

## Summary of ship-strike related research on blue whales in 2011

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Research was conducted during 2011 related to potential impacts of ship strikes on blue whales off California. This work is a collaborative effort by Cascadia Research, Scripps Institution of Oceanography, and Channel Islands National Marine Sanctuary (CINMS). Support for this work came from the Office of Naval Research and CINMS.

The primary goals of this work include:

1. Examine the occurrence of whales off California and identify areas of potential risk from ship strikes.
2. Determine the behavior of blue whales using areas of high ship overlap to identify how and why they are using these areas
3. Examine interactions between whales and ships to better evaluate the efficacy of strategies for reducing ship strikes.

Field effort has been conducted examining these issues since 2008. Past effort focused on the Santa Barbara Channel where shipping lanes pass through areas of frequent use by blue whales. Ship traffic use of the channel changed after the California Air Resources Board (CARB) rules in late 2008 mandating use of cleaner fuels within 24 nmi of shore resulted in many ships abandoning the shipping lanes through the channel. Predicting locations of ship and vessel interactions became more difficult. This field effort represented our first major attempt to examine ship and vessel interactions immediately off Los Angeles and Long Beach where vessels taking varied routes reconverge but are generally travelling slower (12 knots) than in area further from the ports.

Field effort was conducted with two vessels. Cascadia's RHIB *Ziphid* was used during the entire period for tag deployments, recoveries, and monitoring tagged animals. The CINMS vessel *Shearwater* was used from 15-19 August 2011 to survey areas of whale occurrence near shipping lanes, monitor whales, and recover tags. Personnel for the trip are listed in Table 1.

Table 1. Summary of scientific personnel for ship strike work 13-19 Aug and 3-7 Oct 2011.

Person	Organization	Time period
John Calambokidis	Cascadia Research	13-19 August 3-7 October
Erin Oleson	NOAA/Scripps	13-18 August
Megan McKenna	Cascadia Research	15-19 August 3-6 October
Kelli Stingle	Cascadia Research	15-19 August
Elizabeth Vu	Scripps	15-19 August
Ari Friedlaender	Duke University	13-14 August
Steve Katz	Channel Islands Nat. Mar. Sanc.	18-19 August
Ana Sirovic	Scripps	16-17 August
Kera Mathes	Aquarium of the Pacific	19 August 7 October
Chris Garsha		3-6 October

### *Summary of effort 13-19 August 2011*

Over the 7 days of field effort, 14 deployments of four different suction cup tag types were successfully made on blue whales in the LA/Long Beach area (Table 2). In all 7 days of field work, whales were sighted in and around shipping lanes confirming that this region was an important area of potential risk of ship strikes.

Tags deployed included:

1. Two deployments of Wood's Hole Oceanographic Institute Dtags on 13 and 14 August thanks to our collaboration with Ari Friedlaender of Duke who worked with us on these two days. Both of these deployments were in conjunction with deployments of MK-10F tags (see Table 2). Dtags provide both acoustic data (calls of tagged whales and sounds like ship noise being heard by the whale, depth, body position, and acceleration.
2. Six deployments of Wildlife Computers Mk10F tags, often in conjunction with other tags. These tags provide depth but most importantly Fast-Loc GPS positions of whales on most surfacings. This is especially valuable for periods when the whales are not being visually tracked.
3. Four deployments of the Acousonde 3B made by Greeneridge Sciences. The 3B is a different form factor than the 3A and this represented the first deployments of the 3B on a baleen whale and one goal of these deployments was to test these tags. They provide acoustic, depth, and body position information much like the Dtag. We had hoped to make more deployments of the Acousonde but were limited due to the one 3A we had not functioning and also having some trouble with one of the two 3B models we had available.
4. Two deployments of the Bprobe acoustic tag which we used when the Dtag or Acousonde were not available.

### *Summary of effort 3-7 October 2011*

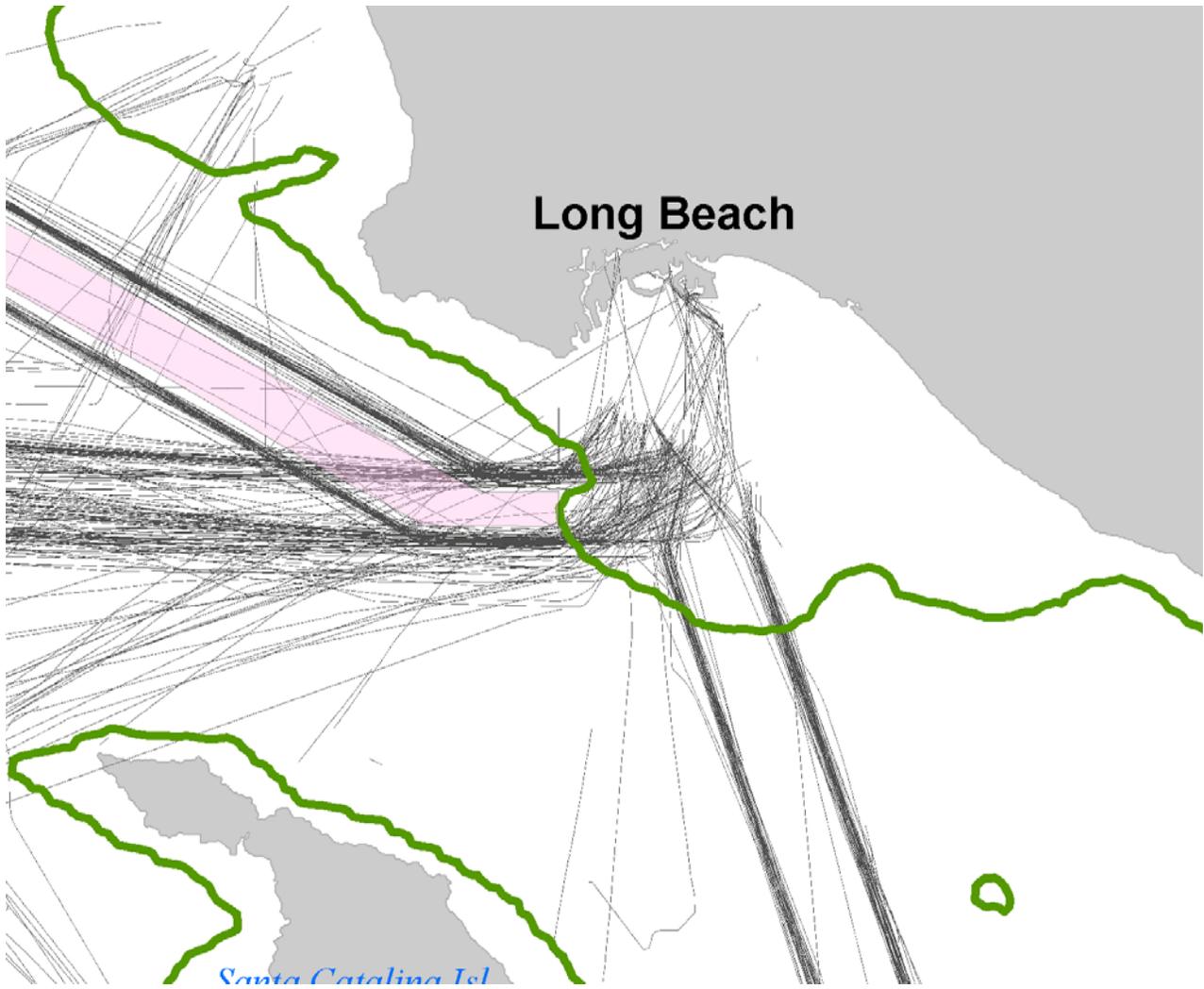
Effort from 3-7 October 2011 was conducted as a single RHIB operation working from Long Beach Harbor. Effort focused on deployments of Mk10 GPS tags on animals in and around the shipping lanes. Overall weather during this period was not very good so the Mk10 tags were ideal because they provided not only dive data but GPS positions on most surfacings even though when we could not conduct surface observations and monitoring.

### *Overall accomplishments*

During the 2011 season 26 tag deployments of four different types of tags were made on blue whales in and around the shipping lanes near the entrance to the ports of Long Beach and Los Angeles. These were primarily conducted in two dedicated time periods in August and October but included some tag deployments on two days in September conducted during the SOCAL BRS. These provided 142 hours of detailed data on blue whale underwater behavior, including 34 hours with detailed acoustics from the Acousonde, Dtags, and Bprobes and 108 hours with GPS-quality positions including through the night (four of these over 18 hour tracks). The detailed position data will be used to integrate with AIS tracks of ships to identify times, distances and behaviors of whales when ships were very close.

Key accomplishments of the research included:

- 1) Identifying the key areas of overlap between whale occurrence and shipping routes in the immediate entrances to the ports of LA and Long Beach (Figure 1). Most of the interactions between ships and whales were observed at the shelf edge where ships inbound in the western shipping lanes enter the precautionary area at the shelf edge and at the N end of the inbound lanes coming from the south again near where they cross the shelf edge.
- 2) Identifying that a small number of blue and fin whales used this area regularly for feeding during the study period. Typically 3-7 blue whales were seen in the area near where the western shipping lanes merge into the precautionary area just a few miles from the entrance to LA and Long Beach Harbors. During August 1-3 fin whales were encountered each day but fewer fin whales were seen in this area in September and October.
- 3) Critical data on the reactions of whales to the close approach of ships was observed on multiple occasions. On 19 August a single and mother/calf pair of blue whales (one of them with an Acousonde tag) were closely monitored during a very close passage by a container ship (Figure 2). Previously only four such close encounters had been documented.
- 4) Four long term deployments, each of over 18 hours were achieved with the Mk10 GPS tags of blue whales in the shipping lanes. These not only provided day-night data on blue whale behaviors but also four long records of movements and behavior in the shipping lanes that when matched with ship AIS data will allow evaluation of reactions of whales to ship close approaches.
- 5) New data was obtained on the synchrony and interactions of pairs of blue whales when both animals in a pair were monitored with different suction cup tags. This occurred on 16 August when an Acousonde was deployed on the trail animal of a pair and this was immediately followed by the deployment of a Bprobe and Mk10 on the lead animal in the pair. While the tags on the lead animal did not stay on long they did provide 1.5 hours of data with multiple tags on multiple animals.



*Figure 1. Ship traffic around the ports of LA/ Long Beach. Green line represents the 200m contour. Pink area represents the traffic separation zone between the north and south bound lanes.*

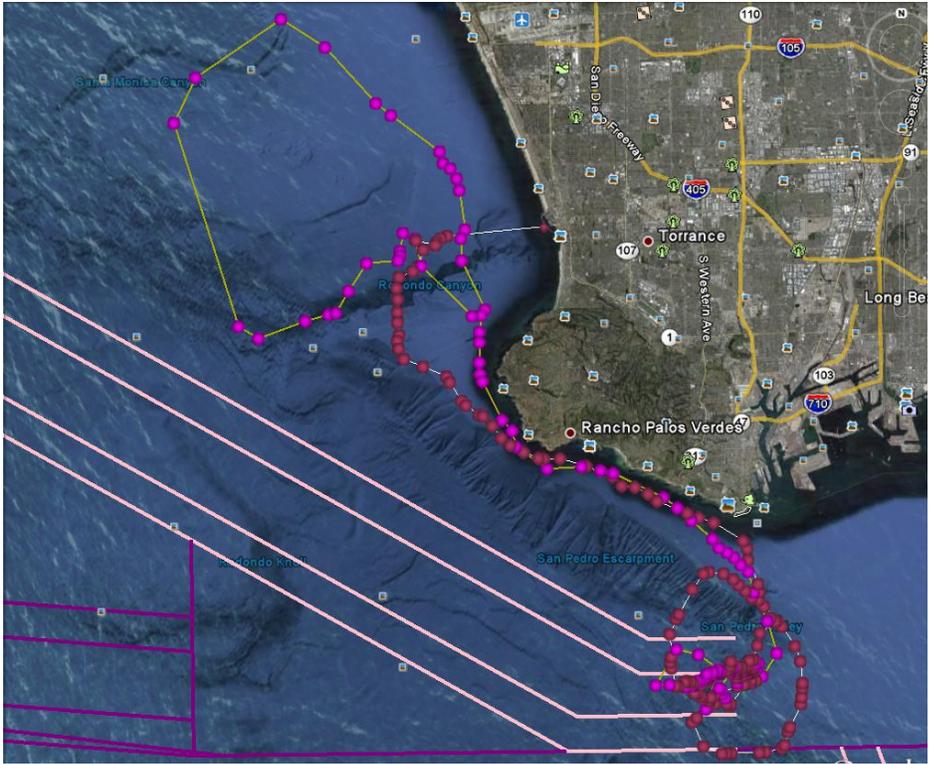


Figure 2. Tracks of two whales based on Mk10 GPS tag deployments on 21 September. Tags recorded 18.6 and 25.4 hours of dive and position data.

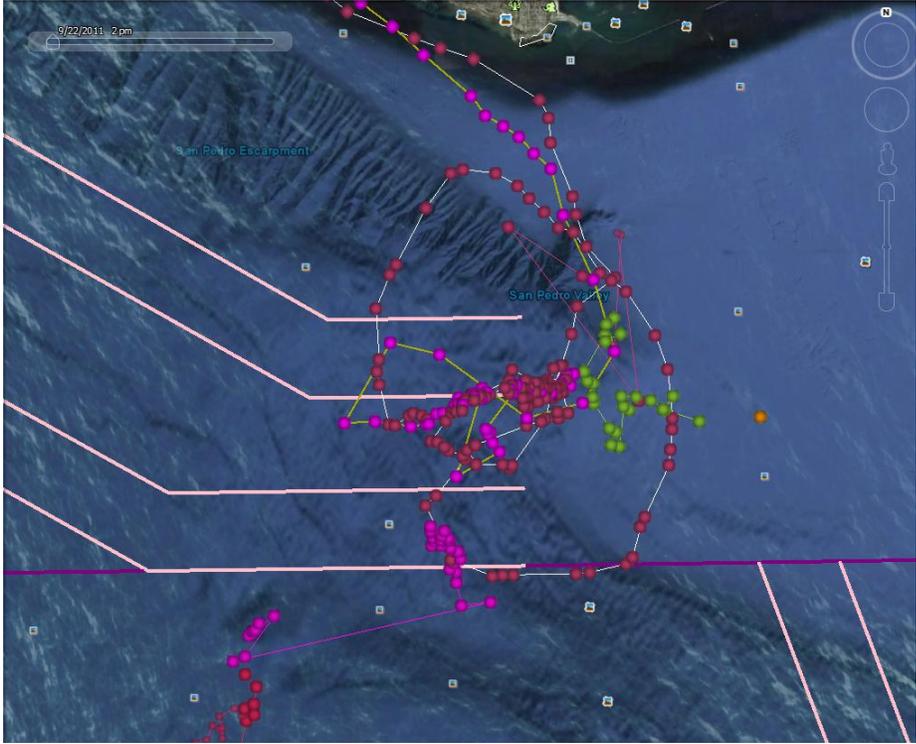


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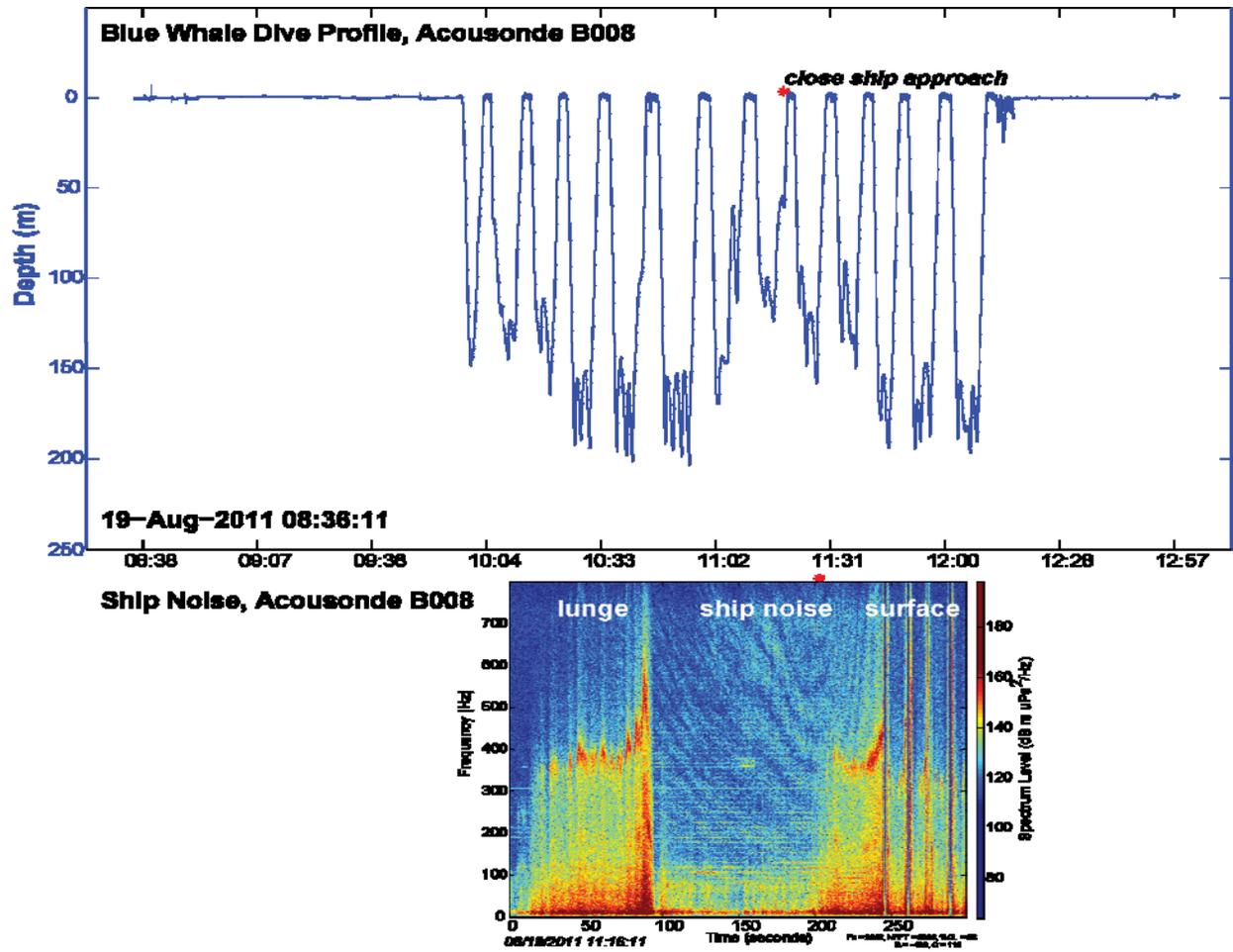


Figure 3. Dive profile for Acousonde B008 deployment on 19Aug2011. Tag started sampling at 08:36 was deployed at 09:59 with ship passing close to whale at about 11:20 (noted by \*).



*Deployment of an Acousonde on a blue whale on 19 August 2011 which provided data during a ship close approach.*



*Blue whale with Acousonde and approaching ship that passed closely on 19 August.*



*Shearwater monitoring movements of blue whale on 19 August.*



*Tanker passing whale with Mk10 tag on early evening of 21 September 2011.*

Table 2. Summary of tag deployments during ship strike work in 2011 including deployments on blue whales in shipping lanes as part of the BRS.

Date	Time	Tag Type	Tag#	Recover Date	Recover Time	Date off	TagOff Time	H On	Comments
13-Aug-11	15:29	Mk10F	3	14-Aug	8:57	13-Aug	18:51	3.4	Acousonde attempt but does not attach
14-Aug-11	11:50	Dtag	230	14-Aug	12:30	14-Aug	12:27	0.6	
14-Aug-11	11:50	Mk10F	1	14-Aug	14:31	14-Aug	14:06	2.3	
14-Aug-11	12:40	Dtag	236	15-Aug	16:07	14-Aug	20:10	7.5	Recovered next day by Ziphid
14-Aug-11	12:40	Mk10F	2	15-Aug	16:35	14-Aug	19:24	6.7	Recovered next day by Ziphid
15-Aug-11	10:49	Acous 3B	B006	15-Aug	11:30	15-Aug	11:28	0.6	Tag had failed
15-Aug-11	11:47	Acous 3B	B006	15-Aug	12:47	15-Aug	12:45	1.0	Tag had failed
16-Aug-11	10:54	Bprobe	B025	16-Aug	15:10	16-Aug	12:23	1.5	With Mk10
16-Aug-11	10:54	Mk10F	3	16-Aug	15:28	16-Aug	12:04	1.2	With Bprobe
16-Aug-11	10:30	Acous 3B	B008	18-Aug	11:13	16-Aug	20:00	9.5	Picked up by Shearwater on 18 Aug 2011
17-Aug-11	8:25	Bprobe	B019	17-Aug	12:30	17-Aug	12:20	3.9	Picked up by Shearwater
17-Aug-11	8:25	Mk10F	3	17-Aug	8:54	17-Aug	8:44	0.3	
19-Aug-11	9:59	Acous 3B	B008	19-Aug	12:53	19-Aug	12:15	2.3	
19-Aug-11	14:03	Mk10F	3	19-Aug	14:14	19-Aug	14:09	0.1	
21-Sep-11	7:42	Mk10F	1	22-Sep	17:36	22-Sep	2:16	18.6	Conducted as part of BRS off LA/LB
21-Sep-11	8:13	Mk10F	2	22-Sep	17:00	22-Sep	9:37	25.4	Conducted as part of BRS off LA/LB
21-Sep-11	14:34	Dtag	243	21-Sep	17:12	21-Sep	17:12	2.6	Conducted as part of BRS off LA/LB
21-Sep-11	14:34	Mk10F	3	21-Sep	19:10	21-Sep	15:26	0.9	Conducted as part of BRS off LA/LB
25-Sep-11	16:02	Mk10F	2	25-Sep	18:51	25-Sep	18:18	2.3	Conducted as part of BRS off LA/LB
25-Sep-11	17:54	Mk10F	1	26-Sep	10:53	25-Sep	19:24	1.5	Conducted as part of BRS off LA/LB
03-Oct-11	9:22	Mk10F	3	4-Oct	10:01	4-Oct	4:31	19.1	
03-Oct-11	9:43	Acous 3B	B008	3-Oct	12:48	3-Oct	11:26	1.7	
04-Oct-11	13:41	Acous 3B	B008	4-Oct	17:21	4-Oct	15:18	1.6	
04-Oct-11	13:41	Mk10F	1	6-Oct	11:15	5-Oct	14:55	25.2	Came off on 5 Oct recovered 6 Oct
04-Oct-11	15:01	Acous 3B	B006	4-Oct	17:30	4-Oct	15:39	0.6	
04-Oct-11	15:01	Mk10F	2	4-Oct	17:12	4-Oct	16:21	1.3	