

Odontocete Studies on the Pacific
Missile Range Facility in August 2017:
Satellite Tagging, Photo-Identification,
and Passive Acoustic Monitoring

Interim field survey report to HDR
under Federal contract number N62470-15-D-8006
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14. ABSTRACT In August 2017, a marine mammal monitoring project was carried out combining boat-based field efforts and passive acoustic monitoring on and around the Pacific Missile Range Facility (PMRF). Commander, Pacific Fleet (PACFLT) funded five days of small-boat effort and the National Marine Fisheries Service funded an additional six days of effort. Information obtained was compared to previous sightings during small-boat effort by Cascadia Research Collective (CRC) off Kauai and Niihau, during 1,119 hr of effort (19,194 km) over nine different years from 2003 through 2016 (see Baird 2016). From August 4-14, 2017 there were 1,113 km (77.4 hr) of small-vessel survey effort. There were 34 sightings of five species of odontocetes, 26 of them on PMRF. Of those 26, 15 were directed by acoustic detections using the Marine Mammal Monitoring on Navy Ranges (M3R) system. Melon-headed whales (<i>Peponocephala electria</i>) were encountered on four occasions (median depth = 781 m), bottlenose dolphins (<i>Tursiops truncatus</i>) on five (median depth = 440 m), rough-toothed dolphins (<i>Steno bredanensis</i>) on 22 (median depth = 677 m), spinner dolphins (<i>Stenella longirostris</i>) twice (median depth = 39 m), and pantropical spotted dolphins (<i>Stenella attenuata</i>) once (depth = 852 m; Figure 2). During the encounters, we took 37,727 photographs for individual identification, with photographs being added to long-term CRC regional photo-identification catalogs for bottlenose dolphins and rough-toothed dolphins. Six satellite tags were deployed on three species, with three tag deployments funded by PACFLT and three by other grants to CRC. All tagged individuals had either left the vicinity of PMRF prior to the antisubmarine warfare exercise component or SCC or the tags had stopped transmitting by that time. Rough-toothed dolphins were the most frequently-encountered species, with 22 of 34 encounters (64.7%) being of this species. Two tags were deployed on rough-toothed dolphins, a depth-transmitting tag funded by PACFLT and a location-		

only tag funded by another grant to CRC, although locations were only received from the location-only tag. During the seven days of location data from the functioning tag the tagged individual remained off the west and northwest coasts of Kaua'i, moving off and on PMRF on 10 occasions (Figure 3), at a median distance from shore of 12.0 km and a median depth of 797 m. The tagged individual, HISb1948 in CRC's photo-identification catalog, had previously been photographed off Kaua'i in 2014 and 2015.

There were four sightings of melon-headed whales. A large group of melon-headed whales was seen two days in a row (group size estimates of 300 and 200), and two that were composed only of the same pair of individuals seen four days apart, once mixed in with approximately 20 rough-toothed dolphins, and the second time mixed in with approximately 28 rough-toothed dolphins. Based on pigmentation patterns and head morphology, one of the two individuals in the pair appeared to be a hybrid between a melon-headed whale and a rough-toothed dolphin. A biopsy sample was collected from the putative hybrid and sent for analyses to the Southwest Fisheries Science Center. The sample was genetically confirmed as being from a male and with the mitochondrial haplotype of a melon-headed whale. Two satellite tags were deployed on individuals in the large group of melon-headed whales when they were first encountered on PMRF. The two individuals remained together during the period of tag overlap. They moved off and back on PMRF in the first day after tagging, then moved to the south and finally east of Kauai. Over the eight days of tag data the individuals moved 786 km, with a median depth and distance from shore of 3,053 m and 44.3 km, respectively.

There was also one sighting of pantropical spotted dolphins, with an estimated group size of 50 individuals. Two satellite tags were deployed on individuals in this group. The two individuals remained associated over the period of tag overlap. In the first two days after tag deployment the tagged individuals moved off and on PMRF three times, before moving south of Kauai, eventually meandering far to the north of Oahu. Over the 14 days of tag data the individuals moved 1,307 km, with a median depth and distance from shore of 3,603 m and 49.5 km, respectively. Movements and habitat use information suggests this group was from the pelagic stock of pantropical spotted dolphins. This sighting provides further support that there is no evidence for an island-associated population of pantropical spotted dolphins off Kauai or Niihau, as there is off the other main Hawaiian Islands.

15. SUBJECT TERMS

Monitoring, marine mammals, toothed whales, satellite tagging, photo-identification, passive acoustic monitoring, biopsy, Hawaii Range Complex, Pacific Missile Range Facility

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As part of a long-term U.S. Navy-funded marine mammal monitoring program, in August 2017 a combined boat-based field effort and passive acoustic monitoring was carried out on and around the Pacific Missile Range Facility (PMRF). The effort was timed to occur immediately prior to a Submarine Command Course (SCC), to potentially allow for assessment of exposure and response of satellite-tagged individuals to mid-frequency active sonar. Commander, Pacific Fleet (PACFLT) funded five days of small-boat effort and the National Marine Fisheries Service funded an additional six days of effort. Information obtained was compared to previous sightings during small-boat effort by Cascadia Research Collective (CRC) off Kaua'i and Ni'ihau, during 1,119 hours of effort (19,194 km) over nine different years from 2003 through 2016 (see Baird 2016). From August 4-14, 2017 there were 1,113 kilometers (77.4 hours) of small-vessel survey effort. Search effort was primarily restricted to the southern-most part of PMRF and areas south of PMRF due to high seas associated with easterly trade winds, with 84% of effort in waters less than 1,000 m depth (median depth = 575 m; Figure 1). There were 34 sightings of five species of odontocetes, 26 of them on PMRF. Of those 26, 15 were directed by acoustic detections using the Marine Mammal Monitoring on Navy Ranges (M3R) system. Melon-headed whales (*Peponocephala electra*) were encountered on four occasions (median depth = 781 m), bottlenose dolphins (*Tursiops truncatus*) on five (median depth = 440 m), rough-toothed dolphins (*Steno bredanensis*) on 22 (median depth = 677 m), spinner dolphins (*Stenella longirostris*) twice (median depth = 39 m), and pantropical spotted dolphins (*Stenella attenuata*) once (depth = 852 m; Figure 2). During the encounters, we took 37,727 photographs for individual identification, with photographs being added to long-term CRC regional photo-identification catalogs for bottlenose dolphins and rough-toothed dolphins. Six satellite tags were deployed on three species, with three tag deployments funded by PACFLT and three by other grants to CRC. All tagged individuals had either left the vicinity of PMRF prior to the antisubmarine warfare exercise component or SCC or the tags had stopped transmitting by that time.

As expected based on previous efforts off Kaua'i and Ni'ihau, rough-toothed dolphins were the most frequently-encountered species, with 22 of 34 encounters (64.7%) being of this species. Nineteen of the 22 encounters were on PMRF, and 10 of those groups were found as a result of acoustic detections from M3R (66.7% of all responses to acoustic detections). One sighting was of a mixed group of rough-toothed and bottlenose dolphins, only the second sighting of a mixed-species group involving those two species in a combined 722 sightings of the two species in CRC's Hawai'i dataset. Two tags were deployed on rough-toothed dolphins, a depth-transmitting tag funded by PACFLT and a location-only tag funded by another grant to CRC, although locations were only received from the location-only tag. During the seven days of location data from the functioning tag the tagged individual remained off the west and northwest coasts of Kaua'i, moving off and on PMRF on 10 occasions (Figure 3), at a median distance from shore of 12.0 km and a median depth of 797 m. The tagged individual, HISb1948 in CRC's photo-identification catalog, had previously been photographed off Kaua'i in 2014 and 2015. Combined with previous tag deployments on rough-toothed dolphins (Baird et al. 2017), this suggests the tagged group was from the resident, island-associated population.

Melon-headed whales had only previously been documented in CRC effort off Kaua'i or Ni'ihau four times, once in June 2003 and three times over a 6-day period in June 2008. In August 2017 there were four additional sightings, two of a large group seen two days in a row (group size estimates of 300 and 200), and two that were composed only of the same pair of individuals seen four days apart, once mixed in with approximately 20 rough-toothed dolphins, and the second time mixed in with approximately 28 rough-toothed dolphins. Based on pigmentation patterns and head morphology, one of the two individuals in the pair appeared to be a hybrid between a melon-headed whale and a rough-toothed dolphin (Figure 4). A biopsy sample was collected from the putative hybrid and sent for analyses to the Southwest Fisheries Science

Center. The sample was genetically confirmed as being from a male and with the mitochondrial haplotype of a melon-headed whale. Nuclear DNA analyses are underway with this sample to determine whether it shows signs of hybrid ancestry. Two satellite tags were deployed on individuals in the large group of melon-headed whales when they were first encountered on PMRF, with the tags funded by PACFLT. This is only the second time that melon-headed whales have been satellite-tagged off Kaua'i or Ni'ihau (the first was in June 2008 prior to RIMPAC; see Baird et al. 2008). The two individuals remained together during the period of tag overlap. They moved off and back on PMRF in the first day after tagging, then moved to the south and finally east of Kaua'i (Figure 5). Over the eight days of tag data the individuals moved 786 km, with a median depth and distance from shore of 3,053 m and 44.3 km, respectively.

The pantropical spotted dolphin sighting, with an estimated group size of 50 individuals, was only the second encounter with this species on PMRF as part of CRC's small-boat efforts (see Baird et al. 2017), and only the 11th sighting off Kaua'i or Ni'ihau since effort began in 2003. Two satellite tags were deployed on individuals in this group, with the tags funded by other grants to CRC. The two individuals remained associated over the period of tag overlap. In the first two days after tag deployment the tagged individuals moved off and on PMRF three times, before moving south of Kaua'i, eventually meandering far to the north of O'ahu (Figure 6). Over the 14 days of tag data the individuals moved 1,307 km, with a median depth and distance from shore of 3,603 m and 49.5 km, respectively. Movements and habitat use information suggests this group was from the pelagic stock of pantropical spotted dolphins. This sighting provides further support that there is no evidence for an island-associated population of pantropical spotted dolphins off Kaua'i or Ni'ihau, as there is off the other main Hawaiian Islands.

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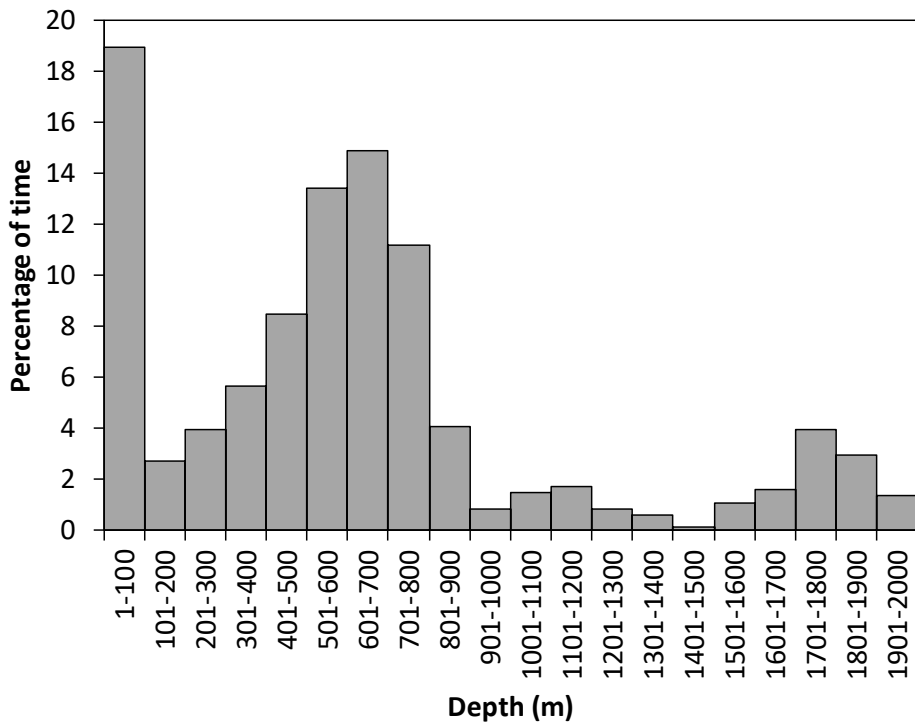


Figure 1. Depth distribution of search effort during 11 days of effort in August 2017.

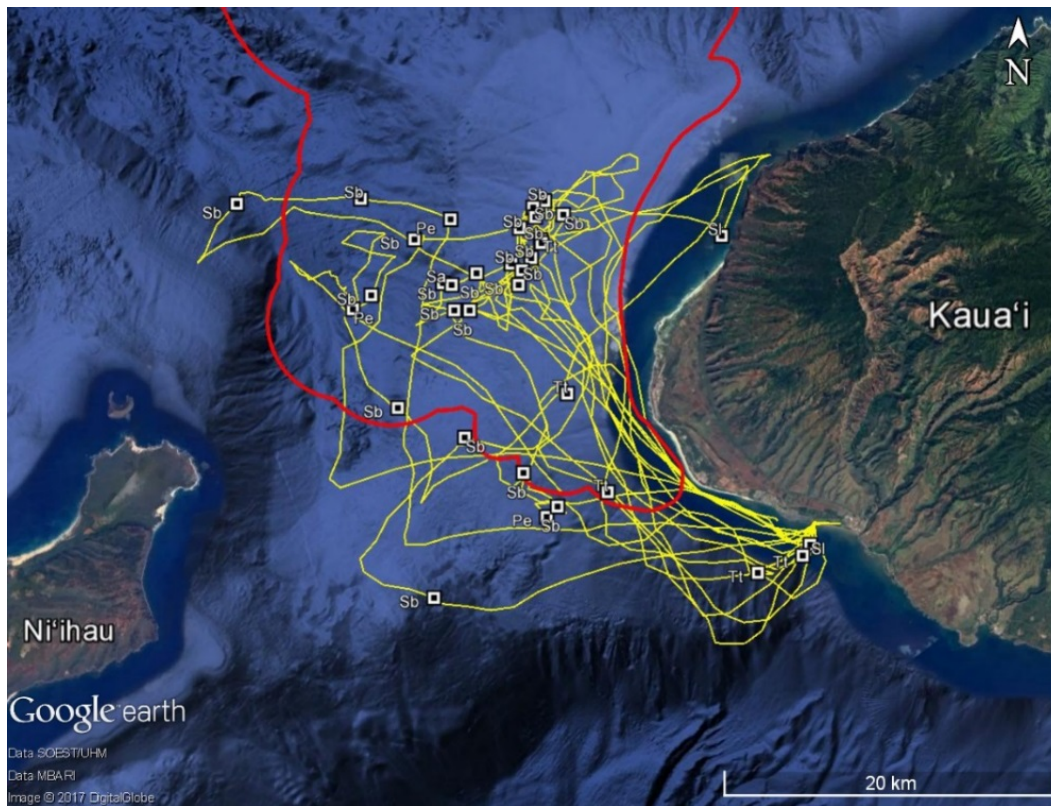


Figure 2. Search effort (yellow lines) and odontocete sightings (white squares) during 11 days of effort in August 2017. Species are indicated by two-letter codes (Sb = *Steno bredanensis*, Tt = *Tursiops truncatus*, Sl = *Stenella longirostris*, Pe = *Peponocephala electra*, Sa = *Stenella attenuata*). The PMRF outer boundary is indicated in red.

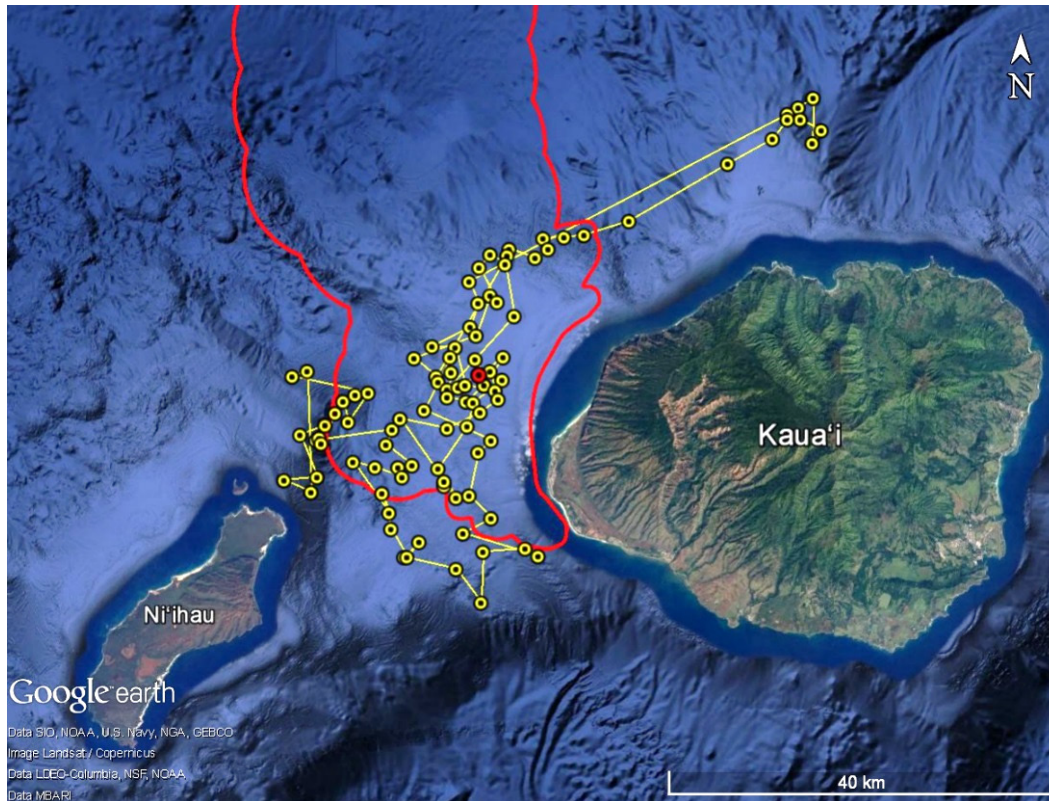


Figure 3. Movements of a satellite-tagged rough-toothed dolphin over a seven-day period from August 7-14, 2017. The tagging location is shown with a red circle, and consecutive locations are joined by a yellow line. The PMRF boundary is outlined in red.



Figure 4. A melon-headed whale (background) and a possible hybrid between a melon-headed whale and a rough-toothed dolphin (foreground), photographed August 11, 2017 off Kaua'i. A skin biopsy sample collected from the putative hybrid is undergoing genetic analyses to confirm hybrid status.

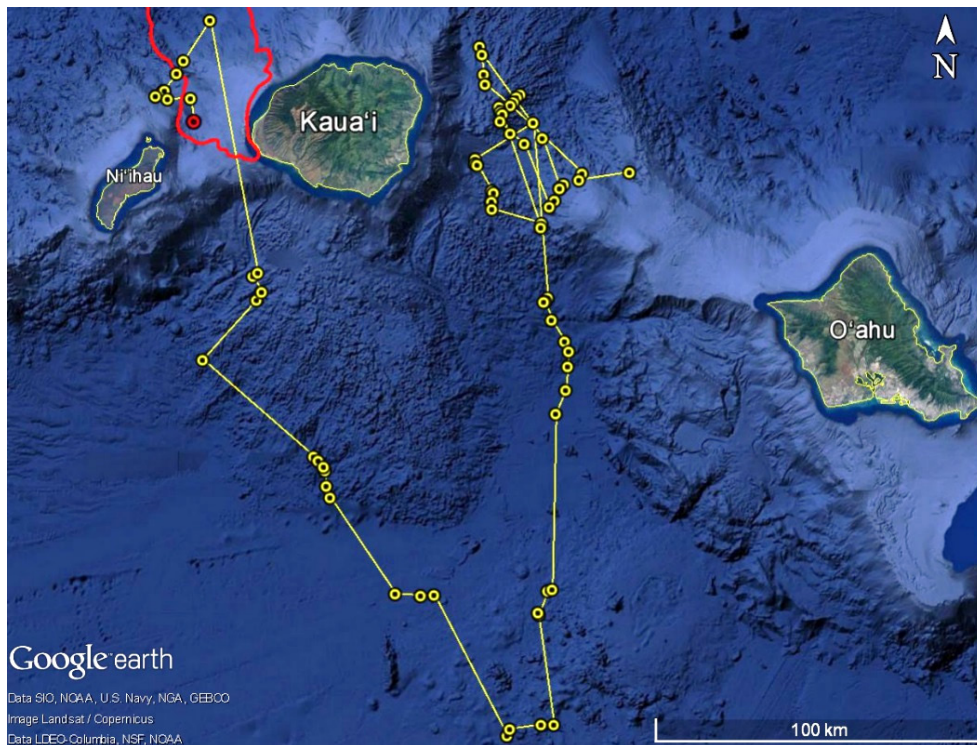


Figure 5. Movements of a satellite-tagged melon-headed whale over an eight-day period from August 13-21, 2017. The tagging location is shown with a red circle, and consecutive locations are joined by a yellow line. The PMRF boundary is outlined in red.

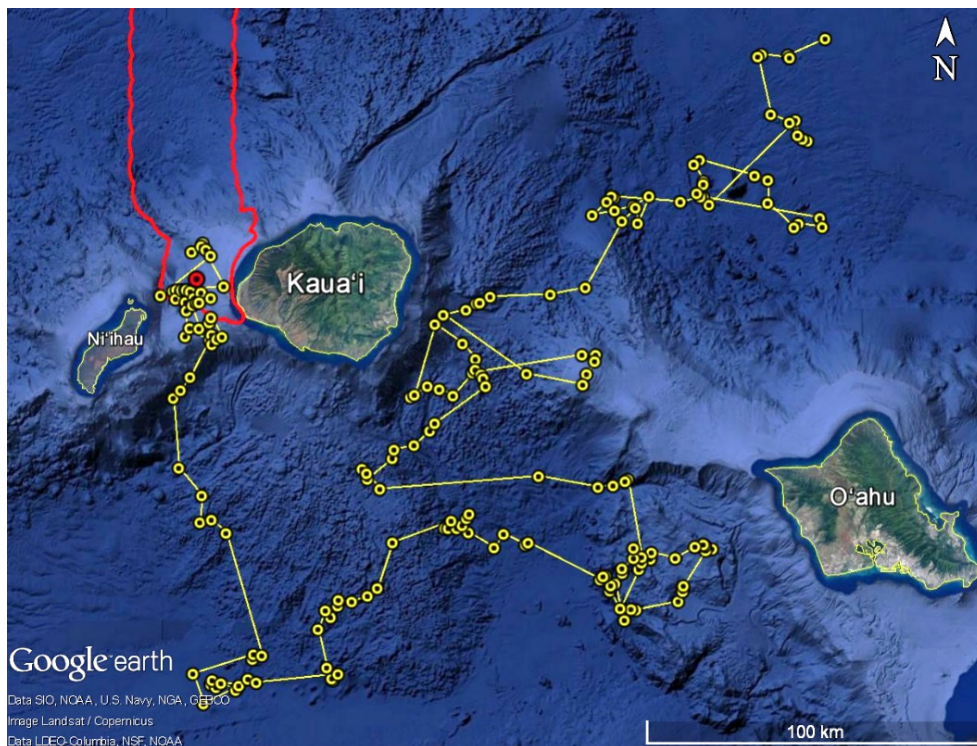


Figure 6. Movements of a satellite-tagged pantropical spotted dolphin over a 14-day period from August 10-24, 2017. The tagging location is shown with a red circle, and consecutive locations are joined by a yellow line. The PMRF boundary is outlined in red.