Aerial Survey Monitoring for Marine Mammals off Southern California in Conjunction with US Navy Major Training Events 2008–2010

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Aerial Surveys Conducted in Conjunction with US Navy Training Exercises off Southern California 2008 - 2010

Mari A. Smultea[1, 2], Cathy Bacon[3, 2], Jenelle Black[4], Kate Lomac-MacNair[5], Thomas A. Jefferson[6], Lori M. Mazzuca[7], and Roxann Merizan[8]

[1]Smultea Environmental Sciences, LLC (SES), 29333 SE 64th St., Issaquah, WA 98027; [2]HDR|EOC Inc., 500 108th Ave. N.E., Suite 1200, Bellevue, WA 98004-5549; [3]SES, 1616 Quails Nest Dr., Fort Worth, TX 76177; [4]Jenelle Black Science Services, P.O. Box 58, Hyak, WA 98068; [5]SES, PO Box 15034, Fritz Creek, AK 99603; [6]Clymene Enterprises/Cetos Research Organization, 5495 Camino Playa Malaga, San Diego, CA 92124; [7]US Navy, SPAWAR Systems Center Pacific, 56530 Hull Street, San Diego, CA 92152; [8]SES, 28617 Newcastle Road, Highland, CA 92346

Zoomed-in high-definition (HD) photos of blue whales at 1500 ft altitude & 1 km distance photographed from aircraft allowed differentiation of individuals using natural markings

Rare confirmed sighting of Bryde's whale identified by diagnostic 3 median rostral ridges

Cow-calf fin whales. Baleen whale behaviors were tracked for extended periods with video both above and underwater

Offshore killer whales photo-documented twice in Nov 2009 from >1000 ft altitude. Individuals could be differentiated, including a juvenile apparently nursing & a juvenile with erect penis

1. SURVEY GOALS

Monitor presence, occurrence, numbers and locations of marine mammals & sea turtles *before*, *during*, and *after* Navy major training activities (MTEs) involving mid-frequency active sonar (MFAS) to identify potential changes, if any, in ***behavior, orientation, location, distribution, and relative abundance***;

- Search for potential stranded, injured or behaviorally stressed animals;
- Obtain sighting locations so that MFAS sound exposure levels can be estimated post-survey;
- Assess the feasibility of monitoring near- and sub-surface tracking and behavior from the survey plane using focal follow methods supported by videography

2. METHODS

Surveys conducted by (L to R) 1 pilot & 3 biologists (*M. Smultea, L. Mazzuca, B. Wuersig*) from twin-engine, fixed-wing Partenavia Observer plus a 2-day feasibility study from a Bell 206 helicopter. Data collected using Apple iTouch/iPhone hardware, customized software, HD video & still digital cameras.

Total 8 surveys:

- 3 *during* sonar exercise, 2 *after*, 3 *during* and *after*
- 0 in winter, 2 in spring, 3 in summer, 3 in fall

Humpback whale off San Diego. *Photo courtesy of Mark Deakos/SES*

Survey Modes

1. **SEARCH** = line-transect and random surveys to collect initial sighting, location, and behavior data
2. **VERIFY** = subsequent circling and photographing to verify species, estimate group size, and calf presence
3. **FOCAL FOLLOW** = circle for focal behavioral sessions at ~365-455 m (1200-1500 ft) altitude and ~0.5-1.0 km (0.3-0.5 nm) radial distance on ***priority species*** (endangered species, beaked, & killer whales, Risso's dolphins)
4. SHORELINE SURVEY = follow San Clemente Island shoreline to search for strandings

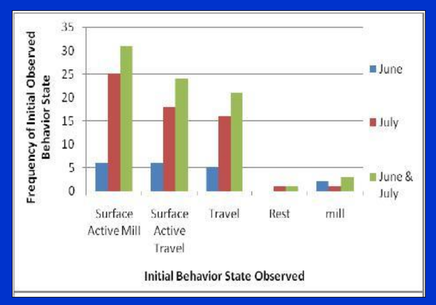
The plane is best when the primary goal is to collect line-transect data & cover large offshore areas. Maximum range is double that of the helicopter.

Bell 206 Helicopter used 2 days in July 2010 was advantageous over airplane for focal behavior follows due to slower speed, and larger & more open windows. However, the helicopter costs were more and carried less fuel than an airplane, thus necessitating shorter flights closer to shore.

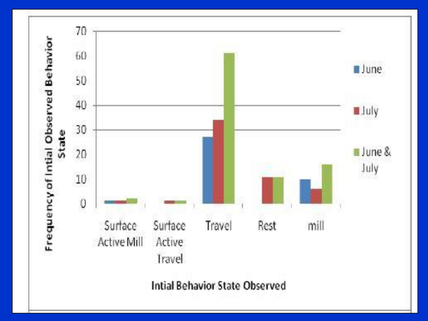
Right: Typical group shape and behavior of Risso's dolphins involving slow travel/rest and inter-individual spacing of <1 to 3 body lengths. Risso's tended to remain at or near the surface for extended periods allowing tracking of behavior for up to 60+ min. *(Publication in prep.)*

3. RESULTS

To Left: Still photo from video of fin whale lunging to left toward a bait ball with mouth agape, with another fin and blue whale at bottom of photo. *Photo courtesy of Bernd Wuersig/SES*



Frequency of initially observed behavior states of common dolphins (above) and Risso's dolphins (below) during the June and July SOCAL 2009 survey periods.



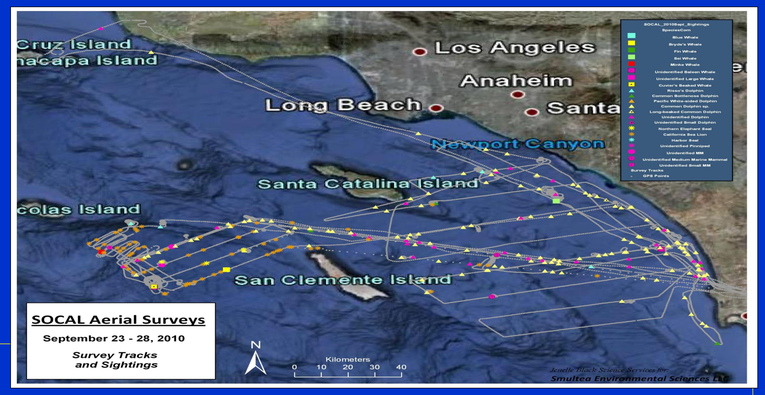
Risso's primarily traveled slowly (<1 km/hr) with no surface-active behaviors while commons were much more surface-active. Both species headed predominantly east or west.

BEHAVIOR

•83 focal follows of 10-60+ minutes with 9 cetacean species, including blue, fin, humpback, and killer whale and Risso's dolphin behavior at and below the water surface.

•Baleen whales tended to travel north or south, with some feeding observed, including lunge-feeding by sei , fin, & blue whales.

10 Cuvier's beaked whales: 5 photographed & individually distinguished



Map of survey area within the Navy's Southern California Range Complex and locations of sightings and tracklines during the Fall 2010 aerial survey. Distributions concentrated along underwater ridges and mounts, coastal waters, and other areas of bathymetric relief.

EFFORT & SIGHTINGS

8 aerial surveys conducted in SOCAL:

- **~37,000 km** (19,978 nm) of observation effort
- **1,284 groups** of marine mammals and **~177, 770 individuals**
- **16 species (13 cetaceans, 3 pinnipeds)**
- Most sightings common dolphins (n= 340 groups) followed by Risso's dolphins (n= 157).

ABUNDANCE ESTIMATES

Estimated abundance (N) and coefficient of variation (%CV) for marine mammals observed in the SoCal aerial survey area during systematic line transect effort 2008-2010.

SPECIES	N	%CV
Blue whale - *Balaenoptera musculus*	13	41-100
Fin whale - *Balaenoptera physalus*	66	34-57
Pacific white-sided dolphin - *Lagenorhynchus obliquidens*	135	87-101
Risso's dolphin - *Grampus griseus*	2,537	32-111
Common bottlenose dolphin - *Tursiops truncatus*	585	72
Common dolphins - *Delphinus* spp.	30, 034	36-62
California sea lion (at sea) - *Zalophus californianus*	2,534	43-109

HIGHLIGHTS

- 2 rare Bryde's & 1 sei whale group photo-documented (*publication in prep*)
- Risso's dolphins more common in June/July 08 vs. Oct/Nov, contrary to earlier Carretta et al. (2000) survey.
- Effort coordinated with other regional, ongoing marine mammal studies (e.g., tagging, photo-ID, sound playback, passive acoustic monitoring, etc.) to compliment efforts when possible.

4. CONCLUSIONS

- **Marine mammals seen before, during and after MTEs on Navy range.** ***Naval training has occurred in SOCAL for > 40 yrs, and marine mammals are also known to (e.g., Carretta et al. 2000; DoN 2009) and continue to be abundant there.***
- ***Results represent the largest, most recent systematic effort within this Navy range and the first systematic behavioral study from aircraft in the Southern California Bight.***
- ***Aerial surveys (1) offer unique overhead and sub-water surface perspectives, (2) do not interfere with behavior when flown at higher altitudes and lateral distances, and (3) allow cetacean behavior to be tracked for extended periods***
- ***Aerial survey data can be combined with vessel and passive acoustic data for "3-D" perspective***
- ***Future analyses will examine distribution and behavior relative to estimated received MFAS sound levels & detailed videotaped behavior***

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