

# A summary of ship strikes and the operation of a high speed ferry in Hawai'i

LYMAN<sup>1</sup>, EDWARD; DAVID K. MATTILA<sup>1</sup>, DAVID SCHOFIELD<sup>2</sup> AND JEFF WALTERS<sup>2</sup>

<sup>1</sup> NOAA, Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS), 726 S. Kihei Road, Kihei, HI 96753 USA

<sup>2</sup> NOAA, National Marine Fisheries Service (NMFS), Pacific Islands Regional Office, 1601 Kapiolani Boulevard, Suite 1110, Honolulu, HI 96814 USA

## ABSTRACT

The population of North Pacific humpback whales, *Megaptera novaeangliae*, that mate and calve in the coastal waters surrounding the Hawaiian Islands each winter, has grown at approximately 6% annually since the cessation of whaling. In 2006 it was estimated that approximately 10,000 humpbacks use this near-shore habitat. This growing population has coincided with a growing concern about whale-vessel collisions, which have been increasing over the past decade. Given humpback whale preference for shallow water (<183 m) and the use of the same habitat by a majority of the vessel traffic, a high risk of contact exists between whales and vessels. The majority (~92%) of vessels known to be involved in whale-vessel collisions have been less than or equal to 19.8 m in length. In addition, more than half (61%) of vessels were traveling 13 kts. or less. Therefore, the introduction of a large (105m), high-speed (35 kt) ferry running between the main Hawaiian Islands, and potentially transiting the shallow waters with the highest known densities of whales, became the focal point of these growing concerns. This generated heated discussion, consultations, governmental orders and legal actions, which ultimately played a role in its cessation of operations. However, in its relatively brief history, the Hawaiian Islands high-speed "Super ferry" did develop and operate under a number of both voluntary and mandated protocols and technologies that may provide some insight into the problem of whale-vessel collisions. A case study of the high speed ferry, and an overview of ship strikes in Hawai'i are reviewed here.

## INTRODUCTION

In the Hawaiian Islands cetaceans are protected by a variety of both State and Federal laws. In addition, because Hawai'i is the primary breeding destination for North Pacific humpback whales and the only humpback breeding grounds in US national waters, much of this habitat was given further protection through the establishment of the Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS, Figure one). The HIHWNMS is jointly managed by National Oceanic and Atmospheric Administration (NOAA) and the State of Hawai'i's Department of Land and Natural Resources (DLNR). These agencies along with NOAA's National Marine Fisheries Service (NMFS) are the primary agencies responsible for mitigating whale-vessel collisions throughout Hawai'i's state and federal waters.

In response to growing concern, primarily from professional mariners, these agencies initiated numerous actions aimed at better understanding and minimizing contact between whales and vessels. Some of these initiatives included: a "Hotline" for reporting collisions, greater education and outreach to increase awareness, increased response and investigation, both at-sea and on shore, to verify reports and better assess the impacts of ship-strike to whales and ocean users, and greater information on the issue in general. The HIHWNMS contracted a review of all known collisions in Hawai'i (Lammers et al., 2003), and the Sanctuary's Advisory Council, an advisory group of government and private citizens representing various Sanctuary stakeholders, convened a vessel collision workshop in 2003 (NOAA HIHWNMS, 2003). Two of the primary recommendations of the workshop were; 1) to increase public education on the whale collision issue, with the intent of increasing reporting and improving safe vessel operations, and 2) improve the collection of information about the circumstances leading to collisions. At this same time a high-speed ferry for Hawaiian waters was proposed, and a representative of Hawai'i Superferry Inc. was invited to participate in the workshop. The company's subsequent whale avoidance policy and procedures (Hawai'i Superferry Inc., 2005), arose, in part, out of continued discussions between Hawai'i Superferry Inc., the Sanctuary Advisory Council and the Lammers et al. (2003) overview of whale and vessel collisions in Hawai'i.

Since the 2003 workshop, NOAA and the State of Hawai'i have placed whale collision avoidance signage at most of Hawai'i's harbours, developed brochures and press releases, and conducted 14 to 18 targeted vessel operator seminars annually, highlighting whale collision avoidance. While it is difficult to know how much this educational effort improved reporting, the number of collision reports has increased noticeably during the period (2003-2011, Figure two). In their review, Lammers et al. (2003) provided a questionnaire to professional mariners that asked, amongst other questions, "what percentage of whale collisions that they were aware of were actually reported to authorities?" The majority estimated that only 25% of collisions were reported prior to 2003. Therefore, it is likely

that much of the increase in reporting after 2003 is a result of the increased awareness resulting from the education and outreach, along with more rigorous record keeping, as many of the early ship strike report in the Lammer's et al review were from newspaper archives. Evidence supporting this comes from the fact that most reports (83.3%, 35 of 42) since 2003 were self-reported. They were reported directly by the vessel operator at or near the time the strike occurred by use of the established Hotline or by contacting one of the mitigating agencies.

In addition to reporting, the amount of information recorded has also increased. Since 2003, data about the whales, vessels and circumstances involved in collisions have all improved. For instance, when the size (age) of the whale was reported during confirmed collision reports, 24 were calves, 11 were reported as juveniles, and 16 as adults. Collision with calves represented 47.1% (24 of 51) - nearly half, of all confirmed reports. While nearly all determinations of age class were based on observer's estimation of the size of the animal, and a significant number (17) were reported as an "unknown" age class, any error in identifying calves should be minimal, since reporters are not likely to mistake a calf for any other age class during Hawai'i's breeding/ calving season. Greater error may lie between juveniles and adults, since these are more likely to be misreported (e.g. a small adult male being reported as a juvenile). Thus, in regard to age class, it appears that calves are at the greatest risk. Only 9 reports had known sex of animal. Of these, 5 were males and 4 were females. It is not known how many collision reports ended up being fatal. Only one confirmed report represented a dead animal - a calf with propeller wounds, but it is uncertain whether the injury - the strike, resulted in the fatality or occurred post mortem. In fact, in many cases the degree of injury could not be determined. In only 36.8% (25 of 68), or approximately one-third of reports, were signs of injury observed (e.g. wounds, blood in water). However, not observing any signs of injury is not necessarily an indication that the animal was not impacted. Minor, incidental contacts, such as those during a curious approach by the whale when the vessel is drifting, were not included. The Sanctuary, along with partnering agencies, attempted to respond to reports of collisions between whales and vessels in order to better assess impact. Since 2003 the Sanctuary has mounted 7 of these on-water assessment efforts.

Most reports provided an indication of the type of vessel (based on use) involved in the whale-vessel collision. In 76.5% - three-quarters (52 of 68), of confirmed reports the vessel type was known. Most (34 of 52) were "tour" boats (e.g. snorkel or whale watch), with the rest reported as, fishing (4), military/ government (4), ferry (3), research (3), private/pleasure (1), cargo (1), and other (2). Most major vessel types were represented. Thrill craft (e.g. jet skis and parasailers) are not allowed in much of the high-risk waters leeward of Maui during the "whale season" (December 15 - May 15). Only a limited number of cruise ships visit the Hawaiian Islands and most spend much of their time within harbours or at anchor. Thus, reports likely reflect the number of vessels represented in each category and the amount of time traversing whale-dense waters (the probability of collision). The greater number of reports from passenger vessels, like the tour boats and ferries, are also likely to reflect a bias in reporting based on those vessels having a large number of eyewitnesses on board. Military/ government and research vessels also have strict protocols, which are likely to influence reporting on those vessels. Size of vessel was reported by vessel operator or determined through research. In 70.6% of confirmed reports (48 of 68) was the size of the vessel determined. Most (~92%, n=44) of vessels involved in whale-vessel collisions were less than or equal to 19.8 m (65 ft). Only 4 reports involved vessels greater than 19.8 m. In a majority (60.3%, n= 41) of the confirmed reports was the speed of the vessel known. As opposed to vessel averages or recorded logs (i.e. GPS logs), vessel operators provided speed of vessel at time of contact. Speed values thus represent estimates and are likely biased based on the source of reporting. In those cases in which speed was represented as a range (e.g. 10 - 13 kts), then the greater value was used in speed determination. Twenty vessels reported that they were travelling 10 kts or less, an additional 5 vessels at 13 kts or less, 12 at 14 to 20 kts, and 4 greater than 20 kts. Thus, more than half (25 of 41) reported going 13 kts or less at time of contact. Interestingly, 9 incidences were reported as the whale making contact with the vessel. This equates to approximately 1 out of every 6 reported collisions, over the last decade in which these reports have occurred, being represented as the whale hitting the vessel. Seven of these "whale hit vessel" reports provided a speed estimate at time of contact and all were 5 kts or less. The average speed from all reports where speed was provided was 11.5 kts (n=41).

Nearly one-third (32.4%, n=68) of reports could not be attributed a position beyond general area (e.g. west of Lahaina, Maui). Of the remaining two-thirds, nearly half (22 of 46) the positions could only be determined from relative description of location (e.g. 2 nm south of Lahaina, Maui). Only 24 reports had absolute (GPS-based) positions and only 18 of these represented collision location as opposed to location of the ship-struck animal. Nearly two-thirds (65%, n=57) of reports occurred in the leeward waters of Maui. This is to be expected, as this area typically has high whale densities with a reasonably high level of boat traffic during the "whale season". It is also the site of the HIHWNMS' primary office and mariners may be more likely to report given the visibility and at sea response provided. Humpback mother and calf pairs are believed to frequent the shallow coastal waters of Hawai'i (Smultea, 1994). While not corrected for representative area, only 2 calves (17%, n=12) were reported struck in

shallow (30 m or less), coastal waters. The time the strike occurred was known in 56 of the confirmed collision reports. Of these 52 or 93% occurred in the January through March time period. February had the highest number of reports at 24. January through March represents the highest densities of humpback whales in Hawai'i.

### **CASE STUDY: HIGH SPEED FERRY**

The 105 m, high speed (35 kts), catamaran operated by "Hawai'i Superferry, Inc." was in operation in Hawaiian waters for only 11 months in 2007 and 2008, before it ceased operations, largely due to the ruling from the Supreme Court of Hawai'i, concerning its environmental impact. During these 11 months it only operated part of one humpback whale season (January and April of 2008). However, through a combination of both voluntary and mandated protocols (State of Hawai'i Executive order no. 07-10), the Superferry kept logbooks of its transits through Sanctuary waters, and any close (<91 m) encounters with whales. One significant mandate was for the Superferry to seek alternate routing (Figure three) and avoid transiting HIHWNMS waters during whale season (January 1 to April 30). Another was that it should decrease its speed to 25 kts if it did transit HIHWNMS waters, or other known humpback whale habitat (i.e. <183 m) during whale season. This speed was a compromise based on the speed of other vessels transiting whale habitat (i.e. up to 25 kts), and the purported manoeuvrability of the Superferry.

Unfortunately, the crew were only mandated to enter "positive" data (e.g. when the vessel transited the Sanctuary, or had a close encounter with a whale) into their logbooks and were not required to record all transits outside of the Sanctuary, nor days when they did not transit at all due to bad weather or logistical issues. And so it is impossible at this time to determine how successful they were at using alternate less risky routes. However, because the vessel always made roundtrips from Oahu to Maui (one leg) and back (a "second" leg), it is clear from the logbooks that the vessel was at least able to avoid transiting the Sanctuary on most of its return trips from Maui to Oahu where conditions tended to be consistently downwind with following seas. And so, on the twenty days that we can confirm from its whale logbooks that the Superferry operated during the 2008 whale season, it transited the Sanctuary during 19 legs of a possible 40 (2 legs x 20 days). This is an overestimate of the percentage of their trips that transited the Sanctuary, as it does not include days when they made both legs on the alternate route. During a "rapid" risk assessment, conducted by an independent consulting company (Belt Collins Hawai'i Ltd., 2008), the Superferry only transited the Sanctuary 4 of 20 one-way legs, during whale season. It is also clear from their logbooks that the Captain confirmed that the vessel did slow to 25 kts when within Sanctuary boundaries.

The Captain was also required to record any observed close encounters (<91 m). During the minimum 20 days that the Superferry operated during the 2008 whale season, they recorded 8 close encounters less than 91 m from the vessel. The closest observed was estimated to pass 4.5-6.5 m from the side of the vessel, and one other close encounter was less than a whale length as well. There were no collisions reported. Interestingly, half of the close encounters occurred outside of the Sanctuary boundaries, although only one was in water deeper than 183 m. However, whales were sighted in deeper water, particularly on the alternate route north of the island of Molokai. The Superferry did not operate during the peak of the season, mid-February – March, when the densities are highest; however, on one of their last days of operation in early February, an independent observer recorded 33 whales during one leg. Aerial surveys between 1993 and 2003 calculated an observed average humpback whale density of 0.2842 sightings per km<sup>2</sup> (Mobley, pers. comm.). Sighting composition averaged between 1-2 whales per sighting.

Finally, the Superferry did make some night-time trips at the end of the whale season in 2008, and although the spotters did have night vision scopes, and whales were seen during the previous daylight leg, the observers did not see any whales at night, with this technology. The independent observer also indicated that, while the radars were turned on, the crew did not use them to find whales. The observers also concluded that other technology on the vessel (e.g. thermal imaging) was not used to find or avoid whales, and the visual observations by vigilant observers, along with slower speeds in known whale habitat, were the primary means used towards effective prevention.

### **CONCLUSIONS**

It is clear that the increasing population of humpback whales in Hawaiian waters is increasing the likelihood of collisions with vessels, and is likely part of the reason for the increase in reports. However, a follow up interview of professional mariners, similar to the one used by Lammers et al. (2003), might help clarify how much of this increase in the number of reports is due to better awareness and compliance. Either way, there has been better record keeping and thus information gained on whale-vessel collisions in Hawai'i over the last decade. In particular, humpback calves appear to be at greater risk than adults. Data also shows that nearly all vessel types, size and speed are represented. However, our vessel had the highest incident of reported collision, though this may reflect their greater probability of encountering an animal, it may also represent biases in reporting. Most reported vessels involved were small or moderate in size (less than 20 m) and more than half of all vessels reported doing less than or equal to 13 kts at time of contact. A majority of reported strikes were in the leeward waters of Maui, where whale densities and vessel traffic is higher. An increasing number of reported collisions over the last decade have been reported as "whales hitting vessels".

The Superferry risk assessment concluded that vigilant trained observers visually searching for whales, and slower speeds, are the best mitigation measures, at this time. The fact that half (4) of the Superferry's close encounters were outside of the Sanctuary support this, as they may not be operating with the same level of vigilance. This could support the concern that the creation of high awareness in one area might cause vessel operators to let their guard down in others. However, without knowing the total distance traveled through the Sanctuary, versus the total distance through whale habitat outside of the Sanctuary, we cannot tell at this time whether this was a factor.

So far the ship strike avoidance technology used in Hawai'i has not proven effective. It is clear that theoretically promising technological approaches need rigorous real life testing in the field. While additional information on whale-vessel collisions have been gained recently, more investigation is needed to better understand and thus mitigate what is likely a growing threat of collision between whales and vessels in Hawai'i waters.

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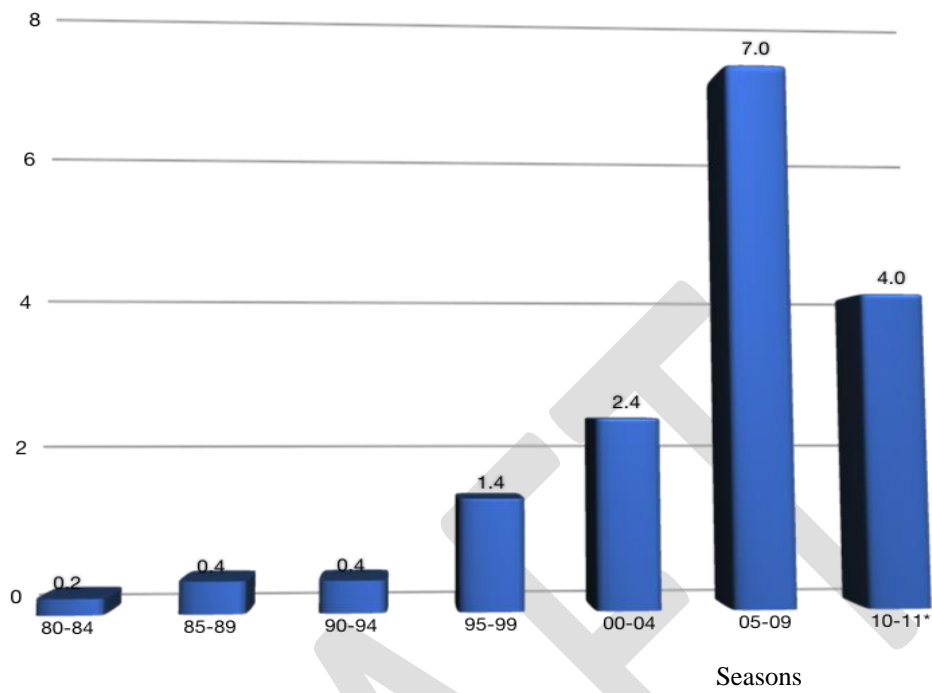
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**Figure One.** Boundaries of HIHWNMS



**Figure two.** Average number of whale strikes/year, in five-year bins



\* Represents annual average over just two seasons.

**Figure three.** Standard route through HIHWNMS and alternate route North of Molokai

