

Provide a Vessel to Conduct Observations and Deploy Sound Source for a Behavioral Response Study of Cetaceans off Southern California

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LONG-TERM GOALS

The long term goal of the Behavioral Response Study is to determine how cetaceans respond to naval sounds, specifically mid-frequency sonar, to better evaluate impacts and develop strategies for mitigation. The goal of this specific grant was to provide a vessel to serve as an observational platform and as a base of operations for a sound source to be used in the Behavioral Response Study conducted off Southern California in summer 2010. All other components of this work were included in other separate grants to the various groups involved in the collaborative study and this report addresses just the vessel to serve as a base of operations and the primary platform for the observation and sound source.

OBJECTIVES

The Behavioral Response Study for southern California began in 2010 (SOCAL-10) as the start of 5-year study to examine the impacts of anthropogenic sounds on local marine mammal species and represents a collaborative effort among a number of parties including Cascadia, Southall Environmental Associates, Woods Hole Oceanographic Institute (WHOI), Southwest Fisheries Science Center (SWFSC), Naval Undersea Warfare Center (NUWC), and Scripps Institution of Oceanography (SIO). Similar studies have been conducted at the AUTECH range and are currently underway in the Mediterranean Sea, all built around a model in which species of interest are fitted with the suction cup-attached tags to record exposure to sound and detailed data on underwater behavior in reaction to these sounds. These efforts have included behavioral observation from both the tag deployment vessel and the source vessel, and in some cases passive acoustic monitoring via an instrumented range, a towed array, or both. Ongoing studies in the region have identified SOCAL as a desirable location to conduct a BRS based on the presence of several species of concern, frequent naval operations, and an established local research presence, although weather in the focal western portion of the complex can be challenging.

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APPROACH

The work involved a collaboration of a number of parties and a number of different components, this report is for the grant that funded a vessel from which to conduct the following:

1. visual observations to sight target and non-target species and monitor behavior during the planned 20 days of operations in August-September 2010
2. Provide a platform from which to operate a sound source for use in the BRS
3. serve as a base of operations for small boat operations to sight animals and deploy tags as well as conduct photo-ID
4. provide housing and food for up to 15 personnel participating in the BRS over the 20 day period

The field effort was conducted 21 August to 10 September 2010 and involved the charter of the vessel Truth out of Santa Barbara, California. A second 10-day field effort was also to be conducted as part of the BRS based from the SIO vessel *Sproul* but is not part of the work included in this proposal. Similar to prior BRS studies, the overall goal of the BRS effort will be successful acoustic playbacks on tagged species of interest to document behavioral changes associated with exposure. Goals during this initial year include:

- Establish collaborations between research groups involved in work in the SOCAL regions and key parties responsible for previous BRS work
- Coordinate protocols so that data collected can be integrated into data structures and analytical framework already in place both regionally and from other BRS
- Conduct semi-flexible field operations where RHIBs may base on ship, island, or coast in response to weather, sightings, and range restrictions
- Use suction-cup tags including the WHOI Dtags as well as Burgess Bprobes and the new Acousounde on cetaceans in the vicinity of the source vessel
- Collect detailed surface behavior and movement data from tagged individuals from various platforms before, during, and after sound exposure

The vessel met the following requirements:

- Area of operations to extend from Moro Bay to San Diego and offshore to include waters west of San Clemente and around San Nicolas and Catalina Islands
- Cruising speed of at least 10 knots and range of 400 nmi or more.
- Operations generally involve daylight ops (12 hours) but transits occurring at night as needed to either return to a sheltered area or harbor or shift to a new area. Occasional night operations tracking a tagged whale.
- Most overnights will be spent either in harbor, anchored, or drifting with up to half the nights underway most of the night either transiting or tracking a whale.
- Fuel usage averaging 200 gal/day (adequate for average of 100 nmi per day travel) included in charter with additional fuel charged as a surcharge.
- Ability to put 2-3 observers on top of wheelhouse with unobstructed visibility forward and to the sides with a 3-4 foot railing added for safety with canvas to provide wind break on railing and intercom or other means of easy communication with bridge and sundeck area behind bridge.

- Carry at least 150 gallons of gasoline (in bladders, drums, or fuel caddies) in a location that allows refueling RHIBs at night while at anchor or at dock (gasoline itself will be paid for by research group)
- Provide adequate bunks for 15 personnel plus crew.
- Provide adequate food, cooks, and stewards to feed number of people specified above. Need to accommodate some special dietary needs of individual passengers (ie. vegetarians). RHIB personnel included in total above would need to take food for lunch and some other meals on RHIBs.

WORK COMPLETED

Leg 1 of the BRS cruise that this report covers was completed 21 August to 10 September 2010 and was more successful than had been anticipated. The platform *Truth* chartered under this grant met all the requirements and was an outstanding platform that helped make the cruise as successful as it was. An excellent observation platform was constructed above the brige for this project and served as an excellent sighting platform (Figure 1).

While results of the observations, tag deployments, and playbacks completed will be more appropriately covered under reports for other components of the overall BRS project but some of the key accomplishments of the work completed are briefly covered here. Tag deploymnets conducted during Leg 1 working in association with the *Truth* are summarized in Table 1.



Figure 1. Blue whale with suction-cup attached Dtag and vessel Truth that was chartered for this work and served as the observation platform, sound source deployment vessel, and base of operations for the work.

Table 1. Summary of tag deployments during leg 1 of the BRS in 2010

Date	Time on	Time Off	Total (hr)	Species	Tag Type	Boat	Sound Type	Comments
23-Aug	0914	1523	6.1	Blue Whale	Dtag 238	Ziphid	MFA-1	Both this and below animal exposed at ~700-1000m
23-Aug	0920	1544	6.4	Blue Whale	Dtag 224	Physalus	MFA-1	Same as above; some issues with timing of signals
23-Aug	1410	1520	1.2	Blue Whale	Bprobe 019	Ziphid	MFA-1	Tag was on 1405, reattached 1548 then playback but shutdown at 18 min from Zc
23-Aug	1439	1410	23.5	Blue Whale	MK-10 07A0575	Ziphid	MFA-1	Mark-10 attached as well as Bprobe on this whale
23-Aug	1544	1715	1.5	Blue Whale	Bprobe 019	Ziphid	MFA-1	
23-Aug	1810	2138	3.5	Blue Whale	MK-10 09A0410	Ziphid	None	Mark-10 deployed at end of day and retrieved in am
24-Aug	0920	1335	4.2	Fin whale	Dtag 224	Ziphid	MFA-1	Both this and below animal exposed at ~700-1000m; TEXTBOOK playback
24-Aug	0945	1430	4.7	Fin whale	Dtag 238	Physalus	MFA-1	Same as above
26-Aug	0908	NA	NA	Sei whale	Sat tag	Physalis	None	Sat tag deployed and biopsy taken from sei whale after fairly long attempt
26-Aug	0925	1432	5.1	Blue Whale	Dtag 238	Ziphid	MFA-1	Double Dtag/Bprobe deployed 2.5 hr ahead of playback -- slightly larger range than
26-Aug	0925	1428	5.1	Blue Whale	Bprobe 019	Ziphid	MFA-1	Same animal as above but double-tagged
26-Aug	1213	1536	3.4	Blue Whale	Dtag 224	Physalus	MFA-1	Tag went on at the exact minute the playback started -- NOT usable in CEE analysis
27-Aug	0944	1530	5.8	Fin whale	Dtag 224	Physalus	MFA-1	Nice double deployment on fin whale that was solo -- playback 2.5 h later but good
27-Aug	0944	1251	3.1	Fin whale	Bprobe 034	Physalus	MFA-1	Same animal as above but double-tagged
27-Aug	1025	1818	7.9	Blue Whale	Dtag 238	Ziphid	MFA-1	Good double-deployment Dtag and Bprobe - about 2000m from playback initiation
27-Aug	1025	1838	8.1	Blue Whale	Bprobe 025	Ziphid	MFA-1	Same animal as above but double-tagged
28-Aug	0815	1837	34.4	Blue Whale	Dtag 238	Ziphid	MFA-1	Double tag simultaneous Dtag and Bprobe -- OUTSTANDING playback!!
28-Aug	0815	0145	15.8	Blue Whale	Bprobe 019	Ziphid	MFA-1	Same animal as above but double-tagged
28-Aug	0821	1048	2.3	Blue Whale	Dtag 224	Physalus	MFA-1	Closer of the two whales on this playback and the focal whale for Truth vis obs
28-Aug	1705	2133	4.5	Blue Whale	MK-10 09A0411	Ziphid	None	Tag deployed near the shipping channel leading to Long Beach and LA harbor
28-Aug	1725	1854	1.4	Blue Whale	MK-10 07A0575	Ziphid	None	Another tag deployed near the shipping channel
29-Aug	0922	1800	8.8	Blue Whale	Dtag 245	Physalus	None	Good double deployment on a blue whale, but used as control due to fin whale calf
29-Aug	0927	1055	1.3	Blue Whale	Bprobe 025	Physalus	None	Same animal as above but double-tagged
29-Aug	1022	1247	2.3	Blue Whale	Bprobe 034	Ziphid	None	No playback due to fin whale calf -- whale about 1500m during the control
30-Aug	1032	0811	14.2	Sperm Whale	Dtag 245	Ziphid	MFA-1	CEE on a satellite tagged sperm whale full 30 min sequence and all good
30-Aug	1602	0420	12.3	Sperm Whale	MK-10 07A0592	Ziphid	MFA-1	Same animal as above but Mark-10 at end of the day
31-Aug	0928	1433	5.1	Blue Whale	Dtag 224	Physalus	PRN -1	CEE on this animal but from ~2-3nm -- first playback with PRN
31-Aug	0928	1433	5.1	Blue Whale	Bprobe 007	Physalus	PRN -1	Same animal as above but double-tagged
31-Aug	1037	1906	9.7	Blue Whale	Dtag 238	Ziphid	PRN -1	Likely same as during double animal CEE -- released late
31-Aug	1037	1430	3.9	Blue Whale	Bprobe 022	Ziphid	PRN -1	Same animal as above but double-tagged
1-Sep	1030	1325	2.9	Fin whale	Dtag 224	Physalus	None	Fin whale a little skittish and headed away no playback
1-Sep	1125	1341	2.3	Fin whale	Dtag 245	Ziphid	None	Animal fast traveling, tag off prior to any playback
1-Sep	1431	1630	2.0	Blue Whale	Dtag 245	Ziphid	None	Short deployment (dual with Mark-10 below) because tag came off
1-Sep	1431	1630	2.0	Blue Whale	MK-10 164.620	Ziphid	None	Dual deployment with above
1-Sep	1559	1741	1.7	Blue Whale	Dtag 224	Physalus	PRN -1	Tag came off during sound exposure
1-Sep	1613	1851	3.6	Blue Whale	Dtag 245	Ziphid	PRN -1	Same CEE as above, but different whale
2-Sep	1238	1633	3.9	Blue Whale	Dtag 238	Ziphid	MFA-1	Good double deployment (with Mark-10 below), CEE focused on fin whale below
2-Sep	1238	0642	18.1	Blue Whale	MK-10 148.037	Ziphid	MFA-1	Dual deployment with above
2-Sep	1252	1805	5.2	Fin whale	Dtag 245	Physalus	MFA-1	Focal whale for MFA-1 CEE -- was in a group with another fin whale
3-Sep	1248	1725	4.6	Blue Whale	Dtag 238	Ziphid	MFA-1	Possibly whale exposed to MFA yesterday
3-Sep	1253	1723	4.7	Blue Whale	Dtag 224	Physalus	MFA-1	Was incidentally exposed and is Cat 1
4-Sep	1130	1608	4.8	Fin whale	Dtag 238	Ziphid	PRN -1	Lone fin whale, CEE 2h later in good spacing and configuration
4-Sep	1300	1334	0.6	Blue Whale	Dtag 224	Physalus	PRN -1	Lead animal in a lead-trail pair, tag came off <1h later and just before CEE.
5-Sep	1314	0330	14.4	Sperm Whale	MK-10 (148.105)	Ziphid	PRN-1	Same sperm whale as sat tagged and Dtagged previously, PRN-1 at end of the day
5-Sep	1337	0329	13.9	Sperm Whale	Dtag 245	Ziphid	PRN-1	Same whale as a above with control sequence plus PRN-1 transmissions;
6-Sep	0840	0843	0.1	Btms dolphin	Dtag "Survivor"	Physalus	None	Trial deployment of dummy Dtag with depth sensor stayed on about 2 min
7-Sep	1715	n/a	n/a	Killer whale	Sat tag	Physalus	None	Sat tag deployed on a young male
8-Sep	1320	1720	4.0	Blue whale	Dtag 238	Ziphid	PRN-1	Possibly 2-3 lowest level PRN transmissions because software glitch issue

Table 2. Summary of playbacks completed during Leg1 of the BRS in 2010

Date	Time	Species	Type	Minutes	Comments
23 Aug 10	1147-1217	Blue whale	MFA-1	30:00	Two tagged blues; all good and full sequence but source software glitches affected timing
23 Aug 10	1147-1217	Blue whale	MFA-1	30:00	Same as above
23 Aug 10	1647-1705	Blue whale	MFA-1	18:00	Truncated exposure (Zc)
24 Aug 10	1150-1220	Fin whale	MFA-1	30:00	Textbook CEE
24 Aug 10	1150-1220	Fin whale	MFA-1	30:00	Same as above
26 Aug 10	1213-1243	Blue whale	MFA-1	30:00	
26 Aug 10	1213-1243	Blue whale	MFA-1	30:00	No baseline data
27 Aug 10	1234-1304	Fin whale	MFA-1	30:00	Solid double deployment and playback
27 Aug 10	1234-1304	Blue whale	MFA-1	30:00	Also a good double deployment 2000m at start of playback
28 Aug 10	0947-1017	Blue whale	MFA-1	30:00	
28 Aug 10	0947-1017	Blue whale	MFA-1	30:00	
29 Aug 10	1155-1225	Blue whale	CONTROL	30:00	Complete control sequence with a Dtag/Bprobe-tagged blue whale at ~500m
29 Aug 10	1155-1225	Blue whale	CONTROL	30:00	Same complete control sequence with a Bprobe-tagged blue whale at ~1500m
30 Aug 10	1314-1344	Sperm whale	MFA-1	30:00	CEE on a sperm whale that had been sat tagged on Aug 16 and tracked for two weeks
31 Aug 10	1239-1309	Blue whale	PRN-1	30:00	
31 Aug 10	1239-1309	Blue whale	PRN-1	30:00	Focal animal in this CEE
1 Sept 10	1724-1754	Blue whale	PRN-1	20:00	Partial sequence (tag came off) though this was the same CEE
1 Sept 10	1724-1754	Blue whale	PRN-1	30:00	Full sequence though this was not the focal whale at the start of the playback
2 Sept 10	1352-1422	Blue whale	PRN-1	30:00	Blue whale tagged by Ziphid first and we tracked this one and below fin as well
2 Sept 10	1352-1422	Fin whale	PRN-1	30:00	Fin and was focal for CEE with an accompanying fin;

<i>Table 2. Summary of playbacks completed during Leg1 of the BRS in 2010 (cont)</i>					
3 Sept 10	1353-1418	Blue whale	MFA-1	25:00	
3 Sept 10	1353-1418	Blue whale	MFA-1	25:00	
4 Sept 10	1344-1414	Fin whale	PRN-1	30:00	Good deployment and follow for several hours baseline then good playback series
4 Sept 10	1344-1414	Blue whale	PRN-1	30:00	Animal tagged just before CEE
5 Sept 10	1753-1823	Sperm Whale	CONTROL	30:00	Waited about five hours monitoring this same sat tagged sperm whale
5 Sept 10	1831-1855	Sperm Whale	PRN-1	24:00	By end of control sequence visibility lifted significantly and we had 1000m+
8 Sept 10	1420-1450	Blue whale	PRN-1	30:00	Part of a group of two; was tagged just north of Santa Cruz Island

RESULTS

This was the first year of an anticipated 5-year study with this grant representing just one component of a larger collaborative effort. Results of the Behavioral Response Study will be the focus of analysis in coming months under other grants. Analysis and reporting will be being conducted under other grants and continued studies that are part of the Behavioral Response Study.

IMPACT/APPLICATIONS

The study demonstrated a successful model for conducting BRS studies and showed that both the BRS team, the region, and the methods employed were ideal and achieved a much higher level of success in the first leg than had been anticipated. The study promises to provide important new data on the behavioral response of cetaceans to Navy sonar and other sounds.

TRANSITIONS

Work will be continuing on this anticipated 5-year project. Enough data was gathered in 2010 to allow analysis and presentation of some of the findings to scientific conferences.

RELATED PROJECTS

This specific grant was to provide a vessel to serve as an observational platform and as a base of operations for a sound source to be used in the Behavioral Response Study conducted off Southern California in summer 2010. Other components of this work were included in other separate grants to the various groups including Cascadia Research, Southall Environmental Associates, Woods Hole Oceanographic Institute (WHOI), Southwest Fisheries Science Center (SWFSC), Naval Undersea Warfare Center (NUWC), and Scripps Institution of Oceanography (SIO). Similar studies have been conducted at the AUTECH range and are currently underway in the Mediterranean Sea, all built around a model in which species of interest are fitted with the suction cup-attached tags to record exposure to sound and detailed data on underwater behavior in reaction to these sounds.