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

Cathy Bacon¹ Mari A. Smultea¹, Bernd Würsig², Kate Lomac-MacNair¹, and Jenelle Black^{1,3}

¹Smultea Environmental Sciences, LLC (SES), 29333 SE 64th St., Issaquah, WA 98027; email cathyebacon@gmail.com

²Marine Mammal Research Program, Texas A&M University at Galveston, Pelican Island, Galveston, TX 77553;

³Jenelle Black Science Services, P.O. Box 58, Hyak, WA 98068



Cow-calf fin whales. Baleen whale behaviors were tracked for extended periods with video both above and through the water from altitude 1500 ft & radial distance 1 km to avoid disturbing whale behavior. Photo by Lori Mazzuca / Permit No. 14451



Zoomed-in high-definition (HD) photos and video of blue whales were taken at 1500 ft altitude & 1 km distance. Photographs from aircraft allowed differentiation of individuals using natural markings. Photo by Lori Mazzuca / Permit No. 14451

ABSTRACT

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. Behavioral data for blue and fin whales were collected during aerial survey line-transect and focal-follow effort. Initially-observed behavior state, group size, heading, and minimum and maximum inter-individual dispersal distance were recorded during line-transect sampling and/or subsequent verification circling by the aircraft. Focal groups were circled for 3-60+ minutes and videotaped from outside Snell's sound cone to avoid disturbance. During 24,736 km of survey effort, 51 fin whale sightings (86 individuals) and 49 blue whale sightings (84 individuals) were seen. Over 7 hours of video was collected for 16 blue and 15 fin focal follows. During the summer, blues (n=48) were seen more commonly than fins (n=35); in fall, fins (n=16) were seen much more frequently than blues (n=1). Mean group size was 1.7 whales for both species. Initially observed blue behavior was usually travel (85%) or mill (11%). Observed fin whale behavior was also mostly travel (87%), mill (6%), or surface-active travel (3%). Both species were seen socializing (e.g., touching) in fall but not summer; foraging was observed in summer through fall. Mean initial dispersal for blues and fins was 8 and 16 body lengths, respectively. In summer, blues were most frequently (26%) seen headed S; in fall (n=2), they were headed only inshore (E). In summer, fin whales were most commonly headed SSW (26%) or WNW (26%); in fall, they were headed mostly NE (38%) or WSW (38%). Both species directly compete for food based on observations of inter-specific maneuvering for a bait ball. 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. Dive/respiration/behavioral event rates were also collected and are currently being analyzed.

METHODS



From 2008-2010, >24,000 km of line transect & focal behavior surveys were conducted from a twin-engine Parnavia aircraft by 2 observers and 1 recorder during the summer and fall off Southern California.

- Line-transect methodology used to survey at 1000 ft altitude & 100 kt.
- Sightings were circled to confirm species/group size/composition via photos as needed/feasible.
- Scan sampling methodology (Altmann 1974) was used to determine behavior state, heading (magnetic), and dispersal between individuals by watching the sighting for 20-45 sec or longer if needed.

BEHAVIOR STATE DEFINITIONS**

Mill - >50% of group swimming with no obvious consistent orientation (non-directional) characterized by asynchronous headings, circling, changes in speed, and no surface activity. Includes foraging and feeding behaviors.

Rest - >50% of group exhibiting little or no forward movement (<1 km/hr, no wake) remaining at the surface in the same location or drifting.

Surface-Active Travel - While traveling, occurrence of aerial behavior that creates a conspicuous splash (e.g., all head, tail, pectoral fin, and leaping behavioral events) while traveling.

Travel - directed point-to-point synchronized movement by >50% of group that creates a wake or white water trail

Social - individuals touching (a modifier for any of the behavior states above)

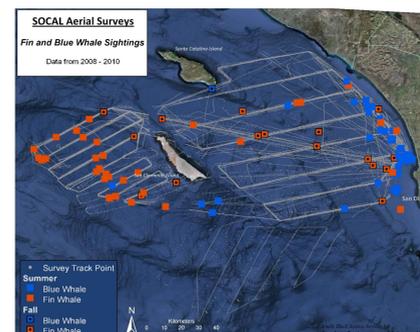
**Developed based on Bauer (1986), Shane (1990), Smultea (1991) and Perrin et al. (2008).



Location of the aerial survey monitoring areas (Areas 1, 2 and 3) and underwater topographic features within the Navy's Southern California Range Complex (SOCAL) west of San Diego, CA.



Fin whale mother-calf pair following a group of over 1,000 northern right whale dolphins (*Lissodelphis borealis*) for ~1 hr. Dolphins bow rode off the whales' heads and the calf chased the dolphin tails.



Sighting locations of fin and blue whales during aerial survey monitoring off Southern California summer and fall 2008-2010. Blues were seen mostly inshore of San Clemente Island, while fin whales were most common west of the island. Blue whales were most concentrated within about 5-10 nm of shore near San Diego. Fins and blues were also seen together in loose feeding aggregation that included interspecific competition for bait balls.

RESULTS ***

SIGHTING NUMBERS & SEASONAL BEHAVIORS

(based on 11,845 km of summer and 12,891 km of fall survey effort ^{1/})

| SPECIES & SEASON | Mill | Rest | Surface - Active Travel | Travel | Unknown Behavior | TOTAL # Individuals | # Indiv. per 1000 km ^{1/} |
|------------------|------|------|-------------------------|--------|------------------|---------------------|------------------------------------|
| Blue whale | 19 | | 3 | 60 | 2 | 84 | 1.98 |
| <i>Fall</i> | | | | 2 | | 2 | 0.08 |
| <i>Summer</i> | 19 | | 3 | 58 | 2 | 82 | 4.05 |
| Fin Whale | 5 | 1 | 3 | 75 | 2 | 86 | 2.06 |
| <i>Fall</i> | | | 1 | 30 | | 31 | 1.24 |
| <i>Summer</i> | 5 | 1 | 2 | 44 | 2 | 55 | 2.95 |

Number of individuals observed during fall and summer in each behavior state when first seen. In summer, blues were more common than fins, but in fall, fins were significantly more common than blues. Surface active behavior was rarely seen and milling (presumed feeding) occurred primarily during summer.

^{1/} based on line-transect, random, and transit point-to-point survey legs

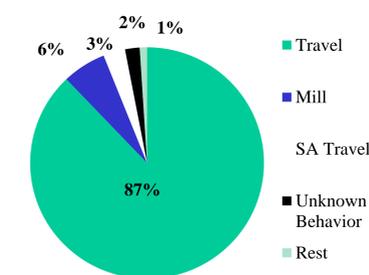
GROUP CHARACTERISTICS

| | Blue Whale | Fin Whale |
|---|-------------|-------------|
| # Groups (Sightings) | 49 | 51 |
| Mean group size (SD) | 1.7 (± 0.4) | 1.7 (± 0.2) |
| Mean dispersal distance (# body lengths) between individuals (SD) | 8 (± 4.6) | 16 (± 8.7) |
| Mean heading (degrees magnetic) (SD) | 203° (± 35) | 189° (± 33) |

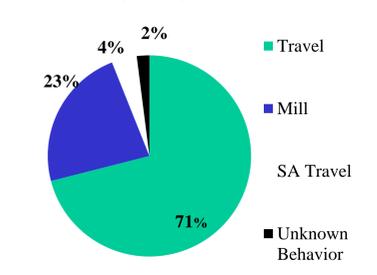
- Blue and fin whales had a similar mean group size of about 2 animals.
- However, inter-individual spacing between fin whales was farther than between blue whales.
- During **summer**, blues were most frequently (26%) seen headed S (south), while fin whales were most commonly headed SSW (26%) or WNW (26%).
- During **fall**, fin whales were headed mostly NE (38%) or WSW (38%); the only 2 blues seen in fall were headed inshore (E).

*** See Smultea et al. 2011 for full study results.

Fin Whale Behavior State (n = 86 individuals)



Blue Whale Behavior State (n = 84)



Distribution of initially-observed behavior states. Both fin and blue whales predominantly were seen traveling in point-to-point coordinated movement. However, blue whales were frequently observed milling related to feeding based on frequent fecal discharge, occasional lunge feeding and feeding bird associations.



Interspecific feeding competition. Still photo from video of fin whale lunging to left toward a bait ball with mouth agape, with another fin whale just below it and a blue whale at bottom of photo. Prior to this shot two blues and the two fins were headed toward the same bait ball. Video photo by Bernd Würsig / Permit No. 15369

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