

# **Acoustic and Visual Survey of Cetaceans at Palmyra Atoll**

**Trip report 09/2007**

**Palmyra, September 18 – October 13, 2007**

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## Summary

### 1. HARP Deployment/Recovery

During a visit to Palmyra from April 6-8, 2007, during the cruise with the S/V Robert C. Seamans, the high-frequency acoustic recording package (HARP) deployed on October 18, 2006 was recovered. It was refurbished and redeployed on April 8, 2007, off the south-western outer reef at close proximity to the previous position (approx. 0.6 nm more easterly due to strong wave action) at 05° 51.882' N 162° 09.362' W in 550 m of water. The instrument had a microcat (SBE 37SM) integrated into the mooring which sampled temperature and salinity. It was recovered during the last field trip on September 19, refurbished and redeployed on September 21, 2007, again off the south-western outer reef close to the previous position at 05° 51.927' N 162° 09.402' W in 550 m of water. The microcat was removed from the instrument. The recording started on September 22, 2007, at 12 am GMT and will be running for approximately 7 months until the hard drives are filled or the battery capacity is used up. On Tuesday October 9, 2007 the HARP was enabled and responded to interrogation pings showing that the location was still as on the day of deployment. At the end of all operations the acoustics of the release was disabled to maintain battery life.

Both instrument were in a mooring style. The recording was set to a sampling frequency of 200 kHz, with a recording duration of 5 minutes and a recording interval of 20 minutes. The instrument is supplied with 16 hard drives of 120 GB data storage capability each, adding up to a total of 1.92 TB of data for each instrument.

### 2. Cetacean Survey and Acoustic Recording

During the three weeks cetacean survey at Palmyra Atoll we had the local 25ft vessel to our disposal for a total of 8.5 days out of which we used 7.5 days for cetacean surveys. The total survey time was approx. 58 hours. The weather conditions were mostly good. The sea state was usually between 3 and 4 on a beaufort scale, only once down to 1 and once up to 5 (see table environment). This allowed us to circle the atoll completely on two survey days, at two days we had to stay along the north shore in the wind shadow of the atoll (see figures 1-9). Generally we spent less survey effort on the eastern side of the atoll due to weather conditions.

For the acoustic survey we used a 4 channel hydrophone array with 80 m of cable. 3 channels recorded simultaneously with a sampling frequency of 192 kHz, 1 channel had a sampling frequency of 480 kHz. The hydrophone array was deployed as soon as deeper waters were reached and the survey speed was between 6 and 9 knots. The array was either towed or stationary depending on the cetacean behavior. When in the presence of melon-headed whales or beaked whales, the boat was stopped, the motor was turned off and the boat drifted with the group of animals. The array was towed 80 m behind the boat over deep waters resulting in an approximate water depth of the hydrophones at 10 to 20 m depending on boat speed, up to a maximum of 80 m when the boat was fully stopped.

About 40% of the total survey time was spent during encounters with the animals. We had a total number of 48 encounters summing up to 23 hours of sighting duration. There were 10 encounters with melon-headed whales (*Peponocephala electra*), 33 encounters with bottlenose dolphins (*Tursiops truncatus*), 3 encounters with spinner dolphins (*Stenella longirostris*) and 1 encounter of an unidentified species of beaked whales. Further sightings were made during 4 afternoons at sea with no dedicated survey effort (figure 10) with 8 sightings of bottlenose dolphins, 2 sightings of spinner dolphins and 2 sightings of beaked whales (1 sighting made by others after we had left the atoll). The term "resighting" was only used if a group of

animals was seen again shortly after the initial sighting but not if maybe the same group of animals was seen later in the day or the next day. As for population estimates there were approximately 700 to 1000 melon-headed whales, 150 to 200 bottlenose dolphins and 100 to 150 spinner dolphins that we met around the atoll. The numbers were stable in comparison to the survey from fall 2006.

The time spent with the melon-headed whales (*Peponocephala electra*) was approximately 11 hours 30 minutes resulting in 650 minutes of recordings. The melon-headed whales were, as during our last visits in July and November 2006, in large numbers of hundreds of whales mostly milling and socially interacting with each other. The animals were used to the presence of the boat. Part of them showed no interest in our presence and pursued their normal course of action while others approached the vessel curiously even if we were drifting. We observed the group to be both passive, mostly in the morning hours, as well as more active later in the day with mother-calf interactions, occasional spyhops, tailslaps, etc. During one encounter when the waves were a little higher the whole pod was surfing waves, similar to what we observed last fall. During another encounter we saw part of the group surfacing in a coordinated manner in a line formation. This behavior was also observed once last year. Both behaviors were displayed in the later afternoon hours. A third more unusual behavior for daylight-hours was the observation of hunting on a big bait ball together with hundreds of naughties and boobies in the late afternoon. The group was generally stretched in loose aggregation forming clusters of two to ten individuals swimming very close to each other and interacting with each other. The melon-headed whales were always together in the whole pod during all encounters and were most often observed on the south side of the atoll always over deeper water. When resting they were in the vicinity of the reef. During previous weeks, when we did not conduct surveys, the group was regularly seen off the north shore in the afternoon.

During almost 5 hours that we spent with the bottlenose dolphins (*Tursiops truncatus*) we were able to acquire about 265 minutes of recordings. We saw the animals both in smaller groups of a few individuals up to bigger groups of 15 to 20, in one occasion up to 100 or more animals. On several days there were small and medium groups stretched out all around the atoll. We would call each group a sighting if we did not see any more animals for several minutes while on other days a larger number of animals seemed to be closer affiliated which we then did not split up into subgroup sightings.

We observed again like last fall several individuals of bottlenose dolphins with circular lesions. There was only one lesion per animal and the animals looked generally healthy. The lesions appeared to be chronic ulcers of unknown cause (see figures 11-14).

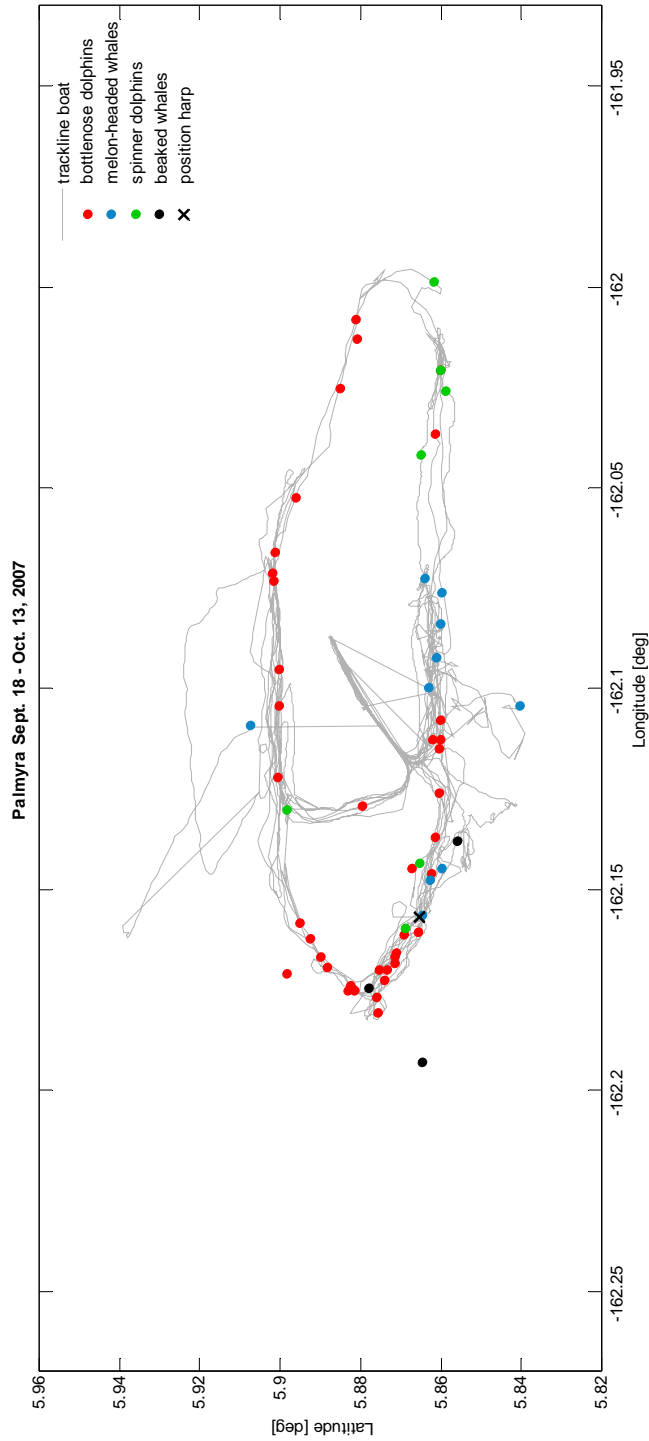
We were able to spend about 2 hours with spinner dolphins (*Stenella longirostris*) which resulted in 120 minutes recordings. The spinner dolphins were more indifferent to the approach of the boat. They came to bow ride in only one occasion. As during the survey in fall 2006 did we not see spinner dolphins on a daily basis. But similar to last year they tended to prefer the eastern terrace which has rougher seas and makes sightings more difficult as well as the area harder to access. The regularity of encounters suggests a strong affiliation with the atoll if not a permanent residency there.

There were 3 sightings of an unknown species of beaked whales. One sighting was during our survey effort, another one during time at sea off effort and a third one by other observers when we had left the atoll already. All three sightings were in the afternoon around the southwestern tip of the reef in close proximity to the HARP. During the off effort sighting we were able to observe two animals breaching from a distance and took pictures that did not lead to a species identification. During the on effort sighting we were able to approach two animals fairly close, took pictures and audio recordings. The animals were a mother/calf pair, surfaced about five times and disappeared on a dive. We did not resight them. According to Robert Pitman, NOAA,

the pictures show beaked whales of the genus *Mesoplodon* (figure 15-17). They did not have obvious similarities with any known *Mesoplodon* and therefore might have been the possible new species suggested in (Dalebout, Baker et al. 2007). Indications for a new species are the distinct indentation between head and body, the large melon, the very large blow-hole and the healing of wounds (e.g. cookie-cutter shark wounds) with dark skin.

All species were recorded during one or several encounters very close or at the location of the HARP. This led to array recordings while the HARP was recording simultaneously. This data can be used as reference data during analysis.

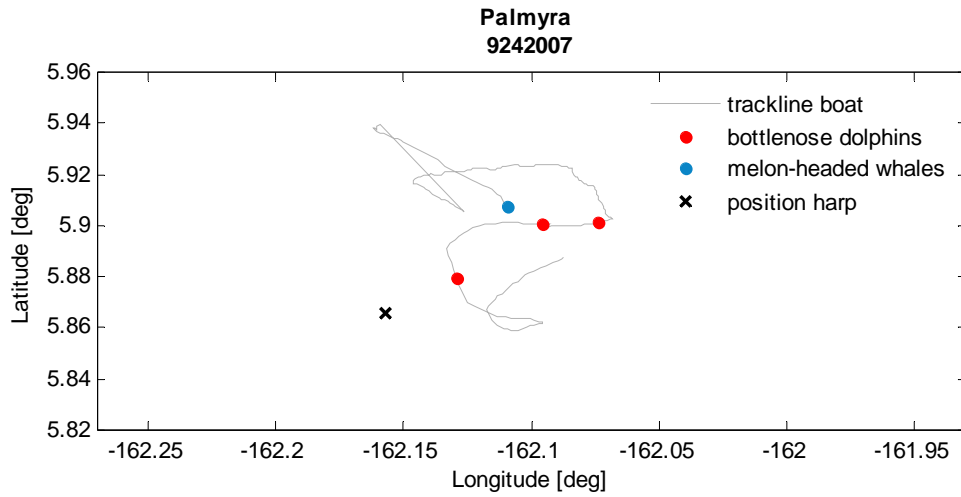
## Sightings



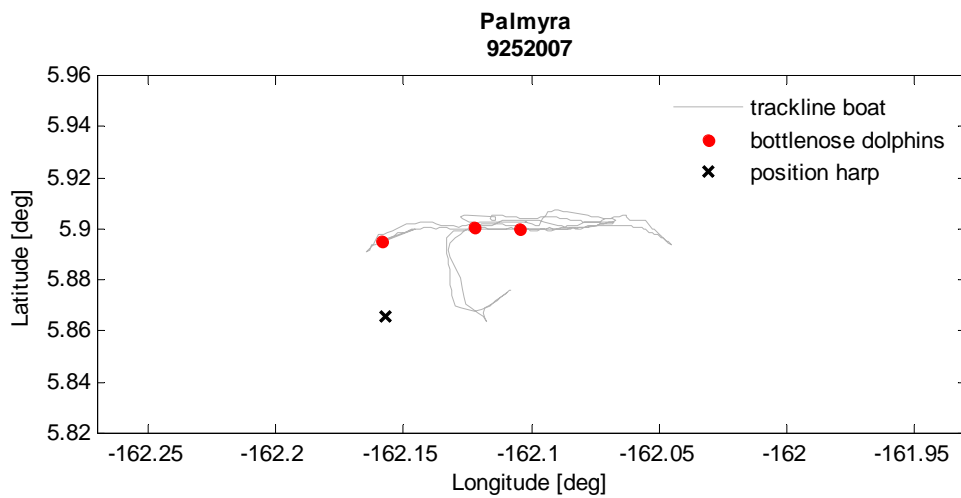
**Figure 1:** Total survey effort and sightings throughout September 18 to October 13, 2007.

# of encounters (including those "off-effort"):  
 melon-headed whales – 10  
 bottlenose dolphins – 41  
 spinner dolphins – 5  
 beaked whales – 4

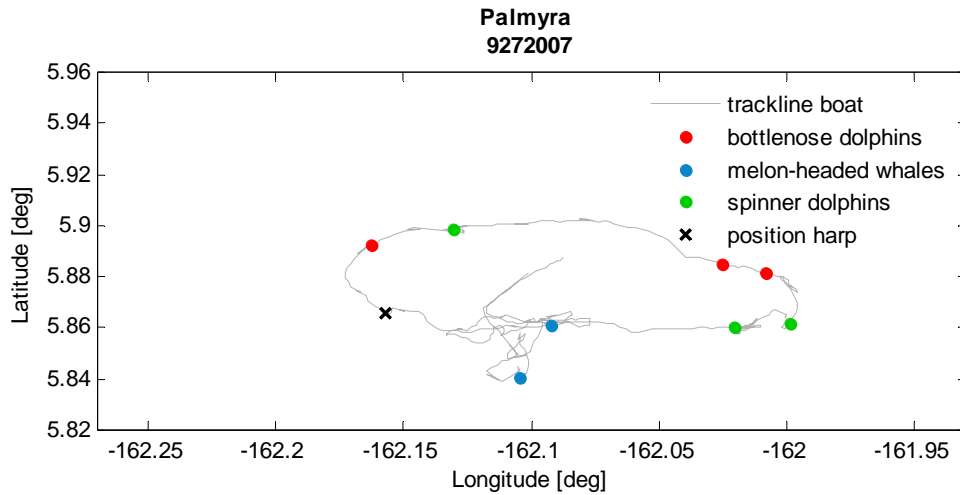
The trackline shows more effort in the western part of the atoll due to weather conditions. During "off-effort" sightings no tracklines were recorded. The boat would usually stay south-west of the atoll then.



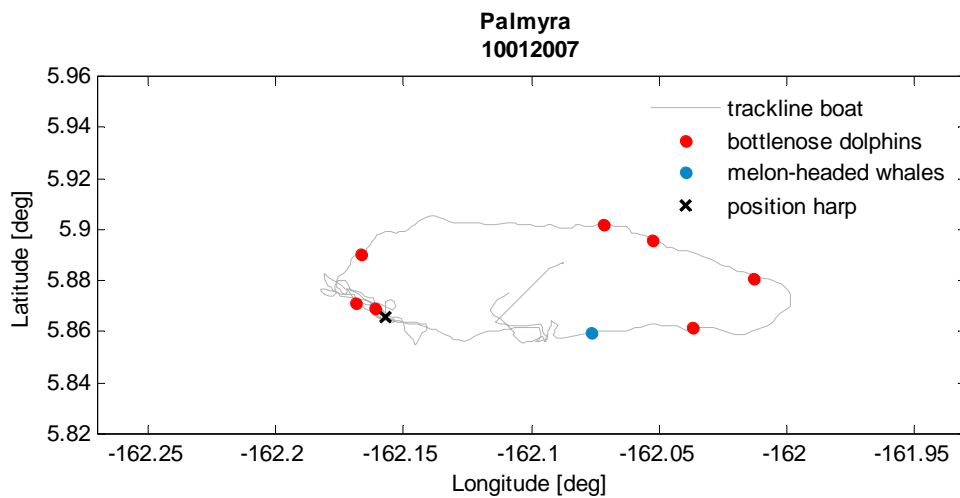
**Figure 2:** Survey track on September 24, 2007 with 3 encounters of bottlenose dolphins and 1 encounter of melon-headed whales.



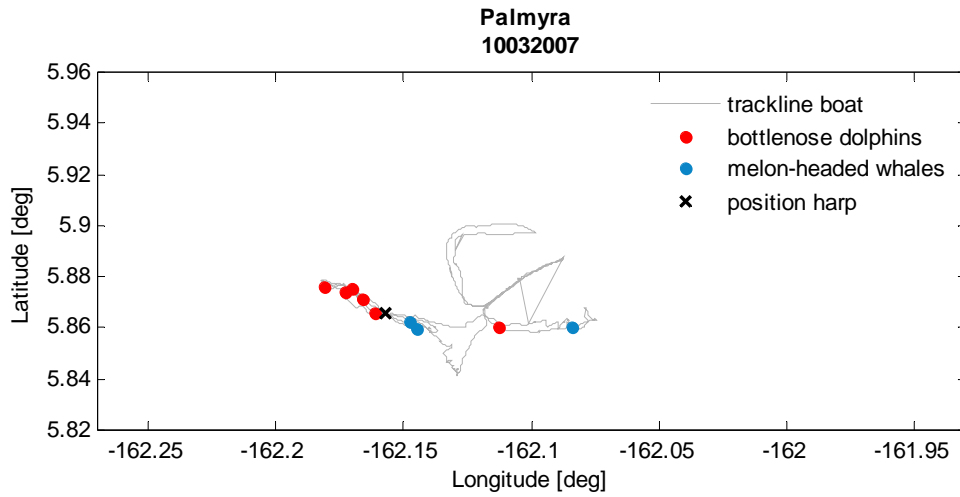
**Figure 3:** Survey track on September 25, 2007 with 3 encounters of bottlenose dolphins.



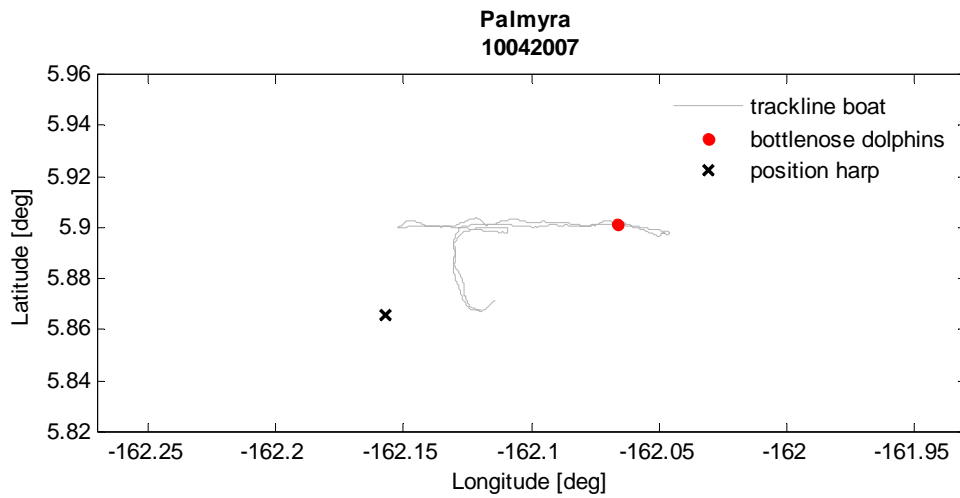
**Figure 4:** Survey track on September 27, 2007 with 3 encounters of bottlenose dolphins, 2 encounters of melon-headed whales and 2 encounters, one resighting of spinner dolphins.



**Figure 5:** Survey track on October 1, 2007 with 7 encounters of bottlenose dolphins and 1 encounter of melon-headed whales.

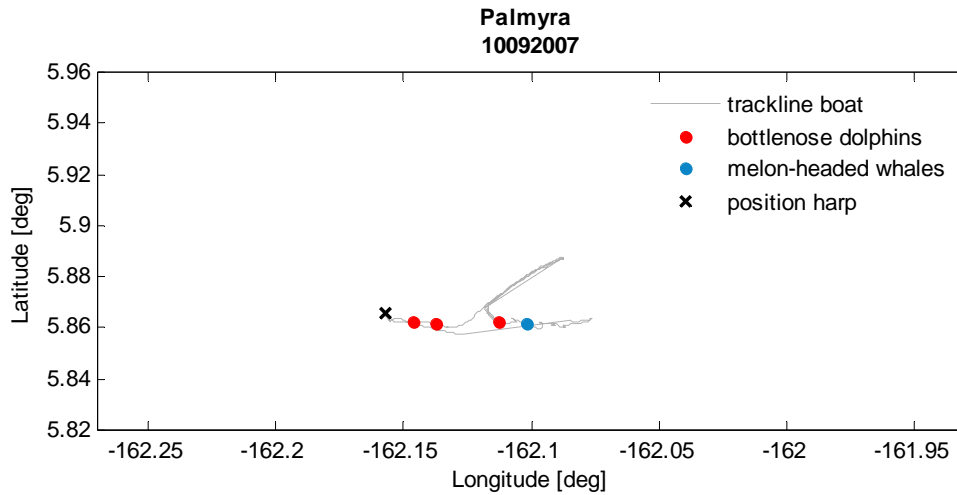


**Figure 6:** Survey track on October 3, 2007 with 4 encounters, 2 resightings of bottlenose dolphins and 3 encounters of melon-headed whales.

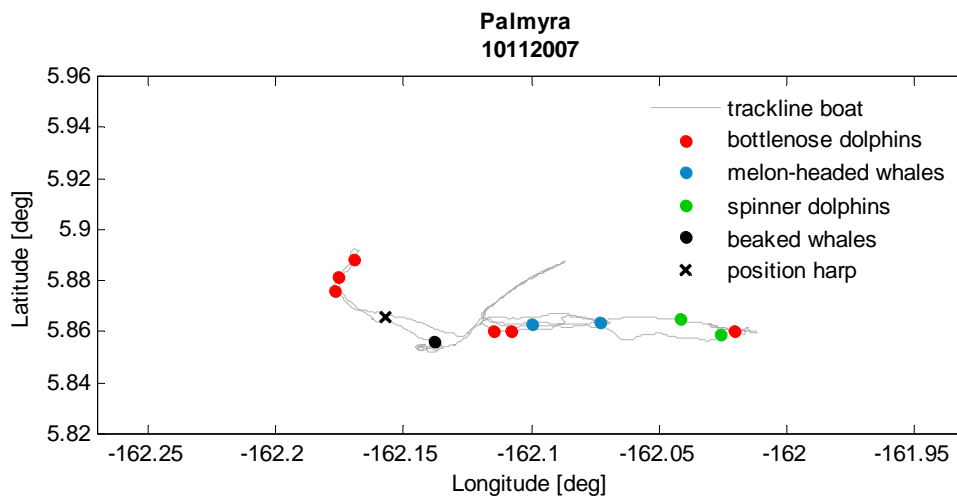


**Figure 7:** Survey track on October 4, 2007 with 1 encounter of bottlenose dolphins.





**Figure 8:** Survey track on October 9, 2007 with 3 encounters of bottlenose dolphins and 1 encounter of melon-headed whales.



**Figure 9:** Survey track on October 11, 2007 with 6 encounters of bottlenose dolphins, 2 encounters of melon-headed whales, 1 encounter, one resighting of spinner dolphins and 1 encounter with an unknown species of beaked whales.

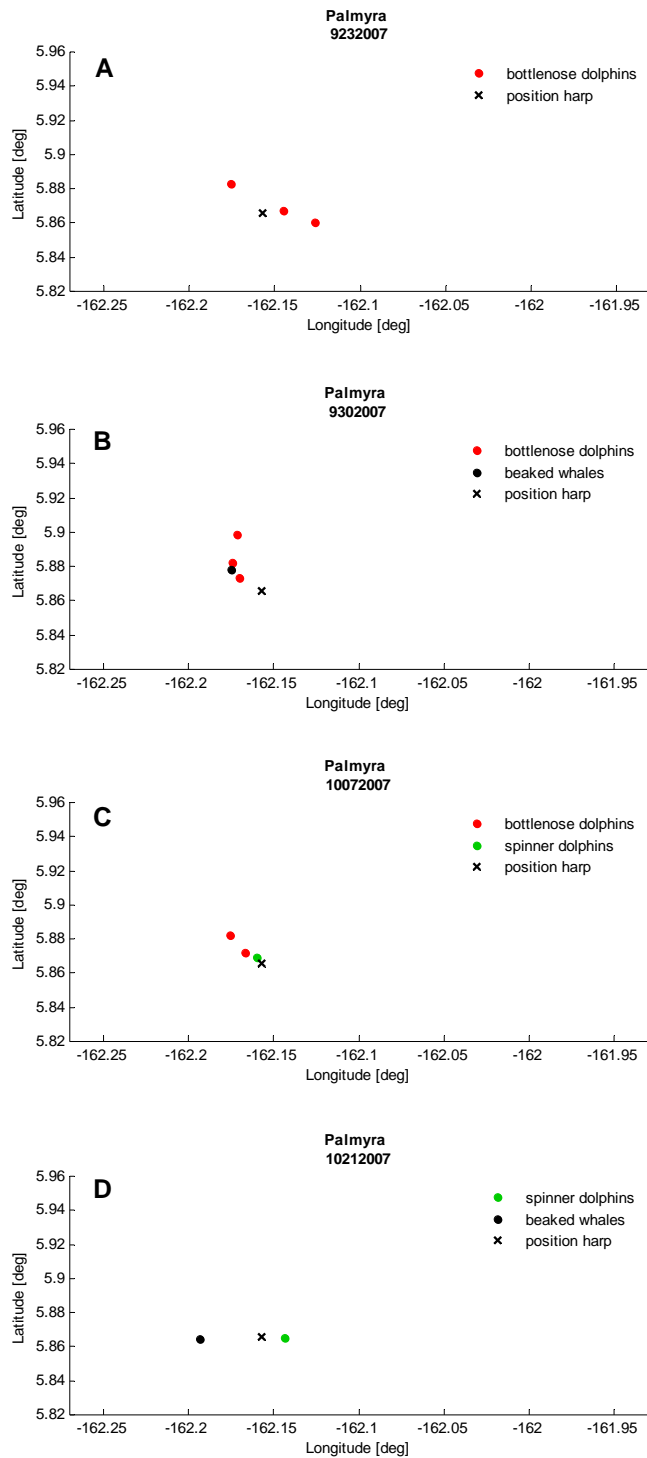
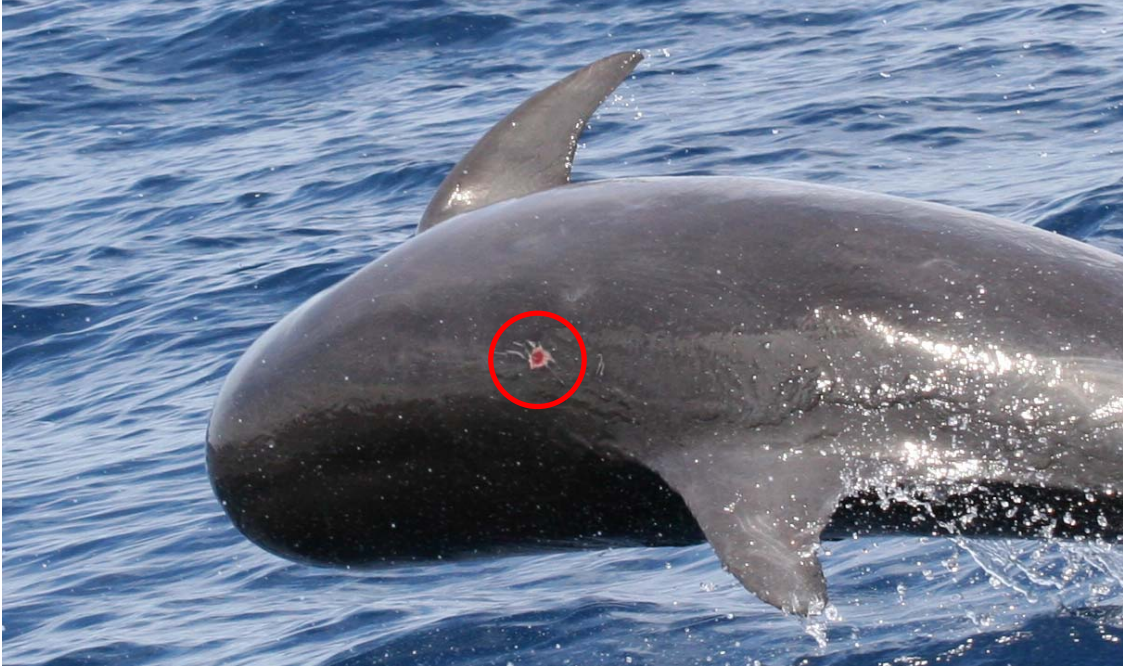


Figure 10: Off effort sightings on (A) September 23, 2007, (B) September 30, 2007, (C) October 07, 2007 and (D) October 21, 2007.



**Figure 11:** Bottlenose dolphin with circular lesion, chronic ulcer of unknown cause. Individual 1, photo from September 28, 2007.



**Figure 12:** Bottlenose dolphin with circular lesion, chronic ulcer of unknown cause. Individual 2, photo from October 01, 2007.



**Figure 13:** Bottlenose dolphin with circular lesion, chronic ulcer of unknown cause. Individual 3, photo from October 08, 2007.



**Figure 14:** Bottlenose dolphin with circular lesion, chronic ulcer of unknown cause. Individual 4, photo from October 08, 2007.



**Figure 15:** Surfacing sequence of unknown species of beaked whale, probably female right and calf left. Photo from October 11, 2007.



**Figure 16:** Surfacing sequence of unknown species of beaked whale, probably female right and calf left. Photo from October 11, 2007.



**Figure 17:** Dorsal view of unknown species of beaked whale, probably female. Photo from October 11, 2007.

**Cited Literature:**

Dalebout, M. L., C. S. Baker, et al. (2007). "A divergent mtDNA lineage among Mesoplodon beaked whales: molecular evidence for a new species in the tropical pacific?" *Marine Mammal Science* **23**(4): 954–966.