Technical Report

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Movements and diving behavior of beaked whales in Monterey Bay, CA: A comparative study site in the California Current Ecosystem

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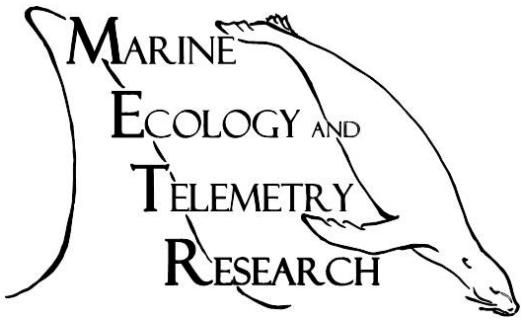


BACKGROUND

The Southern California Offshore Range (SCORE) includes one of the most heavily used antisubmarine warfare (ASW) ranges in the world. Mid-Frequency Active (MFA) sonar is routinely employed during training exercises in the region. Navy-supported research has generated a sizeable collection of photographic and satellite tag dive data for Cuvier's beaked whales at SCORE, which appear to be the most common beaked whale species in the region. This includes over 8,000 hours of dive data with associated movements, and a photo-ID catalog, with associated life-history data, for over 100 individuals. The long-term goal of this research program has been to investigate the effects of military activity on beaked whales and other sensitive species in the area. Schorr et al., (2014) suggested that beaked whales tagged at SCORE appear to conduct fewer deep, presumed foraging, dives per day than those tagged in Hawaii or the Mediterranean Sea. Combining Navy MFAS use and diving behavior from SCORE, Falcone et al. (2017) demonstrate a significant increase in deep dive interval when MFAS is present, which could have a long-term effect on population health.

Collecting complementary datasets from whales in a nearby population that is subject to similar oceanographic effects but not exposed to sonar is a critical component for evaluating the role disturbance might play in shaping the behavior and demographics of whales at SCORE. The availability of such a comparative site is proving invaluable for informing and evaluating Population Consequences of Disturbance (PCoD) models for Blainville's beaked whales at the AUTEC ASW range in the Bahamas (Claridge, DE, 2013; Moretti et al., 2014). Without a comparative site, evaluating population level impacts to Cuvier's beaked whales at SCORE will be challenging. While ongoing photo-ID studies of this species in the Canary Islands (P.I. Aguilar de Soto) and Hawaii (P.I. Baird) are yielding appropriate samples for a comparison to the SCORE population, both are island-associated populations, and fundamental differences in ecology may confound inferences that can be drawn between the behavior and demography of these whales and those in the temperate, continental shelf waters at SCORE.

While there have not been any dedicated surveys for beaked whales in Monterey Bay, CA, approximately 300 nmi (555 km) north of SCORE, Cuvier's beaked whales have been opportunistically documented there by researchers. Beaked whales have also been detected acoustically in recent years on a High frequency Acoustic Recording Package (HARP) deployed off Point Sur (south of the Monterey Canyon complex) on 36% of recording days, with Cuvier's beaked whale accounting for 95% of all these beaked whale detections (Baumann-Pickering et al., 2014). While the relative detection rate of this species off Point Sur is 50% lower than on a HARP deployed in the San Nicolas Basin (which encompasses the SCORE study site), it is 13% higher than a HARP located in the Santa Cruz Basin, where we have successfully located Ziphius visually during RHIB surveys without the real-time acoustic support we have at SCORE (Marine Ecology and Telemetry Research, unpublished data). Additionally, the HARP at Point Sur was located ~16 nmi (30 km) south of the canyon complex (Baumann-Pickering et al., 2014) where we believed Ziphius were likely to be concentrated based on the sighting data and ecology.

Photo-ID and satellite tag data from Cuvier's in Southern California have demonstrated a high degree of regional site-fidelity. A small number of whales tagged at SCORE have moved south to Guadalupe Island, but at least one of these returned to Southern California during the tag transmission period (Schorr et al., 2014), and another was identified photographically having returned to SOAR after the

tag stopped transmitting. While the species is managed as a single contiguous stock along the US West Coast (Carretta et al., 2016), no whales tagged at SCORE have moved north of San Miguel Island, CA. A small comparison of photographs of Cuvier's beaked whales from Monterey, CA to the larger SCORE catalog yielded no matches. These observations, along with findings of generally high site-fidelity to fairly small areas in studies of beaked whales elsewhere (e.g., Claridge, 2013; McSweeney et al., 2007; Schorr et al., 2009), all suggest there is likely to be minimal exchange of individuals between the two regions, though this remains to be proven. If whales from Monterey Bay seldom move south into the heavily used military training areas in Southern California, then this population could provide the data needed for a behavioral and demographic comparison to the regularly-exposed population at SCORE. While there are likely to be some ecological differences between the two regions, both fall within the California Current Large Marine Ecosystem. We believed Monterey to be the closest readily accessible, most ecologically-similar comparative study site to SCORE that is likely to be free of sonar due to use restrictions within the sanctuary.

Monterey was selected as a comparable study site for beaked whales for a number of reasons. There are two boat launches, and abundant services, within 10 nmi (19 km) of beaked whale habitat (bottom depths greater than 3,280 ft (1,000 m)). Parts of the canyon are somewhat sheltered from north or northwesterly prevailing winds, improving odds of better weather. The canyon complex is fairly narrow, restricting the suitable beaked whale habitat into a contiguous area that can be effectively surveyed from a small vessel using visual and auditory (listening for blows, which can be heard at a much greater range than can be seen in calm conditions) detection methods. Finally, the benthic ecosystem of the Monterey Canyon is among the best studied in the world, which may provide access to unique and relevant data for interpreting the sub-surface behavior of any whales that were tagged in this area.

METHODS

Surveys were conducted using a 6.3m rigid-hulled inflatable boat (RHIB), powered by two 75 hp outboard motors and equipped with a raised bow pulpit. The RHIB was launched from the Monterey Bay boat launch each morning and surveys were conducted throughout daylight hours as conditions permitted.

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 species verification where questionable, and for individual identification for species to contribute to ongoing studies. Remote tissue biopsies were collected from species of interest and also on behalf of collaborators at the Southwest Fisheries Science Center (SWFSC) for use with ongoing assessments of offshore populations and stress hormone analyses. Finally, a limited number of satellite tags were deployed during this study. The tags deployed were of the Low Impact Minimally Percutaneous External-electronics Transmitter (LIMPET) SPLASH10-A and SPOT 5 designs (Andrews et al., 2008; Schorr et al., 2014). Sighting data were collected using a custom-built access database with integrated GPS. Individual identification photographs of fin whales and beaked whales were processed and compared using methods described in Falcone and Schorr (2014) to build photographic sighting histories.

RESULTS

Survey effort and sightings

A total of 13 daily surveys were conducted during 2 survey efforts: September 30-October 7, 2016 and May 21-27, 2017 totaling 1,134 nmi (2,100 km) and 111 hours (Table 1, Figure 1). Three days were cancelled due to inclement weather conditions. All surveys were launched out of Monterey, CA. For both survey efforts combined, 59% of the survey effort was conducted in conditions classified as fair to poor quality with only 10% conducted in excellent conditions (Table 1, Figure 2). Swell was considerably lower during the second effort which allowed us to reach offshore waters for a majority of the survey days (Figure 1,2). During the two efforts, we documented 82 sightings of 10 species of cetaceans: Cuvier's beaked whale, humpback whale, fin whale, blue whale, sperm whale, killer whale, minke whale, Risso's dolphin, Pacific white-sided dolphin, short-beaked common dolphins (Table 2, Figure 3). Cuvier's beaked whales were sighted on two days for a total three individuals (Table 2, Figure 4).

Table 1. Survey effort and quality for the 2016 and 2017 Monterey, CA surveys.

Survey Dates	Survey Hours	Survey Mileage (nmi)	% Total Hours in Excellent Conditions	% Total Hours in Good Conditions	% Total Hours in Fair Conditions	% Total Hours in Poor Conditions
Effort 1						
30-Sep-2016	4:33:11	48.4	0%	0%	21%	79%
1-Oct-2016	7:56:51	69.1	5%	13%	41%	41%
2-Oct-2016	9:54:55	106	9%	55%	31%	4%
3-Oct-2016	11:02:07	101	23%	46%	16%	15%
4-Oct-2016	3:28:37	42.7	6%	34%	27%	34%
5-Oct-2016	6:39:09	50.8	13%	64%	13%	9%
7-Oct-2016	7:02:03	77.1	0%	0%	28%	72%
Total	***50:36:53***	***495.1***	***10%***	***33%***	***26%***	***32%***
Effort 2						
21-May-2017	4:31:51	52.5	0%	0%	76%	24%
22-May-2017	10:49:38	121	0%	17%	80%	4%
23-May-2017	10:45:46	113	57%	19%	20%	4%
24-May-2017	10:36:38	130	5%	58%	21%	16%
26-May-2017	12:22:51	134	0%	42%	32%	25%
27-May-2017	11:38:24	88.6	0%	24%	63%	13%
Total	***60:45:08***	***639.1***	***11%***	***30%***	***46%***	***14%***
GRAND TOTAL	**111:22:01**	**1134.2**	**10%**	**31%**	**37%**	**22%**

Figure 1. Survey effort accomplished during the 2016 and 2017 Monterey, CA surveys.

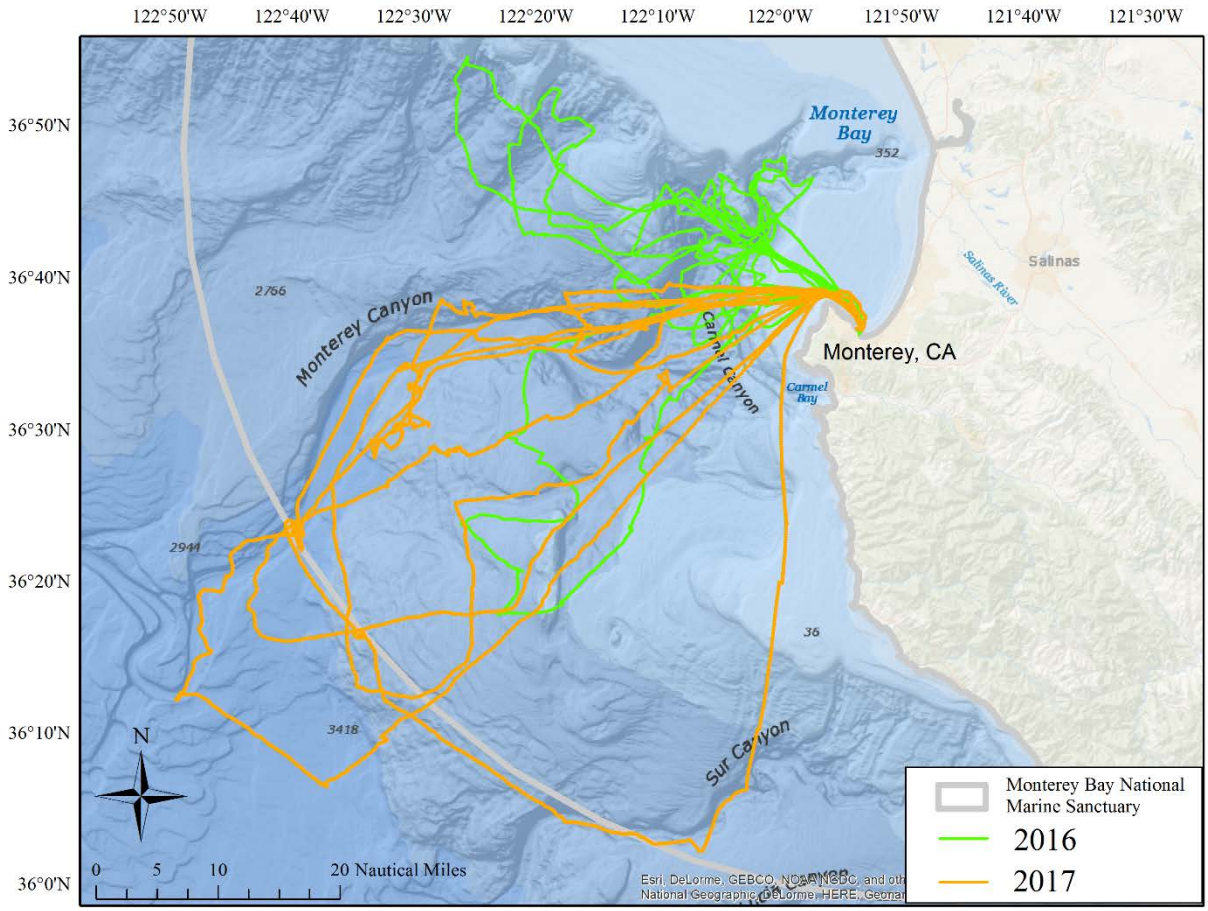


Figure 2. Viewing condition quality for the 2016 and 2017 Monterey, CA surveys.

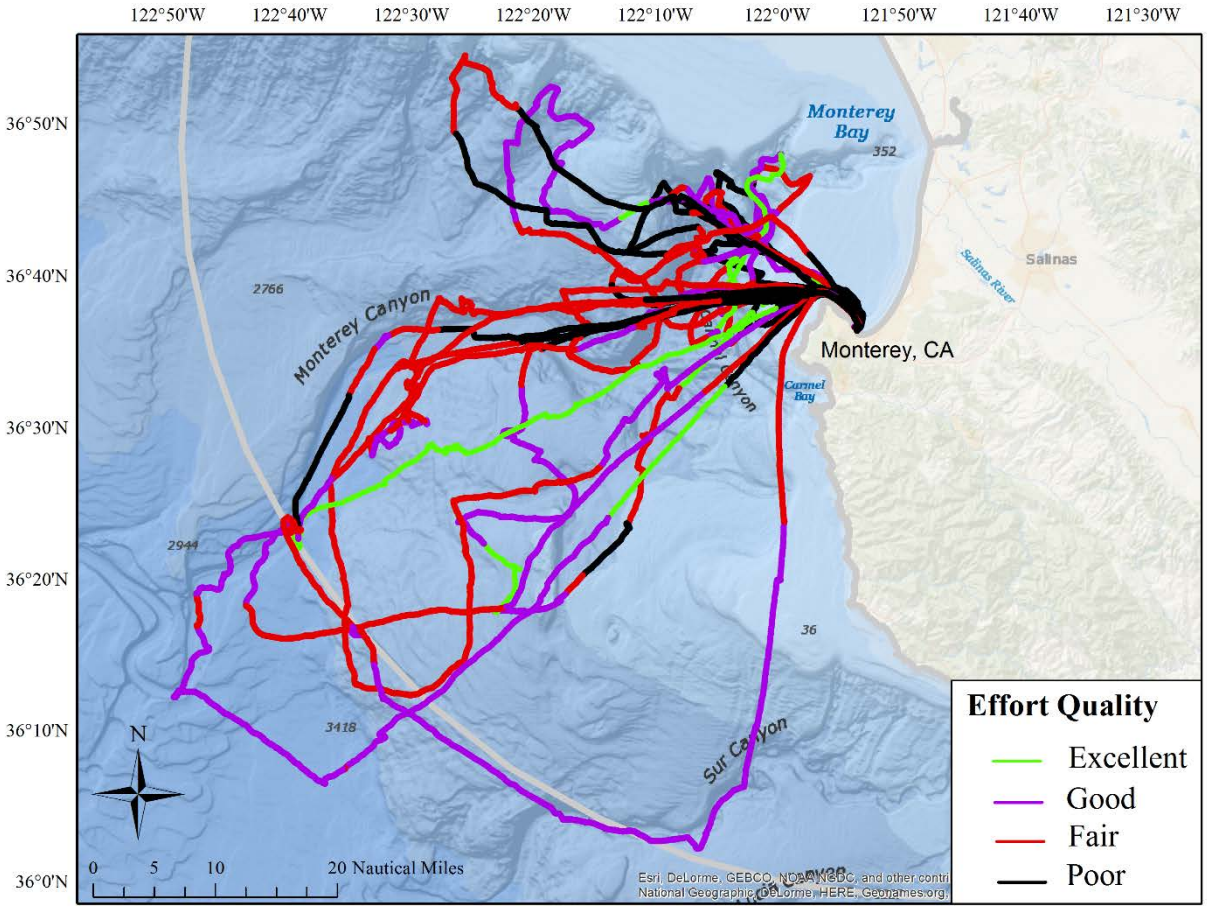


Figure 3. Sighting locations by species for all odontocetes (except Cuvier's beaked whales) and baleen whales encountered during the 2016 and 2017 Monterey, CA surveys.

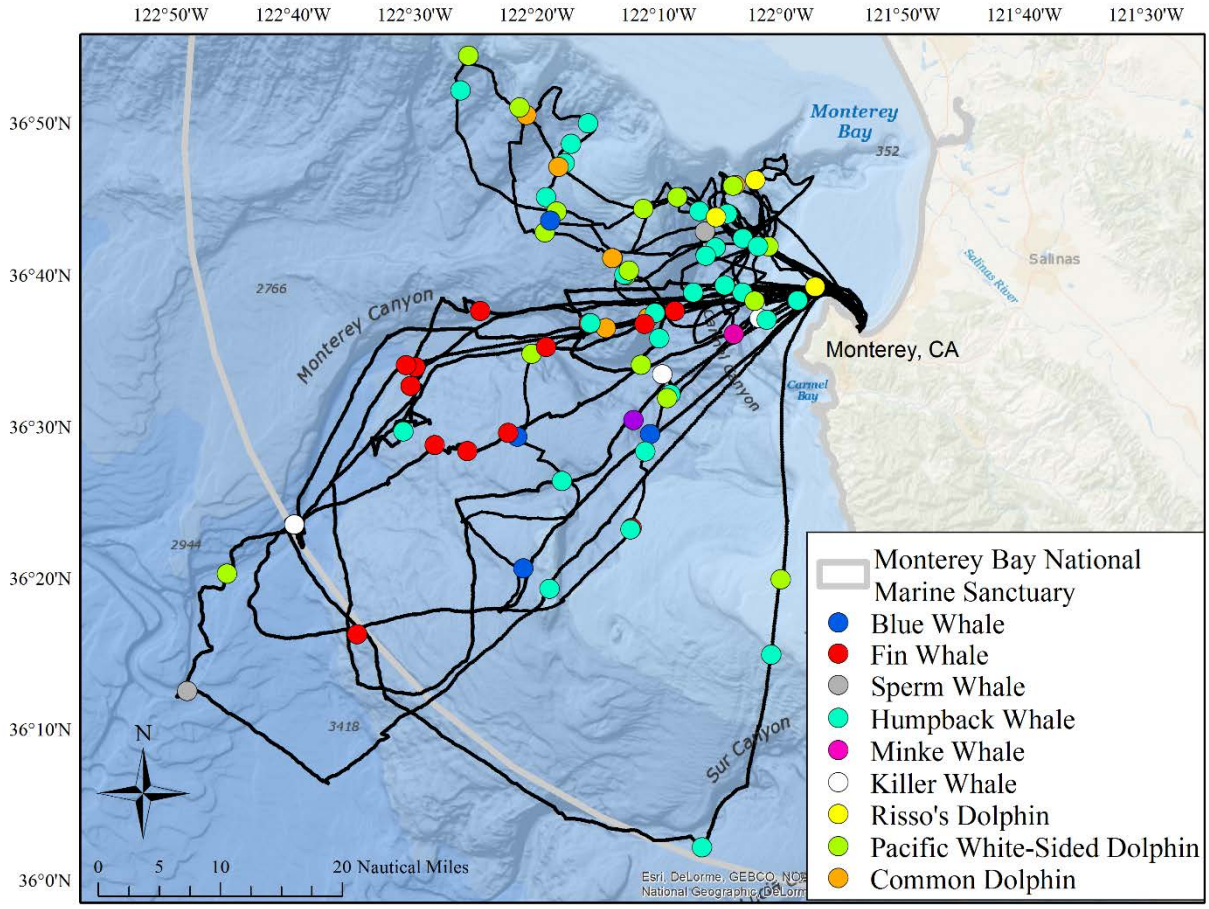


Table 2. Sightings documented during the 2016 and 2017 Monterey, CA surveys.

Date	Latitude	Longitude	Species	Min	Max	Best
30-Sep-2016	36.7643	-122.0617	Common Dolphin	12	20	15
30-Sep-2016	36.7637	-122.065	Pacific white-sided dolphin	12	17	14
30-Sep-2016	36.696	-122.0885	Pacific white-sided dolphin	20	50	30
30-Sep-2016	36.696	-122.0888	Humpback whale	1	1	1
1-Oct-2016	36.7358	-122.1112	Humpback whale	1	1	1
1-Oct-2016	36.7135	-122.1031	Sperm whale	1	1	1
1-Oct-2016	36.687	-122.1023	Humpback whale	2	2	2
1-Oct-2016	36.6653	-122.2113	Pacific white-sided dolphin	8	18	12
1-Oct-2016	36.6661	-122.2136	Humpback whale	2	4	3
2-Oct-2016	36.6707	-122.207	Pacific white-sided dolphin	30	80	50

2-Oct-2016	36.6843	-122.2295	Humpback whale	10	15	12
2-Oct-2016	36.6842	-122.2298	Common Dolphin	50	100	75
2-Oct-2016	36.7127	-122.3222	Pacific white-sided dolphin	13	18	15
2-Oct-2016	36.8321	-122.263	Humpback whale	1	1	1
2-Oct-2016	36.8095	-122.2864	Humpback whale	1	1	1
2-Oct-2016	36.7885	-122.2953	Humpback whale	1	1	1
2-Oct-2016	36.7513	-122.3207	Humpback whale	4	4	4
2-Oct-2016	36.7352	-122.306	Pacific white-sided dolphin	12	17	15
3-Oct-2016	36.6181	-122.0287	Transient Killer whale	2	2	2
3-Oct-2016	36.4882	-122.3598	Blue whale	1	1	1
3-Oct-2016	36.4922	-122.3725	Fin whale	2	2	2
3-Oct-2016	36.5791	-122.3402	Pacific white-sided dolphin	8	12	8
3-Oct-2016	36.5867	-122.3204	Fin whale	2	2	2
3-Oct-2016	36.6073	-122.2389	Common Dolphin	7	10	8
3-Oct-2016	36.6192	-122.1806	Common Dolphin	100	220	150
3-Oct-2016	36.6243	-122.1716	Humpback whale	2	2	2
3-Oct-2016	36.6009	-122.064	Dall's porpoise	8	10	8
3-Oct-2016	36.5347	-122.1504	Humpback whale	1	1	1
3-Oct-2016	36.5305	-122.1549	Pacific white-sided dolphin	500	1200	800
3-Oct-2016	36.491	-122.1782	Blue whale	1	1	1
3-Oct-2016	36.4719	-122.1848	Humpback whale	5	15	7
3-Oct-2016	36.388	-122.2035	Fin whale	1	1	1
3-Oct-2016	36.3862	-122.2051	Humpback whale	1	1	1
3-Oct-2016	36.3433	-122.3516	Blue whale	1	1	1
4-Oct-2016	36.6464	-122.1193	Humpback whale	2	3	2
4-Oct-2016	36.7057	-122.0514	Humpback whale	1	1	1
5-Oct-2016	36.6972	-122.0161	Pacific white-sided dolphin	125	300	200
5-Oct-2016	36.697	-122.0309	Humpback whale	1	2	1
5-Oct-2016	36.7329	-122.0726	Humpback whale	1	1	1
5-Oct-2016	36.7697	-122.0343	Risso's dolphin	70	120	90
7-Oct-2016	36.729	-122.0883	Risso's dolphin	4	7	5
7-Oct-2016	36.7256	-122.3151	Blue whale	1	1	1
7-Oct-2016	36.7513	-122.1409	Pacific white-sided dolphin	12	30	18
7-Oct-2016	36.7383	-122.1877	Pacific white-sided dolphin	6	10	6
7-Oct-2016	36.7844	-122.3033	Common dolphin	8	20	10
7-Oct-2016	36.8411	-122.3475	Common dolphin	4	8	4
7-Oct-2016	36.8495	-122.3566	Pacific white-sided dolphin	35	70	50
7-Oct-2016	36.9055	-122.4266	Humpback whale	3	3	3
7-Oct-2016	36.9059	-122.4267	Pacific white-sided dolphin	10	16	12
7-Oct-2016	36.8679	-122.4378	Humpback whale	2	2	2
5/21/2017	36.6526	-121.9528	Risso's dolphin	1	1	1
5/21/2017	36.6464	-122.0521	Humpback whale	1	1	1

5/21/2017	36.5961	-122.1658	Humpback whale	6	8	6
5/21/2017	36.5672	-122.1906	Pacific white-sided dolphin	20	30	25
5/21/2017	36.6129	-122.262	Fin whale	1	1	1
5/21/2017	36.613	-122.2602	Humpback whale	1	1	1
5/21/2017	36.6545	-122.0762	Humpback whale	1	1	1
5/22/2017	36.626	-122.4107	Fin whale	4	4	4
5/22/2017	36.5647	-122.4989	Fin whale	1	1	1
5/22/2017	36.5441	-122.506	Fin whale	2	2	2
5/22/2017	36.4393	-122.2988	Humpback whale	1	1	1
5/22/2017	36.5064	-122.2008	Minke whale	1	1	1
5/22/2017	36.5569	-122.1615	Killer whale	1	1	1
5/22/2017	36.6166	-122.0186	Humpback whale	2	2	2
5/23/2017	36.6378	-121.9765	Humpback whale	1	1	1
5/23/2017	36.4725	-122.4283	Fin whale	3	3	3
5/23/2017	36.4789	-122.4727	Fin whale	2	2	2
5/23/2017	36.3976	-122.657	Cuvier's beaked whale	1	1	1
5/23/2017	36.3915	-122.6647	Killer whale	3	3	3
5/24/2017	36.3208	-122.3161	Humpback whale	1	1	1
5/24/2017	36.208	-122.811	Sperm whale	4	4	4
5/24/2017	36.3373	-122.757	Pacific white-sided dolphin	15	18	15
5/24/2017	36.5667	-122.5123	Fin whale	4	4	4
5/26/2017	36.2707	-122.5787	Fin whale	1	1	1
5/26/2017	36.0352	-122.1074	Humpback whale	1	1	1
5/26/2017	36.2479	-122.0125	Humpback whale	1	1	1
5/26/2017	36.3311	-121.9998	Pacific white-sided dolphin	8	12	9
5/27/2017	36.6373	-122.0352	Pacific white-sided dolphin	10	15	13
5/27/2017	36.6261	-122.1444	Fin whale	1	1	1
5/27/2017	36.612	-122.186	Fin whale	3	3	3
5/27/2017	36.5041	-122.524	Cuvier's beaked whale	2	3	2
5/27/2017	36.4941	-122.5159	Humpback whale	5	10	7

Figure 4. Cuvier's beaked whale locations from the May 2017 Monterey, CA survey effort.

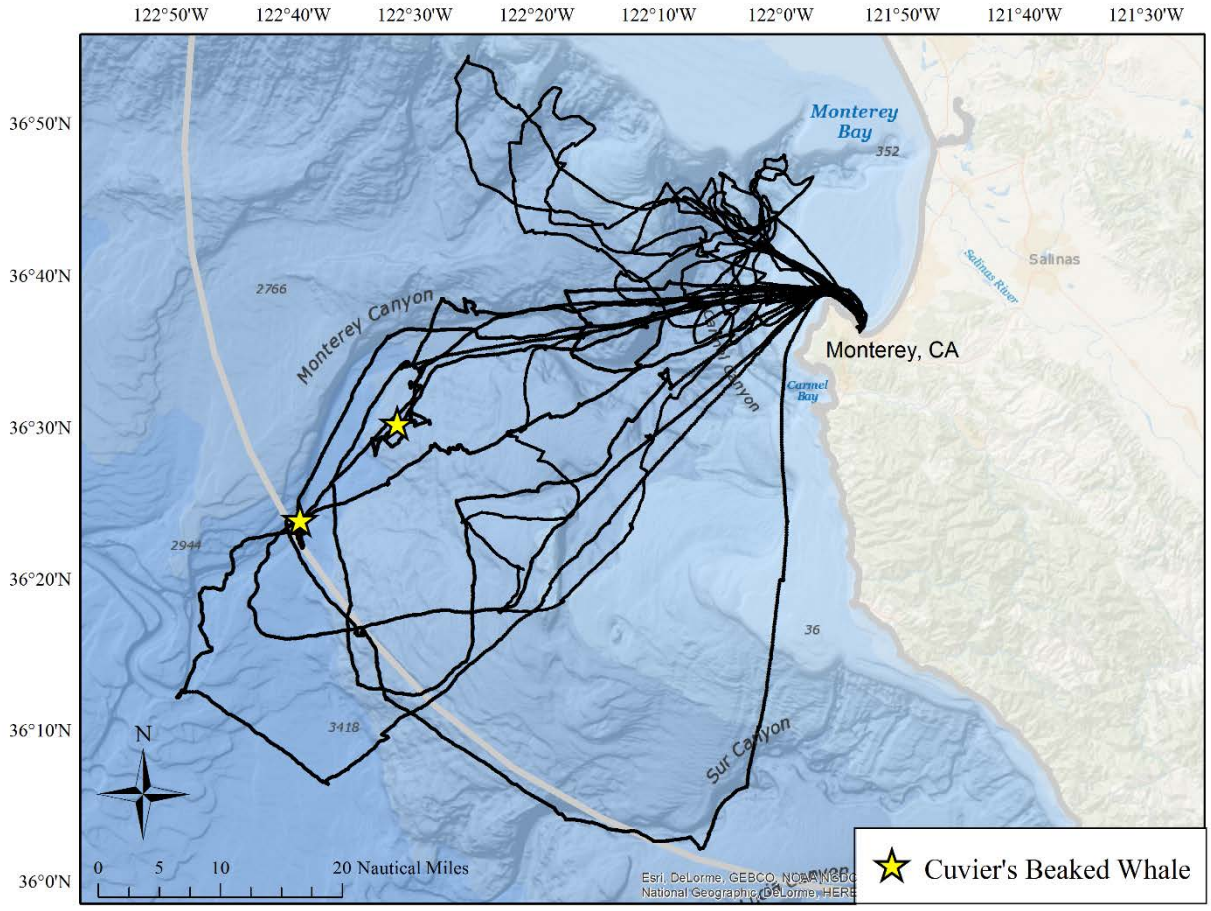


Photo-identification

Photographs were collected from eight cetacean species: blue whale, Cuvier's beaked whale, fin whale, killer whale, sperm whale, Pacific white-sided dolphins, Risso's dolphins, and short-beaked common dolphins (Table 3). These photographs will contribute to ongoing studies.

Table 3. Summary of cetaceans photographed during the 2016 and 2017 Monterey, CA field efforts.

Date	Sighting	Latitude	Longitude	Species	Est ID
10/1/2016	2	36.7135	-122.1031	Sperm whale	0
10/2/2016	4	36.7127	-122.3222	Pacific white-sided dolphin	4
10/3/2016	1	36.6181	-122.0287	Transient killer whale	2
10/3/2016	10	36.4882	-122.3598	Blue whale	1
10/3/2016	11	36.4922	-122.3725	Fin whale	2
10/3/2016	13	36.5867	-122.3204	Fin whale	2
10/3/2016	15	36.6192	-122.1806	Short-beaked common dolphin	5
10/3/2016	5	36.491	-122.1782	Blue whale	1
10/5/2016	4	36.7697	-122.0343	Risso's dolphin	35
10/7/2016	10	36.7256	-122.3151	Blue whale	1
5/21/2017	5	36.6129	-122.262	Fin whale	1
5/22/2017	1	36.626	-122.411	Fin whale	4
5/22/2017	7	36.5569	-122.162	Killer whale	1
5/23/2017	2	36.4725	-122.428	Fin whale	2
5/23/2017	3	36.4789	-122.473	Fin whale	2
5/23/2017	4	36.3976	-122.657	Cuvier’s beaked whale	1
5/23/2017	5	36.3915	-122.665	Killer whale	3
5/24/2017	2	36.208	-122.811	Sperm whale	3
5/24/2017	4	36.5667	-122.512	Fin whale	3
5/26/2017	1	36.2707	-122.579	Fin whale	1
5/27/2017	2	36.6261	-122.144	Fin whale	1
5/27/2017	3	36.612	-122.186	Fin whale	3
5/27/2017	4	36.5041	-122.524	Cuvier’s beaked whale	0

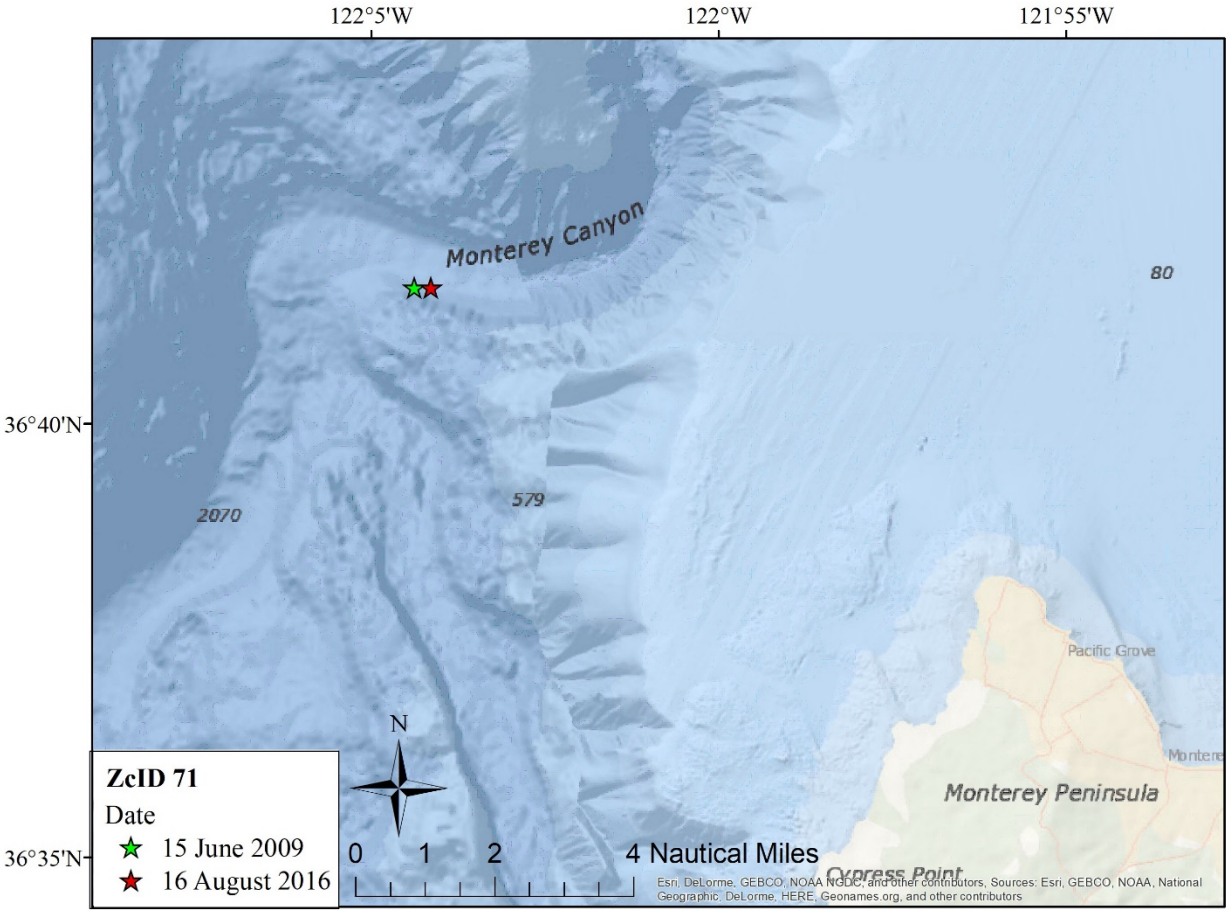
Photographs were collected of one adult male Cuvier’s beaked whale on May 23rd, 2017 field effort (Figure 4). The second encounter on May 27th, 2017 consisted of a pair. We were unable to get close enough for good quality images of these two animals; however, photographs were obtained for species confirmation. In addition to the single individual photographed during this project, we obtained contributions from local researchers and whale watch companies of six additional animals that were photographed opportunistically in Monterey Bay in 2009 (T. Jefferson) and 2016 (K. Cummings) (Table 4). The animal photographed in 2016 was matched to one of the individuals in the group of 6 photographed in 2009. The individual photographed in May 2017 is a possible match to a second animal photographed during the 2009 sighting. However, there is only a left side from the 2017 encounter and a right side from the 2009 encounter. There is not enough information within these two photographs to confirm this possible match (Table 4). There were no matches between Monterey Bay and SOAR animals. Encounter locations of Zc71, photographed in 2009 (T. Jefferson) and 2016 (K. Cummings), were plotted (Figure 5). These sightings occurred within 0.25 nautical miles of one another.

Figure 4. Adult male Cuvier's beaked whale photographed on May 23, 2017.

Table 4. Cuvier's beaked whale sightings and photo-identification results from opportunistic sources and MarEcoTel directed surveys.

Date	Sighting Source	Latitude	Longitude	Group Size	Individual ID
15-Jun-2009	Opportunistic	36.693	-122.073	6	68
15-Jun-2009	Opportunistic	36.693	-122.073	6	69
15-Jun-2009	Opportunistic	36.693	-122.073	6	70
15-Jun-2009	**Opportunistic**	**36.693**	**-122.073**	**6**	**71**
15-Jun-2009	Opportunistic	36.693	-122.073	6	73
15-Jun-2009	Opportunistic	36.693	-122.073	6	74
16-Aug-2016	**Opportunistic**	**36.693**	**-122.069**	**1**	**71**
23-May-2017	MarEcoTel	36.398	-122.657	1	*Possible match to 70
27-May-2017	MarEcoTel	36.504	-122.524	2	no ID photos

Figure 5. Sighting locations of Cuvier's beaked whale ID71; both photographs were collected during opportunistic encounters.



Genetics

During the two field efforts, eight biopsy samples were collected from three species (Table 4). These samples will contribute to ongoing studies.

Table 4. Summary of biopsy samples collected in 2017 in the Monterey Bay National Marine Sanctuary.

Date	Sighting	Species	Sample	Sample Type
10/3/2016	13	Fin whale	METR-20161003-PHY-01	Skin and Blubber
10/5/2016	4	Risso's dolphin	METR-20161005-PHY-01	Skin and Blubber
10/5/2016	4	Risso's dolphin	METR-20161005-PHY-02	Connective Tissue Only
22-May-17	1	Fin whale	METR-20170522-PHY-01	Skin and Blubber
23-May-17	3	Fin whale	METR-20170523-PHY-01	Sloughed Skin
24-May-17	2	Sperm whale	METR-20170524-PHY-01	Skin Only Biopsy
26-May-17	1	Fin whale	METR-20170526-PHY-01	Skin Only Biopsy
27-May-17	2	Fin whale	METR-20170527-PHY-01	Skin Only Biopsy

Satellite telemetry

Three satellite tags were deployed during this effort on two fin whales (BpTag076, BpTag079) and one sperm whale (PmTag027). Transmission durations ranged from 8-11 days (Table 5).

BpTag076, tagged on October 3rd, 2016, was tracked for 8 days. During that time, it remained within close proximity to the deployment location with a maximum distance of just under 13 nmi (24 km) (Figure 6). BpTag079, tagged on May 23rd, 2017, was tracked for 11 days. For the first four days, BpTag079 did not range far from the deployment location (Figure 7); maximum distance was 18 nmi (33 km). This animal was again encountered on May 24th, 2017 within one nautical mile from the deployment location. For the remainder of transmissions, BpTag079 traveled south. The last transmission occurred 330 nmi (611 km) south of the deployment location and 100 nmi (185 km) southwest of the SOAR range off San Clemente Island.

PmTag027 was tagged in a group of four sub-adults located in the offshore waters of the Monterey Canyon on May 24th, 2017 (Figure 6). PmTag027 headed south to the Davidson Seamount, returned to within 5 nmi (9 km) of the deployment location and then headed offshore; maximum distance from the deployment location was 57 nmi (106 km) to the southwest. Average dive depth was 1,722 ft (525 m) with an average dive duration of 32 min. Average surface time was 12 min.

Table 5. Details on satellite tags deployed during the Monterey Bay efforts in 2016 and 2017 (Note, the fin whale tags were provided by other funding sources).

Species	Tag Type	Tag ID	Date Deployed	# Transmission Days
Fin whale	SPOT-5	BpTag076	3-Oct-2016	8
Fin whale	SPOT-5	BpTag079	23-May-2017	11
Sperm whale	Mk10-a	PmTag027	24-May-2017	10

Figure 6. Filtered tracklines of one satellite tagged fin whale (blue; tagged in October 2016) and sperm whale (red; tagged in May 2017).

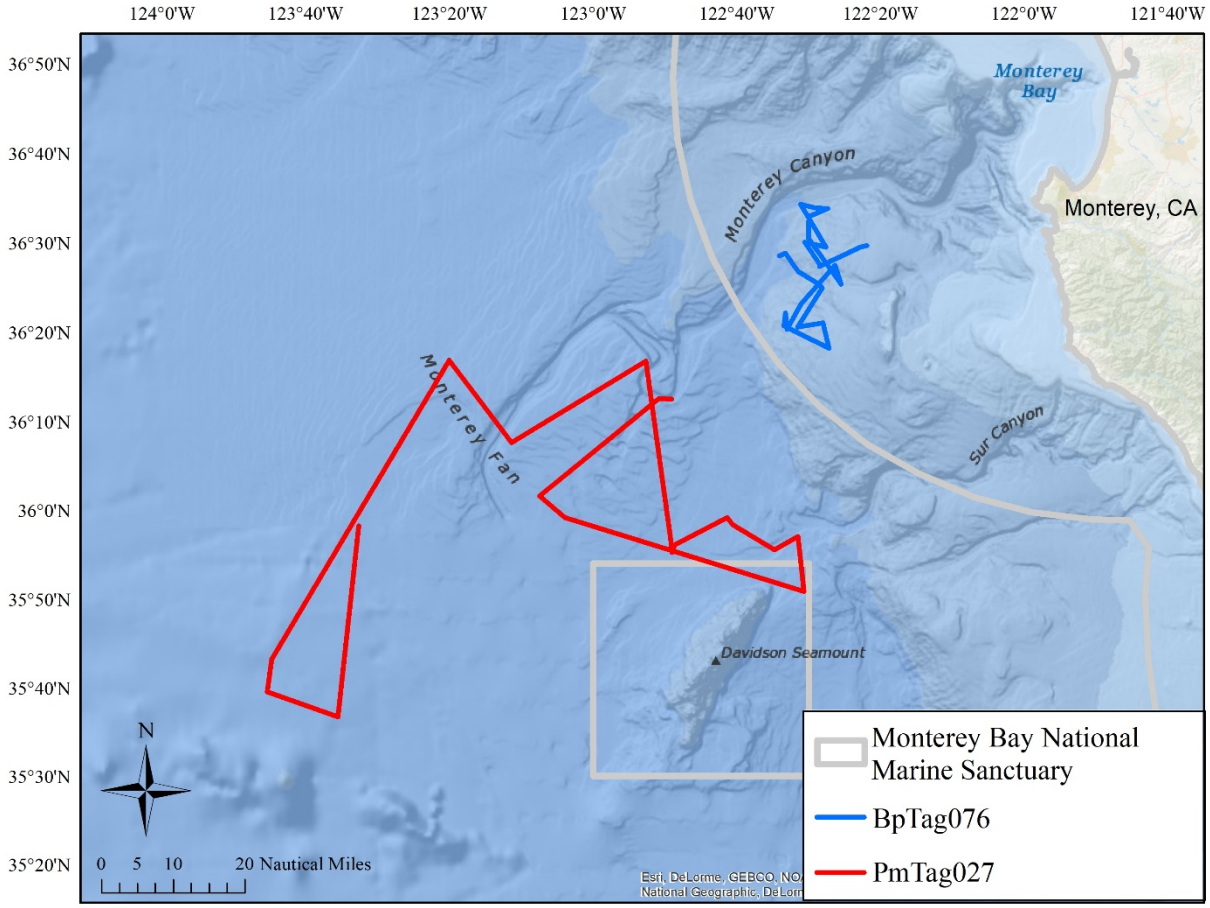
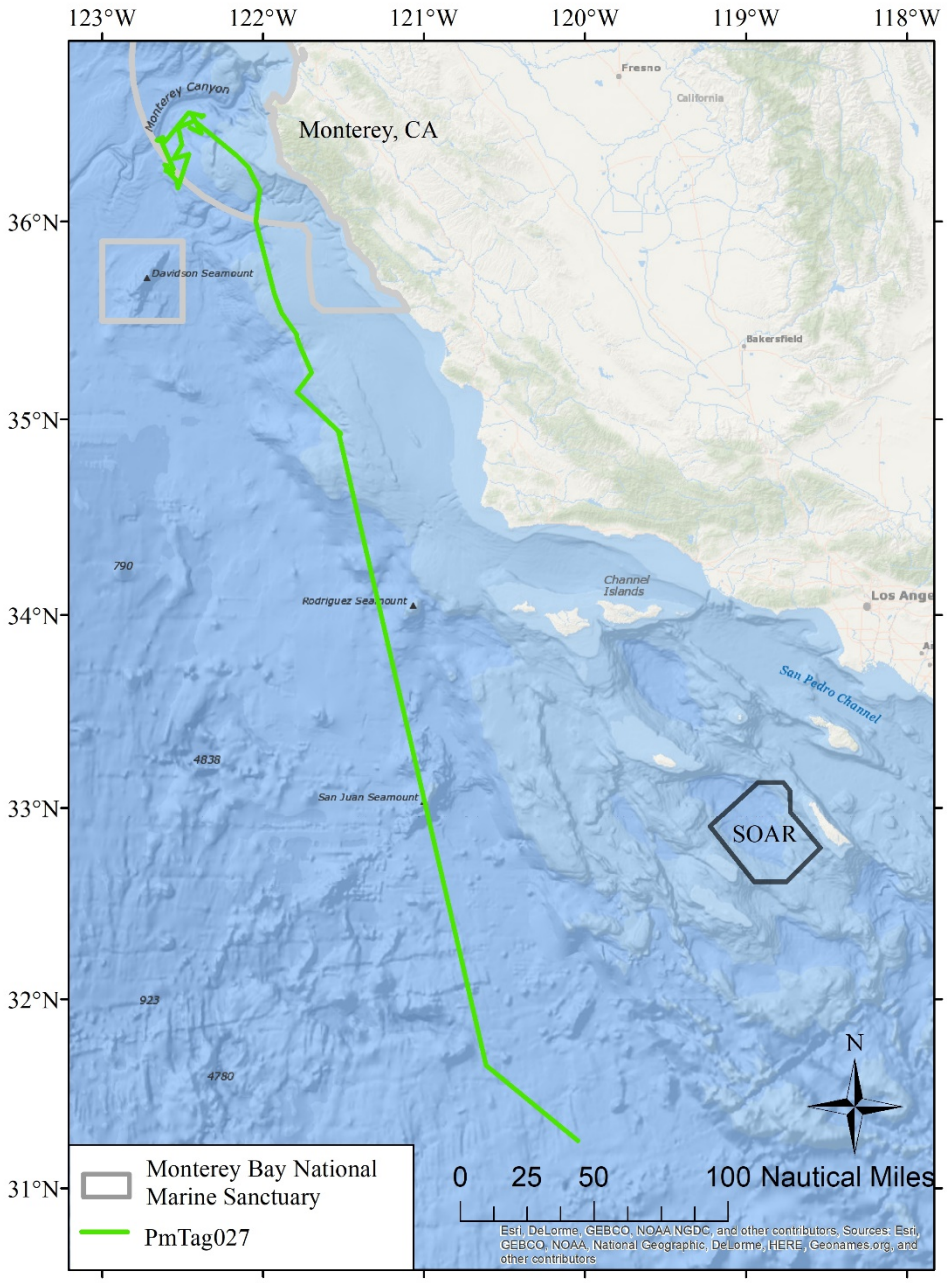


Figure 7. Filtered tracklines of one satellite tagged fin whale (tagged in May 2017).



CONCLUSION

Given the limited sightings of Cuvier's beaked whales during our two field efforts and a resighting of an individual with a seven-year timespan that occurred in the same general location (0.25 nmi apart), this may be a small population with some degree of residency.

Based on our findings from two field efforts, we don't believe this is a suitable location for a comparative population study. This is based on the following factors: 1) low density of animals, 2) location of sightings, and 3) weather conditions. In 2016, effort was mainly focused within the inshore waters of the Monterey Canyon because of the recent sighting that had occurred in August 2016, and the 2009 sighting of six individuals. Additionally, weather conditions limited search effort in offshore waters. It appeared to be a promising study site based on the historic sightings and the ease of accessibility to the study area (~10 nmi (19 km) from the boat ramp in Monterey). However, our efforts required searching great distances within the offshore waters in order to locate animals. It is possible that densities may be higher in the offshore canyons, however, additional effort is needed to make this determination. Decent beaked whale weather (Beaufort 0-2) within this study area was limited (presented in the June 2017 report) and we have concluded that this region is a challenging study site for this objective alone.

RECOMMENDATIONS

If work were to continue in this region, we have the following recommendations. Given the probable low densities, an acoustic component would be helpful in identifying beaked whale activity at the start of field effort. This could be conducted using a drifting acoustic buoy recorder (i.e., DASBR) that can be easily deployed and retrieved from our research vessel and will help narrow the area that we should focus search effort. We suggest dedicating a month window for field effort. We would stage in Monterey for the month and be ready to conduct field effort during good weather conditions until the budgeted field days were fulfilled. Based on the small weather windows, we think this would be the best approach to maximize the good weather days and in turn give us the best chance in locating beaked whales.

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