AERIAL SURVEYS CONDUCTED IN THE SOCAL RANGE COMPLEX FROM 01 AUGUST 2012 TO 31 JULY 2013

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Cover Photo: Blue whale (*Balaenoptera musculus)* photographed 26 July 2013 by B. Würsig under NMFS permit 14451.

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Acronyms and Abbreviations

$\bar{x}$	statistical mean
Bf	Beaufort sea state
BL	body length(s)
DoN	Department of the Navy
DSLR	digital single-lens reflex
ft	foot/feet
FY	fiscal year
GPS	global positioning system
HD	high definition
hr	hour(s)
ICMP	Integrated Comprehensive Monitoring Program
km	kilometer(s)
kt	knot(s)
m	meter(s)
MC	mother-calf
MFAS	mid-frequency active sonar
min	minute(s)
mm	millimeter(s)
mp	megapixel(s)
MTE	major training events
N	number of samples (sample size)
NAOPA	Northern Air Operating Area
NMFS	National Marine Fisheries Service
NAVFAC	Naval Facilities Engineering Command
nm	nautical mile(s)
OBS	Observer
SAG	Scientific Advisory Group
SCB	Santa Catalina Basin
SCI	San Clemente Island
SD	standard deviation
se	standard error
SES	Smultea Environmental Sciences
SNB	San Nicolas Basin
SOAR	Southern California Anti-Submarine Warfare Range
SOCAL	Southern California Range Complex
SMSMP	SOCAL Marine Species Monitoring Plan
U.S.	United States
VPUE	vessels per unit effort

Introduction

The main text of this report summarizes two aerial surveys conducted in March and May 2013 during fiscal year (FY) 2013 between 01 August 2012 and 31 July 2013 on the United States (U.S.) Navy's Southern California (SOCAL) Range Complex. In addition, a preliminary report for a third aerial survey conducted in late July 2013 is discussed separately in Appendix G of this report. This was the fifth FY in which aerial surveys were conducted to obtain baseline data on the occurrence and behavior of marine mammals in the SOCAL. The 2013 monitoring program addressed directives identified in the U.S. Navy's SOCAL Marine Species Monitoring Plan (SMSMP) (Department of the Navy [DoN] 2012a), Integrated Comprehensive Monitoring Program (ICMP) (DoN 2010) and the Scientific Advisory Group's (SAG) recommendations (Department of the Navy [DoN] 2011). Such baseline data are needed to assess future potential changes in these parameters (or lack thereof) relative to various received sound levels from mid-frequency active sonar (MFAS) and underwater detonations, and other major training event (MTE) activities.

Unlike in past years, surveys in FY 2013 did not overlap with any MTEs and occurred only in the Northern Air Operating Area (NAOPA [Santa Catalina Basin]) and the Southern California Anti-Submarine Warfare Range (SOAR [San Nicolas Basin]). The primary goals for the FY 2013 aerial surveys were:

1. Conduct up to three aerial visual survey efforts of up to 40 hours (hr) each using line-transect methodology to obtain data suitable for estimating the winter-spring abundance and density of marine mammals.
2. Conduct opportunistic focal behavior follows of priority species of marine mammals, focused on federally-listed species and beaked whales (if seen), but also delphinids.

Methods

Visual survey methods consisted of protocols implemented during aerial-survey monitoring efforts conducted in the SOCAL during 15 previous aerial surveys (e.g., Smultea and Lomac-MacNair 2010, Smultea et al. 2011a,b,c,d, Smultea and Bacon 2012). Surveys typically started by following systematic line-transects flying at 1,000 feet (ft) altitude and 100 knots air speed. When a sighting occurred, species, group size and minimum number of calves were recorded, along with the first-observed behavior state, heading (degrees magnetic), and minimum and maximum dispersal distance (in estimated body lengths) between nearest neighbors within animal subgroups. Sightings were often subsequently circled for several minutes (min) as needed to confirm species and group size and composition including with photographs, primarily on systematic survey lines but also for whales and unusual sightings. If conditions were suitable (e.g., Beaufort sea state (Bf) <3-4, no low clouds) priority species were circled for at least 10 min at altitude 1,200-1,500 ft and radial distance 500-1,000 meters (m) to conduct focal behavior follows using videography. Focal follow behavior was recorded at approximately 1-min intervals and included behavior state, minimum and maximum dispersal distance, and heading. In addition, behavioral events and times were recorded for large whales (e.g., blow, dive, fluke up, breach, etc.), and were attributed to recognizable individuals as possible.

Effort was divided into "on-effort" (at least one observer searching for animals) and "off-effort" (no observers searching; e.g., while flying over land, or while clouds obscured viewing). The "on-effort" category was further divided into "on line-transect effort" and by leg type (systematic line-transect, connectors [short lines connecting systematic transect lines], transit, random, and circling modes [during "focal follow" and "identify" modes]) (for detailed definitions see Smultea and Bacon 2012).

Surveys were flown from a fixed-wing, twin-engine, Partenavia Observer (OBS) or P68-C, equipped with center-seat bubble windows and one porthole opening in the right or left window at the rear bench seat (tail identification numbers N6602L and N300LF, respectively, www.aspenhelicopters.com). These same aircraft models have been used in the past SOCAL aerial surveys/monitoring (e.g., Smultea and Bacon 2012). Photographs were taken through the opening window by the data recorder in the rear seat to confirm species as needed by breaking from line-transect effort for several minutes then returning to the transect line. Photographs were prioritized for sightings made during systematic line-transect effort given flight range/time restrictions and 2013 survey goals.

Two different high-definition (HD) still cameras were used during this survey. The primary camera was a Nikon D800 digital single-lens reflex (DSLR) camera, 36.3 megapixel (mp) FX-format CMOS, with an 80-400 millimeter (mm) f4.5-5.6 autofocus lens with image stabilization. The backup camera was a Canon EOS 7D equipped with a 100-400 mm lens. Two different HD video cameras were used. For the March 2013 survey, a Sony HDR-XR55OV with internal stabilization and a 37-mm lens was used. For the second survey, a Sony HDR-PJ79OV video camera was used. This camera has advanced stabilization features that greatly improved the quality of video by significantly reducing vibrations caused by the aircraft and/or weather conditions. A chest pod was also used to improve stabilization.

High-resolution (36-mp) photographs usually allowed *in situ* preliminary identification and subsequent confirmation of short- vs. long-beaked common dolphins, and other whale and dolphin species preliminarily unidentified. In the field, digital photos were examined right after circling of the sighting to determine if they were adequate to identify species; if they were not (e.g., due to animals insufficiently above the water surface), circling was continued to obtain more photos. The latter was typically accomplished within 2-5 min. Species confirmation of common dolphins required that most of the animal's body be clearly visible above the waterline, particularly the head and rostrum, in good lighting and Bf conditions. Photographs were later examined in detail by a species expert (Dr. Tom Jefferson, Clymene Enterprises) who confirmed species as possible. Photographs were not typically taken for species easily confirmed visually in the field (e.g., fin whales, Risso's dolphins and gray whales, respectively identified in the field by the right white jaw, conspicuous white coloration, and conspicuous gray-mottling coloration).

Since spring 2012, Mysticetus Observation Platform software, (Entiat River Technologies, www.mysticetus.com), has been used to collect and display data in real-time on a bathymetric map. This program improves efficiency of data collection by providing real-time distance and bearing to a sighting by synthesizing real-time Global Positioning System (GPS) data with declination angles (converted to distance) and sighting times. This feature is critical in helping the pilots relocate sightings quickly, even in higher Beaufort conditions when sightings are typically difficult to re-find. Relative locations of the sighting to the aircraft were continuously displayed on the laptop screen and adapted to changing distances and headings of the aircraft. The recorder communicated to the pilots how to adjust the flight pattern to relocate the sighting.

The primary exceptions to past survey protocols were:

1. One of the digital still cameras used during both surveys was a relatively new model as described above.
2. In addition, during the May survey, a new model of Sony HD video camera with a significantly improved internal stabilization feature was used (see above).
3. A blue tooth (i.e., wireless) Global-Sat BT368i mini Global Positioning System (GPS) was placed on the front dash of the aircraft to transmit GPS data to Mysticetus Observation Software (Mysticetus) running on a laptop personal computer at the rear bench seat. In 2012, a mini GPS attached to the laptop (i.e., non-wireless) was used to transmit GPS data directly into Mysticetus.

Results

The following subsections start with a summary of general results with respect to marine mammal sightings for the two aerial surveys conducted in March and May 2013. Similar to all past monitoring surveys in 2008-2012, no sea turtles were seen and they are thus not further addressed. This section is followed by a short overview of density and abundance results then selected behavioral results, the latter which includes some of the July 2013 results. Funding for selected focal follow analyses was limited. To maximize the utility of this funding, we instead combined selected analyses of particular group compositions and/or species.

Effort and Sightings

25-30 March

A total of 10 survey flights were flown on 6 days during 25 through 30 March 2013. Thus, two flights were made per day except on 26 and 27 March when 1 flight was made due to unfavorable weather conditions; morning flights were curtailed by a heavy low marine fog layer (**Appendix C**). A total of 25.4 hr or 4,923 kilometers (km) (2,658 nautical miles [nm]) of flight time from "wheels up" to "wheels down" was flown over 5 days in the Santa Catalina Basin (SCB) east of San Clemente Island (SCI) and 1 day in the San Nicolas Basin (SNB) west of SCI. (An additional approximate 3 hr was used to ferry the aircraft back and forth from Oxnard to San Diego, plus approximately 1.3 hr of engines-on time on the runway [i.e., waiting in line to take off from the Montgomery Airport]) (**Appendix C**). Observers were on watch for 94 percent of the 34.5 hr of in-air time during systematic line-transect, transit, random, connector, and circling effort (the remaining 6 percent of time was over land between the airport and the water's edge) (**Appendix C**) (see Smultea and Bacon 2012 for detailed protocol and definitions). The total hours and flight descriptions for each day by date are listed in **Appendix C**.

The March 2013 survey was the seventh SOCAL aerial monitoring effort conducted during the cold-water (November-April) winter period (three occurred in 2011 and three in 2012, Smultea and Bacon 2012). A total of 180 sightings of an estimated 14,173 individual marine mammals representing at least 11 species were recorded over the 6 survey days (**Appendix C**). Most sightings (*n*=36, or 20 percent) and individuals (*n*=6,260, or 44 percent) were common dolphins (*Delphinus* sp.). The California sea lion (*Zalophus californianus*) was the second-most frequently seen species in terms of number of sightings (*n*=34, or 19 percent). Unidentified whale and dolphin sightings occurred primarily during transits to and from the survey area when we did not have enough time to circle to identify species. **Appendix C** provides a list of all aerial survey sightings and their GPS locations. A dead gray whale (*Eschrichtius robustus*) was seen on 29 March 2013 approximately 4 km west of La Jolla (**Appendix A**). The dead gray whale sighting was reported by the lead field biologist (M. Smultea, SES) to HDR, who forwarded the information on to the U.S. Navy this was then passed on to NMFS.

22-26 May

This aerial survey was scheduled for 22 – 27 May; however, due to inclement weather on May 27, no flights occurred on that day. Two flights were conducted on 5 survey days (**Appendix C**). A total of 30.1 hr or 5,645 km (3,048 nm) of flight time from "wheels up" to "wheels down" was flown over the 5 days in the Santa Catalina Basin (SCB) east of San Clemente Island (SCI) and 2 days in the San Nicolas Basin (SNB) west of SCI. An additional ~3 hr was used to ferry the aircraft back and forth from Oxnard to San Diego, plus 1.3 hr of engines-on time not over water (see above) (**Appendix C**). Observers were on-watch for 94 percent of the total in-air time during systematic line-transect, transit, and circling effort (the remaining 6 percent of time was over land between the airport and the water's edge) (**Appendix C**). The total hours and flight descriptions for each day by date are listed in **Appendix C**.

A total of 205 sightings of an estimated 7,693 individual marine mammals representing at least 10 species were recorded over the 5 survey days (**Appendix C**). Most group sightings (*n*=102 or 50 percent) were California sea lions, followed by common dolphins (*n*=29 or 14 percent) then Risso's dolphins (27 or 13 percent). However, the common dolphin sp. was the most frequently seen species in terms of number of individuals (*n*=4,160 or 54 percent) followed by the long-beaked common dolphin (*n*=2,150 or 28 percent) then the Risso's dolphin (*n*=354 or 5 percent). **Appendix C** provides a list of all sightings and their GPS locations.

Comparison of March and May 2013 Surveys

When results of the March 2013 (4,923 km [2,658 nm] of flight effort) and May 2013 (5,645 km [3,048 nm] of flight effort) aerial surveys were compared with one another and with past surveys during a similar time period, some differences were noted, including a number of unusual sightings relative to time of year, as summarized below.

- The Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) was seen once during the May 2013 survey. We last saw this species during an aerial survey in SOCAL in May 2010. The 2013 sighting consisted of a single Pacific white-sided dolphin mixed with 25 Risso's dolphins (*Grampus griseus*) including young Risso's calves (**Appendix A**). Since 2008, there have been a total of 21 Pacific white-sided dolphin groups totaling an estimated 603 individuals. During the cold-water season (November-April), there were 17 sightings and during the water-water season (May-October) only four sightings, including this May sighting.
- The northern right whale dolphin (*Lissodelphis borealis*) was seen three times during the March 2013 survey and once during May 2013; this species has been seen previously only during our cold-water season surveys (seven in 2011 and two in 2012). The May 2013 sighting consisted of two northern right whale dolphins swimming in a close mixed-species association (within one body length [BL]) with a group of approximately 10 individual short-beaked common dolphins (*Delphinus delphis*) (**Appendix A**).

- During past surveys, we have previously seen gray whales only during the cold-water season: in 2011 we had five sightings in February, five in March and four in April; 32 sightings in late January-early February 2012; and 24 sightings in March 2013. May 2013 was the first time that we have seen gray whales during the warm-water season (**Appendix A**). In May 2013, we saw two groups of mother/calf (MC) pairs with which we conducted focal behavior follows and obtained video. These two sightings were made 56 and 76 km west of the California coast.
- Two species seen during the March 2013 survey were not observed in May: the minke whale (*Balaenoptera borealis*) (10 sightings in March 2013) and humpback whale (*Megaptera novaeangliae*) (five sightings in March 2013) (**Appendix A**). The last minke whale sighting we made was in March 2012, and the last humpback whale was seen in our March-April 2012 aerial monitoring survey.
- For only the second time since 2008, a blue whale (*Balaenoptera musculus*) MC pair was sighted (**Appendix A**). This pair was seen approximately 12 km west of the mainland coast off Mission Beach. Our first blue whale MC sighting occurred on 02 August 2010, about 50 km west of Oceanside. We have recorded 66 sightings of 103 individual blue whales during our 2008–2013 aerial surveys to-date. Three percent (*n*=2 of the total 66 groups) of those sightings consisted of a calf. Blue whales were not seen during the March 2013 survey. The last blue whale sighting during SOCAL aerial surveys was recorded in May 2011.
- One species not seen during the 2011 or 2012 surveys was observed on 27 March 2013: the northern elephant seal (*Mirounga anguristoris*) (one sighting). The last time we identified this species during SOCAL aerial monitoring was in September 2010.
- In March 2013, there were more individuals (*n*=14,172 during 4,923 km of observation effort) seen than in May 2013 (*n*=7,693 during 5,645 km of observation effort). More groups were recorded in May (*n*=205) than in March (*n*=179).
- Ocean sunfish (*Mola mola*) were more prevalent during the March survey (*n*=154) than May (n=77) (**Appendix C**).
- During 2013, we encountered common dolphins more frequently near the shore. Nearly all these sightings occurred while transiting from Montgomery Airport in San Diego to the systematic survey lines, near the pier at the Scripps Institution of Oceanography over the La Jolla and Scripps canyons (otherwise, we typically do not survey closer than about 17 km from the coastline where the endpoint of our easternmost survey line is located).
    - During the March and May 2013 surveys, 15 groups of 2,189 individuals were identified within 5.8 km of the shore (range 1.1 km [0.6 nm] to 5.8 km [3.1 nm]).
    - In March 2013, 11 groups of 1,639 individuals were seen from 1.8 km (1 nm) to 5.8 km (3.1 nm) from the coast.
    - In May 2013, 4 groups of 550 individuals were seen from 1.1 km (0.6 nm) to 5.1 km (2.8 nm) from the coast.
- In March and May 2013, we saw relatively fewer fin whales *(Balaenoptera physalus*) than we have seen at similar periods during past years, taking into account the relative effort.

- o Nine groups of 16 individual fin whales were seen in March 2013 (4,923 km (2,658 nm) of observation effort) compared to 23 groups of 40 individuals in March 2012 (3,233 km (1,746 nm) of observation effort).
- o Six groups of 8 individuals were seen in May 2013 (5,645 km (3,048 nm) of observation effort) compared to 9 groups of 30 individuals in May 2011 (4,902 km (2,647 nm) of observation effort) (the last survey conducted during the month of May).
- o During the three 2012, we saw 46 groups of 82 individuals (13,733 km (7,415 nm) of observation effort) compared to the 15 groups of 24 fin whales seen in 2013 (10,568 km (5,706 nm) of observation effort).
- o These differences could be related to natural variability, oceanographic differences, differences in geographical regions surveyed, sample size, or other factors. Further analyses would be needed to assess if these differences are potentially statistically different, and/or if sample sizes are sufficiently large to do this.

- On May 24, a pair of Risso's dolphins was seen possibly mating. Social/sexual behaviors were confirmed in photographs (**Appendix A**).
- A mixed-species sighting of Risso's dolphin MC pairs and a Pacific white-sided dolphin was photographed on 24 May 2013 (**Appendix A**). The entire sighting consisted of approximately 25 Risso's dolphins and one observed Pacific white-sided dolphin. This was the first time since 2008 that we have seen Risso's dolphins swimming with the Pacific white-sided dolphin.
- A group of 10 short-beaked common dolphins was in a mixed-species association with two northern right whale dolphins on 25 May 2013 (**Appendix A**). This was the first time since 2008 SOCAL aerial surveys that we have seen these two species swimming together.

Other Species Sightings

In addition to marine mammal sightings, all sightings of ocean sunfish and other non-marine mammals were recorded. These sightings are excluded from the overall sighting counts for marine mammals. Consistent with our past SOCAL aerial surveys, no sea turtles were seen. The most frequently seen non-marine mammal species was the ocean sunfish (see **Appendix C**). All ocean sunfish sightings have been consistently recorded since March 2011. During the two 2013 surveys, 231 ocean sunfish were observed (**Appendix C**). The highest number of individuals occurred in March (n=154) followed by May (n=77). Relative effort during these periods is summarized in **Appendix C**. Other non-marine mammal animals seen during the line-transect surveys included five sightings of solitary sharks and 4 groups of fish bait balls and 3 fish schools (a bait ball herein refers to small fish swarming in a tightly packed spherical shape while a school refers to fish (not necessarily small fish) swimming in a more dispersed, coordinated manner in the same direction) (**Appendix C**). Minimal information was recorded for such sightings to avoid compromising effort focused on searching for marine mammals and sea turtles.

Vessel Sightings

A total of 244 vessels were counted and are summarized in **Appendix A**, Table A-13. Vessel types in descending order of frequency included non-U.S. Navy vessels (n= 79 or 84 percent), U.S. Navy vessels (*n*=9 or 12 percent), U.S. Navy aircraft (*n*=1 or 1 percent), (**Appendix B**, Figure B-24). Based on the 11,384 km of associated systematic effort in 2011 and 2012, the overall number of vessel/aircraft per unit effort (VPUE) was 0.02 vessels per km flown (**Appendix A**, Table A-14). The VPUE of U.S. Navy vessels was 0.03 per km flown. No boats or aircraft were seen west of SCI (**Appendix B**, Figure B-24). In particular, high concentrations of vessels occurred off Silver Strand, just outside San Diego Harbor, and near Avalon, Santa Catalina Island (**Appendix B**, Figure B-24).

Photography/Videography

Over 3,361 digital photographs were taken during 152 (27 percent) of the 556 total sightings made during the March and May aerial surveys in 2013 (**Appendix C**). As indicated previously, photographs were taken primarily of unusual/rare sightings and unidentified species to confirm or verify species as possible, focusing on periods of systematic line-transect effort rather than transit periods (see Methods above). Species photographed during the three surveys were the blue whale, bottlenose dolphin (*Tursiops truncatus*), California sea lion, common dolphin sp., fin whale, gray whale (including one dead gray whale), humpback whale, long-beaked common dolphin (*Delphinus capensis*), minke whale, northern right whale dolphin, Pacific white-sided dolphin, Risso's dolphin, and short-beaked common dolphin (**Appendix C**). Of the total 5,603 photographs, approximately 1,741 digital photographs were taken during the March survey (52 percent), and 1,620 during the May survey (48 percent).

During the two 2013 aerial surveys, a total of 371 min of video was taken during focal behavior follows; this is the preliminarily total considered useable for behavioral analyses based on initial video review (**Appendix C**). Video included footage of systematic observations of the behavior of blue whales, fin whales, Risso's dolphins, northern right whale dolphins, gray whales, a minke whale, a humpback whale, and foraging common dolphin sp. using focal behavioral protocol. Approximately 146 min of video was taken during the March survey, about 157 min during the May survey, and 62 min of video taken during the July survey.

Density and Abundance

Density and abundance estimates of marine mammals in the survey area reported by Jefferson et al. (2012; in Smultea and Bacon 2012) were updated to incorporate results of our two 2013 surveys conducted in March and May. The March data were used for updated cold-water season density and abundance estimates and the May data were used for updated warm-water season density and abundance estimates. These analyses are provided in Appendix F. Data from the third 2013 SOCAL aerial survey conducted in late July will be incorporated and updated this fall into the warm-water season estimate reported in Appendix F.

Summary of Behavioral Analyses

Based on limited funding, we selected a subset of behavioral data to analyze from the 2013 sightings, including the July 2013 survey. Past analysis funding has focused on first-observed behaviors, Risso's dolphin focal follow group behaviors, and Resource Selection Function studies (Smultea and Bacon 2012). Thus, we focused behavioral analyses here on a "case study" type approach to demonstrate the types of analyses that can be done with the currently unanalyzed focal-follow database from whales and dolphins we have collected in SOCAL. These include:

- A case study analysis of the behavior of a MC blue whale pair during a focal follow as documented with video, photographs, and systematic collection of selected behavioral parameters (e.g., respiration rates, dive times, etc.). In addition, we selected some parameters specific to MC pairs (e.g., back riding, nursing, indices of proximity and location of calf relative to the mother, etc.).
- A summary of blue whale behavior and movements based on 5 sightings made during July 2013. This summary includes maps of whale sighting and plane tracks, illustration of the first known successful photo-identification of a blue whale individual from an aircraft, and two focal follows of two different lone blue whales. One of the latter focal follows occurred in the vicinity (closest observed distance about 1.5-5 km) of a U.S. Navy guided-missile frigate (USS McClusky [FFG 41]).

Case Study 1: Analysis of the behavior of a blue whale mother and calf focal follow

The following summary provides an example of the types of detailed behavioral analyses that can be done with the focal follow data we have been collecting in SOCAL since 2008, using focal follow protocol documented with video and audio descriptions (described in Smultea and Bacon 2012). We selected a blue whale MC pair here because of the species' endangered status, the presence of a calf, and the before/during/after close approach by a small vessel. We have unanalyzed data from six more of such focal follows involving whale MC, including two additional blue whale, one fin whale, and two gray whale MC sightings, and one group composed of four sperm whale calves (*Physeter macrocephalus*) with 20 adults. Future analyses would allow comparisons within and across these species and describe little-known behavioral patterns, particularly of MC baleen whales, including respiration rates, dives, behavior state durations, frequency of behaviors, dispersal distances between individuals, nursing, back riding, etc. These variables may change upon exposure to anthropogenic or other potential stressors.

The case study starts with a brief overall summary description of the focal session, followed by a summary of the quantitative approach and results including tables, and ends with a brief concluding discussion.

Descriptive Summary

The blue whale MC was observed for a total of 54 minutes from 8:24 to 9:18 Pacific Standard Time on 24 May 2013 about 12 km west of Mission Beach, over waters with a bottom depth of about 1,064 m. The calf was estimated to be a little over about one-half the BL of the mother (**Figure 1**). The MC were first seen when a small recreational vessel (about 5-6 m long) was about 2 km away. The vessel subsequently passed about 1-1.5 km away and continued on its path. A second small recreational vessel was then seen about 1.5 km away from the blue whales and about 2-3 km behind the first vessel. This second vessel approached the MC to within about 15 BL at which time it stopped, remaining within 10-15 BL of the MC for about 5 min. The vessel then sped up and moved away, continuing on its path.

During the focal follow, the MC remained visible at or just below the surface for much of the time, the calf breathing more frequently than the mother. When the second vessel first approached the MC, the mother was between the calf and the vessel. The calf then moved between the mother and the vessel and approached the vessel. The calf then returned to the mother, remaining between the mother and the vessel. When the vessel picked up speed and took off, the calf quickly swam ("sprinting" with white water created) away from the vessel and the mother to the largest observed dispersal distance of approximately 2 BL from the mother (on the opposite side of the vessel). The calf remained at the surface during this time. About 9 sec after the vessel had moved away, the calf returned to within 0.1 BL of the mother and remained within 0.1-1 BL until we left the MC approximately 9 min later. Over the total 54 min of focal observations, the latter incident was the fastest swim observed from the calf and the farthest dispersal distance of the calf from the mother.

Quantitative Approach

This focal follow allowed detailed behavioral observations to be collected and documented with a Sony HDR-PJ79OV HD video camera. The focal behavior protocol and ethogram applied for the focal follow are described in Smultea and Bacon (2012). In total, four video clips were recorded totaling 38.38 min of footage, 31.13 min (81 percent) of which were deemed "usable" (defined as when at least one individual was in view either at or below the surface with BL and behavior state discernible [**Table 1**]). The video footage provided information on a number of behavioral metrics of the MC. We were also able to investigate the effect of a small vessel on the whales' behavior. Video clips were divided into "vessel present" or "vessel absent" based on whether or not the vessel was visible in the video clip at the same time as the whales (i.e., within about 15-20 BL of a whale). The vessel was a small recreational vessel (approximately 5-6 m long) opportunistically seen near and apparently deliberately approaching the focal whales. Over the course of the observations the vessel was first seen about 1.5 km away from the whales, subsequently approached the whales to within approximately 10-15 (mother blue whale) BL, stopped, then moved away.

We quantified behaviors with four behavior metrics and also investigated the presence of the vessel on each metric. These included the (1) percentage of time in view, (2) dispersion distance (in BL) between the mother and the calf, (3) mean blow interval, and (4) position of the calf relative to the mother. Some of these metrics have been previously applied to studies of South Atlantic right whale (*Eubalaena australis*) MC (e.g., Taber and Thomas 1982, Thomas and Taber 1984) and bowhead whales (*Balaena mysticetus*) (e.g., Würsig et al. 1984, 1989, Richardson et al. 1985a,b, 1995). Behavior metrics from Video 1 (when the vessel was absent) were compared to the behavior metrics in videos two and three (vessel present). We estimated the dispersion of the calf from the mother in approximate BL of the mother at 30-sec intervals using instantaneous sampling methodology following the protocol of Thomas (1986). We followed the same protocol when looking at the relative position of the calf, indicating at 30-sec intervals which quarter of the mother's body the calf was positioned in. Quarter 1 was defined as to the forward right of the mother, Quarter 2 to the right rear of the mother, Quarter 3 to the left rear of the mother and Quarter 4 to the forward left of the mother. The 30-sec intervals were treated as samples. The percentage of 30-sec samples that the calf spent in each quarter was determined as well as the percentage of 30-sec samples that the calf was either out of view in the glare or assumed to be below the mother. Blow intervals were defined as the time between successive blows within a single surfacing event allowing a mean blow interval to be calculated for each whale using continuous, all-event sampling (Altmann 1974, Würsig et al. 1985, 1989, Richardson et al. 1985a,b). The effect of the vessel on dispersion and blow interval was investigated with a Wilcox Mann-Whitney U test. A Fishers exact test was used to determine whether the presence of the vessel influenced on which side of the mother the calf was recorded.

Results

Percentage of time in view: The mother was in view for 96.8 percent of the usable video footage and the calf was in view for 74.7 percent of the usable footage. The whales were together in view for 71.2 percent of the usable footage (**Table 2**). With the presence of the small vessel (i.e., vessel presence) the percentage of time that the calf was in view increased by ~15 percent; however, there was little change in the percentage of time that the mother was in view (**Table 2**). Overall, both whales were in view for 63.3 percent of the time when no vessel was present and 74.6 percent of the time during vessel presence.

Dispersion: The dispersion between the MC ranged from 0 to 2 BL. The overall mean dispersion was 0.32 BL (**Table 3**). In the absence of the vessel the dispersion ranged from 0-1 BL and the mean was 0.30 BL. In comparison, when the vessel was present maximum MC dispersion increased to 2 BL while the mean MC dispersion increased slightly to 0.36 BL (**Table 3**). Based on the small sample size, the presence of the vessel had no detectable effect on the mean dispersion distance between the whales (*Wilcoxon test = 704, p-value = 0.459*).

Blow Intervals: The overall blow interval for the mother was 1.42 min compared to 0.43 min for the calf (**Table 4**). The mean blow interval of the mother decreased from 2 min to 1.19 min with vessel presence. In contrast, for the calf, the mean blow interval increased from 0.25 min to 0.58 min with the vessel presence (**Table 4**). Vessel presence had no detectable effect on the blow interval of the mother whale (*Wilcoxon test = 8, p-value = 0.381*). However, vessel presence led to a nominally significant increase in the blow interval of the calf (*Wilcoxon test = 6, p-value = 0.002*). These results should be considered preliminary as they are limited by small and unequal sample sizes between treatments. There is also an issue of statistical independence, as the Wilcoxon Mann-Whitney U test assumes independent samples.

Calf position relative to the mother: The calf position relative to the mother was determined for 78 30-sec samples in 38.38 min of video. The calf was out of clear view of the observers below the water surface in 44.9 percent (35) of the 78 samples. During these periods, the “outline” or “shadow” of the calf’s body was often visible below the water surface next to the mother. On three occasions during such times the calf was presumed to be nursing based on its orientation and position relative to the mother’s peduncle area and its last and next-seen position close to the mother at the water surface (nursing was identified based on previous experience of the observers). The calf was in view in 55.1 percent of the samples and was positioned on the left side of the mother in the majority of these samples (**Table 5**). The presence of the vessel did not affect the position of the calf relative to the mother *(Fisher exact test p-value = 0.079*). Overall, the calf was recorded in the rear left quadrant (quarter 3) of the mother whale in 30.8 percent of the samples. Notably, the calf was observed riding the back of the mother on four separate occasions as described in Würsig et al. (1999) for bowhead whale MC pairs.

Photo 1. Blue whale mother/calf pair followed for a focal session described in the text. Photographed 24 May 2013 by D. Steckler under NMFS permit 14451.

Table 1. Summary of video footage time including the usable time from which the behavior metrics were calculated for the mother-calf blue whale.

Video	Vessel presence	Total time (min)	Time not useable (min)	Usable (min)
1	no	12.6	2.17	10.43
2	yes	12.6	3.30	9.30
3	yes	12.6	1.78	10.82
4	unknown	0.58	0.00	0.58
Total		**38.38**	**7.25**	**31.13**

Table 2. Summary of the percentage of time that the mother and calf blue whales were visible in the usable video footage.

	Total time mother in view (min)	Total % mother in view	Total time calf in view (min)	Total % calf in view	Total time both in view together (min)	Total % both in view
Without vessel	10.43	100.00	6.60	63.26	6.60	63.26
With vessel	19.12	95.05	16.06	79.85	15.00	74.55
Total	**30.14**	**96.80**	**23.25**	**74.67**	**22.18**	**71.24**

Table 3. Summary of the inter-individual dispersion distances (estimated in mother body lengths) between the mother and calf blue whale overall and in the presence and absence of the small vessel. Dispersion was measured at 30-second (sec) intervals when both whales were in view. N = Number of 30-sec intervals with dispersal distance sampled. se = standard error.

	N	min	max	mean	se
Without vessel	25	0	1	0.303	0.065
With vessel	51	0	2	0.355	0.063
Total	81	0	2	0.320	0.045

Table 4. Summary of the mean blow interval (in minutes) for the mother and calf blue whale, overall and in the presence and absence of the small vessel.

	Mother				Calf		
	N	x̄	se		N	x̄	se
Without vessel	2	2	0.07		8	0.25	0.19
With vessel	5	1.19	0.43		9	0.58	0.16
Total	7	1.42	0.33		17	0.43	0.09

Table 5. Position of the blue whale calf relative to the mother recorded at 30-second sampling periods in vessel presence and absence. While the calf was not in view, there were three occasions when the calf was presumed to be nursing.

Calf position	N	%	Vessel absent		Vessel present	
			N	%	N	%
Q1 -Front right	2	2.56	0	0.00	2	6.90
Q2 - Rear right	6	7.69	0	0.00	5	17.24
Q3 - Rear left	24	30.77	9	69.23	15	51.72
Q4 - Front left	11	14.10	4	30.77	7	24.14
Not in view	35	44.87	-	-	-	-
Total	78	100	13	100	29	100

Summary

Results above demonstrate that the behavior of blue whale MC pairs can be quantified using video-documentation and applying parameters used for other whale species including South Atlantic right and bowhead whales. Additional parameters newly applied were percent of time within view from an overflying aircraft and percent of time the calf spent in four quartiles of the mother's body. While observations are limited to one blue whale MC pair, results indicate that the calf's behavior changed when the vessel was at its closest approach. The calf first approached the vessel while it was stationary. When the small vessel abruptly moved away, the calf quickly swam away from it, maximizing its observed distance from the mother. Despite the small sample size, the calf also significantly decreased its blow interval when the vessel was nearby (within view on the video, i.e., within 10-15 adult blue whale BL). In contrast, the mother did not display any notable changes in behavior in the close absence or presence of the vessel. Results also demonstrate that dispersal distance is a measurable parameter that appears to be indicative of a reaction to a stimulus (in this case, the calf moved away from the vessel and the mother when the vessel began moving again).

Additional analyses of similar existing behavioral data on MC and other whales and dolphins will provide a more robust database for inter- and intra-species comparisons and comparisons relative to various stimuli (vessels, other marine mammal species, Navy vessel activities, etc.). MC pairs are a sensitive component of endangered and other populations. However, there are no known detailed or quantitative descriptions of blue or fin whale MC behavior, particularly nursing or back riding. Data reported herein and our unanalyzed MC baleen whale data contribute to critical further understanding of baseline behavior and potential effects of anthropogenic stimuli.

Behavior and movements of blue whales during the 24-29 July aerial survey

The following provides a summary of the five blue whale sightings made during the 24-29 July 2013 aerial survey. Four of the five sightings were of lone whales and one was a group of three whales (**Table 6**). One of the lone whales seen on July 24 was likely a yearling based on an estimated BL of 40-50 ft (7-15 m). Focal behavior follows were conducted on three of the five groups for periods of up to 75 min; video was obtained for 2 of these groups (**Table 6**). Four of the five groups appeared to be traveling, while the fifth group of three whales was milling. Resighting locations of three groups based on locations between each surface-dive cycle are depicted in **Figures 2-4**. These tracks indicate that two groups were generally zigzagging in the area and thus may have been deep-water foraging, though evidence of feeding was not observed.

Dive and surface durations, blow intervals, and number of blows per surface duration were calculated from focal data obtained via audio recordings, field notes, and/or video for three focal groups of blue whales (**Table 7**). These are compared with similar data collected for other blue whales in SOCAL, Monterey Bay, and the Gulf of California (Shoenherr 1991, Tershy 1992, Lagerquist et al. 2000). In general, available data indicate that blue whales foraging during daytime tend to dive longer than traveling individuals.

Descriptions of two of the three focal follows of blues whales in July 2013 are summarized below, both of which consisted of single individuals. A third sighting of three blue whales, including one smaller individual, occurred for 59 min on 26 July (**Table 6**). Video and photographs were taken of these whales that may allow differentiation of individuals and thus attribution of individual-specific dive and respiration analyses in the future.

Case Study 2: Behavior of a blue whale in the vicinity of a U.S. Navy Frigate (*USS McClusky* [FFG 41])

On 24 July 2013 a single blue whale estimated to be about 19-22 m (60 to 70 ft) was observed in the vicinity (about 3-10 km) of a U.S. Navy guided-missile frigate (USS McClusky [FFG 41]) during a 75-min focal session (**Table 6**). Communications with the Navy Technical Representative indicated that no mid-frequency active sonar was being transmitted during this focal session by the vessel, and no MTEs were occurring during the entire survey period. However, on several occasions, numerous simultaneous large spout-like splashes were seen behind the vessel, erupting in a "row." The source of these splashes was undetermined but consistently occurred within approximately 50-100 ft of the stern of the vessel.

The whale was seen surfacing between dives on six occasions. Photos were taken during three surfacing sequences (i.e., a series of short-spaced blows followed by an extended dive) while the whale was visible below the surface between blows. Later examination of the photos confirmed that the whale was the same individual based on a divot scar on the side of the whale (See **Photos 4 a-c**). A map plot of resightings of this individual between dives showed that it appeared to have a variable "zigzag" track (**Figure 2**). Dive times were calculated as lasting 4 – 16 min (**Table 7**). Based on four surfacing sequences, the mean dive duration for this individual was 12.1 min (SD ± 4.87) (**Table 7**). The three dive times over 14 min were longer for this species than we have typically observed in SOCAL. The dive times were also longer than typical dives based on a preliminary literature review of blue whale dive times off central and southern California and the Gulf of California (Shoenherr 1991; Tershy 1992, Lagerquist et al. 2000; Goldbogen et al. 2013). However, these dive durations are not out of the reported range for blue whales (Sears and Perrin 2009). Few studies have been conducted on blue whale dive times in SOCAL. Studies in the Gulf of California (Tershy 1992) and Monterey, California (Shoenherr 1991, Croll et al. 2001) determined that feeding blue whales had longer dive times (mean = 7.8 min, standard deviation [SD] = ± 1.9) compared to non-feeding blue whales (mean = 4.9 min, SD = ± 2.5) (**Table 7**) (Croll et al. 2001). The longest dive recorded by Croll et al. (1991) among seven blue whales in the Gulf of California was 14.7 min.

Case Study 3: Behavior of a single young blue whale 25 July 2013

On 25 July at 13:19 a single blue whale was followed from 13:19-13:55 (36 min) for a focal follow session. The whale was estimated to be approximately 12.2-15.2 m (40-50 ft) long. Based on this body length, we estimated that the whale was a yearling (newborn blue whales are about 6-7 m long and reach about 16 m at an age of 6-8 months when they are typically weaned (Sears and Perrin 2009)). The whale was first seen as it dove, at a location approximately 16 km from San Diego (**Figure 1**). Photographs and two short video clips were taken of the whale (**Photo 5 and Table 6**). Based on three surfacing sequences, the mean dive duration for this individual was 10.7 min (SD ± 3.13) (**Table 7**). Tracks of resights of this whale, aircraft tracklines, and field notes indicated that the whale was traveling generally north at slow to medium speed throughout the focal session. The whale was visible at or below the surface between blows, as is typical for SOCAL aerial observations of this species.

Summary

The descriptive summaries of blue whale focal follows above provide glimpses of the types of data and information that can obtained from this type of study and thus future analyses of the numerous other focal sessions we have collected on whales and dolphins in SOCAL. Data include social interactions between individuals, respiration rates, dive times, orientation rates, speeds of movement (including based on consecutive resight locations), photo-identification of at least some individuals, and nursing and back riding among cows and calves, among others. The strength of such observations including video and photos is that they allow a "bird's eye" view of individual social interactions, dispersal, and relative orientations to one another. This perspective allows some individuals, particularly MC pairs, to be tracked for extended periods of time at and just below the water's surface. Such data provide insight into the social behavioral context and spacing of individuals, factors that are known to influence the sensitivity and types of behavioral reactions, or lack thereof, to anthropogenic stimuli.

In particular, it is evident from this summary that extended focal data allowing SOCAL-specific surface and respiration data, dispersals, and orientations are lacking in the literature yet are critical to interpreting potential reactions to stimuli. A more robust and larger sample size should be analyzed from the SOCAL database, to include the over 100 focal sessions conducted from 2008-2013 on fin, blue, humpback, sperm, gray, and minke whales as well as large delphinids. These data are also important in providing a comparative baseline for other studies, including the SOCAL Behavioral Response Studies (http://sea-inc.net/socal-brs/). Nowhere else in the world is there such a detailed, media-documented database that can be used to compliment and augment important baseline information on the visually-observed behavior of offshore cetacean species in the SOCAL.

Table 6. Times and Locations of Blue Whale (Balaenoptera musculus) Sightings during SOCAL Marine Mammal Aerial Monitoring Survey 24-29 July 2013.

Date & Time	Grp. Size	Latitude (°N)	Longitude (°W)	Survey Area *	Distance from Shore (nm)	First Observed Behavior State	Initial Heading Magnetic (°) **	Duration of Sighting (min)	Focal Follow Done	Video Taken	Water Depth (ft)
07/24/2013 11:46:43	1	32.7492	-117.6343	SCB	18.4	Medium Travel	274 (W)	11	Yes	No	3,535
07/24/2013 12:35:36 ***	1	32.8429	-117.7938	SCB	25.8	Medium Travel	272 (W)	75	Yes	Yes	3,490
07/25/2013 13:19:18	1	33.1437	-117.5486	SCB	8.5	Medium Travel	328 (NW)	36	Yes	No	2,093
07/26/2013 11:54:05	3	32.6669	-117.4754	SCB	11.3	Mill	N/A	59	Yes	Yes	994
07/28/2013 15:15:21	1	32.7014	-117.8933	SCB	24.1	Rest/Slow Travel	150 (SE)	4	No	No	2,042

* SCB = Santa Catalina Basin

**W= West, NW= Northwest, SE= Southeast, N= North, N/A = Not Available

*** Photographs were taken of this individual blue whale during three separate surfacing sequences between extended dives. These photos were matched as the same individual using photo-identification techniques by matching a divot scar on the animal's side. See photos 4a,b, and c.

Table 7. Summary statistics of blue whale respiration and dive parameters based on two SOCAL 2013 aerial focal follows compared to other regional studies.

	SOCAL Blue Mom 24 May	SOCAL Blue Calf 24 May	SOCAL Aerial - Single Blue 24 July	SOCAL Aerial - Single Blue 25 July	Channel Islds., Monterey Bay, Gulf of CA (Croll et al. 1991)
No. of Whales	1	1	1	1	7
Dive Duration (min)					
Sample size (# events)			4	3	231 (33 per whale)
Mean			12.1	10.7	6.6*
Range			4.2 to 16.2	8.0 to 14.1	4.0 to 8.5**
Stand. Dev.			4.87	3.13	2.26
Blow Interval (min)					
Sample size (# events)	7	17	42	12	
Mean	1.4	0.4	0.3	0.4	
Range (min / max)			0.1 to 3.1	0.1 to 0.6	
Stand. Dev.	0.33	0.09	0.58	0.17	
Surface Duration (SD) (min)					
Sample size (# events)			5	3	
Mean			2.8	1.5	
Range			1.2 to 5.0	0.4 to 2.9	
Stand. Dev.			1.5	1.3	
No. Blows Per SD					
Sample size (# events)			5	3	
Mean			7.6	4.0	
Range			6 to 9	1 to 7	
Stand. Dev.			1.14	3.0	

* Average of median.

** Based on range of averages for 7 whales (raw data not available).

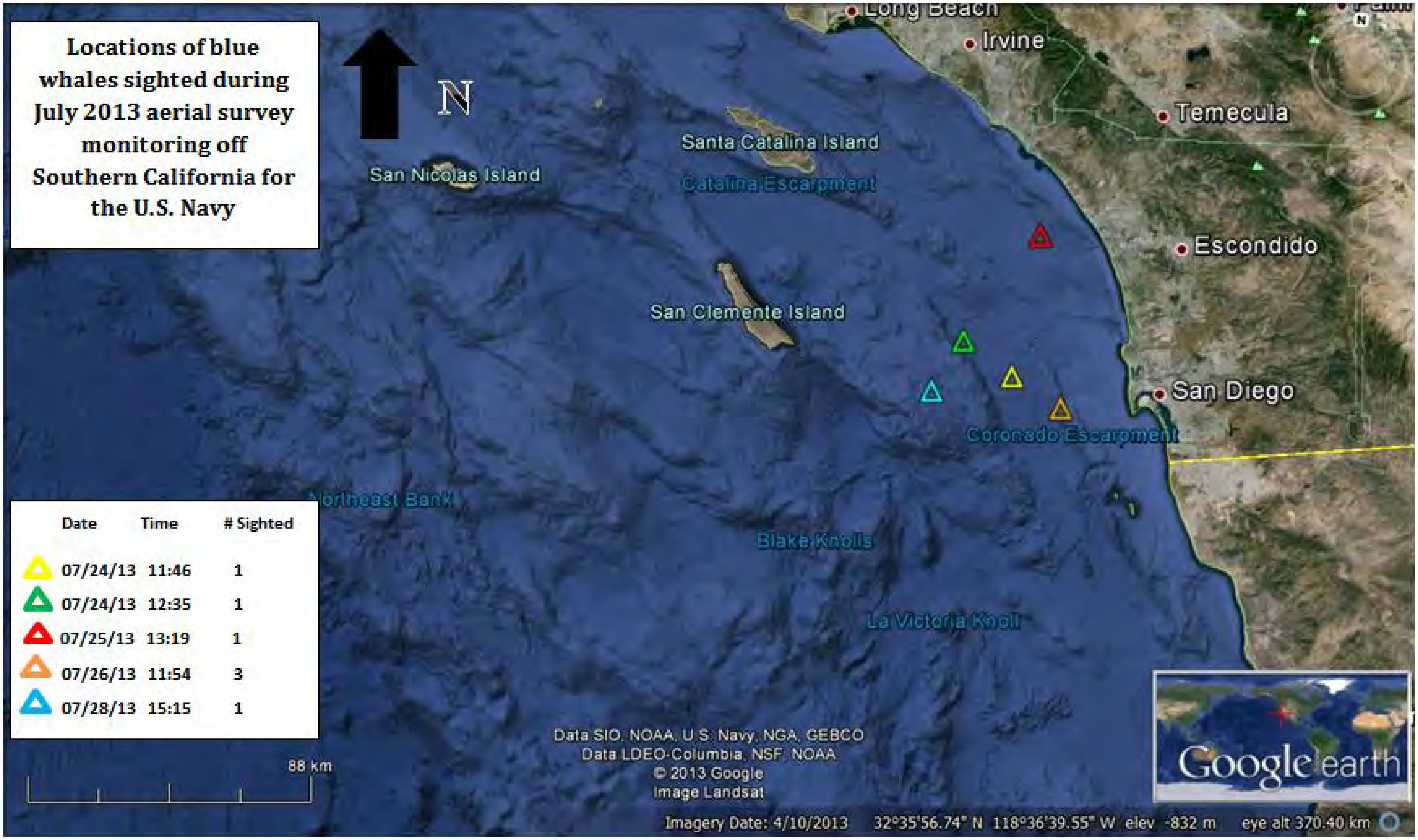

Figure 1. Locations of blue whale sightings made during 24-29 July 2013 aerial survey monitoring off Southern California for the U.S. Navy.

Photo 2. Blue whale. Photographed 24 July 2013 at 11:46 by D. Steckler under NMFS permit 14451.

Photo 3. Blue whale. Photographed 24 July 2013 at 12:35 by D. Steckler under NMFS permit 14451.

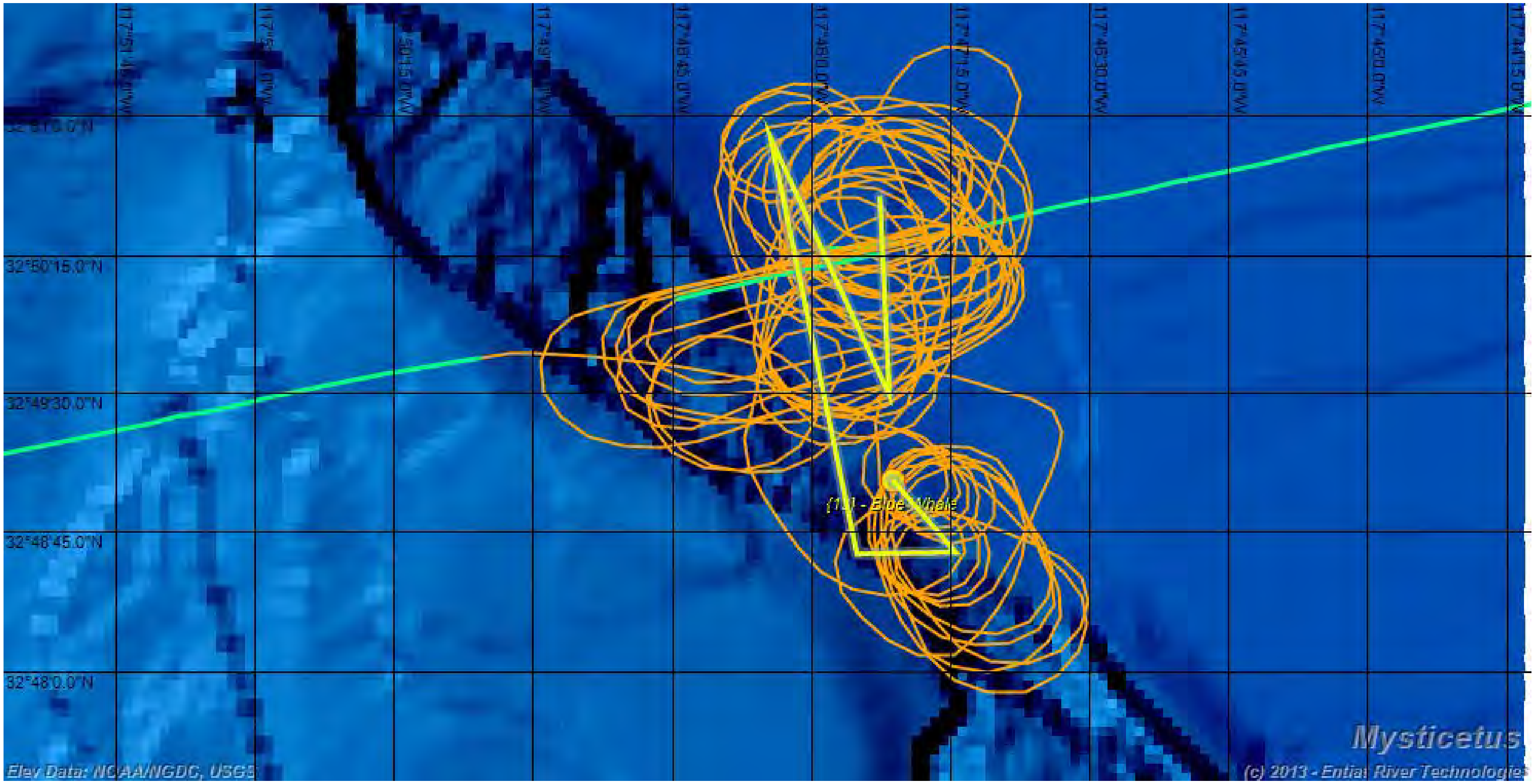

Figure 2. Track and resights of a single blue whale (Photo 2) sighted at 12:35 on 24 July 2013 (Green triangle in Figure 1). The orange lines are those of the planes during the focal follow. A focal behavior follow was conducted on this blue whale for 75 min (see Table 1) while U.S. Navy Frigate USS McClusky was visible in the vicinity.

Photo 4a. Blue whale. Photographed 24 July 2013 at 12:55 by D. Steckler under NMFS permit 14451 (Same sighting as photo 3). Initial sighting time was at 12:35. The red circle denotes a divot scar that was used to photo-identify this individual between dives on three different occasions as depicted in Photos 4a, 4b and 4c. This is the first time we are aware of documentation of this species being individually photo-identified from an aircraft. However, blue whales have been successfully photo-identified from vessels for many years (e.g., see Sears and Perrin 2009).

Photo 4b-c. Blue whale. Photographed 24 July 2013 at 13:34 and 13:49 by D. Steckler under NMFS permit 14451 (same sighting as photos 3 and 4a above). Red circle denotes the divot scar that was used to photo-identify this individual between dive periods.

Photo 5. Blue whale. Photographed 25 July 2013 at 13:19 by D. Steckler under NMFS permit 14451.

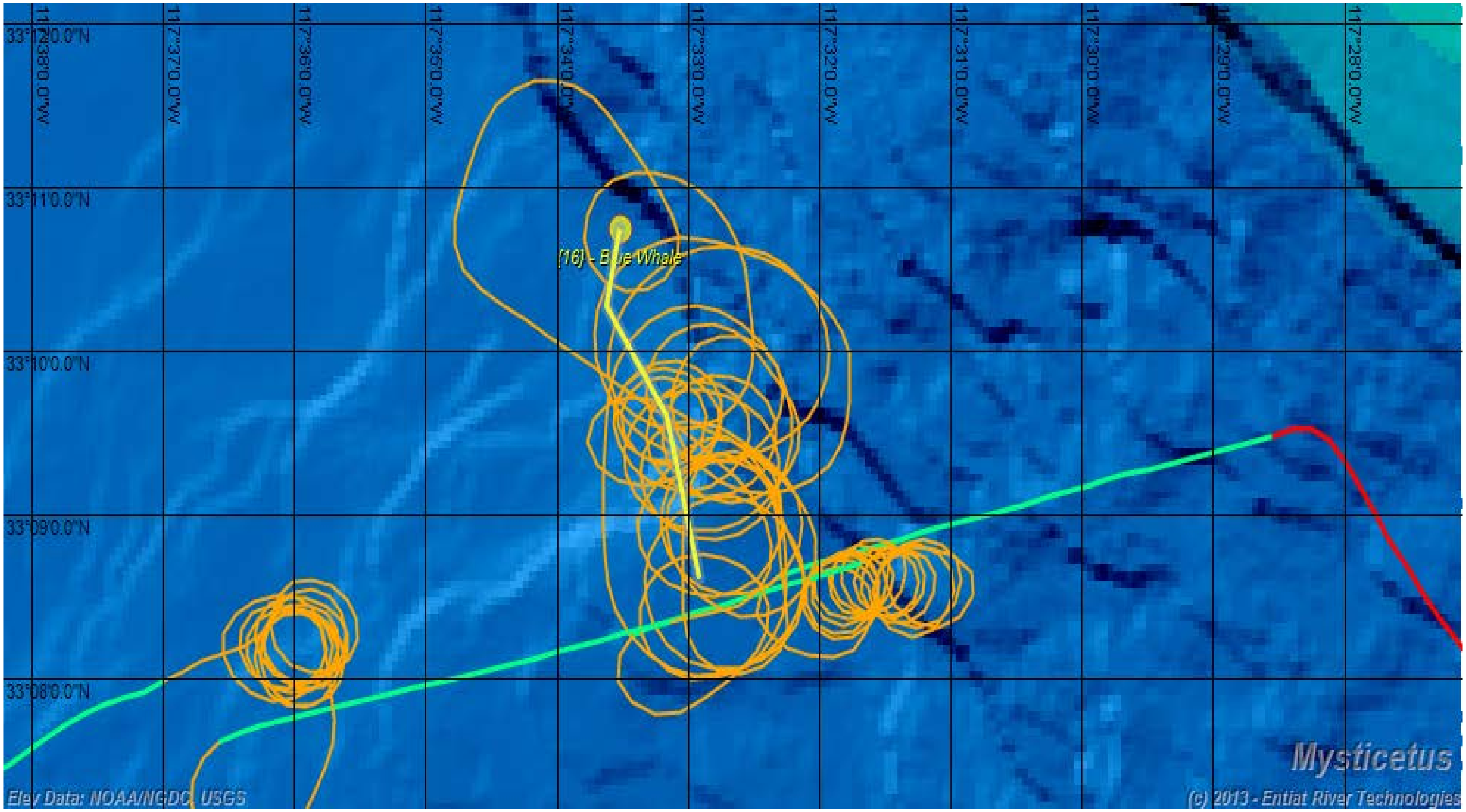

Figure 3. Track (yellow line) of blue whale (Photo 5) sighted at 13:19 on 25 July 2013 (red triangle in Figure 1). The orange lines are those of the plane during the focal follow. A focal behavior follow was conducted on this blue whale for 36 min as it steadily traveled northward at medium speed based on tracks and observed headings while at the surface between dives (see Table 6).

Photo 6. A blue whale fluking-out before a prolonged dive. Photographed 26 July 2013 at 11:54 by B. Würsig under NMFS permit 14451.

Photo 7. Blue whale (Same group as photo 6). Photographed 26 July 2013 at 12:22 by D. Steckler under NMFS permit 14451. This was one of three whales seen during this sighting.

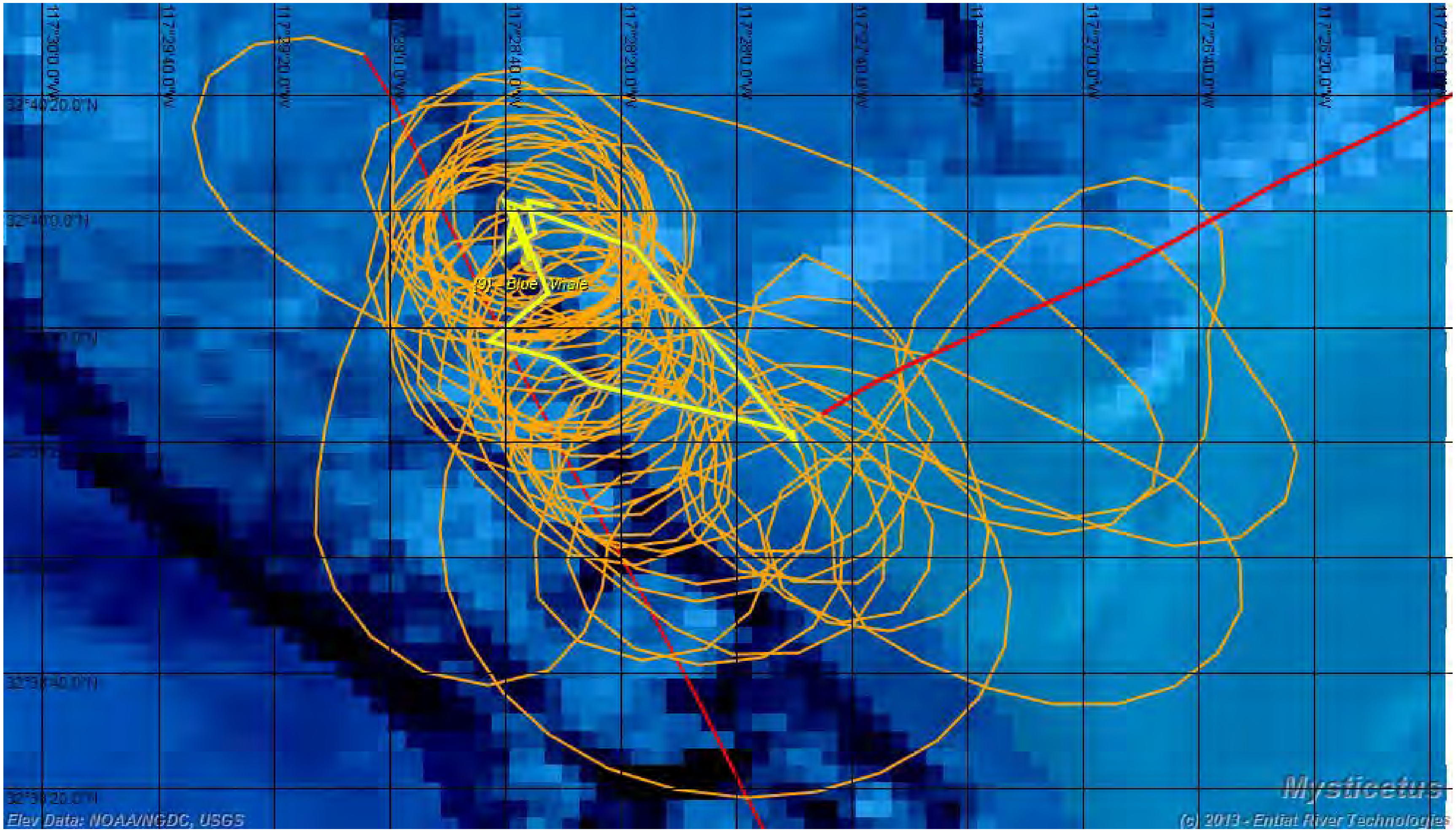

Figure 4. Track (yellow line) of a group of three blue whales (Photos 6 and 7) sighted at 11:54 on 26 July 2013 (orange triangle in Figure 1). The orange lines are those of the plane tracks during the focal follow. The red lines are the systematic transect and connector lines flown before and after the sighting. A focal behavioral follow was conducted on this sighting for 56 min and included video and photographs (see Table 6).

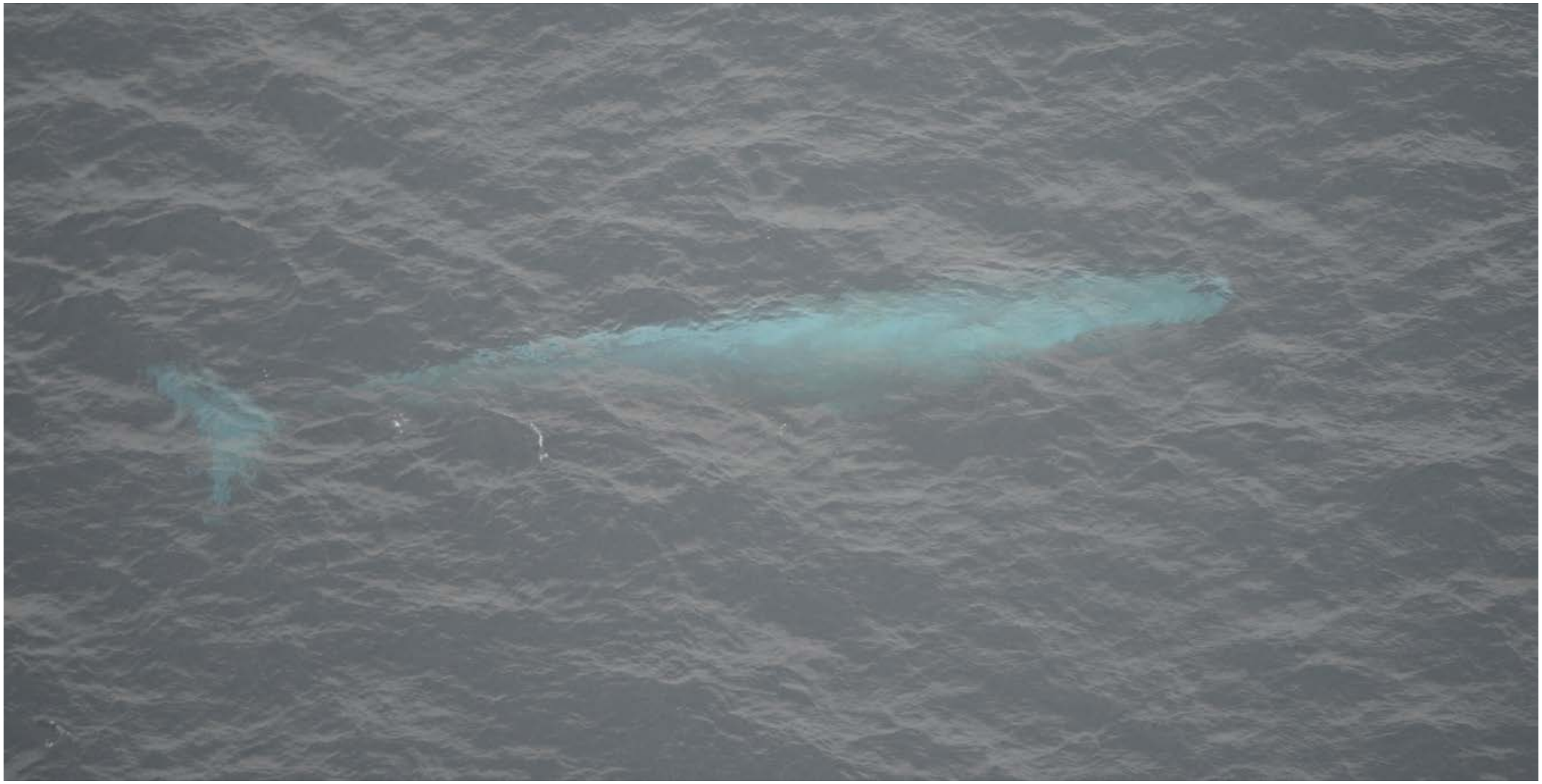

Photo 8. Blue whale. Photographed 28 July 2013 at 12:22 by B. Würsig under NMFS permit 14451. This whale was only seen subsurface. It was estimated to be approximately 60 ft in length.

Pre-Flight and In-Flight Communications

Conducting the aerial surveys involved considerable planning, communications and clearances given the logistical complexity and high degree of safety planning associated with operating in and near the busy airspace near the Southern California coastline and on the SOCAL. These have been described in detail in Smultea et al. (2011e) and thus are not repeated herein. On approximately nine occasions in 2013, we had to adjust our flight pattern to avoid U.S. Navy or other aircraft flight patterns or active “hot” U.S. Navy training areas.

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APPENDIX A: PHOTOGRAPHS

Photo 1. Northern right whale dolphin mother/calf pairs photographed 30 March 2013 by M. Smultea under NMFS permit 14451.

Photo 2. Humpback whale and California sea lion photographed 26 March 2013 by J. Biondi under NMFS permits 14451 and 15369.

Photo 3. Dead gray whale photographed 30 March 2013 by J. Biondi under NMFS permit 14451.

Photo 4. Risso's dolphin mother/calf pair (upper right) with a northern right whale dolphin (left) photographed 30 March 2013 by M. Smultea under NMFS permit 14451.

Photo 5. Fin whale (on left) and minke whale (underwater on right) photographed 26 March 2013 by J. Biondi under NMFS permit 14451.

Photo 6. Ocean sunfish (Mola mola) and gull sitting on water's surface photographed 28 March 2013 by J. Biondi under NMFS permit 14451.

Photo 7. Blue whale mother/calf pair photographed 24 May 2013 at 8:24 by D. Steckler under NMFS permit 14451.

Photo 8. A Pacific white-sided dolphin (far left front) and two Risso's dolphin mother/calf pairs photographed 24 May 2013 at 10:35 by D. Steckler under NMFS permit 14451.

Photo 9. Short-beaked common dolphins with two northern right whale dolphins (blue arrow) photographed 25 May 2013 at 10:41 by B. Würsig under NMFS permit 14451.

Photo 10. Gray whale mother/calf pair observed approximately 77 km west of the southern California coastline off La Jolla. Photographed 26 May 2013 at 14:25 by D. Steckler under NMFS permit 14451.

Photo 11. Possible mating of Risso's dolphins among a larger group of an estimated 22 individual Risso's dolphins. Photographed 24 May 2013 at 14:13 by B. Würsig under NMFS permit 14451.

Photo 12. Nursery subgroup of common dolphin sp. including at least six calves. Photographed 23 May 2013 at 12:17 by D. Steckler under NMFS permit 14451.

APPENDIX B: FIGURES

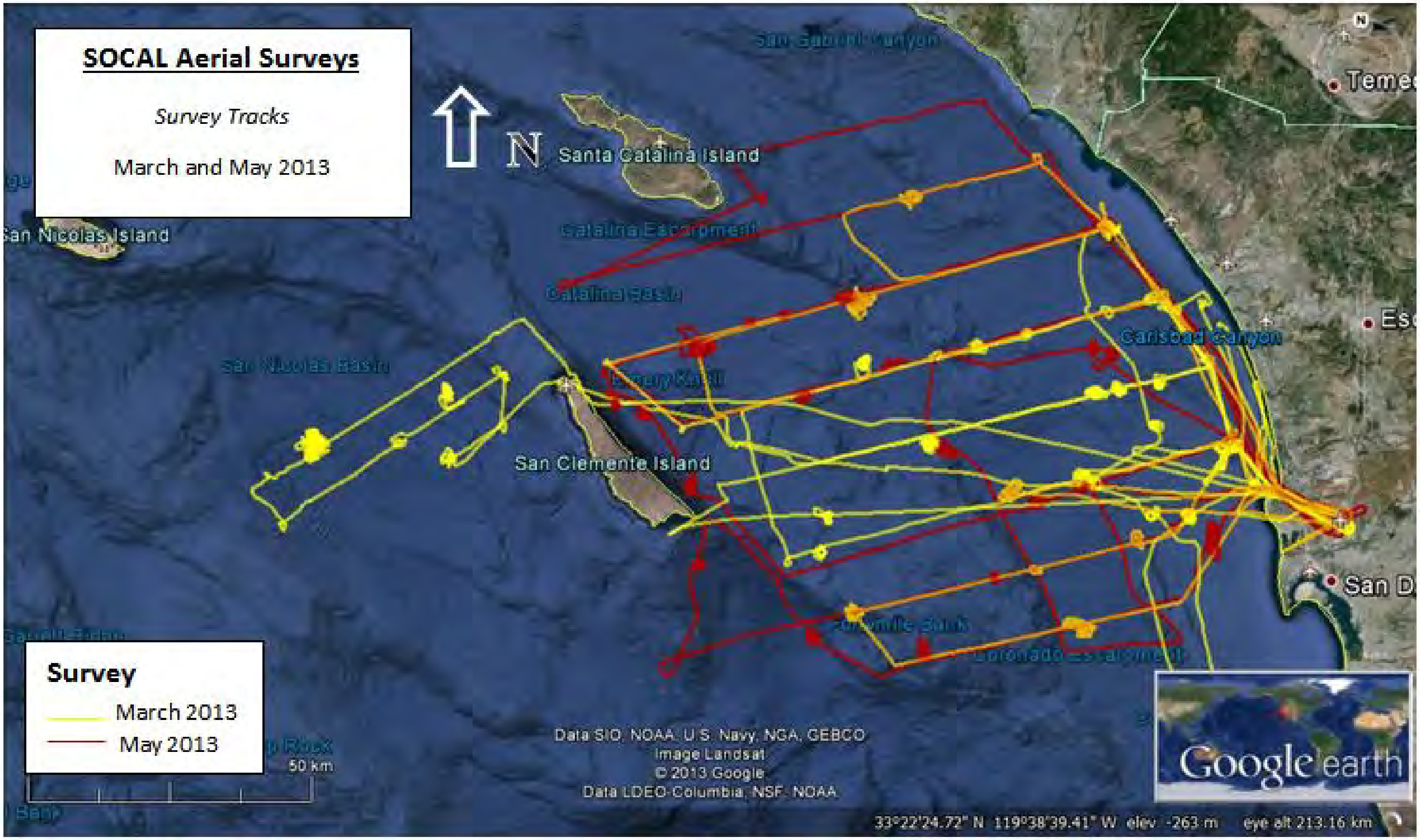

Figure 1. All tracklines made during March-May 2013 aerial monitoring surveys in SOCAL, color-coded by survey month.

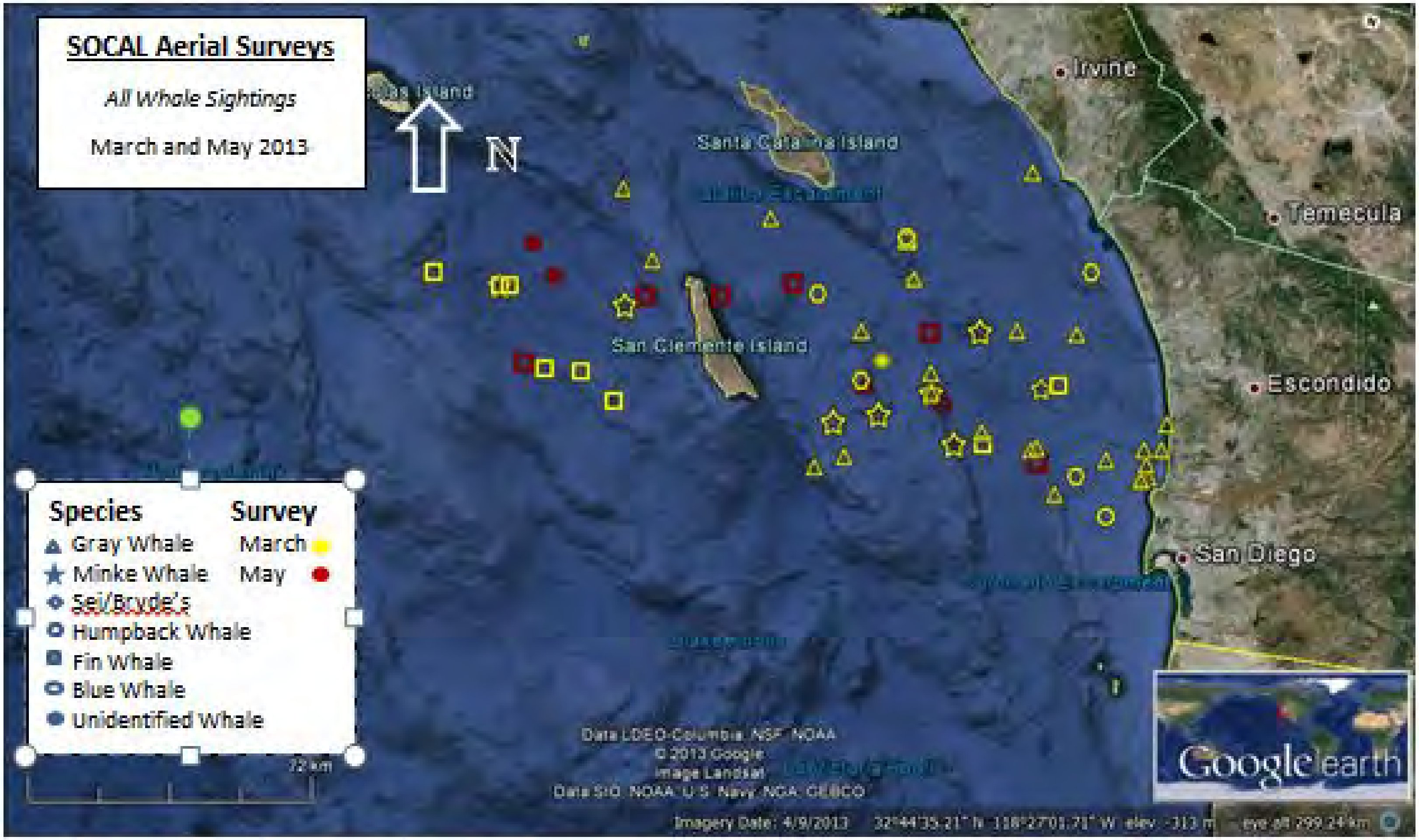

Figure 2. All whale sightings by species color-coded by month during aerial surveys in SOCAL March-May 2013.

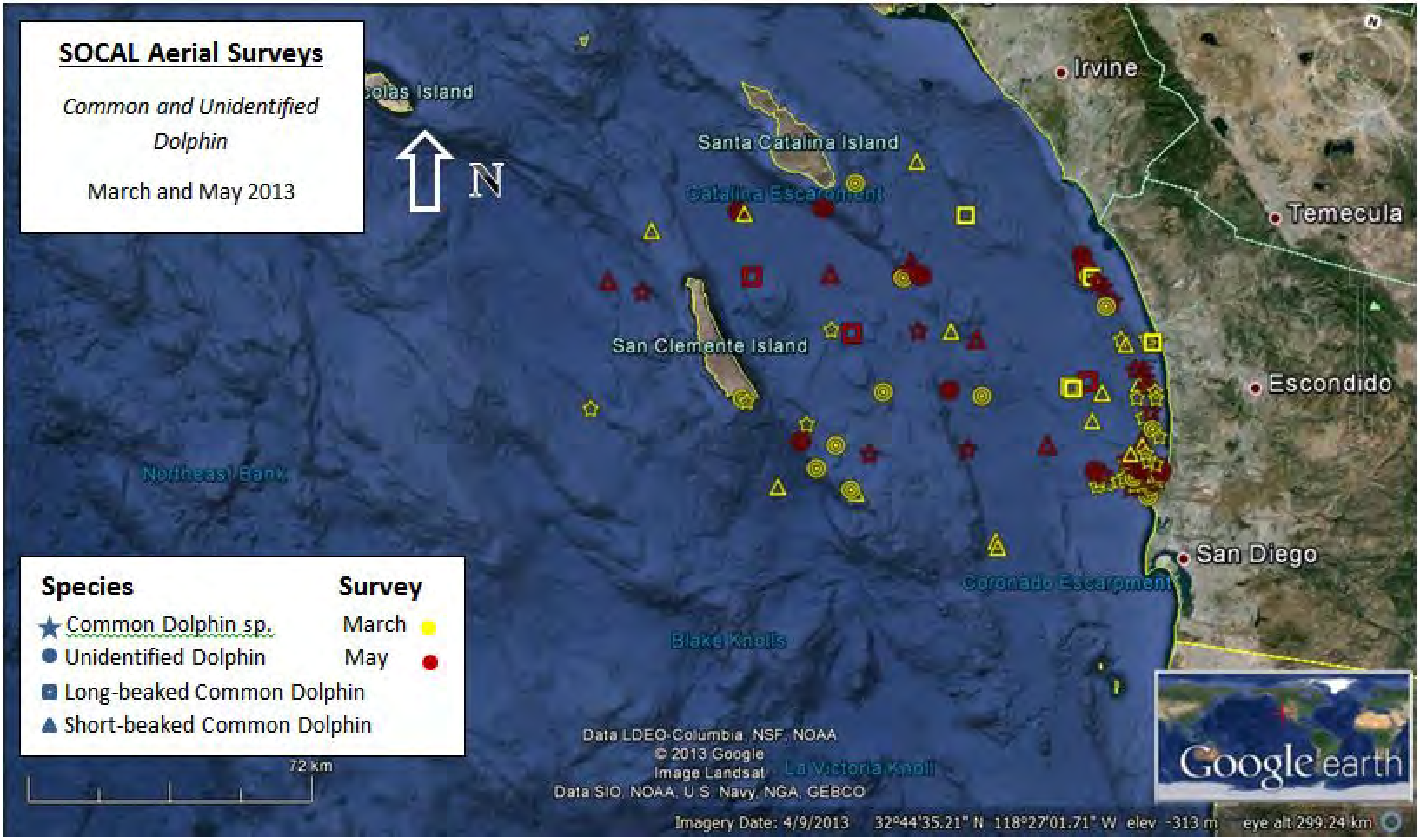

Figure 3. Common dolphin and unidentified dolphin sightings by species color-coded by month during aerial surveys in SOCAL March-May 2013.

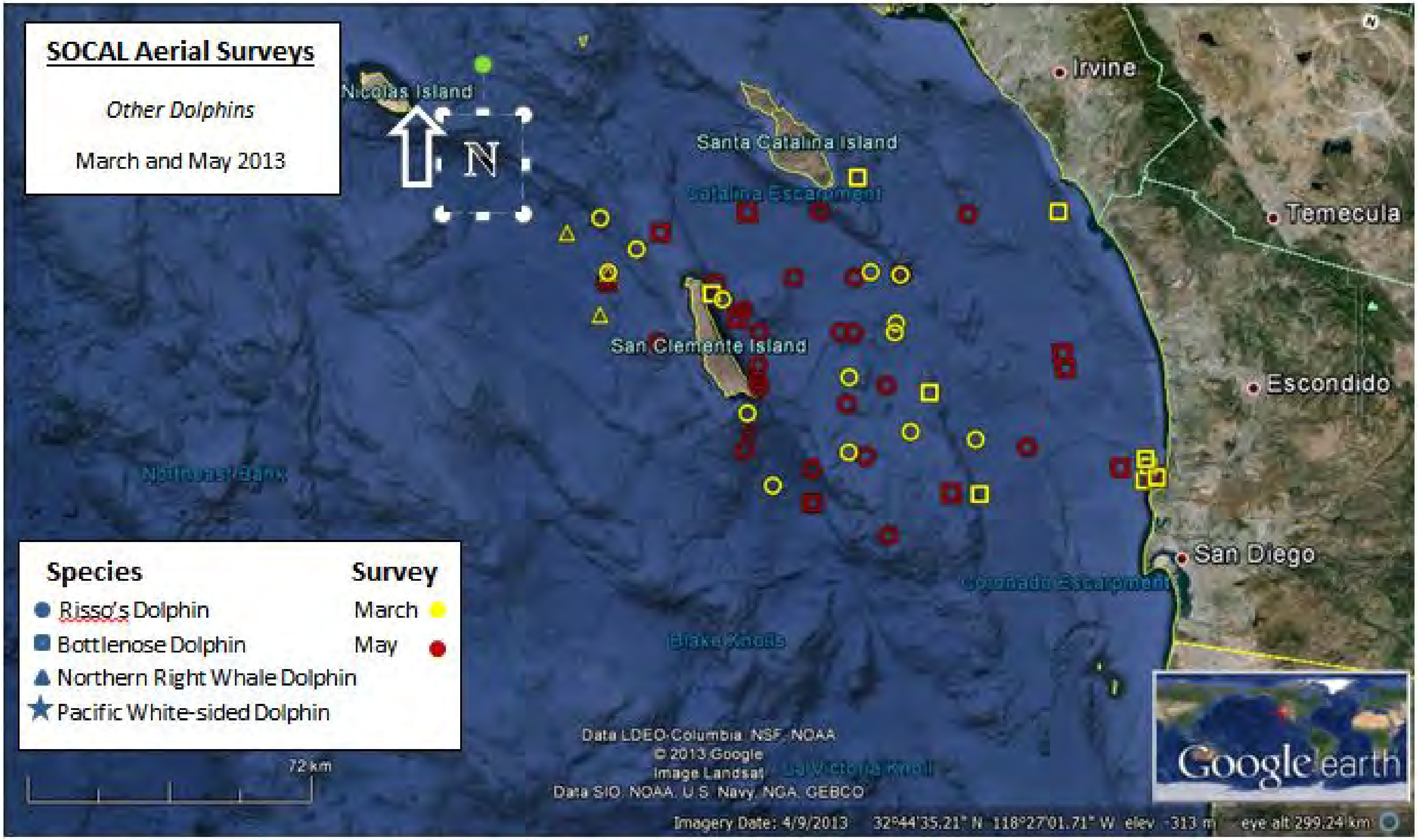

Figure 4. Risso's , bottlenose, northern right whale, and Pacific white-side dolphin sightings by species color-coded by month during aerial surveys in SOCAL March-May 2013.

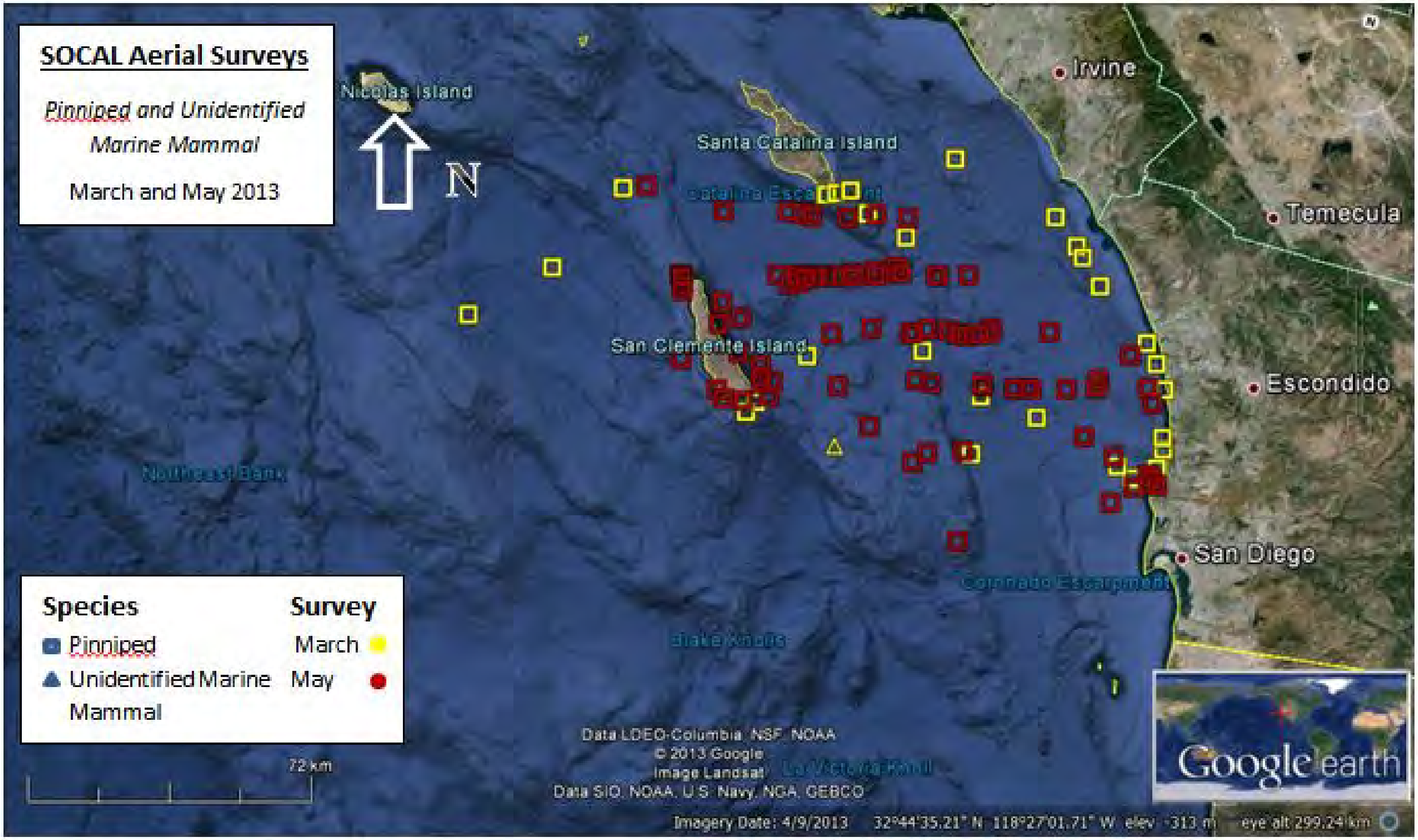

Figure 5. Pinniped and unidentified marine mammal sightings by species color-coded by month during aerial surveys in SOCAL March-May 2013.

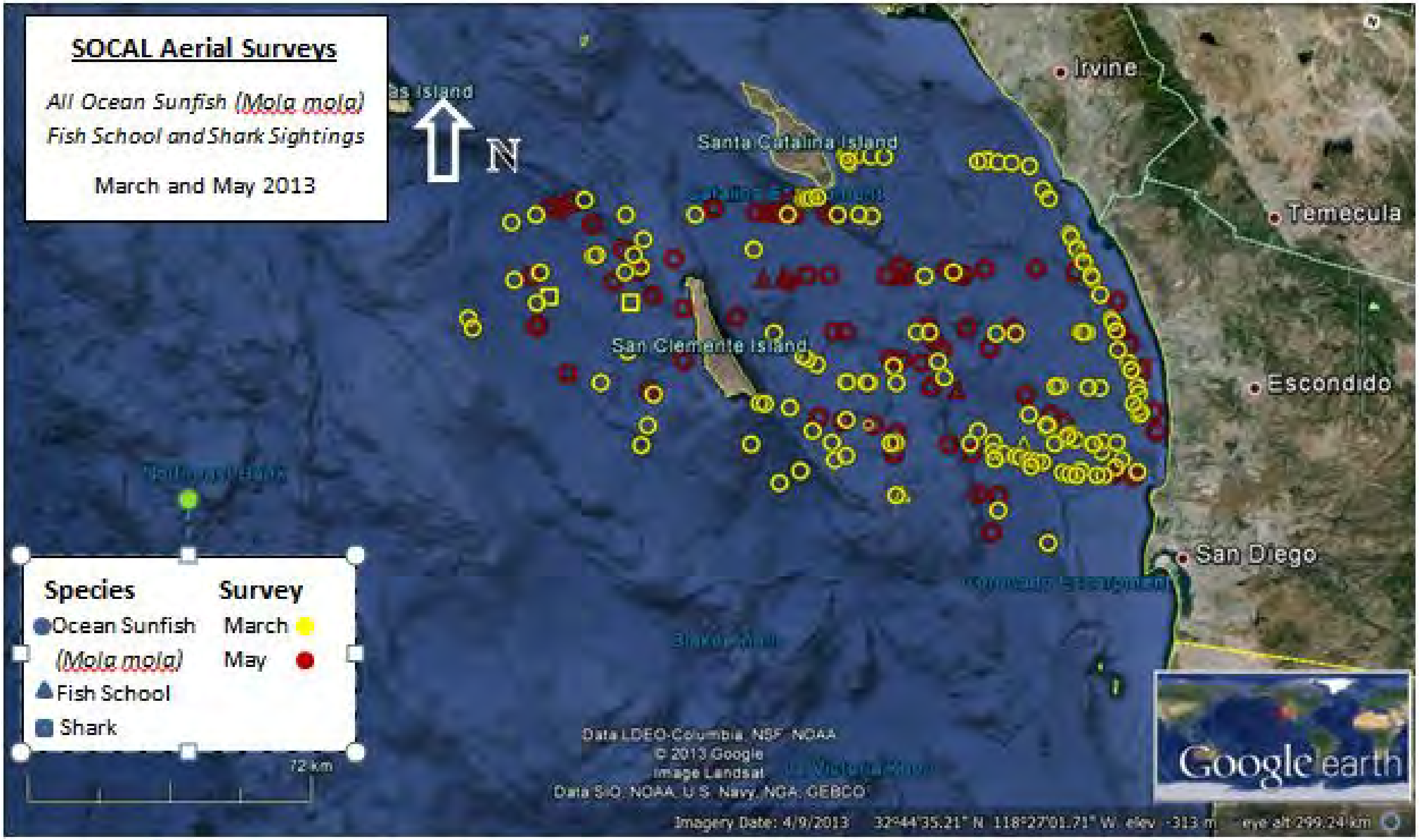

Figure 6. Ocean sunfish (Mola mola), fish school and shark sightings color-coded by month during aerial surveys in SOCAL March-May 2013.

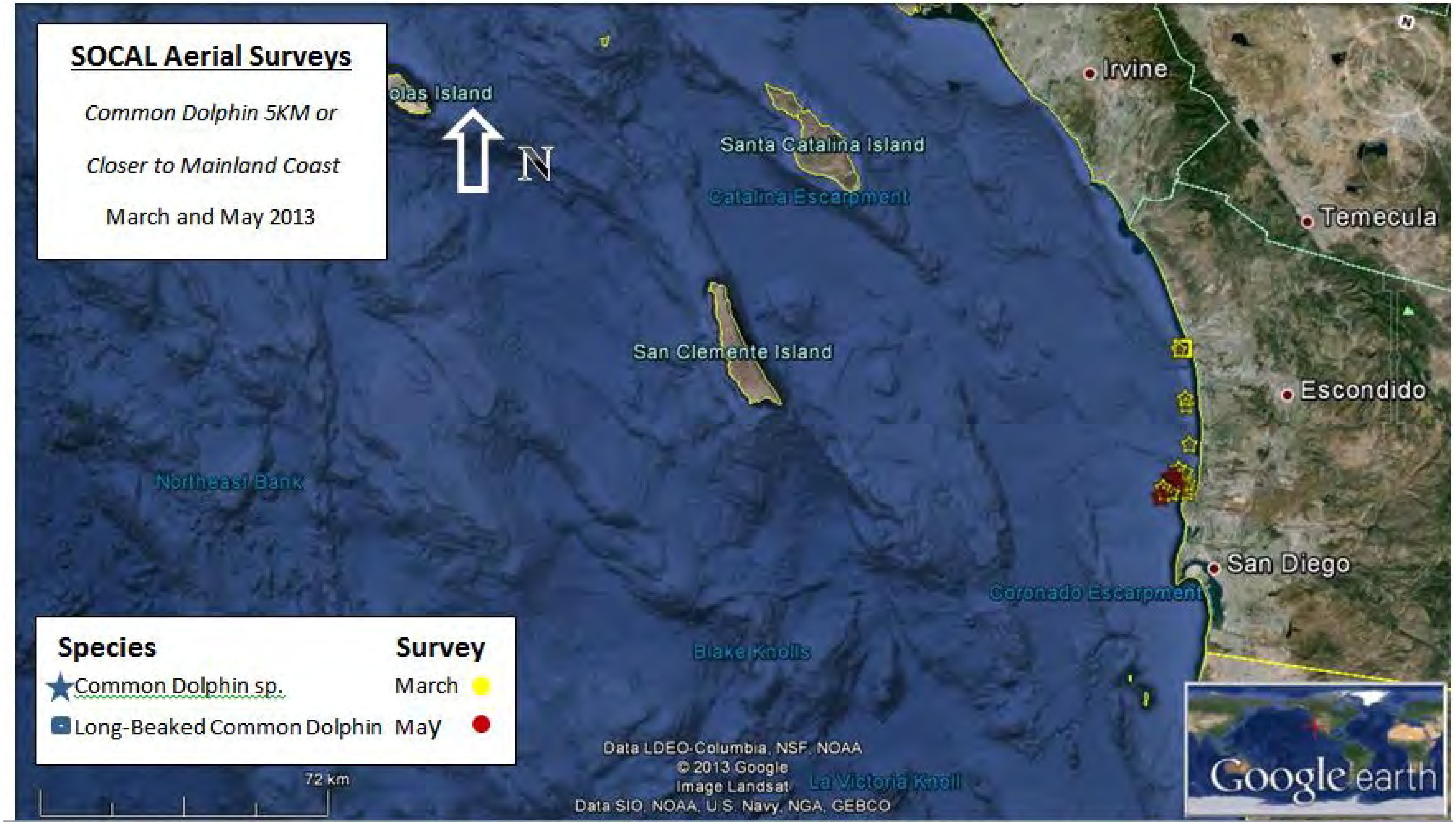

Figure 7. Common dolphin sightings 5 km or closer to the mainland coast color-coded by month during aerial surveys in SOCAL March-May 2013.

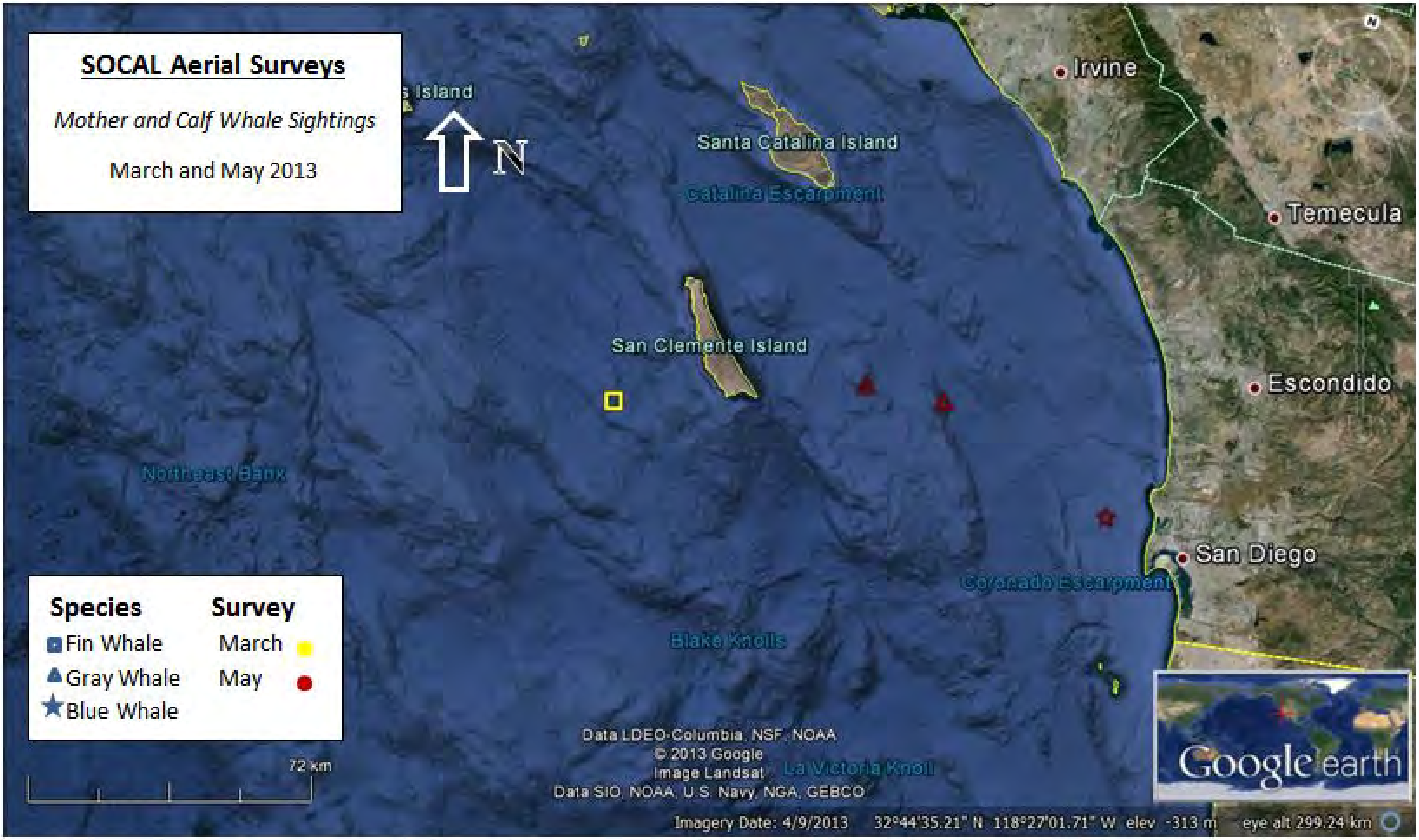

Figure 8. Mother-calf whale sightings color-coded by month during aerial surveys in SOCAL March-May 2013.

APPENDIX C: TABLES

Table 1. Summary of Aerial Surveys March, and May 2013.

Parameter	March	May	Total
Survey Dates	25-30 March 2013	22-26 May 2013	**2 surveys: March, and May**
No. Days Flown	6	5	**11**
Platform Used	Partenavia OBS	Partenavia P68-C	**Partenavia OBS and P68-C**
Major Training Exercise (MTE) Before, During or After Survey?	None	None	**None**
Total Flight Time (hr) (Wheels up/down)	25.7	30.1	**55.8**
Total Observation Effort (km) *(excl. poor weather, over land)*	4922.8 km	5644.5 km	**10,567.3 km**
	2658.2 nm	3047.7 nm	**5,705.9 nm**
No. Groups Seen	179	205	**384**
Estimated No. Individuals	14,172	7,693	**21,865**
Ocean sunfish sightings (*Mola mola*)	154	77	**231**
No. Dead Sightings	1	0	**1**
No. Species	11	10	**11 total species**
No. Focal Groups Circled 5-9 min	0	1	**1**
No. Extended Focal Groups Circled >10 min	14	9	**23**
Longest Focal Follow Duration	29 min (*Fin and Minke whale*)	54 min (*Blue whale*)	54 min (*Blue whale*)
No. Photos Taken	1,741	1,620	**3,361**
Estimated Usable Video (min)	145.5	156.8	**302.3**

Table 2. Unusual or noteworthy observations of marine mammals in SOCAL aerial survey area during March and May 2013.

Date	Time	Species	Group Size	Data Format Available for Review	Comments	Why Considered Unusual
3/26/2013	10:30:45	Fin Whale, *Balaenoptera physalus*, Humpback Whale, *Megaptera novaeangliae*, Minke Whale, *Balaenoptera acutorostrata*	1 Fin, 1 Humpback, 4 Minke	Photographs, Field Notes; Video	Minke whale approaches fin whale, humpback whale thrashing and splashing.	Mixed-Species Association
3/27/2013	14:04:01	Northern Elephant Seal, *Mirounga angustirostris*	1	Field Notes	Last time this species was seen during SOCAL aerial monitoring was in September 2010.	Rarely-Seen Species
3/28/2013	12:00:35	Risso's Dolphin, *Grampus griseus*, Minke Whale, *Balaenoptera acutorostrata*	23 Risso's Dolphin, 1 Minke	Photographs; Video	Risso's dolphin seen charging minke whale.	Mixed-Species Association
3/29/2013	15:14:05	Gray Whale, *Eschrichtius robustus*	1	Photographs; Field Notes	Approximately 4 km west of La Jolla, not bloated, big gouge underneath right pectoral fin, probably male but no penis extruding, judge it to be an immature whale, possibly a yearling.	Dead Animal
5/23/2013	15:27:24	Gray Whale, *Eschrichtius robustus*	2	Photographs, Field Notes	First time gray whales have been seen during the warm-water season.	Mother-Calf Pair
5/24/2013	10:35:48	Pacific White-Sided Dolphin, *Lagenorhynchus obliquidens*, Risso's Dolphin, *Grampus griseus*	1 Pacific White-Side Dolphin, 25 Risso's Dolphin	Photographs, Field Notes	A single Pacific white-sided dolphin swimming with 25 Risso's dolphins including young Risso's calves. Last saw Pacific white-sided dolphin in SOCAL in May 2010.	Mixed-Species Association; Rarely-Seen Species

Date	Time	Species	Group Size	Data Format Available for Review	Comments	Why Considered Unusual
5/24/2013	8:24:38	Blue Whale, *Balaenoptera musculus*	2	Photographs, Field Notes; Video	Second time since 2008, a blue whale mother/calf pair was sighted. Last blue whale sighting during SOCAL aerial surveys was seen in May 2011.	Mother-Calf Pair
5/24/2013	14:13:17	Risso's Dolphin, *Grampus griseus*	2	Photographs	A pair of Risso's was seen possibly mating.	Social/Sexual Behaviors
5/25/2013	10:41:15	Northern Right Whale Dolphin, *Lissodelphis borealis*, Short-Beaked Common Dolphin, *Delphis delphis*	2 Northern Right Whale Dolphin, 10 Short-Beaked Common Dolphin	Photographs, Field Notes	Two northern right whale dolphin swimming in a close mixed-species association (within 1 body length) with a group of approximately 10 short-beaked common dolphins.	Mixed-Species Association
5/26/2013	14:25:46	Gray Whale, *Eschrichtius robustus*	2	Photographs, Field Notes; Video	First time gray whales have been seen during the warm-water season. Possible nursing.	Mother-Calf Pair

Table 3. Numbers of individuals and groups by species seen during SOCAL visual marine species monitoring surveys, March, and May 2013.

Common Name	Scientific Name	March		May		Total	
		# Grps	# Indiv	# Grps	# Indiv	# Grps	# Indiv
Common Dolphin sp.	*Delphinus* sp.	36	6,260	29	4,160	**65**	**10,420**
California Sea Lion	*Zalophus californianus*	34	68	101	244	**135**	**312**
Risso's Dolphin	*Grampus griseus*	15	309	27	354	**42**	**663**
Unidentified Dolphin**	Delphinidae sp.	20	822	14	325	**34**	**1,147**
Gray Whale	*Eschrichtius robustus*	24	41	2	4	**26**	**45**
Bottlenose Dolphin	*Tursiops truncatus*	10	93	10	156	**20**	**249**
Fin Whale	*Balaenoptera physalus*	9	16	6	8	**15**	**24**
Short-beaked Common Dolphin	*Delphinus delphis*	8	5,375	6	285	**14**	**5,660**
Minke Whale	*Balaenoptera acutorostrata*	8	12	0	0	**8**	**12**
Long-beaked Common Dolphin	*Delphinus capensis*	2	700	5	2,150	**7**	**2,850**
Humpback Whale	*Megaptera novaeangliae*	5	5	0	0	**5**	**5**
Northern Right Whale Dolphin	*Lissodelphis borealis*	3	461	1	2	**4**	**463**
Unidentified Whale	Cetacea	0	0	2	2	**2**	**2**
Northern Elephant Seal	*Mirounga angustirostris*	1	1	0	0	**1**	**1**
Sei/Bryde's Whale	*Balaenoptera borealis/brydei/edeni*	1	1	0	0	**1**	**1**
Pacific White-Sided Dolphin	*Lagenorhynchus obliquidens*	0	0	1	1	**1**	**1**
Blue Whale	*Balaenoptera musculus*	0	0	1	2	**1**	**2**
Unidentified Baleen Whale	*Balaenoptera* sp.	1	1	0	0	**1**	**1**
Unidentified Large Whale	Cetacean	1	1	0	0	**1**	**1**
Unidentified Medium Marine Mammal	Cetacean or Pinniped	1	3	0	0	**1**	**3**
Unidentified Small Whale	Cetacean	1	4	0	0	**1**	**4**
Total		**180**	**14,173**	**205**	**7,693**	**385**	**21,866**

** Unidentified dolphins were seen mainly while transiting to or between survey areas when there was no time to circle for photographs and/or the sightings were too far away to confirm species.

Table 4. Locations, species descriptions and group sizes for all marine mammal sightings March – May 2013 SOCAL visual aerial surveys.

Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
3/25/2013 12:58:41	Common Dolphin sp.	*Delphinus* sp.	32.6371	-117.6368	SCB
3/25/2013 12:58:52	Common Dolphin sp.	*Delphinus* sp.	32.6490	-117.6457	SCB
3/25/2013 13:24:33	Unidentified Dolphin	Delphinidae sp.	32.6750	-118.0472	SCB
3/25/2013 13:29:21	Common Dolphin sp.	*Delphinus* sp.	32.6727	-118.0311	SCB
3/25/2013 13:44:27	Bottlenose Dolphin	*Tursiops truncatus*	32.7401	-117.7153	SCB
3/25/2013 13:54:47	Gray Whale	*Eschrichtius robustus*	32.7823	-117.5264	SCB
3/25/2013 14:09:38	Common Dolphin sp.	*Delphinus* sp.	32.8362	-117.4229	SCB
3/25/2013 14:11:35	California Sea Lion	*Zalophus californianus*	32.8764	-117.3836	SCB
3/25/2013 14:27:36	Risso's Dolphin	*Grampus griseus*	32.8538	-117.7616	SCB
3/25/2013 14:31:47	Gray Whale	*Eschrichtius robustus*	32.8728	-117.7531	SCB
3/25/2013 14:50:27	Unidentified Dolphin	Delphinidae sp.	32.8283	-117.2890	SCB
3/25/2013 16:22:03	Gray Whale	*Eschrichtius robustus*	32.8964	-117.3120	SCB
3/25/2013 16:22:23	Bottlenose Dolphin	*Tursiops truncatus*	32.9083	-117.3163	SCB
3/25/2013 16:22:45	Common Dolphin sp.	*Delphinus* sp.	32.9212	-117.3236	SCB
3/25/2013 16:50:19	Gray Whale	*Eschrichtius robustus*	33.0194	-118.1267	SCB
3/25/2013 17:08:22	Unidentified Dolphin	Delphinidae sp.	33.1549	-118.0587	SCB
3/25/2013 17:08:23	Risso's Dolphin	*Grampus griseus*	33.1607	-118.0643	SCB
3/25/2013 17:25:43	Sei/Bryde's Whale	*Balaenoptera borealis/brydei/edeni*	33.1554	-118.0342	SCB
3/25/2013 17:30:38	Gray Whale	*Eschrichtius robustus*	33.1605	-118.0280	SCB
3/25/2013 17:54:15	California Sea Lion	*Zalophus californianus*	33.3730	-117.7080	SCB
3/25/2013 18:00:59	Common Dolphin sp.	*Delphinus* sp.	33.3245	-117.9421	SCB
3/25/2013 18:29:21	Unidentified Dolphin	Delphinidae sp.	33.2654	-117.5877	SCB
3/25/2013 18:29:39	Humpback Whale	*Megaptera novaeangliae*	33.2750	-117.5803	SCB
3/25/2013 18:36:58	Unidentified Dolphin	Delphinidae sp.	33.2101	-117.5219	SCB
3/25/2013 18:44:51	Unidentified Dolphin	Delphinidae sp.	32.9739	-117.3218	SCB
3/26/2013 11:42:17	Bottlenose Dolphin	*Tursiops truncatus*	32.8756	-117.2755	SCB
3/26/2013 11:42:42	Common Dolphin sp.	*Delphinus* sp.	32.8794	-117.2795	SCB

*SCB = Sanra Catalina Basin, SNB = San Nicholas Basin

Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
3/26/2013 11:43:21	Bottlenose Dolphin	*Tursiops truncatus*	32.8951	-117.3040	SCB
3/26/2013 11:43:41	Common Dolphin sp.	*Delphinus* sp.	32.9062	-117.3120	SCB
3/26/2013 11:44:20	Gray Whale	*Eschrichtius robustus*	32.9270	-117.3279	SCB
3/26/2013 11:46:17	Common Dolphin sp.	*Delphinus* sp.	32.9963	-117.3537	SCB
3/26/2013 11:47:29	Unidentified Dolphin	Delphinidae sp.	33.0343	-117.3827	SCB
3/26/2013 11:56:24	California Sea Lion	*Zalophus californianus*	33.3023	-117.6115	SCB
3/26/2013 11:57:09	California Sea Lion	*Zalophus californianus*	33.3222	-117.6340	SCB
3/26/2013 11:59:25	Bottlenose Dolphin	*Tursiops truncatus*	33.3863	-117.7043	SCB
3/26/2013 12:02:17	Gray Whale	*Eschrichtius robustus*	32.8105	-117.1370	SCB
3/26/2013 12:09:51	California Sea Lion	*Zalophus californianus*	33.4397	-118.0035	SCB
3/26/2013 12:12:54	Short-beaked Common Dolphin	*Delphinus delphis*	33.4126	-118.1034	SCB
3/26/2013 12:27:22	Bottlenose Dolphin	*Tursiops truncatus*	33.3435	-118.2401	SCB
3/26/2013 12:27:40	Unidentified Dolphin	Delphinidae sp.	33.3291	-118.2443	SCB
3/26/2013 12:30:00	California Sea Lion	*Zalophus californianus*	33.3120	-118.2488	SCB
3/26/2013 12:30:06	California Sea Lion	*Zalophus californianus*	33.3112	-118.2524	SCB
3/26/2013 12:30:57	California Sea Lion	*Zalophus californianus*	32.8105	-117.1363	SCB
3/26/2013 12:31:08	California Sea Lion	*Zalophus californianus*	33.2984	-118.2838	SCB
3/26/2013 12:31:51	California Sea Lion	*Zalophus californianus*	33.2896	-118.3061	SCB
3/26/2013 12:32:02	California Sea Lion	*Zalophus californianus*	33.2875	-118.3112	SCB
3/26/2013 12:43:57	Common Dolphin sp.	*Delphinus* sp.	33.2016	-118.5059	SCB
3/26/2013 12:51:52	Gray Whale	*Eschrichtius robustus*	33.2076	-118.4343	SCB
3/26/2013 12:55:51	California Sea Lion	*Zalophus californianus*	32.8105	-117.1403	SCB
3/26/2013 13:01:23	California Sea Lion	*Zalophus californianus*	33.2727	-118.1895	SCB
3/26/2012 13:10:00	Risso's Dolphin	*Grampus griseus*	33.2689	-118.1784	SCB
3/26/2012 13:30:45	Fin Whale	*Balaenoptera physalus*	33.2375	-118.0720	SCB
3/26/2012 13:30:45	Minke Whale	*Balaenoptera acutorostrata*	33.2338	-118.0785	SCB
3/26/2013 13:29:45	Humpback Whale	*Megaptera novaeangliae*	33.2441	-118.0758	SCB
3/26/2013 14:06:54	Risso's Dolphin	*Grampus griseus*	33.1498	-118.1420	SCB

*SCB = Sanra Catalina Basin, SNB = San Nicholas Basin

Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
3/26/2013 14:57:32	Minke Whale	*Balaenoptera acutorostrata*	32.9992	-117.6309	SCB
3/26/2013 14:58:52	Fin Whale	*Balaenoptera physalus*	33.0153	-117.5895	SCB
3/26/2013 15:18:39	Short-beaked Common Dolphin	*Delphinus delphis*	33.0162	-117.5520	SCB
3/26/2013 15:25:36	Long-beaked Common Dolphin	*Delphinus capensis*	33.0250	-117.4752	SCB
3/26/2013 15:42:05	Common Dolphin sp.	*Delphinus* sp.	32.8626	-117.2753	SCB
3/27/2013 10:10:13	Unidentified Dolphin	Delphinidae sp.	32.8591	-117.3112	SNB
3/27/2013 10:10:19	Gray Whale	*Eschrichtius robustus*	32.8595	-117.3143	SNB
3/27/2013 10:10:25	Gray Whale	*Eschrichtius robustus*	32.8638	-117.3180	SNB
3/27/2013 10:10:50	Common Dolphin sp.	*Delphinus* sp.	32.8586	-117.3379	SNB
3/27/2013 10:10:54	California Sea Lion	*Zalophus californianus*	32.8583	-117.3395	SNB
3/27/2013 10:11:20	Unidentified Dolphin	Delphinidae sp.	32.8572	-117.3623	SNB
3/27/2013 10:20:39	California Sea Lion	*Zalophus californianus*	32.8208	-117.7640	SNB
3/27/2013 10:28:07	Risso's Dolphin	*Grampus griseus*	32.7547	-118.0746	SNB
3/27/2013 10:28:28	Gray Whale	*Eschrichtius robustus*	32.7470	-117.0879	SNB
3/27/2013 10:30:22	Unidentified Dolphin	Delphinidae sp.	32.7009	-118.1480	SNB
3/27/2013 10:30:25	Gray Whale	*Eschrichtius robustus*	32.7040	-118.1530	SNB
3/27/2013 10:33:04	Short-beaked Common Dolphin	*Delphinus delphis*	32.6408	-118.2331	SNB
3/27/2013 10:33:13	Risso's Dolphin	*Grampus griseus*	32.6404	-118.2437	SNB
3/27/2013 10:50:03	Unidentified Dolphin	Delphinidae sp.	32.7301	-118.7008	SNB
3/27/2013 10:50:13	Fin Whale	*Balaenoptera physalus*	32.7280	-118.7051	SNB
3/27/2013 11:03:56	Common Dolphin sp.	*Delphinus* sp.	32.6989	-118.7586	SNB
3/27/2013 11:43:37	California Sea Lion	*Zalophus californianus*	32.8798	-118.6415	SNB
3/27/2013 11:49:54	Fin Whale	*Balaenoptera physalus*	32.7713	-118.8086	SNB
3/27/2013 12:03:48	Risso's Dolphin	*Grampus griseus*	33.0625	-118.7507	SNB
3/27/2013 12:31:00	Common Dolphin sp.	*Delphinus* sp.	33.1117	-118.7286	SNB
3/27/2013 12:42:45	Gray Whale	*Eschrichtius robustus*	33.1849	-118.8288	SNB
3/27/2013 13:00:14	California Sea Lion	*Zalophus californianus*	33.0590	-119.0712	SNB
3/27/2013 13:10:24	Fin Whale	*Balaenoptera physalus*	32.8953	-119.2507	SNB

*SCB = Sanra Catalina Basin, SNB = San Nicholas Basin

Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
3/27/2013 13:27:00	Northern Right Whale Dolphin	*Lissodelphis borealis*	33.0582	-118.9387	SNB
3/27/2013 13:36:09	Risso's Dolphin	*Grampus griseus*	33.1074	-118.8643	SNB
3/27/2013 13:54:38	Humpback Whale	*Megaptera novaeangliae*	33.0735	-118.2621	SNB
3/27/2013 14:01:29	Risso's Dolphin	*Grampus griseus*	33.0350	-118.0392	SNB
3/27/2013 14:04:01	Northern Elephant Seal	*Mirounga angustirostris*	33.0120	-117.9569	SNB
3/27/2013 14:09:33	Unidentified Dolphin	Delphinidae sp.	32.9487	-117.7787	SNB
3/27/2013 14:13:56	California Sea Lion	*Zalophus californianus*	32.9346	-117.6216	SNB
3/27/2013 14:21:15	Common Dolphin sp.	*Delphinus* sp.	32.8897	-117.3697	SNB
3/27/2013 14:23:31	California Sea Lion	*Zalophus californianus*	32.8576	-117.2968	SNB
3/27/2013 14:23:48	California Sea Lion	*Zalophus californianus*	32.8557	-117.2874	SNB
3/28/2013 09:27:03	Common Dolphin sp.	*Delphinus* sp.	32.8520	-117.3129	SCB
3/28/2013 09:41:26	Risso's Dolphin	*Grampus griseus*	32.8334	-117.9319	SCB
3/28/2013 09:57:26	California Sea Lion	*Zalophus californianus*	32.8082	-118.3455	SCB
3/28/2013 09:58:12	Unidentified Dolphin	Delphinidae sp.	32.8060	-118.3833	SCB
3/28/2013 09:58:37	Common Dolphin sp.	*Delphinus* sp.	32.8046	-118.3702	SCB
3/28/2013 09:59:46	California Sea Lion	*Zalophus californianus*	32.7815	-118.3625	SCB
3/28/2013 09:59:55	Risso's Dolphin	*Grampus griseus*	32.7792	-118.3570	SCB
3/28/2013 10:06:29	Common Dolphin sp.	*Delphinus* sp.	32.7911	-118.2037	SCB
3/28/2013 10:22:12	Gray Whale	*Eschrichtius robustus*	32.9289	-117.9080	SCB
3/28/2013 10:26:11	Minke Whale	*Balaenoptera acutorostrata*	32.9277	-117.9071	SCB
3/28/2013 11:00:09	Short-beaked Common Dolphin	*Delphinus delphis*	33.0189	-117.5617	SCB
3/28/2013 11:08:39	California Sea Lion	*Zalophus californianus*	33.0352	-117.4878	SCB
3/28/2013 11:16:03	Short-beaked Common Dolphin	*Delphinus delphis*	33.1419	-117.4472	SCB
3/28/2013 11:30:16	Gray Whale	*Eschrichtius robustus*	33.1356	-117.5764	SCB
3/28/2013 11:37:05	Gray Whale	*Eschrichtius robustus*	33.1090	-117.7314	SCB
3/28/2013 11:42:49	Unidentified Baleen Whale	*Balaenoptera* sp.	33.0861	-117.8245	SCB
3/28/2013 11:53:42	Short-beaked Common Dolphin	*Delphinus delphis*	33.0702	-117.9008	SCB
3/28/2013 12:00:35	Risso's Dolphin	*Grampus griseus*	33.0555	-118.0417	SCB

*SCB = Sanra Catalina Basin, SNB = San Nicholas Basin

Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
3/28/2013 12:25:06	Minke Whale	*Balaenoptera acutorostrata*	33.0612	-118.0263	SCB
3/28/2013 12:35:17	Unidentified Dolphin	Delphinidae sp.	33.0053	-118.2058	SCB
3/28/2013 12:47:39	Unidentified Medium Marine Mammal	Cetacean or Pinniped	32.7608	-118.1152	SCB
3/28/2013 13:02:04	Minke Whale	*Balaenoptera acutorostrata*	32.8316	-117.8154	SCB
3/28/2013 13:04:15	Fin Whale	*Balaenoptera physalus*	32.8473	-117.7424	SCB
3/28/2013 13:08:32	Gray Whale	*Eschrichtius robustus*	32.8714	-117.6030	SCB
3/28/2013 13:38:11	Common Dolphin sp.	*Delphinus* sp.	32.9112	-117.3617	SCB
3/28/2013 13:51:45	Common Dolphin sp.	*Delphinus* sp.	32.8770	-117.2915	SCB
3/28/2013 15:25:23	Common Dolphin sp.	*Delphinus* sp.	32.8465	-117.3749	SCB
3/28/2013 15:26:13	Common Dolphin sp.	*Delphinus* sp.	32.8344	-117.4007	SCB
3/28/2013 15:26:56	Unidentified Small Whale	Cetacea	32.8172	-117.4172	SCB
3/28/2013 15:27:04	Common Dolphin sp.	*Delphinus* sp.	32.8238	-117.4267	SCB
3/28/2013 16:03:50	Humpback Whale	*Megaptera novaeangliae*	32.8313	-117.4830	SCB
3/28/2013 16:16:53	Short-beaked Common Dolphin	*Delphinus delphis*	32.9597	-117.4821	SCB
3/28/2013 16:36:54	Long-beaked Common Dolphin	*Delphinus capensis*	33.2644	-117.5789	SCB
3/28/2013 16:47:16	California Sea Lion	*Zalophus californianus*	33.2505	-117.5476	SCB
3/29/2013 09:32:50	Common Dolphin sp.	*Delphinus* sp.	32.8709	-117.3002	SCB
3/29/2013 09:43:30	Short-beaked Common Dolphin	*Delphinus delphis*	32.9341	-117.3376	SCB
3/29/2013 10:01:33	Common Dolphin sp.	*Delphinus* sp.	33.0643	-117.3871	SCB
3/29/2013 10:14:16	Common Dolphin sp.	*Delphinus* sp.	33.1495	-117.4622	SCB
3/29/2013 10:23:25	Common Dolphin sp.	*Delphinus* sp.	33.1647	-117.3967	SCB
3/29/2013 10:24:06	Common Dolphin sp.	*Delphinus* sp.	33.1566	-117.3886	SCB
3/29/2013 10:24:09	Common Dolphin sp.	*Delphinus* sp.	33.1598	-117.3802	SCB
3/29/2013 10:25:20	California Sea Lion	*Zalophus californianus*	33.1556	-117.3900	SCB
3/29/2013 10:38:24	Bottlenose Dolphin	*Tursiops truncatus*	32.8102	-117.1368	SCB
3/29/2013 10:38:37	Common Dolphin sp.	*Delphinus* sp.	32.9636	-117.3007	SCB
3/29/2013 10:41:08	California Sea Lion	*Zalophus californianus*	32.8938	-117.2813	SCB

*SCB = Sanra Catalina Basin, SNB = San Nicholas Basin

Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
3/29/2013 10:41:36	Unidentified Dolphin	Delphinidae sp.	32.8824	-117.2746	SCB
3/29/2013 15:03:11	Bottlenose Dolphin	*Tursiops truncatus*	32.8750	-117.2733	SCB
3/29/2013 15:03:27	Common Dolphin sp.	*Delphinus* sp.	32.8813	-117.2802	SCB
3/29/2013 15:06:23	California Sea Lion	*Zalophus californianus*	32.9625	-117.2866	SCB
3/29/2013 15:07:33	Gray Whale	*Eschrichtius robustus*	32.9940	-117.2863	SCB
3/29/2013 15:11:46	California Sea Lion	*Zalophus californianus*	32.9379	-117.2778	SCB
3/29/2013 15:11:49	Gray Whale	*Eschrichtius robustus*	32.9365	-117.2829	SCB
3/29/2013 15:12:57	Common Dolphin sp.	*Delphinus* sp.	32.9032	-117.2914	SCB
3/29/2013 15:14:05	Gray whale- Dead	*Eschrichtius robustus*	32.8704	-117.2976	SCB
3/30/2013 10:21:17	Gray Whale	*Eschrichtius robustus*	32.8843	-117.4182	SNB
3/30/2013 10:19:20	Bottlenose Dolphin	*Tursiops truncatus*	32.8617	-117.3050	SNB
3/30/2013 10:19:00	Unidentified Dolphin	Delphinidae sp.	32.8493	-117.2885	SNB
3/30/2013 10:20:00	Unidentified Dolphin	Delphinidae sp.	32.8604	-117.3385	SNB
3/30/2013 10:33:50	Gray Whale	*Eschrichtius robustus*	32.9701	-117.9221	SNB
3/30/2013 10:37:34	Unidentified Large Whale	Cetacea	32.9689	-118.0543	SNB
3/30/2013 10:51:10	Unidentified Dolphin	Delphinidae sp.	32.8105	-117.1405	SNB
3/30/2013 11:02:02	California Sea Lion	*Zalophus californianus*	32.9752	-118.9523	SNB
3/30/2013 11:05:36	Fin Whale	*Balaenoptera physalus*	32.9117	-119.0490	SNB
3/30/2013 11:27:34	Minke Whale	*Balaenoptera acutorostrata*	32.9063	-119.0729	SNB
3/30/2013 11:27:34	Fin Whale	*Balaenoptera physalus*	32.9064	-119.0729	SNB
3/30/2013 11:59:44	California Sea Lion	*Zalophus californianus*	32.8259	-119.1314	SNB
3/30/2013 12:09:27	Fin Whale	*Balaenoptera physalus*	32.9319	-118.9021	SNB
3/30/2013 12:15:50	Risso's Dolphin	*Grampus griseus*	32.9969	-118.8068	SNB
3/30/2013 12:15:50	Northern Right Whale Dolphin	*Lissodelphis borealis*	32.9969	-118.8068	SNB
3/30/2013 12:44:14	Gray Whale	*Eschrichtius robustus*	33.0496	-118.7053	SNB
3/30/2013 12:53:43	Northern Right Whale Dolphin	*Lissodelphis borealis*	32.9035	-118.7978	SNB
3/30/2013 12:56:36	Minke Whale	*Balaenoptera acutorostrata*	32.8105	-117.1363	SNB
3/30/2013 13:01:24	Minke Whale	*Balaenoptera acutorostrata*	32.9383	-118.7429	SNB

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Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
3/30/2013 13:08:03	Bottlenose Dolphin	*Tursiops truncatus*	33.0124	-118.5302	SNB
3/30/2013 13:08:46	Risso's Dolphin	*Grampus griseus*	33.0060	-118.4982	SNB
3/30/2013 13:17:18	California Sea Lion	*Zalophus californianus*	32.9353	-118.2459	SNB
3/30/2013 13:20:53	Risso's Dolphin	*Grampus griseus*	32.9139	-118.1241	SNB
3/30/2013 13:21:51	Humpback Whale	*Megaptera novaeangliae*	32.9142	-118.0935	SNB
3/30/2013 13:23:35	Unidentified Dolphin	Delphinidae sp.	32.9011	-118.0316	SNB
3/30/2013 13:35:38	Gray Whale	*Eschrichtius robustus*	32.8636	-117.6163	SNB
3/30/2013 13:43:33	Common Dolphin sp.	*Delphinus* sp.	32.8462	-117.3316	SNB
3/30/2013 14:34:37	Common Dolphin sp.	*Delphinus* sp.	32.8709	-117.2770	SCB
3/30/2013 14:40:48	Common Dolphin sp.	*Delphinus* sp.	33.0436	-117.3338	SCB
3/30/2013 14:41:20	Common Dolphin sp.	*Delphinus* sp.	33.0578	-117.3407	SCB
3/30/2013 14:44:23	California Sea Lion	*Zalophus californianus*	33.1166	-117.3514	SCB
3/30/2013 14:46:23	California Sea Lion	*Zalophus californianus*	33.0661	-117.3144	SCB
5/22/2013 11:30:10	California Sea Lion	*Zalophus californianus*	32.6276	-117.7398	SCB
5/22/2013 11:30:10	California Sea Lion	*Zalophus californianus*	32.6276	-117.7398	SCB
5/22/2013 12:01:24	Bottlenose Dolphin	*Tursiops truncatus*	32.8755	-117.3748	SCB
5/22/2013 12:22:51	Short-beaked Common Dolphin	*Delphinus delphis*	32.8825	-117.5803	SCB
5/22/2013 12:39:58	California Sea Lion	*Zalophus californianus*	32.7982	-117.8771	SCB
5/22/2013 12:44:59	Risso's Dolphin	*Grampus griseus*	32.7552	-118.0298	SCB
5/22/2013 13:11:11	Common Dolphin sp.	*Delphinus* sp.	32.7635	-118.0251	SCB
5/22/2013 13:28:33	Unidentified Dolphin	Unidentified Dolphin	32.7492	-118.2064	SCB
5/22/2013 13:35:31	Risso's Dolphin	*Grampus griseus*	32.8929	-118.1564	SCB
5/22/2013 14:04:56	California Sea Lion	*Zalophus californianus*	32.8105	-117.1369	SCB
5/22/2013 14:10:36	California Sea Lion	*Zalophus californianus*	32.8105	-117.1410	SCB
5/22/2013 14:11:33	Long-beaked Common Dolphin	*Delphinus capensis*	32.8105	-117.1374	SCB
5/22/2013 14:22:19	California Sea Lion	*Zalophus californianus*	32.8105	-117.1387	SCB
5/22/2013 14:24:57	California Sea Lion	*Zalophus californianus*	32.9755	-117.7831	SCB
5/22/2013 14:27:20	California Sea Lion	*Zalophus californianus*	32.9840	-117.6986	SCB

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Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
5/22/2013 14:28:20	California Sea Lion	*Zalophus californianus*	32.9915	-117.6668	SCB
5/22/2013 14:28:41	California Sea Lion	*Zalophus californianus*	32.9922	-117.6549	SCB
5/22/2013 14:31:09	California Sea Lion	*Zalophus californianus*	33.0124	-117.5651	SCB
5/22/2013 14:33:17	California Sea Lion	*Zalophus californianus*	33.0322	-117.4900	SCB
5/22/2013 14:37:46	Common Dolphin sp.	*Delphinus* sp.	33.0929	-117.4061	SCB
5/22/2013 14:47:50	California Sea Lion	*Zalophus californianus*	33.1244	-117.6460	SCB
5/22/2013 14:53:40	California Sea Lion	*Zalophus californianus*	33.0799	-117.8221	SCB
5/22/2013 14:54:01	Short-beaked Common Dolphin	*Delphinus delphis*	33.0676	-117.8313	SCB
5/22/2013 15:00:40	California Sea Lion	*Zalophus californianus*	33.0689	-117.8556	SCB
5/22/2013 15:01:16	California Sea Lion	*Zalophus californianus*	33.0675	-117.8746	SCB
5/22/2013 15:01:30	California Sea Lion	*Zalophus californianus*	33.0675	-117.8812	SCB
5/22/2013 15:03:30	Fin Whale	*Balaenoptera physalus*	33.0549	-117.9532	SCB
5/22/2013 15:04:52	California Sea Lion	*Zalophus californianus*	33.0454	-117.9917	SCB
5/22/2013 15:21:55	Risso's Dolphin	*Grampus griseus*	33.0056	-118.1774	SCB
5/22/2013 15:40:09	California Sea Lion	*Zalophus californianus*	33.1991	-117.8911	SCB
5/22/2013 15:49:15	Long-beaked Common Dolphin	*Delphinus capensis*	33.2727	-117.5989	SCB
5/22/2013 15:53:46	Common Dolphin sp.	*Delphinus* sp.	33.2569	-117.5629	SCB
5/22/2013 15:59:04	California Sea Lion	*Zalophus californianus*	33.1208	-117.4240	SCB
5/22/2013 16:00:19	Common Dolphin sp.	*Delphinus* sp.	33.0974	-117.3858	SCB
5/22/2013 16:00:48	Common Dolphin sp.	*Delphinus* sp.	33.0806	-117.3754	SCB
5/22/2013 16:01:19	Common Dolphin sp.	*Delphinus* sp.	33.0665	-117.3645	SCB
5/22/2013 16:03:11	Common Dolphin sp.	*Delphinus* sp.	33.0122	-117.3369	SCB
5/22/2013 16:07:31	Common Dolphin sp.	*Delphinus* sp.	32.8892	-117.2732	SCB
5/23/2013 08:53:11	Common Dolphin sp.	*Delphinus* sp.	32.8694	-117.2739	SCB
5/23/2013 09:22:05	California Sea Lion	*Zalophus californianus*	33.2863	-118.0848	SCB
5/23/2013 09:24:31	California Sea Lion	*Zalophus californianus*	33.2747	-118.1670	SCB
5/23/2013 09:26:40	California Sea Lion	*Zalophus californianus*	33.2530	-118.2377	SCB
5/23/2013 09:29:33	California Sea Lion	*Zalophus californianus*	33.2346	-118.3300	SCB

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Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
5/23/2013 09:34:42	California Sea Lion	*Zalophus californianus*	33.1999	-118.5058	SCB
5/23/2013 10:38:33	Common Dolphin sp.	*Delphinus* sp.	33.1685	-118.0501	SCB
5/23/2013 10:38:52	Risso's Dolphin	*Grampus griseus*	33.1620	-118.0619	SCB
5/23/2013 10:39:31	Risso's Dolphin	*Grampus griseus*	33.1598	-118.0665	SCB
5/23/2013 10:52:01	California Sea Lion	*Zalophus californianus*	33.1658	-118.0639	SCB
5/23/2013 11:00:18	California Sea Lion	*Zalophus californianus*	33.1285	-118.1883	SCB
5/23/2013 11:01:05	California Sea Lion	*Zalophus californianus*	33.1244	-118.2141	SCB
5/23/2013 11:04:00	California Sea Lion	*Zalophus californianus*	33.0999	-118.3048	SCB
5/23/2013 11:04:37	California Sea Lion	*Zalophus californianus*	33.0994	-118.3273	SCB
5/23/2013 11:04:50	Risso's Dolphin	*Grampus griseus*	33.0930	-118.3322	SCB
5/23/2013 11:09:31	California Sea Lion	*Zalophus californianus*	33.0881	-118.3150	SCB
5/23/2013 11:13:30	Fin Whale	*Balaenoptera physalus*	33.0814	-118.3334	SCB
5/23/2013 11:17:59	California Sea Lion	*Zalophus californianus*	33.0761	-118.3399	SCB
5/23/2013 12:03:17	California Sea Lion	*Zalophus californianus*	32.9965	-118.1985	SCB
5/23/2013 12:04:40	Long-beaked Common Dolphin	*Delphinus capensis*	33.0087	-118.1517	SCB
5/23/2013 12:05:04	Risso's Dolphin	*Grampus griseus*	33.0110	-118.1425	SCB
5/23/2013 12:14:12	California Sea Lion	*Zalophus californianus*	33.0313	-118.1034	SCB
5/23/2013 12:17:18	California Sea Lion	*Zalophus californianus*	33.0424	-118.0000	SCB
5/23/2013 12:17:51	Common Dolphin sp.	*Delphinus* sp.	33.0525	-117.9846	SCB
5/23/2013 12:25:18	California Sea Lion	*Zalophus californianus*	33.0613	-117.9606	SCB
5/23/2013 12:25:14	California Sea Lion	*Zalophus californianus*	33.0617	-117.9615	SCB
5/23/2013 12:27:01	California Sea Lion	*Zalophus californianus*	33.0705	-117.9066	SCB
5/23/2013 12:30:12	California Sea Lion	*Zalophus californianus*	33.0878	-117.8003	SCB
5/23/2013 12:30:27	California Sea Lion	*Zalophus californianus*	33.0984	-117.7957	SCB
5/23/2013 14:58:37	Bottlenose Dolphin	*Tursiops truncatus*	33.0568	-117.5810	SCB
5/23/2013 15:07:25	Bottlenose Dolphin	*Tursiops truncatus*	33.0860	-117.5986	SCB
5/23/2013 15:27:24	Gray Whale	*Eschrichtius robustus*	32.9182	-117.8707	SCB
5/23/2013 16:05:55	Fin Whale	*Balaenoptera physalus*	32.8388	-117.5921	SCB

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Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
5/23/2013 16:11:29	Unidentified Dolphin	Unidentified Dolphin	32.8530	-117.4420	SCB
5/23/2013 16:11:55	Common Dolphin sp.	*Delphinus* sp.	32.8524	-117.4167	SCB
5/23/2013 16:15:19	Unidentified Dolphin	Unidentified Dolphin	32.8632	-117.2809	SCB
5/24/2013 08:20:02	California Sea Lion	*Zalophus californianus*	32.8555	-117.2921	SCB
5/24/2013 08:20:37	Unidentified Dolphin	Unidentified Dolphin	32.8464	-117.3062	SCB
5/24/2013 08:21:14	California Sea Lion	*Zalophus californianus*	32.8404	-117.3272	SCB
5/24/2013 08:21:33	Common Dolphin sp.	*Delphinus* sp.	32.8378	-117.3390	SCB
5/24/2013 08:24:02	California Sea Lion	*Zalophus californianus*	32.7791	-117.3771	SCB
5/24/2013 08:24:38	Blue Whale	*Balaenoptera musculus*	32.7618	-117.3808	SCB
5/24/2013 09:12:31	California Sea Lion	*Zalophus californianus*	32.7956	-117.3771	SCB
5/24/2013 09:37:59	Risso's Dolphin	*Grampus griseus*	32.6013	-117.9179	SCB
5/24/2013 10:06:41	Risso's Dolphin	*Grampus griseus*	32.6185	-117.9225	SCB
5/24/2013 10:10:15	Bottlenose Dolphin	*Tursiops truncatus*	32.6257	-118.1290	SCB
5/24/2013 10:34:09	Risso's Dolphin	*Grampus griseus*	32.6275	-118.1254	SCB
5/24/2013 10:35:48	Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	32.6262	-118.1343	SCB
5/24/2013 11:18:23	Bottlenose Dolphin	*Tursiops truncatus*	32.6373	-118.1343	SCB
5/24/2013 11:34:31	Short-beaked Common Dolphin	*Delphinus delphis*	32.7429	-118.3399	SCB
5/24/2013 11:41:15	Common Dolphin sp.	*Delphinus* sp.	32.7420	-118.3400	SCB
5/24/2013 13:26:32	Short-beaked Common Dolphin	*Delphinus delphis*	32.7261	-117.7887	SCB
5/24/2013 13:39:08	Risso's Dolphin	*Grampus griseus*	32.8009	-117.4531	SCB
5/24/2013 14:13:17	Risso's Dolphin	*Grampus griseus*	32.8602	-117.3371	SCB
5/24/2013 14:17:10	California Sea Lion	*Zalophus californianus*	32.9441	-117.3409	SCB
5/24/2013 14:38:53	California Sea Lion	*Zalophus californianus*	32.8664	-117.6251	SCB
5/24/2013 14:39:24	Risso's Dolphin	*Grampus griseus*	32.8557	-118.3542	SCB
5/24/2013 14:40:33	Bottlenose Dolphin	*Tursiops truncatus*	32.8649	-118.3481	SCB
5/24/2013 14:54:33	Risso's Dolphin	*Grampus griseus*	32.9772	-118.4395	SCB
5/24/2013 14:55:43	California Sea Lion	*Zalophus californianus*	32.9942	-118.4397	SCB
5/24/2013 15:14:00	Risso's Dolphin	*Grampus griseus*	32.9744	-118.4482	SCB

*SCB = Sanra Catalina Basin, SNB = San Nicholas Basin

Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
5/24/2013 15:19:41	California Sea Lion	*Zalophus californianus*	33.0056	-118.4959	SCB
5/24/2013 15:21:21	California Sea Lion	*Zalophus californianus*	33.0010	-118.4986	SCB
5/24/2013 15:22:13	California Sea Lion	*Zalophus californianus*	33.0369	-118.5275	SCB
5/24/2013 15:22:41	California Sea Lion	*Zalophus californianus*	33.0902	-118.3770	SCB
5/24/2013 15:22:56	California Sea Lion	*Zalophus californianus*	33.1020	-118.3243	SCB
5/24/2013 15:23:07	California Sea Lion	*Zalophus californianus*	33.0996	-118.2988	SCB
5/24/2013 15:23:45	California Sea Lion	*Zalophus californianus*	33.1072	-118.2811	SCB
5/24/2013 15:26:26	Short-beaked Common Dolphin	*Delphinus delphis*	33.1110	-118.2735	SCB
5/24/2013 15:29:45	Risso's Dolphin	*Grampus griseus*	33.1130	-118.2684	SCB
5/24/2013 15:29:45	California Sea Lion	*Zalophus californianus*	33.1170	-118.2472	SCB
5/24/2013 15:34:11	California Sea Lion	*Zalophus californianus*	33.1218	-118.2464	SCB
5/24/2013 15:34:15	California Sea Lion	*Zalophus californianus*	33.1288	-118.1785	SCB
5/24/2013 15:35:15	California Sea Lion	*Zalophus californianus*	33.1371	-118.1809	SCB
5/24/2013 15:36:14	Unidentified Dolphin	Unidentified Dolphin	33.1453	-118.1273	SCB
5/24/2013 15:43:01	Unidentified Dolphin	Unidentified Dolphin	33.1569	-118.0983	SCB
5/24/2013 15:43:22	Unidentified Dolphin	Unidentified Dolphin	32.8102	-117.1379	SCB
5/24/2013 15:44:22	California Sea Lion	*Zalophus californianus*	33.1576	-118.0640	SCB
5/24/2013 15:44:37	California Sea Lion	*Zalophus californianus*	33.1695	-118.0202	SCB
5/24/2013 15:57:13	Common Dolphin sp.	*Delphinus* sp.	33.1704	-118.0137	SCB
5/24/2013 15:57:51	Common Dolphin sp.	*Delphinus* sp.	33.1802	-117.9739	SCB
5/24/2013 16:06:14	California Sea Lion	*Zalophus californianus*	33.1811	-117.9651	SCB
5/24/2013 16:07:18	California Sea Lion	*Zalophus californianus*	33.2613	-117.5588	SCB
5/24/2013 16:11:51	Unidentified Dolphin	Unidentified Dolphin	33.2498	-117.5424	SCB
5/24/2013 16:12:06	Unidentified Dolphin	Unidentified Dolphin	33.0611	-117.3578	SCB
5/25/2013 09:14:10	California Sea Lion	*Zalophus californianus*	33.0286	-117.3361	SCB
5/25/2013 09:14:11	Bottlenose Dolphin	*Tursiops truncatus*	32.8964	-117.2805	SCB
5/25/2013 09:14:29	California Sea Lion	*Zalophus californianus*	32.8896	-117.2710	SCB
5/25/2013 09:15:02	Common Dolphin sp.	*Delphinus* sp.	32.8704	-117.2881	SCB

*SCB = Sanra Catalina Basin, SNB = San Nicholas Basin

Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
5/25/2013 09:15:09	Common Dolphin sp.	*Delphinus* sp.	32.8777	-117.2862	SCB
5/25/2013 09:15:17	Unidentified Dolphin	Unidentified Dolphin	32.8753	-117.3008	SCB
5/25/2013 09:15:34	Common Dolphin sp.	*Delphinus* sp.	32.8863	-117.3197	SCB
5/25/2013 09:15:48	Common Dolphin sp.	*Delphinus* sp.	32.8820	-117.3267	SCB
5/25/2013 09:16:15	Common Dolphin sp.	*Delphinus* sp.	32.8833	-117.3312	SCB
5/25/2013 09:17:01	California Sea Lion	*Zalophus californianus*	32.8922	-117.3413	SCB
5/25/2013 09:19:16	California Sea Lion	*Zalophus californianus*	32.8877	-117.3521	SCB
5/25/2013 10:37:47	Risso's Dolphin	*Grampus griseus*	32.8956	-117.3686	SCB
5/25/2013 10:41:02	Short-beaked Common Dolphin	*Delphinus delphis*	32.8943	-117.3987	SCB
5/25/2013 10:41:15	Northern Right Whale Dolphin	*Lissodelphis borealis*	32.9203	-117.4886	SCB
5/25/2013 11:01:55	Fin Whale	*Balaenoptera physalus*	32.9776	-118.8052	SNB
5/25/2013 11:53:16	California Sea Lion	*Zalophus californianus*	32.9788	-118.8030	SNB
5/25/2013 12:17:07	Long-beaked Common Dolphin	*Delphinus capensis*	32.9775	-118.7995	SNB
5/25/2013 12:24:32	California Sea Lion	*Zalophus californianus*	32.7568	-118.9579	SNB
5/25/2013 12:34:22	Common Dolphin sp.	*Delphinus* sp.	32.8623	-118.3161	SCB
5/25/2013 14:26:08	California Sea Lion	*Zalophus californianus*	33.0398	-117.5195	SCB
5/25/2013 14:42:50	California Sea Lion	*Zalophus californianus*	33.0503	-117.4898	SCB
5/25/2013 14:43:08	Risso's Dolphin	*Grampus griseus*	32.8659	-117.2677	SCB
5/25/2013 14:53:09	Risso's Dolphin	*Grampus griseus*	32.9719	-117.7801	SCB
5/25/2013 14:56:40	California Sea Lion	*Zalophus californianus*	32.8871	-118.3567	SCB
5/25/2013 14:58:41	Risso's Dolphin	*Grampus griseus*	32.8849	-118.3626	SCB
5/25/2013 15:07:25	California Sea Lion	*Zalophus californianus*	32.9570	-118.3837	SCB
5/25/2013 15:10:27	Risso's Dolphin	*Grampus griseus*	32.9526	-118.4924	SCB
5/25/2013 15:18:04	California Sea Lion	*Zalophus californianus*	32.9167	-118.4376	SCB
5/25/2013 15:40:13	Risso's Dolphin	*Grampus griseus*	32.9028	-118.4210	SCB
5/26/2013 08:20:16	California Sea Lion	*Zalophus californianus*	32.8400	-118.3454	SCB
5/26/2013 08:20:26	California Sea Lion	*Zalophus californianus*	32.8504	-118.3419	SCB
5/26/2013 08:21:13	Common Dolphin sp.	*Delphinus* sp.	32.8556	-118.1118	SCB

*SCB = Sanra Catalina Basin, SNB = San Nicholas Basin

Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
5/26/2013 08:27:29	Common Dolphin sp.	*Delphinus* sp.	32.8576	-117.2711	SCB
5/26/2013 08:32:50	Common Dolphin sp.	*Delphinus* sp.	32.8588	-117.2777	SCB
5/26/2013 08:33:01	California Sea Lion	*Zalophus californianus*	32.8712	-117.3038	SCB
5/26/2013 08:39:20	California Sea Lion	*Zalophus californianus*	32.8468	-117.5579	SCB
5/26/2013 08:47:49	California Sea Lion	*Zalophus californianus*	32.8280	-117.7796	SCB
5/26/2013 08:49:09	California Sea Lion	*Zalophus californianus*	32.8221	-117.7880	SCB
5/26/2013 08:49:57	California Sea Lion	*Zalophus californianus*	32.8218	-118.0409	SCB
5/26/2013 08:53:06	California Sea Lion	*Zalophus californianus*	32.8044	-118.3777	S SCI
5/26/2013 08:55:04	Common Dolphin sp.	*Delphinus* sp.	32.7967	-118.4282	S SCI
5/26/2013 08:55:16	Risso's Dolphin	*Grampus griseus*	32.8120	-118.4513	S SCI
5/26/2013 09:36:34	Fin Whale	*Balaenoptera physalus*	32.8561	-118.5634	SNB
5/26/2013 09:40:35	Common Dolphin sp.	*Delphinus* sp.	32.8781	-118.6267	SNB
5/26/2013 09:49:04	California Sea Lion	*Zalophus californianus*	32.8773	-118.6327	SNB
5/26/2013 09:49:46	California Sea Lion	*Zalophus californianus*	32.9691	-118.6973	SNB
5/26/2013 09:50:14	California Sea Lion	*Zalophus californianus*	32.9747	-118.6970	SNB
5/26/2013 09:50:21	California Sea Lion	*Zalophus californianus*	32.9760	-118.7098	SNB
5/26/2013 09:50:27	California Sea Lion	*Zalophus californianus*	33.0013	-118.6070	SNB
5/26/2013 09:50:30	California Sea Lion	*Zalophus californianus*	33.0129	-118.6108	SNB
5/26/2013 09:55:02	Bottlenose Dolphin	*Tursiops truncatus*	33.0285	-118.6173	SNB
5/26/2013 09:56:45	California Sea Lion	*Zalophus californianus*	33.0318	-118.6188	SNB
5/26/2013 10:15:15	Unidentified Whale	Unidentified Whale	33.0329	-118.6231	SNB
5/26/2013 10:18:17	Unidentified Whale	Unidentified Whale	33.0351	-118.6225	SNB
5/26/2013 10:44:45	California Sea Lion	*Zalophus californianus*	33.1126	-118.7028	SNB
5/26/2013 10:50:53	California Sea Lion	*Zalophus californianus*	33.1192	-118.7064	SNB
5/26/2013 10:51:47	Unidentified Dolphin	Unidentified Dolphin	32.9582	-118.9406	SNB
5/26/2013 11:03:00	California Sea Lion	*Zalophus californianus*	33.0166	-119.0177	SNB
5/26/2013 11:05:41	Bottlenose Dolphin	*Tursiops truncatus*	33.2033	-118.7701	SNB
5/26/2013 11:11:44	California Sea Lion	*Zalophus californianus*	33.1951	-118.5578	SCB

*SCB = Sanra Catalina Basin, SNB = San Nicholas Basin

Date & Time	Species Common Name	Species Scientific Name	Latitude (°N)	Longitude (°W)	Survey Area*
5/26/2013 11:12:55	California Sea Lion	*Zalophus californianus*	33.2006	-118.5227	SCB
5/26/2013 11:14:29	Risso's Dolphin	*Grampus griseus*	32.8105	-117.1397	SCB
5/26/2013 11:15:36	Unidentified Dolphin	Unidentified Dolphin	33.2051	-118.4954	SCB
5/26/2013 11:26:52	California Sea Lion	*Zalophus californianus*	33.2305	-118.3944	SCB
5/26/2013 11:34:28	Risso's Dolphin	*Grampus griseus*	33.2361	-118.3552	SCB
5/26/2013 11:51:09	Unidentified Dolphin	Unidentified Dolphin	33.2483	-118.3121	SCB
5/26/2013 11:55:11	Common Dolphin sp.	*Delphinus* sp.	33.2568	-118.3087	SCB
5/26/2013 14:11:23	Unidentified Dolphin	Unidentified Dolphin	33.2761	-118.1775	SCB
5/26/2013 14:21:22	Risso's Dolphin	*Grampus griseus*	33.3280	-117.9352	SCB
5/26/2013 14:25:46	Gray Whale	*Eschrichtius robustus*	33.3041	-117.6180	SCB
5/26/2013 14:55:01	Risso's Dolphin	*Grampus griseus*	33.2272	-117.5087	SCB
5/26/2013 15:19:00	California Sea Lion	*Zalophus californianus*	32.9430	-117.8651	SCB
5/26/2013 15:23:24	Bottlenose Dolphin	*Tursiops truncatus*	32.9173	-118.0251	SCB
5/26/2013 15:28:28	Fin Whale	*Balaenoptera physalus*	32.9083	-118.0785	SCB
5/26/2013 15:42:31	Long-beaked Common Dolphin	*Delphinus capensis*	32.8342	-118.3326	SCB
5/26/2013 15:49:17	California Sea Lion	*Zalophus californianus*	32.8274	-118.3152	SCB
5/26/2013 15:49:31	California Sea Lion	*Zalophus californianus*	32.8955	-118.4219	SCB
5/26/2013 15:52:54	California Sea Lion	*Zalophus californianus*	33.0127	-118.5063	SCB
5/26/2013 15:54:52	California Sea Lion	*Zalophus californianus*	33.0709	-118.4436	SCB
5/26/2013 15:56:24	California Sea Lion	*Zalophus californianus*	33.1019	-118.3187	SCB
5/26/2013 15:57:22	Short-beaked Common Dolphin	*Delphinus delphis*	33.1042	-118.3123	SCB
5/26/2013 16:14:19	California Sea Lion	*Zalophus californianus*	33.1367	-118.1914	SCB
5/26/2013 16:33:14	California Sea Lion	*Zalophus californianus*	33.1567	-118.1307	SCB

*SCB = Sanra Catalina Basin, SNB = San Nicholas Basin

Table 5. Summary of Flight Effort during SOCAL Marine Mammal Aerial Survey Monitoring 25-30 March 2013.

2013 Date	Flight of Day	Time Engines On	Time Engines Off	Total Engine Time	Time Wheels Up	Time Wheels Down	Total Flight Time	Total Flight Dist (km)	Total Flight Dist (nm)	Start Obs.	End Obs.	Total Obs. Time	Flight Area*	General Weather	Comments
Mar 25	1	12:35	14:57	2:21	12:42	14:55	2:12	427.2	230.7	12:46	14:50	2:04	SCB	Partly Cloudy Bf 2-3	Tried to go to SOAR, ceiling too low
Mar 25	2	16:07	18:52	2:45	16:16	18:52	2:35	515.6	278.4	16:20	18:48	2:28	SCB	Partly Cloudy Bf 2-3	
Mar 26	1	11:28	15:47	4:19	11:38	15:45	4:07	771.0	416.3	11:41	15:42	4:00	SCB	Fog Bf 1-3	Tried to go to SOAR, ceiling too low
Mar 27	1	9:56	14:32	4:35	10:05	14:30	4:24	872.2	471.0	10:08	14:24	4:15	SNB	Clear Sky, Bf 1-4	Started S SOAR first, then moved to N SOAR
Mar 28	1	9:15	14:02	4:46	9:22	13:57	4:35	865.8	467.5	9:25	13:52	4:26	SCB	Partly Cloudy Bf 1-3	Tried SOAR, ceiling too low
Mar 28	2	15:13	17:10	1:56	15:18	17:06	1:47	339.5	183.3	15:22	17:01	1:39	SNB	Partly Cloudy Bf 3-4	
Mar 29	1	9:19	10:53	1:33	9:28	10:48	1:20	242.9	131.2	9:31	10:42	1:10	SNB	Overcast Bf 1-2	Tried SOAR, ceiling too low
Mar 29	2	14:55	15:32	0:36	14:58	15:27	0:28	86.7	46.8	15:02	15:21	0:19	SCB	Overcast Bf 3	
Mar 30	1	10:07	13:51	3:44	10:15	13:51	3:36	706.0	381.2	10:18	13:45	3:26	SNB	Partly Cloudy Bf 1-3	Started N SOAR first
Mar 30	2	14:24	14:58	0:33	14:30	15:01	0:31	95.9	51.8	14:33	14:53	0:19	SCB	Heavy Overcast Bf 3-4	
	10 Flights	**Total Engine Time**		**27:13**	**Total Flown:**		**25:39**	**4,922.8**	**2,658.2**	**Total Obs Time**		**24:10**			**Add 3 hr RT ferry time Oxnard for aircraft**

*SCB = Santa Catalina Basin, SNB = San Nicolas Basin.

Table 6. Summary of Flight Effort during SOCAL Marine Mammal Aerial Survey Monitoring 22-26 May 2013.

Date	Flight of Day	Time Engines On	Time Engines Off	Total Engine Time	Time Wheels Up	Time Wheels Down	Total Flight Time	Total Flight Dist (km)	Total Flight Dist (nm)	Start Obs.	End Obs.	Total Obs. Time	Flight Area*	General Weather	Comments
5/22/2013	1	11:07	16:18	5:11	11:09	16:14	5:05	976	527	11:13	16:08	4:55	SCB	Overcast Bf 1-5	Flew Lines 1-6
5/23/2013	1	8:42	13:00	4:18	8:49	12:57	4:08	786	424	8:53	12:52	3:59	SCB	Light Winds Bf 2-5	Flew lines 7-9
5/23/2013	2	14:36	16:24	1:48	14:45	16:22	1:37	321	173	14:48	16:16	1:27	SCB	Partly Cloudy Bf 2-4	Flew N to Crespi Knoll then S to Fortymile ridge. Flew along the San Diego Trough N to S and along the Coronado Escarpment S to N
5/24/2013	1	8:03	11:51	3:48	8:15	11:56	3:40	674	364	8:19	11:44	3:24	SCB	Partly Cloudy Bf 2-3	Flew Line 1 to the S end of SCI
5/24/2013	2	13:15	16:24	3:09	13:19	16:18	2:59	543	293	13:24	16:13	2:49	SCB	Partly Cloudy Bf 2-3	Flew line 3 to San Clemente Island (SCI), then N to S along drop-off close to E SCI, then W-E line 6
5/25/2013	1	9:01	12:43	3:42	9:10	12:40	3:30	693	374	9:20	12:35	3:15	SCB	Clear Skies Bf 1-5	Skipped every other line to cover entire SOAR area
5/25/2013	2	14:01	16:15	2:13	14:04	16:11	2:07	359	194	14:10	16:06	1:55	SCB	Windy Bf 2-4	Flew drop-off close to E SCI, S to N
5/26/2013	1	8:10	12:19	4:09	8:16	12:15	3:59	760	411	8:21	12:11	3:49	SNB	Windy Bf 2-5	Flew fast transit to SOAR lines 1, 3, 5, 7, then line 7 NAOPA W-E
5/26/2013	2	13:41	16:49	3:08	13:45	16:46	3:01	532	287	13:49	16:41	2:52	SCB	Clear Skies Bf 1-4	Line 4 to SE SCI to do focals
	9 Flights	**Total Engine Time**		**31:26**	**Total In-Air time:**		**30:06**	**5,644**	**3,047**	**Total Obs Time**		**28:25**			**Add 3 hr RT ferry time Oxnard for aircraft**

*SCB = Santa Catalina Basin, SNB = San Nicolas Basin.

Table 7. Summary of Flight Effort during SOCAL Marine Mammal Aerial Survey Monitoring 24-29 July 2013.

Date	Flight of Day	Time Engines On	Time Engines Off	Total Engine Time	Time Wheels Up	Time Wheels Down	Total Flight Time	Total Flight Dist (km)	Total Flight Dist (nm)	Start Obs.	End Obs.	Total Obs. Time	Flight Area*	General Weather	Comments
7/24/2013	1	11:00:39	15:25:40	4:25:01	11:06:36	15:21:33	4:14:57	841.3	454.3	11:09:42	15:04:21	3:54	SCB	Partly Cloudy Bf 2-5	
7/25/2013	1	12:29:16	16:39:18	4:10:02	12:36:36	16:34:18	3:57:42	747.6	403.7	12:40:00	16:29:27	3:49	SCB	Partly Cloudy Bf 2-5	Late start due to fog.
7/26/2013	1	10:47:32	13:12:48	2:25:16	10:58:20	13:07:08	2:08:48	443.7	239.6	11:12:27	13:02:57	1:50	SCB	Partly Cloudy Bf 3-4	Late start due to fog.
7/26/2013	2	14:11:47	15:55:26	1:43:39	14:15:25	16:00:17	1:44:52	326.5	176.3	14:18:50	15:50:17	1:31	SCB	Partly Cloudy Bf 2-4	
7/27/2013	1	13:30:45	16:33:55	3:03:10	13:38:32	16:30:37	2:52:05	572.9	309.3	13:44:44	16:25:54	2:41	SCB	Partly Cloudy Bf 2-5	Late start due to fog.
7/28/2013	1	11:40:32	15:47:58	4:07:26	11:47:55	15:43:06	3:55:11	719.3	388.4	11:51:21	15:37:38	3:46	SCB	Foggy Bf 1-4	Late start due to fog.
7/29/2013	1	10:42:15	15:23:02	4:40:47	10:49:03	15:19:53	4:30:50	869.2	469.3	10:52:27	15:15:42	4:23	SNB	Partly Cloudy Bf 0-2	Late start due to fog.
	8 Flights		**Total Engine Time**	**24:35**		**Total Flown:**	**23:24**	**4,520.5**	**2,440.9**		**Total Obs Time**	**21:56**			**Add 3 hr (RT) for ferry time to and from Oxnard for aircraft**

*SCB = Santa Catalina Basin, SNB = San Nicolas Basin.

Table 8. Summary of Photo and Video Effort during SOCAL Marine Mammal Aerial Survey Monitoring March-May 2013.

Survey	Total Video Clips	Total Videos With Animals In View	Total Video (hh:mm:ss)	Total Photos
Mar-13	30	26	2:25:32	1,741
May-13	30	24	2:43:15	1,620
Total	**60**	**50**	**5:08:47**	**3,361**

Table 9. Summary of video recorded during 25-30 March 2013 aerial monitoring surveys off San Diego, California.

Navy Range	Video Name	Video Raw Number	Date (day mo yr)	Start Time (hr:min:sec)	End Time (hr:min:sec)	Total Video (hr:min:sec)	Daily Sighting ID#	Species	Group Size (best estim.)	Bf[+] sea state	Taken by	Video Utility/ Quality[a]	General Description of Video Content
SOCAL	SOCAL_2013March_25_SES_Video_171943-172024_ID8_Risso's	500	03/25/13	17:19:43	17:20:24	0:00:41	8	Risso's Dolphin	50	2	BW*	Poor	1 animal subsurface medium travel, cannot hear audio, animal in view for only 10 sec of video
SOCAL	SOCAL_2013March_25_SES_Video_172038-172047_ID8_Risso's	501	03/25/13	17:20:38	17:20:47	0:00:09	8	Risso's Dolphin	50	2	BW	Poor	1 animal medium travel, cannot hear audio, video too short
SOCAL	SOCAL_2013March_25_SES_Video_172104-172113_ID8_Risso's	502	03/25/13	17:21:04	17:21:13	0:00:09	8	Risso's Dolphin	50	2	BW	Poor	1 animal medium travel, cannot hear audio, video too short
SOCAL	SOCAL_2013March_25_SES_Video_172159-172521_ID8_Risso's	503	03/25/13	17:21:59	17:25:21	0:03:22	8	Risso's Dolphin	50	2	BW	Poor	Animals seen briefly in video but too far to discern behaviors, no audio on video
SOCAL	SOCAL_2013March_26_SES_Video_131156-132246_ID86_Risso's	505	03/26/13	13:11:56	13:22:46	0:10:50	86	Risso's Dolphin	29	3	BW	Good	Video at times in glare, large group of Risso's dolphins line abreast slow travel, dispersal 0.5 to 3. Some pairing, heading 170.
SOCAL	SOCAL_2013March_26_SES_Video_133433-133547_ID65_Humpback	506	03/26/13	13:34:33	13:35:47	0:01:14	65	Humpback Whale	1	1	BW	Good	Animal seen subsurface active behavior, tail slapping, blows
SOCAL	SOCAL_2013March_26_SES_Video_134038-134205_ID65_Humpback	508	03/26/13	13:40:38	13:42:05	0:01:27	65	Humpback Whale	1	1	BW	Fair	Subsurface slow travel with surfacings, blows, video; in glare at times, video far off animal at times
SOCAL	SOCAL_2013March_26_SES_Video_134952-140019_ID64_87_Minke_Fin	509	03/26/13	13:49:52	14:00:19	0:10:27	64,87	Minke/Fin Whale	4,1	1	BW	Good	Minke whale subsurface in front of fin whale, fin whale not as deep as minke whale, minke whale is only 1 fin whale length ahead of fin, in glare at times, multiple blows seen.

Navy Range	Video Name	Video Raw Number	Date (day mo yr)	Start Time (hr:min:sec)	End Time (hr:min:sec)	Total Video (hr:min:sec)	Daily Sighting ID#	Species	Group Size (best estim.)	Bf[+] sea state	Taken by	Video Utility/ Quality[a]	General Description of Video Content
SOCAL	SOCAL_2013March_26_SES_Video_150524-150540_ID75_Fin	510	03/26/13	15:05:24	15:05:40	0:00:16	75	Fin Whale	3	3	BW	Poor	Animal not seen in this short video.
SOCAL	SOCAL_2013March_26_SES_Video_150639-151654_ID75_Fin	511	03/26/13	15:06:39	15:16:54	0:10:15	75	Fin Whale	3	3	BW	Fair	Shadow of plane over whale with no change of behavior, some of video the glare, medium travel subsurface with multiple surfacings.
SOCAL	SOCAL_2013March_27_SES_Video_111452-111903_ID36_Risso's	512	03/27/13	11:14:52	11:19:03	0:04:11	36	Risso's Dolphin	6	2	BW	Fair	Slow travel subsurface, tightly dispersed, airplane in way of video, video camera put down for photos.
SOCAL	SOCAL_2013March_27_SES_Video_112256-112533_ID36_Risso's	513	03/27/13	11:22:56	11:25:33	0:02:37	36	Risso's Dolphin	6	2	BW	Fair	Very tight staggered line abreast group of 6 Risso's slow travel.
SOCAL	SOCAL_2013March_27_SES_Video_112709-112936_ID36_Risso's	515	03/27/13	11:27:09	11:29:36	0:02:27	36	Risso's Dolphin	6	2	BW	Poor	Video camera not on animals, put down to take photos, behaviors called, slow travel.
SOCAL	SOCAL_2013March_28_SES_Video_102946-104615_ID34_Gray	517	03/28/13	10:29:46	10:46:15	0:16:29	34	Gray Whale	3	2	BW	Good	Gray whales heading 290, medium travel, dispersal 0.25, multiple blows seen, touching/socializing
SOCAL	SOCAL_2013March_28_SES_Video_104616-104804_ID34_Gray	518	03/28/13	10:46:16	10:48:04	0:01:48	34	Gray Whale	3	2	BW	Fair	Gray whale social milling, multiple blows seen
SOCAL	SOCAL_2013March_28_SES_Video_120558-120612_ID55_Risso's	519	03/28/13	12:05:58	12:06:12	0:00:14	55	Risso's Dolphin	23	2	BW	Poor	13 animals with 2 possible calves, swimming line abreast
SOCAL	SOCAL_2013March_28_SES_Video_120614-122242_ID55_Risso's	520	03/28/13	12:06:14	12:22:42	0:16:28	55	Risso's Dolphin	23	2	BW	Good	Medium travel, surface active behavior, lunging, possible foraging, split off in pairs, tail chasing

Navy Range	Video Name	Video Raw Number	Date (day mo yr)	Start Time (hr:min:sec)	End Time (hr:min:sec)	Total Video (hr:min:sec)	Daily Sighting ID#	Species	Group Size (best estim.)	Bf[+] sea state	Taken by	Video Utility/ Quality[a]	General Description of Video Content
SOCAL	SOCAL_2013March_28_ SES_Video_122244-122844_ID55_Risso's	521	03/28/13	12:22:44	12:28:44	0:06:00	55	Risso's Dolphin	23	2	BW	Good	Mother/calf pairs, slow travel, 1 social and interacting with other animals, few subgroups
SOCAL	SOCAL_2013March_28_ SES_Video_131425-133039_ID67_Risso's	522	03/28/13	13:14:25	13:30:39	0:16:14	67	Gray Whale	2	2	BW	Good	Pair of gray whales seen subsurface travel, 1 a little ahead of the other, dispersal is 1 body length
SOCAL	SOCAL_2013March_30_ SES_Video_111756-111843_ID20_Fin	301	03/30/13	11:17:56	11:18:43	0:00:47	20	Fin Whale	2	2	BW	Fair	1 animal seen subsurface travel
SOCAL	SOCAL_2013March_30_ SES_Video_112000-112606_ID20_Fin	302	03/30/13	11:20:00	11:26:06	0:06:06	20	Fin Whale	2	2	BW	Good	Fin whale subsurface slow travel, multiple blows, airplane in way some
SOCAL	SOCAL_2013March_30_ SES_Video_113122-113435_ID21_Fin	303	03/30/13	11:31:22	11:34:35	0:03:13	21	Fin Whale	3	2	BW	Good	Fin whales subsurface travel, see 1 fin whale turning to side towards another fin whale, multiple blows seen, dispersal increasing, all animals seen making a sharp turn to right, 4th whale seen and may be another species
SOCAL	SOCAL_2013March_30_ SES_Video_113459-113527_ID21_Fin	304	03/30/13	11:34:59	11:35:27	0:00:28	21	Fin Whale	3	2	BW	Poor	Animal seen briefly in video, subsurface medium travel
SOCAL	SOCAL_2013March_30_ SES_Video_113632-115250_ID21_26_Fin_Minke	305	03/30/13	11:36:32	11:52:50	0:16:18	21,26	Fin/Minke Whale	3,1	2	BW	Good	Fin and minke whale seen, 2 fin whales seen swimming right up to minke whale, looks as if charging minke whale, 1 fin whale rolling in water,

Navy Range	Video Name	Video Raw Number	Date (day mo yr)	Start Time (hr:min:sec)	End Time (hr:min:sec)	Total Video (hr:min:sec)	Daily Sighting ID#	Species	Group Size (best estim.)	Bf[+] sea state	Taken by	Video Utility/ Quality[a]	General Description of Video Content
SOCAL	SOCAL_2013March_30_SES_Video_122036-122936_ID29_30_Risso's_NRWD	306	03/30/13	12:20:36	12:29:36	0:09:00	29,30	Risso's Dolphin/NRWD	18,1	1	BW	Good	Group of Risso's dolphins spread out, northern right whale dolphin (NRWD) seen in front of group, 1 Risso's dolphin almost touching the NRWD
SOCAL	SOCAL_2013March_30_SES_Video_123501-123844_ID29_30_Risso's_NRWD	307	03/30/13	12:35:01	12:38:44	0:03:43	29,30	Risso's Dolphin/NWRD	18,1	1	BW	Good	Mother/calf pair seen medium travel, NRWD 3 body lengths from m/c pair, then another m/c pair seen all-in 1 group with NRWD
				Total Hours =		**2:24:53**							

a. Video Utility/Quality Definitions

Poor- Behavior and audio indiscernible. E.g., animal never seen in video or behavior cannot be determined because animal too far away, video shaky/out of focus/moving too much, Beaufort sea state too rough (i.e., can't determine dispersal distance between individuals, blows and (for whales), individual surface-active behaviors, and/or orientation of animal), and/or audio cannot be understood due to interference/static noise or was not recorded.

Fair- Some behavior and most audio discernible. E.g., animal seen in video and behavior, orientation, and dispersal can be determined but in view on video for only a short period of time (<30 sec per video clip). Most audio can be understood.

Good- Most behavior and audio discernible. Most periods animal at or near surface are captured on video and most audio is understandable. Animal seen in video for a longer length of time (e.g., >30 sec per video clip) and can determine behavior. Nearly all individual behavioral events, blows (for whales), behavior state, orientation, and dispersal distances can be determined via combined video and/or audio.

Excellent - Behavior easily discernible all times animal in view below/above surface and audio discernible. E.g., animal(s) seen throughout entire video when visible at or below the water surface and all audio can be understood. All behavioral events and blows (for whales), behavior state, heading, and dispersal distance can be determined. Video footage is relatively steady and focused. Usually occurs when Beaufort sea state is less than 3.

*BW = Bernd Würsig, DS =Dave Steckler

+Bf = Beaufort sea state

Table 10. Video recorded during 22-26 May 2013 aerial monitoring surveys off San Diego, California.

Navy Range	Video Name	Video Raw Number	Date (day mo yr)	Start Time (hr:min:sec)	End Time (hr:min:sec)	Total Video (hr:min:sec)	Daily Sighting ID#	Species	Group Size (best estim.)	Beaufort sea state	Taken by	Video Utility/ Quality[a]	General Description of Video Content
SOCAL	SOCAL_2013May_22_SES_Video_125153-130737_ID11_Risso's	523	05/22/13	12:51:53	13:07:37	0:15:44	11	Risso's Dolphin	17	2	BW	Good	Dispersion 1-5, oriented to 360, rest/slow travel, all headed the same direction, possible calves, line abreast
SOCAL	SOCAL_2013May_22_SES_Video_130903-131002_ID11_Risso's	524	05/22/13	13:09:03	13:10:02	0:00:59	11	Risso's Dolphin	17	2	BW	Fair	Group of Unidentified dolphins are 300m behind Risso's and moving away from them at 150, group of Risso's spread
SOCAL	SOCAL_2013May_22_SES_Video_141637-142018_ID50_LBCD	525	05/22/13	14:16:37	14:20:18	0:03:41	50	Long-Beaked Common Dolphin	500	3	DS	Fair	Surface-active fast travel with leaping and pirouetting, lots of white water seen, sub-groups, with birds, inverted swim, heading 150
SOCAL	SOCAL_2013May_23_SES_Video_112441-113502_ID26_Fin	1	05/23/13	11:24:41	11:35:02	0:10:21	26	Fin Whale	2	2	BW	Fair	Large scat seen, slow travel below surface, dispersal 0.5, multiple blows seen, animals then separate to 4 BL, animals under the water quite a bit
SOCAL	SOCAL_2013May_23_SES_Video_120918-121130_ID32_LBCD	2	05/23/13	12:09:18	12:11:30	0:02:12	32	Long-Beaked Common Dolphin	800		DS	Fair	Surface-active fast travel with a dispersal of 0.5-5, occasional inverted swim, group is more elongated than wide
SOCAL	SOCAL_2013May_24_SES_Video_83110-84347_ID7_Blue	3	05/24/03	8:31:10	8:43:47	0:12:37	7	Blue Whale	2	2	BW	Good	Rest/slow travel, dispersal 0.1, mother/calf pair, calf of the year, subsurface with calf a mother's teat area, possible nursing, no reaction when plane flew over

Navy Range	Video Name	Video Raw Number	Date (day mo yr)	Start Time (hr:min:sec)	End Time (hr:min:sec)	Total Video (hr:min:sec)	Daily Sighting ID#	Species	Group Size (best estim.)	Beaufort sea state	Taken by	Video Utility/ Quality[a]	General Description of Video Content
SOCAL	SOCAL_2013May_24 _SES_Video_84347-85623_ID7_Blue	4	05/24/03	8:43:47	8:56:23	0:12:36	7	Blue Whale	2	2	BW	Good	Vessel seen and calf getting closer to mother, rest/slow travel, vessel approaching pair, multiple blows seen, second vessel seen and may cross right in front of whales, calf very close to mother
SOCAL	SOCAL_2013May_24 _SES_Video_85624-90900_ID7_Blue	5	05/24/03	8:56:24	9:09:00	0:12:36	7	Blue Whale	2	2	BW	Good	Vessel only 10 BL away from pair, dispersal 0.5, multiple blows seen, calf moving rapidly away from mom, vessel picking up speed, calf 1.5 BL away from mom and in front, vessel has passed pair, calf and mom close now, calf seen going down to moms belly, possible nursing
SOCAL	SOCAL_2013May_24 _SES_Video_90901-90941_ID7_Blue	6	05/24/03	9:09:01	9:09:41	0:00:40	7	Blue Whale	2	2	BW	Good	Calf parallel to mom, possible nursing, calf arched
SOCAL	SOCAL_2013May_24 _SES_Video_94652-95654_ID7_Risso's	7	05/24/03	9:46:52	9:56:54	0:10:02	9	Risso's Dolphin	20	3	BW	Fair	Slow to medium travel, mostly subsurface, line abreast, 18 individuals, 2 gray animals, possible calves, 3 individuals crossing over, orientation 300
SOCAL	SOCAL_2013May_24 _SES_Video_101617-102327_ID10_Risso's	8	05/24/03	10:16:17	10:23:27	0:07:10	10	Risso's Dolphin_ Bottlenos e Dolphin	15	3	BW	Fair	2 Risso's dolphin approached the bottlenose dolphin, Risso's starting to mill as bottlenose are approaching the group of Risso's, 2 clumps of Risso's one in the front and one in the rear, socially interacting

Navy Range	Video Name	Video Raw Number	Date (day mo yr)	Start Time (hr:min:sec)	End Time (hr:min:sec)	Total Video (hr:min:sec)	Daily Sighting ID#	Species	Group Size (best estim.)	Beaufort sea state	Taken by	Video Utility/ Quality[a]	General Description of Video Content
SOCAL	SOCAL_2013May_24_SES_Video_103801-104821_ID12_Risso's	9	05/24/03	10:38:01	10:48:21	0:10:20	12	Risso's Dolphin	25	3	BW	Fair	Different headings, 25 individuals, on the SE side of San Clemente Island, spread out elongated, slow travel, dispersal 0.5 to 6, possible calves
SOCAL	SOCAL_2013May_24_SES_Video_142130-143206_ID6_Risso's	11	05/24/03	14:21:30	14:32:06	0:10:36	6	Risso's Dolphin	22	2	BW	Good	Social mill, dispersal 0.2 to 2, now medium travel, now social milling again, all below surface.
SOCAL	SOCAL_2013May_24_SES_Video_144706-145144_ID9_Risso's	13	05/24/03	14:47:06	14:51:44	0:04:38	9	Risso's Dolphin	3	2	BW	Good	One animal seen heading to 3 o'clock, slow travel, multiple blows seen
SOCAL	SOCAL_2013May_24_SES_Video_145902-150811_ID12_Risso's	14	05/24/03	14:59:02	15:08:11	0:09:09	12	Risso's Dolphin	4	2	BW	Fair	4 animals seen line abreast, then one oriented itself towards another, all animals dove then only one came to surface
SOCAL	SOCAL_2013May_25_SES_Video_144902-145058_ID7_Risso's	15	05/25/13	14:49:02	14:50:58	0:01:56	7	Risso's Dolphin	3	3	BW	Poor	Slow travel, only 1 Risso's seen at surface
SOCAL	SOCAL_2013May_25_SES_Video_150537-150652_ID10_Risso's	17	05/25/13	15:05:37	15:06:52	0:01:15	10	Risso's Dolphin	15	3	BW	Poor	Group of Risso's heading north, animals seen too far off in distance, then briefly seen at surface medium travel
SOCAL	SOCAL_2013May_25_SES_Video_151133-152409_ID12_Risso's	18	05/25/13	15:11:33	15:24:09	0:12:36	12	Risso's Dolphin	37	2	BW	Good	Animals seen slow travel at surface and spread out, some pairing seen, split into subgroups, surface-active mill
SOCAL	SOCAL_2013May_25_SES_Video_152410-153015_ID12_Risso's	19	05/25/13	15:24:10	15:30:15	0:06:05	12	Risso's Dolphin	37	2	\BW	Fair	Animals spread out in subgroups, briefly seen in echelon formation and then broke up, heading is 160, slow travel

Navy Range	Video Name	Video Raw Number	Date (day mo yr)	Start Time (hr:min:sec)	End Time (hr:min:sec)	Total Video (hr:min:sec)	Daily Sighting ID#	Species	Group Size (best estim.)	Beaufort sea state	Taken by	Video Utility/ Quality[a]	General Description of Video Content
SOCAL	SOCAL_2013May_26_SES_Video_105540-105609_ID49_Unid_Dolphin	20	05/26/13	10:55:40	10:56:09	0:00:29	49	Unidentified Dolphin	4	2	DS	Poor	One dolphin seen coming up in the middle of a fish school, surface- active milling and feeding
SOCAL	SOCAL_2013May_26_SES_Video_105628-110256_ID49_Unid_Dolphin	21	05/26/13	10:56:28	11:02:56	0:06:28	49	Unidentified Dolphin_ California Sea Lion	4_1	2	DS	Fair	One dolphin seen coming up in the middle of a fish school and then a California Sea Lion, surface- active milling and feeding, and seen chasing the school as it moves, keeps turning back around and cutting through middle of fish, with a bird,
SOCAL	SOCAL_2013May_26_SES_Video_143255-144531_ID6_Gray	22	05/26/13	14:32:55	14:45:31	0:12:36	6	Gray Whale	2	3	DS	Good	2 gray whales seen subsurface, m/c pair surface and multiple blows, calf 0.25 body length away, slow travel, calf traveling just to the right of mom, possible nursing, in nursing position
SOCAL	SOCAL_2013May_26_SES_Video_144532-144709_ID6_Gray	23	05/26/13	14:45:32	14:47:09	0:01:37	6	Gray Whale	2	3	DS	Good	M/C pair seen medium travel subsurface, calf about 2/3 the size of mom, multiple blows seen, 0.25 body lengths apart
SOCAL	SOCAL_2013May_26_SES_Video_150128-150221_ID7_Risso's	24	05/26/13	15:01:28	15:02:21	0:00:53	7	Risso's Dolphin	37	2	DS	Poor	2 subgroups seen very spread out, one young calf seen by observer, slow travel, video far off of animals and cannot determine behavior
SOCAL	SOCAL_2013May_26_SES_Video_150224-151217_ID7_Risso's	25	05/26/13	15:02:24	15:12:17	0:09:53	7	Risso's Dolphin	37	2	DS	Good	2 subgroups very spread out, m/c pair seen, calf social with mother and seen crossing over mother's head, 16 individuals in one subgroup, surface active travel, splashing, subgroups are not synchronized when they are coming up to breathe

Navy Range	Video Name	Video Raw Number	Date (day mo yr)	Start Time (hr:min:sec)	End Time (hr:min:sec)	Total Video (hr:min:sec)	Daily Sighting ID#	Species	Group Size (best estim.)	Beaufort sea state	Taken by	Video Utility/ Quality[a]	General Description of Video Content
SOCAL	SOCAL_2013May_26_SES_Video_153424-153740_ID14_Fin	26	05/26/13	15:34:24	15:37:40	0:03:16	14	Fin Whale	2	3	DS	Good	2 fins subsurface travel, one smaller than the other and is on the right side, 1.5 body lengths apart, animal on the right changed heading and second animal followed, pair dove and only one surfaced
SOCAL	SOCAL_2013May_26_SES_Video_155946-160056_ID24_SBCD	27	05/26/13	15:59:46	16:00:56	0:01:10	24	Short-Beaked Common Dolphin	50	2	DS		Large group seen fairly tight surface-active fast travel, leaping
					Total Hours =	3:01:35							

a. Video Utility/Quality Definitions

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Excellent - Behavior easily discernible all times animal in view below/above surface and audio discernible. E.g., animal(s) seen throughout entire video when visible at or below the water surface and all audio can be understood. All behavioral events and blows (for whales), behavior state, heading, and dispersal distance can be determined. Video footage is relatively steady and focused. Usually occurs when Beaufort sea state is less than 3.

*BW = Bernd Würsig, DS= Dave Steckler

+Bf =Beaufort sea state

Table 11. List of Photographs Taken during March and May 2013 U.S. Navy SOCAL Aerial Surveys off San Diego, California. Note: July 2013 Common dolphin sp. and unidentified dolphins have not been confirmed or verified to species.

Date 2013	Daily Sighting ID No.	Species Common Name	Best Group Size Estim.	Start Frame #	End Frame #	Total Photos	First Frame Time	Last Frame Time
25-30 March Photos								
3/25	4	Short-Beaked Common Dolphin	800	1687	1717	31	13:05	13:08
3/25	7	Short-Beaked Common Dolphin	140	1720	1770	51	13:29	13:33
3/25	11	Gray Whale	1	1783	1790	8	13:58	14:03
3/25	22	Gray Whale	3	1792	1820	29	14:31	14:38
3/25	8	Risso's Dolphin	50	1822	1872	51	17:14	17:30
3/25	11	Gray Whale	1	1874	1876	3	17:31	17:31
3/25	16	Long-Beaked Common Dolphin	30	1878	1921	44	18:02	18:07
3/25	19	Humpback Whale	1	1923	1944	22	18:33	18:33
3/26	33	Short-Beaked Common Dolphin	1800	1949	1977	29	12:14	12:17
3/26	58	Short-Beaked Common Dolphin	650	1978	2021	44	12:44	12:49
3/26	59	Gray Whale	1	2023	2024	2	12:52	12:52
3/26	84	California Sea Lion	19	2027	2045	19	13:02	13:04
3/26	86	Risso's Dolphin	29	2047	2096	50	13:06	13:23
3/26	64,65	Minke Whale and Humpback Whale	4,1	2097	2100	4	13:30	13:30
3/26	65	Humpback Whale	1	2101	2165	39	13:30	13:39
3/26	64	Minke Whale	4	2102	2199	27	13:31	13:46
3/26	65,90	Humpback Whale and California Sea Lion	1,1	2151	2167	13	13:38	13:39
3/26	87	Fin Whale	1	2168	2214	25	13:44	13:48
3/26	64,87	Minke Whale and Fin Whale	4,1	2173	2217	15	13:44	13:49
3/26	66	Risso's Dolphin	30	2218	2239	22	14:12	14:15
3/26	75	Fin Whale	3	2240	2247	8	15:00	15:01
3/26	76	Long-Beaked Common Dolphin	50	2248	2284	37	15:19	15:21
3/26	77	Short-Beaked Common Dolphin	575	2285	2324	40	15:26	15:30
3/27	28	Fin Whale	2	2338	2357	20	10:54	10:59
3/27	29	Common Dolphin sp.	40	2360	2409	50	11:05	11:12
3/27	34	Risso's Dolphin	6	2412	2429	18	12:07	12:10
3/27	38	Short-Beaked Common Dolphin	30	2431	2511	81	12:32	12:49
3/27	39	Gray Whale	1	2512	2540	29	12:49	12:51
3/27	44	Fin Whale	2	2542	2565	24	13:11	13:16
3/27	45	Northern Right Whale Dolphin	450	2567	2675	110	13:28	13:32
3/27	50	Humpback Whale	1	2677	2683	7	13:53	13:54

Date 2013	Daily Sighting ID No.	Species Common Name	Best Group Size Estim.	Start Frame #	End Frame #	Total Photos	First Frame Time	Last Frame Time
25-30 March Photos (continued)								
3/28	19	Ocean Sunfish	1	2685	2724	40	9:46	9:51
3/28	34	Gray Whale	3	2726	2851	126	9:59	10:27
3/28	36	Long-Beaked Common Dolphin	1100	2852	2913	62	11:01	11:04
3/28	40	Short-Beaked Common Dolphin	25	2915	2972	58	11:16	11:54
3/28	67	Gray Whale	2	2975	2990	16	13:10	13:11
3/28	69	Short-Beaked Common Dolphin	1750	2991	3027	37	13:44	13:46
3/28	6	Short-Beaked Common Dolphin	2000	3042	3097	56	16:17	16:21
3/28	7	Long-Beaked Common Dolphin	125	3098	3136	39	16:38	16:43
3/29	6	Short-Beaked Common Dolphin	250	3137	3167	31	9:44	9:49
3/29	15	Short-Beaked Common Dolphin	50	3169	3241	73	10:02	10:10
3/29	18	Common Dolphin sp.	10	3243	3280	38	10:15	10:19
3/29	21,22	Long-Beaked Common Dolphin/California Sea Lion	60,8	3282	3318	37	10:25	10:29
3/29	22	California Sea Lion	8	3319	3342	24	10:30	10:30
3/29	9	Dead Gray Whale	1	3344	3379	36	15:14	15:17
3/30	20	Fin Whale	2	3395	3434	39	11:07	11:19
3/30	21	Fin Whale	3	3436	3436	1	11:27	11:27
3/30	28	Fin Whale	1	3439	3449	11	12:10	12:11
3/30	29,30	Risso's Dolphin/Northern Right Whale Dolphin	18,1	3451	3485	34	12:17	12:33
3/30	34	Northern Right Whale Dolphin	10	3486	3504	19	12:55	12:57
3/30	35	Minke Whale	1	3505	3517	12	12:58	12:58
22-26 May Photos								
5/22	7	Bottlenose Dolphin	15	3626	3653	28	12:07	12:08
5/22	8	Common Dolphin sp.	20	3655	3678	24	12:26	12:28
5/22	11	Risso's Dolphin	17	3679	3726	48	12:46	13:12
5/22	12	Common Dolphin sp.	30	3727	3739	13	13:15	13:16
5/22	14	Risso's Dolphin	16	3740	3783	44	13:39	14:00
5/22	50	Common Dolphin sp.	500	3784	3796	13	14:13	14:14
5/22	24	Common Dolphin sp.	70	3797	3835	39	14:55	14:58
5/22	37	Common Dolphin sp.	80	3888	3933	46	15:50	15:51
5/23	16	Risso's Dolphin	32	3935	3965	31	10:43	10:52
5/23	24	Risso's Dolphin	4	3966	4000	35	11:07	11:11
5/23	32	Long-Beaked Common Dolphin	800	4002	4040	66	12:06	12:08
5/23	36	Common Dolphin sp.	24	4042	4094	106	12:21	12:24
5/23	1	Bottlenose Dolphin	20	8232	8266	35	15:01	15:04

Date 2013	Daily Sighting ID No.	Species Common Name	Best Group Size Estim.	Start Frame #	End Frame #	Total Photos	First Frame Time	Last Frame Time
22-26 May Photos (continued)								
5/23	2	Bottlenose Dolphin	65	8267	8293	27	15:08	15:11
5/23	4	Gray Whale	2	8295	8296	2	15:31	15:31
5/24	7	Blue Whale	2	8298	8346	47	8:26	9:18
5/24	9	Risso's Dolphin	20	8349	8393	44	9:41	9:58
5/24	10	Risso's Dolphin	15	8394	8438	33	10:08	10:15
5/24	11	Bottlenose Dolphin	10	8407	8416	10	10:11	10:11
5/24	10_11	Risso's Dolphin and Bottlenose Dolphin	15_10	8417	8418	2	10:12	10:12
5/24	12	Risso's Dolphin	25	8439	8469	27	10:35	10:52
5/24	13	Bottlenose Dolphin	11	8470	8502	33	11:20	11:24
5/24	14	Short-Beaked Common Dolphin	125	8504	8529	26	11:35	11:36
5/24	17	Pacific White-Sided Dolphin	1	8444	8444	1	10:35	10:35
5/24	2	Common Dolphin sp.	1500	8531	8588	58	13:27	13:29
5/24	3	Risso's Dolphin	4	8531	8605	15	13:42	13:45
5/24	6	Risso's Dolphin	22	8633	8684	51	14:16	14:33
5/24	9	Risso's Dolphin	3	8687	8719	33	14:41	14:45
5/24	12	Risso's Dolphin	4	8721	8757	35	14:57	15:11
5/24	14	Risso's Dolphin	4	8760	8760	1	15:14	15:14
5/24	18	Short-Beaked Common Dolphin	10	8761	8763	3	15:26	15:26
5/24	19	Risso's Dolphin	23	8766	8778	13	15:30	15:31
5/24	20	Unidentified Dolphin	4	8781	8789	9	15:39	15:40
5/24	24	Short-Beaked Common Dolphin	450	8792	8795	4	15:57	15:58
5/25	22	Risso's Dolphin	5	6373	6400	19	10:40	10:42
5/25	23_24	Short-Beaked Common Dolphin and Northern Right Whale Dolphin	10_2	6390	6405	14	10:41	10:42
5/25	26	Fin Whale	1	6407	6420	14	11:03	11:03
5/25	30	Long-Beaked Common Dolphin	700	6445	6503	59	12:17	12:23
5/25	7	Risso's Dolphin	3	6505	6510	6	14:45	14:46
5/25	10	Risso's Dolphin	15	6512	6518	7	14:59	15:00
5/25	12	Risso's Dolphin	37	6520	6538	18	15:31	15:33
5/26	23	Common Dolphin sp.	100	6540	6563	24	8:57	9:00
5/26	29	Fin Whale	1	6564	6606	43	9:40	9:45
5/26	38	Bottlenose Dolphin	12	6607	6637	31	9:56	10:02
5/26	49	Unidentified Dolphin	4	6639	6658	20	10:53	10:55
5/26	53	Risso's Dolphin	22	6662	6668	7	11:15	11:15

Date 2013	Daily Sighting ID No.	Species Common Name	Best Group Size Estim.	Start Frame #	End Frame #	Total Photos	First Frame Time	Last Frame Time
22-26 May Photos (continued)								
5/26	54	Risso's Dolphin and Unidentified Dolphin	2	6669	6706	38	11:15	11:21
5/26	56	Risso's Dolphin	13	6709	6733	26	11:38	11:39
5/26	62	California Sea Lion	1	6659	6660	2	11:03	11:03
5/26	5	Risso's Dolphin	8	6749	6758	10	14:22	14:23
5/26	6	Gray Whale	2	6760	6785	26	14:29	14:32
5/26	7	Risso's Dolphin	37	6786	6840	55	14:55	15:13
5/26	10	California Sea Lion	4	6847	6848	2	15:19	15:19
5/26	14	Fin Whale	2	6849	6880	32	15:28	15:32
5/26	15	Long-Beaked Common Dolphin	70	6888	6900	13	15:44	15:44
5/26	24	Short-Beaked Common Dolphin	50	6903	7028	126	15:58	16:08

Table 12. Summary of other marine species seen during the SOCAL marine species aerial monitoring survey, March and May 2013. Species are listed in descending order of sighting frequency.

Species	March	May	Total
Ocean Sunfish (*Mola mola*)	154	77	**231**
Bait Ball	1	3	**4**
Fish School	2	1	**3**
Shark	4	1	**5**
Sea Turtle	0	0	0
Total	**161**	**82**	**243**

Table 13. Summary of groups seen with calves during the SOCAL marine species aerial monitoring survey, March and May 2013. Species are listed in descending order of number of sighting frequency.

Species	# Groups	# Groups with Calves	% of Groups with Calf
California Sea Lion	134	0	0
Common Dolphin sp.	65	3	5
Risso's Dolphin	42	12	29
Unidentified Dolphin	34	0	0
Gray Whale	26	2	8
Bottlenose Dolphin	20	2	10
Fin Whale	15	1	7
Short-beaked Common Dolphin	14	7	50
Minke Whale	8	0	0
Long-beaked Common Dolphin	7	1	14
Humpback Whale	5	0	0
Northern Right Whale Dolphin	4	2	50
Unidentified Whale	2	0	0
Northern Elephant Seal	1	0	0
Sei/Bryde's Whale	1	0	0
Pacific White-Sided Dolphin	1	0	0
Blue Whale	1	1	100
Unidentified Baleen Whale	1	0	0
Unidentified Large Whale	1	0	0
Unidentified Medium Marine Mammal	1	0	0
Unidentified Small Whale	1	0	0

Table 14. Number of vessels and aircraft sighted by type along systematic transect lines flown during March and May 2013 Southern California Marine Mammal Aerial Surveys.

Vessel Type	Number of Vessels in March	Number of Vessels in May	Total Number of Vessels	No. Vessel Sightings per Unit Effort (SPUE) (# / km flown)	Percent of Total Sightings
Boat	0	25	**25**	0.009	28
Sailboat	3	9	**12**	0.004	13.4
Fishing	6	5	**11**	0.004	12.4
Tanker	3	6	**9**	0.003	10.1
U.S. Navy Vessel	2	6	**8**	0.003	9.7
Private	0	4	**4**	0.001	4.4
Recreational	1	3	**4**	0.001	4.4
Unknown	3	0	**3**	0.001	3.3
Cargo Container Ship	1	2	**3**	0.001	3.3
Ferry	0	2	**2**	0.0007	2.2
Patrol Boat	2	0	**2**	0.0007	2.2
Catamaran	0	1	**1**	0.0003	1.1
U.S. Navy Frigate	0	1	**1**	0.0003	1.1
U.S. Navy Aircraft	0	1	**1**	0.0003	1.1
Merchant Marine	1	0	**1**	0.0003	1.1
Yacht	1	0	**1**	0.0003	1.1
Tug	0	1	**1**	0.0003	1.1
Total	**23**	**66**	**89**	**0.002**	**100**

Table 15. Number of kilometers of all flight effort calculated by Beaufort sea state during March and May 2013 aerial monitoring for marine mammals on the U.S. Navy's Southern California Range Complex.

2013	Systematic	Transiting	Random	Navy Directed	Circling	Connector	Opportunistic	Expeditionary
Mar	1174	956	332	35	1646	485	17	0
May	1757	1089	378	17	1860	253	0	36
TOTALS	**2931**	**2045**	**710**	**52**	**3506**	**738**	**17**	**36**

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APPENDIX D: ABSTRACTS SUBMITTED ON BEHALF OF SMULTEA ENVIRONMENTAL SCIENCES (SES)

SOuthern California Marine Mammal Workshop, 1-2 February 2013, Newport Beach, CA

Mixed-species associations seen in the Southern California Bight during aerial surveys 2008-2012

Bacon, C.E.[1,2], and M.A. Smultea[1]

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Fifteen line-transect aerial surveys occurred during fall/summer 2008-2012 to monitor the occurrence, abundance, and behavior of marine mammals in the Southern California Bight (SCB). Thirty-six (2 percent) of 2,151 total sightings consisted of mixed-species associations (i.e., at least two different species swimming together and/or interacting). Very little is known about these associations within the SCB. It appears that a species' habitat selection can be driven by a combination of physical characteristics and the presence/absence of other cetacean species. Our data indicate that the area continues to be used by a substantial number of marine mammal species. The species most frequently seen associated with another marine mammal species was the Risso's dolphin (*Grampus griseus*) (17 or 6 percent of 283 total sightings of this species). Risso's dolphins were seen with one to two other species consisting of: bottlenose dolphin (*Tursiops truncatus*), common dolphin sp. (*Delphinus* spp.), California sea lions (*Zalophus californianus)*, northern right whale dolphins (*Lissodelphis borealis*), sperm whales (*Physeter macrocephalus)*, unidentified dolphins, and long-beaked common dolphins (*Delphinus capensis*). The greatest number of species seen together was three on three different occasions. These mixed sightings consisted of: (1) sperm whales, Risso's dolphins, and northern right whale dolphins, (2) Risso's dolphins, California sea lions, and unidentified dolphins, and (3) Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), common dolphins, and California sea lions. The most unusual mixed species sighting was 24 sperm whales (including four calves) with 11 Risso's dolphins and approximately 50 northern right whale dolphins. It is important to note that cetaceans are hardly ever "individuals", but are instead socially complex groups of animals.

Behavior, Group Characteristics, Density and Habitat-use Patterns of Marine Mammals off Southern California during 2008-2102 Aerial Surveys

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Marine mammal seasonal density, abundance, behavior and habitat-use patterns were monitored off southern California 2008-2012 during 15 aerial surveys for the U.S. Navy. Line-transect, point sampling, and focal follows occurred using video/photography. During 65,238 km of effort (99% Beaufort ≤4), ~190,310 individuals were seen in 2,151 groups (19+ species). Behavior differed significantly by species, depth, slope, aspect, survey subregion (east or west of San Clemente Island (SCI)), time of year/day, and calf presence. Group size and maximum nearest-neighbor distance (in body lengths) generally increased with body size. Group size was significantly larger with calf presence for Risso's, commons, and bottlenose dolphins. Group size increased significantly across the year among Risso's but decreased for commons. Risso's were 13x more likely to rest and significantly less likely to fast travel/be surface active than commons. Resource Selection Function analyses showed that fin whales were significantly more likely to be found west vs. east of SCI, and medium-fast travel predominated over basins vs. rest/mill/slow travel over steep slopes. Density was highest for short-beaked common dolphins followed by long-beaked commons, California sea lions, Risso's, gray whales, bottlenose dolphins, fin, humpback and blue whales and Pacific white-sided dolphins. Calves occurred in 5% of 331 mysticete sightings.

Sights and Sounds in the Sky: Integrated Acoustic/Visual Aerial Monitoring of Marine Mammal Behaviors Using Sonobuoys and Videography

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We conducted aerial-based monitoring of marine mammal behaviors off the Southern California Bight for 7 days during the winter and spring of 2012. We integrated visual methods (visual observations and videography) with passive acoustic methods (sonobuoys) to study behaviors of cetacean groups. We processed data in real-time, and post-survey, using custom-developed software (Difar-Matlab and Mysticetus). We deployed 23 sonobuoys (model AN/SSQ-53F) through a belly chute, with only a 9% (n=2) failure rate. Over 16 hours of acoustic data were recorded and analyzed from 23 in-flight hours. We acoustically detected and recorded sounds from focal groups of fin whales, gray whales, humpback whales and bottlenose dolphins, using DIFAR sonobuoys, and from Risso's dolphins using omni-directional sonobuoys. A possible case of Risso's dolphin call-matching with sonar (e.g. mimicry) was detected. Fin whales were the most commonly encountered species, as they migrated northward through the study area. We recorded high signal-to-noise acoustic signals and videography from five fin whale focal groups. We plotted bearings to sequential fin whale calls with call sources emanating from different directions, indicating counter-calling. During post-processing, we integrated visually estimated animal locations with acoustically determined bearings and/or localizations. Results indicate that fin whales did not call when at the surface. We greatly improved real-time and post-processing capabilities via integration of hardware and upgrades to software. Additional surveys and improvements to the system are planned to increase our understanding of marine mammal behaviors and the effects of anthropogenic activities.

20th BIennial Conference on the biology of marine mammals, 9-13 December 2013, Dunedin, New Zealand

Behavior and group characteristics differ in mixed-species associations of cetaceans in the Southern California Bight

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Effects of mixed-species associations (MSA [at least two different species swimming together and/or interacting]) on cetacean behavior rarely have been quantified, but are important for identifying and differentiating potential anthropogenic impacts. Baseline marine mammal behavior was assessed during 77,390 km of U.S. Navy supported aerial line-transect surveys in the Southern California Bight during 2008-2013. Multinomial logistic regression was used to assess effects of MSA on group size, maximum nearest neighbor distance (a “cohesion” index, in body lengths), behavior state, and heading. Two percent (43) of 2,330 sightings were MSA involving 13 species (5 baleen whales, 7 toothed whales, 1 pinniped). Behavior and group size of some species differed significantly in MSA vs. non-MSA. MSA were predominated by Risso’s dolphins (44%; 19 of 43 MSA). Risso’s dolphins were most frequently associated with bottlenose dolphins (37% of 19 Risso’s MSA groups) followed by northern right whale dolphins (NRWD; 3% of 19). Risso’s dolphins tended to change headings more often in MSA ($p<0.10$), socially interacting by moving/orienting toward or away from other species. Notable MSA included a Risso’s dolphin chasing/charging a lone minke whale, a Risso’s dolphin repeatedly charging the heads of sperm whales that reacted by opening their mouths, and a mother/calf fin whale closely following/interacting with ~1,000 NRWD. Risso’s dolphin mean group size was significantly higher in MSA (26) vs. non-MSA (15). Group cohesion generally decreased in MSA vs. non-MSA but not significantly. Speculated explanations for the observed MSA include kleptoparasitism, feeding, defense of conspecifics, “floating maritories,” play, harassment, and social interest. Increased group sizes and tighter cohesion in MSA may indicate elevated defensiveness and/or facilitate social interactions. Interspecific interactions have remained historically uncommon in the SCB, but similar proportionally based on similar spatial/temporal effort (2-6%). MSA likely involve both benefits and risks to members, depending on species and motivations.

Longitudinal comparisons of digital photography of marine mammals from aircraft and shore

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Rapid progress and affordability of photographic technology with increasing improvements in image resolution have facilitated advancements in efficiency and alternative approaches in data collection for marine mammals. We report these recent improvements by comparing marine mammal photographs taken during 2008-2013 aerial surveys of 16 marine mammal species in the Southern California Bight, shore-based studies of bottlenose dolphins (*Tursiops truncatus)* in Galveston Bay, Texas (2011-2013), and gray whales (*Eschrichtius robustus)* off Sakhalin Island, Russia (2004-2010). Various Canon and Nikon high-definition cameras ranging from 8.2-36.3 MP resolution and 70-1600 mm lenses with image stabilization were used during the studies. Results of these photographic comparisons demonstrate the evolution of digital photography advancements with the successful capture of individuals, as well as detailed information for behavioral ecology studies. For example, (1) individual identification of marine mammal species from aircraft not previously reported (Risso's dolphins (*Grampus griseus*), killer whales (*Orcinus orca*), and blue and fin whales (*Balaenoptera musculus* and *B. physalus*)), (2) shore-based individual identification of bottlenose dolphins up to 500 m and of gray whales up to 2 km from shore, (3) instantaneous differentiation/confirmation of short-beaked vs. long-beaked common dolphins (*Delphinus delphis* and *D. capensis*) from 1,500-ft altitude with a 36 MP camera, (4) reduced proportion of "unidentified" dolphin and whale species, and (5) potential tracking of the behavior, social associations and durations, and relative position within the group of some individually identified delphinids and other species not previously studied in this manner. High-definition digital photography reduces costs and acquisition/processing time from earlier "tried and true" analog photography. This facilitates, advances, and compliments the efficacy of data collection for population and behavioral ecology studies on marine mammals, most recently allowing capture of individual identification images at distances of up to 2 km away.

'Observer effect' from an aerial platform during marine mammal focal observations on Risso's dolphins, short-beaked common dolphins and killer whales in the Southern California Bight

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We video-documented the behavior of Risso's dolphins, short-beaked common dolphins (SBCD) and killer whales in the Southern California Bight (SCB) (2008-2012) to assess whether the observation aircraft (fixed-wing Partenavia) affected selected behavioral variables. Focal observations were conducted from the aircraft to examine potential changes in group cohesion (minimum and maximum distance between nearest neighbors in body lengths [BL]) and heading reorientation rate, to the plane circling at altitude ~700, 1000, 1500 and 2000 feet (ft). Dependent parameters were selected because previous studies show they are indicative of disturbance to anthropogenic or natural threatening stimuli. Five focal sessions were analyzed: two Risso's dolphins, two SBCD, and one killer whale. A total of 67 minutes (min) was spent observing Risso's dolphins, 65 min SBCD and 29 min killer whales. Focal sessions were pooled by species and data

were divided into four plane altitude categories: <750 ft, 750–1250 ft, 1250–1750 ft, and >1750 ft. Analysis of variance (ANOVA) was used to test the null hypothesis that maximum cohesion and reorientation do not vary significantly based on plane altitude. Results suggest that our small plane circling at radial distance 750-1000 ft and altitude 750-2000 ft did not cause measurable changes in cohesion and reorientation, of the three species (based on small sample size). For cohesion (C) and reorientation (R) no significant effects were found (Risso's dolphin: $p = 0.091$ and 0.258; SBC: $p = 0.068$ and 0.847; killer whale: $p = 0.270$ and 0.060 [C and R, respectively]). Results suggest that "undisturbed" baseline observations can be made on these species from our aircraft within parameters examined. This is important when using the aircraft to assess baseline marine mammal behavior and potential effects of anthropogenic activities relative to management and conservation needs.

Resource Selection Function analyses: Assessing habitat use relative to behavior and resource characteristics/availability for five common marine mammal species in the Southern California Bight

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In 2008-2012, fifteen aerial surveys of systematic line-transects were conducted in the Southern California Bight to monitor and obtain baseline data on occurrence, distribution, density, abundance and behavior of marine mammals. Site characteristics at marine mammal locations were analyzed by estimating Resource Selection Functions (RSF) which quantified and described baseline habitat use as a precursor to assessing potential changes in these patterns relative to anthropogenic activities, including Navy exercises. For RSF analyses, characteristics at marine mammal locations were contrasted to characteristics at 35,167 randomly selected "available" locations in the study area. RSFs were estimated via the use-availability approach and predicted probability of species occurrence at all locations in the study area as a function of seven covariate habitat variables. Models for five species ($n = 60$ fin and 40 gray whale groups, 135 Risso's and 31 bottlenose dolphin groups, 157 California sea lion groups) were fit for three behavior states (mill, rest/slow travel, medium/fast travel) and all behavior combined to document behavior and habitat associations. Species differed in habitat use and corresponding habitat associations. For example, medium-fast traveling fin whales were significantly associated with deep water over relatively flat basins/plateaus ($p=0.0017$). Fin whales also had significantly higher probability of using the San Nicolas Basin ($p=0.0517$). For Risso's dolphins, rest/slow travel was associated with deeper water (i.e., steep ridges) ($p=0.0803$). These patterns suggest fast movement across basins and rest/slow travel over ridges. The RSF approach has been successfully implemented for terrestrial systems, quantitatively documenting changes in habitat-use patterns in response to human activities. Results herein illustrate successful application of RSF to pelagic marine mammals, quantitatively considering the role of behavior in habitat selection. Data provide an important 5-year baseline for little-known species to compare potential future changes in habitat selection patterns, assisting in conservation/management decisions in a relatively high-anthropogenic use area.

Received levels and behavior of humpback whales exposed to mid-frequency active sonar during a U.S. Navy training event as observed from an aircraft near Kauai, Hawaii

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Aerial monitoring was conducted off Kauai, Hawaii, for the U.S. Navy's 2008-2012 marine mammal monitoring program to determine whether: (1) marine mammals were exposed to mid-frequency active sonar (MFAS) and (2) such exposure caused changes in behavior. Observations occurred during the biannual Submarine Commanders Course (SCC) event involving anti-submarine warfare (ASW) training in the main Hawaiian Islands. A twin-engine Partenavia (P68) Observer flew elliptical orbits in front of a U.S. Navy-guided missile destroyer (DDG) at altitude 244-305m. When sightings occurred, the plane increased altitude to 457m and circled the sighting at radial distance 500-1000m, flight parameters shown to avoid disturbance by the observation aircraft. A focal follow approach was used to record behaviors with a handheld digital HD Canon video camera. Videos were rated for quality and transcribed into an Excel dataset for more detailed analysis. During five SCC training events spanning August 2008 through February 2012, 18 focal follows were conducted: 16 (89%) with humpback whales, one with false killer whales and one with spinner dolphins. Mean duration of all focal follows was 15.0 min (SD = 13.5). MFAS transmission times, and ship and whale positions were available for four of five humpback focal follows conducted in 2011-2012, allowing calculation of received MFAS sound levels (RLs) for exposed whales. The estimated maximum RLs at the whale locations ranged from 135 to 161 dB (re:1μPa) RMS. One of the four focal follows, a group of two adult humpbacks (16 Feb 2012), was exposed to 23 MFAS transmissions during a 14-min period. During this time the group moved towards the faster-moving ship. Depending on modeling approach used, RLs ranged from 154±7 to 141.5±14.5 dB (re:1μPa) at separation distances of 9.8 to 14.8 km respectively. These RLs represent the first estimates derived from actual training events using this approach.

Comparisons of the behavioral ecology of three delphinid and three baleen whale species: Risks and rewards of group living

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The behavioral ecology of offshore delphinids and baleen whales is poorly known. A comparative approach was used to assess group size and behavior versus risks/rewards of group living in the Southern California Bight, U.S.. Scan sampling/photographs/video documented first-observed group size, maximum nearest-neighbor distance (MNND - in body lengths [BL]), and behavior state during 72,467 km of aerial surveys between 2008-2012. Regression modeling analyses involved 566 common, 293 Risso's and 96 bottlenose dolphin groups and 115 fin, 78 gray and 62 blue whale groups. Species body size, group size, and MNND were correlated. Group size, MNND

and behavior state were significantly influenced by species, sub-region, calf presence, time of day/year, water depth, and/or slope/aspect. Group size was significantly larger for common dolphin sp. (combined) (277.1) vs. bottlenose (19.2) and Risso's (18.4) and with calf presence. MNND was significantly less for commons (5.1 BL) vs. Risso's (6.7). Group size was larger for grays (2.2) vs. fins (1.6) and blues (1.7). Gray MNND (1.5) was significantly closer than fins (5.1) and blues (12.6). Risso's groups were observed resting 13 times more often (38%) than commons (3%). Smaller group size and more daytime resting of Risso's match presumed nocturnal foraging patterns of this species. Larger tighter groups and frequent daytime foraging of commons match clumped, high-density schooling fish distribution. Larger tighter common and gray whale groups match presumed higher predation pressure associated with smaller relative body size. Results indicate species ecological diversion in the same habitat in response to differing predation pressure and food resource availability as predicted by terrestrial mammal group-living patterns. Data lend insight into baseline behavior and ecological triggers influencing behavior. This information is needed to differentiate potential impacts of anthropogenic sources. Larger group size benefits include reduced predation pressure and improved prey detection/mate access, at the risk of increased resource competition.

27th European Cetacean Society Conference, 8-10 April, 2013, Setúbal, Portugal

Comparison of Blue and Fin Whale Behavior and Group Characteristics in the Southern California Bight (SCB) 2008-2012

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Baseline undisturbed behavior and social patterns of blue (*Balaenoptera musculus*) and fin whales (*B. physalus*) are not well described and are needed to identify and understand potential effects of anthropogenic activities in the SCB. In 2008-2012, 72,467 km of aerial line transect and focal-follow effort was conducted in the SCB. Initially observed location, group size, behavior state, heading, and minimum and maximum inter-individual dispersal distance were recorded. Focal groups were circled for 10-60+ minutes and videotaped from outside the plane's sound cone to avoid disturbance. A total of 122 fin whale sightings (208 individuals) and 65 blue whale sightings (104 individuals) were made. Behavior, occurrence and distribution were related to season, location, bathymetry, and time of day. Blue whales were seen only from summer-fall and concentrated primarily close to shore (< 10 km). Fin whales were seen year-round up to 70 km from shore. Both species were associated with steep slopes. During summer, blues (n=61) were more common than fins (n=50); in fall, fins (n=73) were significantly more common than blues (n=4). Mean group size was 1.6 for blues and 1.9 for fins. Blues swam significantly farther apart (12.6 body lengths [BL]) than fins (5.1 BL). Initially observed behavior was usually travel for both blues (80%) and fins (92%). Mill was more common for blues (20%) than fins (7%). Surface-activity was only seen among fins (1%). Both species socialized (touched) in fall but not summer; foraging occurred summer-fall. No significant relationships were found for headings. Dive/respiration/behavioral event rates were also collected. Data represent the most extensive

record of systematic undisturbed behavior on these species in and the SCB, including social interactions not previously documented in this region.

Comparisons of the Behavioral Ecology of Risso's (*Grampus griseus*) and Common Dolphins (*Delphinus delphis and D. capensis*): Risks and Rewards of Group Living ***

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Behavioral ecology of pelagic Risso's and short- and long-beaked common dolphins is poorly known. The comparative approach was used to predict group size and behavior relative to risks/rewards of group living in the same eco-region. Risso's were predicted to occur in smaller, less-cohesive groups and mill less/rest more during daytime than common dolphins based on distribution of prey and predation risk. Video and scan sampling documented first-observed group size, behavior state, and individual spacing (in body lengths [BL]) during aerial surveys (72,667 km) off southern California in January-November 2008-2012 for 290 Risso's and 564 common dolphin groups (commons were combined due to small confirmed *D. capensis* sample size). Behavior was significantly influenced by species, calf presence, time of day, and water depth. Group size was significantly smaller for Risso's (18.4) vs. commons (277.1), and higher with calf presence (Risso's: 25 with calf vs. 15 without) (commons: 485 with calf vs. 205 without). Mean spacing was significantly less for commons (5.1 BL) vs. Risso's (6.7) and decreased significantly across the day for both. Risso's were 13 times more likely to rest than commons. Risso's rest increased significantly across the day and over deep water/steep slopes. Both species associated with deep underwater slopes. Smaller group size, looser group spacing, and more daytime resting of Risso's are adapted to nocturnal foraging. Larger group size, tighter cohesion, and frequent daytime foraging of commons matches clumped, high-density daytime distribution of schooling fish and presumed higher predation risk. Larger group size likely benefits calf survival through dilution effects. Results suggest the species have diverged ecologically in the same habitat in response to differences in food resources and predation pressure as predicted by group-living patterns documented for well-studied terrestrial mammal species. Data lend insight into ecological triggers influencing behavior and habitat use of these deep-diving elusive species.

*** Received Best Student Oral Presentation award at the conference.

10th ANNUAL TEXAS A&M UNIVERSITY SYSTEM PATHWAYS STUDENT RESEARCH SYMPOSIUM, 12 NOvember 2012, Galveston, TX

Comparison of Blue and Fin Whale Behavior, Headings and Group Characteristics in the Southern California Bight during Summer and Fall 2008-2010

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Baseline undisturbed behavior/social patterns of blue/fin whales are not well described and are needed to identify and understand potential effects of anthropogenic activities. Behavioral data were collected during aerial effort. Initially observed behavior state, heading, minimum/maximum inter-individual dispersal distance were recorded during line-transect sampling. During the summer seasons, blues were seen more than fins; in fall, fins were seen more. Initially observed blue behavior was usually travel or mill. Observed fin behavior was mostly travel, mill, or surface-active travel. Both species were seen socializing in fall but not summer; foraging was observed in summer through fall. In summer, blues were seen headed S; in fall, headed inshore. In summer, fins were headed SSW or WNW; in fall, they were headed NE or WSW. Data represent the most extensive record of systematic undisturbed behavior on these species in SOCAL and include social interactions not previously documented in this region.

The Behavioral Ecology of Risso's Dolphins off Southern California

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The behavioral ecology of pelagic Risso's dolphins is poorly known. Fifteen aerial surveys (72,667 km) occurred off southern California (2008-2012) to describe baseline Risso's dolphin behavioral ecology patterns to compare to future potential U.S. Navy mid-frequency active sonar effects. Video and focal group scan sampling documented behavior. First-observed behavioral data were collected year-round for 290 groups (5,384 dolphins). Winter-spring abundance estimate was higher (2,768 dolphins) than summer-fall (N=2,616). Mean group size was significantly larger with calf presence vs. absence (18.4 vs. 25.1 dolphins). Mean maximum distance between nearest neighbors was 6.7 body lengths. 48% of 290 groups medium-fast traveled, 38% slow travel/rested, 14% milled. Fifty-one focal group follows 5-59 min long (mean 21.6, 1359 scans) and Resource Selection Function analyses showed behavior state significantly related to water depth and subregion. Data lend insight into ecological triggers influencing behavior and habitat use of this deep-diving elusive species.

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APPENDIX E: JOURNAL ABSTRACTS SUBMITTED

DENSITY AND ABUNDANCE OF MARINE MAMMALS IN THE SOUTHERN CALIFORNIA BIGHT FROM AERIAL SURVEYS, 2008-2012

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We conducted 15 aerial surveys in the marine waters around San Clemente Island, California, during October 2008 to April 2012, to obtain both observations of marine mammal behavior and data suitable for developing marine mammal density estimates. The primary platform used was a *Partenavia* P68-C or P68-OBS (glass-nosed) high-wing, twin-engine airplane. Density and abundance estimates were made using line-transect methods and the software DISTANCE 6.0. During these surveys, 19 species of marine mammals were sighted. Due to limited sample sizes for some species, sightings were pooled to provide four estimates of the detection function for baleen whales, large delphinids, small delphinids, and California sea lions. Estimates of density and abundance were made for species observed a minimum of eight times on effort. For the warm-water season (May-October) in 2008-2012, the estimated average numbers of individuals present (in descending order) were 9894 short-beaked common dolphins (*Delphinus delphis*), 3847 long-beaked common dolphins (*D. capensis*), 1613 Risso's dolphins (*Grampus griseus*), 781 California sea lions (*Zalophus californianus*), 488 bottlenose dolphins (*Tursiops truncatus*), 317 fin whales (*Balaenoptera physalus*), 248 Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), 41 blue whales (*B. musculus*), and 18 humpback whales (*Megaptera novaeangliae*). During the cold-water season (November-April), the estimated averages were 13,547 short-beaked common dolphins, 5268 long-beaked common dolphins, 2093 California sea lions, 1087 Risso's dolphins, 639 gray whales (*Eschrichtius robustus*), 317 bottlenose dolphins, 246 fin whales, 53 Pacific white-sided dolphins, and 50 humpback whales. Blue whales were not observed during the cold-water season, and gray whales were not seen during the warm-water season. Several other species were observed for which sightings were too few to estimate numbers present and/or were seen off effort: minke whale (*B. acutorostrata*, n = 6 on-effort groups), northern elephant seal (*Mirounga angustirostris*, n = 5), northern right whale dolphin (*Lissodelphis borealis*, n = 5), Dall's porpoise (*Phocoenoides dalli*, *n* = 3), Cuvier's beaked whale (*Ziphiius cavirostris*, *n* = 2), killer whale (*Orcinus orca*, *n* = 2), harbor seal (*Phoca vitulina*, *n* = 1), Bryde's whale (*B. edeni*, n = 1), and sperm whale (*Physeter macrocephalus*, n = 1).

Submitted 02 March 2013 to the *Bulletin of the Southern California Academy of Sciences*, *accepted pending revisions*.

RARE MIXED-SPECIES ASSOCIATION BETWEEN SPERM WHALES, AND RISSO'S AND NORTHERN RIGHT WHALE DOLPHINS OFF THE SOUTHERN CALIFORNIA BIGHT: KLEPTOPARASITISM?

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Inter-specific behavioral interactions between large whales and small odontocetes are rarely described and little understood. Reasons for such associations have been proposed but are difficult to substantiate empirically given the challenges inherent with studying deep- and long-diving cetaceans at sea. Proposed reasons include some of those described for schooling fish, birds, ungulates and primates such as reduced predation through the dilution or predator startle effect, competition for resources, aggression, kleptoparasitism, play and sociality (Norris and Prescott 1961; Fritz and De Garine-Wichatitsky 1996; Weller and others 1996; Clua and Grosvalet 2001; Cameron and Du Toit 2005; Cords and Würsig in press). Herein we describe the first published social interactions of sperm whales (*Physeter macrocephalus*), Risso's dolphins (*Grampus griseus*) and northern right whale dolphins (*Lissodelphis borealis)* (NRWD) as photo- and video-documented off southern California in spring 2011. We hypothesize based on our observations and other studies that this association stemmed from a combination of social parasitism (Cords and Würsig in press) and kleptoparasitism.

Submitted 20 May 2013 to the *Northwestern Naturalist*, accepted pending revisions.

CHANGES IN RELATIVE OCCURRENCE OF CETACEANS IN THE SOUTHERN CALIFORNIA BIGHT: A COMPARISON OF RECENT AERIAL SURVEY RESULTS WITH HISTORICAL DATA SOURCES

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The relative occurrence of 16 cetacean species in the Southern California Bight (SCB) was compared from the 1950s through 2012 by examining at-sea sighting and stranding data. While systematic survey and population abundance/density data are have been available since the 1970s, prior data were opportunistically collected. Comparisons were made through literature review and using recent results from 15 aerial surveys conducted in the SCB in 2008-2012. We attempted to address inconsistency in type of effort across studies by ranking the relative sighting frequency of the most common species based on the most representative study for each period. This comparison revealed changes in the relative occurrence of some species across the approximately 60-year reviewed period. Since the 1950s, common dolphins have remained the most abundant species of cetacean in the SCB. Risso's dolphin, and fin, blue, humpback and Bryde's whales appear to have increased in relative occurrence. The relative abundance of the common bottlenose and northern right whale dolphins, Dall's porpoise, and gray, killer, minke, Cuvier's beaked and sperm whales do not appear to have changed notably since the 1950s. There is possible indication of recent decreased relative occurrence of the Pacific white-sided dolphin. The short-finned pilot whale has decreased since the 1950s and has not been recorded in the SCB since the 1990s, concurrent with the observed relative increase in Risso's dolphins. Overall, recent aerial surveys indicate that the 16 most commonly seen species in the SCB, in descending order of frequency, were common dolphins (two species), Risso's dolphin, fin whale, common bottlenose dolphin, gray whale, blue whale, Pacific white-sided dolphin, humpback whale, northern right whale dolphin, common minke whale, Dall's porpoise, killer whale, Bryde's whale, and Cuvier's beaked whale (the latter three tied in ranking), and sperm whale. Given that the reviewed historical data from the 1950s and 1960s are virtually the only sources of information available to examine trends over the last 50-60 years in this area, we believe this comparative ranking analysis provides useful information not available from other sources.

Submitted 18 March 2013 to *Aquatic Mammals*, accepted pending revisions.

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APPENDIX F: DENSITY AND ABUNDANCE REPORT

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Density and Abundance of Marine Mammals Derived from 2008-2013 Aerial Surveys Within the Navy's Southern California Range Complex

Draft Final Report

1 August 2013

Prepared by:

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Acronyms and Abbreviations

Bf	Beaufort Sea State
ESA	Endangered Species Act
ft	foot/feet
GPS	Global Positioning System
km	kilometer(s)
km^2	square kilometer(s)
M	meter(s)
mm	millimeter(s)
Mysticetus	Mysticetus Observation Platform software
NMFS	National Marine Fisheries Service
SCB	Southern California Bight
SOCAL	Southern California
South of SCI	South of San Clemente Island
SD	standard deviation
SWFSC	Southwest Fisheries Science Center
U.S.	United States

Abstract

We conducted 17 aerial surveys in the marine waters around San Clemente Island, California, from October 2008 to May 2013, to obtain both observations of marine mammal behavior and data suitable for developing marine mammal density estimates. The primary platform used was a *Partenavia* P68-C or P68-OBS (glass-nosed) high-wing, twin-engine airplane. Density and abundance estimates were made using line-transect methods and the software DISTANCE 6.0. During these surveys, 19 species of marine mammals were sighted. Due to limited sample sizes for some species, sightings were pooled to provide four estimates of the detection function for baleen whales, large delphinids, small delphinids, and California sea lions (*Zalophus californianus*). Estimates of density and abundance were made for species observed a minimum of ten times on effort. For the warm-water season (May-October) in 2008-2013, the estimated average numbers of individuals present (in descending order) were 10,179 short-beaked common dolphins (*Delphinus delphis*), 5,997 long-beaked common dolphins (*D. capensis*), 1,967 Risso's dolphins (*Grampus griseus*), 1,025 California sea lions, 722 northern right whale dolphins (*Lissodelphis borealis*), 644 bottlenose dolphins (*Tursiops truncatus*), 325 fin whales (*Balaenoptera physalus*), 249 Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), 43 blue whales (*B. musculus*), 18 humpback whales (*Megaptera novaeangliae*) and 4 gray whales (*Eschrichtius robustus*). During the cold-water season (November-April), the estimates were 18,922 short-beaked common dolphins, 5,968 long-beaked common dolphins, 1,484 California sea lions, 1,299 Risso's dolphins, 677 northern right whale dolphins, 383 bottlenose dolphins, 262 gray whales, 156 fin whales, 53 Pacific white-sided dolphins, and 28 humpback whales. Blue whales were not observed during the cold-water season, and gray whales were only seen once during the warm-water season (May-October). Several other species were observed for which sightings were too few to estimate numbers present and/or were seen off-effort: minke whale (*B. acutorostrata*, *n* = 9 on-effort groups), northern elephant seal (*Mirounga angustirostris*, *n* = 5), Dall's porpoise (*Phocoenoides dalli*, *n* = 3), Cuvier's beaked whale (*Ziphiius cavirostris*, *n* = 2), killer whale (*Orcinus orca*, *n* = 2), harbor seal (*Phoca vitulina*, *n* = 1), Bryde's whale (*B. edeni*, *n* = 1), and sperm whale (*Physeter macrocephalus*, *n* = 1).

Introduction

Ship-based surveys of the entire United States (U.S.) West Coast exclusive economic zone have been conducted by the National Marine Fisheries Service (NMFS) since the early 1980s (with more extensive and consistent coverage since the early 1990s). These surveys have provided estimates of abundance and density, and in some cases trends, for U.S. waters of California, Oregon, and Washington (e.g., Barlow 1995, 2003, 2010; Barlow and Forney 2007; Barlow and Gerrodette 1996; Barlow and Taylor 2001; Forney 1997, 2007; Forney and Barlow 1998). These surveys generally provided data and associated densities over a very large geographic area or stratum. Smaller-scale density estimates specific to ocean areas associated with U.S. Navy at-sea training ranges are needed, but such data are more limited.

Carretta et al. (2000) conducted extensive, year-round aerial surveys of the area around San Clemente Island in 1998 and 1999 and calculated density and abundance for species seen during that time; however, these estimates are now over 14 years old and may not reflect current distribution and density numbers needed to meet U.S. Navy monitoring requirements as identified in the Southern California (SOCAL) Marine Species Monitoring Plan (Department of the Navy [DoN] 2009).

Estimates of density and abundance of marine mammals around San Clemente Island during our 2008-2012 aerial surveys were reported in Jefferson et al. (2012, in Smultea and Bacon 2012). This report updates and revises those estimates to include sightings made during SOCAL aerial surveys in March (cold-water season) and May 2013 (warm-water season), as requested by the Navy. Results of the July 2013 aerial survey will be analyzed and combined with data reported herein to estimate density and abundance in a separate report in fall 2013.

Methods

Data Collection

Three types of aircraft were used. Most (*n*=84) of the 97 survey days were conducted from a small high-wing, twin-engine Partenavia P68-C or P68-OBS (glass-nosed) airplane equipped with bubble observer windows; the remaining 11 survey days occurred from an Aero Commander (9 days) or a helicopter (2 days), both of which had flat observer windows (**Table F-1**). Survey protocol was similar to previous aerial surveys conducted to monitor for marine mammals and sea turtles in Southern California, and elsewhere, as described below (and detailed in Smultea and Bacon 2012). No sea turtles were observed; however, sea turtles have been seen during monitoring surveys in Hawaii, indicating that they can be seen from a small aircraft flying at similar altitude (e.g., Smultea and Mobley 2009, Smultea et al. 2009).

Surveys were conducted in October and November 2008; June, July and November 2009; May, July and September 2010; February, March, April, and May 2011; January, February, and March/April 2012; and March and May 2013 (**Table F-1**).

Table F-1. List of Southern California (SOCAL) aerial surveys from 2008 to 2013.

Survey Year	Survey Dates	Cold-Water Survey Days*	Warm-Water Survey Days**	Aircraft	Observer Window	SOCAL Sub-area Surveyed
2008	17–21 October	0	5	P	B	SCI, Santa Catalina Island, S SCI
2008	15–18 November	4	0	P	B	San Nicolas Basin, SCI, S SCI
2009	5–11 June	0	6	P	B	Santa Catalina Basin, San Nicolas Basin
2009	20–29 July	0	8	P	B	Santa Catalina Basin, San Nicolas Basin
2009	18–23 November	6	0	P	B	Santa Catalina Basin, San Nicolas Basin, SCI
2010	13–18 May 13-18	0	5	P	B	Santa Catalina Basin, San Nicolas Basin
2010	27 July–3 August	0	5	P	B	Santa Catalina Basin, San Nicolas Basin
			2	H	F	
2010	23–29 September	0	6	P	B	Santa Catalina Basin, San Nicolas Basin
2011	14–19 February	4	0	P	B	Santa Catalina Basin, San Nicolas Basin, Silver Strand
2011	29 March 29–3 April	3	0	P	B	Santa Catalina Basin, San Nicolas Basin
2011	12–20 April	9	0	AC	F	Santa Catalina Basin, San Nicolas Basin, Silver Strand
2011	9–14 May	0	6	P	B	Santa Catalina Basin, San Nicolas Basin, Silver Strand
2012	30 January–5 February	7	0	P	B	Santa Catalina Basin, San Nicolas Basin
2012	13-15 March	3	0	P	B	Santa Catalina Basin
2012	28 March–1 April	5	0	P	B	Santa Catalina Basin
2013	25-30 March	6	0	P	B	Santa Catalina Basin, San Nicolas Basin
2013	22-26 May	0	5	P	B	Santa Catalina Basin, San Nicolas Basin

P = Partenavia; H = Helicopter; AC = Aero Commander; B = Bubble; F = Flat; SCI= San Clemente Island; S SCI= ocean area south of San Clemente Island; Santa Catalina Basin (representing the area between SCI and the California mainland); San Nicolas Basin (area west of SCI), *cold-water (November-April), ** warm-water (May-October).

Survey effort involved four modes as described below (see **Table F-2** and Smultea and Bacon 2012):

Search to locate and observe marine mammals and sea turtles via both *systematic* line-transect and *connector* aerial survey effort. Connector effort was search effort between adjacent systematic transect lines.

Identify involving circling of a sighting to photo-document and confirm species, as possible, and to estimate group size and presence/minimum number of calves.

Focal Follow involving circling of a cetacean sighting to conduct extended behavioral observation sampling after a species of interest was located.

Shoreline Survey involving circumnavigating clockwise around San Clemente Island (SCI) approximately 0.5 kilometer (km) from shore to search for potentially stranded or near-stranded animals.

One pilot (2008-2010) or two pilots (2011-2013) and three professionally trained marine mammal biologists (at least two with over 10 years of related experience) were aboard the aircraft. Two biologists served as observers in the middle seats of the aircraft; the third biologist was the recorder in the front right co-pilot seat (2008-2010) or in the rear bench seat (2011-2013). Surveys were flown at speeds of approximately 100 knots (kt) and altitudes of approximately 227-357 meters (m) (800-1000 feet [ft]). In practice, altitude at the time of sightings averaged 261 ± Standard Deviation (S.D.) 49 m based on readings from a Wide Area Augmentation System-enabled Global Positioning System (GPS). When the plane departed the survey trackline during Identify or Focal Follow modes, the pilot usually returned to the transect line within 2 km of the departure point. Occasionally, the return point was several km from the departure point.

Established line-transect survey protocol was used (see Carretta et al. 2000; Buckland et al. 2001; Smultea and Bacon 2012). Parallel transect lines were positioned primarily along a WNW to ESE orientation generally perpendicular to the bathymetric contours/coastline to avoid biasing of surveys by following depth contours (**Figure F-1**). The study area within the Southern California (SOCAL) Range Complex (i.e., study area) overlapped transect lines of previous aerial surveys conducted 1-2 times per month over approximately 1.5 years in 1998-1999 by the National Marine Fisheries Service/Southwest Fisheries Science Center (NMFS/SWFSC) on behalf of the U.S. Navy (Carretta et al. 2000) (see **Figure F-1** for comparison of the Carretta et al. [2000] study areas with ours). However, transect lines were different from and spaced closer together than the 22-km spacing used by Carretta et al. (2000). Given the goal to intensively survey in a prescribed area, we followed transect lines spaced approximately 14 km apart between the coast and San Clemente Island (the Santa Catalina Basin sub-area) (8,473 square kilometers [km^2]) (**Figure F-1**). Our transect lines were spaced 7 km apart to the west (the San Nicolas Basin sub-area) (4,180 km^2) and south of San Clemente Island (the South SCI sub-area) (4,903 km^2).

Table F-2. Description of the four primary study modes designed to address monitoring goals of the aerial survey. Note: (MM = marine mammal)

Mode	Aircraft Speed (kt)	Aircraft Altitude (m)	Flight Pattern	Duration	Data Collected
Search	~100	~305	Systematic transect lines Short "connector" lines Transits	Until MM seen then switch to Identify or Focal Follow Mode	Time & location of sighting Species, group size, min. no. calves Bearing & declination angle to sighting Behavior state Initial reaction (yes or no & type) Heading of sighting (magnetic) Dispersion distance (min. & max. in estim. body lengths)
Identify	~85	~305	Circling at ~305 m radius	<5 min	Photograph to verify species Estimate group size, min. no. calves Note any apparent reaction to plane or unusual behavior
Focal Follow	~85	~365-457	Circling at ~1 km radius	≥5– 60+ min	<u>In order of priority every ~1 min:</u> Time Focal group heading (magnetic) Lat./long. (automatic GPS) Behavior state Dispersion distance Aircraft altitude (feet)(automatic WAAS GPS) Distance of aircraft to MM (declination angle) Reaction (yes or no & type) Bearing & distance to vessels <10 km away or other nearby activity Surface & dive times (whales) Respirations (whales) Individual behavior events (whales)
Shoreline Survey	~100	~305	Circumnavigate San Clemente Island in clockwise direction ~0.5 km from shoreline (random effort)	~45 min	Status (alive, dead or injured) Species, group size, min. no. calves Bearing & declination angle to sighting Behavior state & heading Initial reaction (yes or no & type)

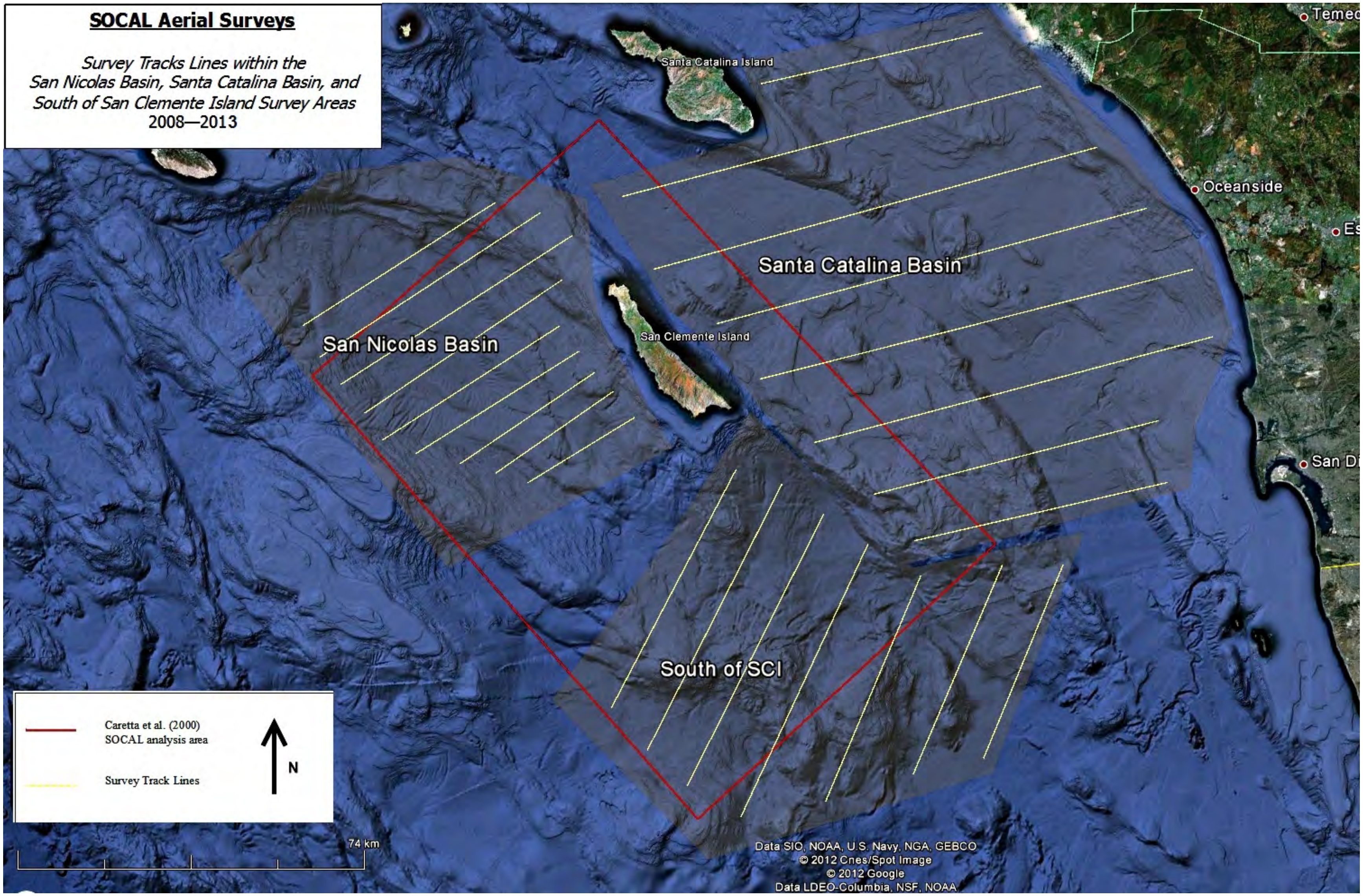


Figure F-1. Systematic survey tracklines within the three survey sub-areas off southern California 2008–2013.

We used the following hardware and software for data collection, including basic sighting and environmental data (e.g., , observation effort, visibility, glare, etc.): (1) BioSpectator on a Palm Pilot TX (pull-down menus or screen keyboard) or an Apple iPhone or iTouch in 2008 and 2009; (2) a customized Excel spreadsheet on a Windows-based notebook computer (2010, 2011); or customized Mysticetus Observation Platform (Mysticetus) software on a notebook computer (2011-2013). Each new entry was automatically assigned a time stamp, a sequential sighting number, and a GPS position. A Suunto handheld clinometer was used to measure declination angles to sightings when the sighting was perpendicular to the aircraft (2008-2010) or in 2011-2013 at the sighting location along with a horizontal bearing from the aircraft using Mysticetus. In 2008-2010, declinations were later converted to perpendicular sighting distance; in 2011-2013, declinations were instantly converted to perpendicular and radial sightings distances by Mysticetus.

Photographs and video were taken through a small opening/porthole through either the co-pilot seat window (2008-2010) or the rear left bench-seat window (2011-2013). One of four Canon EOS or Nikon digital cameras with Image Stabilized (IS) zoom lenses was used to document and verify species for each sighting during Identify Mode, as feasible/needed (Canon 40D with 100-400 millimeters (mm) ET-83C lens; Canon 20D with 70-200 mm 2.8 lens and 1.4X converter; Canon 7D with 100-400 mm lens; Nikon D50 with 100-400 mm lens; Nikon D800 with 80-400 mm lens). A Sony Handycam HDR-XR550, Sony Handycam HDR-XR520 or a Sony HDR-PJ79OV video camera was used to document behaviors during Focal Follow Mode. Observers used Steiner 7 X 25 or Swarovski 10 X 32 binoculars as needed to identify species, group size, behaviors, etc. Environmental data including Beaufort Sea State (Bf), glare, visibility and cloud cover conditions were collected at the beginning of each leg and whenever conditions changed. The GPS locations of the aircraft were automatically recorded at 10-second intervals on WAAS-enabled GPSs: Garmin 495 aviation or Bluetooth Global-Sat BT368, a handheld Garmin 78S GPS, and the aircraft GPS. In 2008-2010, sighting and effort data were merged with the GPS data using Excel after the survey, based on the timestamp information to obtain aircraft positions and altitudes at the times of the recorded events and to calculate distances to sighted animals. In 2011-2013, Mysticetus merged these data automatically in the field.

Data Analysis

We used standard line-transect methods to analyze the aerial survey data (Buckland et al. 2001). Estimates of density and abundance (and their associated coefficient of variation) were calculated using the following formulae:

$$\hat{D} = \frac{n\ \hat{f}(0)\ \hat{E}(s)}{2\ L\ \hat{g}(0)}$$

$$\hat{N} = \frac{n\ \hat{f}(0)\ \hat{E}(s)\ A}{2\ L\ \hat{g}(0)}$$

$$\hat{CV} = \sqrt{\frac{\hat{\text{var}}(n)}{n^2} + \frac{\hat{\text{var}}[\hat{f}(0)]}{[\hat{f}(0)]^2} + \frac{\hat{\text{var}}[\hat{E}(s)]}{[\hat{E}(s)]^2} + \frac{\hat{\text{var}}[\hat{g}(0)]}{[\hat{g}(0)]^2}}$$

where D = density (of individuals),

n = number of on-effort sightings,

f(0) = detection function evaluated at zero distance,

E(s) = expected average group size (using size-bias correction in DISTANCE),

L = length of transect lines surveyed on effort,

g(0) = trackline detection probability,

N = abundance,

A = size of the study area,

CV = coefficient of variation, and

var = variance.

Line-transect parameters were calculated using the software DISTANCE 6.0, Release 2 (Thomas et al. 2010). Previous estimates used both systematic and connector lines (Jefferson et al. 2011, 2012a; though those of Jefferson et al. 2012b did not). However, due to concerns about possible bias, only survey lines flown during systematic (the main line-transect survey lines perpendicular to the coast) transects at a planned altitude of 700-1,050 ft and speed ~100 kt with both observers on-effort were used to estimate the detection function and other line-transect parameters (i.e., sighting rate, n/L, and group size). We used a strategy of selective pooling and stratification to minimize bias and maximize precision in making density and abundance estimates (see Buckland et al. 2001). Due to low sample sizes for most species, we pooled species with similar sighting characteristics to estimate the detection function. This was done to produce statistically robust values with sample sizes of at least 60-80 sightings for each group. The four species groups were: (1) baleen whales, (2) large delphinids, (3) small delphinids, and (4) California sea lions (see **Table F-3, Figure F-2a-d**).

Table F-3. Estimates of the detection function for the four species groups. In the sample size column, two numbers are given: total sample size and the sample size after truncation (in parentheses).

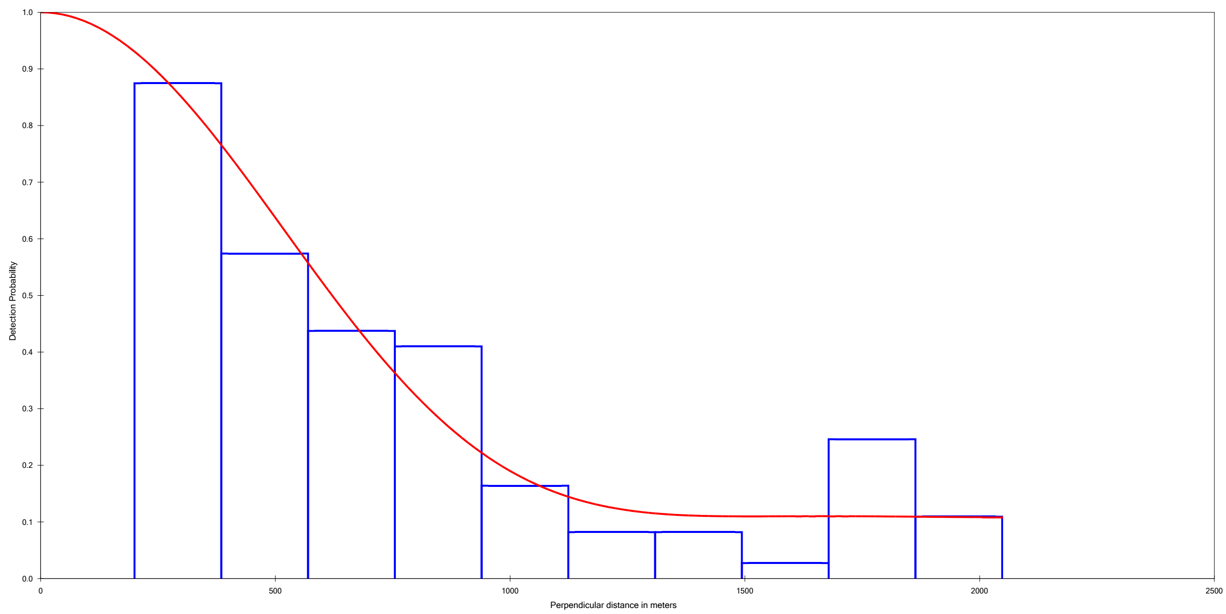
Species Group	Species Included	n	f(0)	%CV
Baleen whales	*Balaenoptera musculus, B. physalus, Balaenoptera* sp., *Megaptera novaeangliae, Eschrichtius robustus,* unidentified baleen whale	389 (91)	0.0018 Uniform/Cosine	13
Large delphinids	*Grampus griseus, Tursiops truncatus*	450 (128)	0.0023 Hazard Rate/Cosine	21
Small delphinids	*Delphinus delphis, D. capensis, Delphinus* sp., *Lagenorhynchus obliquidens, Lissodelphis borealis,* unidentified small dolphin	693 (193)	0.0017 Hazard Rate/Cosine	21
California sea lions	*Zalophus californianus,* unidentified pinniped	604 (103)	0.0047 Uniform/Cosine	9

We used all data collected in sea state conditions of 0-4 and did not stratify estimates by sea state or other environmental parameters. We produced stratified (in terms of sighting rate and group size) estimates of density and abundance for the two survey sub-areas and two seasons, using the pooled species-group f(0) (detection function evaluated at zero distance) values described above. The seasons were defined as warm-water (May through October) and cold-water (November through April), after Carretta et al. (2000).

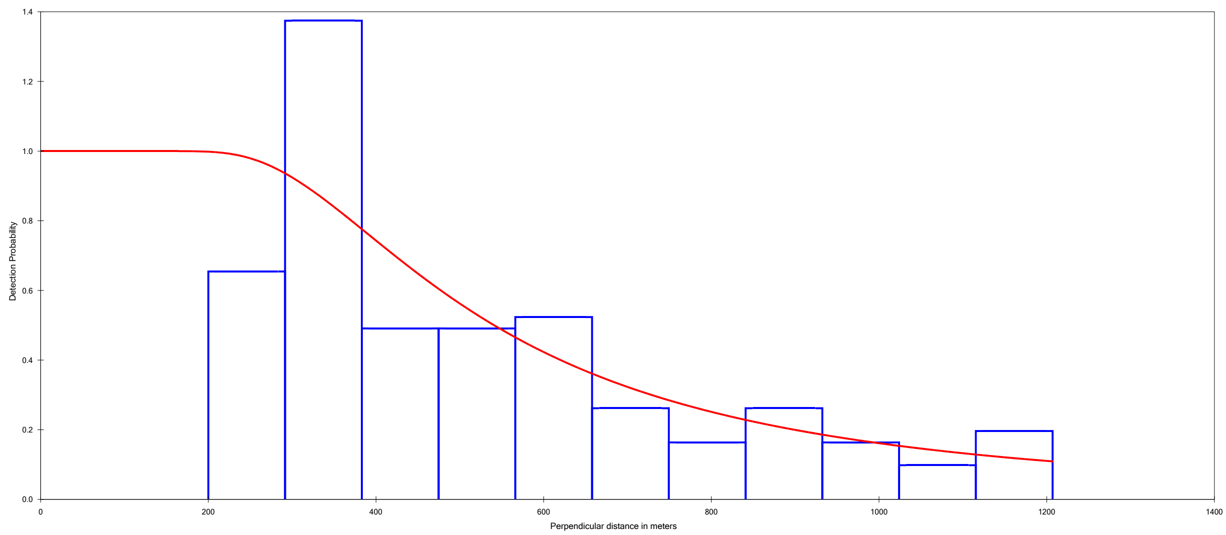
Some sightings (*n*=108 or 11 percent) were unidentified to species (although some of these were identified to a higher-level taxonomic grouping, e.g., unidentified baleen whale, unidentified small delphinid, unidentified pinniped, unidentified *Balaenoptera* sp., or unidentified *Delphinus* sp.). We thus prorated these sightings to species using the proportions of species in the identified sample, adjusted our sighting rates appropriately, and corrected the estimates with these factors. Because of the large proportion (81 percent) of sightings that were identified only to genus for *Delphinus*, we took a slightly different approach with this group. We calculated an overall estimate for *Delphinus* spp., then prorated the estimate to species (*D. delphis* and *D. capensis*), based on the proportion of each species represented in the known sample of sightings (0.72 for *D. delphis* and 0.28 for *D. capensis*). Notably, recent advances in the resolution of digital photography the last few years have facilitated and improved our ability to differentiate between *D. delphis* and *D. capensis* sightings.

To avoid potential overestimation of group size, we used the size-bias-adjusted estimate of average group size available in DISTANCE if it was less than the arithmetic mean group size. In most cases, group size for each estimate was calculated using a stratified approach (i.e., only groups from within a particular stratum were used to calculate average group size for that stratum).

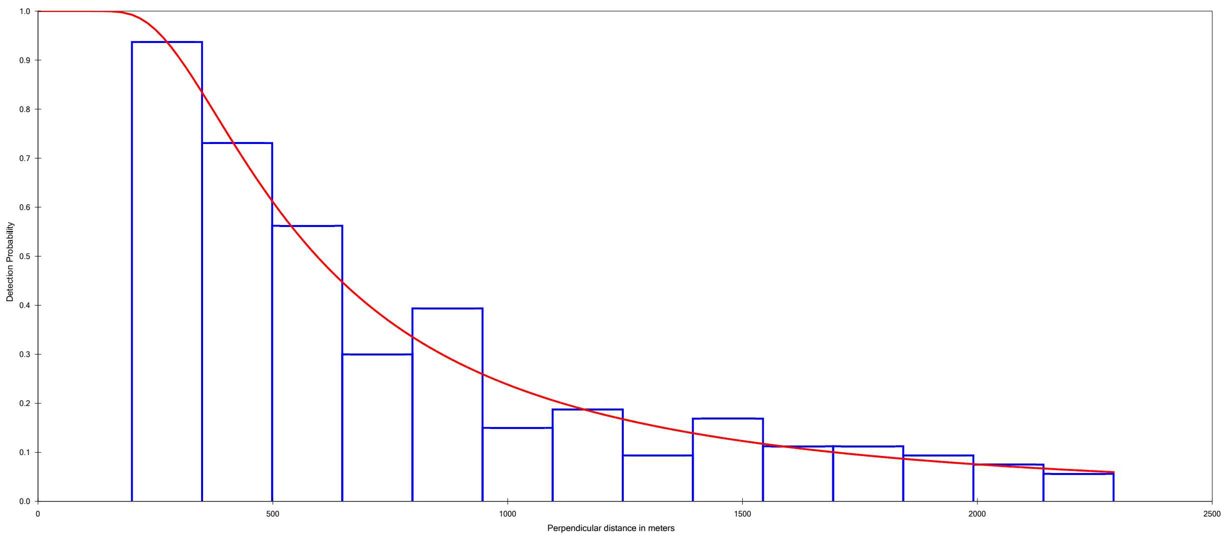
Truncation involved the most-distant 5 percent of the sightings for each species group. We also used left truncation at 200 m due to indications that poor visibility below the aircraft resulted in missed detections near the transect line (the 200-m cut-off was based on examination of the sightings by distance plots). This helped avoid potential underestimation of f(0) due to missed detection data immediately near the transect line. We modeled the data with half-normal (with hermite polynomial and cosine series expansions), hazard rate (with cosine adjustment), and uniform (with cosine and simple polynomial adjustments) models, selecting the model with the lowest value for Akaike Information Criterion.



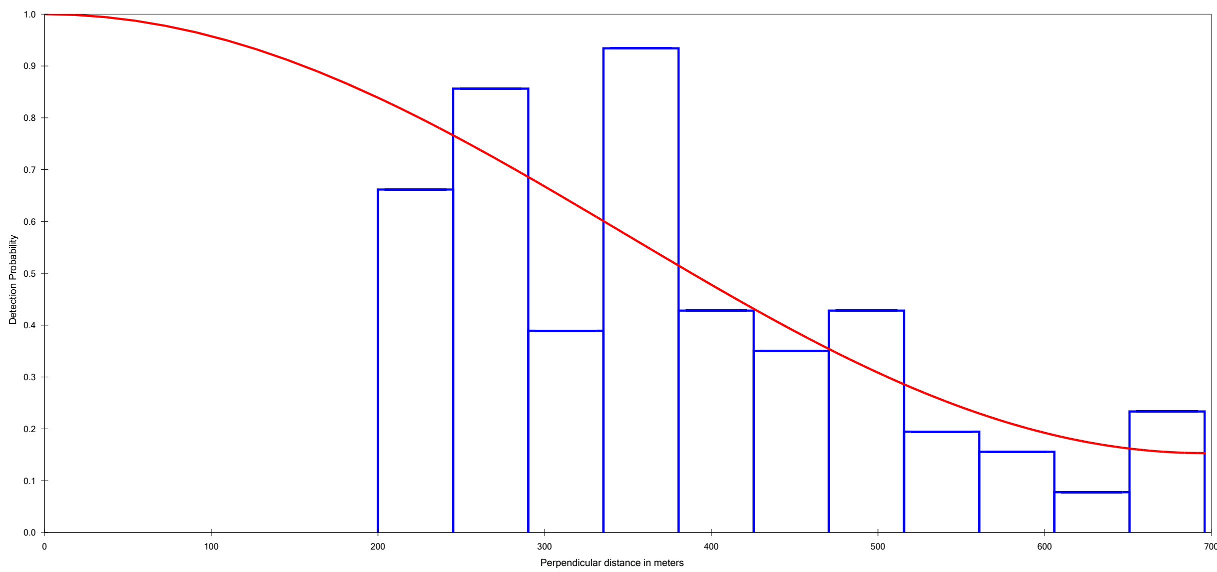
a) Baleen whales



b) Large delphinids



c) Small delphinids



d) California sea lions

Figure F-2a-d. Perpendicular distance plots and fitted detection functions for the four species groups.

We did not have data available to empirically estimate trackline detection probability [g(0)] for this study. However, since our surveys were very similar to those of Carretta et al. (2000), values for g(0) from their study were used to adjust for uncertain trackline detection. Because data for estimating g(0) came from that study, and standard errors were usually not available, we did not incorporate a variance factor for g(0) into the final estimates of abundance. This results in an underestimate of the variance for the final estimates of density and abundance. However, estimates of density and abundance were produced only for those species with at least ten useable, on-effort sightings in the line-transect database (an arbitrary cut-off, based on past experience) to address this issue. Estimates were made for blue and humpback whales

(*Balaenoptera musculus* and *Megaptera novaeangliae*, respectively), even though we had slightly less than 10 sightings for each, due to the endangered status of these species.

Results

Out of a total of 72,468 km flown, 26.0 percent (18,831 km) were flown during on-effort periods for line transect in good sea conditions (Bf 4 or less), during systematic lines, and thus available to estimate density and abundance. Out of the total of 2,510 marine mammal groups sighted during all survey states (on-effort, off-effort), 38 percent (*n* = 960) of these were used to estimate density and abundance in this report (**Table F-4**; **Figures F-3 and F-4**). We sighted at least 19 species of marine mammals, although not all sightings were identified to species level (**Table F-4**). The most commonly sighted marine mammals (with the number of useable sightings given in parentheses) were fin whales *Balaenoptera physalus* (*n* = 69 or 7 percent), gray whales *Eschrichtius robustus* (*n*=47or 5 percent), Risso's dolphins *Grampus griseus* (*n*=157 or 16 percent), bottlenose dolphins *Tursiops truncatus* (n=36 or 4 percent), common dolphins *Delphinus* spp. (*n*=261 or 27 percent, including both species), California sea lions (n=197or 21 percent), Pacific white-sided dolphins *Lagenorhynchus obliquidens* (*n*=11 or 1 percent), northern right whale dolphins *Lissodelphis borealis* (*n*=8 or 1 percent), blue whales (*n*=8 or 1 percent), and humpback whales (*n*=8 or 1 percent), the remaining 4% was not considered useable for density and abundance purposes. Abundance was thus estimated for these species. Line-transect estimates of density and abundance (and their associated coefficients of variation) are shown in **Table F-5**.hre

Identification of common dolphins to species level was often not possible during flights. For this reason, extensive photos were taken of common dolphin (*Delphinus* spp.) schools for later detailed examination. We examined a sample of these photos to see if we could identify the species, and we could in many cases. Short-beaked common dolphins (*Delphinus delphis*) predominated these sightings. Based on the preliminary sample of photos in which we were able to determine species, 72 percent (n=84) of common dolphins sighted were *D. delphis* and only 28 percent (n=44) were long-beaked common dolphins (*D. capensis).*

Table F-4. Marine mammal species observed during the surveys listed in taxonomic order, with total sightings (nT) and sightings available for line transect estimation (nD).

SPECIES	nT	nD
Blue whale, *Balaenoptera musculus*	66	8
Fin whale, *B. physalus*	136	69
Bryde's whale, *B. brydei/edeni*	2	1
Minke whale, *B. acutorostrata*	19	9
Humpback whale, *Megaptera novaeangliae*	18	8
Gray whale, *Eschrichtius robustus*	104	47
Sperm whale, *Physeter macrocephalus*	1	1
Cuvier's beaked whale, *Ziphius cavirostris*	2	2
Killer whale, *Orcinus orca*	2	2
Pacific white-sided dolphin, *Lagenorhynchus obliquidens*	21	11
Risso's dolphin, *Grampus griseus*	328	157
Bottlenose dolphin, *Tursiops truncatus*	123	36
Short-beaked common dolphin, *Delphinus delphis*	84	49
Long-beaked common dolphin, *D. capensis*	44	20
Common dolphin, *Delphinus* sp.	521	192
Northern right whale dolphin, *Lissodelphis borealis*	16	8
Dall's porpoise, *Phocoenoides dalli*	5	3
California sea lion, *Zalophus californianus*	553	197
Harbor seal, *Phoca vitulina*	15	1
Northern elephant seal, *Mirounga angustirostris*	6	5
Unidentified (Unid.) baleen whale	49	23
Unid. delphinid	305	71
Unid. pinniped	47	17
Unid. marine mammal	43	23
TOTAL	**2,510**	**960**

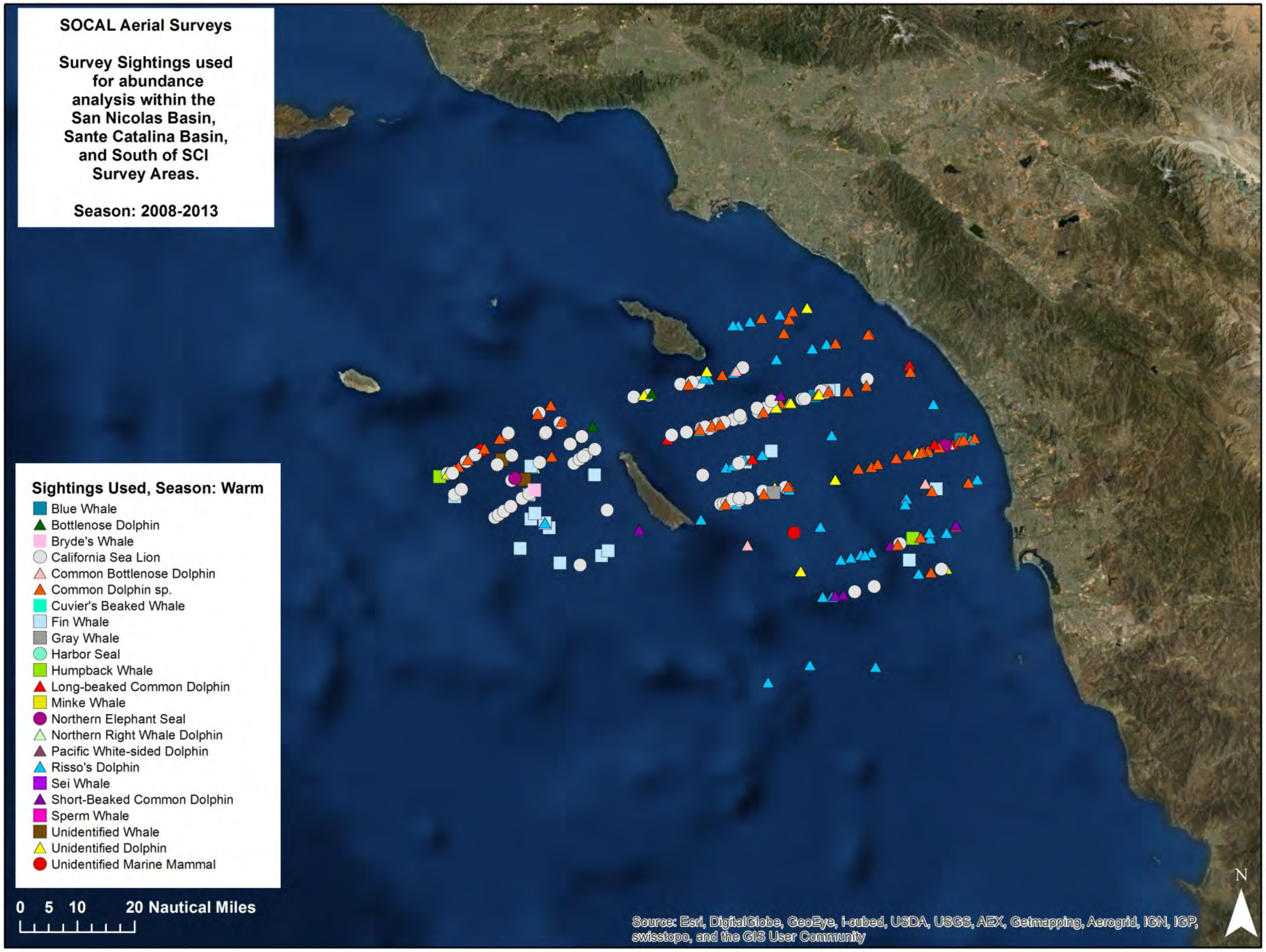


Figure F-3. Systematic survey tracks and sightings used for abundance analysis, warm-water season (May-October) off Southern California, 2008–2013.

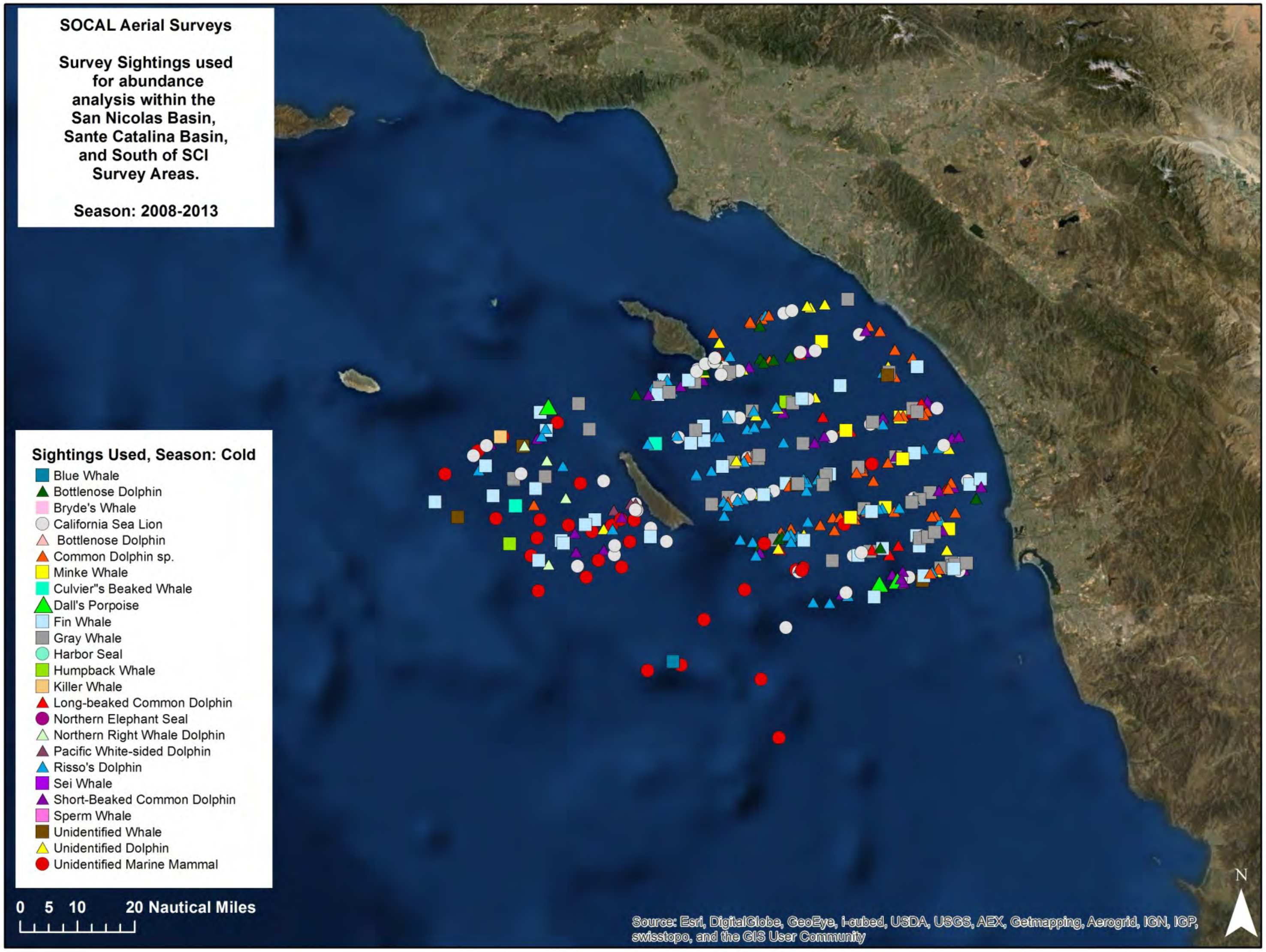


Figure F-4. Systematic survey tracks and sightings used for abundance analysis, cold-water season (November-April) off Southern California, 2008–2013.

Table F-5. Estimates of individual density (Di), abundance (N), abundance incorporating proration of unidentified sightings (N'), and coefficient of variation (%CV) for marine mammals in the Southern California study area for the warm-water (May-Oct) and cold-water (Nov-Apr) seasons.

	WARM-WATER SEASON				COLD-WATER SEASON			
SPECIES*	Di	N	N'	%CV	Di	N	N'	%CV
Blue whale, *Balaenoptera musculus*	**0.00119**	**15**	**18**	**32**	**0.00000**	**0**	**0**	n/a
Santa Catalina Basin	0.00128	10	12	54	0.00000	0	0	n/a
San Nicolas Basin	0.00096	5	6	99	0.00000	0	0	n/a
Fin whale, *Balaenoptera physalus*	**0.00909**	**115**	**137**	**49**	**0.00933**	**118**	**140**	**33**
Santa Catalina Basin	0.00342	29	35	60	0.00740	64	76	32
San Nicolas Basin	0.02047	86	102	37	0.01270	54	64	34
Humpback whale, *Megaptera novaeangliae*	**0.00047**	**6**	**7**	**100**	**0.00142**	**18**	**22**	**86**
Santa Catalina Basin	0.00035	2	2	101	0.00043	4	5	71
San Nicolas Basin	0.00079	4	5	99	0.00323	14	17	101
Gray whale, *Eschrichtius robustus*	**0.00059**	**5**	**6**	13	**0.01162**	**197**	**221**	**53**
Santa Catalina Basin	0.00058	5	6	13	0.01791	152	171	29
San Nicolas Basin	0.00000	0	0	n/a	0.01066	45	50	76
Risso's dolphin, *Grampus griseus*	**0.11080**	**1402**	**1402**	**67**	**0.07824**	**990**	**990**	**51**
Santa Catalina Basin	0.15760	1336	1336	37	0.11013	933	933	32
San Nicholas Basin	0.01559	66	66	96	0.01372	57	57	70
Bottlenose dolphin, *Tursiops truncatus*	**0.02584**	**327**	**496**	**87**	**0.01510**	**191**	**290**	**61**
Santa Catalina Basin	0.03564	302	459	72	0.02263	191	290	61
San Nicholas Basin	0.00577	25	37	102	0.00000	0	0	n/a
Pacific white-sided dolphin, *Lagenorhynchus obliquidens*	**0.01336**	**169**	**207**	**99**	**0.00292**	**37**	**53**	**107**
Santa Catalina Basin	0.01347	115	128	102	0.00132	11	16	84
San Nicholas Basin	0.01305	54	79	96	0.00615	26	37	129
Northern right whale dolphin, *Lissodelphis borealis*	**0.04300**	**719**	**1150**	**108**	**0.11049**	**1847**	**2956**	**325**
Santa Catalina Basin	0.00000	0	0	n/a	0.00000	0	0	n/a
San Nicholas Basin	0.17199	719	1150	108	0..44197	1847	2956	325
Short-beaked common dolphin, *Delphinus* delphis	**0.78200**	**9,894**	**9,894**	**57**	**1.07071**	**13,547**	**13,547**	**46**
Santa Catalina Basin	1.12446	9,528	9,528	32	1.10450	9,358	9,358	28
San Nicholas Basin	0.08751	366	366	81	1.00235	4,189	4,189	64
Long-beaked common dolphin – *Delphinus capensis*	**0.30408**	**3,847**	**3,847**	**57**	**0.41636**	**5,268**	**5,268**	**46**
Santa Catalina Basin	0.43736	3,705	3,705	32	0.42948	3,639	3,639	28
San Nicholas Basin	0.03408	142	142	81	0.38976	1,629	1,629	64
California sea lion, *Zalophus californianus*	**0.05888**	**745**	**824**	**46**	**0.10085**	**1276**	**1416**	**53**
Santa Catalina Basin	0.03379	286	315	28	0.04450	377	418	39

	WARM-WATER SEASON				COLD-WATER SEASON			
SPECIES*	Di	N	N'	% CV	Di	N	N'	% CV
San Nicholas Basin	0.10992	459	509	63	0.21530	899	998	67

***Densities are in individuals per square kilometer. The first line for each species is for the entire Southern California Range Complex and the next two lines are stratified by the two survey sub-areas. The species are listed in taxonomic order.**

DISCUSSION

Potential Biases of the Estimates

As is true of any statistical technique, there are certain assumptions that must hold for line-transect estimates of density and abundance to be accurate. Below we go through the various assumptions of line-transect theory and other issues that may cause bias in our estimates.

Assumption 1: Certain Trackline Detection. Target animals on and very near the trackline must be detected to avoid estimates that are biased low (Buckland and York 2009). This is a central assumption of basic line-transect theory. However, in reality, it is often violated, especially by diving animals like marine mammals. This can be addressed by incorporating a factor into the line-transect equation that accounts for the proportion of missed animals (g(0)). We did this in the present study, by using g(0) factors from studies by other researchers of the target species. However, these often only account for part of the potential bias. Visibility bias in marine mammal surveys is generally divided into two categories. Availability bias is the proportion of animals on the trackline missed due to being on a dive and thus unavailable to be seen by the observers. It is usually modeled from information on dive times (e.g., Barlow 1999; Barlow et al. 1997; Carretta et al. 2000). Perception bias, on the other hand, is the proportion of animals on the trackline that was available to be seen, but was not detected by the observers due to operational factors (such as adverse conditions or observer fatigue). The latter is usually modeled based on detection data collected from multiple-platform or independent/conditionally-independent observer studies (e.g., Carretta et al. 1998; Forney et al. 1995; Forney and Barlow 1998). Ideally, both should be accounted for in marine mammal surveys, but in practice suitable data are often not available to incorporate both types of bias. Since our estimates for some species do not account for both of these types of bias, this results in some residual underestimation.

The inability to see all animals directly under the aircraft also clearly affects the trackline detection. Due to aircraft and personnel limitations, we did not always have the ability to use a belly observer. We have strived to minimize the potential effects of this limitation on the resulting density and abundance estimates by using a 200-m left truncation approach. It is uncertain how much remaining bias from this factor may affect our estimates. We propose to use a belly observer in future surveys to clarify this issue.

Assumption 2: No Responsive Movement. Although it is often stated that there must be no responsive movement to the survey platform, this is not strictly true. However, any responsive movement must occur after detection by the observers, and such movement must be slow relative to the speed of the survey platform (Buckland and York 2009). In our case, the use of a fast-moving aircraft as the survey platform minimizes the chances of this being a significant issue.

This is much more of a concern with vessel surveys, and in aerial surveys is generally not considered to be a problem.

Assumption 3: No Distance Errors. Distances must obviously be measured accurately to avoid inaccuracies in the resulting estimates (Buckland and York 2009). However, in practice, distances are difficult to measure at sea, and it is likely that every marine mammal line-transect survey has suffered from some inaccuracy in distance measurement. However, small and random errors generally do not cause significant problems. It is large and/or directional errors that that cause large errors and are thus of more serious concern. We have strived to measure angles and distances as accurately as possible during this study. At this point, we have no indications that large or directional errors in distance measurement were an issue in this study, and, we are conducting studies to further examine this potential bias.

Other Factors

Besides the above-listed issues, a few other factors may cause some bias in the resulting line-transect estimates. Line placement is a factor that should be considered, as duplicate sightings on different lines on the same day can cause bias. This happened twice and was evident from the similarity of sighting data and timing, recorded activity of the animals (i.e., traveling in a direction consistent with the other sighting location), and the observed aircraft tracks (which included circling sightings) inspected on daily maps. In both cases, the sighting with the least complete data was eliminated from the data set so that the animal/group was only used once. Although we cannot be certain that there are no other instances of this in the data, the high speed of the aircraft in relation to animal movement makes it unlikely to be more than a rare event; our data checking procedures further reduce the likelihood of such instances remaining in the data set.

The sampling design and line spacing should cause no bias. Each sample (i.e., one day's effort) is an independent event, and animals redistribute themselves between samples (i.e., across days). The systematic survey lines were designed and drawn without reference to marine mammal distribution, and there is no evidence that certain lines or areas in-between lines have higher sighting rates than others. Thus, no significant bias should result. Furthermore, systematic lines were generally oriented perpendicular to underwater topography, similar to previous line-transect surveys conducted by the National Marine Fisheries Service (NMFS) Southwest Fisheries Science Center (SWFSC) in this region (e.g., Carretta et al. 2000).

Lack of independence of detections and non-uniform distribution of animals can sometimes cause issues. Some of the specific strategies used in this study to handle issues related to obtaining samples sizes appropriate for modeling the detection function may result in some bias (e.g., prorating unidentified sightings, left truncation, and pooling of Bfs). However, we have no reason to believe that these are major issues, and we believe that they have not caused any major bias in our estimates.

CONCLUSIONS

This report provides the most current fine-scale estimates of density and abundance within portions of the offshore marine waters in Southern California on the U.S. Navy's SOCAL Range

Complex. In particular, densities derived for the cold-water season represent seasonal data and analysis that is notably absent within the region over the last 14 years. Abundance of marine mammals is known to fluctuate from year to year based on changing and dynamic oceanographic conditions in southern California (e.g., El Niño/Southern Oscillation events, prey availability/distribution, etc.). Thus, density and abundance estimates may change as we obtain more data from future surveys and as we further refine strategies to maximize precision and minimize bias. For instance, the NMFS in their spatial habitat models and density estimates generally prefers to pool multi-year survey data to reduce the effect of inter-annual variation. However, based on historical data such as Carretta et al. (2000), we believe that the estimates reported in this paper are generally reflective of numbers of marine mammals within the Navy's SOCAL Range Complex during the survey periods.

Overall, our results are in general agreement with those of Carretta et al. (2000), who surveyed a partially overlapping area using similar methods in the late 1990s. However, our study areas are not the same as those of Carretta et al. (2000), and therefore direct comparisons cannot be made. Our results indicate that the study area continues to be used by a substantial number of marine mammal species during the both the warm- and cold-water seasons. However, numerically, the region is dominated by only a few species. Common dolphins and northern right whale dolphins number in the thousands; Risso's dolphins and California sea lions number in the hundreds to about one-thousand; fin whales, gray whales, and bottlenose dolphins number in the hundreds; Pacific white-sided dolphins number in the tens to low hundreds; and blue whales and humpback whales number only in the tens to single digits. Other species were not seen frequently enough during the study period to derive reliable density or abundance estimates. We hope that future survey work will allow us to estimate abundance for all species that occur in the study area in the future.

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APPENDIX G: PRELIMINARY SUMMARY REPORT JULY 2013

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Aerial Surveys of Marine Mammal/ Sea Turtle Presence and Behavior from 24–29 July 2013 in the U.S. Navy's Southern California (SOCAL) Range Complex

Preliminary Summary Report

Contract No. N62473-10-D-3011 - CTO XE23

Issued to HDR, Inc., San Diego, California

Photo taken by M. Smultea 29 July 2013 under NMFS p

6 August 2013

Prepared by:

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Introduction

This Preliminary Summary Report summarizes the third of three 2013 aerial surveys contracted to be conducted on the United States (U.S.) Navy's Southern California (SOCAL) Range Complex Operating Area (RANGE COMPLEX) to monitor marine mammals and sea turtles as described in the Statement of Work (SOW). This July 2013 survey was the 8th SOCAL aerial monitoring effort conducted during the "warm-water" winter period. The warm-water season in SOCAL for this survey was defined using the definition provided in Carretta et al. (2000) as the months of May through October. The goal of this survey was the same as the previous two 2013 SOCAL aerial surveys: to conduct 40 hours of aerial visual survey effort to (1) obtain data suitable for estimating the abundance and density of marine mammals using line-transect methodology, and (2) continue collection of baseline behavior on marine mammals, including focal follows using videography.

Methods

Methods for aerial surveys have been described in detail in past reports and ; authors recommend referring to Smultea and Bacon (2012) for detailed description. The survey occurred in the Santa Catalina Basin (SCB) and San Nicolas Basin (SNB) in the Southern California Bight within the SOCAL Range Complex and focused on the following three survey modes:

1. Systematic line-transect "search" effort along east-to-west oriented lines located east and west of San Clemente Island (SCI) (flown at 244-305 meters [m] altitude and 100 knots [kt]) and (2);
2. "Verify" involving breaking from line transect effort to circle and photograph sightings to verify species, numbers and behavior with photographs for approximately 2-5 minutes (min); and
3. "Focal follow" involving circling (at 365 to 457 m altitude and 0.5 to 1.0 kilometers (km) radial distance) of high priority species to video and collect focal behavior (i.e. "focal follow") data for periods of 5 to 60 min (typically 10 to 20 min).

The survey was flown from a fixed-wing, twin-engine Partenavia P68-C equipped with center-seat bubble windows (that do not open) and one opening porthole in the left window at the rear left bench seat. This is the same aircraft that has been used during 17 of the 18 aerial monitoring surveys we have conducted in SOCAL since October 2008 (Smultea and Lomac-MacNair 2010, Smultea et al. 2011, Smultea and Bacon 2012). Photographs and video were taken through the opening window by the recorder in the rear left seat to confirm species as needed by pilots breaking from line-transect effort for several minutes then returning to the transect line and/or to collect video on behavior of focal follows. A Nikon D800 HD 36.3 megapixel still camera with a 100-400 millimeter (mm) internally stabilized lens was used to capture photos on July 23 through 28. On July 29, a Canon EOS 7D with a 100-400 mm lens was used to collect photos because the higher-resolution Nikon D800 was not available. A Sony HDR-PJ79OV video camera with internal image stabilization was used for videos of focal follows. The only other new equipment used was a Global-Sat BT368i mini global positioning system (GPS) that was placed on the front dash of the aircraft that transmitted GPS data to Mysticetus Observation Software running on a Dell Inspiron 14R touch-screen laptop personal computer operated by the recorder.

Results

A total of eight survey flights were flown on 6 days during 24 through 29 July 2013. Thus, one flight was made per day except on 26 July when 2 flights were made due to favorable conditions; morning flights were typically curtailed by a heavy low marine fog layer (**Table 1**). A total of 23.4 hours (hr) or 4,521 kilometers (km) (2,441 nautical miles [nm]) of flight time from “wheels up” to “wheels down” was flown over 5 days in the SCB and 1 day in the SNB. An additional 3 hr was used to ferry the aircraft back and forth from Oxnard to San Diego, California, plus approximately 1.2 hr of “engines-on” time on the runway [i.e., waiting in line to take off from the Montgomery Airport (**Table 1**). Observers were on watch for 95 percent of the 21.9 hr of in-air time during systematic line-transect, transit, random, connector, and circling effort (the remaining 5 percent of time was over land between the airport and the water’s edge) (**Table 1**). The total hours and flight descriptions for each day by date are listed in **Table 1**.

A total of 172 sightings of an estimated 7,575 individual marine mammals representing at least 7 identified to species were recorded over the 6 survey days (**Table 2**). Most sightings (i.e., groups) (64 or 37 percent of 172) were of California sea lions (*Zalophus californianus*). Common dolphin sp. (*Delphinus* sp.) was the second-most frequently seen species in terms of number of sightings (50 or 29 percent of 172 sightings) but represented the highest number of individuals seen (6,551 or 86 percent of 7,575). Unidentified whale and dolphin sightings occurred primarily during transits to and from the survey area when we did not have enough time to circle to identify species. **Table 3** provides a list of all aerial survey sightings and their GPS locations.

A number of unusual sightings occurred as summarized below:

- A lone blue whale (*Balaenoptera musculus*) was seen on 29 July 2013 that was estimated to be about 55-60 ft long.
- California sea lions were observed feeding on bait balls of small fish on 9 occasions. Photographs were taken on one such occasion of two California sea lions swimming through a bait ball (**Photo 1**).
- A lone blue whale was followed for an approximately 75-minute long focal session while a U.S. Navy guided-missile frigate (*United States Ship [USS]) McClusky* [FFG 41]) was within view on 24 July. (***See Summary of Behavioral Analyses in main Appendix***).
- Video footage collected during a focal follow of a group of 25 Risso’s (*Grampus griseus*) dolphins off the southeast coast of San Clemente Island on 28 July documented social-sexual behavior among individuals. This behavior has not been frequently documented during our previous SOCAL aerial surveys.
- No confirmed sightings of fin whales were made from 23 through 29 July 2013. One sighting was either a fin, Bryde’s or sei whale. In comparison, in July 2009, 6 fin whale sightings were made and in July 2010, 3 such sightings were made. Our comprehensive analyses of 2008-2012 aerial survey data showed that fin whales were seen significantly more frequently west of San Clemente Island (SCI) in the SNB than east of SCI (Smultea and Bacon 2012). The relatively low number of fin whales seen during July 2013 may have been related to only one of seven flights occurring over SNB during this survey period.

- On July 29, we observed the highest number of overall sightings we have ever had during one flight compared to the total 18 flights we have conducted in SOCAL since October 2008. During this 4.4 hr flight covering 869 km of on-effort observations, we recorded a total of 153 sightings and 1,332 individuals. This consisted of 57 cetaceans (1,208 individuals) and 45 pinniped sightings (60 individuals), 37 Ocean sunfish (*Mola mola*) sightings (39 individuals), 12 sightings of fish bait balls, and a sighting of a school of about 20 large fish, possibly tuna. This resulted in approximate sighting rates of 0.07 cetacean groups/km and 0.05 pinniped sightings per km and approximate sighting rates of 13 cetacean groups/hr and 10.2 pinniped sightings per hr (when all effort types are included e.g., systematic, connector, random, transit and circling). Although sighting numbers were high, species diversity at 5 marine mammal species was actually relatively low, as compared with our previous surveys. Of special interest was the relatively high number of common dolphin sp. sightings: 26 sightings (8 sightings without counts of individuals). Beaufort sea state during this flight ranged from 0-2, which is believed to have contributed to the high number of sightings through increased sightability of disturbances on the nearly flat sea surface.

Other Marine Species Sightings

Opportunistic and/or unusual sightings of other marine species were recorded during survey flights. Very unusual among these flights as compared with the previous 17 SOCAL aerial surveys was the frequency (n = 14) of small-sized fish bait balls (typically approximately 3-5 meters in diameter). We frequently (n=9) saw single California sea lions presumably foraging and feeding on them by apparently circling and cutting through the middle of the baitfish balls (**Photo 1**).

Ocean sunfish sightings have been recorded systematically since the April 2011 survey (and continued through the 2012 and 2013 survey periods). During this survey, 136 sightings of 140 individual ocean sunfish were observed. Ocean sunfish sightings are summarized in **Table 4.**

Vessels

Beginning with the April 2011 survey, vessel counts have been recorded during systematic transect lines (and continued through the four winter 2012 and the two 2013 surveys). A total of 38 vessels were counted and are summarized in **Table 5**.

Additional Notes

The survey was conducted predominantly during Beaufort sea state 3 conditions followed by Beaufort sea state 2 (range Beaufort sea state 0-5). Only one flight could typically be conducted per day due to a heavy marine fog layer that curtailed our ability to fly at 800 feet in altitude or higher during the morning. The morning fog typically delayed our first flight until late morning/early afternoon (**Table 1**).

Photographs of common dolphins will be reviewed by Dr. Tom Jefferson to differentiate long-beaked from short-beaked common dolphins, as possible. A total of 1,235 photographs were taken of common dolphin sp. Preliminary assessment of video indicates that approximately 65 minutes of video was obtained on 13 focal-follow groups of cetaceans (**Table 6**).

Most of the data from this survey are still in preliminary form and therefore, all data have not been analyzed.

Photos

Photo 1. Two California sea lions, including one swimming into a bait ball, photographed 29 July 2013 by M. Smultea under National Marine Fisheries Service (NMFS) permit 15369)

Photo 2. Risso's dolphins photographed 29 July 2013 at 13:55 by .M Smultea under NMFS permit 14451)

Photos 3 a-e. A common dolphin sp. leap sequence photographed 25 July 2013 by D. Steckler under NMFS permit 14451.

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Tables

Table 1. Preliminary summary of flight effort during SOCAL marine mammal monitoring 24-29 July 2013.

Date	Flight of Day	Time Engines On	Time Engines Off	Total Engine Time (hh:mm)[+]	Time Wheels Up	Time Wheels Down	Total Flight Time (hh:mm)	Total Flight Distance (km)[*]	Total Flight Distance (nm)[1]	Start Obs.[2]	End Obs.	Total Obs. Time (hh:mm)	Flight Area[4]	General Weather	Comments
7/24/2013	1	11:00	15:25	4:25	11:06	15:21	4:14	841	454	11:09	15:04	3:54	SCB	Partly Cloudy Bf[3] 2-5	Late start due to fog.
7/25/2013	1	12:29	16:39	4:10	12:36	16:34	3:57	748	404	12:40	16:29	3:49	SCB	Partly Cloudy Bf 2-5	Late start due to fog.
7/26/2013	1	10:47	13:12	2:25	10:58	13:07	2:08	444	240	11:12	13:02	1:50	SCB	Partly Cloudy Bf 3-4	Late start due to fog.
7/26/2013	2	14:11	15:55	1:43	14:15	16:00	1:44	327	176	14:18	15:50	1:31	SCB	Partly Cloudy Bf 2-4	
7/27/2013	1	13:30	16:33	3:03	13:38	16:30	2:52	573	309	13:44	16:25	2:41	SCB	Partly Cloudy Bf 2-5	Late start due to fog.
7/28/2013	1	11:40	15:47	4:07	11:47	15:43	3:55	719	388	11:51	15:37	3:46	SCB	Foggy Bf 1-4	Late start due to fog.
7/29/2013	1	10:42	15:23	4:40	10:49	15:19	4:30	869	469	10:52	15:15	4:23	SNB	Partly Cloudy Bf 0-2	Late start due to fog.
	8 Flights		**Total Engine Time**	**24:35**		**Total Flown:**	**23:24**	**4521**	**2441**		**Total Obs Time**	**21:56**			**Add 3 hours (RT) for ferry time to and from Oxnard for aircraft for total in-air time**

[1]nm= nautical miles, [2]Obs. = Observations, [3]Bf= Beaufort Sea State, [4]SCB = Santa Catalina Basin, SNB = San Nicolas Basin
[+]Time is rounded to hours and minutes (hh:mm). [*]Kilometers (km) are rounded to closest whole number.

Table 2. Number of marine mammal sightings by species seen during the SOCAL marine mammal monitoring survey 24-29 July 2013.

Species Common Name*+	Species Scientific Name	No. Groups Sighted	Estimated No. Individuals Sighted	Estimated Average Group Size
California Sea Lion	*Zalophus californianus*	64	81	1.3
Common Dolphin sp.**	*Delphinus* sp.	50	6,551	156.0
Unidentified Dolphin ***	Delphinidae sp.	27	422	19.2
Risso's Dolphin	*Grampus griseus*	9	133	14.8
Blue Whale	*Balaenoptera musculus*	5	7	1.4
Bottlenose Dolphin	*Tursiops truncatus*	5	118	23.6
Unidentified Small Marine Mammal	Cetacean or Pinniped	4	8	2
Long-Beaked Common Dolphin	*Delphinus capensis*	3	102	34.0
Fin/Sei/Bryde's Whale	*Balaenoptera physalus/borealis/brydei/edeni*	1	1	1.0
Pacific White-Sided Dolphin	*Lagenorhynchus obliquidens*	1	40	40.0
Short-Beaked Common Dolphin	*Delphinus delphis*	1	110	110.0
Unidentified Baleen Whale	*Balaenoptera* sp.	1	1	1.0
Unidentified Pinniped	Pinniped	1	1	1.0
Total		**172**	**7,575**	**31.2**

* Consists of preliminary field identification of species. Species may be revised upon close examination of photos prior to final report.

** Group size for eight groups seen during transit effort was not obtained because sightings were so frequent and simultaneous that this information was missed. Overall estimated group size was thus calculated based on a total of the groups for which group size was recorded.

*** Unidentified dolphins were seen mainly while transiting to or between survey areas when there was no time to circle for photographs and/or the sightings were too far away to confirm species.

+Listed in descending order of sighting frequency, by number of groups sighted.

Table 3. Times and locations of sightings during the SOCAL marine mammal monitoring survey 24-29 July 2013 (listed in chronological order).

Date & Time	Species Common Name	Species Scientific Name	Latitude (°North)	Longitude (°West)	Survey Area*
2013-07-24 11:46:43	Blue Whale	*Balaenoptera musculus*	32.7492	-117.6343	SCB
2013-07-24 12:09:58	Common Dolphin sp.	*Delphinus* sp.	32.9258	-117.3408	SCB
2013-07-24 12:26:02	Common Dolphin sp.	*Delphinus* sp.	32.8810	-117.5838	SCB
2013-07-24 12:35:36	Blue Whale	*Balaenoptera musculus*	32.8429	-117.7938	SCB
2013-07-24 14:00:15	Risso's Dolphin	*Grampus griseus*	32.7726	-118.1007	SCB
2013-07-24 14:55:44	Common Dolphin sp.	*Delphinus* sp.	33.0613	-117.9073	SCB
2013-07-24 14:55:45	Common Dolphin sp.	*Delphinus* sp.	33.0621	-117.9094	SCB
2013-07-25 12:40:21	Unidentified Dolphin	Delphinidae sp.	32.8632	-117.2658	SCB
2013-07-25 12:40:53	Unidentified Pinniped	Pinniped	32.8805	-117.2780	SCB
2013-07-25 12:42:03	Common Dolphin sp.	*Delphinus* sp.	32.9168	-117.2903	SCB
2013-07-25 12:42:09	Unidentified Dolphin	Delphinidae sp.	32.9209	-117.2915	SCB
2013-07-25 12:44:50	Common Dolphin sp.	*Delphinus* sp.	32.9916	-117.3288	SCB
2013-07-25 12:51:08	Bottlenose Dolphin	*Tursiops truncatus*	33.0339	-117.3547	SCB
2013-07-25 12:51:48	California Sea Lion	*Zalophus californianus*	33.0372	-117.3618	SCB
2013-07-25 12:57:48	Common Dolphin sp.	*Delphinus* sp.	33.0959	-117.4300	SCB
2013-07-25 13:03:54	California Sea Lion	*Zalophus californianus*	33.1543	-117.4774	SCB
2013-07-25 13:05:42	Common Dolphin sp.	*Delphinus* sp.	33.1415	-117.5337	SCB
2013-07-25 13:19:18	Blue Whale	*Balaenoptera musculus*	33.1437	-117.5486	SCB
2013-07-25 14:00:16	Common Dolphin sp.	*Delphinus* sp.	33.1352	-117.6037	SCB
2013-07-25 14:51:55	Common Dolphin sp.	*Delphinus* sp.	33.2532	-117.6444	SCB
2013-07-25 15:02:33	Bottlenose Dolphin	*Tursiops truncatus*	33.3031	-117.6274	SCB
2013-07-25 15:13:03	Common Dolphin sp.	*Delphinus* sp.	33.3438	-117.8170	SCB
2013-07-25 15:29:16	Unidentified Dolphin	Delphinidae sp.	33.2958	-118.0355	SCB
2013-07-25 15:35:40	Long-beaked Common Dolphin	*Delphinus capensis*	33.2751	-118.1479	SCB
2013-07-25 16:01:27	Common Dolphin sp.	*Delphinus* sp.	33.4327	-117.7281	SCB
2013-07-25 16:02:10	Bottlenose Dolphin	*Tursiops truncatus*	33.4376	-117.7220	SCB
2013-07-25 16:07:14	Common Dolphin sp.	*Delphinus* sp.	33.3895	-117.6708	SCB
2013-07-25 16:08:40	Common Dolphin sp.	*Delphinus* sp.	33.3609	-117.6351	SCB
2013-07-25 16:17:09	Unidentified Dolphin	Delphinidae sp.	33.1831	-117.4179	SCB
2013-07-26 11:05:22	Unidentified Dolphin	Delphinidae sp.	32.8998	-117.3819	SCB

Date & Time	Species Common Name	Species Scientific Name	Latitude (°North)	Longitude (°West)	Survey Area*
2013-07-26 11:05:39	Unidentified Dolphin	Delphinidae sp.	32.9002	-117.3930	SCB
2013-07-26 11:54:05	Blue Whale	*Balaenoptera musculus*	32.6669	-117.4754	SCB
2013-07-26 14:29:55	Unidentified Dolphin	Delphinidae sp.	33.1439	-117.4656	SCB
2013-07-26 14:45:20	Common Dolphin sp.	*Delphinus* sp.	32.8607	-117.4664	SCB
2013-07-26 15:05:43	Common Dolphin sp.	*Delphinus* sp.	32.6462	-117.4165	SCB
2013-07-26 15:27:00	Common Dolphin sp.	*Delphinus* sp.	32.6241	-117.3212	SCB
2013-07-26 15:42:10	Long-beaked Common Dolphin	*Delphinus capensis*	32.7896	-117.3545	SCB
2013-07-27 14:28:48	Bottlenose Dolphin	*Tursiops truncatus*	32.8276	-118.3346	SCB
2013-07-27 14:29:44	California Sea Lion	*Zalophus californianus*	32.8226	-118.3502	SCB
2013-07-27 15:01:24	Common Dolphin sp.	*Delphinus* sp.	32.8854	-118.3957	SCB
2013-07-27 15:12:38	Unidentified Dolphin	Delphinidae sp.	32.9410	-118.4613	SCB
2013-07-27 15:41:21	California Sea Lion	*Zalophus californianus*	33.3824	-118.3315	SCB
2013-07-27 15:41:48	California Sea Lion	*Zalophus californianus*	33.3938	-118.3392	SCB
2013-07-27 15:54:46	California Sea Lion	*Zalophus californianus*	33.4150	-118.3603	SCB
2013-07-27 15:55:07	California Sea Lion	*Zalophus californianus*	33.4107	-118.3486	SCB
2013-07-27 15:56:22	California Sea Lion	*Zalophus californianus*	33.3915	-118.3109	SCB
2013-07-28 11:51:52	California Sea Lion	*Zalophus californianus*	32.8646	-117.2763	SCB
2013-07-28 11:52:01	California Sea Lion	*Zalophus californianus*	32.8677	-117.2817	SCB
2013-07-28 11:52:11	California Sea Lion	*Zalophus californianus*	32.8712	-117.2875	SCB
2013-07-28 11:52:25	Bottlenose Dolphin	*Tursiops truncatus*	32.8684	-117.3013	SCB
2013-07-28 11:52:37	Common Dolphin sp.	*Delphinus* sp.	32.8725	-117.3077	SCB
2013-07-28 11:52:51	California Sea Lion	*Zalophus californianus*	32.8817	-117.3124	SCB
2013-07-28 11:52:54	California Sea Lion	*Zalophus californianus*	32.8835	-117.3144	SCB
2013-07-28 12:01:17	California Sea Lion	*Zalophus californianus*	33.1085	-117.4393	SCB
2013-07-28 12:02:01	Short-Beaked Common Dolphin	*Delphinus delphis*	33.1295	-117.4460	SCB
2013-07-28 12:15:12	Unidentified Dolphin	Delphinidae sp.	33.1768	-117.4148	SCB
2013-07-28 12:18:53	Common Dolphin sp.	*Delphinus* sp.	33.0769	-117.3479	SCB
2013-07-28 12:27:16	Common Dolphin sp.	*Delphinus* sp.	33.0028	-117.3263	SCB
2013-07-28 12:27:28	Common Dolphin sp.	*Delphinus* sp.	33.0027	-117.3179	SCB
2013-07-28 12:37:32	Common Dolphin sp.	*Delphinus* sp.	32.9755	-117.2884	SCB
2013-07-28 12:48:37	California Sea Lion	*Zalophus californianus*	32.8002	-117.3838	SCB
2013-07-28 12:48:51	California Sea Lion	*Zalophus californianus*	32.7994	-117.3932	SCB
2013-07-28 12:49:36	Risso's Dolphin	*Grampus griseus*	32.7818	-117.4070	SCB

Date & Time	Species Common Name	Species Scientific Name	Latitude (°North)	Longitude (°West)	Survey Area*
2013-07-28 13:21:21	Common Dolphin sp.	*Delphinus* sp.	32.6603	-117.4519	SCB
2013-07-28 13:41:34	California Sea Lion	*Zalophus californianus*	32.6938	-117.5392	SCB
2013-07-28 13:57:23	California Sea Lion	*Zalophus californianus*	32.5745	-117.3793	SCB
2013-07-28 13:58:18	California Sea Lion	*Zalophus californianus*	32.5696	-117.4110	SCB
2013-07-28 14:18:39	Fin/Bryde's/SeiWhale	*Balaenoptera physalus/ borealis/brydei/edeni*	32.7242	-118.0456	SCB
2013-07-28 14:50:50	Common Dolphin sp.	*Delphinus* sp.	32.8396	-118.3605	SCB
2013-07-28 15:15:21	Blue Whale	*Balaenoptera musculus*	32.7014	-117.8933	SCB
2013-07-29 10:52:40	Unidentified Dolphin	Delphinidae sp.	32.8596	-117.3108	SCB
2013-07-29 10:53:25	Common Dolphin sp.	*Delphinus* sp.	32.8660	-117.2935	SCB
2013-07-29 10:53:35	Common Dolphin sp.	*Delphinus* sp.	32.8557	-117.3076	SCB
2013-07-29 10:54:53	Common Dolphin sp.	*Delphinus* sp.	32.8720	-117.3553	SCB
2013-07-29 10:54:57	Common Dolphin sp.	*Delphinus* sp.	32.8759	-117.3576	SCB
2013-07-29 10:55:17	Common Dolphin sp.	*Delphinus* sp.	32.8703	-117.3722	SCB
2013-07-29 10:55:25	Common Dolphin sp.	*Delphinus* sp.	32.8900	-117.3723	SCB
2013-07-29 10:55:33	Common Dolphin sp.	*Delphinus* sp.	32.8737	-117.3827	SCB
2013-07-29 10:55:40	Common Dolphin sp.	*Delphinus* sp.	32.8851	-117.3841	SCB
2013-07-29 10:55:53	Common Dolphin sp.	*Delphinus* sp.	32.8783	-117.3942	SCB
2013-07-29 10:56:23	Common Dolphin sp.	*Delphinus* sp.	32.8870	-117.4128	SCB
2013-07-29 11:13:14	Unidentified Dolphin	Delphinidae sp.	33.0155	-118.0584	SCB
2013-07-29 11:13:32	Unidentified Dolphin	Delphinidae sp.	33.0179	-118.0690	SCB
2013-07-29 11:14:18	Unidentified Dolphin	Delphinidae sp.	33.0258	-118.0972	SCB
2013-07-29 11:14:29	Unidentified Dolphin	Delphinidae sp.	33.0238	-118.1054	SCB
2013-07-29 11:15:19	California Sea Lion	*Zalophus californianus*	33.0382	-118.1355	SCB
2013-07-29 11:20:05	Risso's Dolphin	*Grampus griseus*	33.0681	-118.3218	SCB
2013-07-29 11:20:13	Risso's Dolphin	*Grampus griseus*	33.0761	-118.3253	SCB
2013-07-29 11:22:01	California Sea Lion	*Zalophus californianus*	33.0891	-118.3955	SCB
2013-07-29 11:22:20	Unidentified Dolphin	Delphinidae sp.	33.0951	-118.4063	SCB
2013-07-29 11:22:39	Unidentified Dolphin	Delphinidae sp.	33.0862	-118.4145	SCB
2013-07-29 11:23:07	Unidentified Dolphin	Delphinidae sp.	33.0897	-118.4403	SCB
2013-07-29 11:23:16	Unidentified Dolphin	Delphinidae sp.	33.0962	-118.4443	SCB
2013-07-29 11:23:47	California Sea Lion	*Zalophus californianus*	33.0965	-118.4651	SCB
2013-07-29 11:23:57	California Sea Lion	*Zalophus californianus*	33.1023	-118.4708	SCB

Date & Time	Species Common Name	Species Scientific Name	Latitude (°North)	Longitude (°West)	Survey Area*
2013-07-29 11:23:59	California Sea Lion	*Zalophus californianus*	33.0971	-118.4737	SCB
2013-07-29 11:24:21	California Sea Lion	*Zalophus californianus*	33.1005	-118.4868	SCB
2013-07-29 11:26:29	California Sea Lion	*Zalophus californianus*	33.1226	-118.5663	SCB
2013-07-29 11:27:42	Unidentified Dolphin	Delphinidae sp.	33.1301	-118.6160	SCB
2013-07-29 11:29:30	California Sea Lion	*Zalophus californianus*	33.1420	-118.6862	SCB
2013-07-29 11:30:24	California Sea Lion	*Zalophus californianus*	33.1521	-118.7205	SCB
2013-07-29 11:35:07	California Sea Lion	*Zalophus californianus*	33.1529	-118.8827	SNB
2013-07-29 11:35:15	Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	33.1487	-118.8857	SNB
2013-07-29 11:35:18	Common Dolphin sp.	*Delphinus* sp.	33.1555	-118.8926	SNB
2013-07-29 11:35:26	California Sea Lion	*Zalophus californianus*	33.1462	-118.8911	SNB
2013-07-29 11:42:08	California Sea Lion	*Zalophus californianus*	33.1294	-118.9261	SNB
2013-07-29 11:53:58	Unidentified Dolphin	Delphinidae sp.	32.9454	-119.2391	SNB
2013-07-29 11:54:20	California Sea Lion	*Zalophus californianus*	32.9338	-119.2394	SNB
2013-07-29 11:55:14	California Sea Lion	*Zalophus californianus*	32.9165	-119.2278	SNB
2013-07-29 12:00:55	Unidentified Small Marine Mammal	Cetacean or Pinniped	32.9750	-119.0764	SNB
2013-07-29 12:02:58	Unidentified Dolphin	Delphinidae sp.	33.0068	-119.0185	SNB
2013-07-29 12:03:54	Unidentified Small Marine Mammal	Cetacean or Pinniped	33.0283	-118.9987	SNB
2013-07-29 12:08:42	Common Dolphin sp.	*Delphinus* sp.	33.0966	-118.8548	SNB
2013-07-29 12:12:35	California Sea Lion	*Zalophus californianus*	33.1187	-118.8140	SNB
2013-07-29 12:12:43	California Sea Lion	*Zalophus californianus*	33.1183	-118.8153	SNB
2013-07-29 12:12:54	California Sea Lion	*Zalophus californianus*	33.1247	-118.8053	SNB
2013-07-29 12:13:03	California Sea Lion	*Zalophus californianus*	33.1257	-118.8008	SNB
2013-07-29 12:13:53	California Sea Lion	*Zalophus californianus*	33.1427	-118.7802	SNB
2013-07-29 12:14:18	California Sea Lion	*Zalophus californianus*	33.1446	-118.7650	SNB
2013-07-29 12:15:18	California Sea Lion	*Zalophus californianus*	33.1557	-118.7388	SNB
2013-07-29 12:15:49	California Sea Lion	*Zalophus californianus*	33.1470	-118.7261	SNB
2013-07-29 12:16:10	California Sea Lion	*Zalophus californianus*	33.1462	-118.7158	SNB
2013-07-29 12:21:42	Unidentified Dolphin	Delphinidae sp.	33.1366	-118.6900	SNB
2013-07-29 12:21:47	Unidentified Dolphin	Delphinidae sp.	33.1228	-118.6911	SNB
2013-07-29 12:21:58	Long-beaked Common Dolphin	*Delphinus capensis*	33.1314	-118.6830	SNB
2013-07-29 12:22:07	Common Dolphin sp.	*Delphinus* sp.	33.1220	-118.6821	SNB
2013-07-29 12:35:30	California Sea Lion	*Zalophus californianus*	33.0627	-118.7898	SNB
2013-07-29 12:36:05	Common Dolphin sp.	*Delphinus* sp.	33.0590	-118.8088	SNB

Date & Time	Species Common Name	Species Scientific Name	Latitude (°North)	Longitude (°West)	Survey Area*
2013-07-29 12:42:28	California Sea Lion	*Zalophus californianus*	33.0211	-118.8711	SNB
2013-07-29 12:43:34	California Sea Lion	*Zalophus californianus*	33.0028	-118.9018	SNB
2013-07-29 12:44:43	Unidentified Small Marine Mammal	Cetacean or Pinniped	32.9882	-118.9361	SNB
2013-07-29 12:55:23	California Sea Lion	*Zalophus californianus*	32.9187	-119.0557	SNB
2013-07-29 13:10:00	Common Dolphin sp.	*Delphinus* sp.	32.9292	-118.8959	SNB
2013-07-29 13:17:26	California Sea Lion	*Zalophus californianus*	33.0323	-118.7003	SNB
2013-07-29 13:17:53	California Sea Lion	*Zalophus californianus*	33.0227	-118.7026	SNB
2013-07-29 13:19:27	Common Dolphin sp.	*Delphinus* sp.	32.9757	-118.6953	SNB
2013-07-29 13:19:33	Common Dolphin sp.	*Delphinus* sp.	32.9742	-118.7089	SNB
2013-07-29 13:20:35	California Sea Lion	*Zalophus californianus*	32.9726	-118.6988	SNB
2013-07-29 13:29:23	California Sea Lion	*Zalophus californianus*	32.8913	-118.8451	SNB
2013-07-29 13:33:33	Common Dolphin sp.	*Delphinus* sp.	32.8202	-118.9577	SNB
2013-07-29 13:43:36	Common Dolphin sp.	*Delphinus* sp.	32.8091	-118.9824	SNB
2013-07-29 13:48:01	Common Dolphin sp.	*Delphinus* sp.	32.7631	-119.0742	SNB
2013-07-29 13:49:05	Risso's Dolphin	*Grampus griseus*	32.7359	-119.0504	SNB
2013-07-29 14:17:53	California Sea Lion	*Zalophus californianus*	32.7548	-118.9602	SNB
2013-07-29 14:23:57	Common Dolphin sp.	*Delphinus* sp.	32.8513	-118.7886	SNB
2013-07-29 14:31:27	Unidentified Dolphin	Delphinidae sp.	32.9237	-118.6670	SNB
2013-07-29 14:31:31	Unidentified Dolphin	Delphinidae sp.	32.9210	-118.6588	SNB
2013-07-29 14:32:16	Common Dolphin sp.	*Delphinus* sp.	32.9430	-118.6595	SNB
2013-07-29 14:32:18	Unidentified Dolphin	Delphinidae sp.	32.9426	-118.6504	SNB
2013-07-29 14:32:35	Common Dolphin sp.	*Delphinus* sp.	32.9519	-118.6616	SNB
2013-07-29 14:37:07	California Sea Lion	*Zalophus californianus*	33.0497	-118.5891	SCB
2013-07-29 14:38:28	California Sea Lion	*Zalophus californianus*	33.0455	-118.5407	SCB
2013-07-29 14:38:47	Unidentified Small Marine Mammal	Cetacean or Pinniped	33.0449	-118.5298	SCB
2013-07-29 14:42:57	California Sea Lion	*Zalophus californianus*	33.0199	-118.3814	SCB
2013-07-29 14:43:26	California Sea Lion	*Zalophus californianus*	33.0184	-118.3623	SCB
2013-07-29 14:43:54	California Sea Lion	*Zalophus californianus*	33.0109	-118.3485	SCB
2013-07-29 14:44:08	California Sea Lion	*Zalophus californianus*	33.0088	-118.3396	SCB
2013-07-29 14:44:19	California Sea Lion	*Zalophus californianus*	33.0123	-118.3328	SCB
2013-07-29 14:44:23	California Sea Lion	*Zalophus californianus*	33.0077	-118.3310	SCB
2013-07-29 14:44:48	California Sea Lion	*Zalophus californianus*	33.0074	-118.3156	SCB
2013-07-29 14:45:01	Risso's Dolphin	*Grampus griseus*	33.0079	-118.3077	SCB

Date & Time	Species Common Name	Species Scientific Name	Latitude (°North)	Longitude (°West)	Survey Area*
2013-07-29 14:45:04	Risso's Dolphin	*Grampus griseus*	33.0079	-118.3107	SCB
2013-07-29 14:45:12	Risso's Dolphin	*Grampus griseus*	33.0101	-118.3008	SCB
2013-07-29 14:45:32	Risso's Dolphin	*Grampus griseus*	32.9989	-118.2919	SCB
2013-07-29 14:46:52	California Sea Lion	*Zalophus californianus*	32.9938	-118.2471	SCB
2013-07-29 14:47:24	California Sea Lion	*Zalophus californianus*	32.9949	-118.2279	SCB
2013-07-29 15:00:51	Unidentified Baleen Whale	*Balaenoptera* sp.	32.9102	-117.7746	SCB
2013-07-29 15:01:04	California Sea Lion	*Zalophus californianus*	32.9175	-117.7598	SCB
2013-07-29 15:01:47	California Sea Lion	*Zalophus californianus*	32.9173	-117.7346	SCB
2013-07-29 15:02:01	Common Dolphin sp.	*Delphinus* sp.	32.9137	-117.7254	SCB
2013-07-29 15:02:12	Common Dolphin sp.	*Delphinus* sp.	32.8106	-117.1382	SCB
2013-07-29 15:09:32	Unidentified Dolphin	Delphinidae sp.	32.8686	-117.4748	SCB

*SCB = Santa Catalina Basin, SNB = San Nicolas Basin, S SCI = south of San Clemente Island.

Table 4. Summary of other marine species seen during the SOCAL marine mammal monitoring survey, 24-29 July 2013.

Species*	Number of Groups Sighted	Estimated Number Individuals Sighted	Estimated Average Group Size
Ocean Sunfish (*Mola mola*)	136	140	1.0
Fish Bait Ball	14	N/A**	N/A
School of Large Fish	1	20	20

*Species are listed in descending order of group sighting frequency. **N/A= fish school counts not taken.

Table 5. Number of vessel and aircraft sightings during the SOCAL marine mammal monitoring survey, 24-29 July 2013.

Vessel Type	Number of Vessels*
Navy	9
Vessel	9
Fishing Vessel	8
Sailboat	5
Recreational Vessel	3
Unknown	1
Whalewatch Vessel	1
RHIB (Rubber-hulled inflatable boat)	1
Yacht	1
Total	**38**

*Listed in descending order of sighting frequency. Aircraft were only noted if they were <500 feet above the water.)

Table 6. Summary of photo and video effort during the SOCAL marine mammal monitoring survey, 24-29 July 2013.

Survey	Total Video Clips*	Total Videos With Animals In View	Total Video (hh:mm:ss)	Total Photos
24-29 July 2013	23	21	1:02:05	2,242

*Although two of the 23 video clips did not have any cetaceans within view, these were typically periods while the animals were below the surface; the audio associated with videos is also important in providing narratives of behavior, including indications of when the animals are below the water surface and out of sight.

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