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CRUISE REPORT¹

VESSEL: NOAA Ship *Oscar Elton Sette*, Cruise SE-12-03

CRUISE PERIOD: 23 April–17 May 2012

AREA OF OPERATION: Palmyra Atoll Exclusive Economic Zone (EEZ) (Figs. 1 and 2)

TYPE OF OPERATION: Cetacean line-transect abundance surveys in the Palmyra Atoll EEZ

ITINERARY:

23 April Embarked scientists Oleson, Rowlett, Yin, Ligon, Deakos, Reeb, U, Force, Joyce, Jacobson, Barkley, Coates, Norris, Bradford and Giuseffi. Depart Pago Pago, American Samoa at 0700. Transited to Palmyra Atoll EEZ study area. Conducted visual and acoustic surveys during daylight hours. Dropped expendable bathythermograph (XBT) at 1200 and 1500 and cast conductivity-temperature-depth (CTD) and sonobuoy at dusk.

24–28 April Continued transit to Palmyra Atoll EEZ study area. Conducted visual and acoustic surveys during daylight hours. Dropped XBT at 0600, 0900, 1200, and 1500 and cast CTD and sonobuoy at dusk.

29 April–12 May Surveyed the Palmyra Atoll EEZ study area. Conducted visual and acoustic surveys during daylight hours along standard transect lines. Conducted CTD cast before and after daytime operations. Dropped XBT at 0900, 1200, and 1500 and sonobuoy at dusk.

13–16 May Left Palmyra Atoll EEZ study area and transited to Pearl Harbor, HI. Conducted visual and acoustic surveys during daylight hours on transit course. Dropped XBT at 0600, 0900, 1200, and 1500 and cast CTD and sonobuoy at dusk.

¹PIFSC Cruise Report CR-12-004
Issued 29 June 2012



17 May

Returned to Pearl Harbor, HI. Disembarked all scientific personnel.

MISSIONS AND RESULTS:

A. Cetacean line-transect survey

1. *Methods*

Line-transect survey methods were used to collect cetacean data for abundance estimation.

Search effort began on a given trackline at the beginning of each day. The ship travelled at 8-10 knots (through the water) along the designated trackline.

A daily watch for cetaceans was maintained by scientific observers on the flying bridge during daylight hours (approximately 0630 to 1830) unless precluded by weather. The observers consisted of six scientists that rotated through three positions every 40 minutes and scanned for cetaceans using 25x and 7x binoculars and unaided eyes. Sighting information, watch effort, viewing conditions, and other required information were entered into a computer attached to the ship's Global Positioning System (GPS) (for course, speed, and position information) using the program Wincruz.

The set of standard tracklines surveyed was established prior to the cruise and was intended to cover approximately one half of the Palmyra Atoll EEZ transect line grid used for the 2005 Pacific Islands Cetacean Ecosystem and Assessment (PICEAS; AR-05-07) survey. Survey effort took place on transit paths to and from the study area and on circumnavigations of Palmyra Atoll and Kingman Reef, which were considered non-standard tracklines. The Chief Scientist adjusted scientific activities and length of nighttime transit to meet scientific and scheduling objectives.

Upon sighting a cetacean group or other feature of biological interest, the Chief Scientist or marine mammal observer team on watch requested that the ship be maneuvered to approach the group or feature for investigation. When the ship approached a group of cetaceans, the on-effort observers made independent estimates of group size. Photographic operations occasionally commenced from the bow based on directions from the Chief Scientist or Lead Mammal Observers.

When the observers completed scientific operations for a given sighting, the ship resumed the same course and speed as prior to the sighting. If pursuit of the sighting took the ship more than 5 nm from the trackline, the observers were notified. The Chief Scientist or Lead Mammal Observers sometimes requested that, rather than proceed directly toward the next waypoint, the ship take a heading of 20 degrees back toward the trackline.

It was occasionally necessary to divert the ship's course from the established trackline during regular effort because of glare, rain, or adverse sea conditions. Under these circumstances, the ship diverted from the established course until the ship was 3 nm from the trackline or otherwise directed by the observers, at which point the ship turned back toward the trackline.

At times during the cruise, visual survey operations were not possible due to high wind or sea state. Survey operations were usually suspended at Beaufort Sea State 7 or higher. If rain made visibility 1 nautical mile or less, visual observations were also 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.

2. *Results*

Twenty-four days of on-effort surveying (12 along standard and 12 along non-standard transect lines) were completed during the cruise (Table 1), resulting in 48 visual sightings of 11 cetacean species and three types of unidentified cetaceans (Table 2). The geographic distribution of search effort and sightings within the Palmyra Atoll EEZ is shown in Figures 1 and 2, respectively. Sighting data will be combined with data collected during a 2011 fall survey to yield new abundance estimates for observed species.

B. Photo-identification and biopsy sampling

1. *Methods*

Photographs of cetaceans were taken from the ship on an opportunistic basis. These images were used to confirm species identification and, when possible, will be used to study movement patterns of identified individuals and intraspecific geographic variation. Photographed animals were either approached by the ship as a part of normal survey operations or approached the ship to bow ride.

A small boat was launched on one day designated for photo-identification and biopsy sampling of cetaceans in the nearshore waters of Kingman Reef. These days were determined by transect scheduling and weather.

Photographs were taken with digital SLR cameras and biopsy samples were collected using darts fired from a crossbow. All photographs and biopsy samples were taken under permit. Necessary permits were present on the vessel.

2. *Results*

Over 1900 photographs of 10 cetacean species were collected from the ship during visual survey operations. The small boat operated in the nearshore waters of Kingman Reef on 9 May and its crew members photographed and sampled melon-headed whales, bottlenose dolphins, and spinner dolphins.

C. Passive acoustic monitoring

1. *Methods*

Two oil-filled, four-element hydrophone arrays (a primary and a backup) were available to augment the visual survey effort during this cruise. The primary array was towed at 300 m behind the ship during daylight hours to collect data on cetacean vocalizations and assist with the localization of target species. The array was deployed each morning prior to the start of visual observations and normally retrieved each evening after search effort ended (and whenever increased maneuverability of the ship was required).

The primary array contained two high-frequency elements and two mid-frequency elements. The backup array contained four high-frequency elements. Signals received from the array were amplified and monitored by a team of three acoustic technicians. The technicians rotated through a primary, secondary, and off-effort position every 2 hours while the array was deployed. Incoming acoustic data was recorded to computer hard drives continuously. A record was kept of acoustic effort, comments, and periodic acoustic updates using the program Logger. Real-time visual displays of sounds were monitored and localized using Ishmael and Whaltrak software. The localization angles created were plotted on the Whaltrak display and saved to corresponding files.

Sonobuoys were deployed every day before the evening CTD and could also be deployed opportunistically at the discretion of the Chief Scientist. Sonobuoys transmit acoustic data over an RF 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's signals. The incoming signals were monitored for cetacean sounds using a scrolling spectrogram display in Ishmael and recorded to computer hard drives.

2. Results

A total of 137 acoustic detections of cetaceans were made from the towed hydrophone array. While 8 of the visual detections were not detected acoustically, 96 acoustic detections (mostly unidentified dolphin groups) were not detected visually (Table 4). A total of 22 sonobuoys were deployed, but few cetacean sounds were detected during monitoring. Additional processing of the hydrophone and sonobuoy acoustics data is ongoing.

D. HARP Recovery

On 28 April, we attempted to recover a High-frequency Acoustic Recording Package (HARP) deployed on a seamount near the Equator during the southbound transit. The acoustic release pingers did not respond to repeated attempts to enable and release the instrument. It is possible that the HARP is still on the seafloor and additional attempts will be made to recover it as opportunities arise. On 7 May, a HARP was recovered at Kingman Reef. That HARP had been deployed during the fall survey in the region. The HARP has been collecting broadband acoustic data since 10 November.

**SCIENTIFIC
PERSONNEL:**

Erin Oleson, Chief Scientist, Pacific Islands Fisheries Science Center (PIFSC),
National Marine Fisheries Service (NMFS)
Richard Rowlett, Lead Mammal Observer, PIFSC, NMFS
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Attachments

TABLES:

Table 1.--Visual and acoustic survey effort during SE-12-03.

Date	Effort Start			Effort End			Distance Surveyed (nmi)	Average Beaufort
	Time	Latitude	Longitude	Time	Latitude	Longitude		
4/23/12	919	S14:14.68	W170:24.99	1824	S13:02.45	W169:57.80	118.5	3.3
4/24/12	645	S11:27.45	W169:15.02	1800	S09:49.77	W168:32.47	84.0	4.0
4/25/12	622	S08:14.49	W167:51.83	1800	S06:48.89	W167:14.48	77.6	4.5
4/26/12	612	S05:17.73	W166:35.24	1752	S03:41.25	W165:54.09	98.2	4.0
4/27/12	603	S02:22.87	W165:21.10	1756	S00:47.45	W164:39.73	94.2	4.3
4/28/12	1050	N00:24.94	W164:08.82	1751	N01:23.93	W163:44.09	64.0	5.0
4/29/12	604	N02:42.39	W163:11.42	1754	N03:23.27	W162:43.86	27.3	5.9
4/30/12	647	N04:20.30	W162:40.29	1854	N03:14.77	W163:26.90	78.5	5.2
5/1/12	950	N03:38.23	W163:47.56	1813	N04:35.35	W163:07.57	39.5	4.7
5/2/12	647	N04:59.36	W163:31.06	1900	N03:38.23	W164:30.06	90.3	5.0
5/3/12	650	N04:29.18	W165:04.20	1900	N05:42.53	W164:12.17	88.4	5.6
5/4/12	652	N04:50.93	W164:09.51	1814	N05:59.00	W163:22.40	77.5	5.7
5/5/12	1133	N06:19.90	W162:24.03	1900	N06:27.78	W162:30.55	29.4	4.8
5/6/12	754	N05:50.12	W162:05.45	1850	N05:52.73	W162:14.37	38.9	6.1
5/7/12	727	N05:47.97	W162:04.11	1849	N06:31.92	W161:43.98	50.7	6.2
5/8/12	804	N06:22.01	W162:27.91	1856	N06:22.69	W162:43.14	52.3	4.2
5/9/12	649	N06:53.09	W163:57.51	1853	N08:14.12	W163:00.12	86.8	4.3
5/10/12	644	N08:24.85	W163:30.47	1904	N06:43.26	W164:42.35	124.1	5.6
5/11/12	645	N07:56.50	W164:26.70	1803	N09:00.56	W163:41.73	76.1	5.9
5/12/12	640	N08:21.90	W162:54.10	1848	N09:34.08	W162:04.74	83.7	5.8
5/13/12	630	N10:59.52	W161:30.26	1856	N12:19.74	W161:03.28	82.5	5.1
5/14/12	623	N13:48.57	W160:32.97	1857	N15:25.63	W159:59.36	96.0	5.1
5/15/12	611	N16:51.93	W159:29.70	1900	N18:44.45	W158:50.24	115.2	3.9
5/16/12	604	N18:39.18	W158:15.42	1359	N19:16.19	W157:13.31	65.0	3.9
							1838.7	

Table 2.--All visual sightings of cetacean species made while on standard (S) or non-standard (NS) transect lines and while off-effort (O). Locations of all visual sightings within the Palmyra EEZ study area are shown in Figure 2. Two mixed-species sightings are not double-counted here.

Scientific Name	Common Name	# Sightings	Effort Type
<i>Stenella attentuata</i>	Spotted dolphin	1	S
		1	NS
		2	O
<i>Stenella coeruleoalba</i>	Striped dolphin	1	S
		2	NS
<i>Stenella longirostris</i>	Spinner dolphin	1	S
		2	NS
		1	O
<i>Steno bradaenensis</i>	Rough-toothed dolphin	2	NS
<i>Tursiops truncatus</i>	Bottlenose dolphin	3	NS
		8	O
<i>Lagenodelphis hosei</i>	Fraser's dolphin	1	NS
<i>Grampus griseus</i>	Risso's dolphin	1	NS
<i>Peponocephala electra</i>	Melon-headed whale	1	NS
<i>Pseudorca crassidens</i>	False killer whale	1	NS
		5	O
<i>Physeter macrocephalus</i>	Sperm whale	2	S
		1	NS
<i>Mesoplodon densirostris</i>	Blainville's beaked whale	1	S
	Unid Ziphiid	1	S
		1	NS
	Mesoplodon sp.	1	S
		2	NS
		1	O
	Unid. Dolphin	1	S
	6	NS	
	1	O	
		49	

Table 4.--A comparison of the acoustic cetacean detections from the towed hydrophone array with those detected visually. Acoustic detections within 3 nm are provided as an estimate of the maximum number of detections that may have been available to the visual team under normal survey conditions, if the animals were visible at the surface. This is an overestimation of availability; however, as most analyses of visual detection distance truncate at approximately 2 nmi from the trackline.

Species	Visual Sightings	Total Acoustic Detections	Acoustic Detections (within 3nmi)	Acoustic Detection (Dist. Unknown)	Visual Detections Missed by Acoustics
<i>Species With Accurate Acoustic Species ID</i>					
Sperm whale	3	17	9	3	0
False killer whale	6	13	7	3	0
<i>Detections Requiring Visual ID for Species Confirmation</i>					
Bottlenose dolphin	11 ¹	6	6	0	0
Fraser's dolphin	1	1	1	0	0
Melon-headed whale	1	1	1	0	0
Risso's dolphin	1	1	1	0	0
Rough-toothed dolphin	2 ²	2	2	0	0
Spinner dolphin	4 ¹	3	3	0	0
Spotted dolphin	4 ²	4	4	0	0
Striped dolphin	3 ²	3	3	0	0
Blainville's beaked whale	1	0	0	0	1
Mesoplodon sp.	4	1	1	0	3
Unid.Ziphiid	2	1	1	0	1
<i>Detection without Visual or Acoustic Species ID</i>					
Unid. dolphin	8	84	40	30	3
TOTAL	51	137	79	36	8

- 1 Several bottlenose dolphin groups and a spinner dolphin group were seen by the small boat team and were not near the ship, such that those groups were not available to be heard by the acoustics team.
- 2 One group of rough-toothed dolphins was seen with false killer whales. One group of spotted dolphins was mixed with striped dolphins.

FIGURES:

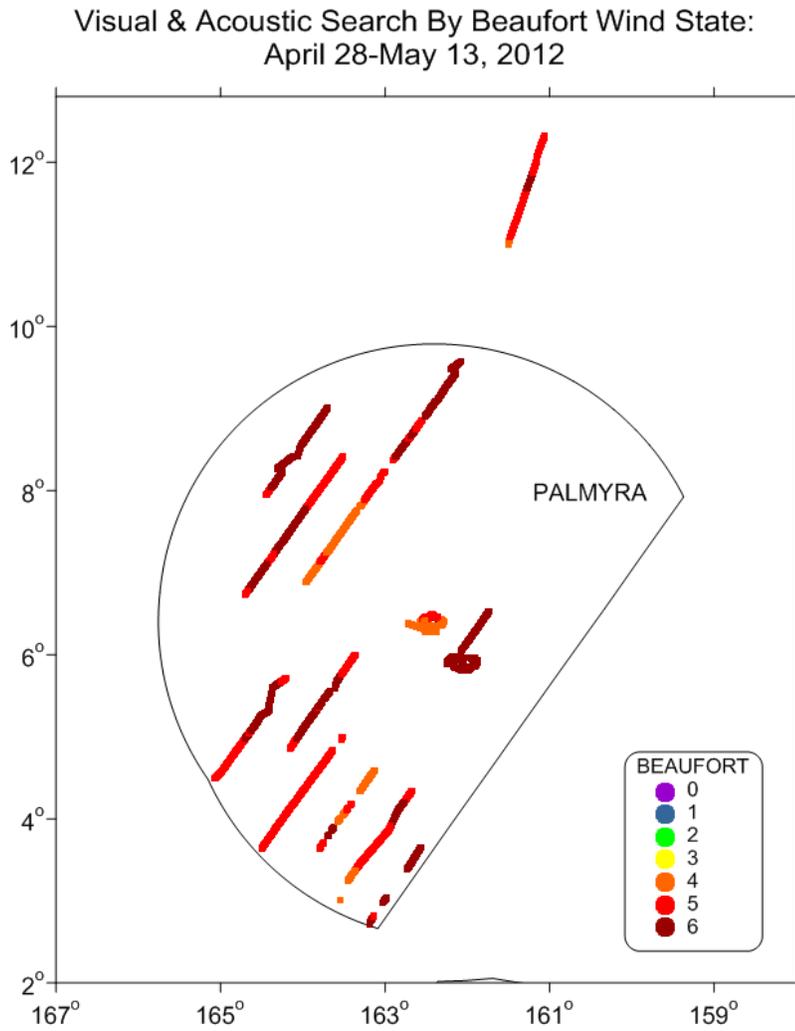


Figure 1.--Visual and acoustic search effort by Beaufort wind state within the Palmyra study area during Leg II.

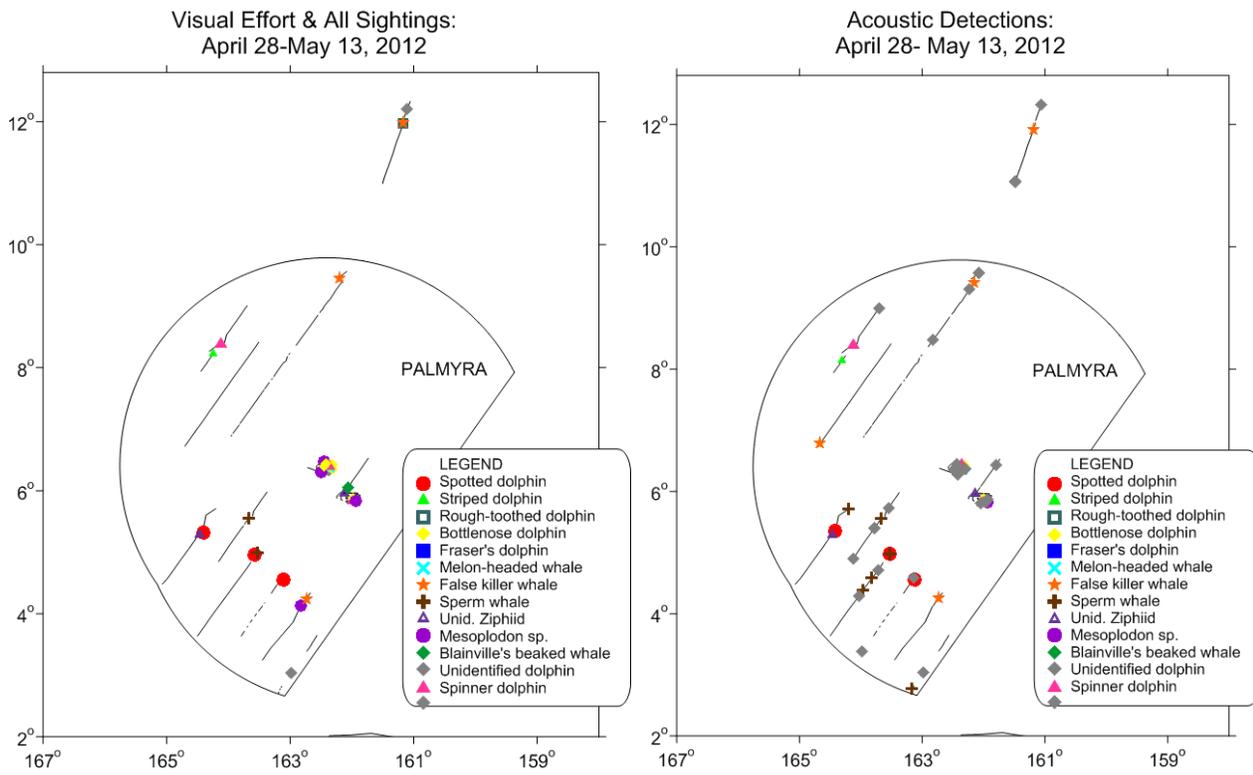


Figure 2.--Visual (left panel) and acoustic (right panel) encounters within the Palmyra study area during Leg II. Additional search effort was conducted on the transit from American Samoa to Palmyra and from Palmyra to Hawaii, but those encounters are not shown here.