

**2010 Report to PACFLT:
Report of Cetacean Surveys in Guam, CNMI, and the High-seas**

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This report covers a number of activities carried out by the Cetacean Research Program (CRP) at the Pacific Islands Fisheries Science Center (PIFSC) in 2009 and 2010 supported with partial funding from U.S. Navy Pacific Fleet (PACFLT). The report is intended to provide preliminary data and results from 4 survey efforts between Hawaii and Guam in early 2010.

CRP conducted cetacean and oceanographic surveys between Honolulu and Guam and within the Exclusive Economic Zones of Guam and the Commonwealth of the Northern Marianas Islands (CNMI) from January 20 and May 3, 2010. These missions included monitoring the presence and distribution of cetaceans on the high-seas and within the Guam/CNMI EEZs. Specifically four separate data collection efforts were carried out:

- 1) cetacean visual and acoustic observations on the high-seas survey between Honolulu and Guam, 20 January – 6 February
- 2) cetacean visual observations during daylight hours during the oceanography survey along the 144°W meridian between 11°N and 23°N, March 20 - April 11
- 3) cetacean visual and acoustic observations on the high-seas survey between Guam ,and Honolulu, 19 April – 3 May
- 4) cetacean visual observations conducted from small boats chartered in Guam, Tinian, and Saipan, 8 February – 16 March

Funding provided by PACFLT in 2010 was also intended to support the deployment of two High-Frequency Acoustic Recording Packages (HARPs) in Guam and Saipan. After the MOU was signed by PACFLT and PIFSC, Navy informed CRP that Passive Acoustic Monitoring (PAM) data funded by Navy may need to be treated as classified upon retrieval. Scripps Institution of Oceanography (SIO), who owns the HARPS, would not authorize their deployment if the data was to be classified. For this reason, the HARPs were not deployed, and the MOU signatories negotiated use of the funds intended for HARP deployment for the collection of additional cetacean occurrence data during the return transit from Guam to Honolulu (April 19-May 3).

Task 1: Cetacean visual and acoustic observations during the high-seas survey between Honolulu and Guam, 20 January – 6 February (OES10-01)

Visual and acoustic observations for cetaceans occurred during an 18 day transit from Hawaii to Guam aboard the NOAA *R/V Oscar Elton Sette*. Detailed information on all projects occurring during this cruise can be found in the survey Cruise Report (<http://www.pifsc.noaa.gov/cruise/Sette/CR1001-EO.pdf>).

Methods:

Visual Surveys

A daily watch for cetaceans was maintained by scientific observers on the flying bridge during daylight hours (approximately 0700 to 1830), except when the ship stopped to conduct sampling operations, or was precluded by weather. Two teams of four observers conducted 2 hour rotations through a port-side 25x binocular station, a center-line data recorder, starboard-side 25x binocular station, and an aft-looking station scanning the 180° arc behind the ship with 7x binoculars. The two 25x stations scanned from the bow to the beam of the ship. The aft-looking observer was considered a “independent” observer, keeping track of sightings separately from the primary team and informing them of the presence of cetacean groups only when such groups approached the ship from behind. Sighting conditions, watch effort, sightings, and other required information were entered into a computer attached to the ship’s Global Positioning System (for course, speed, and position information).

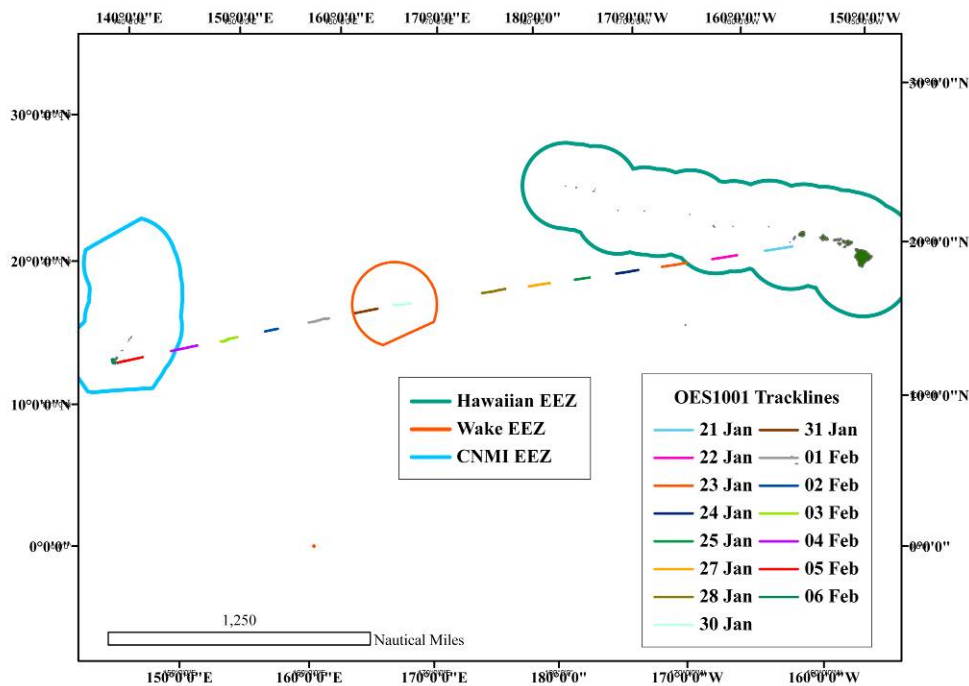


Figure 1: Survey tracklines during OES 10-01 transit from Oahu to Guam, 21 January – 6 February 2010.

During most of the transit the ship was operating in “passing mode” in which groups of cetaceans were not approached for further investigation when they were sighted. During four of the sixteen days the ship operated in “closing mode” and in the event of sighting a cetacean group or other feature of biological interest, the Chief Scientist or marine mammal observer team on watch requested that the vessel be maneuvered to approach the group if within 3 nmi of the trackline. When the ship approached a group of cetaceans, the observers made independent estimates of group size. Photographic operations occasionally commenced from the bow, based on directions from the Chief Scientist or Senior Marine Mammal Observers. On two occasions, the Chief Scientist requested the deployment of a small boat for biopsy and photographic operations.

At times, during the cruise, visual survey operations were not possible because of high winds or seas. Usually, survey operations were suspended at Beaufort Sea State 7 or higher. Also, if rain made visibility 1 nautical mile or less, visual observations were suspended until visibility increased. During these times, a single observer maintained a weather watch in order to notify the rest of the observer team when conditions improved.

Biopsy and Photo Data Collection

Biopsy sample attempts were made on an opportunistic basis. The genetic data will be used to study the population structure of the sampled cetacean groups. Samples were collected using a crossbow and carbon-fiber Ceta-Dart bolts. The animals were either approached by the research vessel during normal survey operations, approached the vessel on their own, or were approached by a small boat. Necessary permits were present on the vessel and the Science Party complied with all permit requirements.

Upon collection, tissue samples are sectioned in half, with one half archived at PIFSC and the other sent to the genetics lab at Southwest Fisheries Science Center (SWFSC) for studies on genetic population structure in the Pacific. Samples were stored in -80⁰ C freezer aboard the vessel and transported in liquid nitrogen to similar freezer storage at PIFSC and SWFSC.

Photographs of cetaceans were taken on an opportunistic basis. These will be used to study social behavior and movement patterns of identified individuals and to study external morphological or pigmentation features that may vary geographically. The photographed animals were either approached by the research vessel during normal survey operations, approached the vessel on their own, or were approached by a small boat. Necessary permits were present on the vessel and the Science Party complied with all permit requirements.

Deployment of the *Sette*'s small boat was requested by the Chief Scientist on an opportunistic basis when the Commanding Officer concurred that operating conditions were safe. The small boat remained within radar and radio contact at all times while deployed.

Acoustic Survey- Towed Array

A 4-element Seiche hydrophone array was used to acoustically monitor for the occurrence of vocal cetaceans. The array was towed 270m behind the vessel and at approximately 7m depth.

The array was monitored during daylight hours (approximately 0700 to 1830), but data was recorded day and night for later processing. Two hydrophones were routed through a MAGREC high pass filter, then to the A/D (MOTU Traveler) before being displayed by the program *Ishmael* on a desktop computer. Two additional hydrophone channels lead directly through the MOTU Traveler; no filter was applied to these two channels. The high-pass filter removed excess ship noise and flow-generated noise below 1kHz. *Ishmael* was used to both record the four hydrophone channels at a 192 kHz sampling rate and localize on acoustic detections. The program *WhalTrack* was used to visualize bearing angles to cetacean detections and determine location from crossed time-difference-of-arrival bearings. The software package *Logger* was used to record an event log associated with acoustic data collection and monitoring. Acoustic survey operations were usually suspended at Beaufort Sea State 7 or higher.

Acoustic Survey- Sonobuoys

Sonobuoys transmit acoustic data over a radio carrier frequency received by a VHF radio on the ship. A VHF antenna was mounted on the trawl house on the 01 deck for reception of the sonobuoy signals. Sonobuoys were generally deployed to 1000 ft. depth and received data in omni-directional mode. Sonobuoys were used for periodic acoustoic monitoring for low-frequency sounds from baleen whales not detectable on the towed array. Incoming signals were monitored using a scrolling spectrogram display in *Ishmael*, and cetacean sounds were noted. Sonobuoys were deployed at regular intervals during the day (0900 and 1500 local), with an occasional additional deployment in late afternoon before sunset.

In contrast with previous sonobuoy efforts which have used surplus sonobuoys provided by the Navy once they've passed their shelf life, this trip new sonobuoys were provided by Operational Navy (CNO-N45) and with assistance from NAVAIR at Pearl Harbor. The new sonobuoys were significantly more reliable than expired buoys.

Results

Visual Surveys

The *R/V Sette* surveyed 1285 nmi of trackline over 16 days. On-effort surveys were completed during 14.5 days (Table 1, Figure 1). The visual observer teams encountered 25 cetacean groups (Table 2; Figures 2 and 3) and obtained group size estimates for all groups. Two of the sightings were made by an independent observer. Eight of the 25 cetacean groups were identified to species. Time and weather limitations prevented the ship's approach of more of the sighted cetacean groups.

Table 1: On-Effort survey data during OES 10-01, transit from Oahu to Guam.

Date (Local)	Start Time	Start Location		End Time	End Location		Distance Surveyed (nmi)	Total # Sightings	Average Beaufort
1/21/2010	8:02	21.337	-160.562	18:25	21.388	-162.554	99.3	1	4.3
1/22/2010	7:36	21.420	-164.786	18:52	21.422	-166.748	109.6	0	4
1/23/2010	7:59	21.400	-168.862	19:05	21.354	-170.850	111.1	1	3.3
1/24/2010	8:31	21.307	-172.862	19:15	21.198	-174.671	98.4	2	4.2

Date (Local)	Start Time	Start Location		End Time	End Location		Distance Surveyed (nmi)	Total # Sightings	Average Beaufort
1/25/2010	8:36	21.068	-176.909	14:12	21.009	-177.793	45.4	1	6
1/26/2010	No Effort							0	7+
1/27/2010	7:49	20.822	179.737	18:48	20.660	177.964	99.5	0	4.8
1/28/2010	7:58	20.523	175.952	19:10	20.239	174.004	105.7	3	3.3
1/29/2010	No Effort							0	7+
1/30/2010	8:27	19.413	167.936	18:37	19.282	166.667	73.6	3	5.1
1/31/2010	7:43	18.922	165.186	18:55	18.503	163.353	105.9	0	4.8
2/1/2010	7:48	17.980	161.194	19:12	17.573	159.567	87.7	3	4
2/2/2010	11:32	16.918	157.072	18:22	16.647	156.090	53.2	2	4.3
2/3/2010	7:19	16.028	153.894	17:47	15.601	152.719	56.6	5	2.6
2/4/2010	7:36	15.108	150.794	19:00	14.522	148.898	114.9	1	4.6
2/5/2010	6:48	13.840	146.770	17:29	13.277	145.061	102	3	4.8
2/6/2010	6:57	13.258	144.862	10:21	13.441	144.539	22.4	0	3.9
Total:							1285.3	25	3.8

Biopsy and Photo Data Collection

The *Sette*'s Safeboat was launched on two occasions for biopsy sampling and photography of sighted animals. Time and weather limitations prevented more small boat launch events. A single biopsy sample was collected from a sei whale in the waters off of Wake Island. The sample was collected from the Safeboat using a dart fired from a crossbow.

Photographs were collected during 10 of the 25 cetacean group encounters. A total of 626 photos were collected. Most of the photos were collected from flying bridge or bow of the *Sette*. Some of these photos will be used for individual identifications.

Table 2: Cetacean sightings during survey from Hawaii to Guam (OES10-01) in January and February 2010.

Date (Local)	Sight #	Species	Effort	Lat	Long	Average Group Size	Behavior Notes	Biopsy?	Photos?
1/21/2010	1	Physeter macrocephalus	ON	21.355	161.130	2	Slow travel	No	Yes
1/23/2010	2	B. borealis/ edeni	ON	21.354	170.718	2	travel; breach	No	No
1/24/2010	IO- 01	Unidentified small whale	ON	21.297	173.015	1	n/a	No	No
1/24/2010	3	Unidentified rorqual	ON	21.286	173.121	2	fast travel	No	No
1/25/2010	4	Stenella coeruleoalba	ON	21.068	176.912	45	porpoising	No	No
1/28/2010	5	Unidentified rorqual	ON	20.515	175.900	1	blows	No	No

1/28/2010	6	Unidentified small dolphin	ON	20.448	175.466	1	single leap	No	No
1/28/2010	7	Unidentified small dolphin	ON	20.376	175.059	2	single leap	No	No
1/30/2010	8	B. borealis/ edeni	ON	19.305	167.210	1	blow	No	No
1/30/2010	9	Balaenoptera borealis	ON	19.255	166.630	3	blow	Yes	Yes
1/30/2010	10	Unidentified rorqual	ON	19.287	166.667	1	blow	No	No
2/1/2010	11	Balaenoptera borealis	ON	17.923	160.960	2	blows; slow travel	No	Yes
2/1/2010	12	Physeter macrocephalus	ON	17.876	160.613	4	logging; fluke up dive; breach	No	No
2/1/2010	13	Physeter macrocephalus	ON	17.708	160.108	1	slow travel; blows	No	Yes
2/2/2010	14	Balaenoptera borealis	ON	16.865	156.885	1	slow travel	No	Yes
2/2/2010	15	Balaenoptera borealis	OFF	16.806	156.669	3	fast travel; wave riding	No	Yes
2/3/2010	16	Pseudorca crassidens	ON	15.821	153.186	5	porpoising	No	Yes
2/3/2010	17	Unidentified medium dolphin	ON	15.796	153.185	6	n/a	No	Yes
2/3/2010	18	B. borealis/edeni	OFF	15.717	153.142	1	blows	No	Yes
2/3/2010	19a	Unidentified medium dolphin	ON	15.742	153.049	63	fast travel	No	Yes
2/3/2010	19b	Mesoplodon sp.	ON	15.724	152.015	3	logging; slow travel	No	No
2/3/2010	20	Unidentified rorqual	ON	15.603	152.739	1	blows	No	No
2/4/2010	21	Unidentified rorqual	OFF	15.094	150.754	1	blow	No	No
2/5/2010	22	Unidentified rorqual	OFF	13.811	146.683	1	blow	No	No
2/5/2010	23	Peponocephala electra	ON	13.417	145.485	53	slow travel; avoidance, porpoising	No	Yes
2/5/2010	24	Unidentified dolphin	ON	13.278	145.064	2	porpoising	No	No

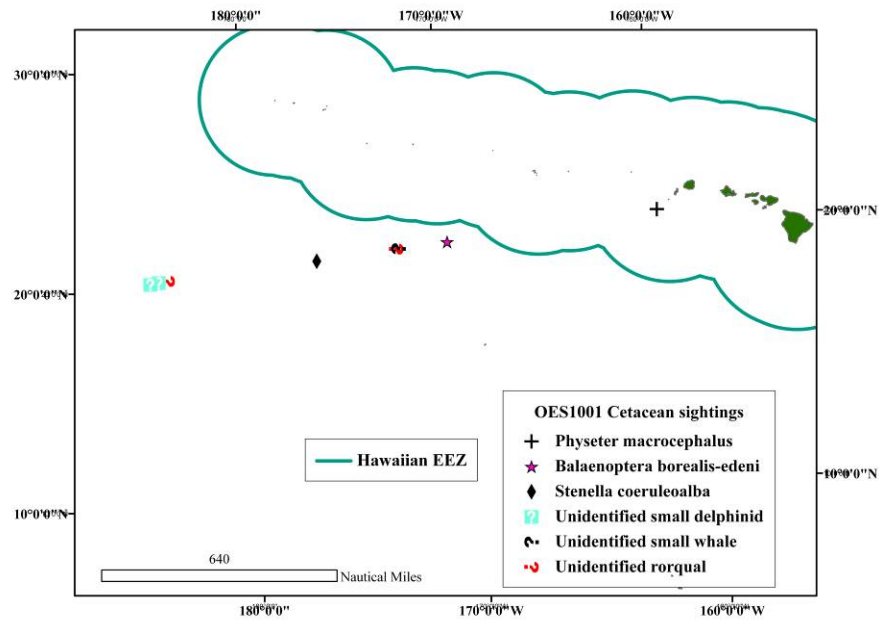


Figure 2: Cetacean sightings during OES 10-01 transit from Oahu to Guam, 21-28 January 2010.

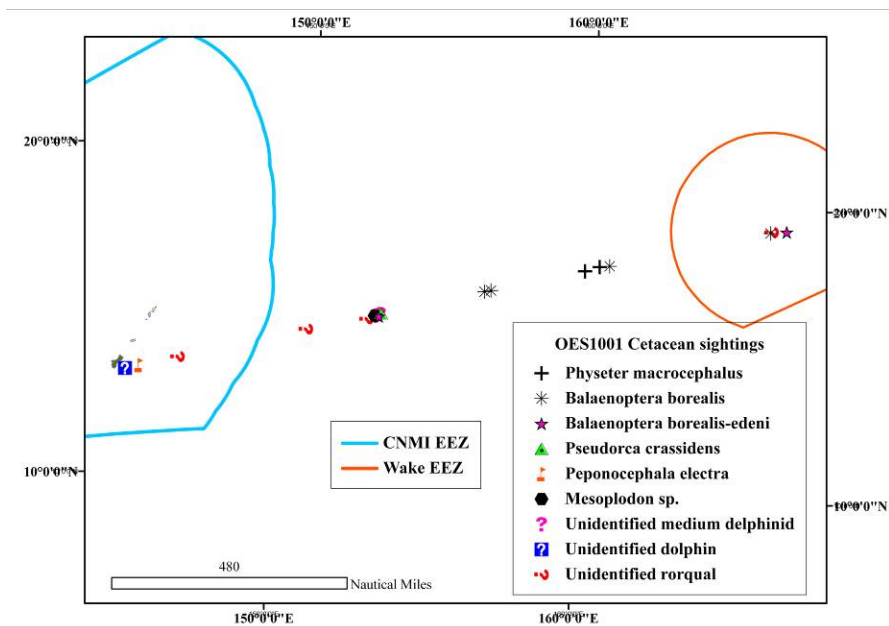


Figure 3: Cetacean sightings during OES 10-01 transit from Oahu to Guam, 30 January – 6 February 2010.

Acoustic Surveys- Towed Array

The towed-array was deployed throughout the cruise collecting nearly continuous high-frequency clean acoustic data from the four hydrophones (Figure 4). Over 100 acoustic detections were noted, consisting primarily of sperm and minke whales. Initial problems with

overnight recordings were eliminated by recording on only two hydrophone channels during the night surveying.

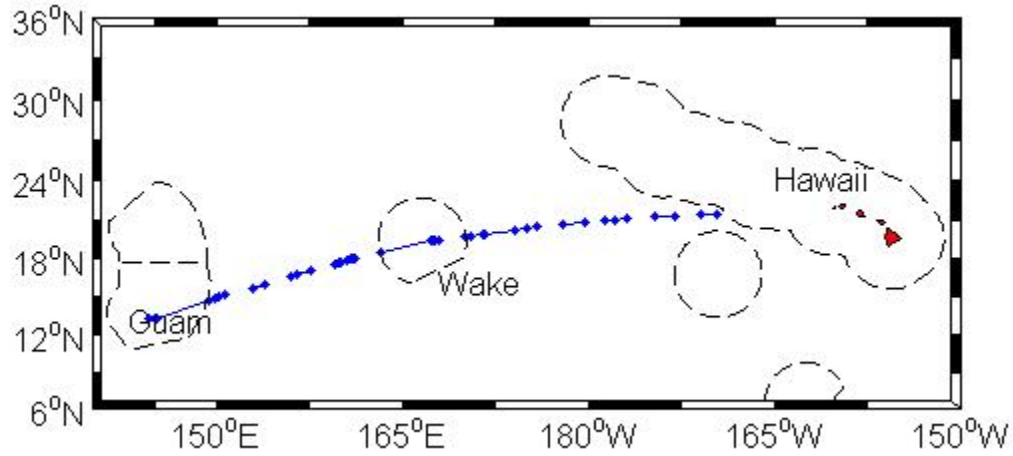


Figure 4: Acoustic towed array effort during OES 10-01 transit from Oahu to Guam

Acoustic Survey- Sonobuoys

Thirty-seven sonobuoys were deployed over 15 days. Cetacean vocalizations detected on sonobuoys included humpback, sperm, minke, fin, and sei whales, and possible delphinid clicks and whistles.

Table 3. Acoustic detections of cetaceans on sonobuoys during OES10-01.

SB #	Date	Time	Sonobuoy Location		Depth (m)	Species heard				
			Latitude	Longitude		Humpback	Minke	Fin	Sperm	Other
1	21-Jan	20:02	21 20.727	-160 57.103	Deep	x	x	x		
2	22-Jan	1:01	21 22.32	-161 55.71	2967	x	x		x	dolphins
3	22-Jan	4:31	21 23.28	-162 34.48	4641		x			
4	22-Jan	19:06	21 25.33	-165 5.22	4696	x	x			
5	23-Jan	1:10	21 25.29	-166 9.05	4654		x			
6	23-Jan	3:58	21 25.29	-166 36.38	4654		x			
7	23-Jan	19:01	21 23.75	-169 2.72	4348	x	x			
8	24-Jan	1:05	21 22.26	-170 8.75	4810					
9	24-Jan	1:18	21 22.21	-170 11.15	4376	x	x			
10	24-Jan	4:28	21 21.18	-170 44.72	4932	x	x			dolphins
11	24-Jan	18:56	21 18.22	-172 56.21	5239	x	x			dolphins
12	25-Jan	0:58	21 14.07	-173 56.962	5362	x	x			
13	25-Jan	19:09	21 3.59	-176 59.82	5563		x			
14	26-Jan	1:59	21 0.03	-177 54.83	3483					
15	26-Jan	21:00	20 49.73	179 34.97	N/A		x	x	x	
16	27-Jan	3:02	20 43.84	178 35.555	N/A		x	x	x	
17	27-Jan	19:28	20 30.45	175 51.85	N/A		x		x	
18	28-Jan	2:02	20 18.12	174 34.16	N/A		x		x	
19	28-Jan	21:01	19 50.69	171 41.69	N/A		x			

SB #	Date	Time	Sonobuoy Location		Depth (m)	Species heard				
			Latitude	Longitude		Humpback	Minke	Fin	Sperm	Other
20	29-Jan	2:14	19 47.549	170 50.228	N/A					
21	29-Jan	19:52	19 24.174	167 51.825	N/A		x		x	dolphins
22	30-Jan	2:04	19 14.907	166 45.5	N/A					
23	30-Jan	2:10	19 14.882	166 44.261	5673		x			
24	30-Jan	6:49	19 14.902	166 38.372	1958		x			
25	30-Jan	21:04	18 52.432	164 58.583	N/A		x			
26	31-Jan	1:48	18 14.196	164 13.34	1107		x	x	x	
27	31-Jan	5:08	18 34.36	163 39.591	320		x		x	
28	31-Jan	20:57	17 55.791	160 59.236	N/A		x		x	dolphins
29	1-Feb	1:51	17 47.162	160 22.051	1288		x		x	dolphins
30	1-Feb	5:34	17 37.926	159 51.208	758		x		x	
31	1-Feb	22:14	17 3.064	157 27.997	554					
32	1-Feb	22:23	17 2.368	157 25.985	1366					
33	1-Feb	23:47	16 57.539	157 11.88	N/A		x			
34	2-Feb	4:07	16 47.847	156 36.482	772		x			
35	3-Feb	22:06	15 56.455	153 35.621	N/A		x		x	
36	3-Feb	3:11	15 44.458	153 4.561	N/A		x		x	dolphins
37	4-Feb	22:12	15 1.538	150 31.744	N/A		x			

Task 2: Cetacean surveys during the Ecosystem Observation Program’s oceanography cruise in the waters of Micronesia and the Commonwealth of the Northern Mariana Islands, 20 March to 11 April (OES10-03).

Visual observations for cetaceans occurred during transit periods of a 23 day oceanography survey around Guam and southern portion of the Northern Mariana Islands. Detailed information on all projects occurring during this cruise can be found in the survey Cruise Report (available on request).

Methods

Visual Surveys

A team of two visual observers searched for cetaceans during daylight hours when the ship was transiting at least 8 kts. One observer used 25X binoculars to search 100° forward of the vessel from 90° (abeam) to 10° on the opposite side of the trackline. The other observer used unaided eye and 7X binoculars to search the 180° forward of the ship out to 300m, with a search emphasis on the trackline. This observer also served as data recorder. Observers rotated positions every 30 minutes. Right or left 25X binocular was chosen based on the least amount of glare or wind affecting the field of view.

Visual search was conducted during daylight hours whenever the ship was moving at ≥ 8 knots so that the data would be comparable to other line-transect survey data. There were frequent breaks in the visual search during the day when the ship stopped in order to conduct CTDs or when the ship speed was reduced to 3-5 knots for fisheries acoustic transects.

Results

Visual Surveys

On effort surveys were conducted over 21 days and covered 792 nmi of trackline (Table 3, Figure 5). The observer team encountered 9 cetacean groups and was able to identify 3 to species (Table 4, Figure 6). Neither photos nor biopsy samples were collected during any of the encounters, as cetacean observation was ancillary to the primary cruise objectives and there was no time available to stop the ship for photographing groups or collecting biopsies.

Table 4: Cetacean survey data collected during transit period of an oceanographic survey around Guam and the southern portion of the Northern Mariana Islands (OES10-03)

Date (Local)	Start Time	Start Location		End Time	End Location		Distance Surveyed (nmi)	Total # Sightings	Average Beaufort
3/20/2010	11:31	13.447	144.501	18:31	12.969	143.800	36.9	0	5.5
3/21/2010	6:47	10.994	143.801	17:20	10.001	144.112	36.8	0	5.9
3/22/2010	No Effort							0	7+
3/23/2010	11:48	9.973	146.593	12:19	9.999	146.662	4.4	0	5
3/24/2010	7:56	10.539	146.648	18:20	11.174	146.667	42.8	0	6

Date (Local)	Start Time	Start Location		End Time	End Location		Distance Surveyed (nmi)	Total # Sightings	Average Beaufort
3/25/2010	7:37	11.545	146.666	18:19	12.235	146.666	36.9	0	5.7
3/26/2010	7:28	12.514	146.671	18:16	13.242	146.665	45	0	5.9
3/27/2010	7:26	13.522	146.672	18:17	14.235	146.667	47.8	1	5.6
3/28/2010	7:27	14.541	146.668	18:16	15.220	146.667	47.3	0	4.8
3/29/2010	7:18	15.535	146.668	18:22	16.238	146.667	53.4	0	2.8
3/30/2010	7:21	16.510	146.663	18:07	17.000	146.037	56.7	5	1.8
3/31/2010	No Effort							0	7+
4/1/2010	No Effort							0	7+
4/2/2010	7:36	15.516	143.809	18:12	14.798	143.800	4	0	6
4/3/2010	7:27	14.497	143.797	18:26	13.750	143.801	42.8	0	5.7
4/4/2010	7:44	13.501	144.646	18:28	13.298	143.801	51.5	1	4.8
4/5/2010	7:26	12.991	143.801	18:19	12.252	143.799	40.3	0	5.4
4/6/2010	7:32	11.993	143.798	18:20	11.255	143.800	39.4	1	5
4/7/2010	7:28	11.001	143.791	18:12	10.283	143.800	41	1	5.7
4/8/2010	7:27	10.003	143.810	18:20	10.002	144.984	47.2	0	5.3
4/9/2010	7:11	10.254	145.227	16:55	10.999	145.233	42	0	5.1
4/10/2010	6:32	11.528	145.235	18:30	12.433	145.233	54.5	0	5.4
4/11/2010	7:30	12.776	145.238	17:30	13.455	145.233	21.3	0	6.5
Total:							792.0	9	4.5

Table 5: Cetacean sightings during transit between oceanographic operations (OES10-03). No photo-ID or biopsy operations were conducted during this effort.

Date (Local)	Sight #	Species	Effort	Time (Local)	Lat	Long	Average Group Size	Behavior Notes
3/27/2010	1	Unidentified. small dolphin	ON	13:20	14.000	146.733	15	Slow travel; milling
3/30/2010	2	Unidentified dolphin	ON	7:24	16.524	146.664	12	Feeding
3/30/2010	3	Unidentified medium dolphin	ON	7:27	16.524	146.664	1	Slow travel;
3/30/2010	4	Unidentified small dolphin	ON	10:07	16.786	146.663	12	leap; slow travel
3/30/2010	5	Grampus griseus	ON	11:25	16.968	146.669	3	Slow travel; rest
3/30/2010	6	Globicephala macrorhynchus	ON	15:26	17.001	146.370	23	Slow travel
4/4/2010	7	Unidentified dolphin	ON	11:36	13.504	144.032	4	slow travel
4/6/2010	8	Stenella coeruleoalba	ON	17:35	11.384	143.800	6	porpoising
4/7/2010	9	Stenella coeruleoalba	ON	18:11	10.286	143.800	12	breach; head slap

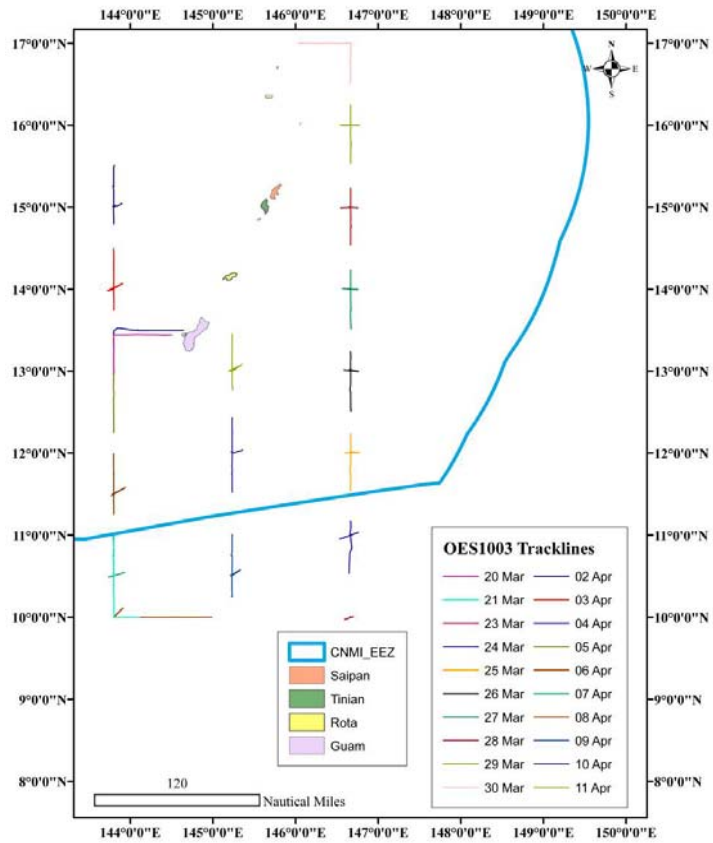


Figure 5: Survey tracklines during OES 10-03, 20 March – 11 April, 2010.

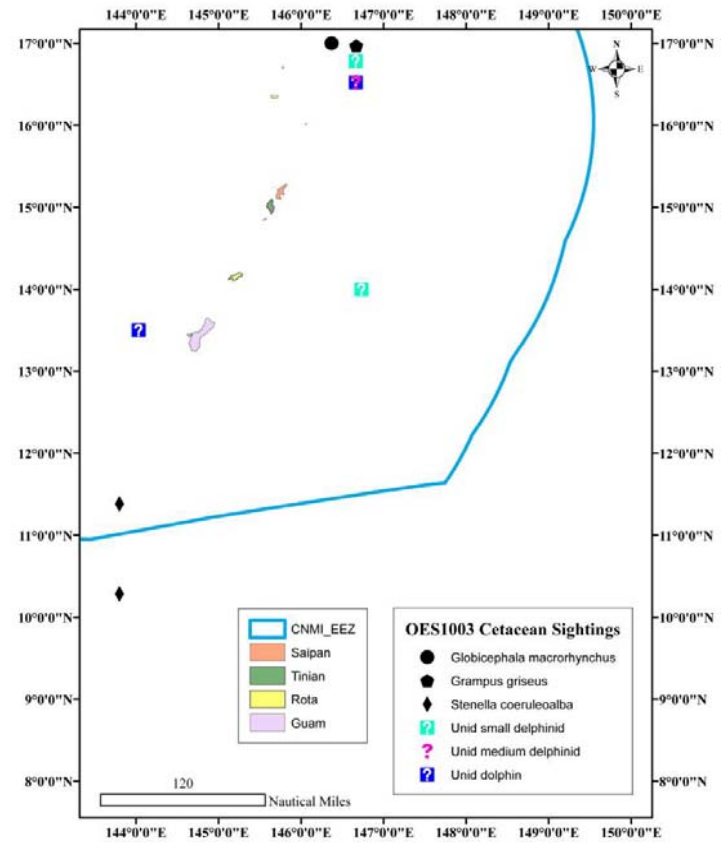


Figure 6: Cetacean sightings during OES 10-03, 20 March – 11 April 2010.

Task 3: Cetacean visual and acoustic observations during the high-seas survey between Honolulu and Guam, 19 April to 3 May (OES10-04).

Visual and acoustic observations for cetaceans occurred during an 17 day transit from Guam to Hawaii aboard the NOAA *R/V Oscar Elton Sette*. Detailed information on all projects occurring during this cruise can be found in the survey Cruise Report (<http://www.pifsc.noaa.gov/cruise/Sette/CR1004-MCH.pdf>). Visual and acoustic data collection methods are identical to that described in Task 1 and are not repeated here.

Results

Visual Surveys

The *R/V Sette* surveyed 1285 nmi of trackline over 16 days. On-effort surveys were completed during 14.5 days (Table 5, Figure 7). The visual observer teams encountered 21 cetacean groups (Table 6; Figures 8 and 9) and obtained group size estimates for all groups. One of the sightings was made by an independent observer. Sixteen of the 21 cetacean groups were identified to species. Time and weather limitations prevented the ship's approach of more of the sighted cetacean groups.

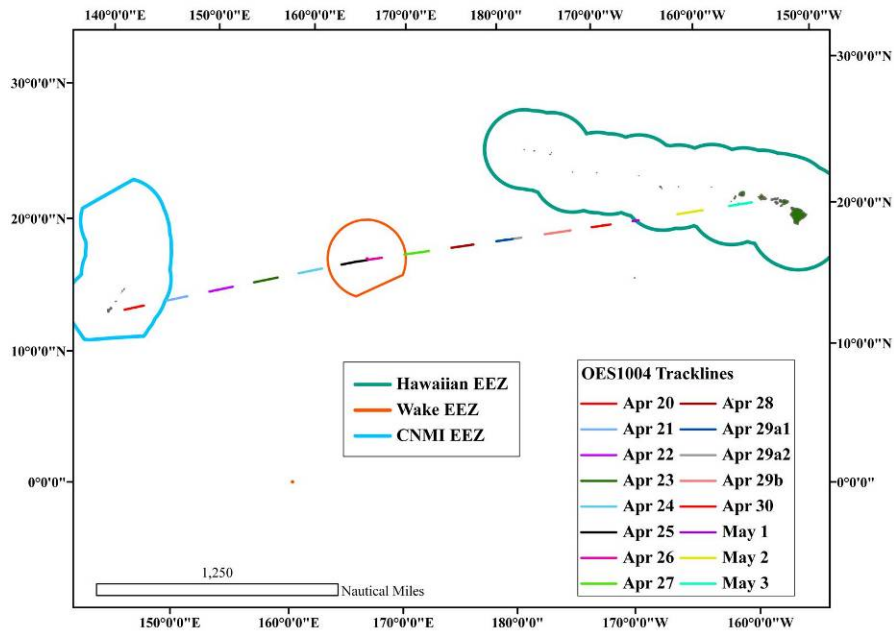


Figure 7: Survey tracklines during OES 10-04 transit from Guam to Oahu, 20 April – 3 May 2010.

Table 6: On-Effort survey data during OES 10-04, transit from Guam to Oahu. April 29 (local time) was repeated after crossing the international dateline.

Date (Local)	Start Time	Start Location		End Time	End Location		Distance Surveyed	Total # Sightings	Average Beaufort
4/20/2010	6:27	13.592	146.014	18:15	14.078	147.504	73.8	0	5.9
4/21/2010	6:02	14.656	149.328	18:00	15.179	151.029	85	0	5.9
4/22/2010	5:36	15.726	152.859	17:44	16.291	154.818	115	0	5.4
4/23/2010	6:19	16.807	156.674	17:30	17.347	158.690	120.1	0	5.6
4/24/2010	6:07	17.817	160.542	18:17	18.323	162.592	107.9	1	4.9
4/25/2010	5:42	18.732	164.347	18:09	19.164	166.527	126.4	0	5.4
4/26/2010	7:48	19.250	166.693	17:51	19.420	167.984	74.4	1	4.3
4/27/2010	6:27	19.728	170.080	18:30	20.027	172.300	125	1	3.8
4/28/2010	6:06	20.282	174.380	18:30	20.504	176.394	108.2	0	4.2
4/29/2010a	5:39	20.711	178.511	18:20	20.905	-179.204	110.9	5	2.4
4/29/2010b	5:29	21.060	-177.048	17:53	21.195	-174.732	119.8	4	2.5
4/30/2010	6:20	21.292	-172.765	18:30	21.345	-171.107	78	2	2.5
5/1/2010	5:59	21.393	-169.129	9:11	21.403	-168.595	29.9	0	4.5
5/2/2010	5:37	21.421	-165.184	18:00	21.396	-163.019	120.7	0	5
5/3/2010	6:25	21.342	-160.754	18:30	21.274	-158.902	73.7	6	3.2
Total:							1468.8	20	4.4

Biopsy and Photo Data Collection

The *Sette*'s small boat was launched on one occasion for biopsy sampling and photography of a group of pilot whales. Time and weather limitations prevented more small boat launch events. Two biopsy sampling attempts were made during this launch, but no samples were collected. Photographs were collected during 10 of the 21 cetacean group encounters. A total of 1243 photos were collected. Most of the photos were collected from flying bridge or bow of the *Sette*. Over 200 photos were taken from the small boat during the pilot whale encounter. Most of these photos will be used for individual identification.

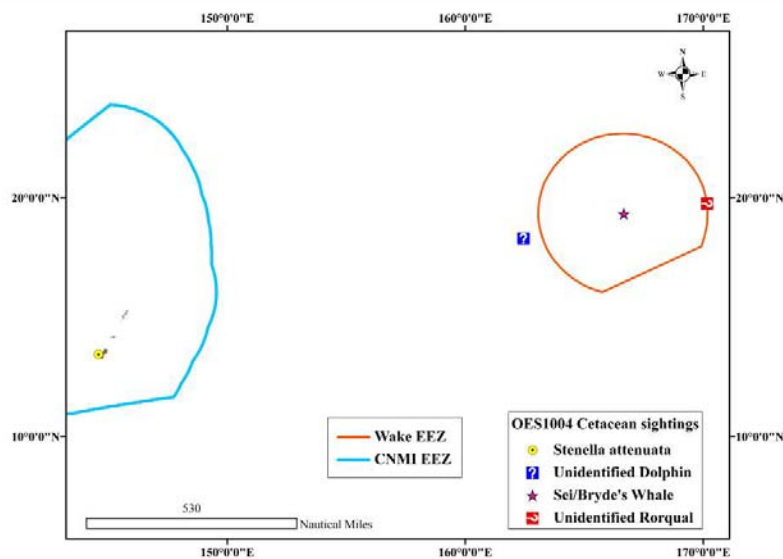


Figure 8: Cetacean sightings during OES 10-04 transit from Guam to Oahu, 19-27 April 2010.

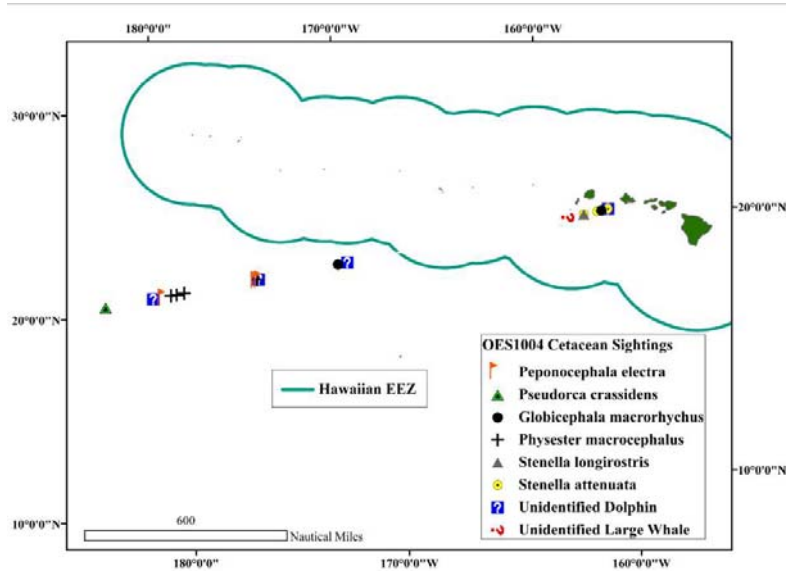


Figure 9: Cetacean sightings during OES 10-04 transit from Guam to Oahu, 28 April – 3 May 2010.

Table 7: Cetacean sightings during survey from Guam to Hawaii (OES10-04). April 29 (local time) was repeated after crossing the international dateline.

Date (Local)	Sight #	Species	Effort	Time (Local)	Lat	Long	Average group size	Behavior Notes	Biopsy?	Photos?
4/19/2010	1	Stenella attenuata	OFF	15:52	13.430	144.587	25	bow riding	No	No
4/24/2010	2	Unidentified dolphin	ON	17:25	18.289	162.449	2	n/a	No	No
4/26/2010	3	B. borealis/edeni	ON	9:13	19.318	166.662	1	blows	No	No
4/27/2010	4	Unidentified roqual	OFF	6:55	19.740	170.163	1	blows	No	No
4/28/2010	5	Pseudorca crassidens	ON	15:50	20.481	176.176	9	travel; mill; breach	No	Yes
4/29/2010a	6	Unidentified dolphin	ON	6:27	20.726	178.672	n/a	n/a	No	No
4/29/2010a	7	Peponocephala electra	ON	10:06	20.782	179.306	51	fast travel; avoidance	No	Yes
4/29/2010a	8	Physeter macrocephalus	ON	12:05	20.804	179.591	21	logging; blowing; fluking	No	No
4/29/2010a	9	Physeter macrocephalus	ON	13:41	20.824	179.886	14	blows; slow travel	No	No
4/29/2010a	10	Physeter macrocephalus	ON	15:45	20.864	-179.719	7	blows; logging	No	No

Date (Local)	Sight #	Species	Effort	Time (Local)	Lat	Long	Average group size	Behavior Notes	Biopsy?	Photos?
4/29/2010b	11	Physeter macrocephalus	ON	11:15	21.129	-175.941	12	blows; logging; fluking	No	Yes
4/29/2010b	12	Peponocephala electra	ON	11:37	21.132	-175.871	72	milling; porpoising	No	Yes
4/29/2010b	13	Unidentified dolphin	ON	11:41	21.132	-175.871	3	social; porpoise	No	Yes
4/29/2010b	14	Peponocephala electra	ON	12:55	21.142	-175.706	43	travel	No	Yes
4/30/2010	15	Globicephala macrorhynchus	ON	11:26	21.321	-171.848	20	slow travel; logging; avoidance at 10m distance	Yes	Yes
4/30/2010	16	Unidentified dolphin	ON	16:54	21.337	-171.381	8	slow travel;	No	No
5/3/2010	17	Unidentified large whale	ON	6:28	21.341	-160.744	2	blows	No	No
5/3/2010	18a	Stenella attenuate	ON	10:35	21.315	-160.009	59	milling; feeding; moderate travel; avoidance	No	Yes
5/3/2010	18b	Stenella longirostris	ON	10:35	21.315	-160.009	1	spinning	No	No
5/3/2010	19	Stenella attenuata	ON	14:30	21.295	-159.406	54	n/a	No	Yes
5/3/2010	20	Globicephala macrorhynchus	ON	16:09	21.287	-159.207	25	slow travel; avoidance	No	Yes
5/3/2010	21a	Stenella attenuata	ON	18:29	21.274	-158.906	6	slow travel	No	No
5/3/2010	21b	Unidentified dolphin	ON	18:29	21.274	-158.906	17	slow travel	No	No

Acoustic Surveys- Towed Array

Over 150 hours of clean acoustic data were recorded from the four hydrophones. Sixty-seven acoustic detections were noted (Figure 10), consisting primarily of sperm and minke whales. Other acoustic detections include pilot whales (*Globicephala macrorhynchus*), melon-headed whales (*Peponocephala electra*), and false killer whales (*Pseudorca crassidens*). In addition, 6 acoustic detections matched the sightings of the visuals team.

Two channel of acoustic towed-array data was collected during the night-time portion of the transit. The incoming data stream was not monitored. During the night of 25 April, the *Sette* made a circuit around Wake Island, approximately 10 nmi offshore while making acoustic recordings on the towed array.

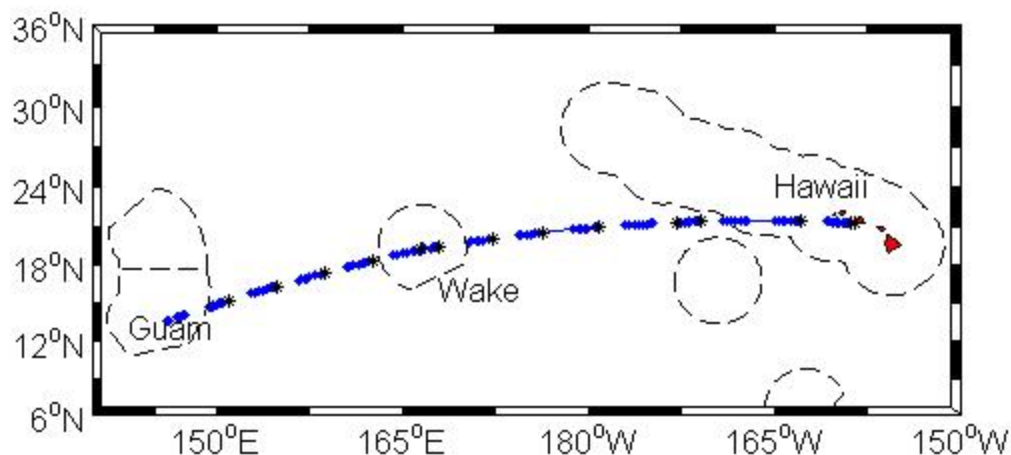


Figure 10: Acoustic towed array effort during OES 10-04, transit from Guam to Oahu

Acoustic Surveys- Sonobuoys

Thirty-seven sonobuoys were deployed over 15 days (Table 7). Cetacean vocalizations detected on the sonobuoys included delphinid whistles and sperm, minke, and sei whales.

Table 8: Acoustic detections of cetaceans on sonobuoys during OES 10-04. April 29 (local time) was repeated after crossing the international dateline.

SB #	Date (Local)	Time (Local)	Sonobuoy Location		Water depth (m)	Species heard			
			Lat	Long		Minke	Sperm Whale	Call X (probable Sei)	Other
SB01	20-Apr	12:18	13.808	146.673	n/a				
SB02	20-Apr	15:17	13.930	147.049	8047	x		x	
SB03	20-Apr	18:45	14.100	147.577	5852	x			
SB04	21-Apr	09:11	14.799	149.796	7315				
SB05	21-Apr	12:15	14.910	150.148	7315	x	x		
SB06	21-Apr	17:07	15.137	150.891	7315	x			dolphins
SB07	22-Apr	08:56	15.890	153.400	5669	x			
SB08	22-Apr	13:13	16.088	154.100	5940			x	
SB09	22-Apr	17:09	16.265	154.724	5000			x	
SB10	23-Apr	09:07	16.930	157.130	6000	x			
SB11	23-Apr	13:12	17.114	157.809	6200	x		x	
SB12	23-Apr	17:21	17.296	158.496	6000	x		x	
SB13	24-Apr	09:05	17.945	161.046	6000	x			
SB14	24-Apr	13:23	18.127	161.789	6000	x			
SB15	24-Apr	17:11	18.279	162.406	5000	x			
SB16	25-Apr	09:02	18.867	164.934	4000	x			
SB17	25-Apr	13:06	19.024	165.643	5800	x			

SB #	Date (Local)	Time (Local)	Sonobuoy Location		Water depth (m)	Species heard			
			Lat	Long		Minke	Sperm Whale	Call X (probable Sei)	Other
SB18	25-Apr	17:16	19.139	166.368	5700	x			
SB19	26-Apr	09:04	19.029	166.675	820	x	x		
SB20	26-Apr	17:05	19.400	167.847	5600	x			
SB21	27-Apr	09:04	19.796	170.555	5000	x	x		
SB22	27-Apr	16:57	19.990	172.012	1300	x			
SB23	28-Apr	08:59	20.341	174.905	4000	x			
SB24	28-Apr	12:59	20.423	175.635	4200	x		x	
SB25	28-Apr	17:20	20.485	176.231	4000	x			
SB26	29a-Apr	09:00	20.764	179.096	3700	x	x		
SB27	29a-Apr	13:10	20.811	179.789	2600	x			
SB28	29a-Apr	17:04	20.884	-179.469	3200	x	x		
SB29	29b-Apr	08:58	21.102	-176.376	4000	x	x		
SB30	29b-Apr	12:46	21.129	-175.867	6000				
SB31	30-Apr	17:00	21.186	-174.907	5980	x	x		
SB32	30-Apr	09:28	21.308	-172.214	5500	x	x		
SB33	30-Apr	17:09	21.338	-171.349	5450				
SB34	1-May	09:09	21.402	-168.608	5000	x			
SB35	1-May	17:13	21.418	-167.271	5200	x			
SB36	2-May	09:00	21.417	-164.643	5230	x		x	
SB37	2-May	17:13	21.399	-163.167	5200	x			dolphins

Task 4: Small boat surveys in the waters surrounding Guam, Saipan, and Tinian, 9 February to 3 March.

Small boat surveys were conducted near Guam, Tinian, and Saipan over 21 days to assess the occurrence of nearshore cetaceans in these waters. Small survey vessels were chartered at each island.

Methods

A team of three observers conducted surveys during daylight hours within the nearshore waters of Guam, Saipan, and Tinian and offshore to the extent that weather allowed. Observers scanned for cetaceans using naked eye, with occasional use of 7X binoculars. When cetaceans were sighted, the survey team conducted behavioral observations, photo-identification and biopsy sampling when possible.

Biopsy sample attempts were made on an opportunistic basis. Samples were collected using a crossbow and carbon-fiber Ceta-Dart bolts. The animals were either approached by the research vessel during normal survey operations or approached the vessel on their own. Necessary permits were present on the vessel and the Science Party complied with all permit requirements.

Photographs of cetaceans were taken on an opportunistic basis. These will be used to study social behavior and movement patterns of identified individuals and to study external features such as morphology or coloration patterns which may vary geographically. The photographed animals were either approached by the research vessel during normal survey operations or approached the vessel on their own. Necessary permits were present on the vessel and the Science Party complied with all permit requirements.

The vessels used during the surveys varied from a 17-foot whaler with a 2-stroke outboard engine to 30-40 foot boats with diesel inboard engines.

Results

Surveys were conducted in the waters surrounding Guam between February 9 and 18 (Table 8, Figure 11). Tracklines covered at total of 387 nmi. The observer team encountered 11 groups of cetaceans and identified 10 of the groups to species (Table 9, Figure 12). A total of 2769 photos and 8 biopsy samples were collected.

Table 9: Cetacean surveys in the waters around Guam.

Date (Local)	Start Time	Start Location		End Time	End Location		Distance Surveyed (nmi)	Total # Sightings	Average Beaufort
2/9/2010	07:24	13.374	144.643	12:43	13.368	144.644	37.9	2	3.8
2/10/2010	07:11	13.366	144.646	13:00	13.367	144.643	33.8	2	3.5
2/11/2010	07:11	13.367	144.648	13:06	13.367	144.644	37.3	2	3.9
2/12/2010	07:14	13.367	144.647	11:51	13.367	144.644	27.8	1	4.1
2/13/2010	06:39	13.367	144.648	14:06	13.368	144.643	46.7	1	3.4

Date (Local)	Start Time	Start Location		End Time	End Location		Distance Surveyed (nmi)	Total # Sightings	Average Beaufort
2/14/2010	06:38	13.366	144.647	12:46	13.368	144.642	40.5	1	3.8
2/15/2010	06:32	13.482	144.752	12:26	13.485	144.752	40.9	1	4.4
2/16/2010	05:53	13.478	144.751	11:54	13.487	144.753	41.7	0	5.1
2/17/2010	07:08	13.484	144.753	13:06	13.482	144.742	49.0	0	5.8
2/18/2010	06:44	13.366	144.647	13:54	13.369	144.641	31.6	1	4.0
Total:							387.1	11	4.2

Table 10: Guam cetacean sightings

Date (Local)	Sight #	Species	Effort	Time (Local)	Lat	Long	Average group size	Behavior Notes	Biopsy?	Photo?
2/9/2010	1	Stenella longirostris	ON	7:44	13.408	144.658	40	rest	No	Yes
2/9/2010	2	Stenella longirostris	ON	11:42	13.407	144.658	40	rest	No	Yes
2/10/2010	1	Stenella longirostris	ON	7:28	13.397	144.658	35	rest	No	Yes
2/10/2010	2	Stenella longirostris	ON	11:43	13.335	144.643	22	rest	No	Yes
2/11/2010	1	Stenella longirostris	ON	7:30	13.405	144.657	75	rest	No	Yes
2/11/2010	2	Unidentified medium dolphin	ON	10:24	13.375	144.624	1	slow travel	No	Yes
2/12/2010	1	Stenella longirostris	ON	7:41	13.396	144.658	85	rest	No	Yes
2/13/2010	1	Stenella longirostris	ON	7:02	13.408	144.656	55	rest	Yes	Yes
2/14/2010	1	Stenella longirostris	ON	7:05	13.407	144.657	60	rest	Yes	Yes
2/15/2010	1	Stenella attenuata	ON	10:15	13.529	144.612	17	travel	No	Yes
2/18/2010	1	Physester macrocephalus	ON	9:13	13.426	144.627	9	logging	Yes	Yes

Between February 22 and March 3, 325 nmi of trackline was surveyed in the waters surrounding Saipan and Tinian (Table 10, Figure 13). Seven cetacean groups were encountered and all were identified to species (Table 11, Figure 14). A total of 971 photos and 4 biopsy samples were collected.

Table 11: Cetacean surveys in the waters surrounding Saipan and Tinian.

Date (Local)	Start Time	Start Location		End Time	End Location		Distance Surveyed (nmi)	Total # Sightings	Average Beaufort
2/22/2010	06:41	13.220	144.724	13:34	15.224	145.723	52.1	2	3.1
2/23/2010	06:40	15.223	145.723	13:35	15.224	145.722	48.7	3	3.4
2/24/2010	06:40	15.225	145.722	13:04	15.224	145.723	55.6	0	4.4
2/25/2010	06:43	15.225	145.721	13:50	15.223	145.723	54.0	1	4.0
3/2/2010	06:34	15.221	145.723	13:35	15.223	145.723	57.8	0	5.5
3/3/2010	06:43	15.222	145.723	13:45	15.224	145.723	57.8	1	4.0
Total:							325.9	7	4.1

Table 12: Cetacean sightings around Saipan and Tinian.

Date (Local)	Sight #	Species	Effort	Time (Local)	Lat	Long	Average group size	Behavior Notes	Biopsy?	Photos?
2/22/2010	1	Stenella longirostris	ON	7:04	15.249	145.702	6	slow travel	No	Yes
2/22/2010	2	Stenella longirostris	ON	9:40	15.439	145.884	36	mill	Yes	Yes
2/23/2010	1	Stenella longirostris	ON	8:38	15.265	145.835	10	bow ride	Yes	Yes
2/23/2010	2	Stenella longirostris	ON	9:51	15.179	145.789	32	mill	Yes	Yes
2/23/2010	3	Stenella longirostris	ON	11:33	15.106	145.757	35	mill	No	Yes
2/25/2010	1	Physeter macrocephalus	ON	8:20	15.346	145.559	6	logging	Yes	Yes
3/3/2010	1	Stenella longirostris	ON	9:02	15.424	145.428	12	mill	No	Yes

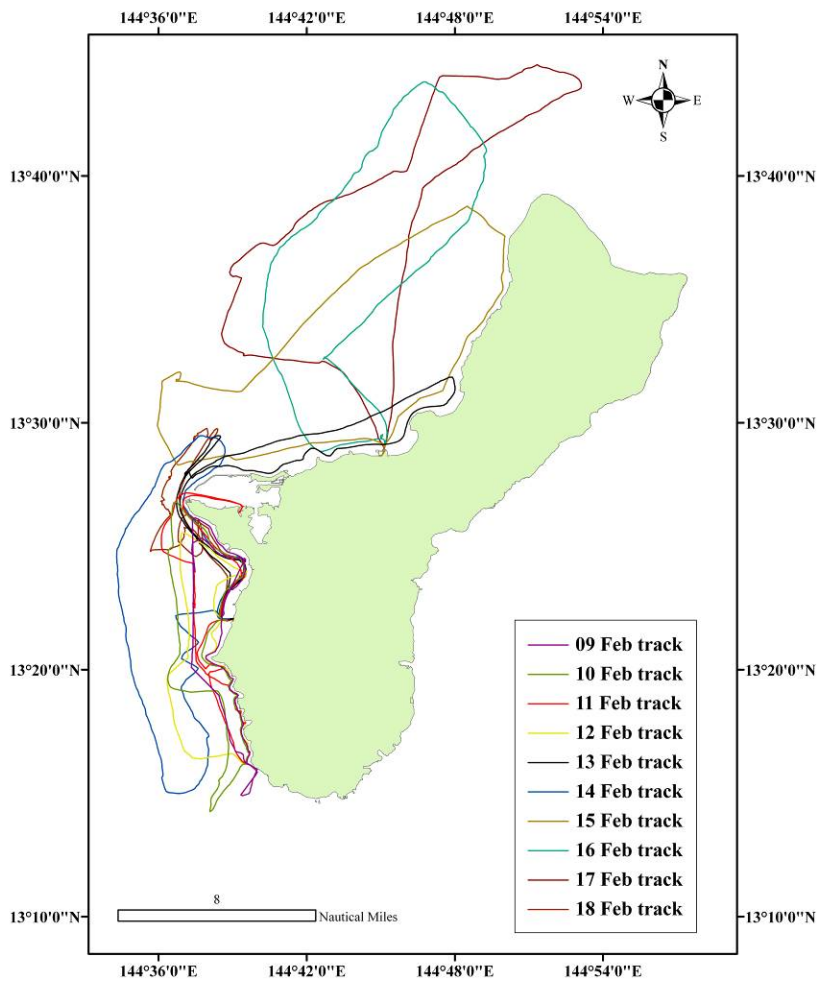


Figure 11: Survey tracklines in the waters surrounding Guam, 9-18 February 2010.

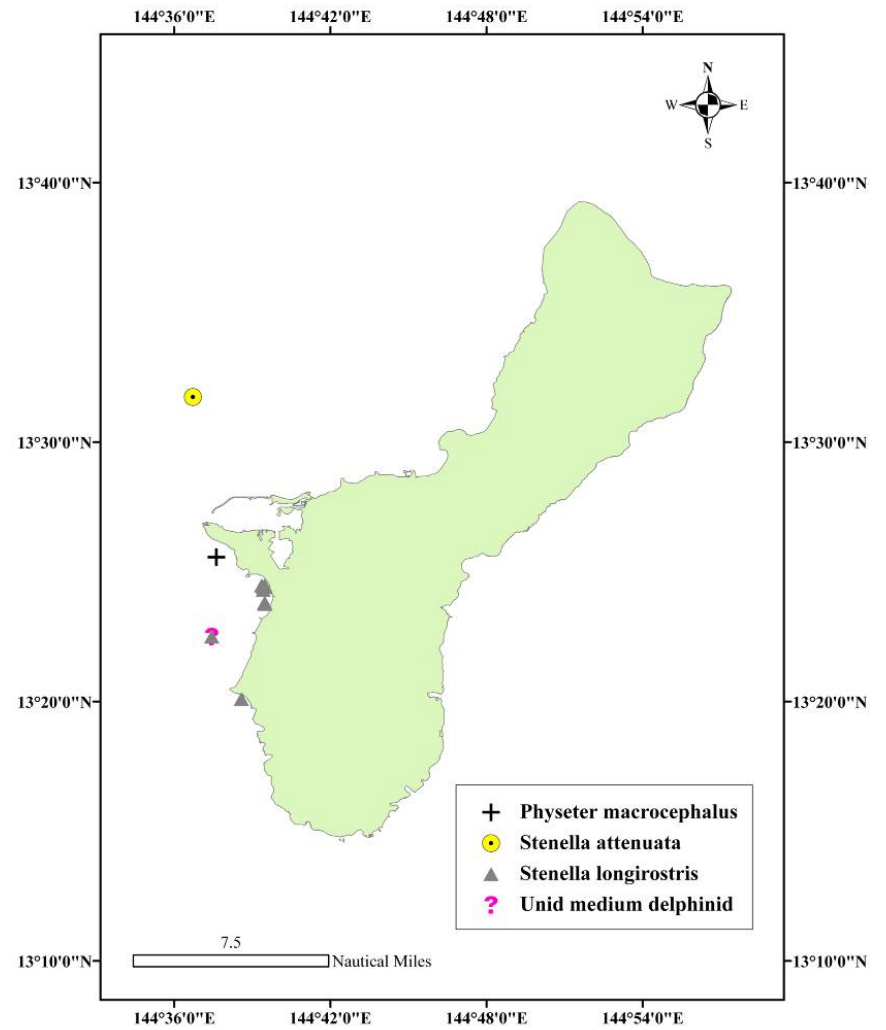


Figure 12: Cetacean sightings off Guam, 09-18 February 2010.

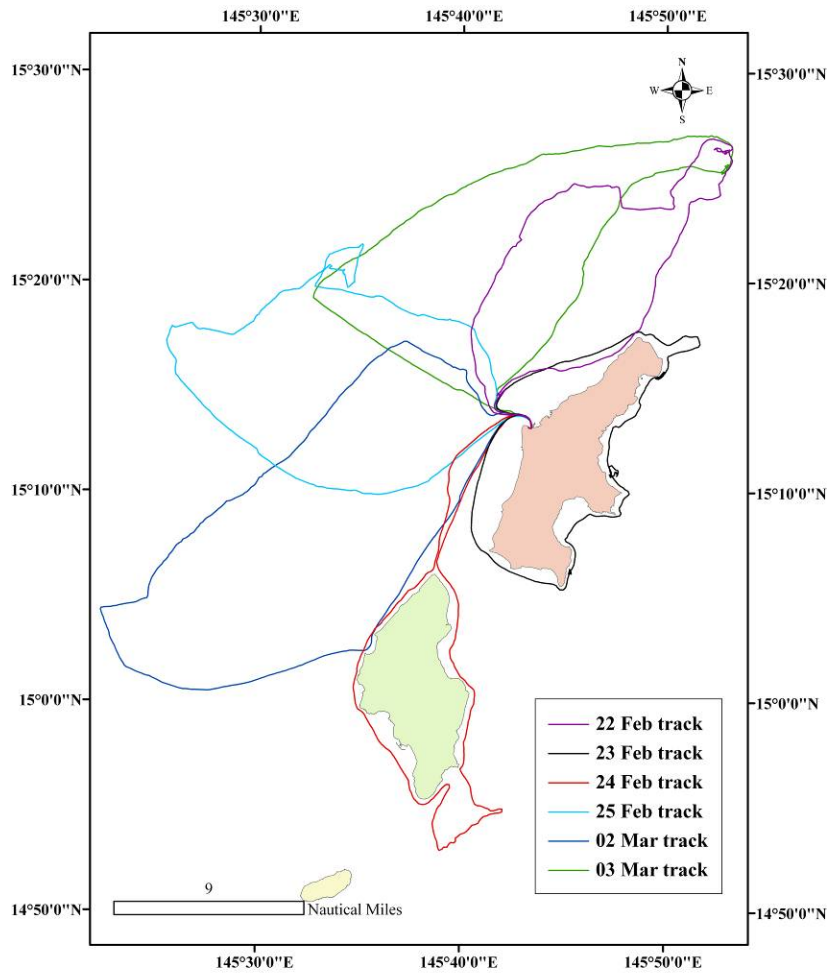


Figure 13: Survey tracklines in the waters surrounding Saipan (pink) and Tinian (green), 22 February – 03 March, 2010.

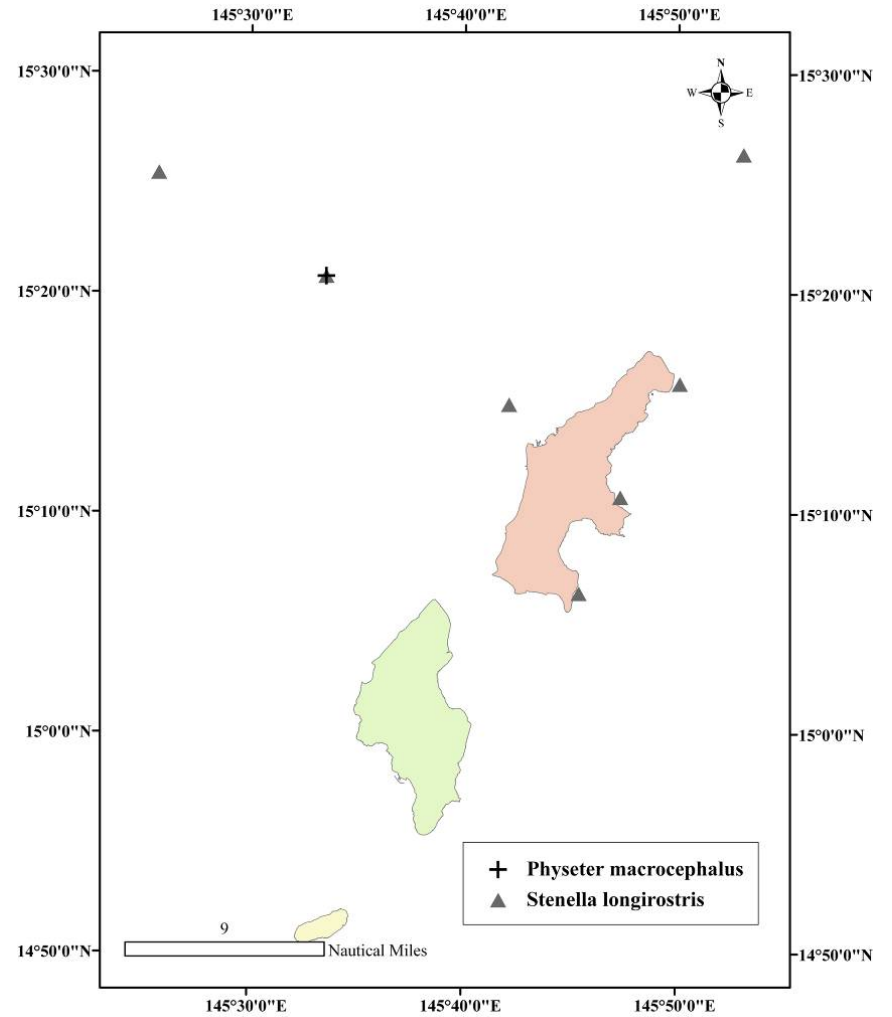


Figure 14: Cetacean sightings off Saipan (pink) and Tinian (green), 22 February – 03 March, 2010.