

Cetacean Monitoring in the Mariana Islands Range Complex, 2017

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Mission

The Pacific Islands Fisheries Science Center's (PIFSC) Cetacean Research Program (CRP) has been conducting visual surveys of cetaceans in the waters surrounding Guam and the Commonwealth of the Northern Mariana Islands (CNMI) as part of an ongoing effort to develop a record of cetacean occurrence in the region. Visual surveys have been conducted aboard small boats (7.6–12.2 m) since 2010 off the southernmost islands of the Mariana Archipelago (Guam, Rota, Saipan, Tinian, and Aguijan). These surveys include the collection of photographs for individual identification, tissue samples for genetic analysis of population structure, and the deployment of satellite tags for assessment of individual movements throughout the broader region. These surveys are conducted in partnership with the Commander, U.S. Pacific Fleet Environmental Readiness Division. Data sets from the small-boat survey efforts are used to evaluate the distribution, stock structure, and movements of cetaceans within the study area. This report includes a summary of the most recent visual surveys that were conducted in the “winter” (February) and “summer” (May) of 2017.

Methods

Field Methods

Winter Visual Surveys

Non-systematic visual surveys, with a primary focus on humpback whales (*Megaptera novaeangliae*), were conducted aboard a 12.2-m sport-fisher (*Sea Hunter*) with a flying bridge and twin-diesel inboard engines during February 2017. Survey efforts focused on shallow waters (<200 m) offshore of Saipan, particularly Chalan Kanoa (CK) and Marpi Reefs, where humpback whales were expected based on known breeding and calving habitat in other locations (Herman and Antinoja, 1977; Frankel et al., 1995), as well as our previous humpback whale surveys off Saipan (Hill et al., 2016a, b, 2017). The survey vessel traveled at a speed of 15–19 km/h, depending on sea conditions. Four observers scanned for marine mammals with unaided eye, collectively searching 360 degrees around the vessel. Each cetacean group sighted was approached for species confirmation, group-size estimates, and photo-identification. Biopsy sampling was planned for humpback whales and all other non-stenellid species. Opportunistic satellite tagging was planned for all species excluding stenellid dolphins. Photo-identification, biopsy sampling, and satellite tagging protocols were the same as those described by Hill et al. (2014, 2015). During small-boat surveys, the occurrences, locations, and size of turtles were recorded, but photos and biological samples were not collected.

Summer Visual Surveys

During May 2017, non-systematic visual surveys for cetaceans were conducted from small vessels off Saipan, Tinian, and Guam. Surveys off Saipan and Tinian were conducted using

Sea Hunter and a 7.9-m Regulator (*Regulator*) with twin 4-stroke outboard engines, while those off Guam were conducted aboard an 8.3 m-Phoenix Marina (*Ten27*) with flying bridge and twin diesel inboard engines. Visual survey effort and vessel tracks were spread out from day to day to ensure broad survey coverage over a wide range of depths. Weather and sea conditions also dictated the direction and scope of the survey effort. The survey vessels traveled at a speed of 15–26 km/h, depending on the size of the vessel and sea conditions. Four to six observers scanned for marine mammals with unaided eye, collectively searching 360 degrees around the vessel.

All cetacean groups sighted were approached for species confirmation, group size estimates, and photo-identification. Biopsy sampling and satellite tagging operations were planned during encounters with all cetacean species except stenellid dolphins. Photo-identification, biopsy, and satellite tagging protocols were the same as those described by Hill et al. (2014, 2015). Occurrences, locations, and sizes of turtles were recorded, but photos and biological samples were not collected.

Data Processing and Analyses

Visual Surveys and Encounters

Visual survey and encounter data were analyzed for effort and encounter location depths and encounter location distance from shore using the same methods and bathymetry data as those described in Hill et al. (2014, 2016b).

Satellite Telemetry

The same methods as those described in Hill et al. (2014, 2015) were used to process and analyze the satellite tag location data related to depth and distance from shore. The data included in these analyses were derived from satellite tags deployed during the 2017 small-boat effort.

Photo-Identification

Photo processing and analysis was continued to add to existing individual photo-identification catalogs, and protocols were identical to those described in Hill et al. (2014).

Results

Visual Surveys and Encounters

Winter

Small-boat visual surveys were conducted off Saipan during 11–22 February 2017. A total of 499 km of trackline was surveyed over six days (Table 1, Fig. 1). Beaufort sea states along much of the on-effort trackline ranged from 4–5 (70%, 348 km) and dominant swell heights were 4–8 ft (86%, 427 km) (Fig. 2). Most of the on-effort time (81%, 33 h) was spent over water depths 0–300 m (Fig. 3).

During the small-boat visual surveys, there were 26 encounters with four cetacean species including humpback whales, short-finned pilot whales (*Globicephala macrorhynchus*), bottlenose dolphins (*Tursiops truncatus*), and spinner dolphins (*Stenella longirostris*) (Table 2, Fig. 1).

There were 13 humpback whale encounters, three of which were with competitive groups. There were two mother-calf pairs, one of which one was accompanied by an escort. Fluke images were collected from 19 individuals. Biopsy samples (n=14) were collected from 12 individuals, including the two moms. The humpback whale encounters were on Marpi Reef, CK Reef, or off the northwest side of Saipan between the two reefs (Fig. 1). Most of the encounters were over water depths <100 m, but three were in depths >200 m (Table 2, Fig. 3).

A group of 35 short-finned pilot whales was encountered on Marpi Reef during a humpback whale encounter (Table 2, Fig. 1). The encounter location was 16 km from shore and in 62 m deep water. More than 1,500 photos and one biopsy sample were collected, and a single satellite tag was deployed during the encounter (Table 3, Fig. 4).

There were three bottlenose dolphin encounters off Saipan, one of which was on Marpi Reef and was a part of a mixed species encounter with humpbacks and pilot whales. The best group size estimates for bottlenose dolphin groups were 2–8 individuals (Table 2). The median depth of the encounter locations was 306 m, and the median distance from shore was 5.4 km.

Spinner dolphins were encountered off the west side of Saipan and on Marpi Reef. All spinner dolphin encounters (n=9) were over water depths <100 m, and group sizes ranged between 25–110 individuals (Table 2).

Only one green sea turtle (*Chelonia mydas*) was observed during the February small-boat cetacean surveys (Table 4). Sea turtle sighting data were provided to the PIFSC Marine Turtle Biology and Assessment Program (MTBAP).

Summer

Small-boat visual surveys were conducted in the waters surrounding Saipan, Tinian, and Guam on 19 days during 6–25 May 2017 (Table 1, Fig. 5). A total of 1,548 km of trackline was surveyed and most was in Beaufort sea states of 3–5 (95%, 1,467 km) and swell heights of 0–4 ft (91%, 1,412 km) (Table 1, Fig. 6). Approximately 22% (20.1 h) of the total effort time was spent inside of the 100-m depth contour (Fig. 7). Similar survey effort was made across depth bins of 101–500 m (21.9 h). A third of the total effort (27.6 h) was spent over water depths 501–900 m. Effort was lowest and reduced gradually over depths of 1,300–2,400 m (Fig. 7).

Twelve cetacean groups were encountered during the summer small-boat survey, resulting in the collection of approximately 6,000 photos, 16 biopsy samples, and the

deployment of 4 satellite tags (Table 5). All but one of the cetacean groups were identified to species. The confirmed species include bottlenose dolphin, spinner dolphin, melon-headed whale (*Peponocephala electra*), and Bryde's whale (*Balaenoptera edeni*). The other group was an unidentified beaked whale.

Spinner dolphins were the most frequently encountered species ($n = 7$) (Tables 5–6; Fig. 5a–b). All encounters were in depths <100 m and were within 1 km of shore (Table 6). Group sizes ranged 29–60 individuals. More than 3,100 photos were collected for photo-id.

A large group of approximately 400 melon-headed whales was encountered off Guam (Table 5, Fig. 5a). The depth of the encounter location was 903 m, and the distance from shore was 2.6 km (Tables 5–6). Approximately 5,000 photos were collected for photo-id, and 12 biopsy samples were collected for genetic analysis. Two satellite tags were deployed to investigate individual movements and spatial use (Table 3, Fig. 8).

Bottlenose dolphins were encountered twice off Saipan during the small-boat surveys (Table 5, Fig. 5b). The depths of the encounter locations were 30 m and 459 m, and the distances from shore were 5.7 km and 9.9 km (Table 6). Group sizes were 5–6 individuals. More than 400 photos were collected for photo-id, and four biopsy samples were collected for genetic analysis. Two satellite tags were deployed to investigate individual movements and spatial use (Table 3, Fig. 9).

A single Bryde's whale was encountered 16.7 km off the west side of Saipan in 1,183 m deep water (Table 5, Fig. 5b). More than 200 photos were collected.

An unidentified beaked whale was encountered off Guam (Table 5, Fig. 5a). No photos were collected during the encounter and, as a result, species could not be determined. The depth of the encounter location was 1,815m, and the distance from shore was 6.5 km.

A total of 35 sea turtles were observed during the 2017 summer (May) small-boat surveys; 16 were identified as green sea turtles (Table 4). The rest were not identified to species. Sea turtle sighting data were provided to the PIFSC MTBAP.

Satellite Telemetry

During 2017, satellite tags were deployed on one short-finned pilot whale, two bottlenose dolphins, and two melon-headed whales (Table 3, Figs. 4, 8–9). A location-only (SPOT5) satellite tag was deployed on an adult short-finned pilot whale off Saipan (at Marpi Reef) on 11 February. The tag transmitted for 27.4 d during which the whale traveled north as far as Pagan before heading southeast to the Mariana Trench (Fig. 4). The whale zig-zagged south along the Trench until the tag stopped transmitting on 9 March. The median depth of the satellite tag locations was 4,369 m, and the median distance to shore was 151 km.

Two location-only (SPOT5) satellite tags were deployed on melon-headed whales off Guam in May 2017. One of the tags transmitted only a single location. The second tag transmitted for 1.8 d during which the whale moved off the southwest side of Guam (Fig. 8). A total of 17 locations from both tags remained after the Douglas Argos filtering (DAF) process. The median depth of the DAF locations was 1,379 m, and the median distance from shore was 22.7 km (Table 3).

Two satellite tags (1 SPOT5, 1 SPLASH10) were deployed on bottlenose dolphins during 2 encounters off Saipan during the May small-boat surveys (Table 3). Tag durations were 7.9 d and 13.2 d. A total of 276 DAF locations were obtained. Although the dolphins were not tagged during the same encounter, they appeared to travel together for several days. They spent six days moving off the west sides of Saipan and Tinian and north to Marpi Reef before traveling north-northwest to East Diamante, a submarine volcano, where one of the individuals spent another six days (Fig. 9). The second tag stopped transmitting on 1 June; the first day at East Diamante. The median depth for the DAF locations was 574 m, and the median distance from shore was 14.8 km. The maximum dive depth recorded on the SPLASH10 tag was 347 m with the maximum dive duration of 12 min.

Photo-Identification

Existing photo-identification catalogs for cetacean species within the Marianas include spinner dolphins, bottlenose dolphins, rough-toothed dolphins, short-finned pilot whales, false killer whales, pygmy killer whales, sperm whales, and humpback whales (Hill et al., 2013, 2014, 2015, 2016b, 2017).

During the 2017 winter (February) small-boat surveys, photos were collected during 13 encounters with humpback whales, including fluke images from 19 individuals. The photo-id catalog now contains 35 non-calf individuals for which there are fluke images from 24 individuals. In 2017, three individuals were re-sighted from previous years. One individual was first seen in 2007. The second individual was first seen in 2015, and the third individual was first seen in 2016 with a calf.

Photos of short-finned pilot whales encountered at Marpi Reef in February 2017 have gone through preliminary processing and some initial matching. A few individuals have been matched to those from a group that had only been seen once before in 2012 off Aguijan (Hill et al., in review).

Photos from the summer effort are awaiting processing and matching. Processing and analysis of melon-headed whale, bottlenose dolphin, and spinner dolphin photos from previous years are still in progress.

Discussion

The 2017 winter and summer small-boat surveys off Saipan, Tinian, and Guam represent a continuation of the collaborative effort between the PIFSC's CRP and the U.S. Navy towards a better understanding of the occurrence and distribution of cetaceans in waters off the southernmost islands of the Mariana Archipelago.

The NMFS (PIFSC) is responsible for the assessment of marine mammal stocks in the Exclusive Economic Zone (EEZ) waters of Guam and the CNMI. The U.S. Navy is mandated by Letters of Authorization and Biological Opinions issued under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) to monitor cetacean presence within the Mariana Islands Training and Testing study area. We discuss the preliminary results from the 2017 cetacean surveys in an effort toward answering questions presented within the U.S. Navy's monitoring plan below.

During the May 2017 visual surveys, the overall encounter rate (0.78 encounters/100 km effort; Table 6) was lower than all previous surveys that were not humpback whale focused. The overall encounter rate for 2010-2016 was 1.40 encounters/100 km effort (excluding within day re-sights). The sea state conditions may have contributed to the lower encounter occurrence during the May 2017 surveys. Most of the survey effort (81%) was in Beaufort sea states 4–5, which was higher than any previous (non-humpback whale focused) survey.

- 1. What species of beaked whales and other odontocetes occur around Guam and Saipan?**
- 2. Are there locations of greater relative cetacean abundance around Guam and Saipan?**

In May 2017, there was a single unidentified beaked whale encounter off Guam. The encounter location's (Fig. 5a) distance from shore (6.5 km) and depth (1,815 m) were similar to beaked whale encounters in previous years (Hill et al. 2014, 2015, 2017). Blainville's and Cuvier's beaked whales are the only two visually confirmed species we have encountered during small-boat surveys. A third unidentified beaked whale species is known to occur within the region based on acoustic data. We have had a number of unidentified *Mesoplodon* encounters.

Habitat use (depth and distance from shore) and encounter rates reveal varying patterns for species occurring around Guam, Rota, Saipan, Tinian, and Aguijan. Patterns of habitat use by some odontocetes (e.g., spinner dolphins, bottlenose dolphins) evident from the 2017 visual surveys were similar to those described in previous years by Hill et al. (2014, 2015, 2016b, 2017), while new information emerged for other species (e.g., short-finned pilot whales).

Spinner dolphins were once again the most frequently encountered species during the May 2017 visual surveys ($n=7$; 0.45 encounters/100 km effort) and were found in similar locations as previous years (Hill et al. 2014, 2015, 2016b, 2017; Table 6, Fig. 5a–b). They were also encountered 9 times during the February 2017 surveys in locations 80–200 m from previous encounter locations (May–September in 2011–2016), which suggests they may use these areas year-round. All 2017 encounter locations were in water depths <100 m, and those that were not on Marpi Reef were within 1 km from shore (Tables 2, 5–6).

Bottlenose dolphins were encountered a total of 5 times during the February and May 2017 small-boat surveys. Encounter locations had similar depths (30–615 m) and were at similar distances from shore (4.7–15.9 km) (Tables 2, 5–6, Figs. 1, 5a–b) as those in previous years (Hill et al. 2014, 2015, 2016b, 2017). All of the 2017 bottlenose dolphin encounters were off Saipan, including one offshore encounter at Marpi Reef during which the dolphins were interacting with humpback whales and short-finned pilot whales.

Short-finned pilot whales were encountered on Marpi Reef during the February humpback whale surveys. The distance from shore (16.1 km) of the encounter location was similar to those of previous encounters, but the depth (62 m) was much shallower (Hill et al. 2014, 2015, 2017). The preliminary photo-id data from the February 2017 group indicate that these individuals have not been seen repeatedly in previous years but were seen on only one other occasion in 2012. The satellite tag location data from the February 2017 satellite-tagged individual (141699) varied from previously tagged short-finned pilot whales. The median distance from shore of the tag locations from previously tagged individuals was 13.2 km (Hill et al., in review), but that of tag 141699 was 151 km (Table 3). In addition, none of the previously tagged individuals went further north than Anatahan. Tag 141699 transmitted locations from Pagan approximately 200 km north of Anatahan (Fig. 4). The median depth of tag locations from previously tagged short-finned pilot whales was 952 m, while that of tag 141699 was 4,369 m (Table 3). The photo-id and satellite tag data suggest that the population of short-finned pilot whales in the Marianas may include groups of individuals that are associated within the southern portion of the archipelago, as well as those that are intermittent visitors to the nearshore waters of Guam, Rota, Saipan, and Tinian.

3. What is the seasonal occurrence of baleen whales around Guam, Saipan, Tinian, and Rota?

This was the third year that the observer team has encountered baleen whales during our small-boat surveys in the Marianas. The team specifically conducted surveys during February 2017 to coincide with the known seasonal occurrence of humpback whales off Saipan and Tinian based on the 2015 and 2016 small-boat surveys, an encounter during a 2007 shipboard survey (Fulling et al. 2011), acoustic records (Oleson et al. 2015, Hill et al. 2016a,

Fulling et al. 2011), and anecdotal reports. The encounter rate with humpback whales during the 2017 small boat surveys was similar to those of 2015 and 2016, but more adult whales were present; resulting in the contribution of an additional 18 individuals to the photo-identification catalog, which now has 35 non-calf individuals.

A Bryde's whale was encountered in May 2017. All previous sightings of Bryde's whales during PIFSC small-boat surveys were also during summer months. Bryde's whale was the only other baleen whale species observed across all years of the PIFSC small-boat effort.

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Tables

Table 1: Effort summaries for 2017 Marianas winter (February) and summer (May) small-boat surveys for cetaceans.

Local Date (2017)	Location	Vessel	Survey Description	On Effort Time (h:mm)	On Effort Distance (km)
11-Feb	CNMI-Saipan/Marpi Reef	Sea Hunter	Saipan west to Marpi Reef.	9:44	102.6
12-Feb	CNMI-Saipan/Marpi Reef	Sea Hunter	Saipan west side.	4:02	59.3
19-Feb	CNMI-Saipan	Sea Hunter	Saipan west loop to CK Reef south then north to Saipan northern tip and back	7:30	110.2
20-Feb	CNMI-Saipan	Sea Hunter	Saipan west side loop.	2:17	35.4
21-Feb	CNMI-Saipan/Marpi Reef	Sea Hunter	Saipan west to Marpi Reef. Humpbacks with competitive group of 5	9:20	112.3
22-Feb	CNMI-Saipan	Sea Hunter	Saipan west loop north then to CK Reef	8:19	79.5
6-May	Guam	Ten 27	Hagatna- NW to SW loop	5:48	87.2
7-May	Guam	Ten 27	Hagatna- SW loop	5:11	85.7
8-May	Guam	Ten 27	Hagatna-NW figure eight	4:39	79.8
9-May	Guam	Ten 27	Hagatna-SW loop	5:01	84.2
11-May	Guam	Ten 27	Agat-SW loop	5:24	83.6
12-May	Guam	Ten 27	Agat- SW loop	7:22	85.0
13-May	Guam	Ten 27	Agat-NW loop	5:55	98.9
14-May	Guam	Ten 27	Agat-SW loop	5:57	96.4
17-May	CNMI-Saipan	Regulator	Saipan west loop	4:12	80.8
18-May	CNMI-Saipan	Sea Hunter	Saipan HARP pickup	6:07	85.0
20-May	CNMI-Saipan	Regulator	Saipan west loop	3:02	61.5
21-May	CNMI-Saipan/Tinian	Regulator	Saipan-Tinian west loop	4:53	99.7
22-May	CNMI-Saipan	Regulator	Saipan west loop	5:25	91.1
23-May	CNMI-Saipan/Tinian	Regulator	Saipan-Tinian west loop	5:34	114.4
24-May	CNMI-Saipan	Regulator	Saipan west loop	5:21	89.9
25-May	CNMI-Saipan/Tinian	Regulator	Saipan-Tinian west loop	7:18	102.7
26-May	CNMI-Saipan/Tinian	Regulator	Saipan-Tinian west loop	5:58	121.6
			Winter:	41:14	499.2
			Summer:	93:16	1547.6

Table 2: Details of the cetacean encounters during the 2017 Marianas winter (February) small-boat surveys off Saipan. YOY - young of the year.

Local Date (2017)	Sighting	Common Name	Local Time (UTC +10)	Location	Latitude (N)	Longitude (E)	Depth (m)	Shore Distance (km)	Beaufort	Swell Height (ft)	Total Best	YOY Best	Neonate Best	Behavior	# Photos	# Biopsy Samples	# Tags
11-Feb	1	Humpback whale	8:11	Saipan	15.25452	145.70755	51	3.9	2	2 to 4	3	0	0	travel synch dive/surface evasive mill surface active	622	0	0
11-Feb	2	Spinner dolphin	11:03	Marpi Reef	15.40121	145.86932	74	13.8	3	4 to 6	110	0	0	mill synch dive/surface evasive	31	0	0
11-Feb	3a	Humpback whale	11:26	Marpi Reef	15.41887	145.87460	62	15.8	3	4 to 6	8	0	0	travel mill social surface active synch dive/surface	2356	4	0
11-Feb	3b	Short-finned pilot whale	11:31	Marpi Reef	15.42298	145.87262	62	16.1	3	4 to 6	35	0	0	mill rest/log	1506	1	1
11-Feb	3c	Bottlenose dolphin	12:24	Marpi Reef	15.42100	145.87290	62	15.9	3	4 to 6	8	0	0	travel social boat approach/bow ride	94	0	0
11-Feb	4	Bottlenose dolphin	16:50	Saipan	15.32259	145.77181	615	5.4	3	4 to 6	2	0	0	boat approach/bow ride	0	0	0
11-Feb	5	Spinner dolphin	17:33	Saipan	15.24259	145.69870	0	3.2	1	4 to 6	25	0	0	travel boat approach/bow ride	0	0	0
12-Feb	6	Humpback whale	8:00	Saipan	15.25732	145.70935	63	4.1	1	6 to 8	2	0	0	travel evasive	211	0	0
12-Feb	7	Bottlenose dolphin	11:04	Saipan	15.24859	145.68438	306	4.7	5	6 to 8	4	0	0	boat approach/bow ride	0	0	0
19-Feb	8	Spinner dolphin	7:38	Saipan	15.22749	145.69799	12	2.2	3	0 to 2	32	0	0	mill synch dive/surface	0	0	0
19-Feb	9	Spinner dolphin	12:15	Saipan	15.26308	145.77331	47	1.0	4	4 to 6	34	1	1	boat approach/bow ride mill synch dive/surface	131	0	0
19-Feb	10	Humpback whale	13:13	Saipan	15.27801	145.77435	377	1.8	4	4 to 6	2	0	0	travel social evasive	180	1	0
19-Feb	11	Spinner dolphin	14:42	Saipan	15.25118	145.70759	32	3.6	4	4 to 6	25	0	0	travel	0	0	0

Local Date (2017)	Sighting	Common Name	Local Time (UTC +10)	Location	Latitude (N)	Longitude (E)	Depth (m)	Shore Distance (km)	Beaufort	Swell Height (ft)	Total Best	YOY Best	Neonate Best	Behavior	# Photos	# Biopsy Samples	# Tags
19-Feb	12	Spinner dolphin	15:10	Saipan	15.22802	145.70933	12	1.2	4	2 to 4	70	1	1	mill travel surface active	339	0	0
21-Feb	13	Humpback whale	9:45	Marpi Reef	15.39375	145.84549	307	12.0	4	6 to 8	2	0	0	synch dive/surface	151	0	0
21-Feb	14	Humpback whale	10:52	Marpi Reef	15.40971	145.83826	265	13.6	4	6 to 8	1	0	0	travel	231	1	0
21-Feb	15	Humpback whale	12:04	Marpi Reef	15.44237	145.86353	98	17.8	3	6 to 8	1	0	0	travel	156	0	0
21-Feb	16	Spinner dolphin	12:39	Marpi Reef	15.43192	145.88717	89	17.7	3	6 to 8	35	0	0	surface active mill	0	0	0
21-Feb	17	Humpback whale	13:27	Marpi Reef	15.40367	145.84842	59	13.2	4	6 to 8	5	0	0	social surface active mill	2290	5	0
21-Feb	16-resight	Spinner dolphin	14:55	Marpi Reef	15.43602	145.88669	75	18.1	4	6 to 8	60	1	0	boat approach/bow ride	0	0	0
21-Feb	18	Humpback whale	15:25	Marpi Reef	15.40271	145.85425	57	13.3	4	6 to 8	1	0	0	n/a	0	0	0
22-Feb	19	Spinner dolphin	7:38	Saipan	15.22825	145.69541	12	2.5	3	2 to 4	55	2	1	mill synch dive/surface	0	0	0
22-Feb	20	Humpback whale	8:29	Saipan	15.28606	145.79906	126	0.5	4	4 to 6	2	0	0	synch dive/surface	250	0	0
22-Feb	21	Humpback whale	10:44	Saipan/CK Reef	15.22842	145.65164	39	7.0	5	4 to 6	2	0	0	synch dive/surface	704	1	0
22-Feb	22	Humpback whale	12:48	Saipan/CK Reef	15.17114	145.61835	33	8.2	5	4 to 6	3	1	0	mill synch dive/surface	1312	1	0
22-Feb	23	Humpback whale	13:55	Saipan/CK Reef	15.16735	145.61162	34	8.1	4	2 to 4	2	1	0	mill	885	1	0
Total:															11449	15	1

Table 3: Summary of satellite tags deployed on cetaceans during small-boat surveys in February 2017 (off Saipan) and in May 2017 (off Saipan, Tinian, and Guam). The satellite tag deployment information and summary of depth and distance to shore for the Douglas ARGOS filtered (DAF) tag locations are listed by species and tag ID.

Species and Tag ID	Tag Type	Deployment Location	Local Date-Time (UTC +10)	Sighting	Latitude (N)	Longitude (E)	Duration (d)	No. DAF Locations	Median Depth (m) (min-max)	Median Shore Distance (km) (min-max)
Short-finned pilot whale								161	4369 (24-9213)	151.0 (0.1-265.5)
141699	SPOT5	Saipan - Marpi Reef	2/11/2017 12:38	3b	15.4207	145.8749	27.4	161	4369 (24-9213)	151.0 (0.1-265.5)
Melon-headed whales								17	1379 (697-1794)	22.7 (6.3-31.4)
141706	SPOT5	Guam	5/12/2017 10:42	3	13.3314	144.6198	1.8	16	1373 (697-1650)	23.0 (12.6-31.4)
141707	SPOT5	Guam	5/12/2017 11:55	3	13.3322	144.6068	0.1	1	1794	6.3
Bottlenose dolphins								276	574 (18-3715)	14.8 (1.8-53.6)
169421	SPLASH10	Saipan	5/25/2017 7:01	10	15.2257	145.6512	7.9	96	581 (18-1722)	11.4 (3.1-44.1)
141698	SPOT5	Saipan	5/25/2017 9:15	11	15.2283	145.6172	13.2	180	569 (61-3715)	33.4 (1.8-53.6)

Table 4: Sea turtle sightings during the 2017 Marianas winter (February) small-boat cetacean surveys off Saipan and summer (May) small-boat cetacean surveys off Saipan, Tinian, and Guam.

Local Date (2017)	Local Time (GMT +10)	Location	Latitude (N)	Longitude (E)	Description
22-Feb	15:53	Saipan	15.22365	145.69616	Green Turtle-med (1.5-2.5 ft)
6-May	11:10	Guam	13.39646	144.6535	Green Turtle-med (1.5-2.5 ft) x2
6-May	13:01	Guam	13.4816	144.75214	Green Turtle-med (1.5-2.5 ft)
7-May	11:58	Guam	13.48504	144.74746	Turtle-med (1.5-2.5 ft)
7-May	11:59	Guam	13.48473	144.74992	Turtle-med (1.5-2.5 ft)
8-May	9:39	Guam	13.5125	144.79093	Green Turtle-large (>2.5 ft)
8-May	11:04	Guam	13.48306	144.72415	Turtle-large (>2.5 ft)
11-May	10:44	Guam	13.37491	144.64248	Turtle-large (>2.5 ft)
11-May	10:45	Guam	13.37716	144.64265	Green Turtle-large (>2.5 ft)
11-May	10:59	Guam	13.4054	144.65795	Turtle-med (1.5-2.5 ft)
11-May	11:03	Guam	13.41032	144.65017	Turtle-med (1.5-2.5 ft)
11-May	11:04	Guam	13.41105	144.64651	Green Turtle-med (1.5-2.5 ft)
17-May	6:45	Saipan	15.22553	145.6968	Turtle-med (1.5-2.5 ft)
17-May	9:19	Saipan	15.17975	145.67625	Turtle-large (>2.5 ft)
17-May	9:38	Saipan	15.14293	145.67481	Turtle-large (>2.5 ft)
17-May	10:08	Saipan	15.20456	145.69144	Green Turtle-med (1.5-2.5 ft) x5
17-May	10:11	Saipan	15.20684	145.69284	Green Turtle-med (1.5-2.5 ft)
17-May	10:11	Saipan	15.20892	145.69335	Green Turtle-large (>2.5 ft)
18-May	6:34	Saipan	15.15865	145.68623	Turtle-small (<1.5 ft)
18-May	6:41	Saipan	15.14074	145.6819	Turtle-med (1.5-2.5 ft)
20-May	9:35	Saipan	15.20434	145.69229	Turtle-large (>2.5 ft)
20-May	9:39	Saipan	15.21569	145.68893	Turtle-large (>2.5 ft)
22-May	10:51	Saipan	15.18287	145.696	Green Turtle-small (<1.5 ft)
22-May	10:52	Saipan	15.18439	145.69602	Turtle-med (1.5-2.5 ft)
23-May	12:03	Saipan	15.2256	145.6867	Turtle-med (1.5-2.5 ft)
24-May	10:12	Saipan	15.11348	145.69966	Green Turtle-med (1.5-2.5 ft)
24-May	10:28	Saipan	15.15359	145.68813	Turtle-med (1.5-2.5 ft)
24-May	10:29	Saipan	15.15688	145.68972	Turtle-small (<1.5 ft)
24-May	10:46	Saipan	15.20471	145.69732	Turtle-med (1.5-2.5 ft)
25-May	12:15	Saipan	15.04704	145.59397	Turtle-med (1.5-2.5 ft)

Table 5: Details of the cetacean encounters during the 2017 Marianas summer (May) small-boat surveys off Saipan, Tinian, and Guam.

Local Date (2017)	Sighting	Common Name	Local Time (UTC +10)	Location	Latitude (N)	Longitude (E)	Depth (m)	Shore Distance (km)	Beaufort	Swell Height (ft)	Total Best	YOY Best	Neonate Best	Behavior	# Photos	# Biopsy Samples	# Tags
6-May	1	Spinner dolphin	6:52	Guam	13.4859	144.7500	61	0.4	2	0 to 2	60	0	0	travel mill boat approach/bow ride	280	0	0
11-May	2	Spinner dolphin	9:31	Guam	13.3159	144.6527	9	0.2	4	0 to 2	29	1	0	boat approach/bow ride rest/log mill surface active	264	0	0
12-May	3	Melon-headed whale	10:22	Guam	13.3196	144.6239	903	2.6	4	0 to 2	380	6	1	travel boat approach/bow ride rest/log	2197	12	2
14-May	4	Unid. Beaked whale	7:58	Guam	13.3435	144.5754	1815	6.5	4	2 to 4	1	0	0	unknown	0	0	0
17-May	5	Spinner dolphin	10:16	Saipan	15.2249	145.7008	14	0.4	4	0 to 2	46	0	0	mill boat approach/bow ride synch dive/surface	433	0	0
18-May	6	Bryde's whale	8:11	Saipan	15.2402	145.5395	1183	16.7	5	2 to 4	1	0	0	travel evasive	208	0	0
18-May	7	Spinner dolphin	12:08	Saipan	15.2231	145.7024	11	0.3	4	0 to 2	35	0	0	synch dive/surface mill social surface active	326	0	0
22-May	8	Spinner dolphin	10:53	Saipan	15.1870	145.6979	23	0.5	3	0 to 2	50	0	0	synch dive/surface mill travel social rest/log	848	0	0
24-May	9	Spinner dolphin	10:47	Saipan	15.2090	145.6981	16	0.5	4	0 to 2	55	1	0	mill synch dive/surface surface active boat approach/bow ride	715	0	0
25-May	10	Bottlenose dolphin	6:47	Saipan	15.2205	145.6427	30	5.7	2	2 to 4	6	0	0	travel evasive boat approach/bow ride	123	1	1

Local Date (2017)	Sighting	Common Name	Local Time (UTC +10)	Location	Latitude (N)	Longitude (E)	Depth (m)	Shore Distance (km)	Beaufort	Swell Height (ft)	Total Best	YOY Best	Neonate Best	Behavior	# Photos	# Biopsy Samples	# Tags
25-May	11	Bottlenose dolphin	8:42	Saipan	15.2158	145.6041	459	9.9	3	2 to 4	5	0	0	boat approach/bow ride travel	306	3	1
25-May	12	Spinner dolphin	13:11	Saipan	15.2161	145.6985	10	0.6	4	0 to 2	55	0	0	synch dive/surface mill surface active	286	0	0
Total:															5986	16	4

Table 6: Species encounter summary including encounter rate (No. encounters/100 km effort), depth (m) and distance from shore (km) for 2017 Marianas summer (May) small-boat cetacean surveys (1,548 km survey distance) off Saipan, Tinian, and Guam. Includes total encounters and overall encounter rates across all survey years (2010–2017) for species encountered during summer 2017 surveys off Saipan, Tinian and Guam (20,583 km total survey distance).

Species	No. Species Encounters (Total 2010–2017*)	Encounters/ 100km Effort (Overall 2010–2017*)	Best Group Size Estimate (min-max)	Median Depth (m) (min-max)	Median Shore Distance (km) (min-max)
Spinner dolphin	7 (129)	0.45 (0.63)	29-60	15 (10-61)	0.4 (0.2-0.6)
Bottlenose dolphin	2 (29)	0.13 (0.14)	5-6	244 (30-459)	7.8 (5.7-9.9)
Bryde's whale	1 (4)	0.06 (0.02)	1	1183	16.7
Melon-headed whale	1 (3)	0.06 (0.01)	380	903	2.6
Unid. beaked whale	1 (3)	0.06 (0.01)	1	1815	6.5
Total:	12 (278)	0.78 (1.35)			

*2015-2017 winter efforts not included in calculations because the effort targeted humpback whales. Same-day resights not included.

Figures

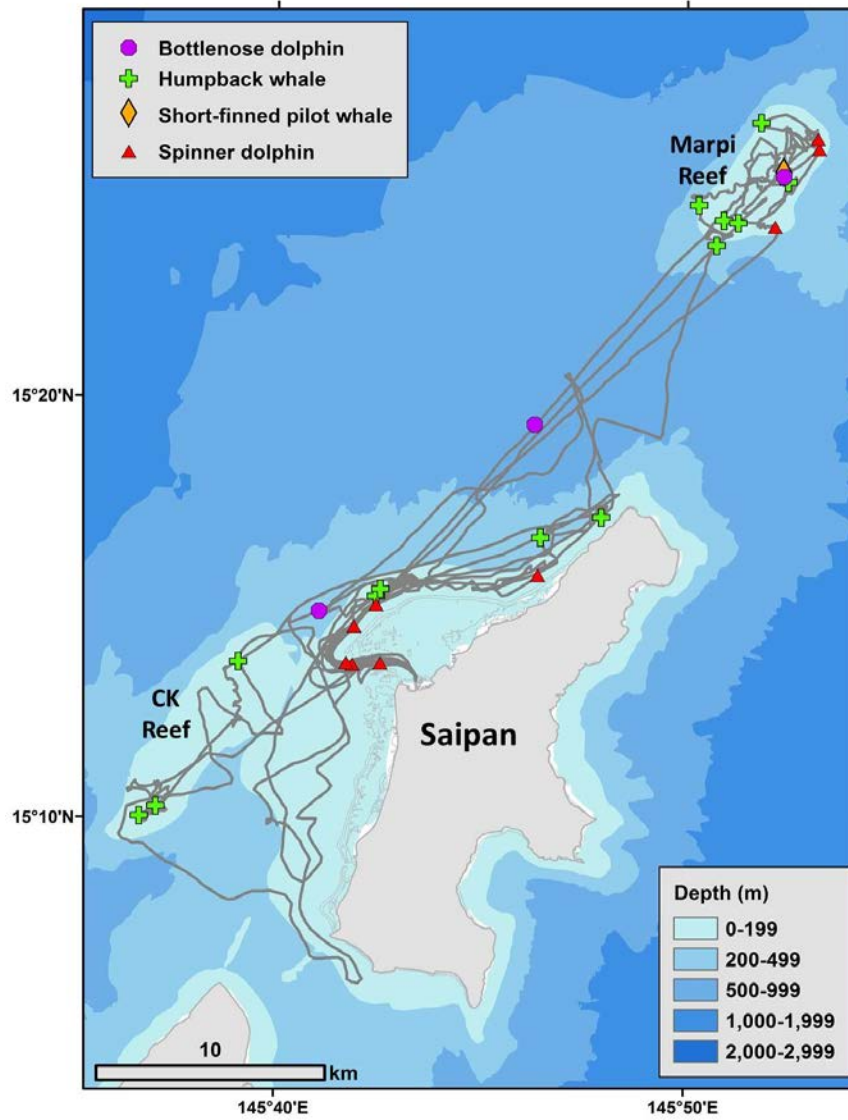


Figure 1: Tracklines and cetacean encounter locations during the 2017 Marianas winter (February) small-boat surveys off Saipan.

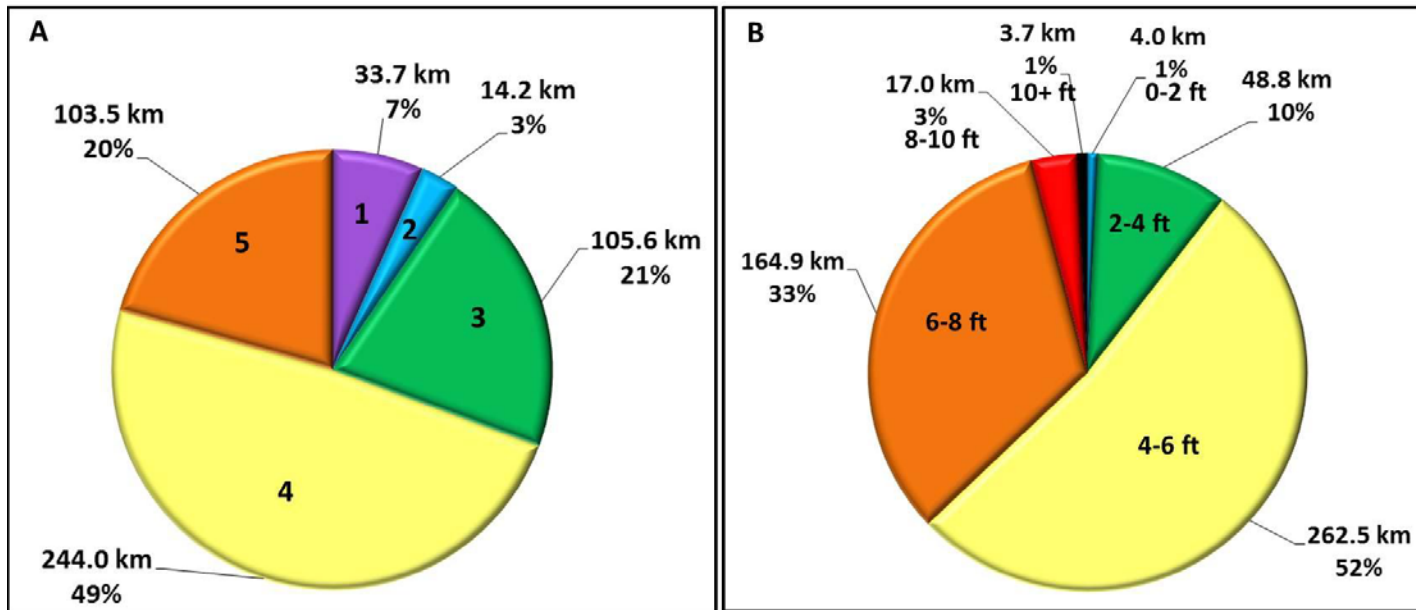


Figure 2: Effort by (A) Beaufort sea state and (B) swell height (ft) during the 2017 Marianas winter (February) small-boat cetacean surveys off Saipan.

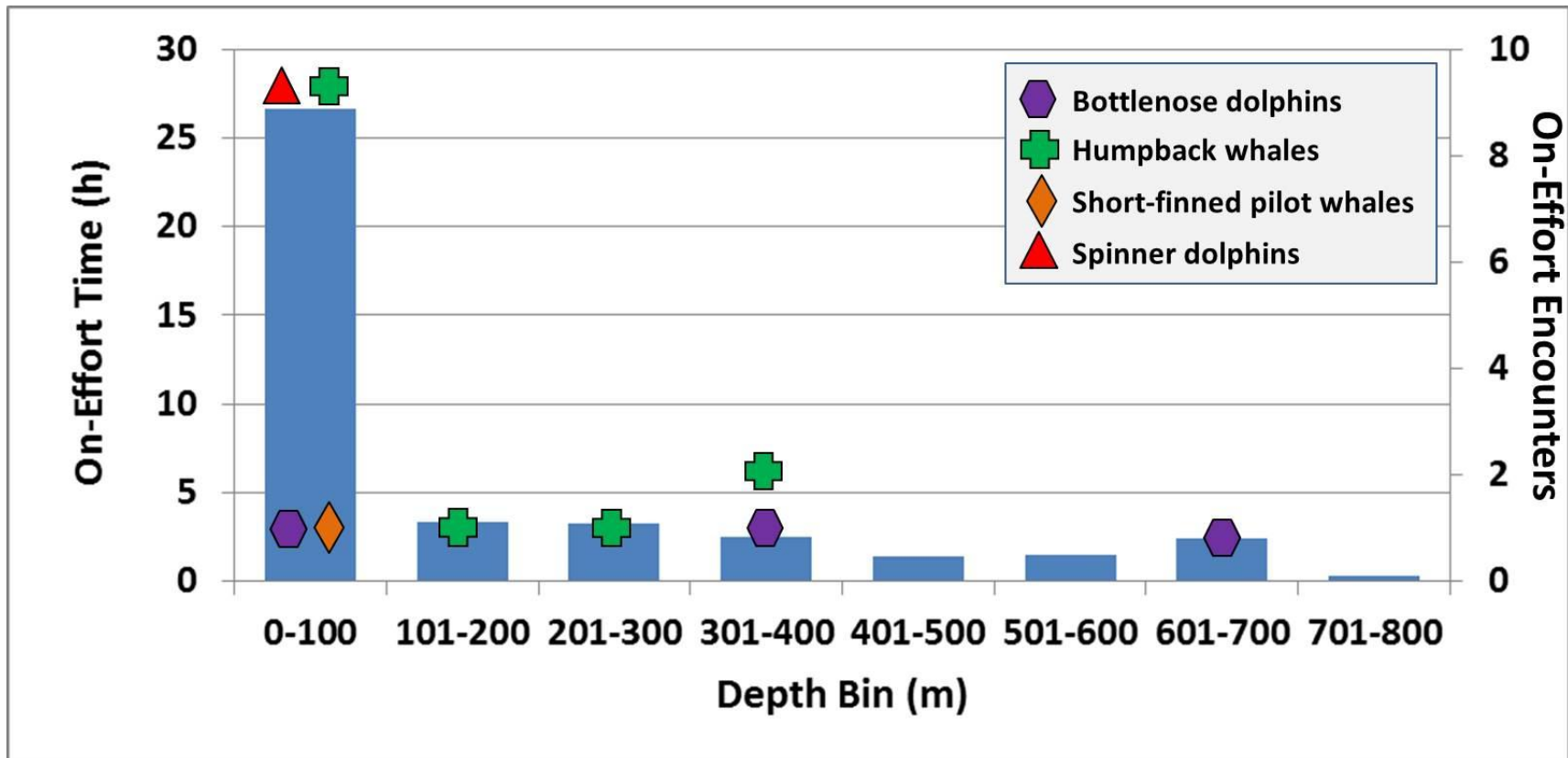


Figure 3: Effort and encounters by depth during the 2017 Marianas winter (February) small-boat cetacean surveys off Saipan. Survey efforts were focused on shallow waters (< 200 m) where humpback whales were expected based on known breeding and calving habitat in other locations (Herman and Antinaja, 1977; Frankel et al., 1995).

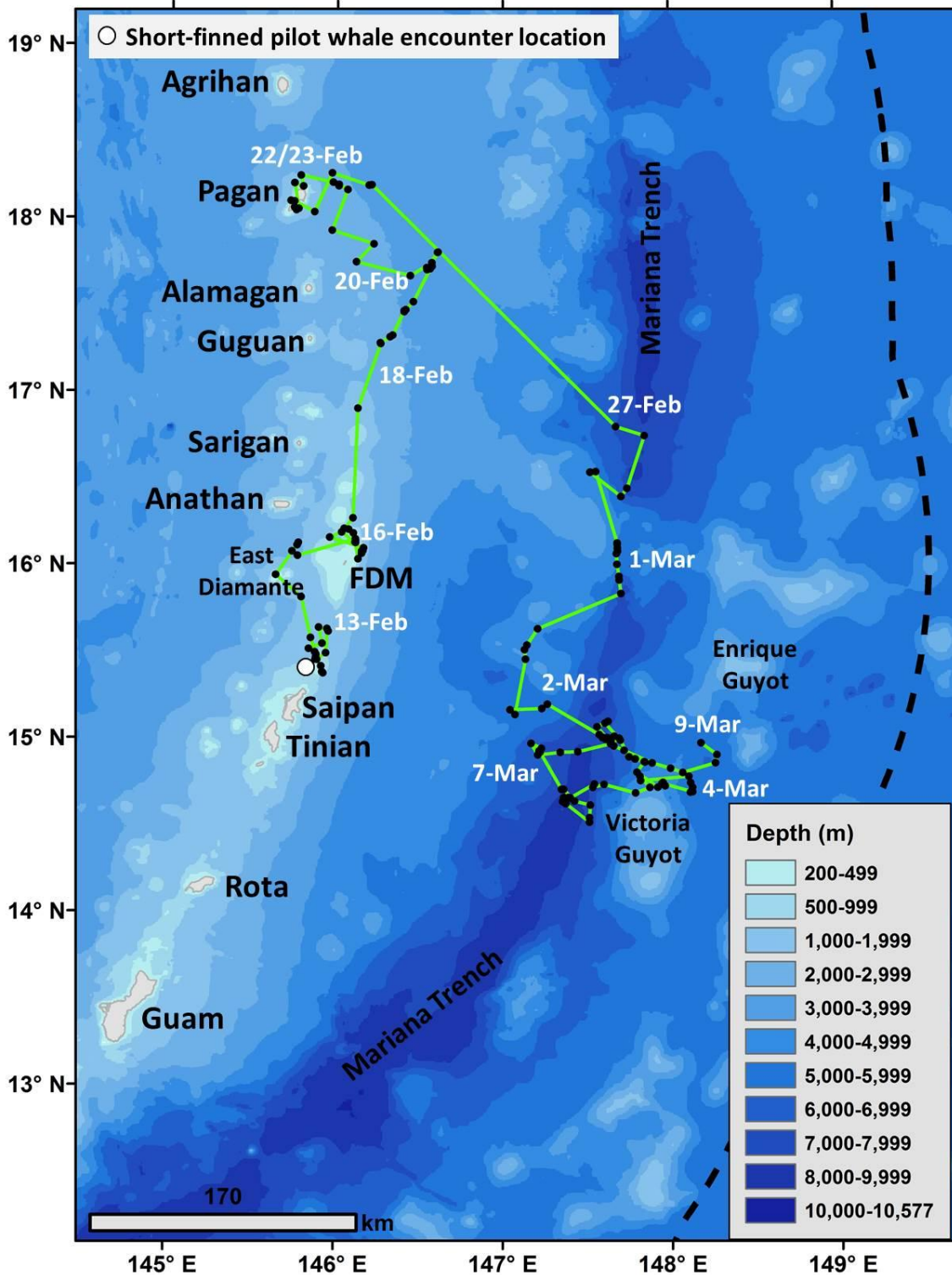


Figure 4: Douglas Argos Filtered locations and track for a satellite tag (141699) deployed on short-finned pilot whale off Saipan (11 February) during small-boat cetacean surveys off Saipan. Duration of the tag was 27.4 d.

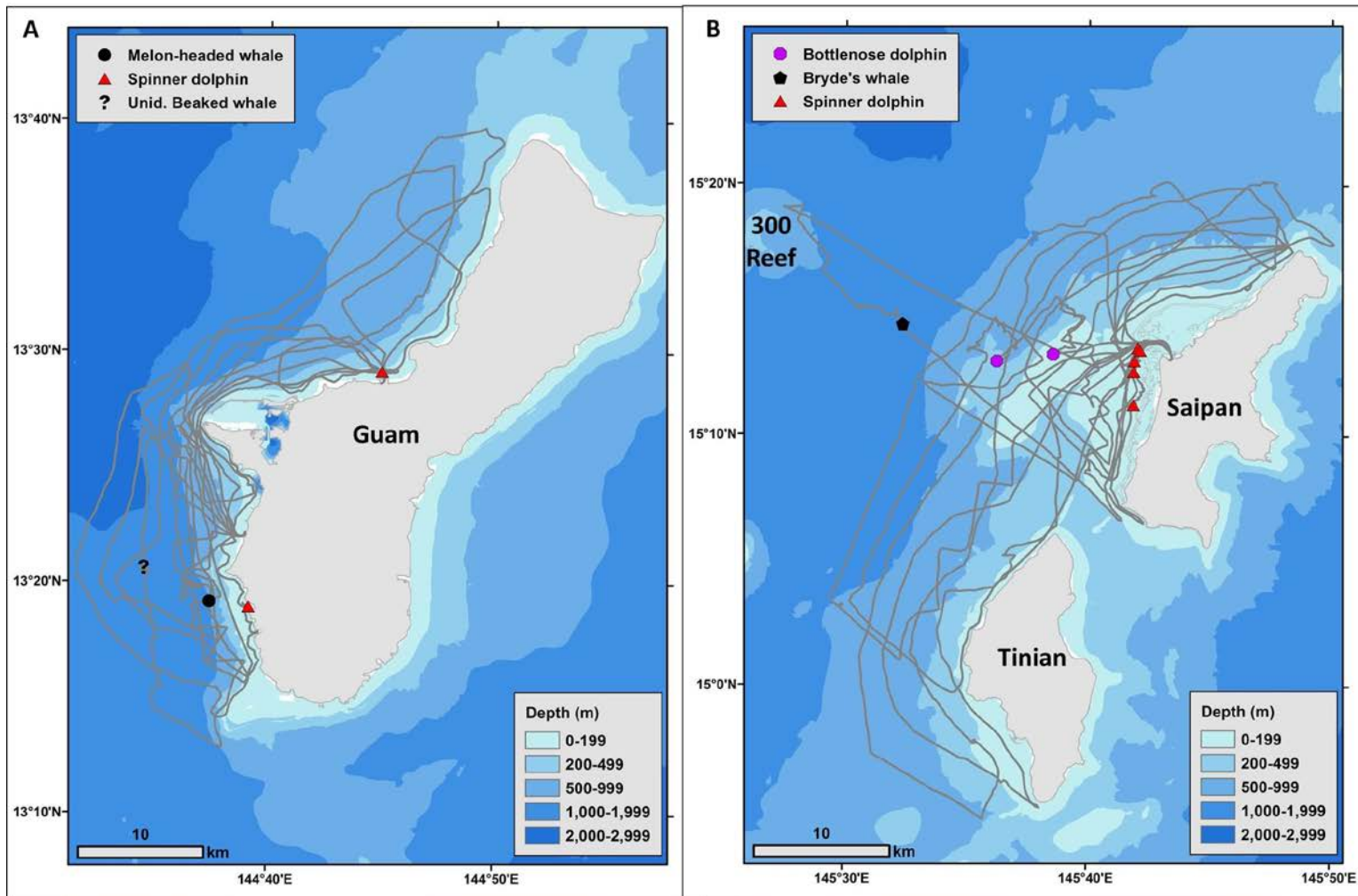


Figure 5: Tracklines and cetacean encounter locations during the 2017 Marianas summer (May) small-boat surveys off Guam (A; 701 km trackline) and Saipan and Tinian (B; 847 km trackline).

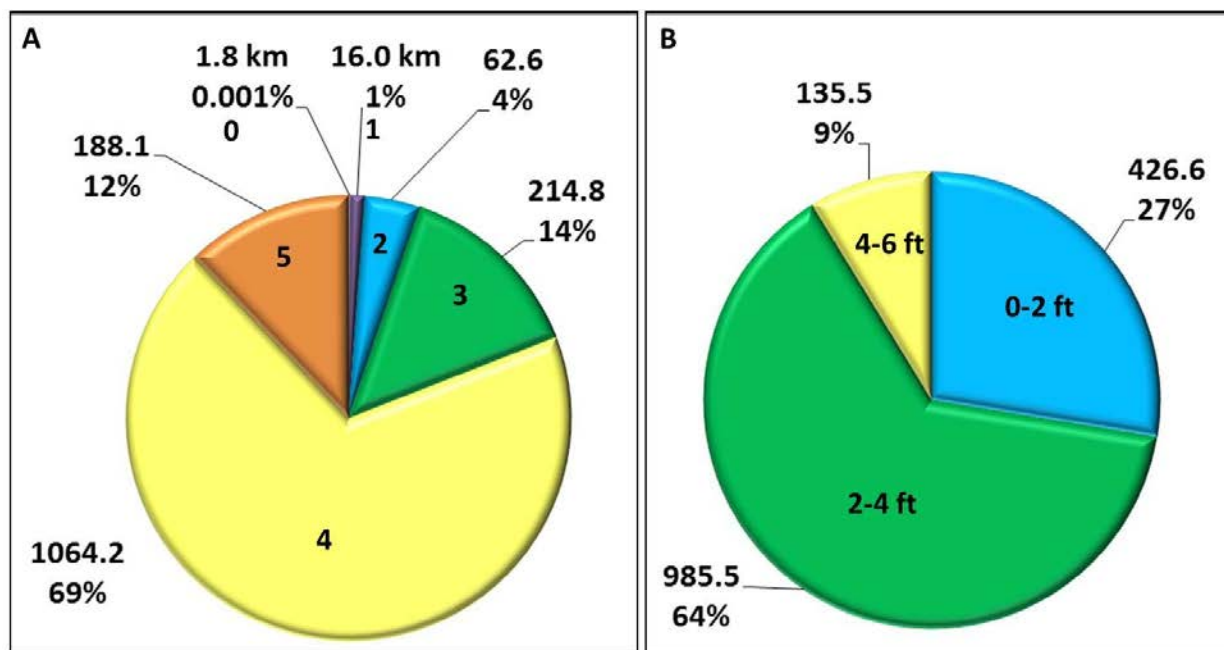


Figure 6: Effort by (A) Beaufort sea state and (B) swell height (ft) during the 2017 Marianas summer (May) small-boat cetacean surveys off Saipan, Tinian, and Guam.

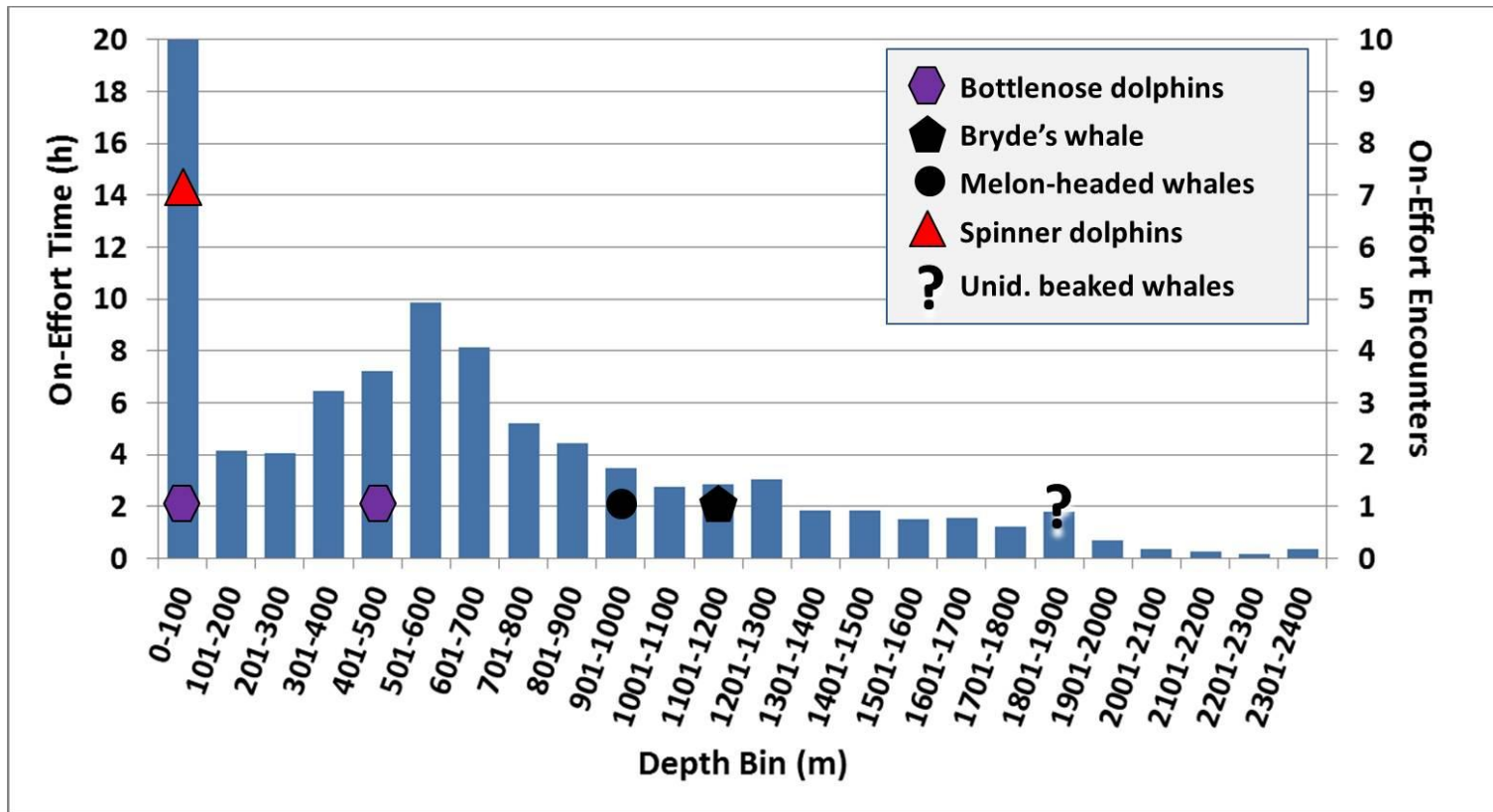


Figure 7: Effort and encounters by depth during the 2017 Marianas summer (May) small-boat cetacean surveys off Saipan, Tinian, and Guam.

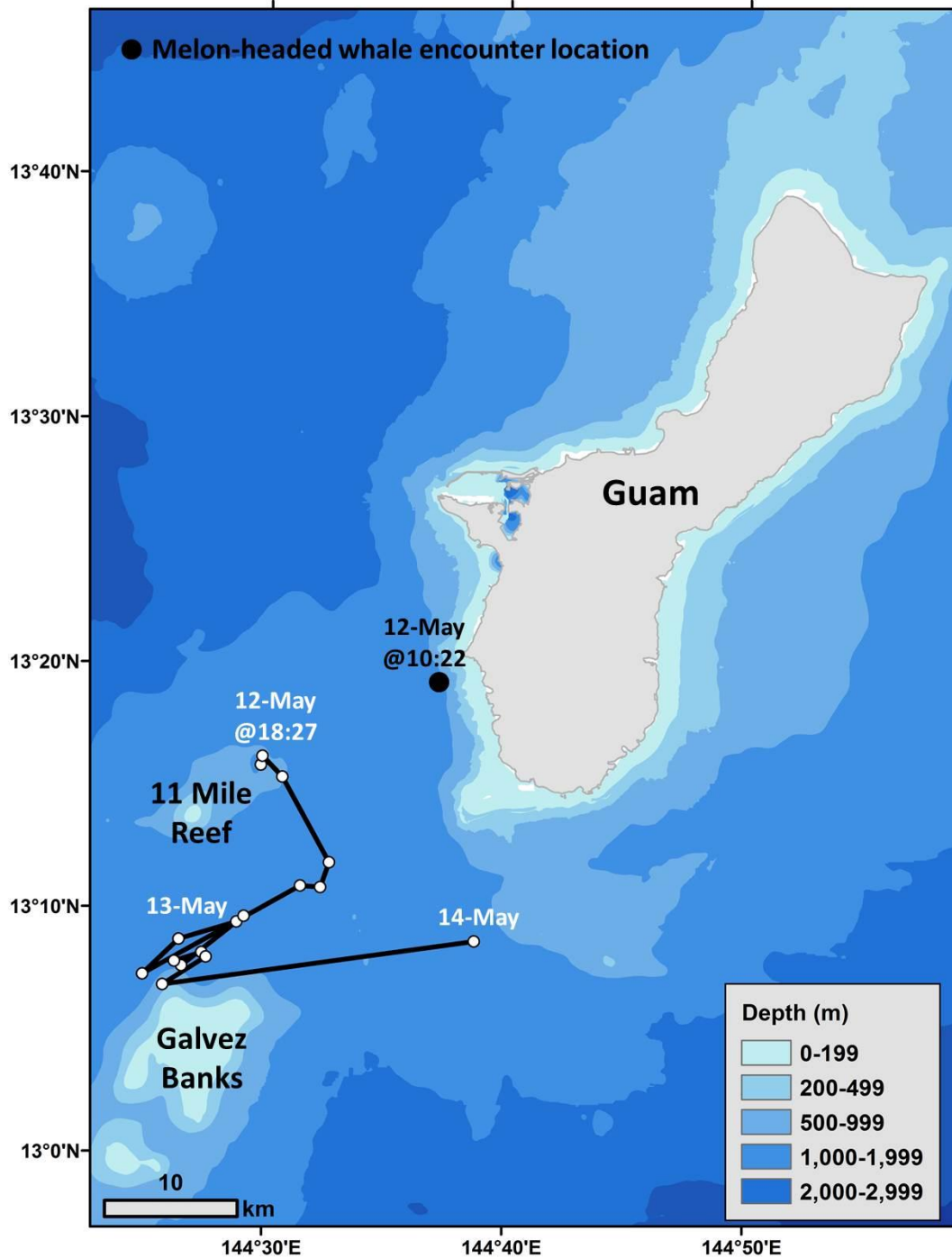


Figure 8: Douglas Argos Filtered locations and tracks for a satellite tag (141706) deployed on a melon-headed whale off Guam (12 May) during small-boat cetacean surveys. Duration of the tag was 1.8 d. A second satellite tag (141707) was deployed but it transmitted only one location near the encounter location and is therefore not depicted here.

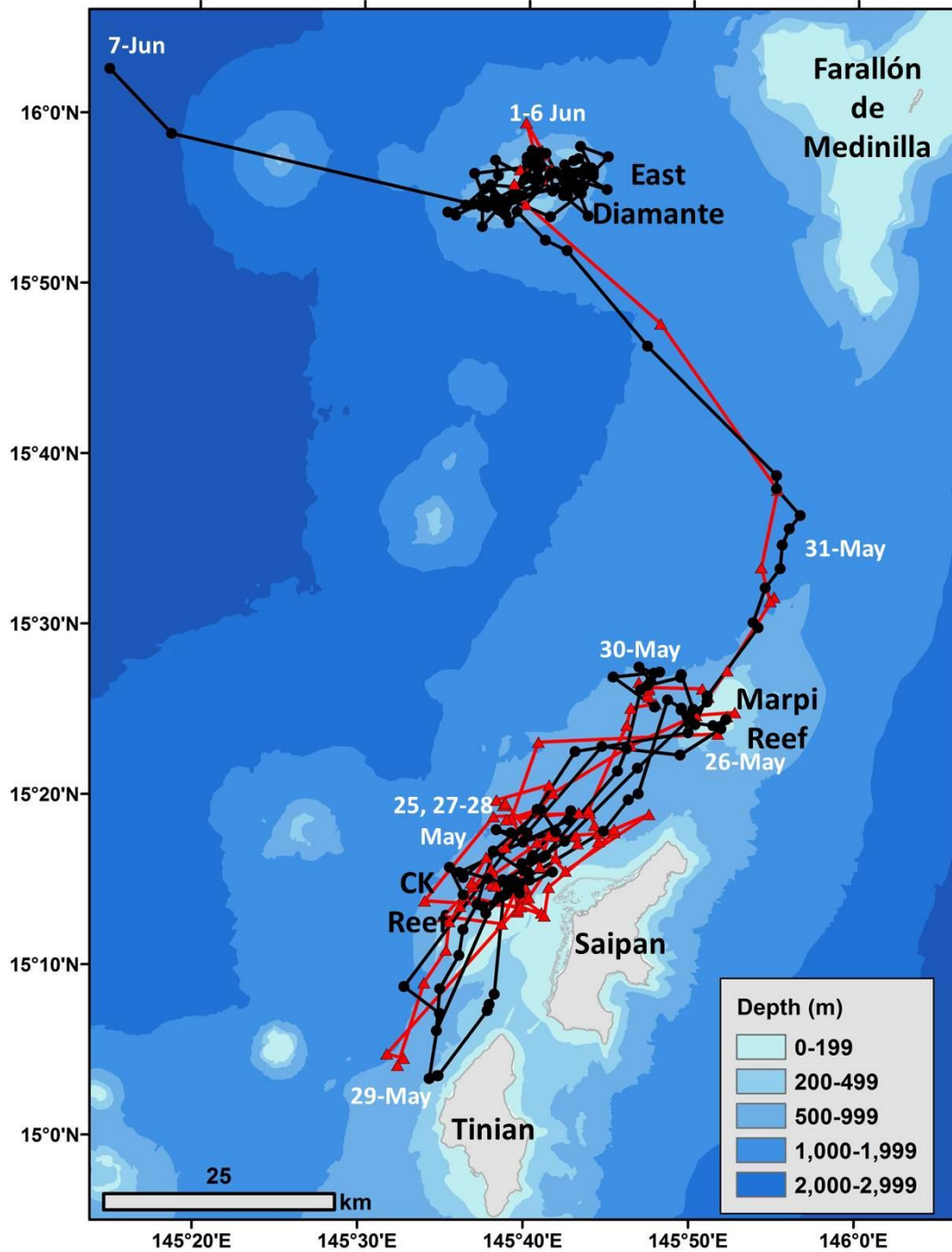


Figure 9: Douglas Argos Filtered locations and tracks for satellite tags (169421 and 141698) deployed on bottlenose dolphins off Saipan (25 May) during small-boat cetacean surveys. Durations of the tags were 7.9 d and 13.2 d.