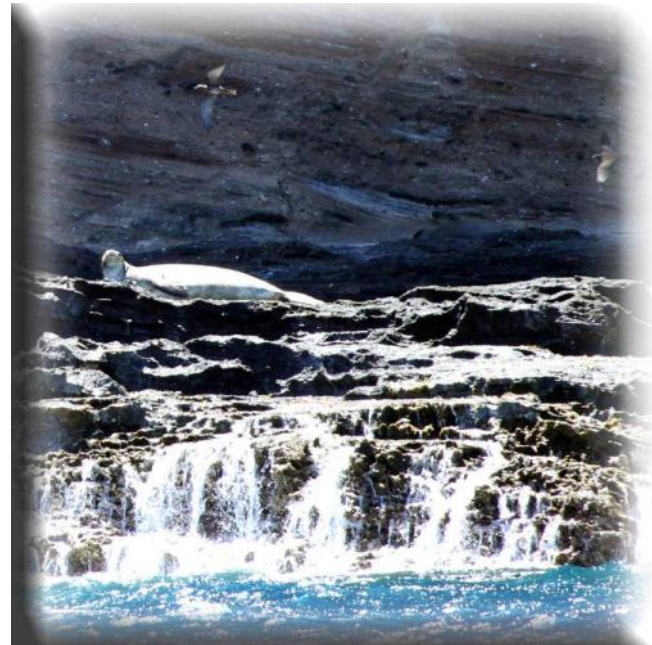


APPENDIX D. Ka'ula Island Ship-based Marine Mammal Survey June 30, 2011, Hawaii Range Complex. Final Report.

August 12, 2011
Final Report
Ka'ula Island Ship-based Marine
Mammal Survey June 30, 2011
Hawaii Range Complex

Prepared for:
Commander, U.S. Pacific Fleet



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List of Acronyms and Abbreviations

ft	feet
HRC	Hawaii Range Complex
kts	knots (nautical miles per hour)
m	meters
MFAS	mid-frequency active sonar
MMO	Marine Mammal Observer
nm	nautical miles
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
PMRF	Pacific Missile Range Facility
RIMPAC	Rim of the Pacific, (Major Training Exercise)

1. INTRODUCTION

1.1 MARINE MAMMAL AND SEA TURTLE MONITORING

In order to train with mid-frequency active sonar (MFAS), the Navy has obtained a Letter of Authorization (permit) from the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act and a Biological Opinion under the Endangered Species Act. The Hawaii Range Complex (HRC) Monitoring Plan, finalized in December 2008 for implementation in January 2009, and amended in 2010, was developed with NMFS to comply with the requirements under the permit. The monitoring plan and reporting will provide science-based answers to questions regarding whether or not marine mammals are exposed and reacting to Navy MFAS. The objectives of the monitoring plan are to answer the following questions:

1. Are marine mammals and sea turtles exposed to MFAS at regulatory thresholds of harm or harassment? If so, at what levels and how frequently are they exposed?
2. If marine mammals and sea turtles are exposed to MFAS in the HRC, do they redistribute geographically in the HRC as a result of repeated exposure? If so, how long does the redistribution last?
3. If marine mammals and sea turtles are exposed to MFAS, what are their behavioral responses? Are they different at various levels?
4. What are the behavioral responses of marine mammals and sea turtles that are exposed to various levels and distances from explosives?
5. Are the Navy's suite of mitigation measures for MFAS and explosives (e.g., Protective Measures Assessment Protocol [PMAP], measures agreed to by the Navy through permitting and consultation) effective at avoiding harm or harassment of marine mammals and sea turtles?

The Ka'ula Island monitoring effort is intended to provide data towards answering questions 1, 2, and 5 above.

1.2 KA'ULA ISLAND BACKGROUND

1.2.1 Property Description

Ka'ula is a small, uninhabited islet near the islands of Niihau and Kauai in the Hawaiian Archipelago (Fig. 1; latitude: 21°39'29" North, longitude: 160°32'39" West; Palmer 1936). It is located 20 nautical miles (37 kilometers [km]) west-southwest of Niihau and approximately 60 nautical miles (111 km) southwest of the Pacific Missile Range Facility (PMRF) Main Base, Kauai. Ka'ula has an area of approximately 136 acres (55 hectares), with a summit elevation of 540 feet (ft) (164.6 meters [m]) (Palmer 1936). The island is crescent-shaped, with a curving crest line approximately 5,500 ft (1,676 m) in length (Fig. 2). The terrain drops steeply from the crest at a mean slope of 36° (Palmer 1936), and steep V-shaped ravines have been cut by ephemeral streams on the windward slopes, such that the island has little level terrain (Elmer and Swedberg 1971). The northern horn of the island extends 2,500 ft (762 m) from the summit and ends at an approximate elevation of 280 ft (85 m), while the southern horn extends 3,000 ft (914 m) from the summit and ends at an approximate elevation of 100 ft (30 m) (Palmer 1936). The southeastern tip (1000 ft) of the island is currently used by the U.S. Navy as a range for inert ordnance and aircraft gunnery (Fig. 2). During a 1971 survey, a freshwater source was recorded approximately 1,000 ft (305 m) from the impact area with a flow rate of approximately 1 pint (0.47 liters) per hour (Elmer and Swedberg 1971).

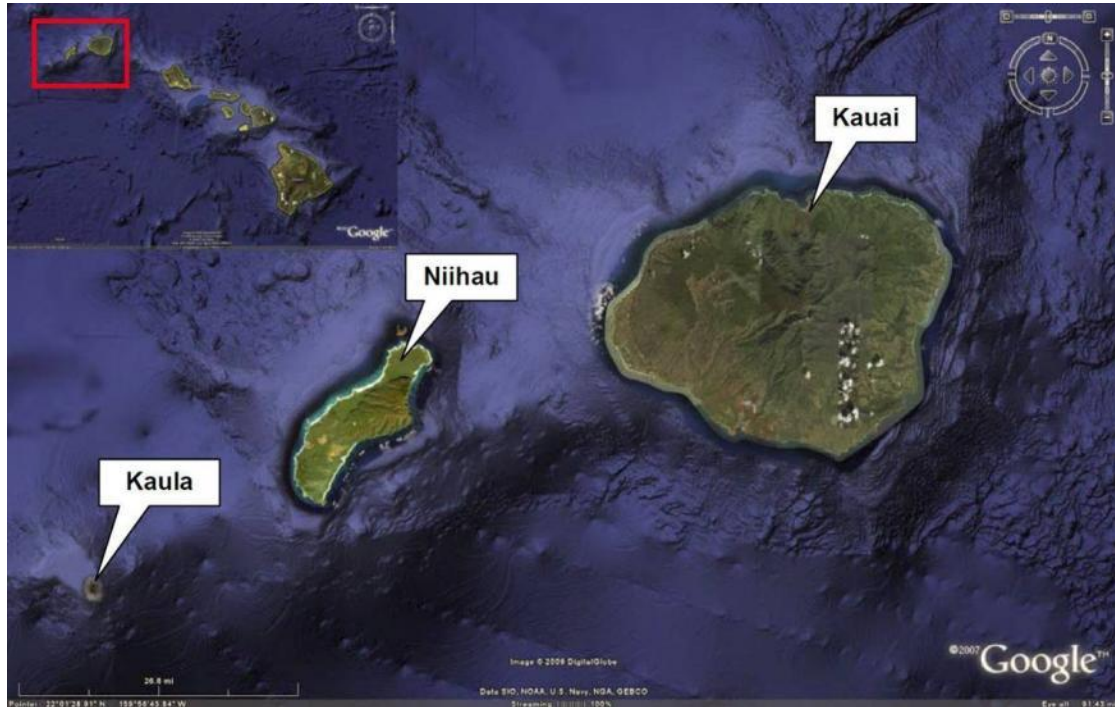


Figure 1. Location of Ka'ula Island relative to the main Hawaiian Islands (inset) and Kauai and Niihau (imagery from Google Earth).



Figure 2. Aerial imagery of Ka'ula Island (Walker and Associates).

1.2.2 Prior Use

The U.S. Lighthouse Service established an automatic gas light near the summit of Ka'ula Island on August 18, 1932. Lighthouse Service personnel were able to land on the west side of the island during steady trade wind weather, and an ascent trail was built from a wave-cut bench near sea level to the lighthouse site near the summit (Palmer 1936). The gas light provided 480 candlepower and was visible for a distance of up to 27 miles in clear conditions. Two gas tanks on the west side of the island supplied fuel to the main and backup light via 1,500 ft-long pipes. The lighthouse on Ka'ula was operated until 1947.

Following World War II, USCG used Ka'ula Island as a radar navigation target. In 1952, after receiving permission to use the island for munitions training, the Navy designated the southeastern tip (1000 ft) of the island as a practice range for air-to-surface and surface-to-surface weapons delivery (Elmer and Swedberg 1971, DON 1976a). Both live and inert ordnance were used during training missions through 1980. From 1981 through the present, the Navy restricted its munitions training at Ka'ula to inert ordnance delivery and aircraft gunnery (Walker 1979, 1983, 1984, 1993).

1.2.3 Marine Mammal Survey History and Species Observations

Two National Oceanic and Atmospheric Administration (NOAA) marine mammal surveys, not associated with the on-island plant and seabird surveys at Ka'ula Island, have examined the waters surrounding the island (Mobley et al. 2000, Baird et al. 2003). Both surveys recorded spinner dolphins (*Stenella longirostris*) and bottlenose dolphins (*Tursiops truncatus*) near Ka'ula (Mobley et al. 2000; Baird et al., 2003). In March 2000, Mobley et al. (2001) sighted killer whales (*Orcinus orca*) in nearby waters offshore the west coast of Niihau (~27km NW of Ka'ula).

Since 1998, access to the island for land-based surveys has not been granted due to increasing concerns by the Navy regarding the potential for injury to personnel visiting Ka'ula by unexploded ordnance, bird aircraft strikes, and steep, unstable terrain. In January 2009, the Navy contracted a private company to obtain aerial imagery of Ka'ula Island via small airplane in order to conduct seabird surveys using high-resolution digital images. The resolution of the imagery obtained during those flights, however, was not high enough to accurately assess seabird species abundance or presence on the island.

On 21-22 July 2009 avian surveys were conducted by Navy biologists via vessel platform to continue collection of seabird data on Ka'ula Island in the absence of direct access to land. Marine mammals surveys were conducted concurrently (Pepi et al. 2009), marking the beginning of a series of surveys incorporating marine mammal effort on the avian survey vessel. Subsequent surveys have occurred in June 2010, Feb 2011, and the topic of the current report, June 2011. Below follow summaries of the three past surveys in this series:

21-22 July 2009

Five biologists, including four seabird observers and one marine mammal observer, carried out this survey. This group included a seabird observer from the US Fish and Wildlife Service, as well as one from the Hawaii State Department of Land and Natural Resources. Observations of seabirds and marine mammals were conducted from the platform above the bridge, approximately 24 ft (7 m) above the water. Four species of marine mammals were observed near Ka'ula Island, including three species of odontocetes and one species of pinniped. Bottlenose

dolphins (*Tursiops truncatus*) and spinner dolphins (*Stenella longirostris*) were all sighted off of the northwest coast of the island within 820 ft (250 m) of the coastline. The spotted dolphins (*Stenella attenuata*) were sighted during transit to the survey area off of the southeast coast of Ka'ula within 4.9 miles (8 km) of the coastline. Hawaiian monk seals (*Monachus schauinslandi*) were observed hauled out on two separate ledges on the leeward (western) side of the island.

26-28 June 2010

Seven biologists, including three participating as marine mammal observers, carried out this survey. This group included a seabird observer from the US Fish and Wildlife Service, as well as one from the Hawaii State Department of Land and Natural Resources (Uyeyama & Hanser, 2010). The survey was conducted from the same vessel as the July 2009 effort. Marine mammal surveys were also conducted in waters between Kauai and Niihau, and the vessel was outfitted with two pairs of 25x150 Fujinon "Big Eye" binoculars mounted on the platform above the bridge. Species observed near Ka'ula were spinner dolphins (*Stenella longirostris*) approximately 1 km east of Ka'ula, and false killer whales (*Pseudorca crassidens*) approximately 21km ENE of Ka'ula (about halfway between Ka'ula and Niihau). The two adult *Pseudorca* dorsal fins did not match any animals in the Cascadia Research Collective catalog of photographs for the Insular Hawaiian population. Additionally, two sightings of bottlenose dolphins (*Tursiops truncatus*) were made offshore Niihau, and rough-toothed dolphins (*Steno bredanensis*) were sighted off the SW shore of Kauai. No Hawaiian monk seals were sighted.

15-20 February 2011

Due to limited space for personnel aboard the vessel, no dedicated marine mammal effort was conducted at the portion of the cruise that investigated waters offshore Ka'ula, although on-effort sightings during the transit from Niihau included two large whales (one unidentified ~18km NE of Ka'ula, and one humpback whale [*Megaptera novaeangliae*] ~10km NE of Ka'ula), and an in-water Hawaiian monk seal (*Monachus schauinslandi*) upon arrival at Ka'ula. Additionally, an off-effort sighting was made offshore of Ka'ula of a pod of spinner dolphins (*Stenella longirostris*) during the circumnavigation of the island for the avian survey. Also bottlenose dolphins (*Tursiops truncatus*) were sighted offshore the northern tip of Niihau ~2km NE of Lehua islet.

After the initial portion of the cruise dedicated to the avian survey at Ka'ula, there was a personnel change of the science crew aboard the vessel to a dedicated marine mammal group, enabling the subsequent phase of the cruise which was a marine mammal tagging and survey effort. This phase was concentrated on performing a tagging effort offshore of Kauai that involved deploying a dedicated RHIB operated by three biologists from Cascadia Research Collective (Richie & Fujimoto, 2011). In addition, there were three marine mammal biologists on the main vessel including one from NOAA's Kauai Marine Mammal Response Program. Due to prevailing weather conditions, the effort was performed in waters off the north shore of Kauai.

Additional sightings

Additionally the NOAA PIFSC on August 2, 2006, June 3, 2010, and July 6, 2010, and the Hawaii state DLNR Kauai Division of Aquatic Resources (on unidentified dates) have observed Hawaiian monk seals (*Monachus schauinslandi*) ranging in number between 3 and 15 animals (personal communication, 2011).

2. METHODS

2.1 SHIP-BASED SEA BIRD AND MARINE MAMMAL SURVEY: June 30, 2011.

Ship-based surveys were again conducted for seabirds and marine mammals offshore of Ka'ula Island and in the waters between Niihau and Kauai on 30 June 2011.

The waters of the survey area included the PMRF areas W-186 and W-187 (Fig. 3). Eight biologists, including six from the U.S. Navy, one from the NOAA Protected Species Division, and one from the University of Hawaii, carried out the surveys (Table 1). Surveys were conducted from the Motor Vessel Searcher, a 96 ft (29.3 m) ship capable of sleeping a scientific crew of eight, and is owned and operated by the Medical Foundation for the Study of the Environment. The M/V Searcher has an observation deck above the bridge, placing observers approximately 24 ft (7 m) above the surface of the water (Fig. 4). Distance to the horizon from this height was ~8 nm. A canopy structure covered the flying bridge to minimize exposure of observers and equipment to sun and rain.

2.2 SURVEY TIMELINE

The scientific crew of eight biologists boarded the M/V Searcher at Nawiliwili Harbor, Kauai, on the evening of 29 June. The vessel made the transit to Ka'ula overnight, and the marine mammal survey effort began on the morning of June 30 approximately 4.5km NE of Ka'ula as the vessel approached the island at approximately 12 knots over the course of an hour. Upon reaching Ka'ula, a bird survey was conducted during three circumnavigations of the island. Subsequently, the vessel dedicated time to obtaining dorsal fin photographs of bottlenose and spinner dolphins observed off the SE shore of the island during the bird survey. The vessel then headed ~5km to the NE of the island to deploy a passive acoustic device offshore, then returned to the island to examine hauled-out monk seals originally observed during the bird survey. Afterwards, the vessel transited directly to Kauai, during which a marine mammal survey was conducted. All of the scientific crew disembarked immediately upon arrival at Port Allen at the end of the day of 29 June.

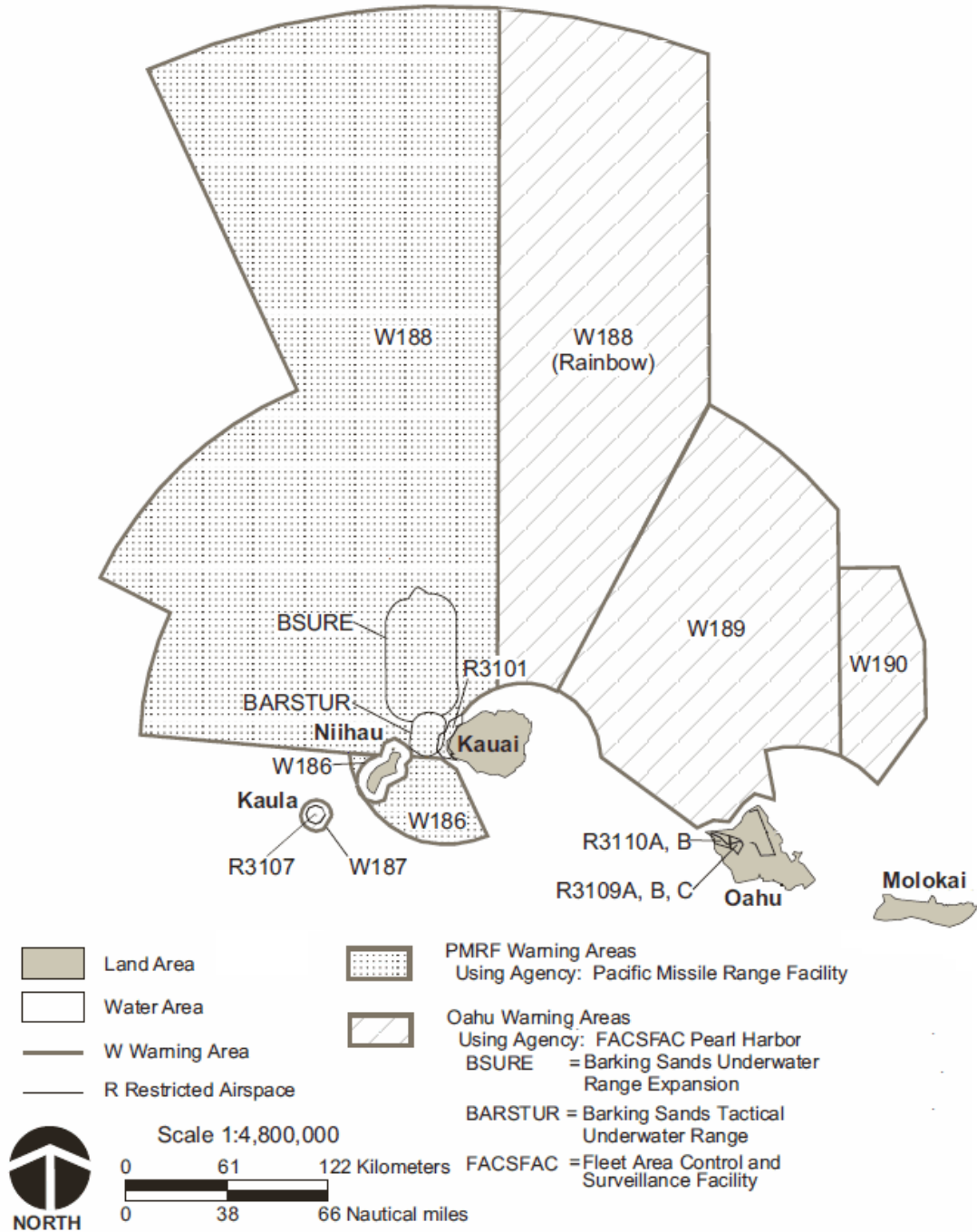


Figure 3. Depiction of PMRF Warning Areas W-186 and W-187 in relation to the Hawaiian Islands



Figure 4. M/V Searcher. A view from the stern shows several decks, including the covered flying bridge at top.

2.3 SHIP-BASED MARINE MAMMAL SURVEY METHODOLOGY

Data collection protocols and forms generally followed those used during previous vessel-based marine mammal and sea turtle monitoring programs conducted in conjunction with other naval exercises in the HRC (Smultea et al. 2007, 2008a, 2008b). The marine mammal survey portion of the cruise was conducted by four Navy biologists. The primary goals were to locate and identify marine mammals and sea turtles. Two biologists were experienced with line-transect survey methodology and had experience in field identification of subtropical Pacific marine mammal and sea turtle species, were knowledgeable of marine mammal biology and behavior, and had previous experience conducting marine mammal observations from vessels. Observations were made from the flying bridge of the M/V Searcher. Each observer rotated through three stations at 30-minute intervals: port observer, data recorder, and starboard observer. The data recorder also was able to make opportunistic observations. All three observers were equipped with 7x hand-held reticled binoculars. All observers were also equipped with digital cameras, two with a 400mm zoom lens, and one with a wide-angle zoom lens. The survey during the initial leg to Ka'ula, as well as the return transit to Kauai was conducted in "passing mode," i.e., the vessel was not diverted from the track line in the case of sightings. Once a sighting occurred, all three observers on duty were assigned the task of projecting independent estimates of group composition using a minimum, maximum, and best estimate approach. The average of the "best" estimates from the three observer team was then recorded for group size.

Except for the portion of the cruise devoted to the bird count during circumnavigations of Ka'ula Island, the marine mammal survey effort occurred during all daylight hours during "acceptable"

survey conditions (i.e., Bf <=5) with no rain or other environmental conditions impeding the ability to sight marine mammals near the vessel.

3. RESULTS

A total of six marine mammal groups were sighted during the cruise (Table 1) across a total of 11 hours 29 minutes of survey effort. All of the sightings were confirmed to species and consisted of three groups of bottlenose dolphins (*Tursiops truncatus*), one group of rough-toothed dolphins (*Steno bredanensis*), one group of spinner dolphins (*Stenella longirostris*), and a set of hauled-out Hawaiian monk seals on a short stretch of shoreline. At least one calf was among the Hawaiian monk seals, and a juvenile was sighted within one group of bottlenose dolphins, as well as within one group of spinner dolphins. No sea turtles were sighted.

Table 1. Summary of marine mammal sightings

Species	Group size (Min/Max/Best)	Date	Time (HST)
<i>Stenella longirostris</i>	16/37/26	30 June	07:40*
<i>Monachus schauinslandi</i>	5/5/5**	30 June	07:52
<i>Tursiops truncatus</i>	10/17/13	30 June	09:35
<i>Tursiops truncatus</i>	2/3/2	30 June	11:25
<i>Tursiops truncatus</i>	5/7/6	30 June	13:52
<i>Steno bredanensis</i>	4/8/6	30 June	17:21

All sightings and their locations with reference to survey tracks are depicted in Figs. 5 & 6.

* resighted at approximately same location on each of two successive circumnavigations of island

** original group size estimate was 2/3/2; when the location was more closely approached at 10:54-11:20, Five animals were counted, including two animals that hauled out of the water during this later approach

The marine mammal survey effort began on the morning of June 30 approximate 4.5km NE of Ka'ula (Fig. 5). Upon reaching Ka'ula Island, as with the 2009 ship-based survey, a seabird survey of the island was conducted as the vessel circumnavigated the island at a distance of approximately 750 ft (228 m) from the coastline; actual distance varied from approximately 150m to 600m depending on the bottom depth. The avian survey consisted of three clockwise circumnavigations of the island to provide multiple counting opportunities across different observers. Marine mammal sighting effort during the avian survey consisted of the NOAA monk seal biologist and one Navy biologist scanning the shoreline opportunistically during the vessel's circumnavigations; the water surface was not scanned continuously as for the dedicated marine mammal survey portion of the cruise. During the avian survey, two monk seals were sighted hauled-out on the NW corner of the island; it was decided that the vessel would return to this location after completing other tasks for a closer and dedicated search for monk seals so that the sun will have risen to maximally within the available survey window to light the shoreline area; standardized NOAA monk seal surveys are typically conducted closer to mid-day, when seals are most likely to haul out. Also a group of approximately six spinner dolphins were sighted at the SE tip of the island during each circumnavigation, and photographing of dorsal fins was attempted from the bow of the vessel by one biologist.

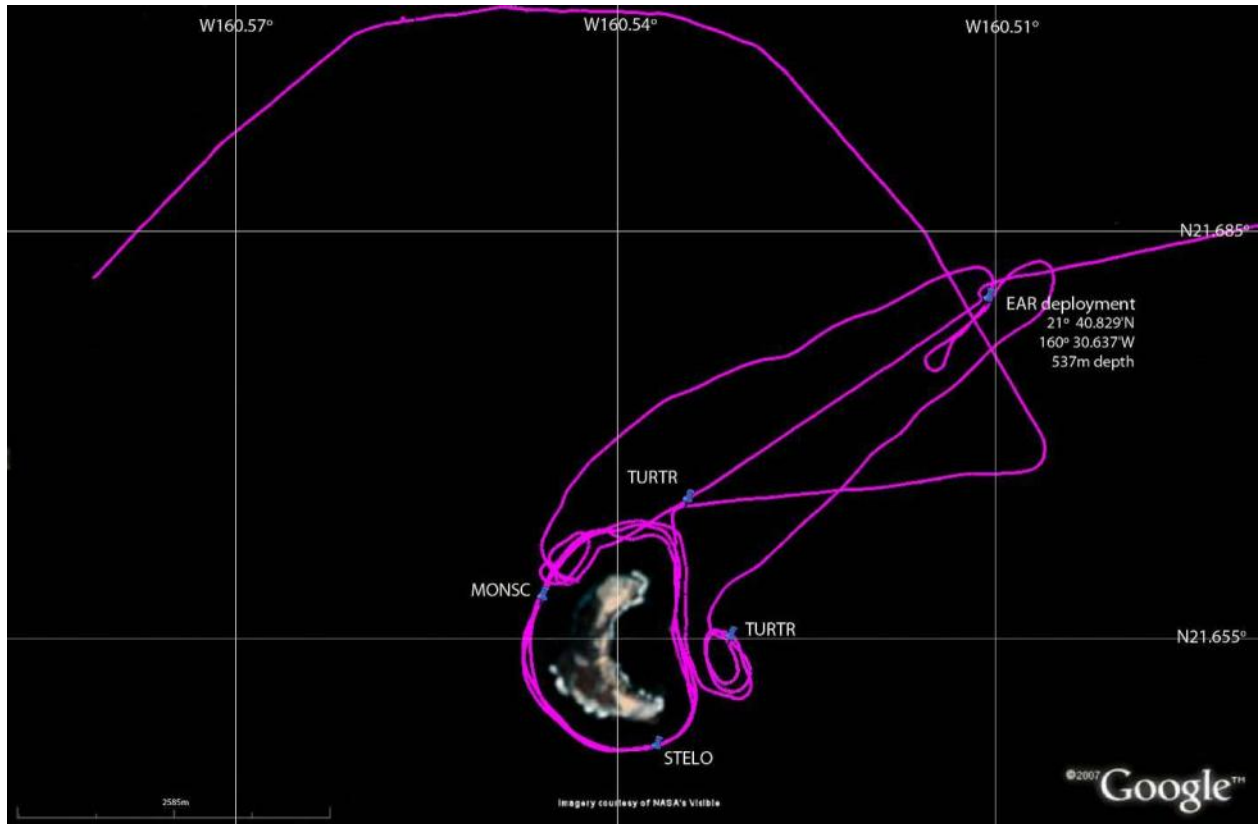


Figure 5. Sightings and EAR deployment near Ka'ula STELO=*Stenella longirostris*, TURTR=*Tursiops truncatus*, MONSC=*Monachus schauinslandi*. On-effort marine mammal survey track begins at far left, followed by three clockwise circumnavigations of Ka'ula during the avian survey, following a group of bow-riding *Tursiops* to the east of Ka'ula, deploying the EAR, re-examining hauled-out monk seals on the NW shore of Ka'ula, checking the EAR deployment, and departing for the return transit to Kauai with continued marine mammal survey effort. Imagery adapted from Google Earth.

After the avian survey, efforts were dedicated toward:

1. Obtaining spinner dolphin dorsal fin photographs for individual identification purposes
2. Deploying a passive acoustic monitoring device (an EAR) offshore to the east of the island
3. Examining the NW shore of the island where monk seals had been sighted
4. Conducting marine mammal survey in passing mode during the return transit to Kauai (Fig. 6)

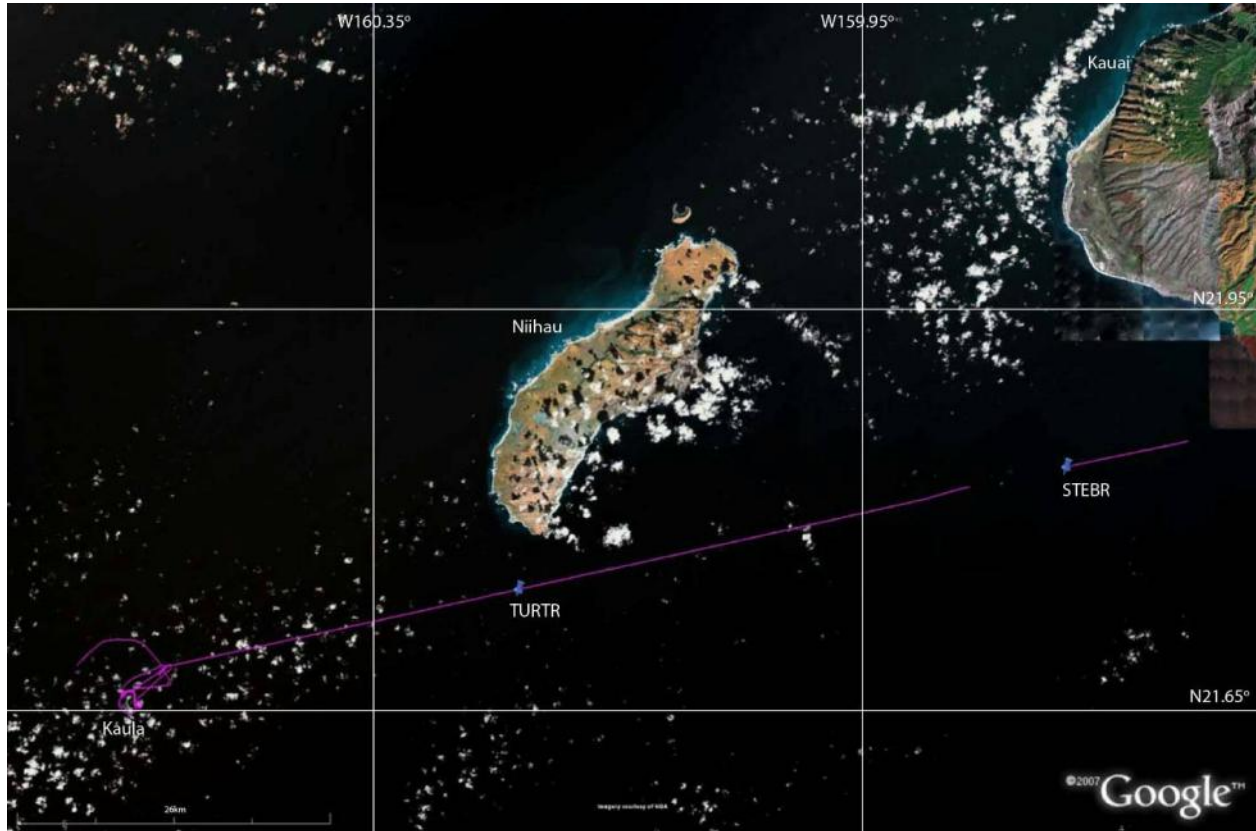


Figure 6. Overall on-effort track of June 30, 2011 with sightings. Effort begins at far left NW of Ka'ula. Sightings on the return transit from Ka'ula to Kauai are shown. TURTR=*Tursiops truncatus*, STEBR=*Steno bredanensis*. Detail of area near Ka'ula are shown in Fig. 5. Imagery adapted from Google Earth.

Dorsal fin photography: Two biologists were positioned at the bow of the vessel to take dorsal fin photographs (Appendix B) of bow-riding spinner dolphins (Fig. 7) off the SE shore of the island. Photography of these dolphins continued until reaching the waters directly off the central eastern shore, when a group of bottlenose dolphins were encountered, and as these began to bow-ride, the spinner dolphins were apparently displaced and departed from sight.

Photographic effort shifted to documenting the dorsal fins of the bottlenose dolphins (Appendix A) for approximately 20 minutes, until the animals departed. A large fraction of the animals had multiple cookie-cutter shark scars (Fig. 8), as well as a few individuals with fresh cookie-cutter shark wounds. The bottlenose dolphins were breaching and spiral-swimming, and many of the individuals appeared to be attempting to dislodge remoras with aerial behaviors (Fig. 9). Several individuals were identified as male by observing the genital region during leaping behaviors.

For comparison with existing libraries of marine mammals in Hawaiian waters, all photographs of spinner dolphin dorsals were provided to PIPIN (Pacific Islands Photo-Identification Network), and those of bottlenose dolphins to Cascadia Research Collective and The Dolphin Institute.



Figure 7. Spinner dolphins (*Stenella longirostris*) at Ka'ula



Figure 8. Bottlenose dolphin (*Tursiops truncatus*) at Ka'ula. This individual and several others in the group had cookie-cutter shark scars.



Figure 9. Bottlenose dolphin (*Tursiops truncatus*) at Ka'ula exhibiting aerial behavior with multiple remoras.

Acoustic device deployment: The biologist from the University of Hawaii deployed the passive acoustic device. The device was an Ecological Acoustic Recorder (EAR) (Lammers et al., 2008) (Fig. 10), and was configured for a long-term deployment of six months with a duty cycle of recording for 30 seconds every five minutes with a sampling rate of 80kHz. The device is a relatively compact package that is designed to be deployed by hand without use of heavy machinery such as a winch (Fig. 11).

The intention had been to deploy at 800m depth, as found near approximately 21° 40'N 160° 31'W. This location will complement three other EARs that are planned to be deployed in July 2011 in nearby waters offshore the northern, southwestern, and eastern shores of Niihau at a depth of approximately 800m.

When it was determined that the vessel's depth sounder displayed only to a maximum depth of 500m, and because the bottom drop-off was steep and not "smooth" in this area, it was decided to make a conservative deployment at just beyond 500m. Therefore, the vessel moved to the 500m contour, then moved offshore from this location before deploying. The actual deployment location was 21° 40.829'N 160° 30.637'W at a depth of 537m, approximately 5 km NE of the circumnavigation trackline for the avian survey.



Figure 10. Components of the EAR device. Pictured are ballast (cement and sand bag), acoustic release, syntactic foam float with signal flag, and EAR acoustic recording device.



Figure 11. Deployment of EAR. The EAR is designed to be manually deployable without heavy equipment. Deployment location was $21^{\circ} 40.829'N$ $160^{\circ} 30.637'W$ at a depth of 537m. See Fig. 5 for location relative to Ka'ula.



Figure 12. Communicating with EAR acoustic release to confirm deployment orientation and depth. Display at upper left reads a depth of “537 m”; vertical deployment orientation was also confirmed.

Hawaiian monk seal effort: Due to the requirement to wait for the EAR to sink fully to its deployment depth before checking its deployment status by communicating with the acoustic release device, the vessel departed and returned to the NW shore of Ka‘ula, to where monk seals had been sighted during the avian survey. The vessel moved closer to approximately 200m from the shore, and transited slowly across this area for approximately 25 minutes. The two monk seals originally sighted during the avian survey were re-sighted, as well as three additional animals that hauled out during this closer dedicated monk seal survey period. All five hauled-out monk seals were photographed with cameras equipped with 400mm lenses (Fig. 13, 14). At minimum one individual (one of the two that hauled out during this closer approach) appeared to be a juvenile (Fig. 14). All five animals were sighted on the ledge shoreline to the south of the large sea cave visible from the NW side of Ka‘ula (Figs. 15, 16). Only one animal’s posterior flippers were well visualized by photography as it hauled out, and no artificial identification tags were visible on this animal (Fig. 17).

There were a total of five seals observed. All were of unknown sex because the ventral area was not clearly visualized in photographs or observations to make a determination. This size class composition was: 2 adults, 1 immature, 1 juvenile, and 1 undetermined size.

After the effort was complete, the vessel returned to the EAR deployment location where, by communication with the acoustic release device, successful deployment was verified and vertical orientation and depth were determined (Fig. 12). All photographs of monk seals were provided to the NOAA Protected Species Division.



Figure 13. Three Hawaiian monk seals (*Monachus schauinslandi*) hauled out at NW shore of Ka'ula. From left to right: adult, immature (note green algae on hind flippers), and undetermined size.



Figure 14. Two Hawaiian monk seals (*Monachus schauinslandi*) hauled out at NW shore of Ka'ula. These animals were located to the right (as seen from the boat) of the three animals shown in Figure 13. One appears to be a juvenile.

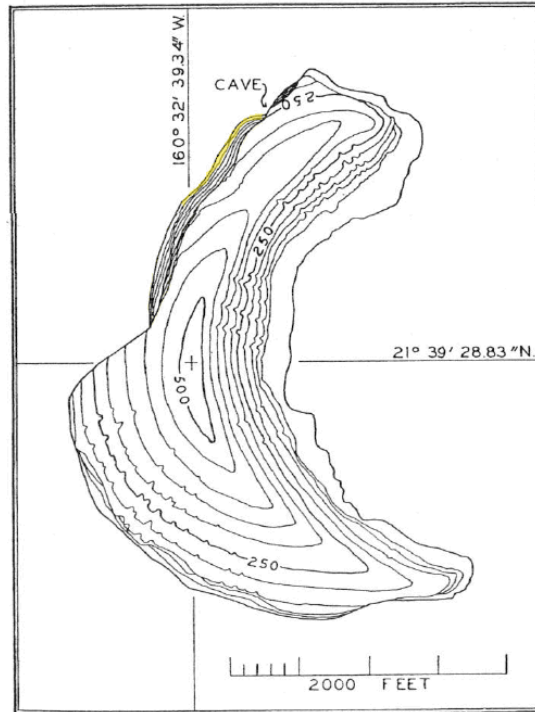


Figure 15. Map of Ka'ula showing location of sea cave and the shoreline (yellow) visible to its south upon which monk seals were sighted. (Figure adapted from Palmer, 1936, p. 7.)



Figure 16. Sea cave viewed from northernmost tip of Ka'ula. Monk seals were sighted on the ledge beyond the image to the right of the cave.



Figure 17. Close view of monk seal showing probable lack of an artificial flipper tag. This animal is also pictured at the far right of Fig. 13.

4. CONCLUSIONS

4.1 NIIHAU-KAUAI-KA'ULA PROJECT AREA

Few data are available from intensive marine mammal surveys specific to the waters surrounding the Niihau-Kauai project area, and only two that extend to Ka'ula Island (Mobley et al. 2000, Baird et al. 2003) other than the recent series of combined seabird-marine mammal surveys (Pepi et al., 2009; Uyeyama et al., 2010; Richie & Fujimoto, 2011). Therefore, comparison to past studies with the results of this survey are difficult to interpret.

However, as this survey is the fourth of a series of surveys envisioned to be conducted in conjunction with Ka'ula Island sea bird surveys, possible goals for long term monitoring have become apparent. The deployment of a passive acoustic monitoring device to the waters surrounding the island is intended to begin a long-term acoustic survey of these waters, and will complement three devices to be placed around Niihau. Every effort has observed spinner dolphins at Ka'ula, suggesting the possibility of a resident population. Other cetacean species have been regularly observed, and the characterization of these populations and their relation to other populations within Hawaiian waters may be possible with the continued use of photo-identification, as well as biopsy of satellite tagging—also individual animals satellite-tagged nearby in waters offshore Kauai may potentially reveal transits of these animals to Ka'ula. In this survey, it was planned that should an interesting species be sighted, for example a beaked whale or blackfish species, that the vessel would be directed to break from its track to follow these animals for photo-ID and behavioral recording. However, these species were not sighted, and the

two longer sightings of dolphin species appeared to be cases where the animals approached the vessel to bowride, which facilitated photography of dorsal fins. The characterization of monk seals at Ka'ula can also be conducted due to the planned regularity of future surveys; it is possible that closer approaches by small boats may allow individual identification through either natural marks or artificial tags.

4.2 SURVEY PROTOCOL

The cooperative combination of marine mammal and sea turtle survey effort with long-term vessel-based sea bird surveys of Ka'ula Island have continued to prove to be a cost-effective and productive research protocol. The collection of data in these waters utilizing these proven methods are anticipated to continue to provide baseline information regarding marine mammal and sea turtle populations in the Hawaii Range Complex.

Having an experienced monk seal biologist from NOAA was useful to have during the seabird portion of the survey, as the seals are quite difficult to sight from the distance of the bird survey track, especially when there is a swell or waves due to wind. The NW corner of Ka'ula to the south of the cave where the five monk seals were observed this cruise (Fig. 15) may be a frequently used haul out location. No seals were observed on the ledge of the SW shoreline near the southern tip of the island where seals had been observed on the 2009 cruise. It is worth noting that these Western shorelines are in shadow through most of the early morning, and that the seals are known to be also less likely to haul out in the earliest part of the morning. Therefore it was beneficial that the science team performed monk seal observations after other tasks (such as PAM deployment and cetacean dorsal fin photography) had been completed, because there was more sunlight available, and additional seals did haul out as compared to the earlier observations during the avian survey leg. The 400mm lenses were sufficient to capture photography from the safe distance from shore required by the M/V Searcher. Photography of shorelines where monk seals were not apparent in binoculars was also performed for a post-survey examination for more seals; no additional seals were positively confirmed through such photography.

Regarding cetacean dorsal fin photography, the relatively high position of the M/V Searcher's bow, as well as the dolphins' tendency to be bow-riding directly below the bow made it difficult to obtain photography with the particularly high quality and perpendicular angle necessary for individual identification of spinner dolphins. However photography of the bottlenose dolphins was judged to be sufficient for individual identification purposes.

The M/V Searcher's echosounder was only capable of displaying bottom depths to 500m. Due to the steep and unpredictable dropoff in the area, PAM deployment was therefore performed by moving slightly offshore of the 500m isobaths, then deploying. This method was judged to be a good balance between the risk of deploying past the device rating of 1000m, yet closer to the ideal depth of 800m. A successful deployment was thereby accomplished to a depth of 537 m which is sufficient for detecting high priority deep-diving odontocetes such as beaked whales.

4.3 ACKNOWLEDGEMENTS

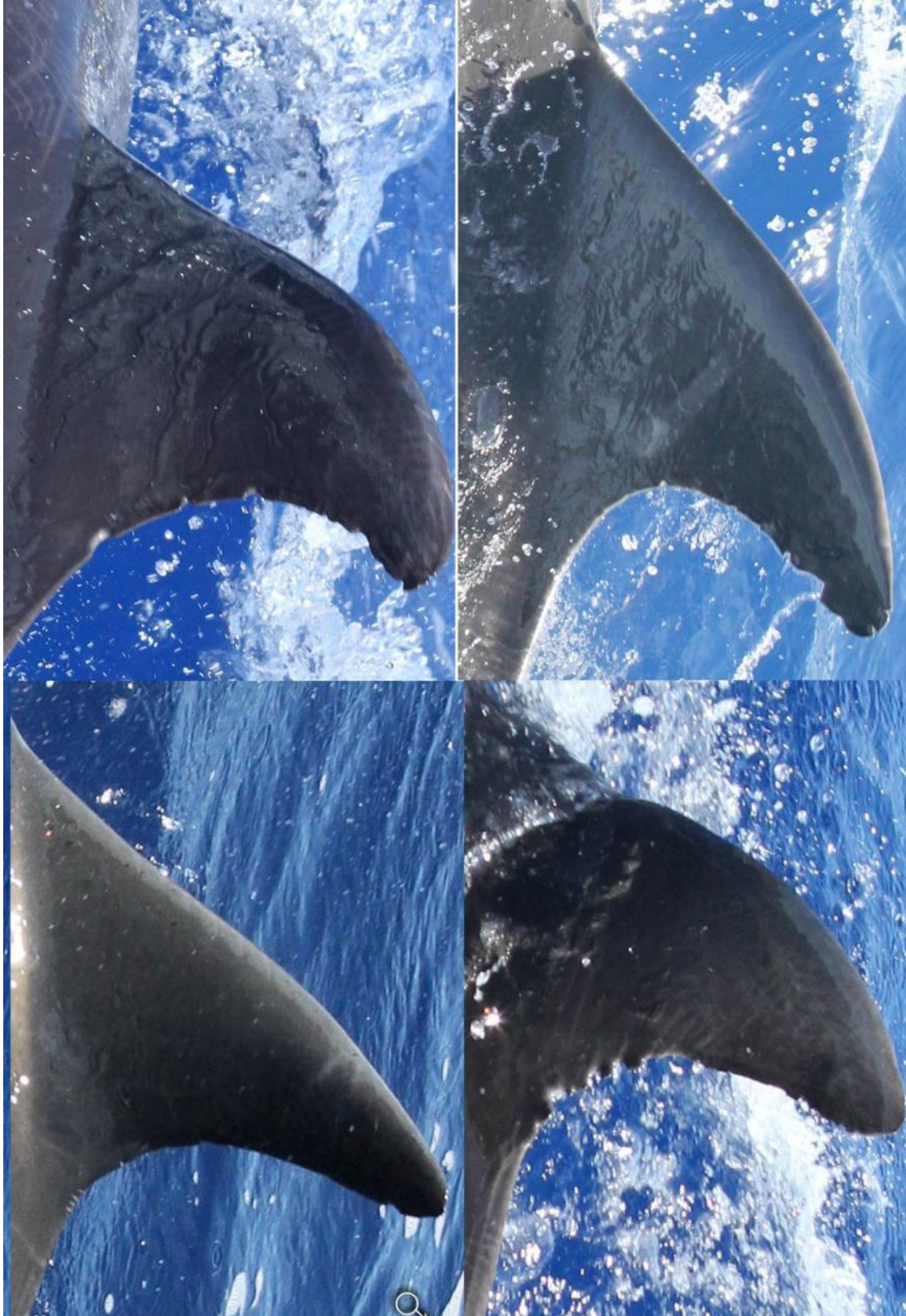
We thank the crew of the M/V Searcher for their hospitality and safe execution of the survey, as well as Brenda Becker of the NOAA PIFSC Protected Species Division, for expert participation in, and advice during, the survey as well as insightful comments during the writing of this report.

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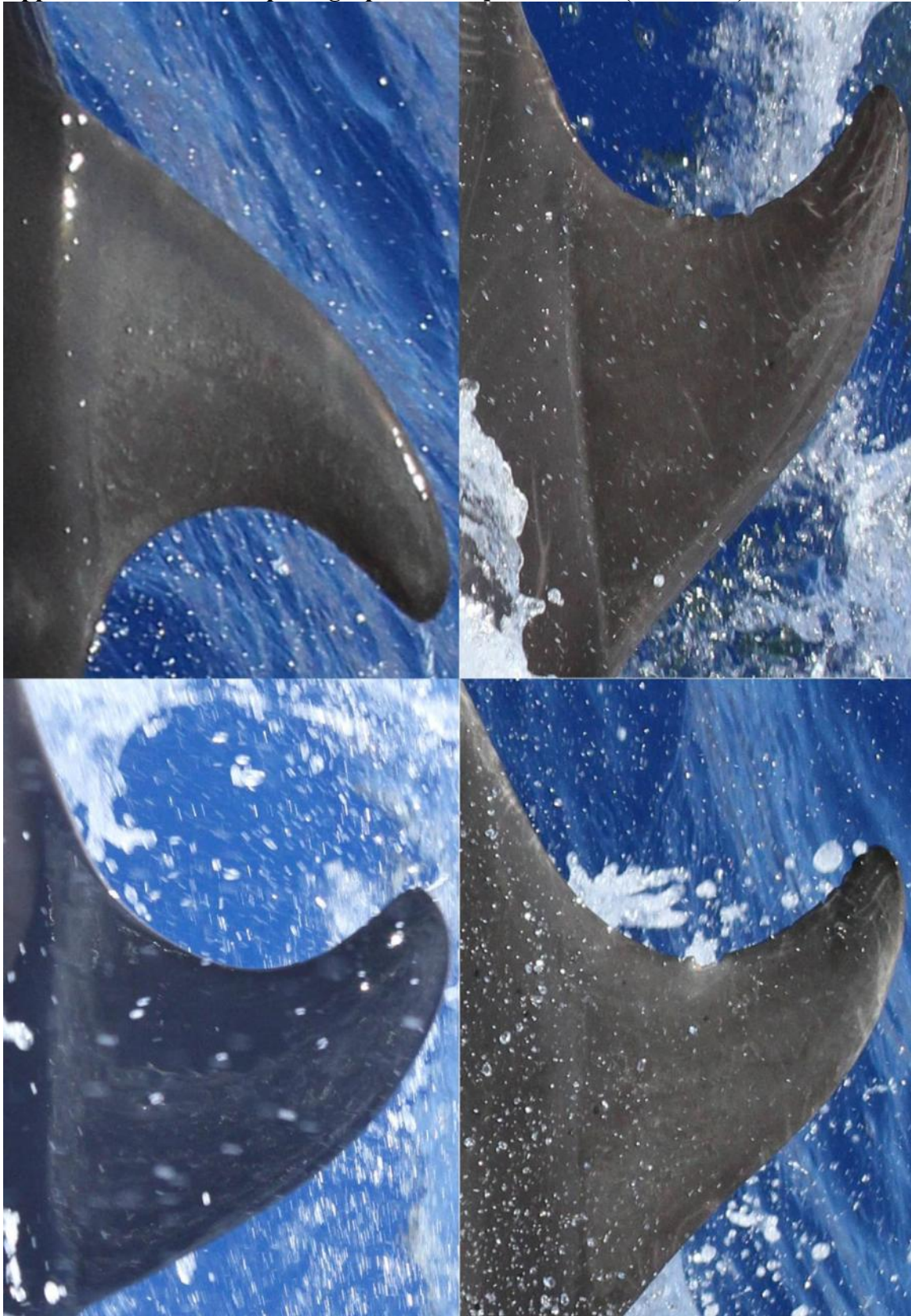
Appendix A. Dorsal fin photographs: *Tursiops truncatus*



Appendix A. Dorsal fin photographs: *Tursiops truncatus* (continued)



Appendix A. Dorsal fin photographs: *Tursiops truncatus* (continued)



Appendix A. Dorsal fin photographs: *Tursiops truncatus* (continued)



Appendix B. Distinctive dorsal fin photographs: *Stenella longirostris*



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