

SOCAL 34 Preliminary Cruise Report

R/V Sproul, July 21-28, 2009

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Executive Summary

During July 21-28, 2009 the R/V Sproul conducted a simultaneous visual and acoustic survey for marine mammals in the Southern California Range Complex (SOCAL) area. A total of 70 hours were spent on-effort covering 539 nm of trackline. Within this effort, 47 hours (306 nm) were devoted to transect lines at the SOAR hydrophone range, which will be compared to passive acoustic monitoring data of range hydrophones and aerial survey data, collected at the same time. A total of 153 marine mammal sightings and 36 acoustic detections were recorded. Additional work conducted during this cruise included servicing High-frequency Acoustic Recording Packages, and conducting an acoustic propagation test at Tanner Bank in support of the Shallow Water Tracking Range development.

Introduction

SOCAL 34 was a shipboard cruise on the R/V Sproul to conduct a simultaneous acoustic and visual survey for marine mammals in the Southern California Range Complex (SOCAL) area. The focus of this cruise was in the instrumented SOAR range, located to the west of San Clemente Island. The R/V Sproul departed San Diego at 8:00 am on 21 July, 2009 and returned to port at 5:30 am on July 28, 2009. Cruise participants are listed in Table 1.

The primary mission of SOCAL34 was to conduct a visual and acoustic towed-array survey of the SOAR range, coincident with monitoring of the range's permanent hydrophones using the Marine Mammal Monitoring on Navy Undersea Ranges (M3R) system of the Naval Undersea Warfare Center (NUWC Dave Moretti) and an aerial survey conducted by Marine Mammal Research Consultants (MMRC Joe Mobley). A total of 70 hours of visual and acoustic survey effort were conducted by the R/V Sproul, with 47 hours of effort devoted to transect lines located within the area of the SOAR range.

High-frequency Autonomous Recording Packages (HARPs) designed for continuous recording of marine mammals vocalizations were recovered, refurbished and redeployed. A one-day effort to study sound propagation in the Tanner-Cortez Banks region was conducted for NUWC. Figure 1 shows the SOCAL region, ship trackline, HARP locations, and the site of the NUWC sound propagation study.

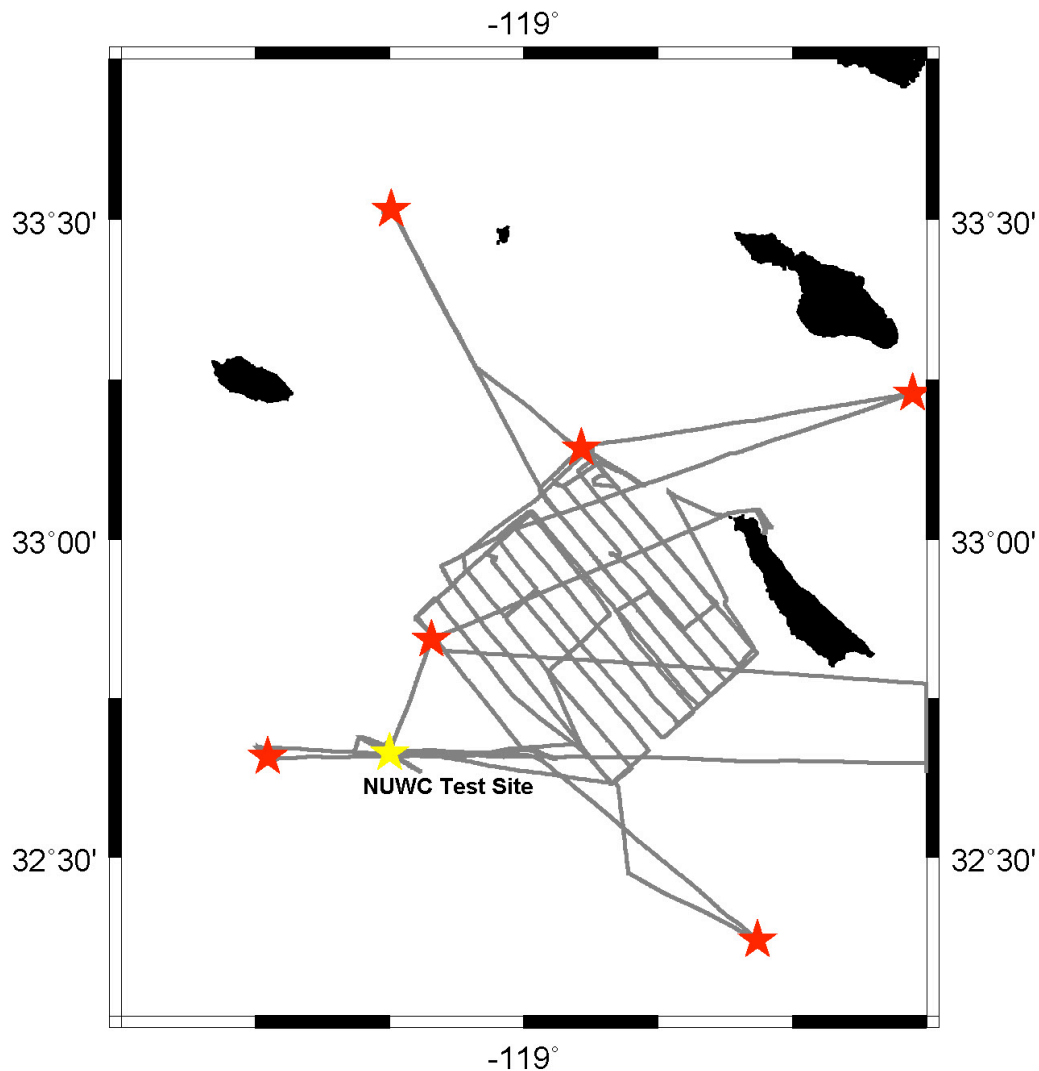


Figure 1. R/V Sproul ship track (gray line) for June 21-28, 2009, with HARP locations (red stars), and the NUWC sound propagation test site (yellow star).

Methods

During daylight hours, visual and acoustic surveys were conducted by the R/V Sproul. The visual and acoustic surveys were conducted independently, so that each would yield independent marine mammal detections. After animals had passed down the side of the vessel the visual observers relayed their sighting information to the acoustic observers, but in no case were the visual observations used to queue the acoustic detections nor the acoustic detections used to queue the visual observers. The survey was conducted during transit between stations, as well as along a set of transects that were designed to cover the SOAR hydrophone array area, so that shipboard observations could be compared with detections from the M3R system and from an aerial survey. These transect lines are

shown in Figure 2, with letters designating each line. The lines are about 20 nm long and run northwest-to-southeast, at about 2 nm spacing. Table 2 gives daily survey effort in hours and distance.

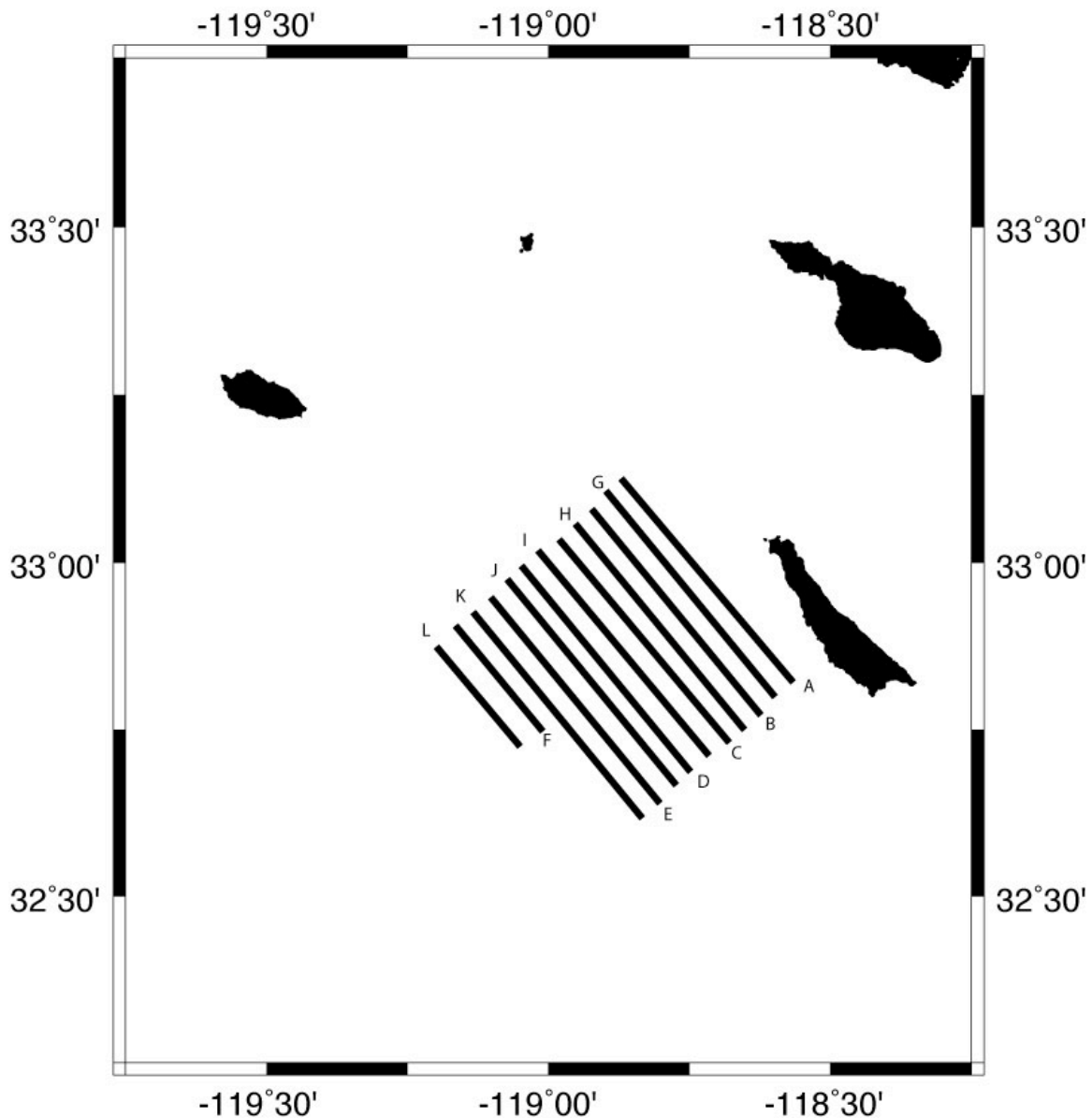


Figure 2. Location of the transect lines covering the area of the SOAR hydrophone arrays.

Visual observations

The visual survey effort was undertaken by the Cascadia Research Collective (Anne Douglas lead observer). At least one experienced marine mammal observer, and one student intern were responsible for maintaining visual observations during day light hours. Observers were posted on both sides of the bridge of the Sproul, approximately 25 feet above the water line of the ship. Port and starboard observers searched out to the

horizon from directly ahead of the vessel to 90° of the bow on their respective sides of the vessel. Observations were conducted using 7 X 50 handheld binoculars and naked eye. Image stabilizing 20X binoculars were available for identification of distant animals. The visual watch was rotated between four team members, with two observers on watch, one assigned to data recording, and one resting at any given time. The observers broke effort halfway along all transit lines so there was not a chance of searching into the upcoming survey line

Towed Hydrophone Array

A six element towed hydrophone array was deployed from the R/V Sproul to conduct an acoustic survey for marine mammal sounds. The array was sampled at 500 kHz, and had an effective bandwidth of 2 – 200 kHz. One pair of array hydrophone elements was monitored at all times, and sound recordings were collected at times when marine mammal sounds were detected on a real-time spectrogram display. The time difference of arrival of sounds at the two hydrophones allowed calculation of bearing angle to the sound source in real-time. Most of the survey was conducted at a ship speed of 8 knots. The towed array was deployed on a 300 m long wire, and at the 8 knot tow speed it was held at a constant depth of about 17 m. During periods of slower tow speed (1 – 5 knots) the array was found to tow at significantly deeper depths (up to 100 m for sustained periods at 1 knots).

High-frequency Autonomous Recording Packages

HARPs were deployed during SOCAL34 to continue efforts to listen for the presence of marine mammals in the SOCAL area. The position and depth of each HARP is listed in Table 4. The HARPs record with a sampling rate of 200 kHz. These instruments rest on the seafloor with a hydrophone suspended approximately 10 meters above the instrument. They can record 2 Tbytes of data and have a deployment life of 2 months with continuous data recording. A transponder is built into each unit, allowing communication between the HARP and the ship. The transponder provides the capability to determine the position of the instrument, as well as to enable the acoustic release mechanism, allowing the instrument to be retrieved at a later date.

Acoustic Propagation Test

During SOCAL 34 the Sproul conducted an at-sea test in support of the Shallow Water Tracking Range (SWTR) development program at NUWC DIVNPT. The test took place in the Tanner Bank region located to the West of San Clemente Island (SCI), during 21-22 July 2009. The test goals were to gather, process, and analyze appropriate field test data to assist SWTR personnel with verifying that acoustic propagation in planned range area meet modeled assumptions, including the ability to detect multipath signals in areas where multipath tracking capability is planned. Three hydrophone receivers were deployed for this test: (1) HARP, (2) PADN, and (3) SWATS. The HARP is a seafloor package provided and deployed by SIO personnel to record data for the duration of the test. Upon test completion, the HARP buoy was retrieved and the recorded data will be provided to NUWC. The PADN node was provided and deployed by NUWC personnel. Similar to the HARP buoy, the PADN is a subsurface node to passively record data for

the duration of the test. The SWATS buoy has a bottom-mounted hydrophone tethered to a surface float (provided and deployed by NUWC personnel). The SWATS system transmits data over a standard sonobuoy channel. The existing sonobuoy antenna and receiver located on the Sproul was used to receive data from the SWATS buoy. A pinger subsystem on the Sproul was used to transmit acoustic signals of interest from into the water. A synchronous test ping generator (TPG), amplifier, transducer, and related hardware and software (provided by NUWC) interfaced to the existing Sproul pinger pole. Two different acoustic signals were transmitted during the test: (1) Shallow-water format 76-bit DPSK pings at 12.931 kHz, and (2) SFSK signals. These signals were transmitted along tracks run adjacent to the deployed hydrophone receivers.

Results

Visual observations

A total of 153 visual sightings were recorded by the R/V Sproul during 70 hours of survey effort. These were divided between 105 cetaceans and 48 pinnipeds. The most common cetacean species sighted was the fin whale (22) followed by the short-beaked common dolphin (16). The most common pinniped sighted was the California sea lion (38). Table 4 gives a summary of sightings by species and numbers of individuals, and the cetacean sightings are plotted along the shipboard trackline in Figure 3.

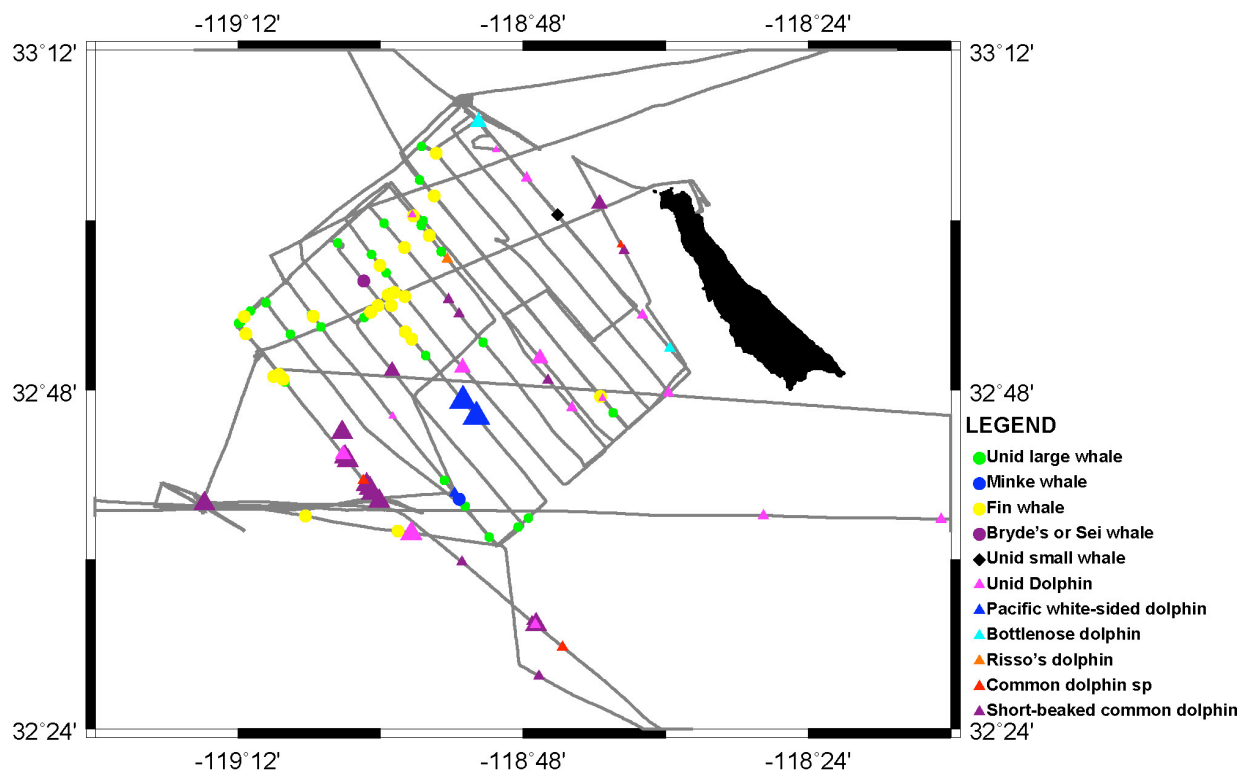


Figure 3. Visual cetacean sightings during SOCAL34. The species is denoted by the color of the symbol and the group size is denoted by the size of the symbol.

Acoustic Detections

Owing to the recording bandwidth of the towed array (2-200 kHz), only odontocetes (toothed whales) were included in the acoustic detections. A total of 36 acoustic detections were recorded during 70 hours of survey effort. The identification of all detections by species has not been completed, although it is known that at least three species are represented in these data: short-beaked common dolphin, bottlenose dolphin, and Pacific white-sided dolphin. Figure 4 indicates the position of acoustic detections along the shipboard trackline.

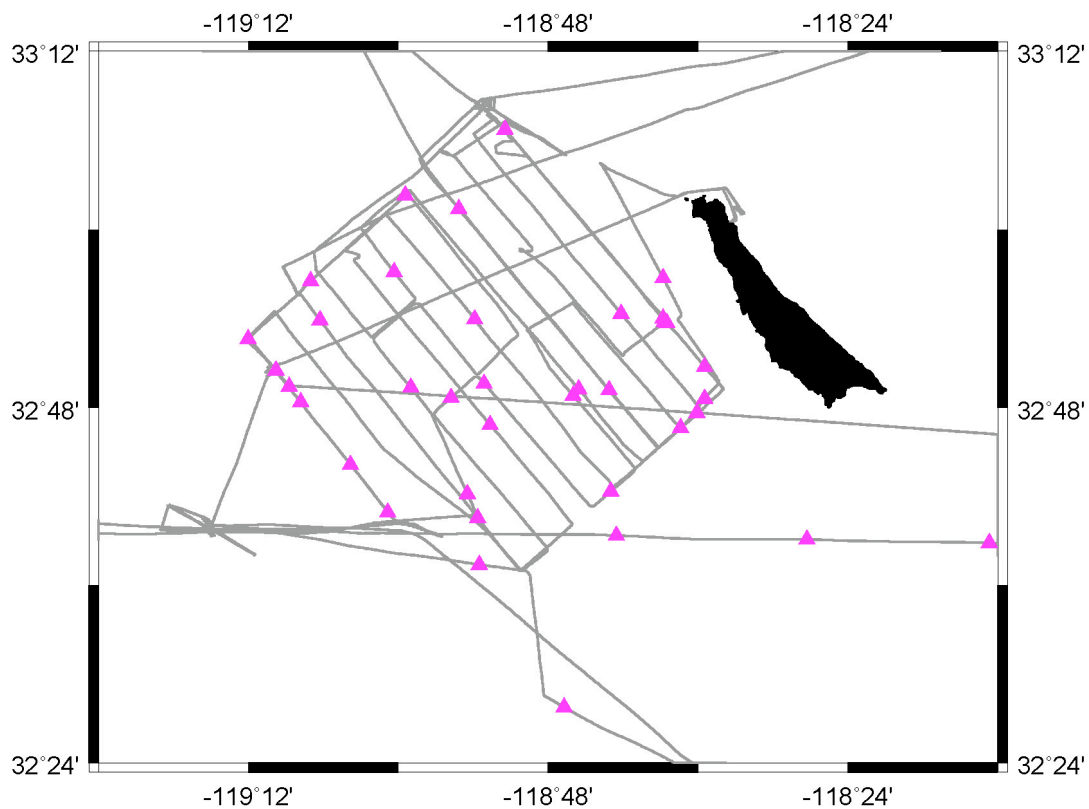


Figure 3. Acoustic array odontocete detections during SOCAL34.

Acoustic Propagation Test

The SWATS, PADN, and HARP buoys were successfully deployed at Tanner Bank (32-39.84'N, 119-14.94'W) during 2000 – 2230 on July 21, 2009. Acoustic transmissions along a series of tracklines ending at about 5 km distance from these receivers were conducted during 0000 – 0500 on July 22. During this time the first six transmission lines (events in the SWTR test schedule) were completed, involving synchronous DPSK transmissions. At 0500 the R/V Sproul was asked to leave the Tanner Bank region by the Pacific Missile Range. At this time, the acoustic transmissions were secured and the Sproul departed the test site. The Sproul returned to the Tanner Bank test site at 1530 on July 22, and completed events 10 and 11 by 1800. At this time the Sproul began recovery of the SWATS buoy and the HARP. The PADN was not recovered; although it responded to the acoustic release command, the instrument did not come to the surface.

Table 1: Cruise participants

Name	Organization	Role
John Hildebrand	SIO	Chief Scientist
Ethan Roth	SIO	HARP Engineer
Brent Hurley	SIO	HARP Engineer
Josh Jones	SIO	Towed Array
Hannah Bassett	SIO	Towed Array
Anne Douglas	Cascadia Research	Visual Survey Lead
Chris Cutler	Cascadia Research	Visual Survey Observer
Kelly Cunningham	Cascadia Research	Visual Survey Intern
Corina Leahy	Cascadia Research	Visual Survey Intern
James Kendera	NUWC	Seagoing Technician
Ian Sabo	NUWC	Seagoing Technician
Gus Aprans	SIO	Resident Technician

Table 2: Survey effort

Date	Start Time	End Time	Hours on Effort	Hours on Transect	Distance on Effort (nm)	Distance on Transect (nm)	Comments
21-Jul-2009	9:13	18:57	9.73	0.00	42.39	0.00	Transit to Tanner Bank
22-Jul-2009	7:18	18:43	7.88	0.00	35.05	0.00	South of Tanner Bank.
23-Jul-2009	7:26	17:54	8.25	8.13	82.02	45.97	SOAR Survey lines B,C,D,E
24-Jul-2009	7:32	19:52	10.97	8.70	92.09	69.24	SOAR Survey lines C,D,E,F,L
25-Jul-2009	7:09	19:19	11.43	10.22	93.23	68.85	SOAR Survey lines A,B,G,H
26-Jul-2009	7:12	19:30	11.30	10.62	99.77	72.39	SOAR Survey lines H,I,J,K
27-Jul-2009	7:08	18:40	10.75	9.25	94.31	49.79	SOAR Survey lines A,C,L
		Total	70.32	46.91	538.85	306.23	

Table 3: Summary of Visual Sightings

	Total Sightings		On Transect		Off Transect	
	Sightings	Individuals	Sightings	Individuals	Sightings	Individuals
Species						
Elephant Seal	4	4	2	2	2	2
California Sea Lion	38	51	20	24	18	27
Unidentified Otariid Species	3	4	2	2	1	2
Unidentified Pinniped Species	3	3	2	2	1	1
Minke Whale	1	1	1	1		
Sei or Bryde's Whale	1	1	1	1		
Fin Whale	22	30	13	18	9	12
Short-beaked Common Dolphin	16	1144	6	588	10	556
Common Dolphin Species	6	236	1	8	5	228
Risso's Dolphin	2	15	1	9	1	6
Northern Right Whale	1	25	1	25		
Dolphin Pacific	2	236	2	236		
White-sided Dolphin						
Bottlenose Dolphin	3	67	2	59	1	8
Unidentified Delphinid	20	449	9	97	11	352
Unidentified Small Cetacean	1	20	1	20		
Unidentified Large Cetacean	29	34	21	25	8	9
Unidentified Marine Mammal	1	1	1	1		
Pinniped Total	48	62	26	30	22	32
Cetacean Total	105	2259	60	1088	45	1171
Total	153	2321	86	1118	67	1203

Table 4: Location and water depth of the HARPs deployed during SOCAL34.

Site	Latitude	Longitude	Depth (m)
Socal34-E	32.65898°N	119.4772°W	1334
Socal34-G2	33.14265°N	118.8931°W	1106
Socal34-H	32.84282°N	119.1716°W	992
Socal34-M	33.51545°N	119.2466°W	902
Socal34-N	32.36977°N	118.5648°W	1287