HICEAS: Hawaiian Islands Cetacean and Ecosystem Assessment Survey

November 4, 2010

Leg 2, *Oscar Elton Sette* Report: 5-29 October 2010

Marie Hill, Cruise Leader

The 2010 HICEAS cruise has now come to an end for the *Oscar Elton Sette*. We have completed the second of two legs for the Hawaii-based ship and returned to our home port in Pearl Harbor. We departed Honolulu on October 5 and headed southeast through the main islands to our official starting point east of Hilo. We covered the southeast portion of the study area and then headed northwest along the southern edge of the Hawaiian Exclusive Economic Zone (EEZ) border, which is 200 nautical miles from all Hawaiian land masses (see Fig. 1). We went approximately as far northwest as Lisianski Island but remained 100-200 nmi offshore. Weather was a major factor during this leg. At times, winds were blowing 25-30 kts and on a few days we had swells as large as 10ft. We had a total of 5 days that the cetacean visual team was unable to survey because conditions were too bad to see anything on the surface of the water. High winds prevented the bird observers from surveying for a combined total of 8 hours and the acoustics team had to pull in the hydrophone array on one day because of the large swells. We toughed it out though, had some spectacular and very productive days, and made it back to port safely on October 29.

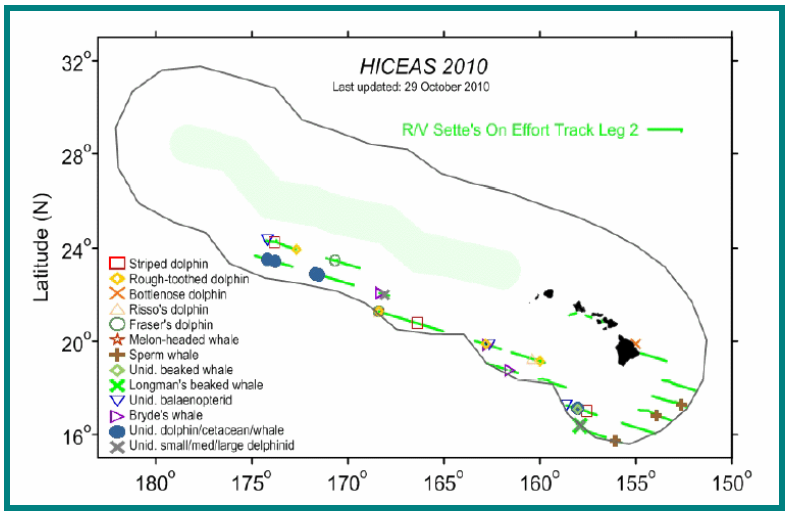

Figure 1. Map of the NOAA Ship *Oscar Elton Sette's* on effort trackline during the second leg of the 2010 HICEAS cruise, including the cetacean species encountered. The outer gray line defines the Hawaiian EEZ. The solid light blue area defines the Papahanaumokuakea Marine National Monument.

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ADDITIONAL CRUISE INFORMATION:
http://swfsc.noaa.gov/prd-hiceas.aspx

ADDITIONAL INFORMATION ABOUT PROTECTED RESOURCES DIVISION:
http://swfsc.noaa.gov/prd.aspx

Cetacean Photography Report – Allan Ligon and Adam Ü

Compared to Leg 1, Leg 2 of HICEAS – *Oscar Elton Sette* had fewer opportunities for collecting photographs. We made the most of our opportunities and managed to collect nearly three thousand images during the past few weeks of effort. Ten species of cetaceans were documented in total; Bryde's whales (*Balaenoptera edeni*) and rough-toothed dolphins (*Steno bredanensis*) were the most commonly photographed species (four sightings each) but the Fraser's dolphins (*Lagenodelphis hosei*) were the photographers favorites with 769 images being taken over two sightings.

Table 1. Summary of photographs.

Species	Sette Leg 2 sightings	Sette Leg 2 sightings with photos	Total photos Leg 2
Striped dolphin	3	2	326
Rough-toothed dolphin	3	4	448
Bottlenose dolphin	1	1	15
Risso's dolphin	2	2	317
Fraser's dolphin	2	2	769
Melon-headed whale	1	1	321
Short-finned pilot whale	1	1	277
Sperm whale	3	2	63
Ziphiid sp.	1	1	6
Mesplodon sp.	1	0	0
Longman's beaked whale	1	0	0
Unid. rorqual	3	0	0
Bryde's whale	4	4	323
Unid. dolphin	4	0	0
Unid. large whale	1	0	0
Unid. cetacean	1	0	0
Unid. whale	1	0	0
Unid. large delphinid	2	0	0
Total	**35**	**20**	**2865**

Cetacean Biopsy Report – Juan Carlos Salinas and Ernesto Vázquez

Given the poor conditions that dominated the second leg, we didn't have many opportunities to collect biopsy samples. We collected only two samples during a single Bryde's whale sighting.

Table 2: Summary of biopsy effort.

Species	Common name	Sette Leg 1 samples	Sette Leg 1 takes	Total samples	Total takes
Balaenoptera edeni	Bryde's whale	2	2	3	4
Physeter macrocephalus	Sperm whale	0	0	9	16
Pseudorca crassidens	False killer whale	0	0	18	26
Stenella attenuata	Pantropical spotted dolphin	0	0	1	2
Stenella longirostris longirostris	Gray's spinner dolphin	0	0	16	20
Tursiops truncatus	Bottlenose dolphin	0	0	39	66
	Total	**2**	**2**	**84**	**132**

Cetacean Acoustics Report – Yvonne Barkley, Susannah Calderan, and Hannah Bassett

For the HICEAS *Sette* Acoustics Team, Leg 2 was very successful (Table 3). After several days of preparing our new set-up, including spooling on a new tow cable, building new connectors and splicing on a new array, we were expecting to have the hard part done. The first day we deployed the array, we knew we were faced with even bigger problems. The ship's power was our worst enemy. Our new setup seemed to pick up more electrical noise than that of the previous leg. Noise was introduced into the system via anything connected to the ship's power, whether it was turned on or simply off and still plugged into the power receptacle. In order to overcome this unfortunate circumstance, we converted our entire set-up to run completely off 12V battery power. With a totally isolated system, we were able to make cleaner recordings than ever thought possible on the *Sette* and run our localizing software and detectors.

During the second leg, we had only 5 joint acoustic and visual encounters, 11% of total visual and acoustic encounters while both were on effort (see Table 4). Comparatively, we experienced 28 joint encounters during Leg 1 (31% of total). This may partly be due to the difference in weather conditions between legs. The superb weather during Leg 1 allowed the visual team to see animals much farther than the array could originally detect, and change the course of the ship in order to get closer to the animals, eventually resulting in a joint visual and acoustic detection. The often blustery conditions during Leg 2 made it difficult to spot the less conspicuous animals, meaning that many of our acoustic detections were never seen by the visual team. In particular, the acoustics team had several unidentified dolphin detections that were not sighted by visuals due to the poor sea state, which did not occur as frequently during Leg 1. The Leg 2 survey area was another factor to take into account when looking at the lower number of animals detected both visually and acoustically. Surveying over deep, offshore water compared to circumnavigating the Northern Hawaiian Islands seemed to contribute to the difference in the number of animals detected overall. We had 24 acoustic detections during Leg 2 and an astounding 170 hours of effort. Table 3 displays information about each acoustic detection and the corresponding visual sighting.

The acoustics team continued their flawless record of detecting 100% of the sperm whale sightings and even led a successful acoustic chase to help the visuals team locate a group. However, our ability to successfully locate animals did not always work as swimmingly with every species. While attempting to locate 2 separate 'possible *Pseudorca*' detections, the animals eluded us despite our strategic turns. Their vocalizations were sporadic and at times, it felt as if we were the ones being chased. When animals don't cooperate according to protocol, it makes it very difficult to find them. To add to the confusion, during both chases, the visual team sighted two completely different species, *Indopacetus pacificus* and *Ziphius* sp. Acoustic passes were performed for both of these sightings and will be analyzed post-process. Table 4 provides a comparison of acoustic and visual encounter rates.

Table 3. Information for each acoustic detection during HICEAS 2010 *Sette's* Leg 2.

Date/Time	Acoustic species identification	Latitude (N)	Longitude (W)	ROCCA whistles	Visual sighting	Visual ID
10/12/10 1:11	Sperm whale	16.3712	155.2611	NA	NA	Sperm whale
10/12/10 21:35	unidentified dolphin	16.4981	155.7481	0	NA	NA
10/13/10 18:23	Sperm whale	15.7341	156.0811	NA	101	Sperm whale
10/14/10 17:11	unidentified dolphin	15.9091	156.7128	0	NA	NA
10/14/10 21:47	unidentified dolphin	16.0969	157.3878	0	NA	NA
10/15/10 0:58	unidentified cetacean	16.3837	157.9205	24	NA	NA
10/15/10 18:38	unidentified dolphin	16.9293	157.5298	0	NA	N/A

Date/Time	Acoustic species identification	Latitude (N)	Longitude (W)	ROCCA whistles	Visual sighting	Visual ID
10/15/10 22:40	unidentified dolphin	17.1047	158.0049	0	NA	NA
10/16/10 2:48	unidentified dolphin	17.2070	158.4870	0	NA	NA
10/16/10 19:46	unidentified dolphin	18.0618	158.7934	0	NA	NA
10/16/10 20:10	unidentified dolphin	18.0720	158.8291	0	NA	NA
10/17/10 4:11	unidentified dolphin	18.3873	160.1218	0	NA	NA
10/19/10 17:45	unidentified dolphin	19.7244	162.2529	7	NA	NA
10/19/10 21:41	unidentified cetacean	19.8759	162.7324	23	NA	NA
10/20/10 0:42	unidentified dolphin	19.8896	162.7916	0	113	Rough-toothed dolphin
10/20/10 17:03	Sperm whale	20.4519	165.1073	0	NA	NA
10/20/10 18:12	unidentified dolphin	20.5022	165.3120	0	NA	NA
10/22/10 0:58	unidentified dolphin	21.2177	168.4403	50	115	multiple species
10/24/10 17:48	unidentified dolphin	24.3302	174.2397		NA	NA
10/24/10 18:17	unidentified dolphin	24.3013	174.1617	22	NA	NA
10/24/10 20:22	unidentified dolphin	24.2790	173.9413		NA	NA
10/25/10 4:17	unidentified dolphin	23.9123	172.6792	31	124	Rough-toothed dolphin
10/25/10 20:30	unidentified dolphin	23.4643	170.6011	0	125	Fraser's dolphin
10/28/10 17:38	unidentified dolphin	20.5216	162.2305	32	NA	NA

Table 4. Comparison of visual and acoustic encounter rates on HICEAS Sette Leg 2 when both visual and acoustic teams were on effort (subsequent analysis of BURP, sonobuoy and full-bandwidth recordings may also provide acoustic detections for baleen and beaked whales).

Acoustic ID	Visual ID	Total no. acoustic encounter	Total no. visual encounter	Joint visual/acoustic	% of all encounters detected acoustically
	Physeter macrocephalus	2	1	1	100
Unidentified Dolphin	All delphinids	19	13	3	66
	Unidentified delphinid	16	4	0	80
	Stenella coeruleoalba	0	3	0	0
	Grampus griseus	0	1	0	0
	Lagenodelphis hosei	1	1	1	100
	Steno bredanensis	2	3	2	67
	Tursiops truncatus	0	1	0	0
Multiple species encounter unidentified dolphin	Multiple species *(Grampus, Steno, Peponocephala, Lagenodelphis)*	1	1	1	100
Mixed species encounter	Mixed group: *Indopacetus pacificus*/unid. large dolphin	0	1	0	0
Balaenopterid	*Balaenoptera edeni*	0	4	0	0
	Balaenoptera sp.	0	3	0	0
Ziphiid	*Ziphius* whale	0	1	0	0
	Mesoplodon sp	0	1	0	0
Unidentified	Unidentified cetacean	0	1	0	0
	Unidentified whale	0	2	0	0

On the afternoon of October 21, 2010, an exciting multi-species group was encountered while passing over a prominent seamount. Confirmed species included Risso's dolphins (*Grampus griseus*), Fraser's dolphins (*Lagenodelphis hosei*), rough-toothed dolphins (*Steno bredanensis*), and melon-headed whales (*Peponocephala electra*). We recorded many different vocalizations, including interesting clicks and whistles, but we were not able to distinguish between the species given the variable ranges and locations of each group. Despite this unfortunate realization, the entire acoustics team was thrilled at the sounds we heard and the spectrograms we viewed. We heard the majority of whistles after the small boat was retrieved after pursuing the melon-headed whales for photos and biopsy samples and have our suspicions that it was that species that produced the vocalizations (Figure 2). We may not be able to confirm this acoustic species identification, but the whistles were unusual and very interesting.

Another great detection included a wonderful sunset *Steno bredanensis* sighting on October 24, 2010.

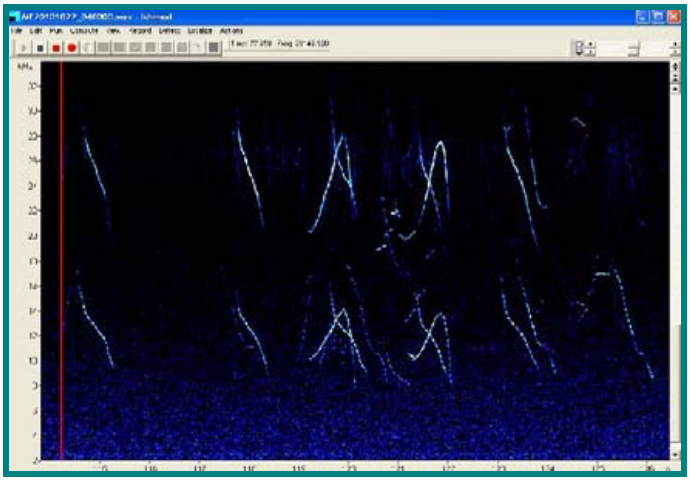


Figure 2. A spectrogram of interesting dolphin whistles that occurred after small boat retrieval for the multi-species group, acoustic detection A57 and sighting 115.

We recorded extremely loud echolocation clicks and beautiful whistles characteristic of this species. Steno is one of our favorite species to detect due to their dynamic and enthusiastic vocalizations. Figure 3 shows spectrograms of their intense clicks and distinct whistles we encountered during that detection.

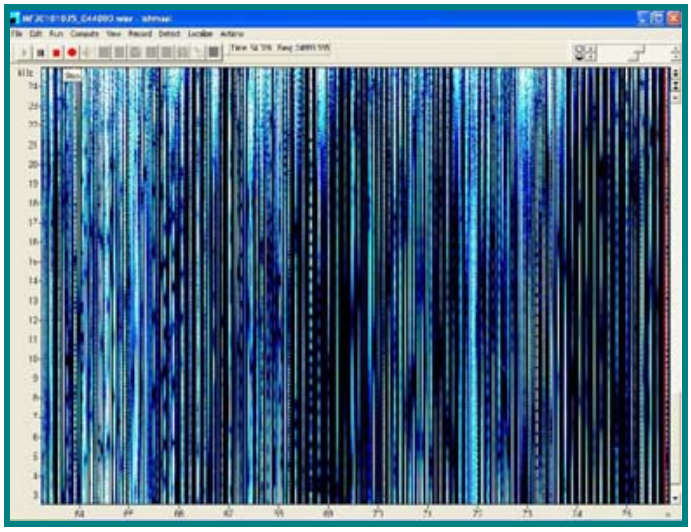
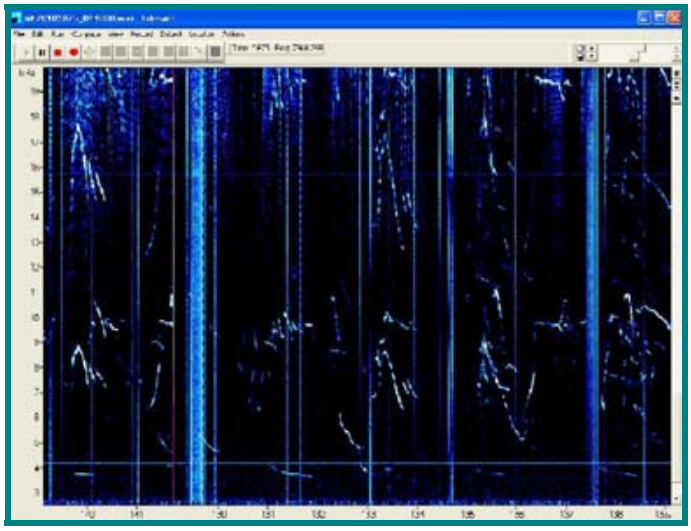
a)  b) 

Figure 3: Echolocation clicks (a) and whistles (b) from a group of Steno bredanensis.

One species the acoustics team never detected this leg was striped dolphins (*Stenella coeruleoalba)*. With three striped dolphin sightings from the visuals team, we never heard a peep. We speculate that the animals may not have been vocalizing due to their fleeing behavior or they were too distant and oriented away from the array while vocalizing. At times when the animals were close, we still did not detect them, assuming they were not vocalizing at all.

Throughout Leg 2, we have had fewer beaked whale sightings and therefore fewer BURP opportunities and acoustic passes. We launched the BURP only once during this leg on a *Mesoplodon* sp. sighting. The recordings will need to be reviewed further for confirmation of vocalizations. We suspect the fewer beaked whale sightings were due to poorer sea state or lack of animals in general for this area.

Evidence of the first minke whales of the season was detected on the array on two occasions. Their vocalizations were too quiet to be seen on our spectrogram indicating either very distant and/or very quiet whales. Another minke whale was also recorded on a routine sonobuoy. As few animals have been detected during the regular midday, evening, and baleen whale sighting sonobuoy launches, encountering the minke whale was a nice surprise.

Overall, the HICEAS *Sette* acoustics experience has been an eye-opener for everyone. We are proud to have tackled the major noise issues and to have found a method to successfully obtain quality recordings and acoustic data on this ship.

The Sette acoustics team would especially like to thank the entire *Sette* crew for offering their help, advice, expertise, and condolences, throughout our acoustic effort during the cruise. It has made this experience even more memorable and worthwhile.

Seabirds – Dawn Breese and Scott Mills

Our total bird species seen for HICEAS from the Sette was 45. On Leg 2, a total of 36 bird species were observed (vs 39 on Leg 1). Nine of 39 were seen on Leg 1 only, and six of 36 were seen on Leg 2 only. Daily species totals this Leg ranged from 4 to 20 with a mean of 11.7 (vs 9 to 21 with a mean of 14.6 on Leg 1). Unlike Leg 1, the species seen on most days was the Black-winged Petrel, seen 24 of 25 days (vs 16 of 28 on Leg 1), with the previous legs' species seen the most days, Wedge-tailed Shearwaters and Red-footed Boobies being seen on 21 and 19 days, respectively, (vs 27 of the 28 days at sea on Leg 1). Five species were each seen on only one day: Herald Petrel, Galapagos (Wedge-rumped) Storm-Petrel, Tristram's Storm-Petrel, Black Noddy, and Ruddy Turnstone, with the Galapagos Storm-Petrel perhaps being the first Hawaii state record. Of the thirty-six species seen, ten were Pterodroma Petrels heading south on migration (except the resident breeding Hawaiian Petrel) - Kermadec, Herald, Murphy's (new this Leg, seen on two days), Mottled (new this Leg, seen on 17 days), Juan Fernandez (seen 7-11 Oct in the SE corner of the EEZ), Hawaiian, White-necked (seen 23-26 Oct in the central outer zone of the EEZ, with a high of 20 individuals seen 24 October) Black-winged, Cook's, and Stejneger's (new this Leg, seen 8-12 Oct in the SE corner of the EEZ). Shearwaters seen were the resident Wedge-tailed, Newell's and Christmas, plus the migratory Buller's, Sooty and Short-tailed. The Short-tailed's were primarily seen on both Legs in the western half of the study area but their numbers on our transects fell from 3790 on Leg 1 to 19 on Leg 2. We saw Sooty's in low numbers on both Legs (19 & 9). We saw three new storm-petrel species on Leg 2, plus two species from Leg 1 (Band-rumped and Wilson's) as well. New were Leach's (all with white rumps), Tristram's and Galapagos. Since it could turn out to be the first Hawaii record, we sent our description of the Galapagos to Peter Pyle who compiles Hawaii bird records for the Bishop Museum in Honolulu. Both resident tropic birds, White-tailed (26/34) and Red-tailed (36/11), all three resident boobies, Red-footed (236/107),

Masked (59/17), and Brown (46/2), and the resident Great Frigatebird (96/27 totals include unid. frigatebird) were all seen (please note: numbers in parentheses denote Leg1/Leg2). Two species of shorebirds were observed; both regularly winter in Hawaii (Pacific Golden Plover and Ruddy Turnstone). Four species of terns, all resident breeders – White Tern, Black Noddy, Brown Noddy and Sooty Tern – were seen. The remaining three species observed were South Polar Skua, Pomarine and Parasitic Jaeger, all seasonal visitors. Seven species of shorebirds, terns or jaegers seen on Leg 1 but missing from Leg 2, were most likely already on an island for their winter (Wandering Tattler, Bristle-thighed Curlew and Sanderling), already passed through on migration (Bar-tailed Godwit and perhaps Red Phalarope), breeding in the NW Hawaiian Islands and too far from our track line (Grey-backed Tern) or we just plain missed them (Long-tailed Jaeger).

An interesting observation on Leg 2 regarded Wedge-tailed Shearwaters. This species is polymorphic, with light and darks (and some intermediate) morphs. On Leg 1 and the first part of Leg 2, light morphs constituted over 98% of sightings. Between 16-19 Oct, the percentage of dark and intermediate morphs increased dramatically (44%, 31%, 68% & 56%) and dark morphs actually outnumbered light morphs on the 18th and 19th. The cruise was wonderful. We saw excellent birds, fantastic marine mammals, worked with great folks, and really were lucky to be doing this work. Thanks go out to all!

Oceanographic Data Collections – Corey Sheredy

Concluding the *Sette's* part of HICEAS 2010 went relatively smoothly. As with the previous leg, we started each day with a CTD cast an hour before sunrise, four XBT/bucket samples throughout the day, and a final CTD cast one hour after sunset. CTD water samples are collected at 1000, 500, 200, 170, 140, 120, 100, 80, 60, 40, 20 meters depth and at the surface. These water samples and the surface chlorophyll samples are analyzed for their chlorophyll a and phaeophytin content. These analyses are very helpful and indicative of determining the productivity of the water.

XBTs (Expendable Bathymetric Thermograph) are an important component of oceanography as well. Each probe is dropped off the stern of the ship and records temperature for 760m depth. Our main purpose for this is to outline the thermocline or the layer within the water column where temperature changes rapidly with depth. The thermocline separates the warmer, upper layer of water known as the mixed layer from the colder, deeper (and calmer) waters. Thermoclines and mixed layer depths can vary quite a bit depending on the region as they are dependent mainly on water temperature, wind, waves and heat (evaporation or freezing). Most of this leg we have seen very deep thermoclines (typical of tropical regions), although it has been fascinating to correlate a rise in its depth with cetacean abundance and of course, fish! Midway through Leg 2, rise in the mixed layer (almost 100m!) coincided with multiple sightings and delicious Mahi Mahi.

Closing Leg 2 was a bit anticlimactic, unfortunately. Rough seas have forced the poor CTD to remain unused for the last three days. Regardless, it has been a productive leg for oceanography. A special thanks to *Sette's* Survey Tech Stephanie Floyd, Summer Martin, Jamie Barlow and Cruise Leader Marie Hill for their invaluable help during CTD casts. Team Oceo out!

Table 4. Summary of oceanographic effort, *Oscar Sette*, Leg 2.

Leg	No. CTD casts	No. Surface chlorophyll samples	No. XBT drops
Leg 2	39	106	90
Cruise total	89	227	209

SQUID PROJECT SUMMARY – SUMMER MARTIN

During this leg of the cruise we collected squid for an ongoing project at the Southwest Fisheries Science Center (SWFSC). We collected a total of 36 purpleback squid (*Sthenoteuthis oualaniensis*) by jigging during the evening CTD casts. Thanks to the efforts of Jamie Barlow and Hannah Bassett, we caught squid at 11 different locations. We photographed, measured, dissected, and sampled 29 specimens and saved 7 whole specimens. Almost all of the squid were females, but we did collect a few males. They ranged in size (average total length of 31.5 cm) and reproductive maturity (including several fully mature females). The samples, which include the gladius (pen), beak, mantle muscle, gill, statoliths, and stomach, will be used in the SWFSC stable isotope study on pelagic trophic dynamics and feeding ecology of cetaceans, particularly sperm whales.

Figure 4. Hannah Bassett, Survey Tech Stephanie Floyd and Summer Martin proudly displaying their squid.

Table 5. Summary of effort, Leg 2.

Date	Beginning time/ Ending time	Begin latitude-longitude Ending latitude-longitude		Distance	Average beaufort
100510	1218	N21:07.29	W157:37.78	26.1	4.2
	1811	N20:49.34	W156:43.45		
100610	0926	N19:29.61	W154:44.87	78.9	5.0
	1752	N19:09.25	W153:24.12		
100710	0612	N18:19.80	W153:37.48	97.8	5.0
	1740	N17:53.48	W151:54.80		
100810	0610	N17:11.46	W152:21.83	99.5	4.4
	1753	N17:38.98	W154:08.39		
100910	0619	N17:03.35	W154:51.63	49.3	5.8
	1150	N16:52.37	W154:01.38		
101010	0627	N16:36.55	W153:09.12	46.5	5.5
	1121	N16:49.23	W153:57.09		
101110	0617	N16:01.92	W153:58.71	50.2	5.5
	1128	N16:15.33	W154:49.63		
101210	0617	N16:16.28	W154:52.97	48.2	5.9
	1139	N16:29.71	W155:44.21		
101310	0619	N15:38.39	W155:44.08	21.2	5.0
	0837	N15:44.11	W156:05.28		
101410	0630	N15:52.69	W156:35.35	84.2	5.2
	1759	N16:19.99	W157:50.68		
101510	0629	N16:49.99	W157:01.95	89.3	4.3
	1744	N17:14.41	W158:37.01		
101610	0911	N18:01.44	W158:38.79	85.4	3.7
	1801	N18:22.87	W160:05.79		
101710	0635	N19:05.57	W159:45.95	96.3	3.7
	1811	N19:31.93	W161:29.36		
101810	0649	N18:38.79	W161:09.08	78.1	3.0
	1811	N19:03.39	W162:41.39		
101910	0652	N19:40.12	W162:01.52	74.9	3.7
	1814	N20:00.86	W163:22.76		
102010	0704	N20:26.04	W165:02.36	109.6	3.7
	1836	N20:55.82	W167:00.26		
102110	0708	N20:56.64	W167:03.41	77.2	3.4
	1459	N21:16.78	W168:23.30		
102210	0726	N22:24.73	W169:43.22	109.5	2.2
	1849	N22:54.09	W171:40.88		
102310	0738	N23:12.10	W172:53.10	110.4	3.8
	1856	N23:41.21	W174:50.71		
102410	0745	N24:19.83	W174:14.43	85.0	5.1
	1801	N23:57.17	W172:41.37		
102510	0735	N23:34.16	W171:07.50	94.7	5.0
	1836	N23:08.26	W169:22.25		
102610	0736	N22:04.05	W168:20.43	35.4	5.4
	1426	N21:57.30	W167:50.79		
102910	0641	N21:06.95	W158:29.01	22.1	4.4
	0855	N21:13.26	W158:06.34		

Table 6. Summary of marine mammal sightings, Leg 2.

Code	Species	No. sightings
013	*Stenella coeruleoalba*	3
015	*Steno bredanensis*	3
018	*Tursiops truncatus*	1
021	*Grampus griseus*	2
026	*Lagenodelphis hosei*	2
031	*Peponocephala electra*	1
036	*Globicephala macrorhynchus*	1
046	*Physeter macrocephalus*	3
049	*Ziphiid* whale	1
051	*Mesoplodon* sp.	1
065	*Indopacetus pacificus*	1
070	*Balaenoptera* sp.	3
072	*Balaenoptera edeni*	4
077	Unid. dolphin	4
079	Unid. large whale	1
096	Unid. cetacean	1
098	Unid. whale	1
377	Unid. large delphinid	2
	Total	**35**