Aerial Survey Monitoring for Marine Mammals and Sea Turtles in the Hawaii Range Complex in Conjunction with a Navy Training Event

SCC February 15 – 25, 2012
FINAL--Field Report

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Cover Photo: Humpback whales (*Megaptera novaeangliae*) photographed with a telephoto lens from the aircraft during an aerial monitoring survey in Hawaii. Photograph by J. Mobley taken under NOAA Permit No. 642-1536-03 issued to Joseph R. Mobley, Jr. Graphic: K. Lomac-MacNair.

ACRONYMS AND ABBREVIATIONS

ASW	Anti Submarine Warfare
BARSTUR	Barking Sands Tactical Underwater Range
BSURE	Barking Sands Underwater Range Extension
DDG	missile destroyer
HD	high-definition
HST	Hawaii Standart Time
HRC	Hawaii Range Complex
km	kilometer
MFAS	Mid-frequency Active Sonar
MM/ST	Marine mammals and sea turtles
NTR	Navy Technical Representative
PMRF	Pacific Missile Range Facility
SCC	Submarine Commander’s Course
SOW	statement of work

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Section 1 Introduction

Aerial surveys to monitor marine mammals and sea turtles (MM/ST) were conducted in conjunction with a U.S. Commander Pacific Fleet (COMPACFLT) training event in the Hawaii Range Complex (HRC) on the Pacific Missile Range Facility (PMRF) Barking Sands Tactical Underwater Range (BARSTUR) and Barking Sands Underwater Range Extension (BSURE) between Kauai and Ni'ihau, Hawaii during the period February 15 to 25, 2012 (**Figure 1**). Surveys in support of the Submarine Commander's Course (SCC) event occurred on 3 consecutive days from February 15 to 17, 2012, in waters adjoining Kauai and Ni'ihau where the missile destroyer (DDG) *USS Paul Hamilton* and other ships were conducting a training exercise, followed by shoreline surveys of Kauai and Ni'ihau on two separate days thereafter: February 23 and 25, 2012. The survey methods and sampling design were submitted and approved in advance per the statement of work (SOW), to the Navy Technical Representative (NTR) and followed previously established protocol (Mobley 2011, Mobley and Milette 2010, Smultea et al. 2009a,b).

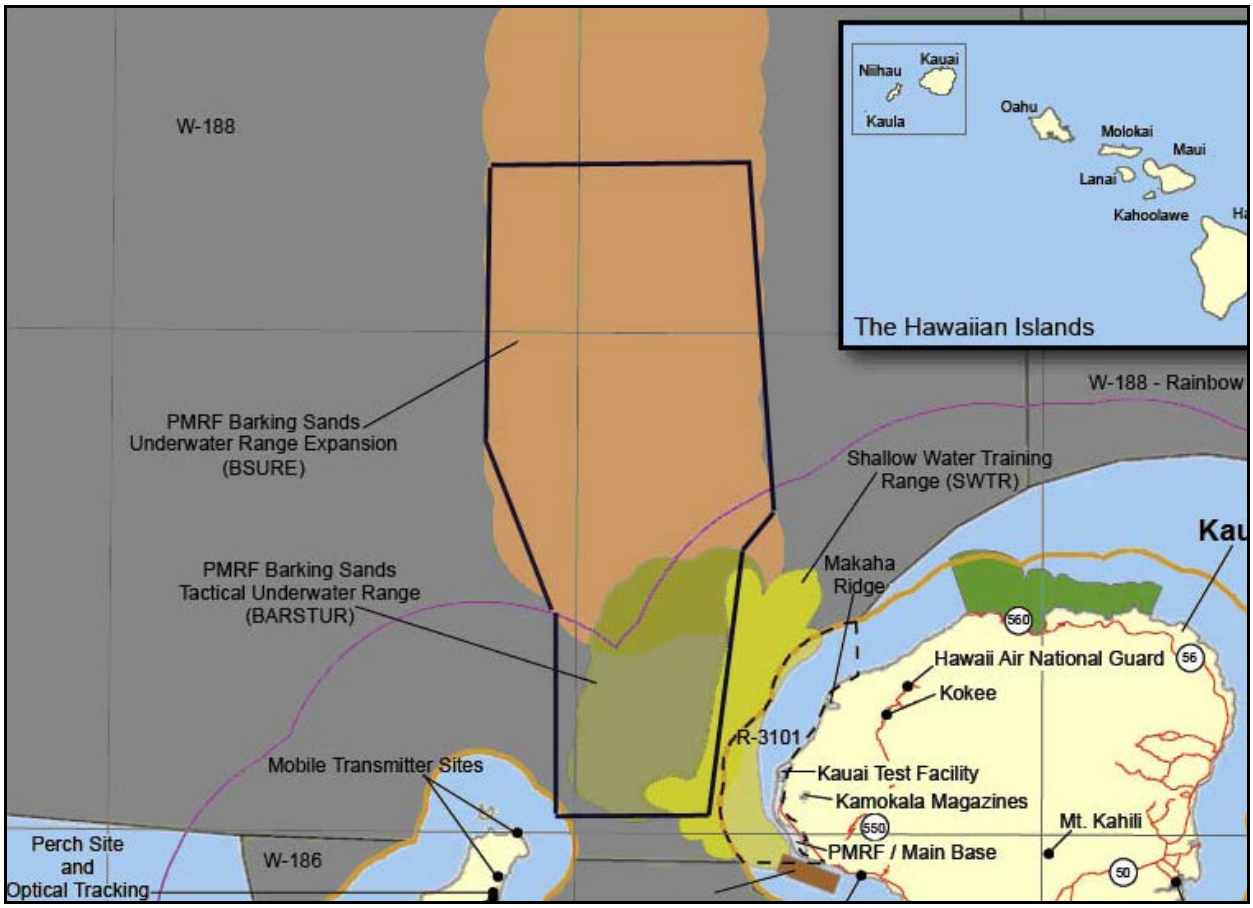

Figure 1. Location of the aerial survey monitoring area (black box area for ship follows) in and near the U.S. Navy PMRF Range west and northwest of Kauai, Hawaii.

Prior to the training event, the Principal Investigator (Joseph Mobley) and pilot (Stephen Holmes) attended pre-planning sessions known as 'pre-sails' with the Navy Technical Representative (NTR) and other Navy staff at Pearl Harbor, Honolulu, Oahu, Hawaii, to

coordinate survey efforts with the SCC February 2012 training exercise. Per the Statement of Work (SOW, the goal of the aerial survey was to monitor and report the presence and behavior of MM/ST before, during and after the training event as well as monitor for any stranded or near stranded marine mammals along the shorelines of Kauai/Ni'ihau following the event. During the event, the goal was to identify whale or dolphin pods near the DDG (within five kilometers [km]), then perform focal follows to monitor their behavior for any changes using accepted observation methods.

The DDG being followed by the aircraft was conducting anti-submarine warfare (ASW) exercises such that the vessel was sometimes utilizing mid-frequency active sonar (MFAS). Since mid-frequency active sonar (MFAS locations and transmission times were unknown to the observers during this field survey effort, no effort was made to determine types or level of response of MM/ST to these transmissions. Rather, as stated in the SOW, survey data collected during this monitoring effort will be compiled with previous (Mobley 2011, Mobley and Milette 2010) and subsequent data, and analyzed by the Navy.

Survey effort during this training event was of three types (**Table 1**):

1. Ship follows (February 15–17): flying elliptical orbits in front of the DDG per previous training events (Mobley 2011; Mobley and Milette 2010; Smultea et al. 2009a, 2009b).
2. Visual verification of species identification of targets acoustically detected from the PMRF fixed hydrophone range (February 18).
3. Circumnavigation of islands: flying along the coastlines of Kauai and Ni'ihau (February 23 and 25) to search for stranded or near-stranded marine mammal/sea turtle (MM/ST). In all cases the mission was to document the presence of MM/ST including species identity, group composition, behavior, and any obvious reactions.

Table 1. Summary of Effort Type, Hours, and Beaufort Sea State by Date

Date	Type of Effort	No. Hrs Effort*	Mean Beaufort Sea State
2/15/12	With DDG	6:52	3.14
2/16/12	With DDG	6:25	5.23
2/17/12	With DDG	6:15	5.98
2/18/12	Acoustic groundtruthing	4:05	6.40
2/23/12	Shoreline survey—Kauai/Ni'ihau	3:28	4.48
2/25/12	Shoreline survey—Kauai/Ni'ihau	1:53	2.48
Total		**28:59 hrs**	**4.80**

* Note: Computed wheels up to wheels down

Section 2 Methods

Monitoring effort followed protocols implemented in previous SCC training events (Mobley 2011, Mobley and Milette 2010). The approach involved flying elliptical-shaped patterns in

advance of the Navy vessel (DDG) that extended from the front of the ship (approximately 200 meters) out to approximately 2,500 meters over a width of five km.

Surveys were conducted from a small fixed-wing Partenavia P68 Observer for all but the final day (February 15-18 and 23) and an Agusta 109a helicopter on the second shoreline survey (February 25). Both aircrafts flew at 100 knots groundspeed and an altitude of approximately 305 meters (1,000 feet), unless the pilot was directed to fly at alternate altitudes by flight controllers for safety reasons. Observations from the monitoring aircraft involved five personnel including the pilot and copilot, plus two biologist observers and a data recorder/videographer. The survey crew and pilot were not informed as to the status of MFAS transmissions, which minimized the potential for observational bias. When animals were detected, the vertical angle to the sighting when abeam at 90 degrees to the trackline was recorded using hand-held Suunto clinometers, typically followed by orbiting to identify species and, in the case of marine mammals, to characterize behavior and direction of travel. Photographs were taken opportunistically by the data recorder to assist in species identification using a Canon 5D digital camera with a Canon 100-400 mm telephoto lens with image stabilizer. Environmental data (Beaufort Sea State, glare and visibility) were recorded at the start of the effort and when conditions changed. Positional data via GPS were automatically recorded every 3 seconds and manually when sightings occurred.

When pods were observed close to the DDG (i.e., within five km) and were judged to be suitable (i.e., were visible at the surface for extended periods) focal follows were performed using accepted methods (Altmann 1974). The aircraft ascended to 457 meters (1,500 feet), an altitude shown to minimize reactivity to fixed-wing aircraft (Smultea et al. 1995), and the pod was orbited and behavior video recorded for as long as possible. A high-definition Canon Vixia HF10 camcorder with 12-power optical zoom was used to video focal follows. The intercom system of the aircraft inputted to the audio port of the digital camcorder so that all behavioral observations could be recorded with a minimum of ambient noise. Time stamps on the Canon camcorder were synchronized with those from the Garmin GPS receiver. The resultant digital audio/video file and digital photos will be made available to the Navy for subsequent behavioral analysis.

Overall survey effort was divided into three parts as summarized below:

1. Ship follows, SCC event (February 15–17, 2012): This involved flying elliptical orbits in front of the DDG (**Figure 2**) with the goal of finding target species in the vicinity of the DDG and observing and recording their behavior using focal follow methods (Altmann 1974).
2. Visual verification of acoustic detections (February 18, 2012): Working in conjunction with Steve Martin of SPAWAR Systems Center Pacific, locations of acoustic detections made with hydrophones of the BSURE and BARSTUR ranges were sent via electronic text to the aerial survey team so that the suspected species in question could be visually verified (**Figure 3**).
3. Circumnavigation surveys, post-SCC event (February 23 and 25, 2012): following the SCC event, the aircraft flew along the coastlines of Kauai and Ni'ihau (**Figure 4**) looking for stranded or near-stranded marine mammals as well as target species along the shoreline during this effort.

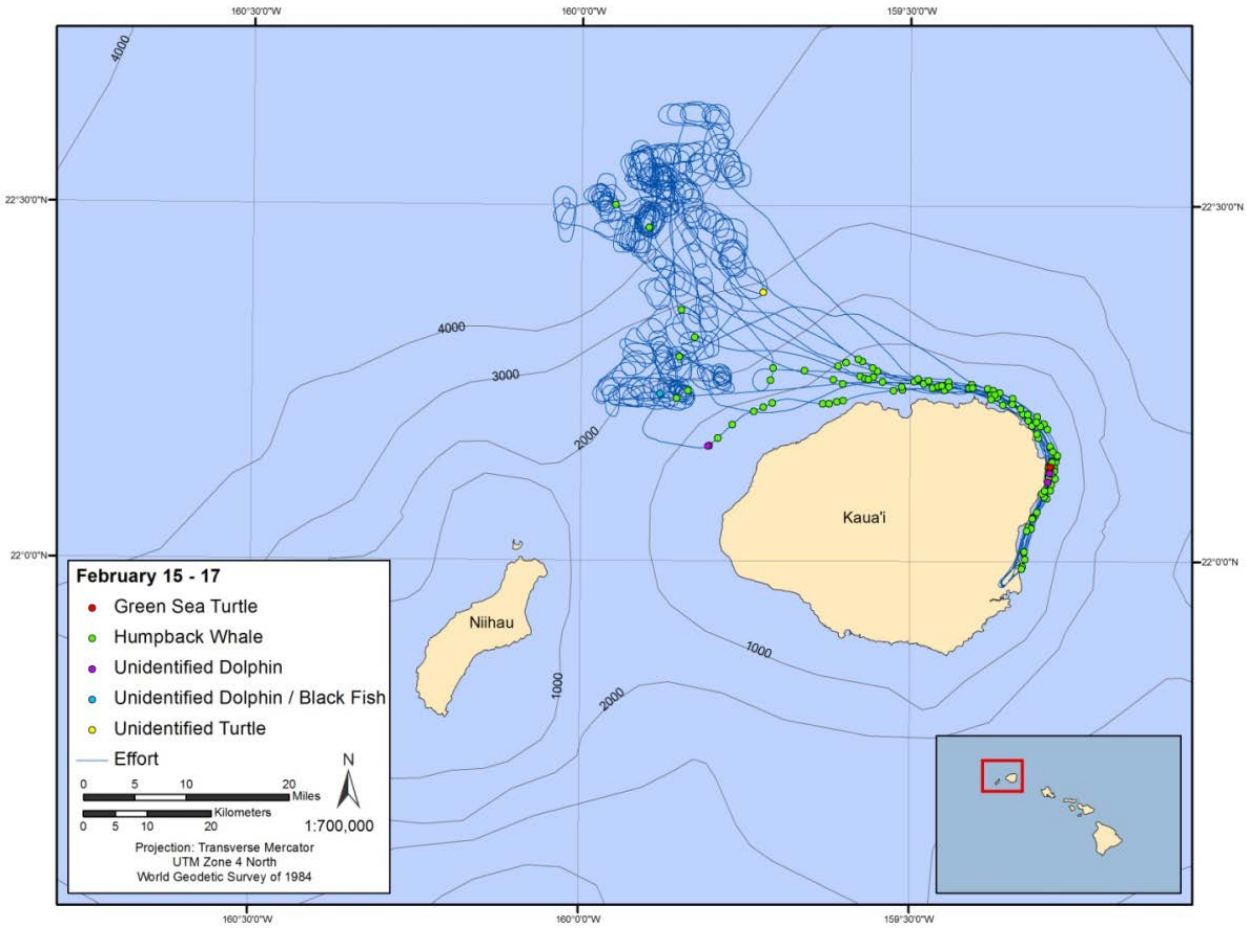

Figure 2. Effort and sighting locations during days involving ship follows with the DDG (February 15–17, 2012).

Most sightings during the 3-day SCC event occurred during transits between Lihue, Kauai, and the ship's position **(Figure 2)**. Seven sightings of humpback whales occurred in the vicinity of the DDG (green circles shown in elliptical plots), four of which became the target of a focal follow session with video.

Communications

Communications were reliably established between the survey aircraft and marine mammal observers aboard the DDG using aviation-band VHF radios broadcasting on 123.45 MHz. This system proved to be reliable whenever the aircraft was in the vicinity of the ship (i.e., less than 10 km); whereas, communications at greater distances were possible via radio communications with PMRF Range Control or Outrider Bravo. Daily locations of the DDG were usually communicated via onboard VHF radio once in the air via PMRF Range Control or Outrider Bravo. A standard operating procedure was established prior to the event which was to be followed in the event that communications were lost (**Appendix D**). During visual verifications of acoustic detections (February 18) communications were established via email on an Android smart phone.

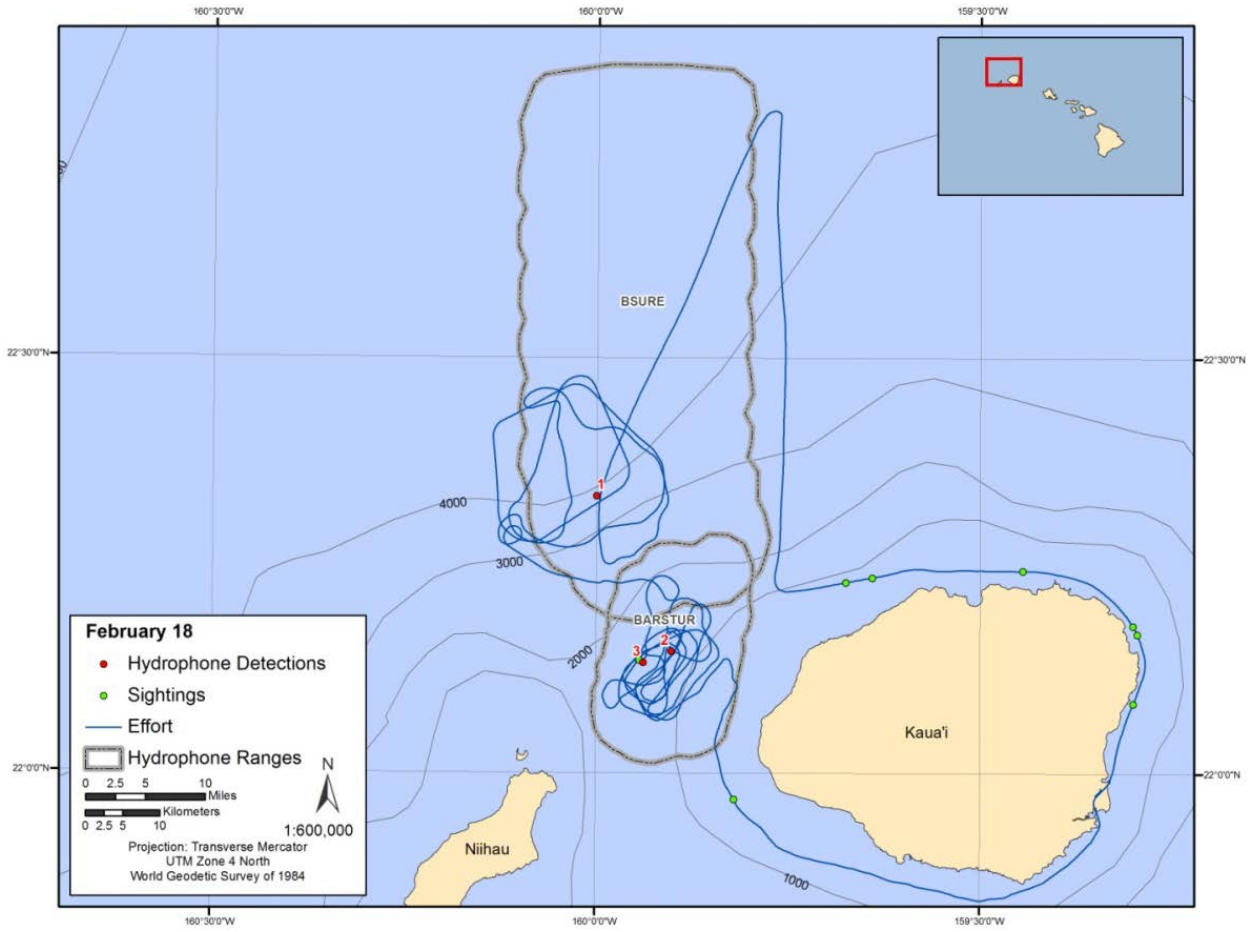

Figure 3. Post-SCC event (February 18). Effort, acoustic detections and sighting location during visual verification exercise using BSURE/BARSTUR phone detections assist. Point 1 (red dot) indicates acoustic detection of clicking cetaceans (possible pilot whales), and points 2 and 3 indicate acoustic detections of suspected beaked whales.

Safety

Safety on the PMRF Range is paramount. After a safety debriefing held at PMRF on July 27, 2011, rules were established to ensure the safe operation of our civilian aircraft in the context of a Navy training event with active military aircraft in the vicinity (**Appendix D**). Safety issues were further discussed as part of the pre-sail briefing held on February 13, 2012 prior to the training event.

Section 3 Results and Discussion

Effort

During the SCC event (February 15–17), the survey aircraft accompanied the DDG for 14 hours (72 percent) of the total 19.5 hours of SCC-related flight time (**Table 2**). The remaining 5.5 hours (28 percent) while not with the DDG primarily involved transiting between the DDG's

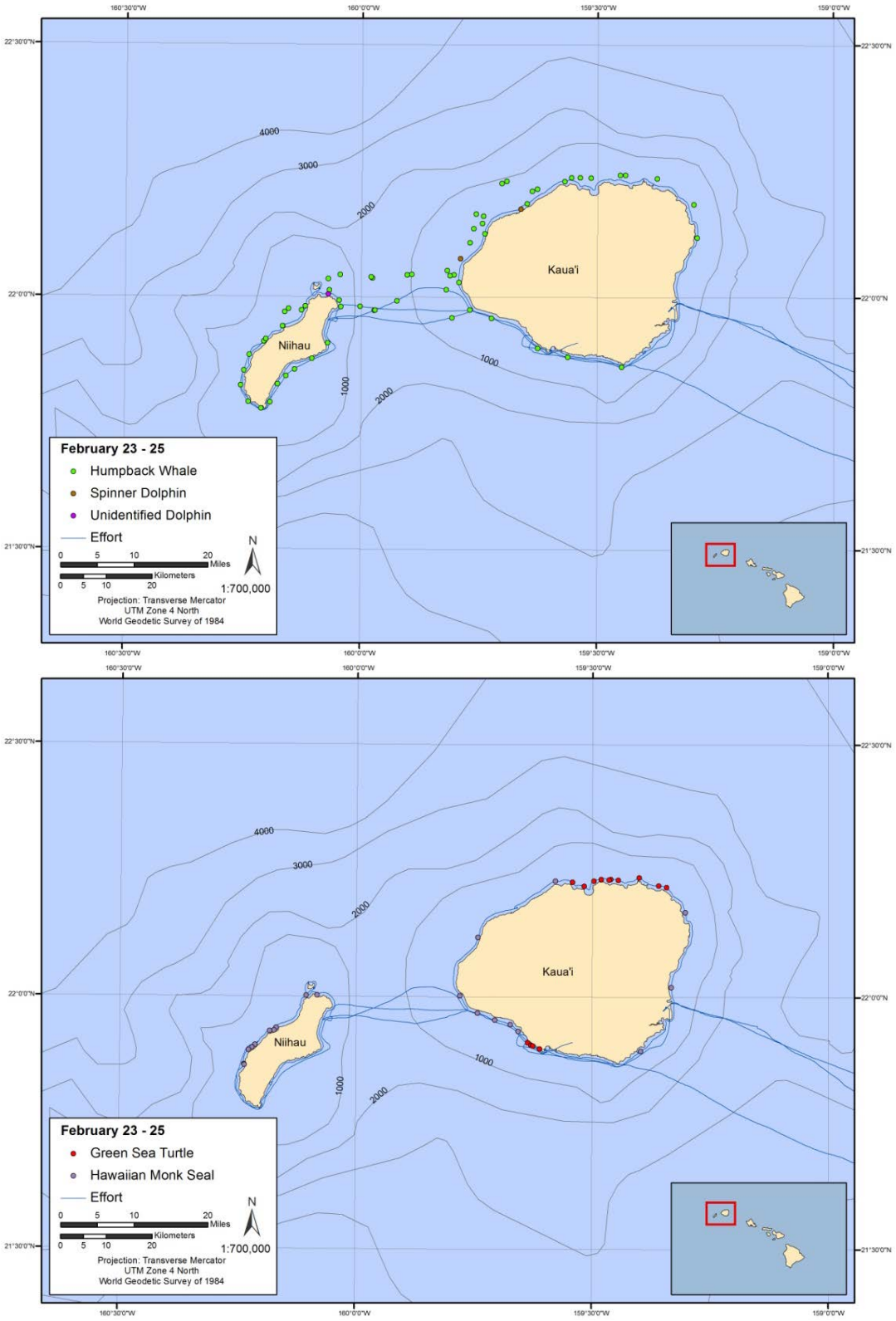

Figure 4. Shoreline surveys (February 23 and 25). Circumnavigation of shorelines of Kauai and Ni'ihau, using Partenavia aircraft (February 23) and Agusta 109a helicopter (February 25). Top: whale/dolphin sightings; Bottom: Hawaiian monk seals (hauled out) and green sea turtle (coastal water) sightings.

Table 2. Survey Effort (with and not with DDG). All time information are Hawaii Standard Time (HST).

Date	Time Wheels Up	Time Wheels Down	Total Flight Hours	Period not with DDG*	Total Hours not with DDG	Period with DDG*	Total Hours with DDG	No. Sightings With DDG*	No. Sightings Away from DDG*
2/15/2012	08:21 13:34	11:57 16:50	6:52	8:21-8:50 11:30-11:57 13:34-13:55 16:20-16:50	1:47	8:50-11:30 13:55-16:20	5:05	2	64
2/16/2012	07:38 12:51	11:12 15:42	6:25	7:38-8:01 10:43-11:12 12:51-13:24 15:16-15:42	1:51	8:01-10:43 13:24-15:16	4:34	4	32
2/17/2012	07:49 12:19	11:02 15:21	6:15	7:49-8:11 10:30-11:02 12:19-12:48 14:52-15:21	1:52	8:11-10:30 12:48-14:52	4:23	3	16
2/18/2012	7:42	11:47	4:05	n/a	4:05	n/a	n/a	n/a	8
2/23/2012	8:05 11:27	10:39 12:21	3:28	n/a	3:28	n/a	n/a	n/a	51
2/25/2012	8:59	10:52	1:53	n/a	1:53	n/a	n/a	n/a	50
Total			**28:58**	**5:30**	**14:56**	**-**	**14:02**	**9**	**221**

Note: *Survey plane noted as "with DDG" during elliptical orbits around ship; otherwise noted as "not with DDG." Sightings were noted as "with DDG" if initially recorded during orbits; otherwise noted as "away from DDG."

Key: n/a = not applicable

location and Lihue, Kauai, and maintaining a holding pattern per the instructions of PMRF Range Control (**Figure 2**). The aircraft was considered "with the DDG" upon commencement of elliptical orbits around the ship's location and "not with the DDG" when not orbiting (**Figure 5)**. Sightings that were initially recorded while orbiting were noted as "sightings with DDG" otherwise they were noted as "away from DDG."

Visual verification of acoustic detections was performed on one day (February 18) (**Figure 3**). Shoreline surveys were conducted as part of the SCC event in the waters surrounding Kauai/Ni'ihau (**Figure 4** and **Table 3**) on two days (February 23 and 25).

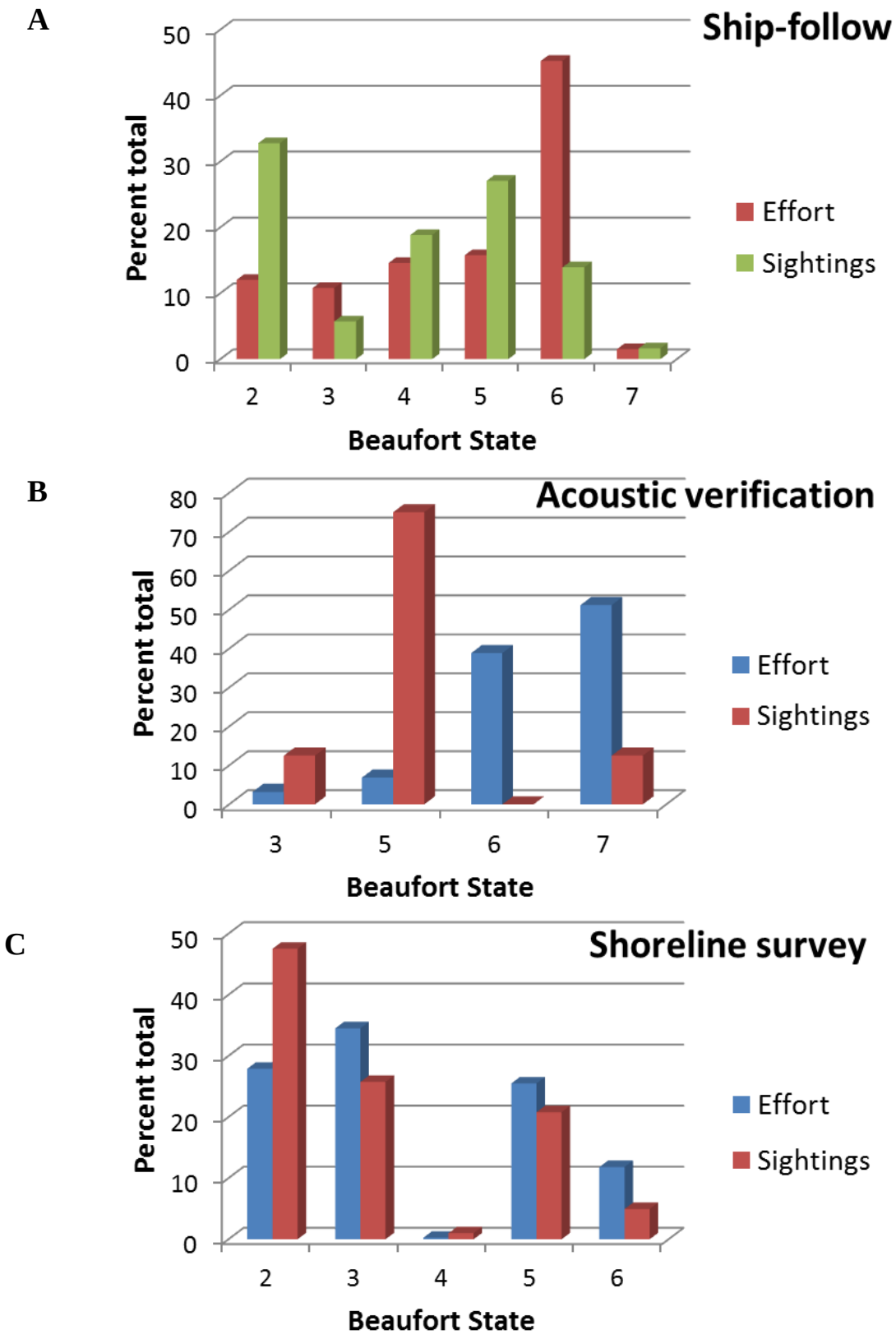

Figure 5. Beaufort Sea State conditions for effort and for sightings for: (A) Ship follow; (B) Acoustic verification; and (C) Shoreline surveys.

Table 3. Summary of Sightings for Kauai-Ni'ihau Shoreline Surveys (February 23 and 25)

Species	Region	No. Groups	No. Individuals
Green sea turtle	Kauai	10	13
	Ni'ihau	4	7
Humpback whale	Kauai	42	69
	Ni'ihau	21	30
Hawaiian Monk Seal	Kauai	11	12
	Ni'ihau	10	18
Spinner dolphin	Kauai	2	120
	Ni'ihau	0	0
Unid. delphinid spp.	Kauai	0	0
	Ni'ihau	1	20
Total		**101**	**286**

Sea State

The majority of overall effort (38.3 percent) was spent in unfavorable sea state conditions (i.e., Beaufort Sea State 6) where only 8 percent of combined sightings occurred (**Figure 5**). The majority of sightings (38.1 percent) occurred in more favorable conditions, with most in Beaufort Sea State 2. This pattern is consistent with known effects of sea state on sighting probabilities (Buckland et al. 2001).

Ship Follow Results

The first four days of survey effort involved flying elliptical orbits in front of the DDG for a total of 14 hours (**Table 2**). An additional 15 hours was spent in transit to and from the DDG and was recorded as "not with DDG." Nine sightings were recorded during this effort, including seven humpback whale pods, one sighting of an unidentified blackfish spp and one sighting of an unidentified turtle species (**Table 4**). Focal follows were initiated during four of the seven humpback whale sightings and were recorded on video. The purpose of the focal follows was to provide detailed descriptions of behavior when in relative proximity to the DDG (i.e., when initially sighted within 5 km).

Behavioral Focal Follows

Humpback whale pods were seen within the vicinity of the DDG (less than or equal to 5 km) on seven occasions during the SCC event (February 15-17) (**Table 5**), and focal follows were initiated and videotaped in four instances. In all three of the other instances, the target pod was not resighted after initial detection. The focal follows involved circling at an altitude of approximately 425 to 455 meters (1,400 to 1,500 feet) and a lateral distance of approximately 1 km. The higher altitude for focal follows was designed to reduce the potential for reactivity to plane engine noise, thereby permitting naturalistic observation of whales in the vicinity of the DDG (Smultea et al. 1995).

Table 4. Summary of Sightings by Species—All Surveys Combined

Species	No. Groups	No. of Individuals	Average Pod. Size
Humpback Whale *(Megaptera novaeangliae)*	188	296	1.4
Green Sea Turtle (*Chelonia mydas*)	15	21	1.4
Spinner Dolphin *(Stenella longirostris)*	2	120	60
Unidentified Dolphin	4	89	29.7
Hawaiian Monk Seal	21	30	1.4
Unidentified sea turtle	1	1	1
Unidentified Cetacean	1	1	1
Total	**232**	**--**	**--**

Table 5. Summary of Pods Observed within 5 km of DDG (February 15–17)

Date	Time Sighted (HST)	Species	No. Indiv	Video? (Y/N)	Session Length (min)	If No, Reason Video not Initiated
02/15/2012	9:01:00	Unid turtle spp	1	N		Not suitable
	15:00:00	Humpback whale	2	Y	18	
02/16/2012	8:39:33	Humpback whale	2	Y	30	
	9:41:14	Humpback whale	1	N		Not resighted
	10:16:18	Humpback whale	1	N		Not resighted
	13:36:27	Humpback whale	1	N		Not resighted
02/17/2012	8:14:37	Humpback whale	2	Y	30	
	8:46:00	Unid blackfish	1	N		Not resighted
	9:47:23	Humpback whale	2	Y	11	

The four behavioral focal follow sessions conducted while monitoring near the DDG (February 18; **Appendix B**) all involved pods of two humpback whales. The durations of the taped sessions varied from 11 to 30 minutes for a total of 89 minutes of recorded observations. During much of this time, however, the whales were not in view due to the orientation of the plane or when the pods were traveling underwater. Sessions were initiated when pods were within 5 km of the DDG, but throughout the observation period, the pods were no more than 10 km away from the ship. During all observations, no obvious indications of stress were seen. The animals did not appear to move in a direct fashion away from the DDG nor did they dive quickly, though, as noted earlier, any specific response to MFAS could not be determined since the observers were unaware of sonar transmission status throughout the event. As noted, the animals remained within 4 to 10 km of the DDG throughout the 89-minute total observation period, suggesting that the activities and presence of the ship were not overly disturbing.

During the focal follows, behavior was called out in real time and recorded onto the audio of the digital videocam. Thus in many instances, behavioral events (e.g., respiration) were recorded on the audio portion though not visually apparent on the video recording. The digital video files and the still photos will be made available to the Navy for subsequent behavioral analysis. Current plans call for analysis of these and other videotaped focal follows as part of a separate task order to be issued by the Navy.

Visual Verification of Acoustic Detections

Since the SCC event finished by the morning of February 18, we were able to transit throughout the range on that day without risk of interfering with the training event. This period overlapped with the work of Steve Martin of SPAWAR Systems Center Pacific, who was monitoring the hydrophones of the BSURE and BARSTUR ranges. The task for that morning was to visually confirm from the survey plane the preliminary species identifications of the acoustic detections that were coming from the hydrophones of the BSURE and BARSTUR ranges. We were able to communicate with the hydrophone monitoring room using email messages that contained hydrophone and/or latitude/longitude locations. Details of these transmissions are included in **Appendix C**.

We investigated two acoustic detections, one of clicking cetaceans (possible pilot whales) and humpback whales shown in the northern circular tracks of **Figure 3**, and another of likely beaked whales, indicated in the southern tracks of the figure. During the total four hours of effort, we were able to confirm detection of a single humpback whale in the vicinity of the recording hydrophone, where humpback vocalizations had been observed. We were unable to confirm the beaked whale detections in the area of the southern phones. However, survey effort was seriously hampered by the Beaufort 6 Sea State conditions prevailing on that day.

Shoreline Surveys

We recorded 15 sightings of green sea turtles and 1 sighting of an unidentified turtle species, all the green sea turtles were observed in the shallow coastal waters where the animals were highlighted against the light sandy bottom (**Figures 2** and **4**). Thus, these numbers are likely an undercount of sea turtle species given the limited range of conditions under which they were observed. A single unidentified turtle sighting occurred offshore at a depth of approximately 3,000 meters on February 15 during the ship follow surveys. The 15 sightings of sea turtles recorded during the non-ship follow surveys produced a sighting rate of .005 sea turtle sightings/km effort. This is half of the encounter rate estimate of 0.010 for this species estimated from the 2011 SCC training event. Given the variability in sighting conditions along the island coastlines, this difference is likely a non-significant finding.

One striking result that departs from that of previous surveys of this area is the total of 21 Hawaiian monk seal sightings observed during the two shoreline surveys of the Kauai/Ni'ihau coastlines. This is noteworthy because no monk seal sightings were recorded during the previous two SCC events (Mobley 2011, Mobley and Milette 2010) but were recorded in previous SCC events (nine individuals in eight sightings on Ni'ihau during the August 2009 SCC event, Smultea et al. 2009a; nine individuals in six sightings on Ni'ihau during the July 2008 RIMPAC event, Mobley 2008). Although much of the increase in sightings in the present case was likely due to the use of a helicopter (see below), the relatively large number of sightings is

also consistent with reports of increasing numbers of monk seals residing in the main Hawaiian Islands (Baker and Johannos 2004). Only one of the 21 sightings in the current series was observed on February 23 from the fixed wing aircraft (Partenavia) flying 1-2 km offshore. The remaining 20 sightings occurred on February 25 as observed from the Ni'ihau-based Agusta 109a helicopter. The greater ability of the helicopter to maneuver along the island coastlines and to hover when verifying sightings supports the recommendation that future shoreline surveys should similarly utilize rotowing aircraft. The greater prevalence of monk seals on the shoreline of Ni'ihau is likely due to their known preference for relatively deserted beaches with little boat traffic in the main Hawaiian Islands (Baker and Johannos, 2004).

Overall Sightings

There were 230 sightings made during the 6 days of surveys (**Table 4**). The majority (81.7 percent) of these sightings was of humpback whales observed in shallow areas (less than 183 meters), known to be preferred habitat of humpbacks based on past survey results (Mobley 2004). Of the sightings of humpback whales, 181 were seen during transits to and from the DDG and during shoreline surveys (i.e., not including those seen during ship follows). When converted to sighting rates, the result is 0.065 humpback sightings/km effort (*Note:* Effort calculated as time [hours] x 100 knots mean speed). This represents more than three times the sighting rate for humpbacks seen north of Kauai during the 2006 North Pacific Acoustics Laboratory surveys—0.020 humpback sightings/km effort (Mobley 2006), and 63 percent higher than the 0.040 sighting rate estimated from the 2011 SCC event surveys (Mobley 2011). The greater rate of humpback whale sightings recorded during the present surveys is consistent with previous reports of increases in the Hawaii wintering population (Mobley et al. 1999, Mobley 2004, Calambokidis et al. 2008).

No instances of unusual behavior or signs of distress (e.g., defensive or evasive behaviors) were observed throughout the series of surveys. Additionally, the shoreline surveys revealed no cases of strandings or near-strandings by any cetacean species.

Section 4 Overall Conclusions

Given the caveats noted, overall there were no direct observations of adverse effects of the training event. As for the effects of sonar, since the status of MFAS transmissions throughout the survey period was unknown, any specific response of the animals observed to such transmissions would require more detailed behavioral analyses by the Navy with knowledge of the time/duration of MFAS and the received levels at the animals. The time-stamped audio/video files from the focal follows will be provided to the Navy to enable such detailed analyses. Per the SOW, the data obtained in this study are meant to contribute to a growing baseline of information on the distribution, occurrence, and behavior of MM/ST near Navy training events in the HRC per the HRC marine species monitoring plan (DoN 2009a) and as revised in the Pacific Fleet Annual Monitoring Report (DoN 2009b).

Section 5 Recommendations

In light of the issues summarized in this report, the following recommendations are offered:

1. Use helicopters for shoreline surveys. The comparison of results for the two shoreline days of February 23 in the Partenavia plane vs February 25 in the Agusta 109a helicopter made it very clear that the latter is the better platform for shoreline observations.

2. Continue briefing Range Control officers concerning the mission of the marine mammal monitoring team. Range Control interventions were reduced to near zero during the present event. As a result, there was virtually no disruption of the marine mammal monitoring effort, unlike the case in the previous year (Mobley 2011). This was likely due to the briefing of the Range Control Officers that took place during the pre-event debriefing, the continuous and reliable level of communications with Range Control and Outrider Bravo during the event, as well as having standard operating procedures in the form of PACMISRANFAC INSTRUCTION 3125.1 in place for operating our civilian aircraft on the PMRF Range.

Section 6 Acknowledgements

We are grateful to Navy personnel from U.S. Pacific Fleet Environmental (N01CE1) and Naval Facilities Engineering Command Pacific EV24 (NAVFAC PAC) and to Steve Martin (SPAWARSYSCEN-PACIFIC) and PMRF range control for their support, coordination, and facilitation in the implementation of these surveys. Many thanks to our observers Lenisa Blair and Brad Dawe, and to our pilots Stephen Holmes and James Murphy. All observations were made in accordance with National Oceanic and Atmospheric Administration permit no. 14451 issued to Joseph R. Mobley, Jr.

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Smultea, M.A., and J.M. Mobley 2009

Appendix A: Summary of Sightings with Positions (GPS)

Date	Time (HST)	Species*	Composition	Latitude (N)		Longitude (W)	
			(# Indivs)	(degrees)	(minutes)	(degrees)	(minutes)
2/15/2012	8:23:14	MN	1	22	2.871	159	18.987
2/15/2012	8:23:45	MN	3	22	3.887	159	18.601
2/15/2012	8:25:10	UD	60	22	6.735	159	17.427
2/15/2012	8:25:30	UD	12	22	7.48	159	17.288
2/15/2012	8:25:45	CM	1	22	8.019	159	17.249
2/15/2012	8:29:57	MN	1	22	14.612	159	22.933
2/15/2012	8:30:37	MN	2	22	14.967	159	24.381
2/15/2012	8:31:57	MN	1	22	14.711	159	27.498
2/15/2012	8:32:09	MN	2	22	14.683	159	27.965
2/15/2012	8:33:20	MN	3	22	14.502	159	30.719
2/15/2012	8:33:41	MN	2	22	14.439	159	31.524
2/15/2012	8:35:33	MN	1	22	13.582	159	36.106
2/15/2012	8:35:58	MN	1	22	13.485	159	36.697
2/15/2012	8:36:14	MN	1	22	13.323	159	37.402
2/15/2012	8:36:31	MN	3	22	13.316	159	37.996
2/15/2012	8:38:30	MN	2	22	13.352	159	42.574
2/15/2012	8:38:54	MN	2	22	12.995	159	43.4
2/15/2012	8:39:19	MN	2	22	12.641	159	44.248
2/15/2012	8:40:17	MN	1	22	11.518	159	46.207
2/15/2012	8:41:04	MN	5	22	10.398	159	47.521
2/15/2012	8:41:30	MN	2	22	9.744	159	48.32
2/15/2012	8:41:32	UD	17	22	9.692	159	48.425
2/15/2012	9:01:00	UT	1	22	22.7	159	43.457
2/15/2012	11:42:17	MN	1	22	15.215	159	29.646
2/15/2012	11:42:44	MN	5	22	15.035	159	28.766
2/15/2012	11:43:24	MN	2	22	14.804	159	27.444
2/15/2012	11:43:41	MN	2	22	14.485	159	26.89
2/15/2012	11:44:50	MN	2	22	14.637	159	24.629
2/15/2012	11:46:17	MN	2	22	13.869	159	22.068
2/15/2012	11:47:47	MN	3	22	12.464	159	19.724
2/15/2012	11:48:10	MN	1	22	11.917	159	19.247
2/15/2012	11:48:29	MN	1	22	11.485	159	18.901
2/15/2012	11:49:07	MN	1	22	10.442	159	18.304
2/15/2012	11:49:09	MN	1	22	10.442	159	18.304
2/15/2012	11:50:20	MN	2	22	8.492	159	17.107
2/15/2012	11:50:38	MN	1	22	7.977	159	16.836
2/15/2012	11:51:07	MN	2	22	7.013	159	16.798
2/15/2012	13:35:15	MN	2	21	59.597	159	19.772
2/15/2012	13:35:53	MN	2	22	0.758	159	19.614

Date	Time (HST)	Species*	Composition	Latitude (N)		Longitude (W)	
			(# Indivs)	(degrees)	(minutes)	(degrees)	(minutes)
2/15/2012	13:35:55	MN	2	22	0.854	159	19.611
2/15/2012	13:38:45	MN	1	22	6.05	159	17.299
2/15/2012	13:39:35	MN	2	22	7.675	159	16.85
2/15/2012	13:39:58	MN	1	22	8.477	159	16.704
2/15/2012	13:40:10	MN	1	22	8.878	159	16.603
2/15/2012	13:40:11	MN	1	22	8.878	159	16.603
2/15/2012	13:40:13	MN	1	22	8.979	159	16.576
2/15/2012	13:41:22	MN	1	22	11.201	159	17.496
2/15/2012	13:41:37	MN	2	22	11.646	159	17.804
2/15/2012	13:42:00	MN	2	22	12.261	159	18.428
2/15/2012	13:43:12	MN	2	22	13.782	159	20.656
2/15/2012	13:43:45	MN	2	22	14.27	159	21.848
2/15/2012	13:44:02	MN	1	22	14.447	159	22.418
2/15/2012	13:45:50	MN	1	22	15.183	159	26.506
2/15/2012	13:48:45	MN	1	22	16.072	159	32.981
2/15/2012	13:49:00	MN	2	22	16.344	159	33.45
2/15/2012	13:49:30	MN	1	22	16.895	159	34.375
2/15/2012	13:49:44	MN	1	22	17.105	159	34.75
2/15/2012	15:00:00	MN	2	22	30.06	159	56.928
2/15/2012	16:34:39	MN	1	22	15.45	159	29.287
2/15/2012	16:36:00	MN	1	22	14.862	159	27.114
2/15/2012	16:36:25	MN	1	22	14.761	159	26.458
2/15/2012	16:38:42	MN	2	22	14.076	159	22.611
2/15/2012	16:41:51	MN	2	22	10.806	159	18.438
2/15/2012	16:43:35	MN	1	22	8.018	159	17.366
2/15/2012	16:44:31	MN	3	22	6.543	159	17.115
2/15/2012	16:45:12	MN	1	22	5.353	159	17.543
2/15/2012	16:46:47	MN	1	22	2.948	159	19.213
2/16/2012	7:40:27	MN	1	22	3.717	159	18.811
2/16/2012	7:41:26	MN	1	22	5.472	159	17.768
2/16/2012	7:41:48	MN	2	22	6.036	159	17.242
2/16/2012	7:43:25	MN	1	22	9.652	159	17.188
2/16/2012	7:43:27	MN	1	22	9.759	159	17.244
2/16/2012	7:45:09	MN	1	22	12.937	159	19.934
2/16/2012	7:46:09	MN	2	22	14.111	159	22.274
2/16/2012	7:46:56	MN	1	22	14.673	159	24.33
2/16/2012	7:48:30	MN	2	22	15.287	159	28.339
2/16/2012	7:50:23	MN	3	22	15.593	159	33.361
2/16/2012	8:39:33	MN	2	22	18.891	159	49.675
2/16/2012	10:16:18	MN	1	22	21.204	159	50.902
2/16/2012	10:54:30	MN	1	22	15.357	159	37.037

Date	Time (HST)	Species*	Composition	Latitude (N)		Longitude (W)	
			(# Indivs)	(degrees)	(minutes)	(degrees)	(minutes)
2/16/2012	11:02:33	MN	1	22	13.257	159	21.572
2/16/2012	11:06:21	MN	1	22	7.493	159	17.398
2/16/2012	11:07:06	MN	1	22	5.964	159	17.795
2/16/2012	12:52:50	MN	1	22	0.21	159	19.511
2/16/2012	12:55:00	MN	2	22	4.195	159	18.425
2/16/2012	12:56:30	MN	1	22	7.161	159	17.337
2/16/2012	12:56:55	MN	1	22	8.019	159	17.12
2/16/2012	12:57:05	MN	1	22	8.446	159	17.048
2/16/2012	12:57:30	MN	2	22	9.312	159	17
2/16/2012	12:58:40	MN	2	22	11.434	159	18.123
2/16/2012	12:59:20	MN	2	22	12.428	159	19.281
2/16/2012	13:00:05	MN	1	22	13.305	159	20.685
2/16/2012	13:08:30	MN	1	22	16.111	159	39.646
2/16/2012	13:11:50	MN	1	22	15.284	159	42.742
2/16/2012	13:12:20	MN	1	22	16.324	159	42.527
2/16/2012	13:36:07	MN	1	22	28.149	159	53.869
2/16/2012	15:24:57	MN	1	22	16.499	159	36.564
2/16/2012	15:26:15	MN	2	22	15.635	159	34.582
2/16/2012	15:26:33	MN	1	22	15.464	159	34.126
2/16/2012	15:26:45	MN	2	22	15.396	159	33.816
2/16/2012	15:28:39	MN	2	22	14.754	159	30.763
2/16/2012	15:37:46	MN	2	22	5.75	159	17.989
2/17/2012	7:49:50	MN	1	21	59.414	159	19.845
2/17/2012	7:51:51	MN	1	22	2.819	159	18.944
2/17/2012	7:54:25	MN	1	22	7.429	159	17.113
2/17/2012	7:56:40	MN	1	22	11.803	159	18.479
2/17/2012	8:14:37	MN	2	22	13.734	159	51.292
2/17/2012	8:46:00	UD/black fish	4	22	14.122	159	52.815
2/17/2012	9:47:23	MN	2	22	14.386	159	50.263
2/17/2012	10:02:10	MN	-	22	17.236	159	51.08
2/17/2012	10:44:00	MN	2	22	15	159	36.156
2/17/2012	10:46:13	MN	1	22	15.185	159	32.545
2/17/2012	10:51:57	MN	1	22	13.729	159	22.63
2/17/2012	10:57:10	MN	1	22	5.997	159	17.754
2/17/2012	10:58:47	MN	1	22	2.602	159	19.351
2/17/2012	11:30:32	MN	1	n/a	n/a	n/a	n/a
2/17/2012	11:32:43	MN	2	n/a	n/a	n/a	n/a
2/17/2012	11:33:30	MN	2	n/a	n/a	n/a	n/a
2/17/2012	11:34:00	MN	2	n/a	n/a	n/a	n/a
2/17/2012	11:34:25	MN	1	n/a	n/a	n/a	n/a
2/17/2012	15:04:26	MN	1	22	16.81	159	35.839

Date	Time (HST)	Species*	Composition	Latitude (N)		Longitude (W)	
			(# Indivs)	(degrees)	(minutes)	(degrees)	(minutes)
2/17/2012	15:17:58	MN	1	22	3.653	159	18.839
2/18/2012	7:46:46	MN	1	22	5.069	159	18.04
2/18/2012	7:49:26	MN	1	22	10.063	159	17.714
2/18/2012	7:49:47	MN	1	22	10.681	159	18.057
2/18/2012	7:54:09	UC	1	22	14.664	159	26.662
2/18/2012	7:58:39	MN	2	22	14.151	159	38.446
2/18/2012	7:59:27	MN	3	22	13.816	159	40.504
2/18/2012	9:58:52	MN	1	22	8.173	159	56.603
2/18/2012	11:24:18	MN	3	21	58.119	159	49.204
2/23/2012	8:52:00	MN	1	22	11.101	159	17.775
2/23/2012	8:54:48	MN	1	22	14.18	159	22.417
2/23/2012	8:56:52	MN	1	22	14.593	159	26.464
2/23/2012	8:57:09	MN	2	22	14.57	159	27.108
2/23/2012	8:58:53	MN	1	22	14.236	159	30.843
2/23/2012	8:59:32	MN	3	22	14.271	159	32.238
2/23/2012	9:00:00	MN	1	22	14.279	159	33.321
2/23/2012	9:02:20	MN	2	22	12.892	159	37.674
2/23/2012	9:02:40	MN	4	22	12.654	159	38.342
2/23/2012	9:04:39	MN	1	22	13.572	159	42.184
2/23/2012	9:06:00	MN	1	22	13.834	159	41.574
2/23/2012	9:09:38	MN	1	22	8.78	159	44.638
2/23/2012	9:10:42	MN	2	22	9.673	159	44.526
2/23/2012	9:10:43	MN	1	22	9.673	159	44.526
2/23/2012	9:11:31	MN	2	22	9.902	159	45.456
2/23/2012	9:12:38	MN	2	22	8.194	159	45.755
2/23/2012	9:13:44	MN	1	22	6.505	159	46.223
2/23/2012	9:15:03	SL	70	22	4.596	159	47.439
2/23/2012	9:24:55	MN	2	22	2.687	159	48.23
2/23/2012	9:25:14	MN	2	22	2.567	159	48.741
2/23/2012	9:25:40	MN	2	22	3.172	159	49.118
2/23/2012	9:28:14	MN	1	22	2.727	159	53.616
2/23/2012	9:28:30	MN	1	22	2.644	159	54.212
2/23/2012	9:30:40	MN	1	22	2.277	159	58.592
2/23/2012	9:30:46	MN	1	22	2.384	159	58.77
2/23/2012	9:32:58	MN	1	22	2.673	160	2.713
2/23/2012	9:33:50	MN	1	22	2.154	160	4.219
2/23/2012	9:39:20	MN	2	21	58.838	160	2.616
2/23/2012	9:39:50	MN	2	21	59.613	160	2.839
2/23/2012	9:43:26	MN	2	22	0.814	160	4.064
2/23/2012	9:45:30	MS	2	22	0.153	160	4.963
2/23/2012	9:49:52	MN	2	21	58.408	160	7.607

Date	Time (HST)	Species*	Composition	Latitude (N)		Longitude (W)	
			(# Indivs)	(degrees)	(minutes)	(degrees)	(minutes)
2/23/2012	9:50:50	MN	1	21	58.602	160	9.274
2/23/2012	9:51:13	MN	2	21	58.196	160	9.746
2/23/2012	9:52:28	MN	2	21	56.49	160	9.951
2/23/2012	9:54:19	MN	2	21	54.698	160	12.37
2/23/2012	9:55:19	MN	1	21	53.093	160	14.219
2/23/2012	9:56:27	MN	1	21	51.228	160	14.873
2/23/2012	9:57:35	MN	1	21	49.455	160	15.288
2/23/2012	9:59:00	MN	1	21	47.508	160	14.297
2/23/2012	10:01:19	MN	2	21	47.456	160	11.537
2/23/2012	10:03:40	MN	1	21	50.599	160	9.527
2/23/2012	10:04:32	MN	1	21	51.386	160	8.454
2/23/2012	10:12:36	MN	1	21	58.415	159	58.37
2/23/2012	10:12:40	MN	1	21	58.453	159	58.274
2/23/2012	10:14:11	MN	1	21	59.566	159	55.496
2/23/2012	10:17:38	MN	3	22	0.899	159	49.24
2/23/2012	10:21:37	MN	2	21	57.51	159	43.446
2/23/2012	10:26:03	MN	1	21	53.97	159	37.574
2/23/2012	10:28:52	MN	1	21	52.936	159	33.753
2/25/2012	9:04:37	MN	2	21	51.763	159	26.914
2/25/2012	9:07:04	MS	1	21	53.603	159	23.815
2/25/2012	9:14:16	MS	1	22	1.191	159	19.954
2/25/2012	9:18:22	MN	4	22	7.137	159	17.329
2/25/2012	9:20:23	MS	1	22	10.088	159	18.184
2/25/2012	9:22:28	CM	2	22	13.072	159	20.556
2/25/2012	9:22:59	CM	1	22	13.249	159	21.548
2/25/2012	9:24:41	CM	1	22	14.206	159	24.066
2/25/2012	9:26:25	CM	1	22	13.914	159	26.708
2/25/2012	9:26:59	CM	1	22	14.002	159	27.668
2/25/2012	9:27:12	CM	1	22	13.94	159	27.883
2/25/2012	9:27:54	CM	2	22	14.025	159	28.869
2/25/2012	9:28:27	CM	2	22	13.805	159	29.808
2/25/2012	9:30:04	CM	1	22	13.189	159	31.048
2/25/2012	9:31:12	CM	1	22	13.68	159	32.55
2/25/2012	9:32:13	MN	1	22	13.81	159	34.199
2/25/2012	9:32:36	MS	1	22	13.807	159	34.712
2/25/2012	9:35:36	MN	2	22	11.175	159	38.98
2/25/2012	9:37:55	SL	50	22	10.524	159	39.777
2/25/2012	9:41:20	MN	1	22	7.572	159	44.341
2/25/2012	9:41:39	MS	2	22	7.088	159	44.56
2/25/2012	9:45:29	MN	2	22	1.786	159	47.605
2/25/2012	9:46:36	MS	1	22	0.143	159	46.807

Date	Time (HST)	Species*	Composition	Latitude (N)		Longitude (W)	
			(# Indivs)	(degrees)	(minutes)	(degrees)	(minutes)
2/25/2012	9:49:17	MN	2	21	57.564	159	48.501
2/25/2012	10:07:20	MS	1	22	0.101	160	6.334
2/25/2012	10:08:42	MN	2	21	58.905	160	7.12
2/25/2012	10:11:32	MN	2	21	56.517	160	10.005
2/25/2012	10:11:48	MS	1	21	56.251	160	10.154
2/25/2012	10:12:22	MS	1	21	55.933	160	10.425
2/25/2012	10:12:50	MS	1	21	55.866	160	10.978
2/25/2012	10:13:54	MN	2	21	54.98	160	12.106
2/25/2012	10:14:50	MS	1	21	54.226	160	12.816
2/25/2012	10:15:15	MS	2	21	53.889	160	13.193
2/25/2012	10:15:34	MS	1	21	53.616	160	13.614
2/25/2012	10:16:47	MS	4	21	51.903	160	14.212
2/25/2012	10:16:59	MS	1	21	51.825	160	14.169
2/25/2012	10:21:45	MN	4	21	46.733	160	12.665
2/25/2012	10:24:57	MN	2	21	49.632	160	10.592
2/25/2012	10:29:05	MN	1	21	52.684	160	6.236
2/25/2012	10:30:55	MN	3	21	54.524	160	4.257
2/25/2012	10:35:53	MN	1	21	58.881	160	0.173
2/25/2012	10:43:18	MN	1	21	58.493	159	46.223
2/25/2012	10:44:17	MS	1	21	58.081	159	44.557
2/25/2012	10:45:46	MS	1	21	57.273	159	42.352
2/25/2012	10:46:59	MS	1	21	56.712	159	40.387
2/25/2012	10:47:47	MS	1	21	55.927	159	39.379
2/25/2012	10:48:58	CM	2	21	54.585	159	38.189
2/25/2012	10:49:21	CM	3	21	54.3	159	37.754
2/25/2012	10:49:31	CM	1	21	54.189	159	37.516
2/25/2012	10:50:09	CM	1	21	53.832	159	36.669

*Species Code	Species (Latin name)
CM	green sea turtle (*Chelonia mydas*)
MS	Hawaiian monk seal *(Monachus schauinslandi)*
	Note: All monk seal sightings were hauled out
MN	humpback whale (*Megaptera novaeangliae*)
SL	spinner dolphin (*Stenella longirostris*)
UD	unidentified dolphin spp.
UC	unidentified cetacean spp.
UT	unidentified sea turtle spp.

Appendix B: Summaries of Behavior

Date	Time (HST)	Group #	Group size	Species	Behavior	Animal bearing	Comments
2/15/2012	8:23:14	1	1	MN	sl sw	135	
2/15/2012	8:23:45	2	3	MN	sl sw	315	
2/15/2012	8:25:10	3	60	UD	sl sw	315	
2/15/2012	8:25:30	4	12	UD	sl sw	260	
2/15/2012	8:25:45	5	1	CM	sl sw	360	
2/15/2012	8:29:57	6	1	MN	sl sw	90	
2/15/2012	8:30:37	7	2	MN	sl sw	150	
2/15/2012	8:31:57	8	1	MN	sl sw	180	
2/15/2012	8:32:09	9	2	MN	sl sw	90	
2/15/2012	8:33:20	10	3	MN	sl sw	90	
2/15/2012	8:33:41	11	2	MN	sl sw	90	
2/15/2012	8:35:33	12	1	MN	sl sw	360	fluke slapping
2/15/2012	8:35:58	13	1	MN	sl sw	90	
2/15/2012	8:36:14	14	1	MN	sl sw	90	
2/15/2012	8:36:31	15	3	MN	sl sw	45	surface active
2/15/2012	8:38:30	16	2	MN	sl sw	60	
2/15/2012	8:38:54	17	2	MN	sl sw	60	
2/15/2012	8:39:19	18	2	MN	sl sw	-	breaching
2/15/2012	8:40:17	19	1	MN	sl sw	60	
2/15/2012	8:41:04	20	5	MN	sl sw	30	
2/15/2012	8:41:30	21	2	MN	sl sw	240	
2/15/2012	8:41:32	22	17	UD	sl sw	90	
2/15/2012	9:01:00	23	1	UT	sl sw	-	
2/15/2012	11:42:17	24	1	MN	sl sw	20	
2/15/2012	11:42:44	25	5	MN	milling	-	
2/15/2012	11:43:24	26	2	MN	milling	-	
2/15/2012	11:43:41	27	2	MN	sl sw	180	
2/15/2012	11:44:50	28	2	MN	sl sw	3	
2/15/2012	11:46:17	29	2	MN	sl sw	315	
2/15/2012	11:47:47	30	3	MN	sl sw	120	
2/15/2012	11:48:10	31	1	MN	sl sw	315	
2/15/2012	11:48:29	32	1	MN	sl sw	-	
2/15/2012	11:49:07	33	1	MN	blow	-	
2/15/2012	11:49:09	34	1	MN	blow	-	
2/15/2012	11:50:20	35	2	MN	sl sw	150	
2/15/2012	11:50:38	36	1	MN	sl sw	150	
2/15/2012	11:51:07	37	2	MN	sl sw	150	
2/15/2012	13:35:15	38	2	MN	sl sw	180	
2/15/2012	13:35:53	39	2	MN	sl sw	90	

Date	Time (HST)	Group #	Group size	Species	Behavior	Animal bearing	Comments
2/15/2012	13:35:55	40	2	MN	sl sw	90	
2/15/2012	13:38:45	41	1	MN	sl sw	360	
2/15/2012	13:39:35	42	2	MN	surface active	-	
2/15/2012	13:39:58	43	1	MN	sl sw	90	
2/15/2012	13:40:10	44	1	MN	sl sw	90	
2/15/2012	13:40:11	45	1	MN	sl sw	90	
2/15/2012	13:40:13	46	1	MN	sl sw	360	
2/15/2012	13:41:22	47	1	MN	sl sw	90	
2/15/2012	13:41:37	48	2	MN	sl sw	135	
2/15/2012	13:42:00	49	2	MN	sl sw	300	
2/15/2012	13:43:12	50	2	MN	sl sw	300	
2/15/2012	13:43:45	51	2	MN	sl sw	120	
2/15/2012	13:44:02	52	1	MN	sl sw	180	
2/15/2012	13:45:50	53	1	MN	sl sw	135	
2/15/2012	13:48:45	54	1	MN	sl sw	-	dove
2/15/2012	13:49:00	55	2	MN	sl sw	90	
2/15/2012	13:49:30	56	1	MN	sl sw	90	
2/15/2012	13:49:44	57	1	MN	sl sw	90	
2/15/2012	15:00:00	58	2	MN	sl sw	360	ship within 3 mi
2/15/2012	16:34:39	59	1	MN	sl sw	-	
2/15/2012	16:36:00	60	1	MN	sl sw	30	
2/15/2012	16:36:25	61	1	MN	med sw	60	
2/15/2012	16:38:42	62	2	MN		-	swimming different directions
2/15/2012	16:41:51	63	2	MN	sl sw	30	
2/15/2012	16:43:35	64	1	MN	surface/milling	mill	fluke slapping
2/15/2012	16:44:31	65	3	MN	surface/milling	mill	breaching
2/15/2012	16:45:12	66	1	MN	active	45	dove
2/15/2012	16:46:47	67	1	MN		135	
2/16/2012	7:40:27	1	1	MN	sl sw	135	
2/16/2012	7:41:26	2	1	MN	sl sw	90	
2/16/2012	7:41:48	3	2	MN	sl sw	120	
2/16/2012	7:43:25	4	1	MN	surface	0	breaching
2/16/2012	7:43:27	5	1	MN	sl sw	90	
2/16/2012	7:45:09	6	1	MN	surface	-	breaching
2/16/2012	7:46:09	7	2	MN	surface	-	breaching
2/16/2012	7:46:56	8	1	MN	sl sw	270	
2/16/2012	7:48:30	9	2	MN	sl sw	210	
2/16/2012	7:50:23	10	3	MN	surface	90	breaching
2/16/2012	8:39:33	11	2	MN	sl sw	-	breach focal #1, heading towards sighting

Date	Time (HST)	Group #	Group size	Species	Behavior	Animal bearing	Comments
2/16/2012	9:44:14	12			surface	-	breaching returning at 951
2/16/2012	10:16:18	13	1	MN	surface	-	breaching/approaching pod
2/16/2012	10:54:30	14	1	MN	surface	-	
2/16/2012	11:02:33	15	1	MN	surface	110	breaching
2/16/2012	11:06:21	16	1	MN	surface	90	
2/16/2012	11:07:06	17	1	MN	surface	-	breaching
2/16/2012	12:52:50	18	1	MN	sl sw	90	breaching
2/16/2012	12:55:00	19	2	MN	milling	-	
2/16/2012	12:56:30	20	1	MN	sl sw	90	
2/16/2012	12:56:55	21	1	MN	sl sw	60	
2/16/2012	12:57:05	22	1	MN	underwater	300	
2/16/2012	12:57:30	23	2	MN	sl sw	-	
2/16/2012	12:58:40	24	2	MN	sl sw	120	
2/16/2012	12:59:20	25	2	MN	sl sw	130	
2/16/2012	13:00:05	26	1	MN	sl sw	30	
2/16/2012	13:08:30	27	1	MN	sl sw	90	
2/16/2012	13:11:50	28	1	MN	sl sw	360	
2/16/2012	13:12:20	29	1	MN	sl sw	90	
2/16/2012	13:36:07	30	1	MN	sl sw	-	breach
2/16/2012	15:24:57	31	1	MN	sl sw	60	
2/16/2012	15:26:15	32	2	MN	sl sw	30	
2/16/2012	15:26:33	33	1	MN	sl sw	90	
2/16/2012	15:26:45	34	2	MN	sl sw	90	
2/16/2012	15:28:39	35	2	MN	surface	60	breach
2/16/2012	15:37:46	36	2	MN	sl sw	-	
2/17/2012	7:49:50	1	1	MN	sl sw	180	
2/17/2012	7:51:51	2	1	MN	sl sw	90	
2/17/2012	7:54:25	3	1	MN	surface	-	breach
2/17/2012	7:56:40	4	1	MN	surface	90	breach
2/17/2012	8:14:37	5	2	MN	sl sw	-	Leaving to focal follow 30 min video
2/17/2012	8:46:00	6	4	UD/black fish	sl sw	-	black fish sighting/affiliation
2/17/2012	9:47:23	7	2	MN	sl sw	270	breach cue video but no whales, ship within 2 miles
2/17/2012	10:02:10	8	-	MN	sl sw	-	
2/17/2012	10:44:00	9	2	MN	sl sw	240	
2/17/2012	10:46:13	10	1	MN	sl sw	60	
2/17/2012	10:51:57	11	1	MN	sl sw	110	

Date	Time (HST)	Group #	Group size	Species	Behavior	Animal bearing	Comments
2/17/2012	10:57:10	12	1	MN	sl sw	-	
2/17/2012	10:58:47	13	1	MN	sl sw	-	breach
2/17/2012	11:30:32	14	1	MN	sl sw	135	
2/17/2012	11:32:43	15	2	MN	sl sw	90	
2/17/2012	11:33:30	16	2	MN	sl sw	90	
2/17/2012	11:34:00	17	2	MN	sl sw	60	
2/17/2012	11:34:25	18	1	MN	sl sw	60	
2/17/2012	15:04:26	19	1	MN	sl sw	-	
2/17/2012	15:17:58	20	1	MN	sl sw	-	breach, video trying to find sub
2/18/2012	7:46:46	1	1	MN	milling	mill	
2/18/2012	7:49:26	2	1	MN	sl sw	135	breach
2/18/2012	7:49:47	3	1	MN	underwater		
2/18/2012	7:54:09	4	1	UC	sl sw		
2/18/2012	7:58:39	5	2	MN	milling		
2/18/2012	7:59:27	6	3	MN	sl sw	70	
2/18/2012	9:58:52	7	1	MN	milling		by phone - informed MN vocalizations
2/18/2012	11:24:18	8	3	MN	sl sw	330	
2/23/2012	8:52:00	1	1	MN	surface	-	breach
2/23/2012	8:54:48	2	1	MN	surface	-	breach
2/23/2012	8:56:52	3	1	MN	sl sw	90	
2/23/2012	8:57:09	4	2	MN	sl sw	180	
2/23/2012	8:58:53	5	1	MN	surface	-	breach
2/23/2012	8:59:32	6	3	MN	sl sw	90	
2/23/2012	9:00:00	7	1	MN	sl sw	270	
2/23/2012	9:02:20	8	2	MN	sl sw	90	
2/23/2012	9:02:40	9	4	MN	sl sw	270	
2/23/2012	9:04:39	10	1	MN	sl sw	-	breach
2/23/2012	9:06:00	11	1	MN	surface	-	breach
2/23/2012	9:09:38	12	1	MN	sl sw	270	
2/23/2012	9:10:42	13	2	MN	sl sw	180	
2/23/2012	9:10:43	14	1	MN	sl sw	270	
2/23/2012	9:11:31	15	2	MN	sl sw	270	
2/23/2012	9:12:38	16	2	MN	sl sw	360	
2/23/2012	9:13:44	17	1	MN	sl sw	180	
2/23/2012	9:15:03	18	70	SL	milling	-	
2/23/2012	9:24:55	19	2	MN	sl sw	270	
2/23/2012	9:25:14	20	2	MN	sl sw	180	
2/23/2012	9:25:40	21	2	MN	sl sw	180	
2/23/2012	9:28:14	22	1	MN	sl sw	360	
2/23/2012	9:28:30	23	1	MN	sl sw	-	

Date	Time (HST)	Group #	Group size	Species	Behavior	Animal bearing	Comments
2/23/2012	9:30:40	24	1	MN	sl sw	180	
2/23/2012	9:30:46	25	1	MN	fast sw	180	
2/23/2012	9:32:58	26	1	MN	sl sw	360	
2/23/2012	9:33:50	27	1	MN	sl sw	180	
2/23/2012	9:39:20	28	2	MN	sl sw	20	
2/23/2012	9:39:50	29	2	MN	sl sw	180	
2/23/2012	9:40:40	30		UD	sl sw	360	
2/23/2012	9:43:26	31	2	MN	milling	-	
2/23/2012	9:45:30	32	2	MS	swimming	-	MONK SEAL
2/23/2012	9:49:52	33	2	MN	sl sw	180	breach
2/23/2012	9:50:50	34	1	MN	sl sw	90	
2/23/2012	9:51:13	35	2	MN	sl sw	180	
2/23/2012	9:52:28	36	2	MN	sl sw	180	
2/23/2012	9:54:19	37	2	MN	milling	290	
2/23/2012	9:55:19	38	1	MN	sl sw	-	underwater
2/23/2012	9:56:27	39	1	MN	sl sw	190	
2/23/2012	9:57:35	40	1	MN	sl sw	270	
2/23/2012	9:59:00	41	1	MN	sl sw	300	
2/23/2012	10:01:19	42	2	MN	sl sw	360	
2/23/2012	10:03:40	43	1	MN	sl sw	-	
2/23/2012	10:04:32	44	1	MN	sl sw	90	breach
2/23/2012	10:12:36	45	1	MN	sl sw	360	
2/23/2012	10:12:40	46	1	MN	sl sw	360	
2/23/2012	10:14:11	47	1	MN	sl sw	90	
2/23/2012	10:17:38	48	3	MN	sl sw	180	
2/23/2012	10:21:37	49	2	MN	sl sw	270	
2/23/2012	10:26:03	50	1	MN	sl sw	270	
2/23/2012	10:28:52	51	1	MN	sl sw	190	
2/25/2012	9:04:37	1	2	MN	sl sw	90	dove
2/25/2012	9:07:04	2	1	MS	hauled out	BEACH	monk seal
2/25/2012	9:14:16	3	1	MS	hauled out	BEACH	
2/25/2012	9:18:22	4	4	MN	sl sw	180	
2/25/2012	9:20:23	5	1	MS	hauled out	BEACH	monk seal
2/25/2012	9:22:28	6	2	CM		-	turtles
2/25/2012	9:22:59	7	1	CM		-	turtle
2/25/2012	9:24:41	8	1	CM		-	turtle
2/25/2012	9:26:25	9	1	CM		-	turtle
2/25/2012	9:26:59	10	1	CM		-	turtle
2/25/2012	9:27:12	11	1	CM		-	turtle
2/25/2012	9:27:54	12	2	CM		-	turtle
2/25/2012	9:28:27	13	2	CM		-	turtle

Date	Time (HST)	Group #	Group size	Species	Behavior	Animal bearing	Comments
2/25/2012	9:30:04	14	1	CM		-	turtle
2/25/2012	9:31:12	15	1	CM		-	turtle
2/25/2012	9:32:13	16	1	MN	surface		
2/25/2012	9:32:36	17	1	MS	hauled out	BEACH	beach
2/25/2012	9:35:36	18	2	MN	sl sw	90	
2/25/2012	9:37:55	19	50	SL	milling	MILL	
2/25/2012	9:41:20	20	1	MN	sl sw	360	
2/25/2012	9:41:39	21	2	MS	hauled out	BEACH	beach
2/25/2012	9:45:29	22	2	MN	sl sw	180	
2/25/2012	9:46:36	23	1	MS	hauled out	BEACH	beach
2/25/2012	9:49:17	24	2	MN	sl sw	90	
2/25/2012	10:07:20	25	1	MS	hauled out	BEACH	beach
2/25/2012	10:08:42	26	2	MN	sl sw	360	
2/25/2012	10:11:32	27	2	MN	sl sw	225	
2/25/2012	10:11:48	28	1	MS	hauled out	BEACH	beach
2/25/2012	10:12:22	29	1	MS	hauled out	BEACH	beach
2/25/2012	10:12:50	30	1	MS	hauled out	BEACH	beach
2/25/2012	10:13:54	31	2	MN	sl sw	180	
2/25/2012	10:14:50	32	1	MS	hauled out	BEACH	beach
2/25/2012	10:15:15	33	2	MS	hauled out	BEACH	NI'IHAU/beach
2/25/2012	10:15:34	34	1	MS	hauled out	BEACH	beach
2/25/2012	10:16:47	35	4	MS	hauled out	BEACH	beach
2/25/2012	10:16:59	36	1	MS	hauled out	BEACH	beach
2/25/2012	10:21:45	37	4	MN	sl sw		
2/25/2012	10:24:57	38	2	MN	sl sw		
2/25/2012	10:29:05	39	1	MN	dove		
2/25/2012	10:30:55	40	3	MN	sl sw	180	
2/25/2012	10:35:53	41	1	MN	sl sw	90	
2/25/2012	10:43:18	42	1	MN	sl sw		
2/25/2012	10:44:17	43	1	MS	hauled out	BEACH	Beach
2/25/2012	10:45:46	44	1	MS	hauled out	BEACH	Beach
2/25/2012	10:46:59	45	1	MS	hauled out	BEACH	Beach
2/25/2012	10:47:47	46	1	MS	hauled out	BEACH	Beach
2/25/2012	10:48:58	47	2	CM			turtles
2/25/2012	10:49:21	48	3	CM			turtles
2/25/2012	10:49:31	49	1	CM			turtles
2/25/2012	10:50:09	50	1	CM			turtles

Appendix C: Email Communications with Steve Martin on 2/18/12

1) **Steve is on station at pmrf- time 0741**

   Martin, Steve W CIV SPAWARSYSCEN-PACIFIC, 71510 steve.w.martin@navy.mil
   Feb 18 7:42 AM
   Please reply to know you received this
   Joe's response: sent 7:52 AM
   We're up and approaching Kilauea lighthouse

2) **Activity near L04 (Lima 4) phone - clickers and humpies?**

   Martin, Steve W CIV SPAWARSYSCEN-PACIFIC, 71510 steve.w.martin@navy.mil
   Feb 18 8:18 AM
   Joe's response: sent 8:18 AM
   OK Steve—we will try to check it out

3) **your approx location?**

   Martin, Steve W CIV SPAWARSYSCEN-PACIFIC, 71510 steve.w.martin@navy.mil
   Feb 18 (2 days ago) 8:24 AM
   To help give info closer to you
   Joe's response: sent 8:30 AM
   22 31
   159 55
   Is our current location, Heading to 22 20; 160 00
   Joe's response: sent 8:31 AM
   Any idea of possible range from L04?

4) **about 12km**

   Martin, Steve W CIV SPAWARSYSCEN-PACIFIC, 71510 steve.w.martin@navy.mil
   Feb 18 8:38 AM
   -----Original Message-----
   Joe's response—sent 8:36 AM
   Are the clickers likely beaked whales?

5) **clickers likely not bw, maybe pilot**

   Martin, Steve W CIV SPAWARSYSCEN-PACIFIC, 71510 steve.w.martin@navy.mil
   Feb 18 8:39 AM
   Joe's response; sent: 8:59 AM
   It's beaufort 6 so hard to see anything but still looking
   Steve's response; sent 9:03 AM
   Understand, range fairly quiet now, maybe clickers will surface
   Will look for things closer in
   Joe's response; sent: 9:03AM
   Is L04 still picking them up?

6) **L04 no clickers for a while now**
Martin, Steve W CIV SPAWARSYSCEN-PACIFIC 71510 steve.w.martin@navy.mil
Feb 18 9:25 AM
Joe's response: sent: 9:28 AM
Any other prospects?

7) **prospects**
Martin, Steve W CIV SPAWARSYSCEN-PACIFIC, 71510 steve.w.martin@navy.mil
Feb 18 9:40 AM
One or two beaked whale groups south down at 406 and 408
The group at 408 just ceased vocalizing
Earlier thought beaked around phone K01 / 501 so maybe check there on way down?
One minke east of range too far to locate

Joe's response sent: 9:46 AM
OK Steve—will do both areas

8) **posit for BW**
Martin, Steve W CIV SPAWARSYSCEN-PACIFIC
Feb 18 9:55 AM
Clicking bw posit at 09:52 near phone 405
22d 8.8' -159d 54.14'

Joe's response sent: 9:57 AM
Heading to 406 408 now

Joe's response sent: 10:00 AM
We just saw humpback at phone 406

Joe's response sent: 10:01 AM
Were you hearing humpbacks there?

9) **406 area clicks stopped**
Sent: 10:02 AM

Last posit for bw 22d 8.4'
-159 54.4'

Also hearing humpbacks in most areas
But confirmed these bw clicks

Steve's response: 10:05 AM
Understand humpback sighting, hearing them strong also
Bw posits seem good, stopped clicking only – 5 min ago
Takes them -20 to 30 min to come up
Sighting conditions any better down here?

Joe's response; sent: 10:06 AM
Heading there now

Joe's response sent: 10:08 AM
Sighting conditions suck. But we're on top of posit right now and looking

Joe's response sent: 10:43 AM
Still looking. He hasn't started clicking again?

Steve's response sent 10:49 AM
No, typically takes an hour and half or two (plus) for next dive vocal peroit
Vocal periods range 20 to 40 min per dive
Beaked are hard to sight even when good condiions though…
Still looking for a minke on range, just no takers yet

10) low activity am

Date: Feb 18, 2012, 11:01 AM

It has been a low activity am (except lots of humpbacks)
Only one strong minke but well east of range, so far my localizations are not reliable.
A few/several beaked whale group dives but hard to get good posit and even harder to see them today given conditions. I am fairly certain of the beaked whale groups give the period of the clicks, click frequencies, inter-click-intervals, and given they go away (corresponding to animals coming up from foraging dive).
Needed a couple of more planets to line up…
Still looking for another hour on my end…
Joe's response sent: 11:04 AM
Steve:
We're good fuel-wise for another 20 min since it takes about 30 min to get back.

Steve's response sent: 11:18 AM
Ok—nothing new on this end, beaked whales still not clicking
Lots of humpback sounds though….
Let me know when you depart.

Joe's response sent: 11:22 AM
Steve:
We've hit our time limit so heading back.
It was a great plan but the wrong conditions. We did see that humpback though where you were hearing them so that was pretty cool.
Thx for your support today!
--Joe

Steve's response sent: 11:29 AM
Have a good trip back to Lihue.
Too bad we didn't have better luck with more animals, esp. minke!

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Appendix D: Mitigation Flight Guidelines

DEPARTMENT OF THE NAVY
PACIFIC MISSILE RANGE FACILITY
P.O. BOX 128
KEKAHA, HAWAII 96752-0128

IN REPLY REFER TO:
PMRFINST 3125.1
N3R/:RC:src
13 FEB 2012

PACMISRANFAC INSTRUCTION 3125.1

From: Commanding Officer, Pacific Missile Range Facility

Subj: MARINE MAMMAL MITIGATION FLIGHT GUIDELINES

Ref: (a) Meeting at PMRF with COMPACFLT Environmental Personnel on 27Jul11

1. Purpose. In accordance with (IAW) reference (a), this instruction is to establish procedures for operational execution and contract oversight for Marine Mammal Mitigation (M3) Flights during fleet exercises.

2. Background. As part of the Navy's permit to train with Medium Frequency Active Sonar (MFAS), marine mammal monitoring is required. This involves 120-160 hours of visual surveys by boat or air. Fleet exercises, such as the Submarine Commander Course (SCC), provide optimal opportunity to accomplish these requirements due mainly to the size and scope of their operations. In an effort to accomplish the M3 goals and ensure safe operation of all craft involved, procedures need to be put in place for civilian observer aircraft.

3. Operational Execution.

a. Aircraft check in points – remain at 2000 feet (ft) or above until cleared by air operations then descend to 800-1000ft as agreed to by Commander, Destroyer Squadron Three One (COMDESRON THREE ONE) and Pacific Missile Range Facility (PMRF) Range Safety.

(1) Northern approach – Makaha Ridge

(2) Southern approach – South Kauai Vortec

b. Check in procedures – aircraft should state the following information upon check in with PMRF Air Operations.

(1) Working call sign

(2) Mission (to include time on range)

PMRFINST 3125.1
13 FEB 2012

(3) Mode 3

(4) Number of souls on board

(5) Fuel state (meaning hours left on station)

c. Aircraft safe holding area/lost communications procedure – it is a requirement that aircraft have one (1) working radio at all times. Loss of radio communication will require aircraft to depart operating area.

(1) Aircraft must have at least one (1) working radio and be in communication with Range Operations at all times. Radio checks will be conducted if no communication from either the aircraft or Range Air Operations has been received on the quarter hour. If unable to establish radio communications, aircraft will be required to exit operation area, return to base, and call Range Control via land line to report loss of communications.

(2) Safe holding area is 10-15 miles on 360 radial at 2000 ft, weather permitting. In the event of bad weather they will depart the range and return to base. PMRF is a VFR (visual flight rules) range.

(3) Should communications fail, aircraft must attempt to contact Range Facility Control (RFCO) on VHF 125.2 first then the tower on VHF 126.2. If unable, return to base of origination, call Range Operations on a land line explaining loss of communication.

(4) Declared emergency

(a) Squawk 7700 for one (1) minute

(b) Call tower on VHF 125.2

(c) Send out International Air Distress on VHF 121.5

(d) Proceed to PMRF for emergency landing.

(e) All other emergencies, communicate intentions to PMRF if possible

d. Class D Airspace – aircraft is not permitted to enter any Class D airspace unless cleared to enter by Air Operations Control coordinated with PMRF tower.

e. PMRF Operation areas

PMRFINST 3125.1
13 FEB 2012

(1) Area of exercise (SCC operations or other scheduled exercises) is instrumented range within W-188.

(2) Minimum three (3) mile standoff of Niihau island.

(3) Unless in pursuit of mammals, the marine mammal observer aircraft is to remain off the bow of their assigned observer ship. When conducting observations of mammal groups, aircraft will inform PMRF Air Operation Control of sighting and remain with mammal group until observations are completed. Then return to station, which in most cases transects ahead (bow) of assigned ship.

(4) Observer aircraft are prohibited from entering pre-determined ships radii other than assigned unit unless cleared by air operations.

(5) Prior to the execution of any air launches, ships will be required to call in flight quarters. Flight quarter status changes of the assigned M3 surface vessel will be communicated to the M3 aircraft.

(6) Maintain 800 ft hard deck to allow U.S. Navy participating aircraft to maintain an airspace plan to work 500ft and below and 1500ft and above. Working altitude should be 800-1000 ft once cleared by assigned range air controller.

f. Operating around ships

(1) Safety briefs will define safe operating procedures and reference this instruction while also including special instances to include live fire events, Electromagnetic Interference (EMI), Hazards of Electromagnetic Radiation to Person (HERP), and Hazards of Electromagnetic Radiation to Ordnance (HERO) concerns.

(2) Marine Mammal Mitigation team to provide CONOPS of daily activities

(3) Aircraft will communicate clearly and regularly throughout their time on range, particularly when changing their course or altitude. They will inform range control when mammals are observed, when observations have ended, and when they are going to return to assigned ship.

PMRFINST 3125.1
13 FEB 2012

g. Pre-Flight Procedures for M3 aircraft

(1) Contact range on land line for following information

(a) Daily flight plan will include confirming relevant radio channel frequencies

(b) Situation report (SITREP) from PMRF

(c) Confirm contact phone numbers for all crew on board, PMRF, RFCO and Operations Conductor

(2) Provide PMRF with operational frequencies between aircraft and Marine Mammal Observer onboard ship.

h. Operational instructions between both ships and aircraft and aircraft to aircraft will be addressed at the mandatory safety briefs.

(1) Follow PMRF Air Operation procedures as required for safe operation and mission success.

(2) Operating areas – stay in W-188 unless cleared

4. Conclusion. Safety is of utmost importance and flight check in procedures will be strictly enforced. Failure to comply with range instructions will result in immediate expulsion from range area and termination of Marine Mammal Mitigation participation in fleet exercises.

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Distribution:
List 1