

Short Note

Survival of a Common Bottlenose Dolphin (*Tursiops truncatus*) Calf with a Presumptive Gunshot Wound to the Head

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Gunshot injuries and fatalities are common in pinnipeds worldwide, but rarer in odontocetes. In the United States, evidence of gunshot injuries in marine mammals have been previously reported in several locations, including the Gulf of Mexico (Morgan & Patton, 1990; Vail, 2016; Sinclair et al., 2017), off the west coast (Leatherwood et al., 1980; Bigg et al., 1987; Danil et al., 2010), and Hawai'i (Shallenberger, 1981; Tummons, 1997; Baird, 2016). Shootings are reported to occur in response to depredation of bait or catch from fishermen (Kuljis, 1983; Morgan & Patton, 1990; Tummons, 1997; Baird, 2016), and opportunistic hunting (Higdon & Snow, 2008), though confirming the circumstances behind gunshot wounds after their occurrence remains challenging at best and is frequently not undertaken. In Hawai'i, interviews with fishermen and fisheries observer accounts reveal that some species of odontocetes depredate fish in hook and line fisheries (Kuljis, 1983; Forney et al., 2011), and anecdotal accounts indicate that fishermen occasionally shoot at odontocetes to deter them from stealing bait or catch (Shallenberger, 1981; Baird, 2016). Gunshot wounds could result in serious injury or mortality of individuals and, therefore, are of relevance to policymakers, as well as raise animal welfare concerns.

Common bottlenose dolphins (*Tursiops truncatus*) are a regularly encountered species in Hawai'i that live in four independent island-associated resident populations around Kaua'i/Ni'ihau, O'ahu, Maui Nui (including Maui, Lāna'i, Kaho'olawe, and Moloka'i), and Hawai'i Island, as well as a separate offshore population (Baird et al., 2009;

Martien et al., 2011). The total abundance of bottlenose dolphins within the Hawaiian Exclusive Economic Zone has been estimated at 21,815 individuals (CV = 0.57; Bradford et al., 2017), though the abundance of each of the island-associated resident populations are generally thought to be in the low hundreds (Baird et al., 2009).

Herein, we report an incident in which a resident bottlenose dolphin calf from the O'ahu population was apparently shot through the melon and survived for at least 11 mo subsequent to the shooting. The likely mother of the calf, individual HITt0538 in the Cascadia Research Collective Hawai'i bottlenose dolphin photo-identification catalog, was first documented off O'ahu in 2007, and had been seen on 25 d in seven different years prior to being first documented with the calf (HITt1093) on 10 November 2017 (Cascadia Research Collective, 2007-2019, unpub. raw data). The last sighting of HITt0538 without a calf present was on 23 June 2017, suggesting HITt1093 was at most 4.5 mo old when first documented. Both individuals have been documented associating with other individuals from the resident O'ahu social network of bottlenose dolphins (Baird et al., 2009). The mother-calf pair was seen on three additional occasions, and photos of the melon of HITt1093 from as recent as 30 April 2018 showed no evidence of a wound (Table 1).

Photos obtained on 30 June 2018 by a tour operator off O'ahu showed the first evidence of injury—an irregularly shaped open wound on the left side of the melon, with granulation tissue visible. A subsequent encounter on 14 July 2018 provided additional high-quality photos (Figure 1), suggesting a gunshot wound to the melon. Photos show a small, round

wound with inverted margins on the right side of the melon consistent with a bullet entry wound, and a more irregularly shaped wound with granulation tissue and an extruded margin on the left side,

consistent with an exit wound (Quatrehomme & İşcan, 1999). Additionally, the relative placement of the presumed entry and exit wounds indicates that the source of the injury may have originated from



Figure 1. Photographs of a bottlenose dolphin (*Tursiops truncatus*) calf HITt1093 with gunshot wound visible on the right (top) and left (bottom) sides of the melon 14 July 2018. The accompanying adult is likely the mother based on close proximity during all encounters of the calf. (Photos by Chuck Babbitt)

above the animal, which is to be expected from a gunshot wound, assuming that the shot was fired downward from a boat. Other possible causes for the presumed entry and exit wounds include abrasion and billfish jabs. Each of these theories might explain the entry or exit wounds individually, but the simultaneous detection of both wounds suggests that they stem from a single injury, making these theories less compatible. In the absence of witnesses to a shooting, the recovery of a bullet or bullet fragment is the only diagnostic indicator for a gunshot wound (Read & Murray, 2000). The characteristics of the wounds on the calf combined with a lack of other compatible theories strongly support the notion that this animal sustained a gunshot wound. The calf did not display any unusual behaviors during the encounters on 30 June or 14 July, swimming closely alongside HITt0538 for the duration of both encounters and surfacing at regular intervals.

At the next sighting of the calf with its mother on 1 October 2018, the skin had healed over the assumed entry and exit wounds leaving small depigmented (i.e., white) scars. High-quality photos from an encounter on 6 December 2018 showed that the depigmented scar at the site of the assumed entry wound was noticeably smaller and surrounded by a broader area of healed tissue (Table 1; Figure 2). At the most recent sighting on 2 June 2019, the only remaining evidence of the exit wound was a single depigmented scar over a broader area of light pigmentation on the left side of the melon (Table 1; Figure 2). As of the last sighting in June 2019, the calf appeared to be in good body condition with no overt signs of emaciation, although the calf was at most approximately 23 mo old and likely still dependent (Mann et al., 2000). Thus, it is not known whether it will be able to survive independently.

Table 1. Sighting details of bottlenose dolphin (*Tursiops truncatus*) HITt1093 prior to and following the injury

Date	Source	Side of melon visible	Photographed appearance of wound site
10 Nov 17	Dolphin Excursions	None	N/A
6 Dec 17	Ocean Joy Cruises	Both	No wound
26 April 18	Ocean Joy Cruises	Right	No wound
30 April 18	Ocean Joy Cruises	Right	No wound
30 June 18	Wild Side Specialty Tours	Left	Open exit wound with pink tissue, possibly concave center, and extruded margin
14 July 18	C. Babbitt	Both	Small, round entry wound on right side with evidence of healing; exit wound on left appears flat, with pink tissue still visible and extruded margin.
1 Oct 18	Ocean Joy Cruises	Both	Small depigmented (i.e., white) scar on right at site of entry wound; exit wound appears flat, healed, with a patchy network of depigmented scars visible.
11 Oct 18	Dolphin Excursions	Right	Small depigmented scar at site of entry wound
5 Nov 18	Ocean Joy Cruises	Left	Exit wound appears flat, with a patchy network of depigmented scars
6 Nov 18	Dolphin Excursions, Ocean Joy Cruises	Both	Small depigmented scar at site of entry wound; exit wound may be slightly concave, with one large and two small depigmented scars that have markedly shrunk in size.
8 Nov 18	Wild Side Specialty Tours	Left	Distant photos show exit wound on left appears flat, with a single visible large depigmented scar and lighter coloration over area of original wound
16 Nov 18	Wild Side Specialty Tours	Right	Small depigmented scar is visible at site of entry wound
6 Dec 18	Wild Side Specialty Tours	Right	Small depigmented scar, likely < 1.5 cm across, on right at site of entry wound over broader area of healed tissue
19 April 19	Ocean Joy Cruises	Both	Distant photos show small depigmented scar on right at site of entry wound over a broader area of healed tissue; off-angle photos show some evidence of remaining depigmented scarring on left at site of exit wound.
23 April 19	Ocean Joy Cruises	Left	Exit wound on left appears flat, with a single large depigmented scar and lighter coloration over area of original wound
2 June 19	Dolphin Excursions	Both	Exit wound on left appears flat, with a single large depigmented scar and lighter coloration over area of original wound; poorly lit photos of the right side show no discernible evidence of the entry wound.

Based on the relative positioning of the assumed entry and exit wounds, anatomical structures that may have been damaged include the melon and sinuses, which could potentially reduce the long-term likelihood of survival for this individual by

impairing echolocation and vocalization (Norris & Harvey, 1972; Reidenberg & Laitman, 2008; McKenna et al., 2012; Berta et al., 2014).

This report presents evidence that Hawaiian odontocetes are at least occasionally shot at,



Figure 2. Photographs of bottlenose dolphin calf HITt1093 with largely healed wound visible on right side of the melon on 6 December 2018 (top) and left side of the melon on 2 June 2019 (bottom) (Photos by Noelle Shaughnessy [top] and Kimberly Wood [bottom])

possibly as a result of perceived or actual interactions with fisheries (Shallenberger, 1981; Baird, 2016) or in illegal opportunistic hunts, which may have implications for conservation policymakers and fisheries management in Hawaiian waters. In spite of the remarkable survival and healing of this bottlenose dolphin calf, gunshot wounds can result in serious injury or the mortality of individuals, and steps should be taken to ensure their prevention. This might include increased education and outreach to both fishermen and the general public, electronic monitoring of fisheries, and a greater law enforcement presence on the water.

This note also appears to represent the first documented multi-month survival of an odontocete calf with a presumptive gunshot wound to the head, with no observed atypical behavior or changes in body condition. In 1972, an adult male bottlenose dolphin sustained a gunshot wound close to the right eye in British waters, surviving for at least 5 years following the injury, though the individual shied away from human contact following the injury (Lockyer & Morris, 1990). In contrast, the calf in this report has shown no aversion to human contact, frequently coming close enough for tour boat operators to take high-quality photographs (Table 1).

The remarkable progression of healing in this calf from a serious injury is noteworthy, especially given the location of the injury. However, sightings of this individual over a longer time period will be required to assess the long-term survival of this individual post-weaning. This note also highlights the importance of community science contributions in the monitoring of odontocete populations as without regular photo contributions from tour boat operators, both the initial injury and its healing could not have been monitored so closely.

Acknowledgments

We thank David Schofield and Debbie Duffield for reviewing photos of the injured animal; Jenna Morris of Dolphin Excursions and the other boat drivers from Ocean Joy Cruises and Wild Side Specialty Tours; and Annie Gorgone, Sabre Mahaffy, Enrico Corsi, and two anonymous reviewers for providing comments on a draft of this note. Funding for catalog matching was provided by a grant from the Pacific Islands Fisheries Science Center to the Cascadia Research Collective.

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