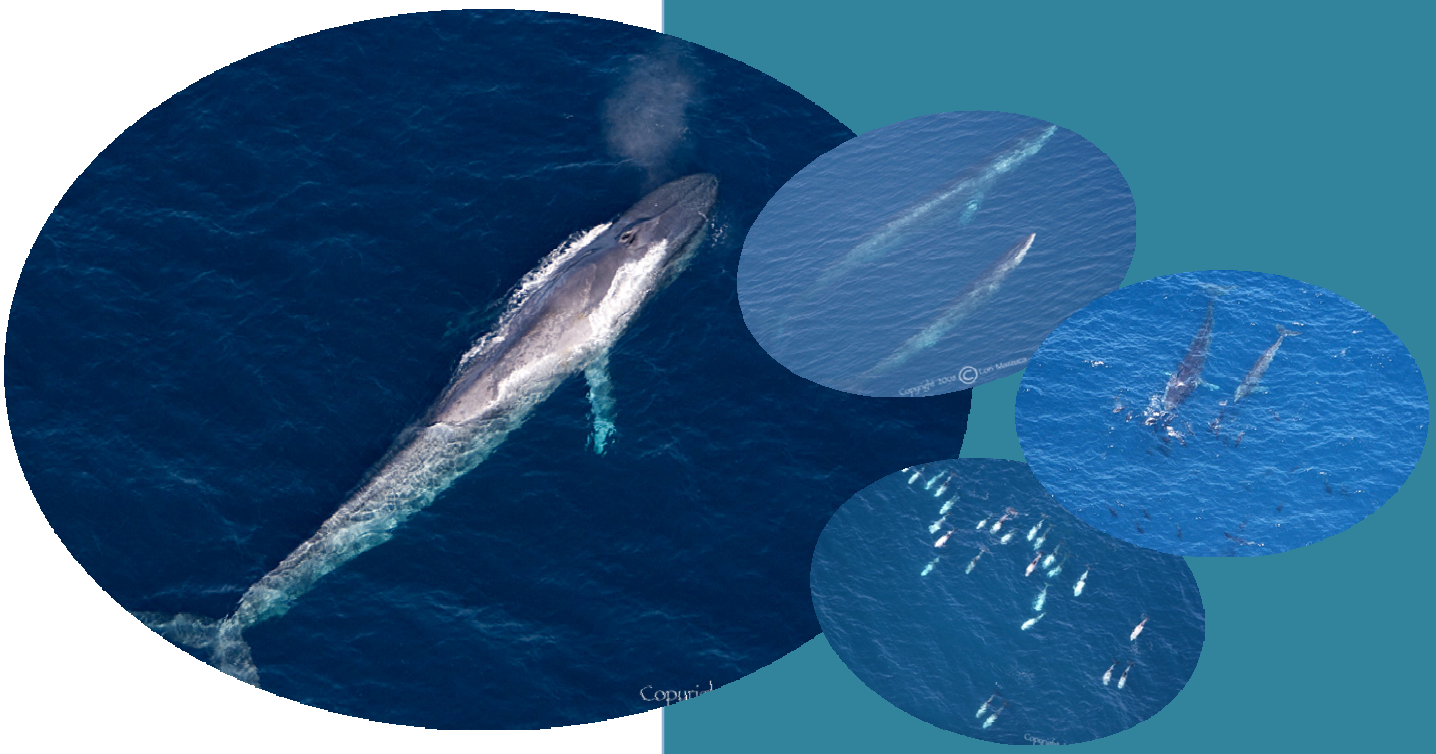
Aerial Survey Monitoring for Marine Mammals off Southern California in Conjunction with US Navy Major Training Events

June 5-11 and July 20-29, 2009 - *Final Field Report*



Submitted to
NAVFAC Pacific EV2 Environmental Planning
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Citation for this report is as follows:

Smultea, M.A., J.R. Mobley, Jr., and K. Lomac-MacNair. 2009. Aerial Survey Monitoring for Marine Mammals off Southern California in Conjunction with US Navy Major Training Events, June 5-11 and July 20-29, 2009 - Final Field Report. Submitted to Naval Facilities Engineering Command Pacific, EV2 Environmental Planning, Pearl Harbor, HI. Submitted by Marine Mammal Research Consultants, Honolulu, HI, and Smultea Environmental Sciences, LLC., Issaquah, WA, under Contract No. 28H-1087365 issued by California Institute of Technology (CalTech) via Scripps Institution of Oceanography of the University of California, San Diego.

Cover Photo: Blue whale (*Balaenoptera musculus*), fin whale mother & calf (*B. physalus),* fin whale with Northern right whale dolphins (*Lissodelphis borealis*), & Risso's dolphins (*Grampus griseus*) photographed with a telephoto lens from the aircraft during the SOCAL June 09 aerial monitoring survey. Photos courtesy of Lori Mazzuca and Mark Deakos.

Table of Contents

List of Tables

List of Figures

.

Section 1 Introduction

In support of the U.S. Navy's (Navy) Marine Mammal Monitoring Plan (M3P) in the Southern California Range Complex (SOCAL) (DoN 2009), aerial surveys were conducted by Marine Mammal Research Consultants (MMRC) and Smultea Environmental Sciences (SES) to monitor marine mammals and sea turtles (MM/ST) during June and July 2009 in the SOCAL area. Monitoring occurred in conjunction with several Navy Major Training Events (MTEs) involving mid-frequency-active sonar (MFAS). Portions of these MTEs took place in the offshore waters near San Clemente Island (SCI) off San Diego, California. Naval training has been conducted within SOCAL for over 40 years, and marine mammals are also known to be abundant there (e.g., summarized in Carretta et al. 2000, 2008; DoN 2008, 2009). As part of SOCAL, the Navy operates the Southern California Anti-submarine Warfare Range (SOAR) W of San Clemente Island (Figure 1).

The contracted work involved considerable pre-survey planning via email and telephone with the Navy Technical Representative (NTR) given the logistical complexity of the MTEs. In particular, coordinating multiple Navy activities on the SOCAL range was logistically challenging and time-consuming for Navy personnel given the high degree of safety planning. Protocol was similar to that implemented for aerial surveys in SOCAL in Fall 2009 (see Smultea et al. 2009)

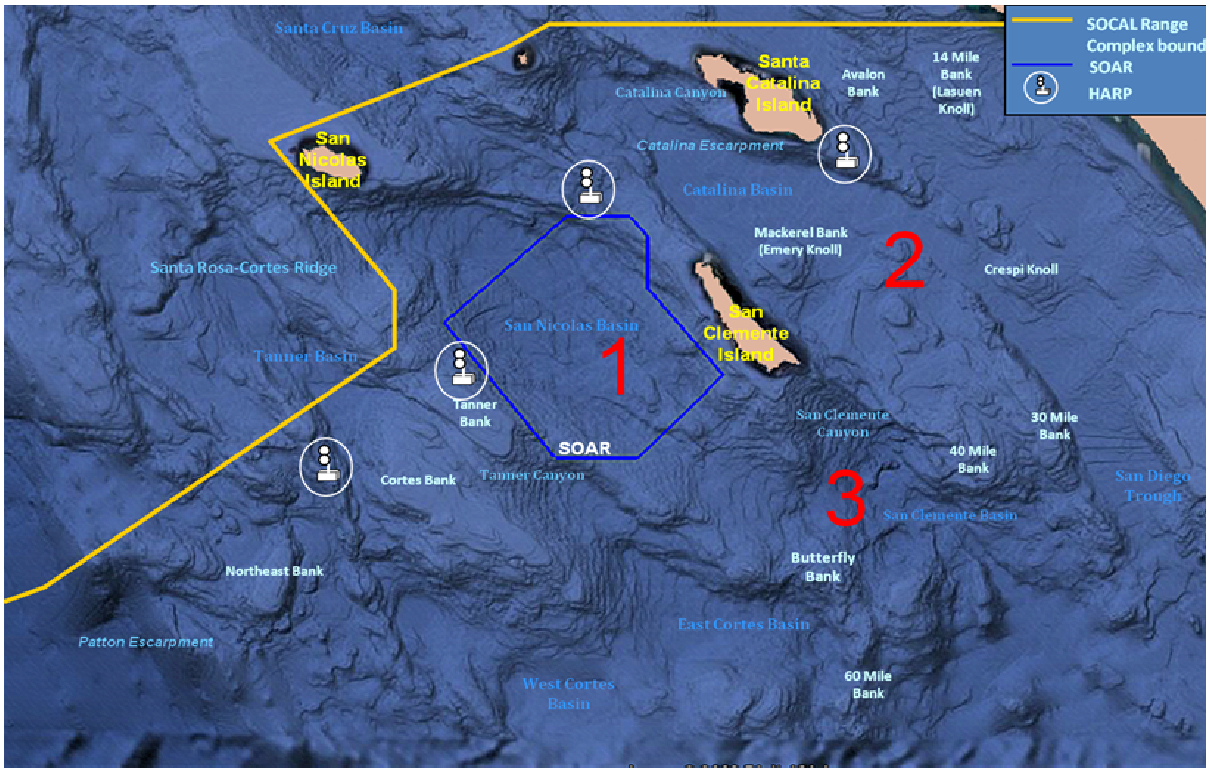

Figure 1. Location of the aerial survey monitoring area and underwater topographic features within the Navy's Southern California Range Complex (SOCAL). Numbers indicate survey areas of interest to the Navy in order of priority; orange line designates the SOCAL boundary; blue lines designate the Southern California Offshore Anti-submarine Warfare Range (SOAR); icons are approximate locations of Navy-funded bottom-mounted passive- acoustic high-frequency acoustic recording packages (HARPs).

Project Planning

Meetings and communications with Navy personnel identified the actual survey areas, periods, and communications protocols to be used. This was required to coordinate logistics and ensure safety and open communication between the Navy and the aerial monitoring team during the surveys given the complexity of multiple naval aircraft and vessel operations involved with the MTEs and other missions. Clearance from various Navy commands was obtained by Navy environmental planners on behalf of MMRC/SES prior to the research aircraft flying in the SOCAL. In addition, pre-planning sessions with the NTR and other Navy staff and local researchers, including at Scripps Institution of Oceanography (SIO), La Jolla, California were conducted. These communications were needed to coordinate survey efforts with others conducting marine mammal research in the same region and period including the Naval Undersea Warfare Center (NUWC), SIO and Cascadia Research Collective (CRC). Other ongoing studies involved passive acoustics, tagging, photo-identification, and behavioral studies from small and large vessels (including the R/V *Sproul* and a CRC vessel), some of which were funded by the Office of Naval Research (ONR) and N45 funds (e.g., Falcone et al. 2009a,b). Communications identified ways the various research groups and platforms could collaborate and assist one another in obtaining complimentary data and thus maximizing the utility of simultaneously operating studies. Of particular focus was conducting simultaneous aerial and vessel (*Sproul*, SIO) line transect surveys while NUWC and SIO researchers conducted passive acoustic monitoring studies and CRC conducted tagging and photo-identification studies on July 25-26, west of SCI.

For the July 2009 aerial survey M. Smultea and J. Mobley (co-Principal Investigators for the SOCAL aerials) were officially added (through coordination with the Office of Protected Resources and Southwest Fisheries Science Center [SWFSC]) for the period of the survey to an existing Federal Permit issued to National Marine Fisheries Service (NMFS)/SWFSC to fly aerial surveys and obtain photographs at altitudes ≥500 ft.

Project Questions and Hypotheses

Project questions and hypotheses were developed by SES/MMRC based on the five questions identified in the Navy's SOCAL M3P designed to assess potential effects of MFAS and underwater detonations on MM/ST during Navy MTEs (DoN 2009; see Smultea et al. 2009). See the 2008 SOCAL aerial survey report (Smultea et al. 2009) for more related information.

An important factor limiting the ability to assess potential effects of MFAS in this report is that the Navy did not disclose MFAS transmission times and locations for national security reasons. Thus, it is not possible for us herein to compare data from specific operational MFAS "on" and "off" periods during MTEs, nor data on distance and relative location of MFAS sources *vs.* sightings.

Approach

The approach implemented to address SOCAL M3P requirements was to conduct fixed-wing aircraft-based surveys to monitor the occurrence and behavior of MM/ST in the SOCAL relative to MFAS transmission periods. The primary survey areas were SOAR W of SCI and the NAOPA range between SCI and the mainland coast (Figure 1). The study approach involved implementing search, verify, and focal follow modes as described in Smultea et al. (2009). Two sets of surveys were conducted: one in June and one in July 2009. Notably, sea turtles were considered unlikely to be seen in the MTE based on available data (reviewed in DoN 2008). See Smultea et al. (2009) for a detailed list of primary monitoring goals of the aerial surveys.

As described in Smultea et al. (2009), priority species were (1) MM/ST exhibiting unusual or distressed behavior, (2) near-stranded, stranded, or dead MM/ST, (3) MM/ST species listed as endangered or threatened under the ESA, (4) beaked whales, and (5) Risso's dolphins, dwarf/pygmy sperm whales (*Kogia* sp.), and other deep-diving odontocetes considered potential "surrogate" representatives for deep-diving beaked whales (see DoN 2009).

Section 2 Methods

Methods implemented during this study generally followed those described in the report for the fall 2008 aerial monitoring surveys conducted in SOCAL off San Diego, see Smultea et al. (2009). Survey tracks for the June and July events are shown in Figures 2 and 3.

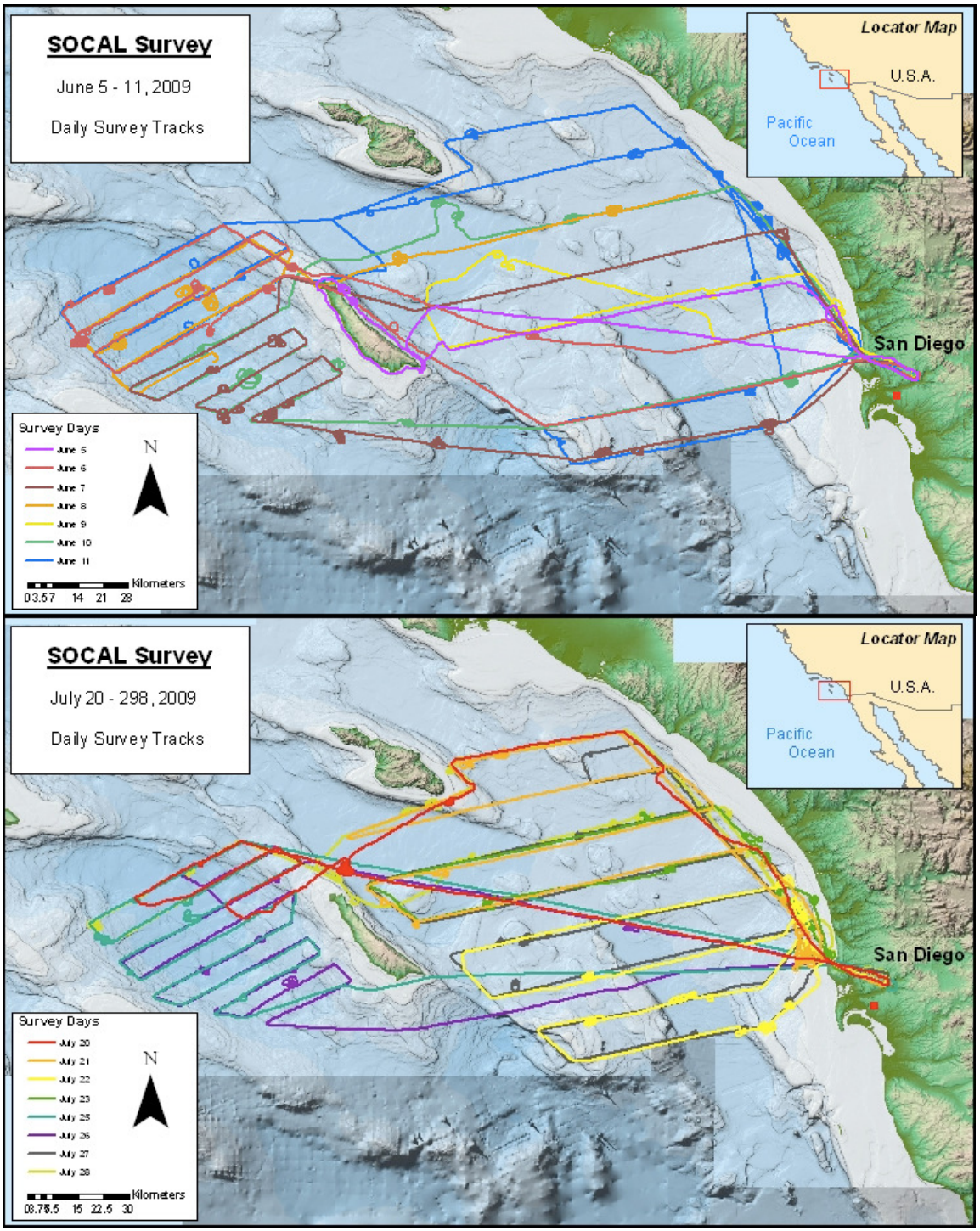

Figure 2. Aerial survey track lines and observation effort in the SOCAL during a Major Training Event (MTE) (5 – 11 June 2009 - top panel), and after the MTE (20-29 July 2009 - bottom panel).

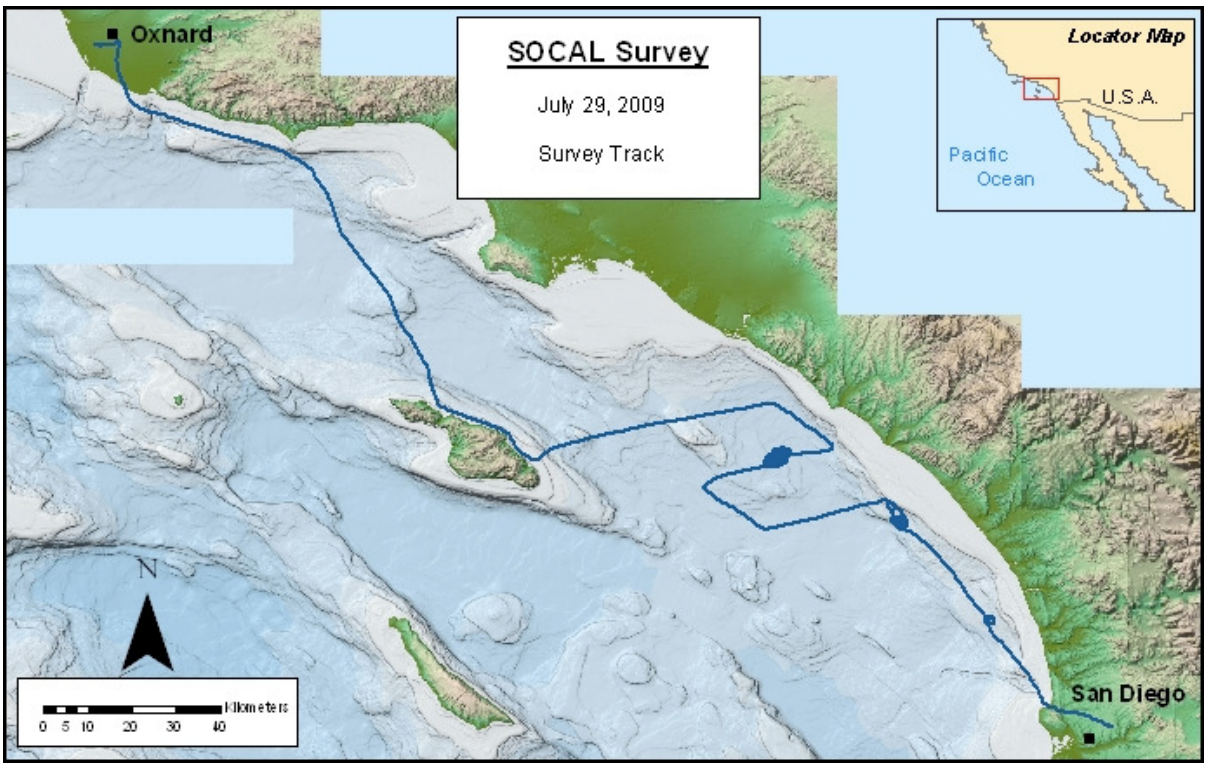

Figure 3. Aerial survey track line during the last day (July 29) of the July 2009 SOCAL aerial survey en route to return the observation aircraft to Oxnard, California.

Section 3 Results

This section closely follows the format of the Fall 2008 SOCAL aerial survey monitoring report (Smultea et al. 2009). Results are summarized in Tables 1-4, Figures 2-13, and Appendices A and B. Some unconfirmed species in this report may be confirmed after photographs are reviewed by species experts, which had not been completed at the time of this report.

Effort

A total of 63.8 hr of flight hours and ~13,769 km of flight time were conducted during the June and July SOCAL aerial survey between aircraft "wheels up" off the ground to "wheels down" when the plane landed (Tables 1 and 2). More of this flight time occurred in July (7386 km) than June (6382 km). However, more flight days (n = 8) and hours (33.9 hr, mean 4.2 hr/day) occurred in July than June (6 days, 29.9 hr, mean 5.0 hr/day). Surveys were flown on every day except July 23 when heavy low fog persisted all day and thus surveys could not be flown safely in the project area (Table 1).

Observers were on full watch during 92% or 12,640 km of the total 13,769 km of flight time (Table 2). Observations for marine mammals did not occur during the remaining 8% (1129 km) of total flight time due to poor weather (e.g., heavy fog and/or low clouds) that partially or fully obscured the observers' views or while transiting over land (Table 2). Overall, most (44%) of the total 12,640 km of observation effort in June and July consisted of circling sightings for focal follows and/or species identification; this was followed by systematic line-transect (29%), transit (20%), and random effort (7%) (Table 2). The proportion of systematic observation effort was 29% for June and 28% for July (Table 2). Random effort consisted primarily of transits to and from systematic survey lines but also in June included two circumnavigations of SCI totaling 76 km searching for potential stranded animals (Figure 2 and Table 2).

Overall, Bf ranged from 1-6 during both June and July, and Bf 3 predominated (43%) during both months (Figure 4). Bf was 0-3 during most of June (64%) and July (72%).

During both June and July, effort was fairly equally divided between the SOAR grid west of SCI and the NAOPA survey grid E of SCI (Figure 2).

Sightings

A total of 401 sightings of ~32,208 individual marine mammals was seen: 161 groups and ~9489 individuals during June and 240 groups and ~22,719 individuals during July based on periods with observation effort in June (6140 km) and July (6500 km)(Table 2). Of the total 401 sightings, 72% were identified to species (n = 224) or genus (n = 65) (Appendices A and B). At least 14 different species were verified including 11 species in June and 10 during July (most of which were the same species across months) (Table 3). This included at least five baleen whales (blue, fin, Bryde's or sei, humpback and minke whales), Cuvier's beaked whale, six dolphin species (bottlenose, short- and long-beaked common, Pacific white-sided, Risso's, and Northern right whale dolphin), and two pinniped species (California sea lion and harbor seal)(Table 3). Unidentified sightings usually occurred when there was no time to circle.

Overall, the Risso's dolphin was the most frequently identified species group (23% or 93 of 401 total groups) followed by common dolphins of the genus Delphinus (16% or 63 groups) (Table 3). In terms of number of individuals seen, the common dolphin was the most abundant (n = ~16,772 or 52% of the total 32,208 individuals seen). This was true for both June and July, though more individual common dolphins were seen in July (n = 12,020) vs. June (n = 4572) (Table 4). Numbers of blue whales were higher during July than June (Figure 10) while the opposite was true for fin whale numbers (Figure 11 and Table 3). California sea lions (n = 49 groups of 102 individuals) were the most commonly identified pinniped species (77% of 64 pinniped groups, including unidentified pinnipeds). The one sighting of ~4

Cuvier's beaked whales, a lone minke whale, and a Bryde's/fin/ or sei whale were seen in July (Table 3). Species identification of the minke whale was confirmed by the CRC vessel.

Only two mixed-species sightings were made: a mother-calf fin whale with a large group of Northern right whale dolphins in June (see photo on report cover page), and in July a group of short-beaked common dolphins with California sea lions (Appendices A and B).

Estimated mean group sizes were highest for common dolphins in both June and July, with a somewhat higher mean during June vs. July (297 vs. 256 individuals/group, respectively) (Figure 9). Mean group sizes for other delphinid species (n = 168 groups) were considerably smaller. For example, overall mean group size for 93 Risso's dolphin sightings was 15.9 individuals/group (Figure 9). Whales had the smallest observed group sizes (mean group size for all whales except Cuvier's = 1.3 whales/group, n = 106 groups).

Two dead, floating unidentified sea lions (probable California sea lions) were seen separately on July 25. The first was seen at 14:46 approximately 70 km W of SCI; the second was seen at 17:23 approximately 40 km W of San Diego (Figure 7). Photographs were taken of both sightings. Both carcasses were bloated. See Appendix B for further detail on these pinniped locations.

Distribution

In both June and July 2009 line-transect surveys were conducted only E and W of SCI and effort was similarly distributed in both months (see Figure 2). Transect lines E of SCI in NAOPA were the same as those followed in Oct and Nov 2008 (see Smultea et al. 2009). Survey lines W of SCI in SOAR in June-July 2009 were in the same area as Oct-Nov 2008, but were spaced slightly farther apart during June-July (~7 km apart) vs. Oct-Nov (~5 km apart). Lines were farther apart in SOAR during June-July to maximize coverage of the Navy-identified survey area within the ~5-hr limit of the aircraft's fuel tank.

In both June and July 2009 blues whales were seen primarily along the edge of the coastal continental, shelf drop-off and the continental slope off San Diego and Los Angeles (Figure 5). In June, fin whale sightings were limited largely to the NW quarter of the survey area in SOAR W of SCI along the NE edge of Tanner Bank (Figures 1 and 5). Fins, unlike blue whales, did not appear to be strongly associated with steep bathymetric relief. Rather, fin whales were most commonly sighted across the San Nicolas Basin/SOAR between SCI and Tanner Bank, primarily in June (Figure 5). In contrast, during July, fin whale sightings were more spread-out across the study area.

On July 25, a group of ~4 Cuvier's beaked whales was seen in San Nicolas Basin/SOAR in the vicinity of the CRC small tagging vessel (Figures 1 and 5). In that same area and time period, several other species were documented by the aircraft and CRC observers (see Unusual Observations below and Figure 5).

In June, the distribution of Risso's and common dolphins appeared to be segregated. Risso's were seen predominantly in offshore waters along and west of 30- and 40-Mile Banks and over 50 km W of San Diego (Figure 6). In particular, Risso's sightings were concentrated along the steep eastern edge of SCI. In contrast, in June, common dolphins were seen mostly along the coast within ~35 km of the shoreline. However, in July, both Risso's and common dolphins were most frequently seen concentrated along the continental slope, with very few sightings made W of SCI in SOAR.

In June, pinnipeds (comprised primarily of California sea lions) were seen nearly exclusively along the coast of SCI during the two circumnavigations of that coastline (Figure 7). In contrast, in July, many more such sightings were made at sea spread-out across the survey area.

Behavior

Four species or genus had sample sizes considered large enough ($n \geq 10$) to warrant summarizing initially observed behavior state, heading, and estimated mean dispersal distance between individuals: blue whales (n = 29), fin whales (n = 29), common dolphins (n > 70), and Risso's dolphins (n = 85)(Figures 10-13).

In both June and July blue and fin whales were nearly always initially observed traveling (Figures 10 and 11). In both months, blue whales were first seen headed a variety of directions with slight trends for some animals to head mostly SSW/NNE magnetic (Figure 10). Fin whales exhibited a more distinct directional trend, heading predominantly to the WSW magnetic (Figure 11).

Common dolphins were surface active and/or traveling when first seen in both June and July (Figure 12). In contrast, Risso's dolphins were rarely seen engaged in surface-active behaviors; rather, they predominantly traveled and also exhibited rest and milling more frequently than common dolphins (Figure 13). The most frequently observed heading among common dolphins was to the WSW (Figure 12). Inter-individual spacing (i.e., dispersal) for both common and Risso's dolphins was usually ≤3 body lengths, though spacing was sometimes as much as 12-15 body lengths (Figures 12 and 13).

Focal Follows

Approximately 76 (19%) of the 401 sightings were circled for at least 5 min by the aircraft to photo-verify species and make group-size estimates as needed/feasible. Fifteen of these sightings were circled for at least 10 min and up to 48 min to conduct "extended focal follows" (defined in Smultea et al. 2009)(Table 4). For extended follows, altitude was increased to 1200-1500 ft and radial distance maintained as possible at 0.5-1.0 km. The total 15 extended focal follows most frequently involved fin whales (n = 5) or common dolphins (n = 4).

Detailed analyses of focal follow behavioral data (e.g., re-orientation and respiration rates, dive times, etc.) were not conducted given the inability to know MFAS transmission times, the small sample sizes, budget limitations, and goals of the SOW. Future detailed analyses of this kind may be undertaken in the future and combined with results herein to provide a larger sample size.

Unusual Observations

Our observations based on aerial survey effort are necessarily limited only to those animals we saw and most of those observations were brief in duration, restricting the ability to make a more informed assessment. We did not observe any animals or behavior that appeared distinctly "unusual" and potentially related to exposure to MFAS. We did, however, observe a few noteworthy events as follows.

- Two dead floating probable California sea lions were seen on the same date (June 25 as described above).
- On June 6, for ~48 min, we circled a fin whale mother and calf to collect behavioral data using the video and photographs. The whales appeared to closely follow a large group of ~1000 Northern right whale dolphins, and were always seen at the tail end of the dolphin group. The dolphins appeared to interact with the fin whale mother and calf by swimming between and around them, while the fin calf often rolled on its mother's back/rostrum, meandering while traveling slowly.
- On June 11, from ~10:00-10:45, we circled a lunge feeding blue whale. Our goal was to collect detailed continuous behavioral data from different aircraft altitudes and a lateral distance of ~1.0 km to systematically assess whether the aircraft might affect the whale's behavior. The blue whale continued lunge feeding throughout the observations and did not appear to be disturbed by the aircraft circling for ~5 min at ~1.0 km lateral distance at each altitude of ~2000 ft then ~1500 ft then ~1000 ft. This was the first and only lunge feeding blue whale we saw during the entire June-July survey period. The whale was located within ~20 km of the Los Angeles coastline region. Extensive behavioral data were collected using the iPhone and handwritten notes. However, analysis of these detailed behavioral data was outside the scope of the SOW.
- On July 25 from ~15:00-15:50, up to four different cetacean species were seen in the same small (~4-6 km^2) area in SOAR W of SCI. These sightings included at least 5 fin whales, 1 minke whale, ~4 Cuvier's beaked whales, and a possible Bryde's/sei or fin whale (Figure 5). We found it unusual that

such a diverse array of species would occur in such a small area. The CRC tagging vessel was in the area when we first arrived but they appeared to be following different animals than we were circling. The Cuvier's whales were seen ~2-3 km from the CRC vessel; however, this vessel later indicated that they had not seen the Cuvier's. All three of the aircraft observers saw the Cuvier's, sometimes more than once, but were unable to obtain photographs. As we departed the area we saw surface-water disturbance created by the vortex of several whale tail beats near the CRC vessel and we also saw a medium-sized animal nearby. We did not confirm species in the field, but upon return to land, a CRC vessel observer indicated that they had been following a minke whale at that time. The vessel observers had also seen fin whales, but they had not seen the Cuvier' beaked whales.

Photography/Videography

Over 3400 digital photos were taken during ~113 (28%) of the total 401 sightings (Table 4). No photos were taken during the remaining 288 sightings because the animals were too far away and/or the sighting was too brief.

A total of ~2.2 hr of video was taken during focal follows that was considered useable for behavioral analyses (Table 4). Video included footage of systematic observations of the behavior of Risso's dolphins, common dolphins, fin and blue whales, and Northern right whale dolphins.

Table 1. Aerial survey flight times and total flight hours by date and survey period during the June and July SOCAL 2009 MTE aerial surveys.

2009 Date	Wheels Up Time	Wheels Down Time	Total Hours	Comments
4-Jun				Aspen commutes plane from Oxnard to Montgomery
5-Jun	16:23	18:27	2.1	Delayed departure due to thunderstorms & 4 hot spots around SCI then had to depart SOAR before 18:00 given restricted access. Circumnavigated SCI: no strandings seen. Surveyed 1 systematic leg & 1 transit leg NAOPA.
6-Jun	12:38	16:59	4.3	Surveyed N half SOAR & 1.5 systematic line NAOPA. Navy communications required adjusting survey plans. Extended focal behavior session on fin whale mother/calf with N right whale dolphins.
7-Jun	12:42	17:27	4.7	Fuel truck arrived late to fuel plane. Surveyed S half SOAR & 2 systematic lines NAOPA. Navy communications required adjusting survey plans. Two extended focal behavior sessions on 1 humpback then 2 blue whales.
8-Jun	8:21	12:55	4.6	Surveyed N half SOAR & 2 systematic lines NAOPA. Low clouds & Navy communications required adjusting survey in some areas. Circled fin whale entangled in long ~300 ft fishing line & buoy 09:49-10:04 at N latitude 33 05.045 / W longitude 118 24.692. Informed passing Coast Guard plane about entangled whale. Departed SOAR before 12:00. Reported entangled whale to NTR upon landing at Montgomery Field.
9-Jun	8:09	9:58	1.8	Surveyed 1.5 systematic lines NAOPA then returned to airport (low ceilings persisted all day). Attempted to relocate entangled fin whale seen yesterday but Navy communications & low clouds required adjusting survey.

2009 Date	Wheels Up Time	Wheels Down Time	Total Hours	Comments
10-Jun	8:21	13:02	4.7	Surveyed S half of SOAR & 2 partial systematic lines NAOPA. Navy communications required restricted flight pattern in parts of NAOPA. Departed SOAR <12:00. Extended focal session (fin whale & Risso's dolphins).
11-Jun (#1)	8:41	13:25	4.7	Two flights today. Surveyed N half SOAR & N & S ends NAOPA. Extended focal behavior session on two groups of feeding blue whales. Navy communications required restricted flight pattern in parts of NAOPA.
11-Jun (#2)	16:00	18:57	2.9	
12-Jun				Aspen commutes plane from Montgomery Field to Oxnard (no observers onboard).
TOTAL			**29.9**	
2009 Date	**Wheels Up Time**	**Wheels Down Time**	**Total Hours**	**Comments**
20-Jul	12:17	14:57	2.7	Had to end early due to heavy marine fog layer.
21-Jul	12:29	16:47	4.3	Heavy fog near SOAR and equipment malfunction. NAOPA: spotty fog off & on, hot airspace. 1 controlled circling of Risso's dolphins at 500/1000/1500/2000 but tankers nearby. 6 blue, 1 fin, commons, Risso's, CA sea lions
22-Jul	12:56	17:34	4.1	Late start due to fog. Intermittent fog & hot spots near SCI. Focal follows on Risso's dolphins.
23-Jul	NA	NA	0	No flight due to weather, heavy marine fog layer.
24-Jul	16:14	19:09	2.9	SOAR off limits due to Navy exercise.
25-Jul	13:30	17:41	4.2	Flew SOAR; modified last line due to low fuel.
26-Jul	13:05	17:25	4.5	Completed all SOAR lines except 1&2 due to heavy clouds.
27-Jul	13:49	18:16	4.5	Completed nearly all NAOPA lines.
28-Jul	14:10	18:28	4.3	Heavy fog over SOAR prevented completion of SOAR.
29-Jul	13:21	15:45	2.4	Completed 3 N. NAOPA lines then transited to Oxnard (Aspen) with observers on watch.
TOTAL			**33.9**	**33 of 33.9 hr within the SOCAL survey area.**

Table 2. Summary of aerial survey effort (km) by survey period, effort type, and Beaufort sea state during the June and July SOCAL 2009 aerial surveys.

Effort Type (# km)	June	July	Total
Systematic	1737	1865	3602
Random	369	474	844
Transiting	1451	1060	2511
Circling	2507	3101	5608
Circumnavigating coast of San Clemente Island	76	0	76
Opportunistic effort during fog	0 (no fog)	520	520
Over land	225	202	427
Off effort (not observing due to poor weather obscuring visibility)	17	164	181
Total km flown	**6382**	**7386**	**13,769**
Total km effort with observers on full watch	**(6140)**	**(6500)**	**(12,640)**
Beaufort Sea State			
1	347	508	855
2	713	1866	2578
3	2750	3082	5832
4	1689	1175	2864
5	619	516	1135
6	22	11	33
N/A (not recorded/applicable)	242	229	471
Total km flown	**6382**	**7386**	**13,769**

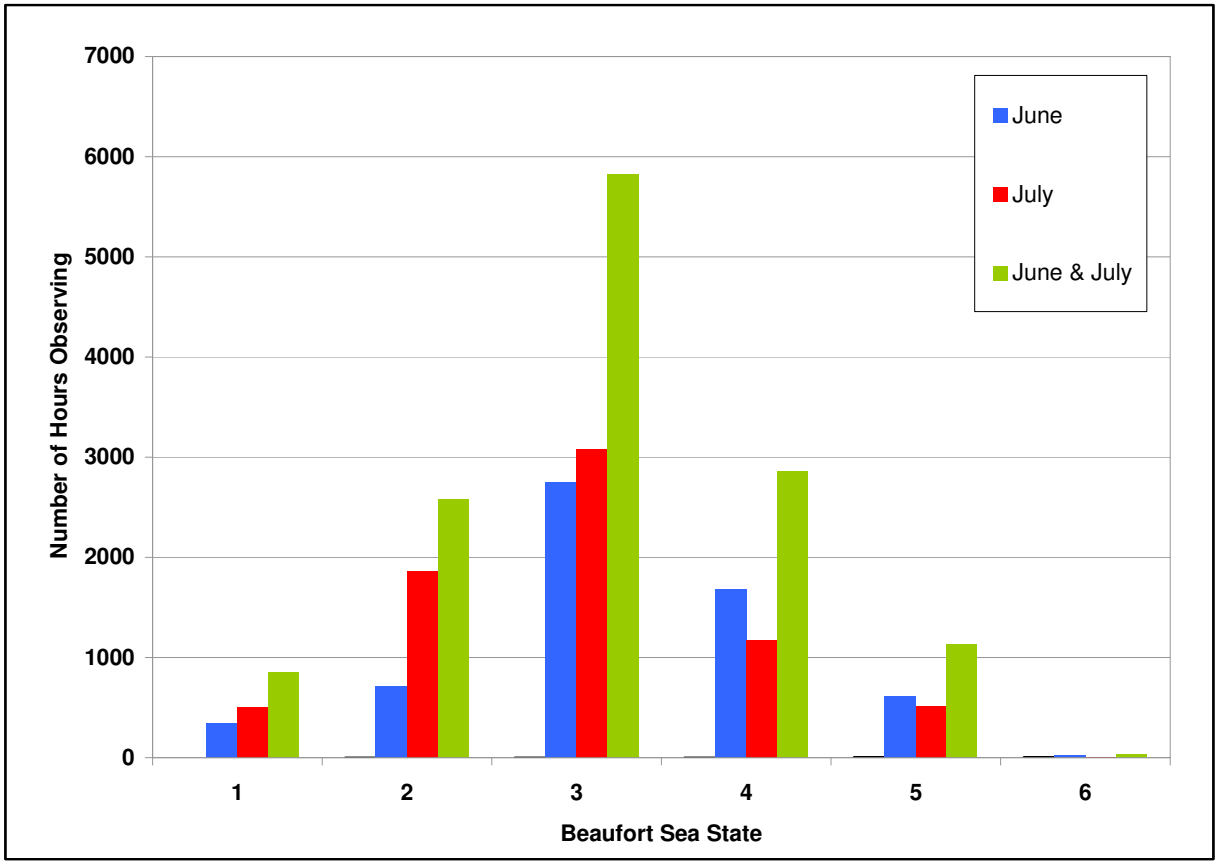

Figure 4. Beaufort sea state during aerial survey monitoring effort (km) during the June and July SOCAL 2009 aerial surveys.

Table 3. Summary of marine mammal sightings by species and survey month during the SOCAL 2009 aerial surveys.

Species Identification	Scientific Name	JUNE			JULY			JUNE & JULY		
		Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size	Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size	Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size
Blue Whale	*Balaenoptera musculus*	9	11	1.2	20	26	1.3	29	37	1.3
Fin Whale	*B. physalus*	23	34	1.5	6	7	1.2	29	41	1.4
Probable Fin Whale	*B. physalus*	1	2	2.0	0	0	0	1	2	2.0
Fin or Sei Whale	*B. physalus or B. borealis*	0	0	0	1	4	4	1	4	4.0
Fin, Sei or Bryde's Whale	*B. physalus, B. borealis, or B. edenii*	0	0	0	1	1	1	1	1	1.0
Minke Whale	*B. acutorostrata*	0	0	0	1	1	1	1	1	1.0
Humpback Whale	*Megaptera novaeangliae*	2	2	1.0	0	0	0	2	2	1.0
Unidentified Baleen Whale	Balaenopteridae sp.	13	14	1.1	3	3	1	16	17	1.1
Unidentified Medium-sized Whale	Cetacea	0	0	0	1	1	1.0	1	1	1.0
Cuvier's	*Ziphius cavirostris*	0	0	0	1	4	4.0	1	4	4.0

Table 3. Summary of marine mammal sightings by species and survey month during the SOCAL 2009 aerial surveys. (cont'd)

Species Identification	Scientific Name	JUNE			JULY			JUNE & JULY		
		Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size	Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size	Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size
Beaked Whale										
Bottlenose Dolphin	*Tursiops truncatus*	1	11	11.0	1	15	15	2	26	13.0
Common Dolphin sp.	*Delphinus sp.*	16	4752	297.0	47	12,020	255.7	63	16,772	266.2
Long-beaked Common Dolphin	*D. capensis*	1	400	400.0	5	1057	211.4	6	1457	242.8
Short-beaked Common Dolphin	*D. delphis*	0	0	0	5	1355	271	5	1355	271.0
Short-Beaked Common Dolphin & California Sea Lion	*D. delphis* & *Zalophus californianus*	0	0	0	1	230	230	1	230	230.0
Unidentified Dolphin: Common Dolphin sp. or Bottlenose Dolphin	Delphinidae sp.	0	0	0	1	9	9	1	9	9.0
Probable	*Delphinus* sp.	3	475	158.3	3	1260	420	6	1735	289.2

Table 3. Summary of marine mammal sightings by species and survey month during the SOCAL 2009 aerial surveys. (cont'd)

Species Identification	Scientific Name	JUNE			JULY			JUNE & JULY		
		Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size	Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size	Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size
Common Dolphin sp.										
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	0	0	0	1	35	35	1	35	35.0
Risso's Dolphin	*Grampus griseus*	40	701	17.5	53	779	14.7	93	1480	15.9
Unidentified dolphin: possible Risso's Dolphin	Delphinidae sp.	0	0	0	1	300	300	1	300	300.0
Unidentified Dolphin	Delphinidae sp.	16	1503	93.9	51	5554	108.9	67	7057	105.3
Northern Right Whale Dolphin	*Lissodelphis borealis*	3	1500	500.0	0	0	0	3	1500	500.0
California Sea Lion	*Zalophus californianus*	23	69	3.0	26	33	1.3	49	102	2.1
Harbor Seal	*Phoca vitulina*	1	1	1.0	1	1	1	2	2	1.0
Unidentified Sea Lion	Pinnipedia	0	0	0	1	1	1	1	1	1.0
Unidentified Pinniped: Probable CA	Pinnipedia	0	0	0	1	1	1	1	1	1.0

Table 3. Summary of marine mammal sightings by species and survey month during the SOCAL 2009 aerial surveys. (cont'd)

Species Identification	Scientific Name	JUNE			JULY			JUNE & JULY		
		Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size	Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size	Total No. of Sightings	Total Estimated No. Individuals Observed	Mean Group Size
Sea Lion										
Unknown Pinniped	Pinnipedia	6	9	1.5	3	6	2	9	15	1.7
Dead Pinniped	Pinnipedia	0	0	0	2	2	1.0	2	2	1.0
Unidentified Marine Mammal	Cetacea or Pinnipedia	1	3	3.0	1	1	1.0	2	4	2.0
Unidentified Small Marine Mammal	Cetacea or Pinnipedia	1	1	1.0	2	13	6.5	3	14	5.0
Unidentified Whale	Cetacea	1	1	1.0	0	0	0	1	1	1.0
TOTAL		**161**	**9489**	**58.9**	**240**	**22,719**	**94.6**	**401**	**32,208**	**80.3**

Table 4. Summary of survey results for the October and November 2008 and June and July 2009 aerial surveys for marine mammals in the SOCAL off San Diego, California.

Parameter	Oct-08	Nov-08	Jun-09	Jul-09	Total
Survey Dates	17-21 Oct	15-18 Nov	5-11 June	20-29 July	**Oct-Nov, June-July**
No. Days Flown	5	4	6	9	**24**
Major Training Exercise (MTE) Period?	Yes	No	Yes	No	**Yes & No**
Total Flight Hours (Wheels Up/Down)	27.5	21.4	29.9	33.9	**112.7**
Total Observation Effort in km (nm) *(excludes poor weather, over land, etc.)*	4561 km	3834 km	6140 km	6500 km	**21,035 km**
	(2462 nm)	(2070 nm)	(3316 nm)	(3507 nm)	**(11,355 nm)**
No. Navy-directed Survey Changes	~9	~7	~12	~10	**~38**
No. Coastline Surveys for Strandings (around San Clemente Island)	0	2	1	0	**3**
No. Sightings	115	185	161	240	**701**
Estimated No. Individuals	12,587	5732	9489	22,719	**~50,527**
Mean Group Size	109.4	31.0	58.9	94.7	**72.1**
No. Dead Sightings	0	3 (2 CA sea lions, 1 blue whale)	0	2 (2 probable CA sea lions)	**5**
No. Species	9	9	11	10	**13**
No. Focal Groups Circled 5-9 min	22	20	24	37	**103**
No. Extended Focal Groups Circled >10 min	5	7	7	8	**27**
Longest Focal Follow Duration (min)	28 min (fin whale)	60 min (fin whale)	48 min (fin whale)	38 min (long-beaked common dolphin)	**60 min**
No. Photos Taken	1050	1280	1099	2301	**5730**
Estimated Useable Video (min)	53	41	83	50	**227**

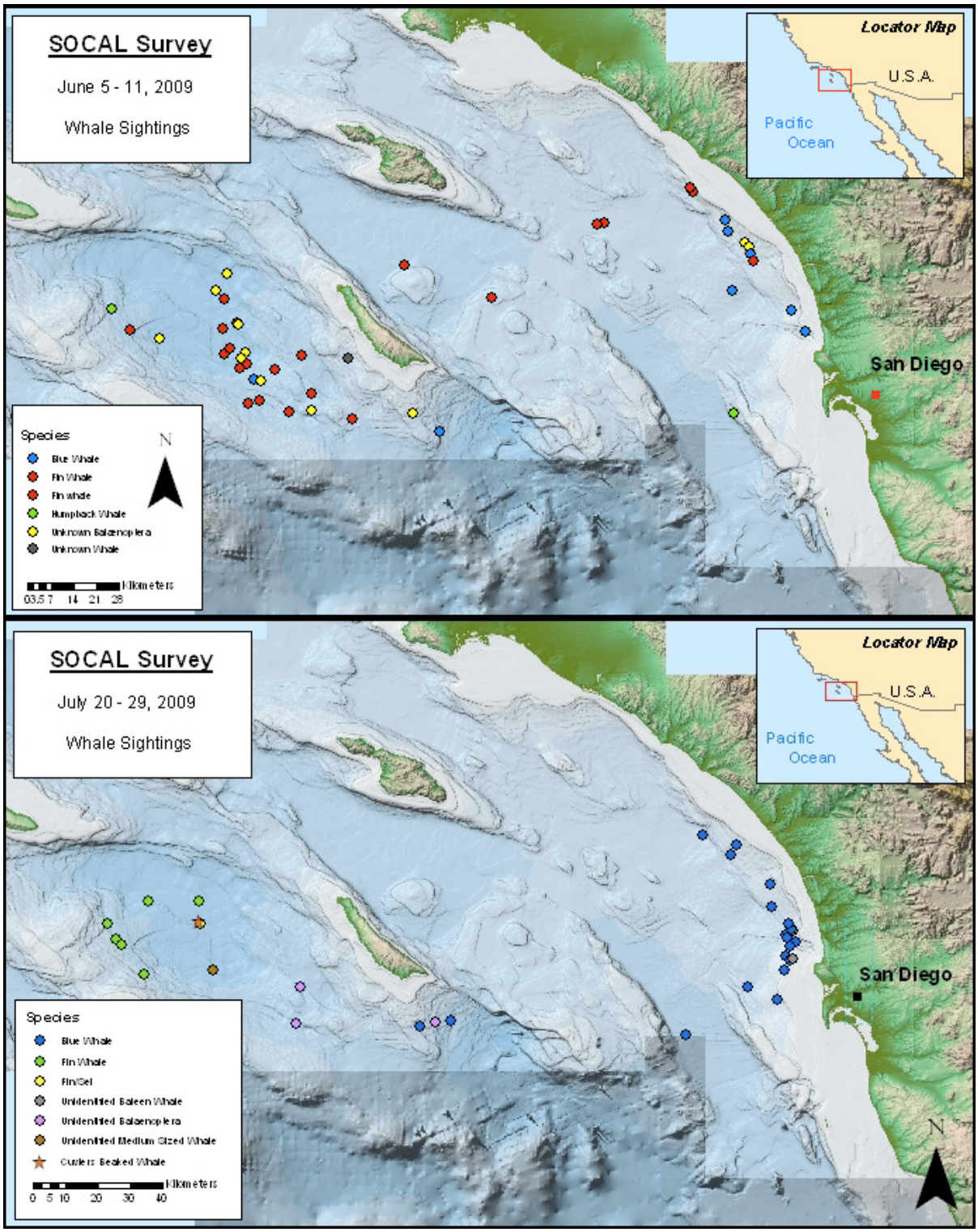

Figure 5. June and July 2009: Whale sightings in the SOCAL aerial survey study area. (See Figure 2 for all track line effort).

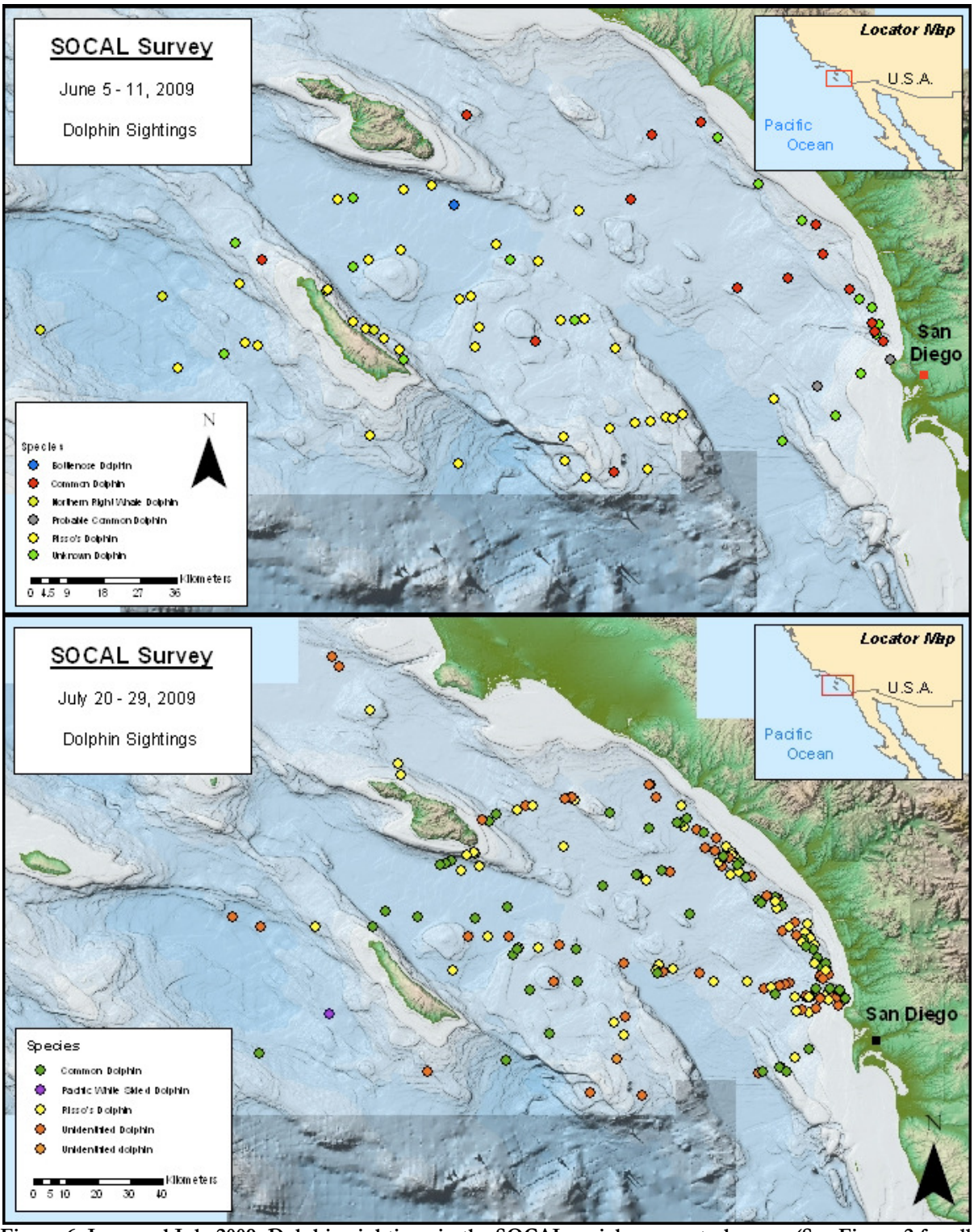

Figure 6. June and July 2009: Dolphin sightings in the SOCAL aerial survey study area. (See Figure 2 for all track line effort).

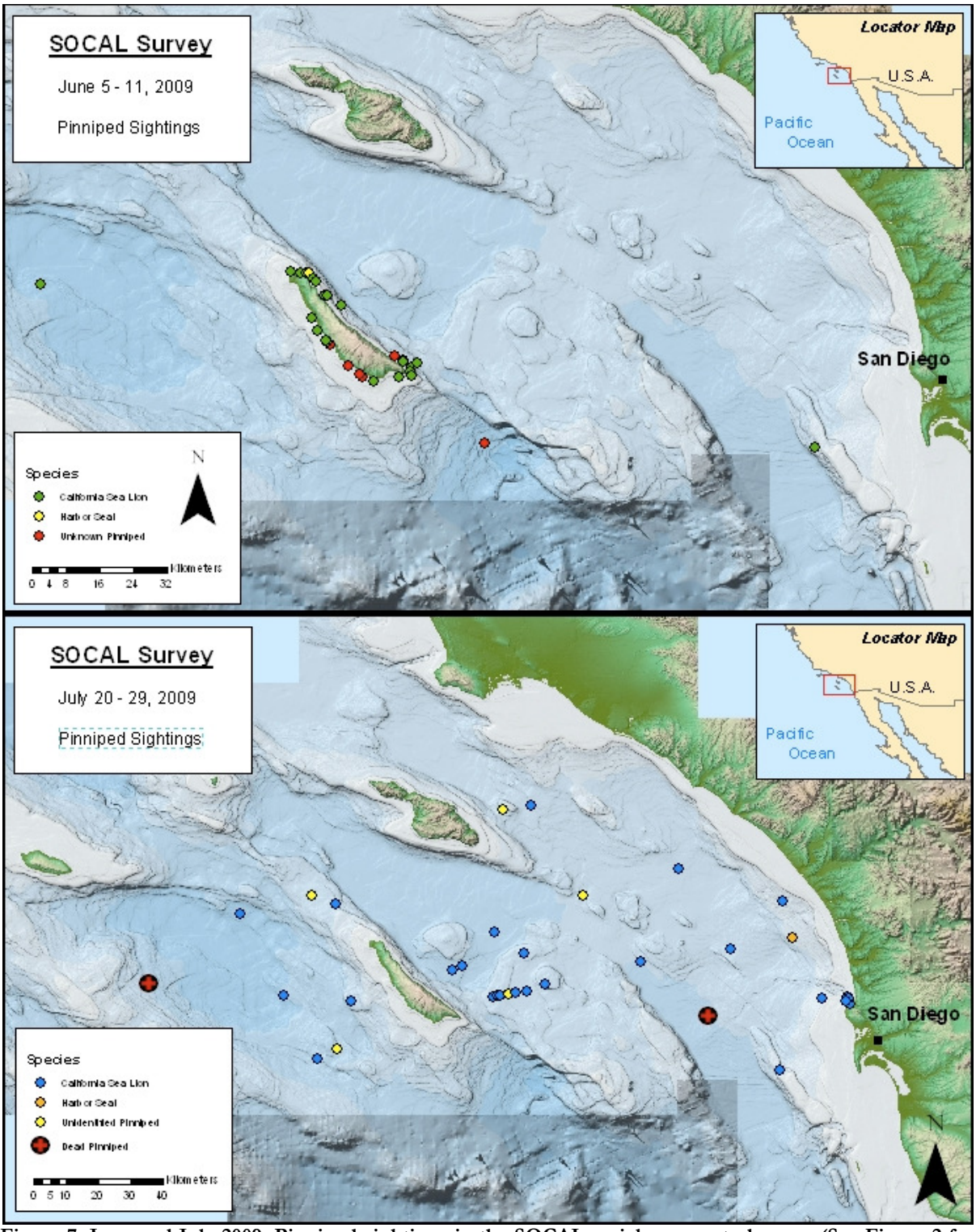

Figure 7. June and July 2009: Pinniped sightings in the SOCAL aerial survey study area. (See Figure 2 for all track line effort).

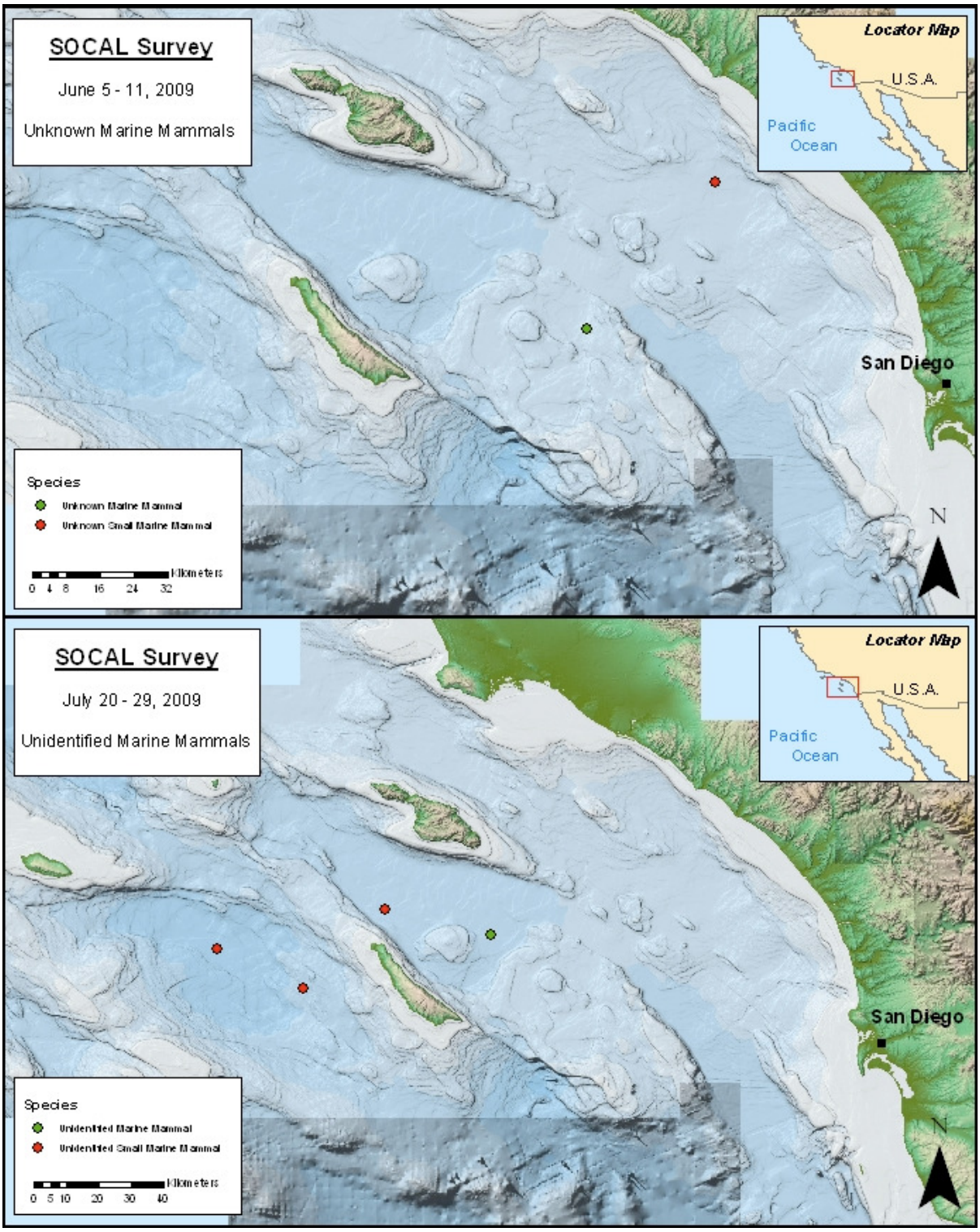

Figure 8. June and July 2009: Unidentified marine mammal sightings in the SOCAL aerial survey study area. (See Figure 2 for all track line effort).

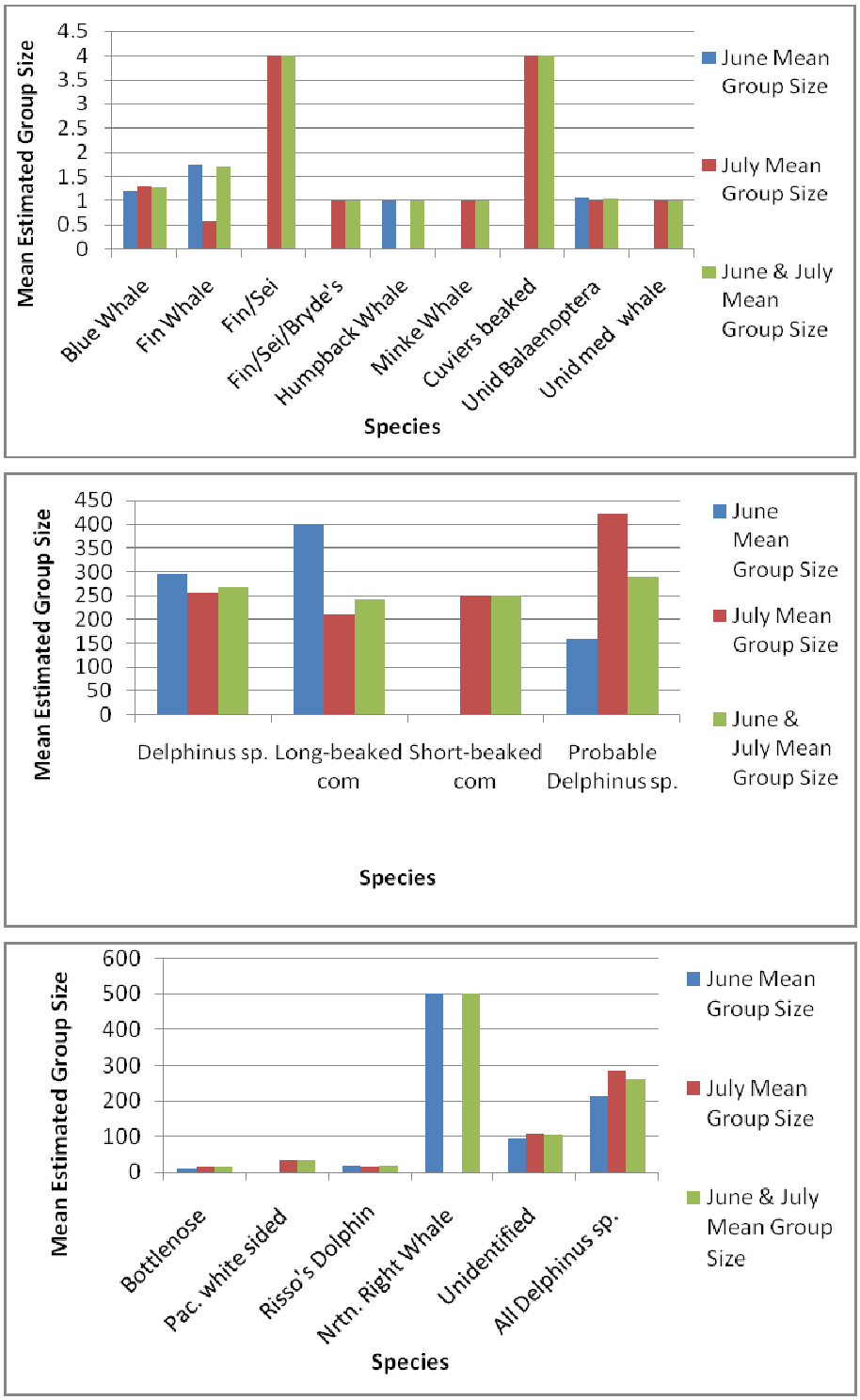

Figure 9. Mean group size by species or species group during the June and July 2009 SOCAL aerial survey periods. Upper panel: whales; middle panel: common dolphins; bottom panel: dolphins.

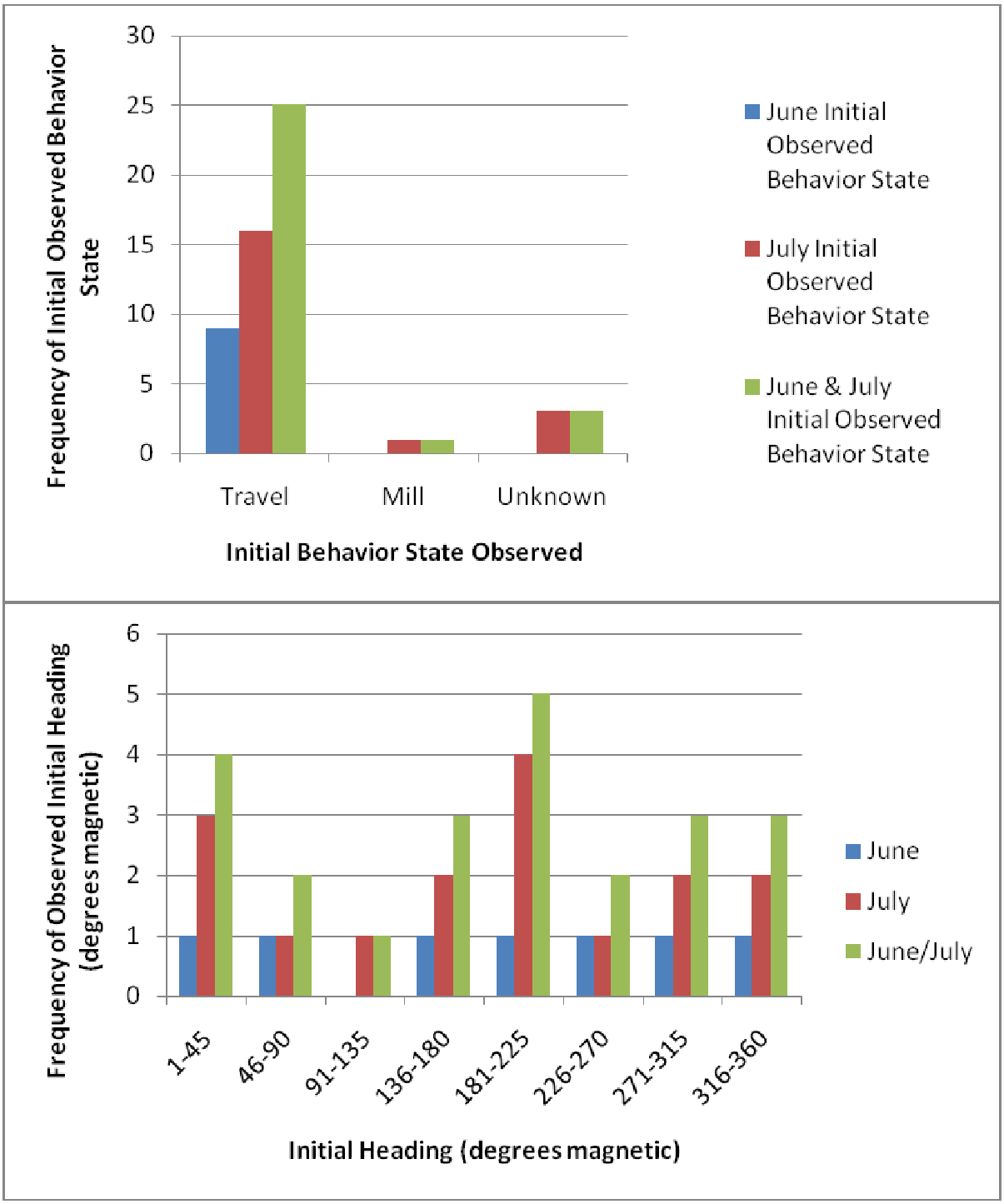

Figure 10. Blue whales during the June and July SOCAL 2009 survey periods. Top panel: frequency of initially observed behavioral states. Bottom panel: frequency of initially observed headings (degrees magnetic).

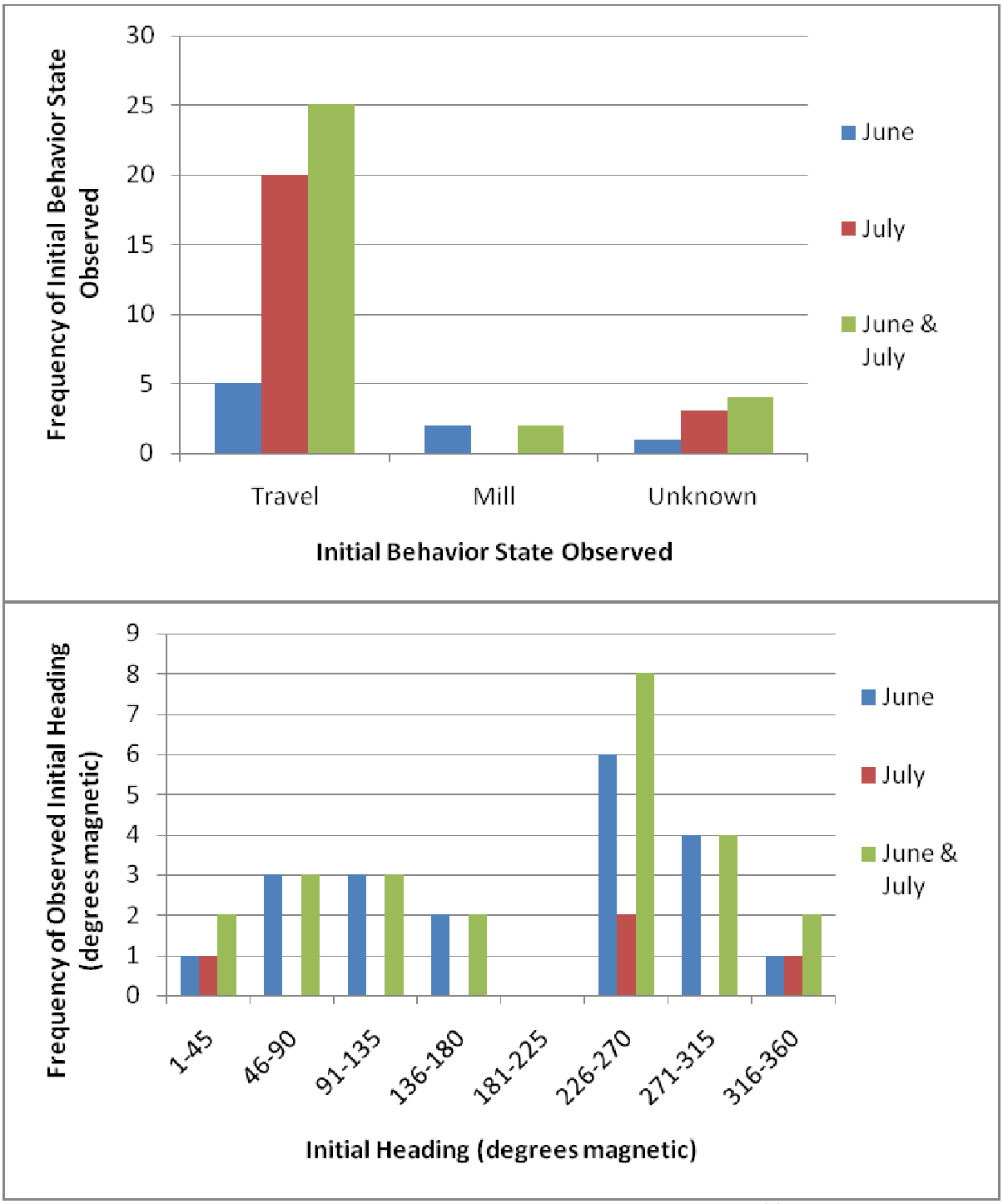

Figure 11. Fin whales during the June and July SOCAL 2009 survey periods. Top panel: frequency of initially observed behavioral states. Bottom panel: frequency of initially observed headings (degrees magnetic).

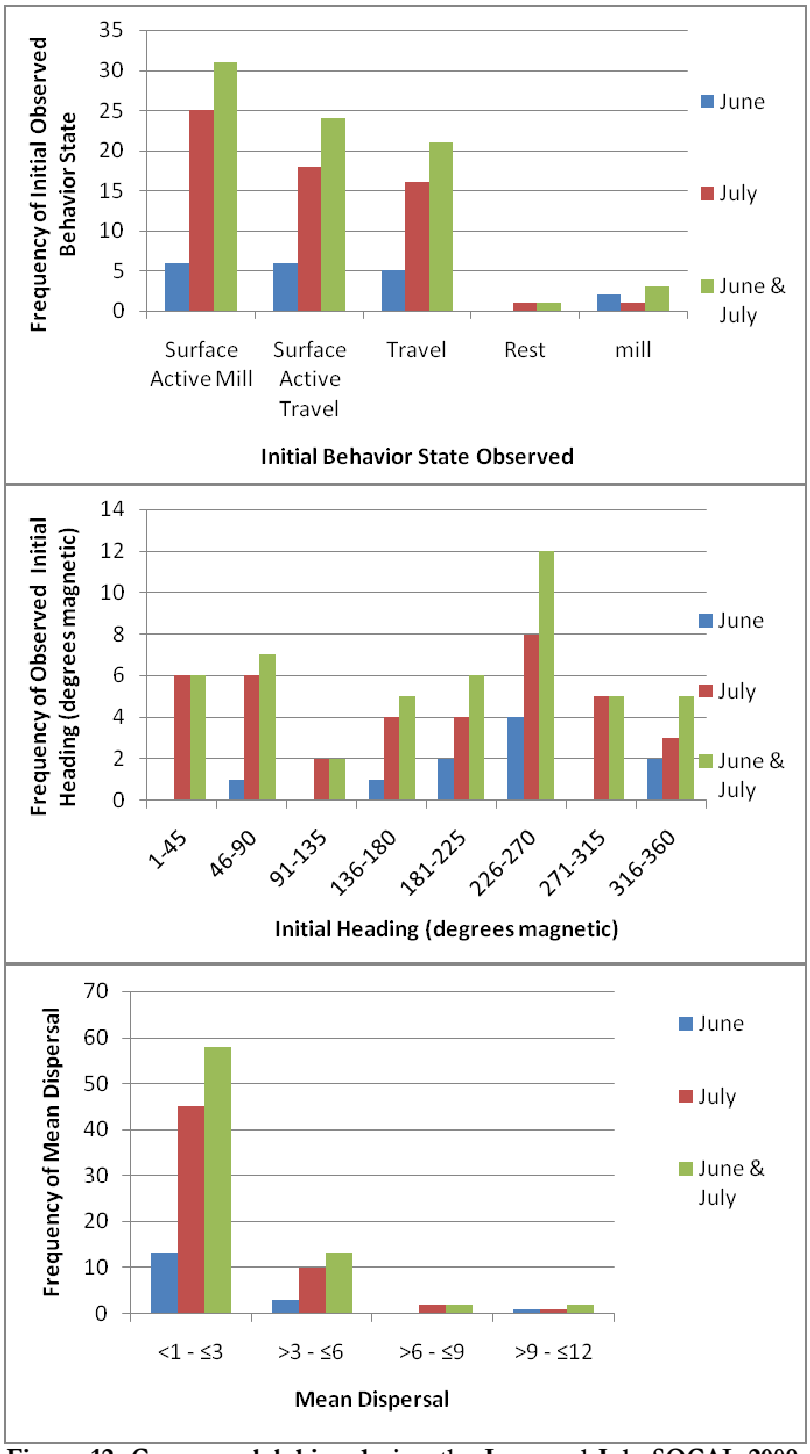

Figure 12. Common dolphins during the June and July SOCAL 2009 survey periods: Upper panel: frequency of initially observed behavioral states. Middle panel: frequency of initially observed headings (degrees magnetic). Bottom panel: frequency of mean dispersal distance between individuals (in estimated body lengths).

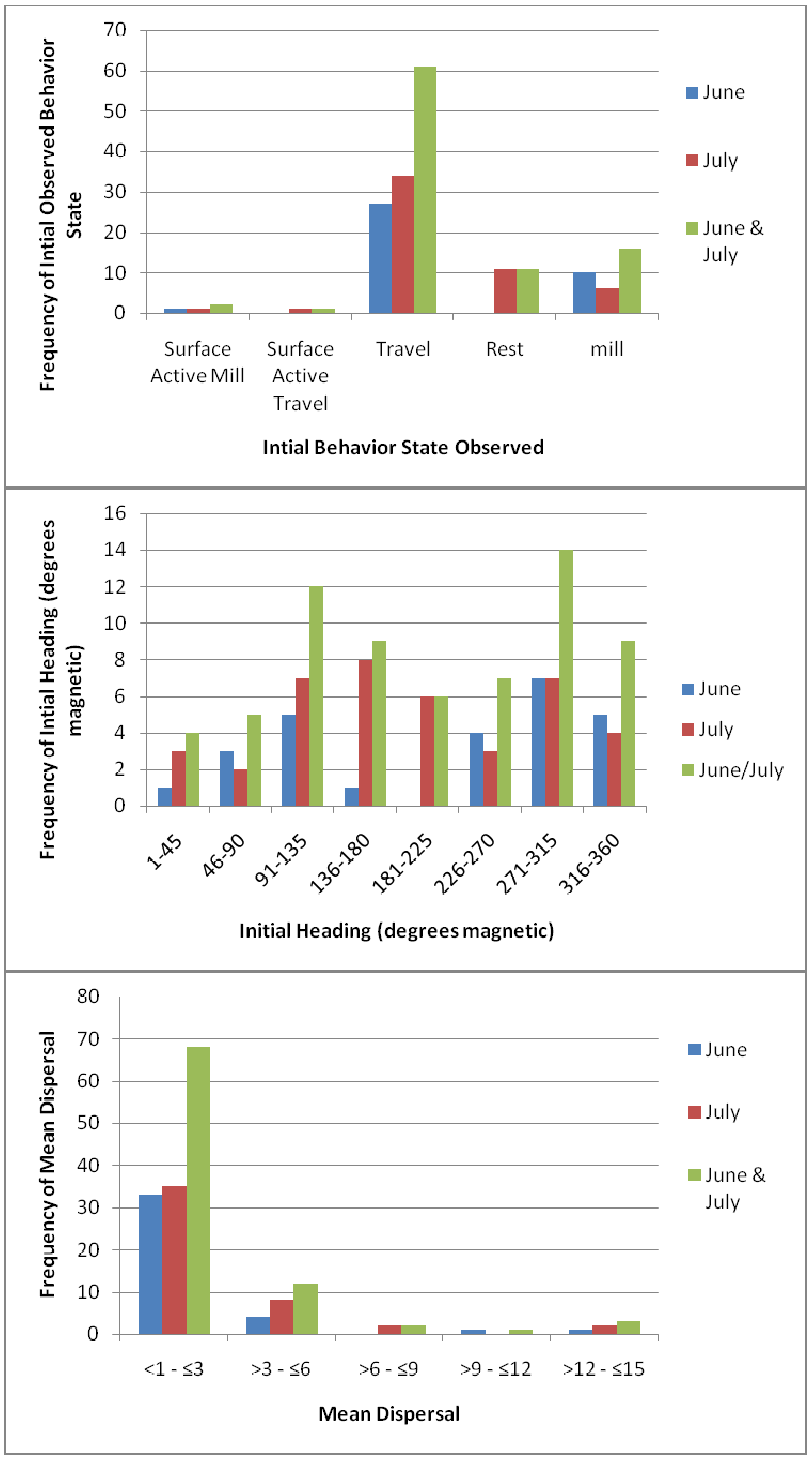

Figure 13. Risso's dolphins during the June and July SOCAL 2009 survey periods: Upper panel: frequency of initially observed behavioral states. Middle panel: frequency of initially observed headings (degrees magnetic). Bottom panel: frequency of mean dispersal distance between individuals (in estimated body lengths).

Section 4 Discussion

Key Role of Aerial Surveys

Survey results provide further support of the key and unique roles that aerial surveys play in addressing Navy monitoring plan goals (see review in Smultea et al. 2009). These include:

(1) providing the advantage of surveying key Navy areas of interest (e.g., areas W and E of SCI) *within one day, providing a "snapshot" of marine mammal numbers, presence, distribution and behavior* before, during and after MTEs,

(2) *collecting quantifiable behavioral data* known to be indices of stress/disturbance,

(3) *conducting focal follows* of priority cetacean species including video-documentation of underwater behavior,

(4) providing a platform from which the *behavior and potential reactions of cetaceans to MTEs may be studied without confounding results* (vs. from vessels), and

(5) locating and identifying dead floating and stranded animals.

Results Highlights

The relative importance and contextual contribution and significance of specific key results are listed below.

- Over ~20,000 km of aerial survey observations and over 700 sightings of marine mammals were obtained during the Oct-Nov 2008 (Smultea et al. 2009) and June-July 2009 SOCAL aerial surveys. This effort represents the most up-to-date and comprehensive visual survey from the SOCAL/SOAR vicinity since the SWFSC aerial surveys there in 1998-99 (Carretta et al. 2000).

- On July 25-26, W of SCI, aerial and vessel (R/V *Sproul*, SIO) line-transect surveys for marine mammals were successfully conducted simultaneously to passive acoustic monitoring studies by NUWC and SIO researchers, and satellite tagging and photo-identification surveys by CRC. Analyses are underway to compare results between the various platforms. Complimentary data will be synthesized to provide a 3-D snapshot of marine mammal behavior, occurrence and distribution in the area. Visual data will also be used to ground-truth acoustic detections. The *collaborative* nature of these studies facilitates maximization of data collection and synthesis relative to goals of the SOCAL Marine Monitoring Plan (DoN 2009).

- The aerial survey grids W and E of SCI were each surveyed *within one day* on several different days. This demonstrates the unique ability of aerials to *obtain a "snapshot"* of a large area providing information on the numbers, occurrence, (re-) distribution, species, behavior, and disposition of marine mammals in high-priority Navy areas within a short (<1 day) time. This ability provides information for the area *before, during and after* MTEs. These data cannot be obtained from a vessel or from passive acoustics within one day in such a large area.

- A live fin whale dragging ~100 m of fishing rope and a buoy was observed E of SCI in June. Sighting information was immediately communicated to a passing US Coast Guard helicopter and to the Navy NTR. The Navy contacted the NMFS. In addition, two dead probable California sea lions were observed in July: one E and one W of SCI over the middle of underwater basins. These sightings show that the aircraft is an effective way to *quickly identify dead and injured/stranded MM*. This was

similarly demonstrated in Oct-Nov 2008 aerial surveys off SOCAL when a dead blue whale and two sightings of a dead California sea lion were made (see Smultea et al. 2009).

- Sample sizes of species sightings collected during June and July 2009, especially when combined with our aerial surveys conducted in Oct-Nov 2008, are *sufficiently large (>60-80) to calculate reasonable density and abundance estimates for some species* (e.g., common and Risso's dolphins, possibly blue and fin whales). These data can be used to estimate populations in the area, including before, during, and/or after MTEs. We are currently working in collaboration with the Navy to produce such preliminary estimates. This will facilitate comparison with abundance and density estimates derived from aerial surveys conducted in the same region by the SWFSC in 1998-1999 (Carretta et al. 2000)

- Marine mammals were seen *in* and *near* the active area W of SCI *during* the June MTE period as well as *in* and *near* this area in July *after* the MTE. This is similar to results of the Oct (*during*) and Nov (*after*) SOCAL aerial surveys (Smultea et al. 2009).

- Seven systematic assessments of the potential effect of our aircraft circling at different altitudes and ~1 km lateral distance were undertaken on Risso's and common dolphins and fin and blue whales. Preliminary analyses indicate that flying at altitudes of ~1500 ft and in some cases ~1000 ft and lateral distance of ~1 km did not result in obvious changes in behavior, heading, or dispersal. One blue whale continued lunge feeding and Risso's dolphins continued resting at the surface throughout the ~40-min observation periods. This *provides support that the aircraft can be used to assess cetacean behavior without affecting that behavior* at these altitudes and distances. These are *the first systematic assessments of this type conducted on delphinids, and blue and fin whales* to our knowledge. The only other similar systematic assessments of potential observation aircraft effects were conducted on bowhead whales in the Arctic (e.g., reviewed in Richardson et al. 1995) and on Hawaiian humpback whales (Bowles 1995, Smultea et al. 1995).

- Blue whales were seen more frequently in June while fin whales were seen more frequently in July. In both June and July, blue whales concentrated along the coastal shelf break. In contrast, fin whales were more widely distributed with highest numbers in the basin W of SCI. In July, fin whales were seen more frequently in the NW section of this basin vs. in the central basin in June. These results indicate that fin and blue whales are more common in the region than during the 1998-1999 SWFSC aerial surveys (Carretta et al. 2000).

- Overall, Risso's dolphins were the most frequently sighted species followed by common dolphins. In contrast, in Oct-Nov, commons were by far the most frequently seen species (Smultea et al. 2009). Risso's dolphins were common in both June and July while common dolphins were more common in July.

- In June, Risso's dolphins were distributed widely in offshore waters, with a concentration along the steep drop-off on the E side of SCI. In contrast, commons occurred primarily in near-shore slope waters. In July, Risso's were more clustered along coastal slope waters similarly to common dolphins. Both species tended to be associated with high-relief bathymetric features as was found in Oct-Nov surveys (Smultea et al. 2009). Relatively few sightings of either species occurred in waters W of SCI within SOAR, particularly in July.

- Humpback whales (n = 2 groups) and Northern right whale dolphins (n = 3) were seen only in June while the Pacific white-sided dolphin, minke whale, and Cuvier's beaked whale (n = 1 each) were seen only in July. One group of four Cuvier's beaked whales was detected in July W of SCI.

- In June, California sea lions were frequently seen along the coast of SCI during the two circumnavigations of SCI with few seen at sea. In contrast, California sea lions were frequently seen at sea in July. This pattern is related to the June haul-out period on SCI and the subsequent dispersal of the species at sea in July (e.g., Carretta et al. 2000).

- Mean group size, behavior state, heading, and dispersal distance were similar in Oct, Nov, June and/or July within the cetacean species examined: blue whale, fin whale, common dolphin, Risso's dolphin, Pacific white-sided dolphin. However, common dolphins appeared to head predominantly NE/E and SW/W in both June and July, similar to data from Oct and Nov (Smultea et al. 2009). Risso's tended to head most frequently to the W in June and July.
- Focal follows further documented with photographs and video that all species observed could be tracked below the water surface from the aircraft, some for longer periods than others dependent on Bf conditions, body coloration, behavior state, etc. This addressed one of the project hypotheses and predictions (see Smultea et al. 2009). It also addressed goals of the SOCAL M3P (DoN 2009).
- Our work contributes to the ultimate goal of developing, establishing and ensuring standardized data collection techniques that facilitate comparison between and among different data from future SOCAL and other Navy range monitoring efforts, a goal of the M3P and the Navy-wide Integrated Comprehensive Monitoring Program (ICMP) (DoN 2009: p. 3).
- This effort was successfully performed for the third and fourth times without interfering with at-sea Navy training involving multiple Navy assets. However, extensive multi-command pre-survey coordination is required in order to obtain permission for airspace access.
- Data collected during this study contribute to baseline data important in developing and implementing effective marine mammal monitoring for future planned Navy activities identified in the SOCAL M3P and ICMP and other Navy range M3Ps (DoN 2008, 2009). As such, the survey contributes to the "overall knowledgebase of marine species", a goal of the SOCAL M3P and ICMP (DoN 2009: p. 3).

Section 5 Recommendations

A comprehensive list of recommendations to improve data collection techniques, analyses, interpretations, and applications was provided in the SOCAL 2008 aerial survey report (Smultea et al. 2009). Below are a few recommendations in addition to those.

1. Sighting data from 2008 and 2009 SOCAL aerial surveys should be preliminarily analyzed using free DISTANCE software (Buckland et al. 2001) to ascertain whether existing samples sizes are sufficiently large to calculate reasonable abundance and density estimates for some marine mammal species. This requires additional data analysis and preparation beyond the scope of this study. This is important to assess whether changes in abundance can be statistically linked to *before, during and after MFAS activity periods*. Additional DISTANCE analyses can be conducted if preliminary results are promising.

2. Preliminary and follow-up statistical analyses of behavioral indices successfully collected and summarized herein should be analyzed using a behavioral analysis program. Because data were collected using BioSpectator Go software, their current format is most amenable to analyses that can be run in that software program. This analysis was beyond the scope of our study. Such information is important to statistically identify minimum sample sizes required to identify statistically significant changes in attributes that could be related to MFAS activities, in consultation with a professional statistician.

3. Video of behavioral data collected during this study should be analyzed using NOLDUS video analysis software (www.noldus.com). Analysis of video data is typically a tedious and time-consuming process. However, Noldus has developed video data analysis software that increases analysis efficiency and helps to standardize the process. Such results provide the most detailed and accurate method for objectively quantifying measurable behavioral data (e.g., inter-animal dispersal distances, respiration rates, relative changes in orientation, frequency of behaviors, etc.) because videotape can be re-reviewed, etc. The most effective approach is to combine the video data with a recorded vocal narration of behavior, notes taken using a behavioral software program, e.g., BioSpectator Go, and/or handwritten notes on forms, all of which we did during the study. This approach has been successfully used to quantify and identify subtle and other significant changes in measurable behavioral variables of bowhead, gray and humpback whales, that in turn were statistically shown to be influenced by anthropogenic underwater sound and other stimuli (reviewed in Richardson et al. 1995). However, the above analyses were beyond the scope of the current study.

4. Formal **Pre-Planning Meetings** should be conducted and attended **by all key** research and Navy representatives. This allows coordinating and maximizing the ability of various simultaneously operating platforms to collect data useful to assess potential effects of Navy training activities on marine mammals. This helps to reduce data-collection costs through multi-use of platforms. It also increases efficiency and safety of field operations and provides the opportunity for team building, data sharing, and collaboration.

5. A formal post-field **Information Transfer Meeting** should be held ~2-3 months after the fiscal monitoring year has been completed. This allows the various researchers and Navy representatives to share data and techniques, to identify additional future collaborative efforts, and to build relationships between researchers and Navy representatives involved in the activities. This could include Navy personnel explaining the challenges faced when trying to coordinate and obtain approval for the monitoring research, and identifying ways in which researchers can assist in this process. It also gives both research and Navy representatives the opportunity to question one another about results and goals, and to identify ways to improve and smooth related endeavors, and to assist one another in data collection and meeting study goals.

Section 6 Acknowledgements

We are grateful to Navy personnel from U.S. Pacific Fleet Environmental and Naval Facilities Engineering Command Pacific for their support, coordination and facilitation in implementing these surveys. We thank Dr. John Hildebrand, Paula Hodgkiss, Linda Sawyer, and other assisting staff at the Scripps Institution of Oceanography and the California Institute of Technology for facilitating this contract. Many thanks also to the hard working survey crew and technical assistants including observers M. Deakos and L. Mazzuca, and graphics/document/data management support from Jenelle Black. We thank Rick Throckmorton and Barry Hansen and our astute and enthusiastic pilot Kathleen Veatch of Aspen Helicopters for providing us with our aircraft and pilots.

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Appendix A List of All June Sightings

Appendix A. 5-11 June 2009: Summary of all individual marine mammal sightings, including location latitudes and longitudes, made during the SOCAL 2009 aerial monitoring surveys off San Diego, California.

SOCAL June 09 Species List					
Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude ˚N	Longitude ˚W
5-Jun	1	Unidentified Dolphin	16:48:02	32.937	117.988
5-Jun	3	Risso's Dolphin	16:48:44	32.938	118.016
5-Jun	3	Unidentified Dolphin	17:02:44	32.85	118.368
5-Jun	1	California Sea Lion	17:03:02	32.848	118.364
5-Jun	1	California Sea Lion	17:03:43	32.835	118.347
5-Jun	1	California Sea Lion	17:05:16	32.814	118.372
5-Jun	2	California Sea Lion	17:07:30	32.803	118.428
5-Jun	1	Unidentified Pinniped	17:08:32	32.813	118.451
5-Jun	1	Unidentified Pinniped	17:08:48	32.818	118.458
5-Jun	1	Unidentified Pinniped	17:10:02	32.837	118.48
5-Jun	4	Unidentified Pinniped	17:12:27	32.881	118.521
5-Jun	1	California Sea Lion	17:12:50	32.888	118.526
5-Jun	1	California Sea Lion	17:12:59	32.891	118.529
5-Jun	4	California Sea Lion	17:13:54	32.913	118.547
5-Jun	1	California Sea Lion	17:15:11	32.94	118.559
5-Jun	4	California Sea Lion	17:19:48	33.038	118.604
5-Jun	1	California Sea Lion	17:20:32	33.037	118.583
5-Jun	1	California Sea Lion	17:20:48	33.036	118.572
5-Jun	1	Harbor Seal	17:20:59	33.035	118.567
5-Jun	1	California Sea Lion	17:21:27	33.024	118.556
5-Jun	1	California Sea Lion	17:21:44	33.017	118.55
5-Jun	4	California Sea Lion	17:21:45	33.017	118.55
5-Jun	12	Risso's Dolphin	17:22:21	33.005	118.541
5-Jun	4	California Sea Lion	17:27:22	32.987	118.532
5-Jun	10	Risso's Dolphin	17:36:16	32.936	118.481
5-Jun	11	Risso's Dolphin	17:37:19	32.919	118.453
5-Jun	1	Unidentified Pinniped	17:40:21	32.857	118.383
5-Jun	5	California Sea Lion	17:40:59	32.845	118.365
5-Jun	2	California Sea Lion	17:41:44	32.824	118.348

SOCAL June 09 Species List

Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude ˚N	Longitude ˚W
5-Jun	2	California sea Lion	17:42:13	32.815	118.347
5-Jun	2	California sea Lion	17:44:09	32.844	118.335
5-Jun	6	Risso's dolphin	17:48:45	32.878	118.209
5-Jun	3	Unidentified marine mammal	17:55:37	32.925	117.977
5-Jun	1	Blue whale	18:14:47	32.965	117.343
6-Jun	1	Blue whale	12:45:48	32.905	117.304
6-Jun	400	Unidentified dolphin	12:49:58	32.908	117.314
6-Jun	24	Risso's dolphin	13:08:06	32.874	117.894
6-Jun	75	Common dolphin sp.	13:13:22	32.89	118.073
6-Jun	27	Risso's dolphin	13:20:28	32.923	118.198
6-Jun	175	Common dolphin sp.	13:36:05	33.073	118.684
6-Jun	40	Unidentified dolphin	13:43:00	33.11	118.743
6-Jun	1	California sea lion	13:56:32	33.013	119.141
6-Jun	1	Humpback whale	14:06:17	32.969	119.233
6-Jun	2	Fin whale	14:12:06	32.91	119.182
6-Jun	1000	Northern right whale dolphin	15:01:51	32.917	119.18
6-Jun	300	Northern right whale dolphin	15:26:14	32.992	118.905
6-Jun	2	Fin whale	15:51:35	32.927	118.886
6-Jun	1	Unidentified baleen whale	15:51:46	32.925	118.881
6-Jun	38	Risso's dolphin	16:01:21	33.021	118.733
6-Jun	3	California sea lion	16:14:50	32.987	118.527
6-Jun	25	California sea lion	16:15:46	32.965	118.497
6-Jun	200	Northern right whale dolphin	16:18:01	32.916	118.433
6-Jun	4	Risso's dolphin	16:20:54	32.899	118.411
6-Jun	25	Risso's dolphin	16:21:55	32.873	118.377
6-Jun	15	Risso's dolphin	16:35:55	32.697	117.909
6-Jun	6	Risso's dolphin	16:40:28	32.728	117.745
7-Jun	1	Humpback whale	12:55:41	32.677	117.502
7-Jun	1	California sea lion	12:57:12	32.663	117.484
7-Jun	130	Unidentified dolphin	13:27:26	32.67	117.522
7-Jun	60	Risso's dolphin	13:36:43	32.606	117.823
7-Jun	52	Common dolphin sp.	13:42:16	32.599	117.899
7-Jun	23	Risso's dolphin	13:53:33	32.588	117.961
7-Jun	3	Risso's dolphin	14:02:11	32.618	118.247

SOCAL June 09 Species List

Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude ˚N	Longitude ˚W
7-Jun	2	Blue whale	14:04:19	32.629	118.32
7-Jun	2	Fin whale	14:19:32	32.661	118.564
7-Jun	2	Fin whale	14:40:56	32.683	118.739
7-Jun	2	Fin whale	14:57:07	32.733	118.677
7-Jun	1	Fin whale	15:17:42	32.714	118.821
7-Jun	2	Fin whale	15:22:04	32.704	118.853
7-Jun	3	Fin whale	15:27:40	32.707	118.854
7-Jun	1	Blue whale	15:35:43	32.771	118.838
7-Jun	2	Unidentified baleen whale	15:41:35	32.767	118.818
7-Jun	4	Risso's dolphin	15:51:13	32.888	118.723
7-Jun	19	Risso's dolphin	15:53:45	32.882	118.693
7-Jun	1	Unidentified dolphin	16:01:12	32.863	118.768
7-Jun	1	Fin whale	16:04:21	32.816	118.856
7-Jun	1	Fin whale	16:05:05	32.805	118.878
7-Jun	1	Fin whale	16:21:19	32.843	118.92
7-Jun	18	Risso's dolphin	16:35:46	33.007	118.538
7-Jun	28	Risso's dolphin	16:43:55	32.985	118.242
7-Jun	50	Risso's dolphin	16:44:37	32.991	118.217
7-Jun	1	Fin whale	16:45:43	33	118.175
7-Jun	350	Common dolphin sp.	17:05:09	33.152	117.449
7-Jun	15	Unidentified dolphin	17:16:22	32.984	117.349
8-Jun	22	Risso's dolphin	8:27:33	33.211	117.876
8-Jun	25	Common dolphin sp.	8:29:38	33.214	117.879
8-Jun	1	Unidentified baleen whale	8:50:34	33.091	118.403
8-Jun	400	Common dolphin sp.	8:59:26	33.077	118.403
8-Jun	1	Blue whale	9:05:44	33.08	118.409
8-Jun	35	Risso's dolphin	9:12:33	33.023	118.618
8-Jun	2	Fin whale	9:19:27	33.128	118.788
8-Jun	500	Common dolphin sp.	9:25:12	33.043	118.948
8-Jun	1	Risso's Dolphin	9:48:11	32.891	119.118
8-Jun	1	Fin whale	9:49:38	32.875	119.097
8-Jun	1	Unidentified baleen whale	10:38:33	32.843	119.053
8-Jun	1	Fin whale	10:59:42	32.831	118.871
8-Jun	1	Unidentified baleen whale	11:02:57	32.831	118.871

SOCAL June 09 Species List

Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude ˚N	Longitude ˚W
8-Jun	1	Unidentified baleen whale	11:49:42	32.831	118.871
8-Jun	1	Unidentified baleen whale	11:59:26	32.831	118.871
8-Jun	1	Unidentified baleen whale	12:26:11	32.831	118.871
8-Jun	2	Unidentified baleen whale, probable fin whale	12:29:00	32.831	118.871
8-Jun	25	Risso's dolphin	12:33:22	32.831	118.871
9-Jun	15	Unidentified dolphin	8:16:33	32.967	117.322
9-Jun	60	Common dolphin sp.	8:35:15	33.011	117.623
9-Jun	15	Risso's dolphin	8:51:18	32.942	117.966
9-Jun	50	Risso's dolphin	9:18:29	33.108	118.16
9-Jun	220	Unidentified dolphin	9:23:46	33.073	118.131
9-Jun	5	Risso's dolphin	9:27:00	33.071	118.068
10-Jun	150	Unidentified dolphin, probable common dolphin sp.	8:34:22	32.852	117.282
10-Jun	11	Unidentified dolphin	8:36:16	32.82	117.347
10-Jun	125	Unidentified dolphin, probable common dolphin sp.	8:39:26	32.79	117.445
10-Jun	1	Unidentified pinniped	9:13:16	32.671	118.188
10-Jun	1	Unidentified baleen whale	9:19:27	32.676	118.396
10-Jun	6	Risso's dolphin	9:26:55	32.68	118.443
10-Jun	1	Unidentified baleen whale	9:34:22	32.685	118.677
10-Jun	1	Unidentified whale	9:45:56	32.831	118.576
10-Jun	1	Fin whale	10:12:25	32.798	118.78
10-Jun	1	Fin whale	10:42:01	32.838	118.706
10-Jun	2	Fin whale	11:06:56	32.86	118.905
10-Jun	2	Risso's dolphin	11:34:18	33.239	118.307
10-Jun	11	Bottlenose dolphin	11:43:51	33.196	118.255
10-Jun	37	Risso's dolphin	12:02:52	33.184	117.976
10-Jun	2	Fin whale	12:32:44	33.203	117.882
10-Jun	1	Unidentified small marine mammal	12:37:39	33.238	117.704
10-Jun	1	Unidentified dolphin	12:45:55	33.162	117.478
10-Jun	1	Unidentified baleen whale	12:46:21	33.153	117.471
10-Jun	1	Unidentified baleen whale	12:46:50	33.141	117.46
10-Jun	3	Unidentified dolphin	12:54:54	32.93	117.306
11-Jun	60	Common dolphin sp.	8:47:28	32.914	117.315
11-Jun	15	Common dolphin sp.	8:48:06	32.934	117.322

SOCAL June 09 Species List

Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude ˚N	Longitude ˚W
11-Jun	500	Common dolphin sp.	8:54:09	33.085	117.433
11-Jun	1	Blue whale	8:59:04	33.119	117.454
11-Jun	100	Common dolphin sp.	9:44:59	33.38	117.703
11-Jun	140	Common dolphin sp.	10:09:00	33.396	118.227
11-Jun	1	Risso's dolphin	10:29:05	33.206	118.515
11-Jun	1	Unidentified baleen whale	11:06:03	33.065	118.912
11-Jun	1	Fin whale	11:45:32	32.914	118.924
11-Jun	125	Unidentified dolphin	12:01:09	33.058	118.48
11-Jun	7	Risso's dolphin	12:02:39	33.073	118.445
11-Jun	8	Unidentified dolphin	12:10:54	33.21	118.481
11-Jun	15	Risso's dolphin	12:16:14	33.229	118.367
11-Jun	400	Common dolphin sp.	12:32:50	33.352	117.816
11-Jun	200	Unidentified dolphin, probable common dolphin sp.	12:45:48	33.345	117.666
11-Jun	1	Fin whale	12:48:02	33.294	117.618
11-Jun	1	Fin whale	12:50:46	33.303	117.622
11-Jun	300	Unidentified dolphin	12:55:00	33.242	117.577
11-Jun	1	Fin whale	13:00:46	33.099	117.45
11-Jun	400	Long-beaked common dolphin	13:06:20	33.009	117.374
11-Jun	1200	Common dolphin sp.	13:13:49	32.892	117.298
11-Jun	230	Unidentified dolphin	16:09:58	32.725	117.402
11-Jun	25	Risso's dolphin	16:32:07	32.625	118.01
11-Jun	8	Risso's dolphin	16:37:44	32.679	118.013
11-Jun	8	Risso's dolphin	16:41:55	32.709	117.852
11-Jun	7	Risso's dolphin	16:42:55	32.715	117.817
11-Jun	8	Risso's dolphin	16:43:53	32.722	117.783
11-Jun	3	Risso's dolphin	16:45:51	32.721	117.768
11-Jun	35	Risso's dolphin	16:52:38	32.765	117.542
11-Jun	1	Blue whale	17:14:00	33.02	117.507
11-Jun	700	Common dolphin sp.	17:14:30	33.032	117.509
11-Jun	1	Blue whale	17:32:29	33.216	117.526
11-Jun	2	Blue whale	17:41:18	33.182	117.518

Appendix B List of All July Sightings

Appendix B. 20-29 July 2009: Summary of all individual marine mammal sightings, including location latitudes and longitudes, made during the SOCAL 2009 aerial monitoring surveys off San Diego, California.

SOCAL July 09 Species List					
Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude °N	Longitude °W
20-Jul	30	Unidentified dolphin	12:32:39	32.949	117.783
20-Jul	2	Unidentified dolphin	12:35:14	32.971	117.895
20-Jul	13	Risso's dolphin	12:41:01	33.014	118.133
20-Jul	18	Unidentified dolphin	12:45:33	33.046	118.328
20-Jul	1	California sea lion	12:54:25	33.136	118.702
20-Jul	1	Unidentified small marine mammal	13:10:17	33.018	119.033
20-Jul	150	Unidentified dolphin	13:14:15	33.072	118.906
20-Jul	900	Unidentified dolphin, possible common dolphin sp.	13:40:24	33.128	118.567
20-Jul	650	Common dolphin sp.	14:04:32	33.276	118.308
20-Jul	1	Unidentified sea lion	14:17:38	33.398	118.233
20-Jul	200	Unidentified dolphin	14:19:32	33.41	118.169
20-Jul	1	Unidentified dolphin	14:23:13	33.435	118.041
20-Jul	200	Unidentified dolphin	14:45:00	33.084	117.417
21-Jul	1	Blue whale	12:34:58	32.868	117.359
21-Jul	500	Long-beaked common dolphin	12:35:33	32.886	117.36
21-Jul	2	Blue whale	12:36:35	32.928	117.358
21-Jul	2	Blue whale	12:46:09	32.831	117.36
21-Jul	1	Fin whale	12:56:36	32.94	117.337
21-Jul	1	Blue whale	12:56:53	32.944	117.341
21-Jul	2	Blue whale	12:59:20	33.007	117.398
21-Jul	280	Unidentified dolphin	13:04:13	33.063	117.453
21-Jul	1	Blue whale	13:09:31	33.208	117.588
21-Jul	20	Risso's dolphin	13:09:45	33.218	117.596
21-Jul	300	Unidentified dolphin	13:10:40	33.242	117.62
21-Jul	200	Unidentified dolphin	13:12:27	33.293	117.668
21-Jul	30	Risso's dolphin	13:14:31	33.353	117.724
21-Jul	60	Common dolphin sp.	13:14:47	33.364	117.733
21-Jul	50	Unidentified dolphin	13:17:05	33.434	117.804

SOCAL July 09 Species List

Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude ˚N	Longitude ˚W
21-Jul	6	Risso's dolphin	13:23:13	33.426	118.03
21-Jul	13	Risso's dolphin	13:26:34	33.41	118.149
21-Jul	1	California sea lion	13:28:46	33.408	118.155
21-Jul	35	Risso's dolphin	14:01:14	33.399	118.19
21-Jul	400	Common dolphin sp.	14:02:45	33.387	118.248
21-Jul	13	Risso's dolphin	14:17:23	33.281	118.314
21-Jul	25	Common dolphin sp.	14:19:20	33.257	118.377
21-Jul	5	Common dolphin sp.	14:19:45	33.251	118.392
21-Jul	3	Risso's dolphin	14:31:05	33.231	118.349
21-Jul	9	Risso's dolphin	14:32:42	33.243	118.297
21-Jul	6	Risso's dolphin	14:39:37	33.298	118.06
21-Jul	9	Risso's dolphin	14:52:31	33.318	117.634
21-Jul	8	Risso's dolphin	14:53:31	33.297	117.61
21-Jul	25	Risso's dolphin	14:54:14	33.282	117.594
21-Jul	50	Risso's dolphin	14:54:44	33.271	117.585
21-Jul	16	Risso's dolphin	14:56:14	33.252	117.628
21-Jul	16	Risso's dolphin	15:01:56	33.202	117.83
21-Jul	1	Unidentified pinniped, probable CA sea lion	15:07:10	33.16	118.009
21-Jul	700	Common dolphin sp.	15:16:06	33.099	118.308
21-Jul	14	Risso's dolphin	15:35:48	32.952	118.37
21-Jul	1	California sea lion	15:37:15	32.952	118.374
21-Jul	1	California sea lion	15:41:19	32.966	118.348
21-Jul	300	Common dolphin sp.	15:45:42	32.997	118.204
21-Jul	1	Blue whale	16:05:16	33.154	117.512
21-Jul	150	Unidentified dolphin	16:10:23	33.151	117.462
21-Jul	60	Unidentified dolphin, possible common dolphin sp.	16:14:55	33.055	117.382
21-Jul	1	Blue whale	16:23:49	32.859	117.344
21-Jul	1	California sea lion	16:24:24	32.873	117.345
21-Jul	1	Unidentified baleen whale	16:25:14	32.861	117.337
21-Jul	28	Common dolphin sp.	16:30:32	32.9	117.358
22-Jul	100	Common dolphin sp.	13:06:11	32.733	117.377
22-Jul	9	Unidentified dolphin, possible common dolphin or bottlenose dolphin	13:14:27	32.683	117.454
22-Jul	4	California sea lion	13:24:48	32.674	117.461

SOCAL July 09 Species List

Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude ˚N	Longitude ˚W
22-Jul	40	Common dolphin sp.	13:26:02	32.68	117.461
22-Jul	800	Common dolphin sp.	13:29:15	32.672	117.44
22-Jul	12	Unidentified dolphin	13:37:03	32.667	117.518
22-Jul	300	Unidentified dolphin, possible common dolphin sp.	13:49:51	32.606	117.843
22-Jul	300	Unidentified dolphin, possible Risso's dolphin	13:54:16	32.613	117.988
22-Jul	80	Unidentified dolphin	14:01:00	32.704	117.914
22-Jul	1	Blue whale	14:34:16	32.783	117.464
22-Jul	80	Unidentified dolphin	14:38:12	32.878	117.384
22-Jul	1	Blue whale	14:39:52	32.922	117.352
22-Jul	80	Unidentified dolphin	14:40:11	32.932	117.346
22-Jul	4	Unidentified dolphin	14:41:11	32.961	117.331
22-Jul	2	Blue whale	14:41:54	32.959	117.352
22-Jul	40	Unidentified dolphin	15:00:02	32.916	117.432
22-Jul	175	Unidentified dolphin	15:00:25	32.913	117.444
22-Jul	12	Unidentified dolphin	15:00:53	32.909	117.461
22-Jul	60	Unidentified dolphin	15:02:07	32.9	117.501
22-Jul	39	Risso's dolphin	15:14:32	32.806	117.921
22-Jul	2	Risso's dolphin	16:02:24	33.059	117.387
22-Jul	1	Blue whale	16:06:39	33.069	117.4
22-Jul	3	Risso's dolphin	16:09:10	33.08	117.381
22-Jul	13	Risso's dolphin	16:10:30	33.043	117.372
22-Jul	25	Risso's dolphin	16:11:06	33.024	117.364
22-Jul	70	Common dolphin sp.	16:13:15	32.959	117.343
22-Jul	1	Blue whale	16:21:14	32.907	117.331
22-Jul	2	Blue whale	16:22:15	32.899	117.346
22-Jul	6	Risso's dolphin	16:26:52	32.884	117.327
22-Jul	1	Unidentified dolphin	16:27:29	32.892	117.316
22-Jul	700	Common dolphin sp.	16:47:42	32.902	117.317
24-Jul	40	Unidentified dolphin	16:21:30	32.942	117.324
24-Jul	1400	Common dolphin sp.	16:29:36	32.986	117.353
24-Jul	1200	Common dolphin sp.	16:37:55	33.012	117.366
24-Jul	900	Common dolphin sp.	16:42:30	33.04	117.394
24-Jul	40	Common dolphin sp.	16:49:24	33.133	117.452
24-Jul	1	California sea lion	16:58:50	33.146	117.455

SOCAL July 09 Species List

Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude ˚N	Longitude ˚W
24-Jul	18	Common dolphin sp.	16:59:32	33.157	117.473
24-Jul	75	Common dolphin sp.	17:14:03	33.107	117.71
24-Jul	20	Risso's dolphin	17:34:27	33.013	118.188
24-Jul	35	Common dolphin sp.	17:38:43	33.013	118.193
24-Jul	1	California sea lion	17:41:15	33	118.175
24-Jul	9	Unidentified dolphin	18:16:10	33.228	117.766
24-Jul	2	Blue whale	18:30:58	33.18	117.494
24-Jul	14	Common dolphin sp.	18:53:12	32.871	117.279
25-Jul	5	Risso's dolphin	13:36:23	32.869	117.322
25-Jul	300	Unidentified dolphin	13:37:05	32.873	117.347
25-Jul	4	Risso's dolphin	13:37:50	32.879	117.375
25-Jul	15	Unidentified dolphin	13:38:10	32.882	117.385
25-Jul	35	Risso's dolphin	13:41:12	32.904	117.481
25-Jul	35	Risso's dolphin	13:43:19	32.919	117.551
25-Jul	1	Unidentified dolphin	13:47:27	32.944	117.684
25-Jul	10	Risso's dolphin	13:49:43	32.958	117.759
25-Jul	10	Risso's dolphin	13:50:57	32.966	117.796
25-Jul	1	California sea lion	13:52:36	32.976	117.852
25-Jul	200	Common dolphin sp.	13:57:53	33.013	118.026
25-Jul	30	Unidentified dolphin	13:59:19	33.023	118.075
25-Jul	500	Unidentified dolphin	14:03:42	33.048	118.214
25-Jul	1	California sea lion	14:04:58	33.056	118.256
25-Jul	1	Unidentified marine mammal	14:05:28	33.059	118.272
25-Jul	10	Common dolphin sp.	14:11:31	33.103	118.47
25-Jul	5	Common dolphin sp.	14:14:17	33.118	118.558
25-Jul	1	California sea lion	14:27:30	33.108	118.966
25-Jul	2	Fin whale	14:33:24	33.023	119.129
25-Jul	1	Unidentified sea lion, probable California sea lion (Dead)	14:46:44	32.918	119.223
25-Jul	1	Fin whale	14:49:24	32.916	119.22
25-Jul	1	Fin whale	14:53:29	32.903	119.204
25-Jul	1	Fin whale	15:04:44	33.023	118.99
25-Jul	4	Fin or sei whale	15:28:55	32.961	118.986
25-Jul	4	Cuvier's beaked whale	15:35:52	32.967	118.989
25-Jul	1	Minke Whale	15:47:58	32.82	119.14

SOCAL July 09 Species List

Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude ˚N	Longitude ˚W
25-Jul	500	Unidentified dolphin	17:17:03	32.825	117.889
25-Jul	1	Unidentified sea lion, probable California sea lion (Dead)	17:23:10	32.825	117.663
25-Jul	8	Risso's dolphin	17:30:39	32.837	117.378
26-Jul	15	Unidentified dolphin	13:10:02	32.853	117.296
26-Jul	1	Unidentified dolphin	13:11:50	32.847	117.358
26-Jul	10	Unidentified dolphin	13:12:56	32.844	117.396
26-Jul	35	Risso's dolphin	13:26:29	32.773	117.895
26-Jul	1500	Common dolphin sp.	13:35:19	32.702	118.222
26-Jul	1	Blue whale	13:37:18	32.691	118.291
26-Jul	1	Unidentified Baleen Whale	13:38:32	32.684	118.331
26-Jul	1	Blue whale	13:39:49	32.675	118.377
26-Jul	80	Unidentified dolphin	13:41:39	32.671	118.441
26-Jul	1	Unidentified baleen whale	13:50:03	32.682	118.719
26-Jul	1	California sea lion	13:52:29	32.706	118.752
26-Jul	1	Unidentified pinniped	13:54:10	32.731	118.696
26-Jul	1	Fin, sei or Bryde's whale	14:05:01	32.785	118.709
26-Jul	225	Short-beaked common dolphin	14:20:44	32.72	118.912
26-Jul	35	Pacific white-sided dolphin	14:30:45	32.831	118.714
26-Jul	1	California sea lion	14:35:48	32.866	118.656
26-Jul	1	Unidentified medium-sized whale	14:56:29	32.832	118.95
26-Jul	1	California sea lion	15:11:11	32.882	118.845
26-Jul	12	Unidentified small marine mammal	15:12:53	32.909	118.796
26-Jul	1	Unidentified pinniped	16:14:03	33.161	118.765
26-Jul	8	Risso's dolphin	16:28:12	33.075	118.756
26-Jul	5	Risso's dolphin	16:45:31	33.046	118.273
26-Jul	4	Risso's dolphin	16:59:08	32.953	117.804
26-Jul	70	Common dolphin sp.	16:59:42	32.942	117.801
26-Jul	34	Risso's dolphin	17:08:04	32.919	117.642
26-Jul	35	Common dolphin sp.	17:12:53	32.888	117.47
26-Jul	45	Risso's dolphin	17:14:22	32.877	117.418
27-Jul	1	Blue whale	13:57:07	32.748	117.381
27-Jul	30	Risso's dolphin	14:01:22	32.708	117.417
27-Jul	60	Short-beaked common dolphin	14:04:31	32.671	117.506
27-Jul	1	Blue whale	14:11:10	32.65	117.636

SOCAL July 09 Species List

Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude ˚N	Longitude ˚W
27-Jul	10	Risso's dolphin	14:44:37	32.839	117.413
27-Jul	20	Risso's dolphin	14:49:25	32.878	117.376
27-Jul	900	Short-beaked common dolphin	15:18:05	32.775	118.102
27-Jul	1	California sea lion	15:30:59	32.878	118.263
27-Jul	1	California sea lion	15:31:14	32.88	118.252
27-Jul	1	California sea lion	15:31:33	32.882	118.24
27-Jul	4	Unidentified Pinniped	15:32:18	32.886	118.217
27-Jul	3	California sea lion	15:32:45	32.889	118.199
27-Jul	1	California sea lion	15:33:33	32.894	118.169
27-Jul	230	Short-beaked common dolphin and California sea lion	15:33:57	32.897	118.157
27-Jul	1	California sea lion	15:38:59	32.914	118.116
27-Jul	25	Unidentified dolphin	15:39:44	32.919	118.088
27-Jul	70	Common dolphin sp.	15:46:41	32.919	118.025
27-Jul	1	California sea lion	16:00:44	33.012	117.601
27-Jul	110	Short-beaked common dolphin	16:13:18	33.15	117.519
27-Jul	60	Short-beaked common dolphin	17:05:17	33.186	117.951
27-Jul	150	Common dolphin sp.	17:21:23	33.265	117.615
27-Jul	10	Risso's dolphin	17:25:03	33.274	117.592
27-Jul	100	Common dolphin sp.	17:31:13	33.365	117.743
27-Jul	200	Common dolphin sp.	17:43:01	33.392	117.934
27-Jul	8	Unidentified dolphin	17:52:08	33.345	117.689
27-Jul	300	Unidentified dolphin	17:54:16	33.283	117.639
27-Jul	1	Harbor seal	18:03:46	33.041	117.427
27-Jul	300	Unidentified dolphin	18:07:41	32.938	117.347
27-Jul	30	Unidentified dolphin	18:08:02	32.929	117.34
27-Jul	40	Unidentified dolphin	18:10:02	32.877	117.3
27-Jul	1	California sea lion	18:11:09	32.857	117.265
28-Jul	200	Unidentified dolphin	14:14:58	32.894	117.29
28-Jul	35	Common dolphin sp.	14:15:10	32.898	117.293
28-Jul	6	Risso's dolphin	14:20:33	33.029	117.397
28-Jul	80	Unidentified dolphin	14:21:30	33.05	117.414
28-Jul	5	Risso's dolphin	14:22:21	33.073	117.431
28-Jul	60	Unidentified dolphin	14:25:51	33.161	117.495
28-Jul	75	Unidentified dolphin	14:28:01	33.169	117.501

SOCAL July 09 Species List

Date 2009	Estim. Group Size	Species Identification	Initial time	Latitude ˚N	Longitude ˚W
28-Jul	60	Common dolphin sp.	14:29:24	33.173	117.504
28-Jul	15	Possible bottlenose dolphin	14:30:38	33.177	117.507
28-Jul	1	California sea lion	14:45:10	33.181	117.51
28-Jul	250	Common dolphin sp.	14:48:45	33.185	117.514
28-Jul	25	Common dolphin sp.	14:59:16	33.189	117.517
28-Jul	1000	Common dolphin sp.	14:59:29	33.193	117.52
28-Jul	50	Common dolphin sp.	15:17:12	33.197	117.523
28-Jul	350	Long-beaked common dolphin	15:34:33	33.201	117.527
28-Jul	10	Unidentified dolphin	15:58:28	33.206	117.53
28-Jul	1	Fin whale	16:12:50	33.21	117.533
28-Jul	80	Common dolphin sp.	16:58:07	33.214	117.536
28-Jul	11	Risso's dolphin	17:03:34	33.218	117.539
28-Jul	40	Common dolphin sp.	17:13:11	33.222	117.543
28-Jul	130	Common dolphin sp.	17:41:03	33.227	117.546
28-Jul	25	Common dolphin sp.	17:47:36	33.231	117.549
28-Jul	35	Long-beaked common dolphin	17:55:43	33.235	117.553
28-Jul	7	Risso's dolphin	18:00:06	33.239	117.556
28-Jul	5	Risso's dolphin	18:06:23	33.244	117.56
28-Jul	37	Long-beaked common dolphin	18:08:42	33.248	117.563
28-Jul	3	California sea lion	18:13:15	33.252	117.567
28-Jul	25	Common dolphin sp.	18:13:30	33.257	117.571
28-Jul	1	California sea lion	18:21:21	33.261	117.575
28-Jul	1	California sea lion	18:21:38	33.265	117.58
29-Jul	4	Risso's dolphin	13:28:22	33.269	117.585
29-Jul	100	Common dolphin sp.	13:30:56	33.271	117.591
29-Jul	8	Risso's dolphin	13:39:59	33.269	117.596
29-Jul	95	Common dolphin sp.	13:43:17	33.267	117.602
29-Jul	2	Risso's dolphin	13:44:09	33.263	117.605
29-Jul	75	Common dolphin sp.	13:44:47	33.258	117.604
29-Jul	135	Long-beaked common dolphin	14:12:17	33.255	117.599
29-Jul	30	Common dolphin sp.	14:52:54	33.256	117.592
29-Jul	12	Risso's dolphin	14:54:50	33.261	117.589
29-Jul	100	Common dolphin sp.	14:57:50	33.263	117.594
29-Jul	40	Unidentified dolphin	14:58:06	33.262	117.599

SOCAL July 09 Species List					
Date 2009	**Estim. Group Size**	**Species Identification**	**Initial time**	**Latitude ˚N**	**Longitude ˚W**
29-Jul	20	Unidentified dolphin	15:04:25	33.264	117.603
29-Jul	70	Unidentified dolphin	15:04:50	33.268	117.603
29-Jul	20	Unidentified dolphin	15:12:01	33.271	117.598
29-Jul	8	Risso's dolphin	15:20:56	33.268	117.593
29-Jul	5	Risso's dolphin	15:22:04	33.264	117.592
29-Jul	4	Risso's dolphin	15:27:39	33.261	117.595
29-Jul	600	Unidentified dolphin	15:31:53	33.261	117.6
29-Jul	50	Unidentified dolphin	15:32:50	33.265	117.602
29-Jul	1	Blue whale	15:34:45	33.269	117.599