – 28 and November 22 – December 1, 2024. Note that visibly verified acoustic detections are likely an underestimate, as we only used sightings verified in the field, not via post-processing of sighting and acoustic data.

Species			Acoustic Detections Logged	Acoustic Detections Directed	Acoustic Detections Visually Verified
ID	Common Name	Scientific Name			
Zc	Goose-beaked whale	<i>Ziphius cavirostris</i>	172	40	20
Bp	Fin whale	<i>Balaenoptera physalus</i>	28	5	2
Bm	Blue whale	<i>Balaenoptera musculus</i>	2	0	0
Er	Gray whale	<i>Eschrichtius robustus</i>	1	0	0
Mn	Humpback whale	<i>Megaptera novaeangliae</i>	4	0	0
Gg	Risso's dolphin	<i>Grampus griseus</i>	4	1	1
UD	Unidentified dolphin	Delphinidae sp.	75	0	0
UM	Unidentified baleen whale	Mysticete sp.	14	0	0
Totals			300	46	23

A total of 300 acoustic detections were logged (Figure 9 & 10), including 172 for goose-beaked whales, 28 for fin whales, two for blue whales, four for humpback whales, one for gray whales,

and four for Risso's dolphins. There were acoustic detections that could not be identified to the species level, including 75 for delphinidae species and 14 for baleen whales. Note that the detections do not necessarily indicate unique groups; in fact, goose-beaked whale detections often recur in the same area periodically throughout the day, which may indicate a unique foraging group in a particular location. In addition, not all species that were present were logged. Due to M3R personnel constraints and species priority, not all dolphin and baleen whales present on range were logged.

M3R directed MarEcoTel to animals of interest for 46 of the acoustic detections. Here 'directed' acoustic detections are considered those in which a location was sent, and the field team decided to go to the location. MarEcoTel visually verified 20 groups of goose-beaked whales, two groups of fin whales, as well as single group of Risso's dolphins. There are many cases where a species, particularly for dolphins, may be identified both visually and acoustically, but those are not reconciled in real-time (e.g. boat is passing quickly to get to a higher priority sighting). These could be reconciled at a later date if requested.

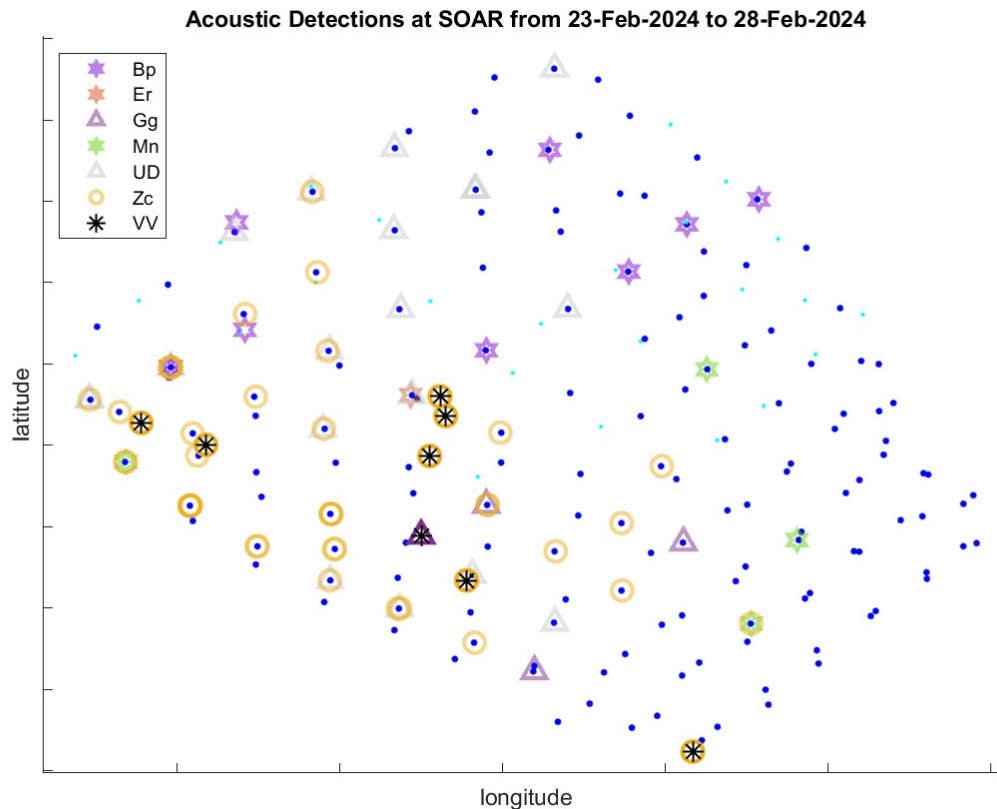


Figure 9. Acoustic detections at SOAR from February 23 – 28, 2024. Species included goose-beaked whale (Zc), fin whale (Bp), gray whale (Er), humpback whale (Mn), Risso's dolphin (Gg),

and unidentified delphinidae species (UD). Detections that were visually verified (VV) by MarEcoTel are overlaid with an asterisk.

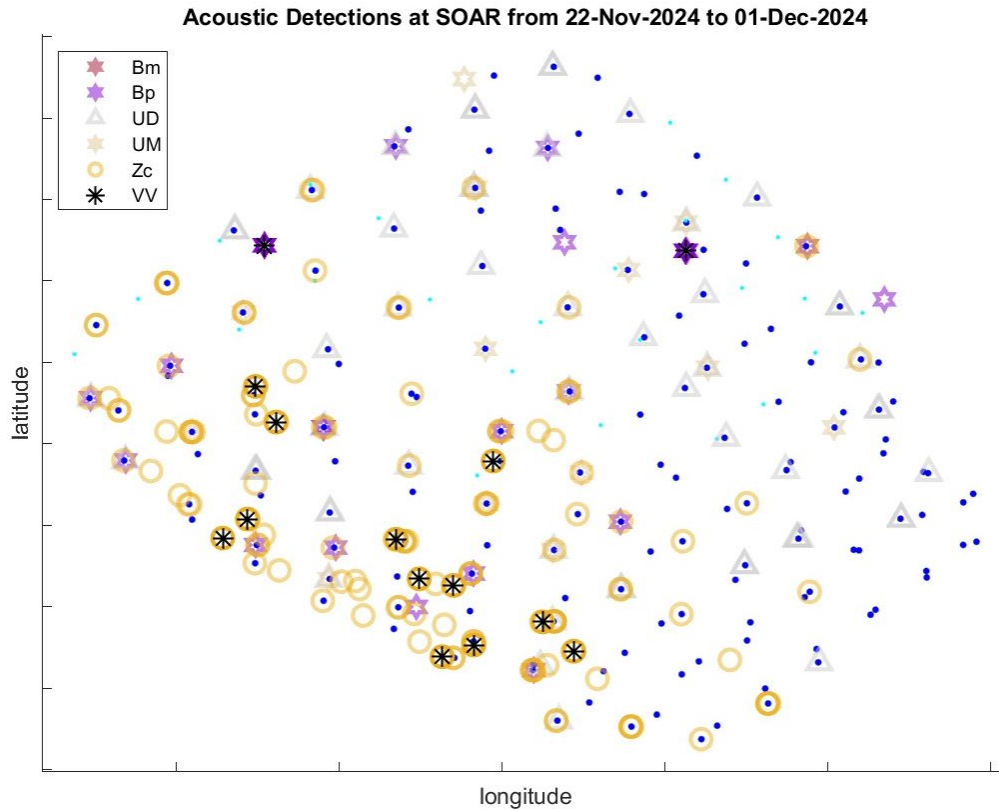


Figure 10. Acoustic detections at SOAR from November 22 – December 1, 2024. Species included goose-beaked whales (Zc), fin whale (Bp), blue whale (Bm), and unidentified mysticete (UM) and delphinidae (UD). Detections that were visually verified (VV) by MarEcoTel are overlaid with an asterisk.

2. Attendance of the Annual US Navy's Monitoring Program Review meeting, and Effect of Sound on Marine Mammals (ESOMM) meeting

The Principal Investigators attended the ICMP at the request of the Navy, presented the results of the work completed on monitoring within the SCTTR since the inception of the project, and participated in discussions regarding future monitoring directions. Two of the principal investigators attended the biennial ESOMM meeting to present the up-to-date results of our understanding of responses of beaked whales to Navy sonar.

3. Outfitting of Vessel for Sonobuoy Control Box

Our primary research vessels were outfitted with a storage rack on the tow bar to facilitate the carrying of the Directional Command Activated Sonobuoy System (DICASS), or drone case, plus an inverter to allow for the deployment and command of DICASS buoys as part of an upcoming project.

4. Data Analysis Progress

Data analysis during the period of this report consisted of matching goose-beaked and fin whale sightings (both our own images, and contributor images) to our historical photo-ID catalogs. Tag to whale frame conversions of the accelerometry data for the two SMRT tags deployed in February are complete, as are the acoustic audits. Data from the three SMRT tags recovered in December 2024 are undergoing the initial acoustic audit for anthropogenic sounds, as well as foraging clicks. Photo-ID matching for 2024 is ongoing. A paper discussing the impact of dart-attached tags to beaked whales and fin whales, which includes data from this study, will be submitted to the *Journal of Cetacean Management and Research* by the end of January 2025. Further progress was made with the analytical framework being built to analyze all the SMRT tag data incorporating necessary covariates. Analysis of two whales exposed to the same sonar event, which includes a Continuous Active Sonar bout, has begun.

5. References

Jarvis, S.M., Morrissey, R.P., Moretti, D.J., DiMarzio, N.A., Shaffer, J.A. 2014. Marine Mammal Monitoring on Navy Ranges (M3R): A toolset for automated detection, localization, and monitoring of marine mammals in open ocean environments. *Marine Technology Society Journal*, 48(1), pp.5-20.

6. Publications and presentations

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