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Records of Indo-Pacific Humpback Dolphins, *Sousa chinensis* (Osbeck, 1765), from the Waters of Western Taiwan

John Y. Wang,[1, 2] Samuel K. Hung,[3] and Shih-Chu Yang[4]

[1]*FormosaCetus Research & Conservation Group, 310-7250 Yonge Street, Thornhill, Ontario, Canada, L4J-7X1*
[2]*National Museum of Marine Biology & Aquarium, 2 Houwan Road, Checheng, Pingtung County, 944, Taiwan*
[3]*Hong Kong Cetacean Research Project, 12 Kak Tin Kung Miu Village, Tai Wai, New Territories, Hong Kong*
[4]*FormosaCetus Research & Conservation Group, 5F-5, #78, Chung-Mei 13 Street, Hualien, Hualien County 970, Taiwan*

In Formosa [= Taiwan] *I have never seen Porpoises; but the coast there is too exposed and the rivers too barred, I should think, for regular visits of Porpoises.*

—Robert Swinhoe
(28 January 1868 letter to
W. H. Flower; in Flower, 1870)

Abstract

There are few and sporadic records of the Indo-Pacific humpback dolphin, *Sousa chinensis* (Osbeck, 1765), from the waters of Taiwan. In June 2002, an exploratory survey of the coastal waters off central western Taiwan resulted in the sighting of several groups of Indo-Pacific humpback dolphins in the coastal waters of Miaoli, Taichung, and Changhua counties. The minimum combined total number of dolphins observed in all sightings was estimated to be 28. Other details of the sightings are presented, past records of this species in Taiwanese waters are reviewed, and threats to this species in the waters of western Taiwan are discussed.

Key Words: Indo-Pacific humpback dolphins, *Sousa chinensis*, Taiwan, survey, stranding records, conservation

Introduction

The Indo-Pacific humpback dolphin (henceforth "humpback dolphin"), *Sousa chinensis* (Osbeck, 1765), is primarily a nearshore, shallow water inhabitant that tends to be associated with the mouths of large rivers. It is found throughout most of the Indian Ocean and the Indo-Pacific region from South Africa to Australia and north to the East China Sea (Jefferson, 2000; Jefferson & Karczmarski, 2001; Ross et al., 1994). Although there are many sighting records of this species from western Taiwan Strait, there have been no reliable sighting records from western Taiwan, on the eastern side of the Taiwan Strait (Jefferson, 2000; Jefferson & Karczmarski, 2001). Furthermore, ship-based surveys of the coastal waters of central to southwestern Taiwan (Chen et al., 1997; Huang, 1996) resulted in no sightings of humpback dolphins, and a review of the fauna and distribution of cetaceans in Taiwan stated that this species is unlikely to occur in the waters of Taiwan proper (Huang, 1996). Only some stranding records and sporadic, unconfirmed sighting reports of humpback dolphins exist for the coastal waters of Taiwan (Chou et al., 1995; J. Y. Wang, unpublished data). Because the origins of stranded cetaceans are generally unknown (e.g., carcasses may have been carried to the stranding location by prevailing winds, currents, or tides), stranding records may not indicate the normal presence of humpback dolphins in Taiwan. The species is very poorly known in most regions of the world, including Taiwan, where almost nothing is known. This lack of information about humpback dolphins (and other cetaceans) in the coastal waters of western Taiwan is concerning because there are numerous threats to marine life in these waters such as vast amounts of untreated, human sewage and industrial discharge, persistent pollutants in the run-off from agriculture, many land reclamation projects, rapid industrial development, depletion of fish stocks due to overfishing, and mortality caused by fishing gear. The need to know more about this and other cetacean species in the near-shore waters of western Taiwan led to the first dedicated cetacean survey of these waters. In this paper, we present the results of this survey; we share the first confirmed sightings of humpback dolphins from western Taiwan; and we review records of

this species in the waters of Taiwan, including the islands of Chinmen (see Appendix for a short chronological summary of all records).

Materials and Methods

Exploratory surveys of the coastal waters of Miaoli, Taichung, and Changhua counties of central western Taiwan (Figure 1) were conducted on each day between 23 and 26 June 2002 during daylight hours. Surveys were conducted along a thin strip of water from Tungshiau (Miaoli County) to Fangyuan (Changhua County) and from the shoreline out to about 3.6 km (=2 nmi) using a 19-m long fishing boat traveling between 6.5 and 16.5 km per hour during search times. Three observers, situated on a platform that was about 3.5 m above sea level, searched for cetaceans with unaided eyes and binoculars (Leica Trinovid 10x42 BN, Fujinon 7x50, and Bushnell Natureview 8x30). Information collected included time, position, navigational information, atmospheric and marine conditions, species observed, number of individuals (including number of mother/calf pairs), their distance and position relative to the boat, direction of travel, water depth, closest approach to the boat, and some behavioral observations. Navigational data were obtained using handheld Geographic Positioning System (GPS) units (*Magellan GPS 2000* and *Magellan Colortrack GPS*). When animals were sighted, photographs were taken with Nikon and Canon SLR cameras with a 80-200-mm, a 300-mm, or a 300-mm lens with a 1.4 teleconverter using colour slide (Kodachrome 64 and Fujichrome 100) and colour print (Kodak Gold 100) films.

Other records from Taiwan waters are also reviewed.

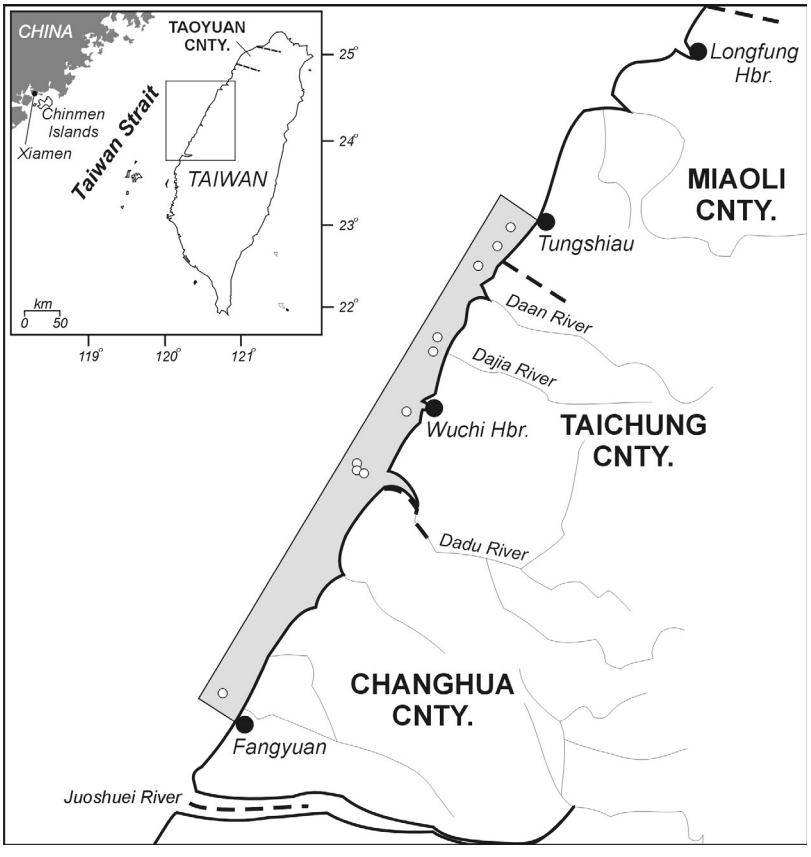


Figure 1. Map of the locations of sighting and stranding records of Indo-Pacific humpback dolphins in the waters of Taiwan. The shaded region represents the surveyed region, open circles represent groups of humpback dolphins that were observed during the present survey, and thick broken lines approximate the county lines.

Results

Survey Results

Four survey trips, varying from 3.3 to 8.1 hours and between 36.2 and 128.1 km per trip, were conducted during the study period. The linear distance of coastal waters covered by the survey was about 80 km and the total area surveyed was about 290 km^2. Cetaceans were sighted during each trip, but only humpback dolphins were recorded. In total, ten groups of dolphins were sighted.

Description of the Humpback Dolphins—The colour patterns of the humpback dolphins observed in Taiwan were somewhat similar to those in Hong Kong and Xiamen (Jefferson, 2000). The calves were dark grey in colour, while the large adults were pinkish white in colour with moderate to little spotting on their bodies (Figure 2a-c); however, the mottled and speckled dolphins (presumably adult males) in Taiwan appeared to retain more dark spots than the Hong Kong dolphins and maintained their grey background colour especially on their dorsal fins, whereas mottled dolphins in Hong Kong lose their grey colour and dark spots on their dorsal fins. Even the large adults of Taiwan still retained a fair amount of dark spots on their dorsal fins, which is different from those observed in Hong Kong and suggestive of a discrete population. Furthermore, comparing photographs of recognizable dolphins in Taiwanese waters with thousands of photographs of dolphins of Hong Kong and Xiamen resulted in no matches (T. A. Jefferson, pers. comm.). More studies on the differences in colouration patterns of the Taiwanese humpback dolphins may help to determine whether these animals are distinct from the Hong Kong and Xiamen dolphins. Undoubtedly, direct genetic analyses of dolphins from these three regions will be very important for answering this question.

Location of Humpback Dolphin Sightings—On 23 June, one sighting of two dolphins was made in the turbid estuarine waters of Dadu River (south of Wuchi [= Taichung] Harbor). A larger group of six to ten (best estimate=8) humpback dolphins, including two mother calf pairs, was observed in the same area on 24 June. On 25 June, 8 to 12 (best estimate=10) dolphins with at least two calves were observed again at the mouth of the Dadu River. Also, on 25 June, the largest group of humpback dolphins (15 to 25; best estimate=20) was recorded north of the mouth of Juoshuei River, but still in the turbid waters of this estuary—at least four calves were seen in this group. Near the end of this survey trip, another group of humpback dolphins (about seven to ten individuals) was spotted at the entrance of Wuchi Harbor. On the final day, 26 June, five sightings of small groups of humpback dolphins (between one and three individuals) were made north of Wuchi Harbor, mostly near the Dajia and Daan Rivers.

Most of the humpback dolphin groups were sighted initially in water < 10 m deep (maximum depth was 13 m), but dolphins frequently entered waters that were < 5 m deep and, on one occasion, < 2 m deep. Most humpback dolphins also were found in or near the turbid waters of estuaries, as previously reported for other areas (e.g., Jefferson, 2000; Ross, 2002; Ross et al., 1994).

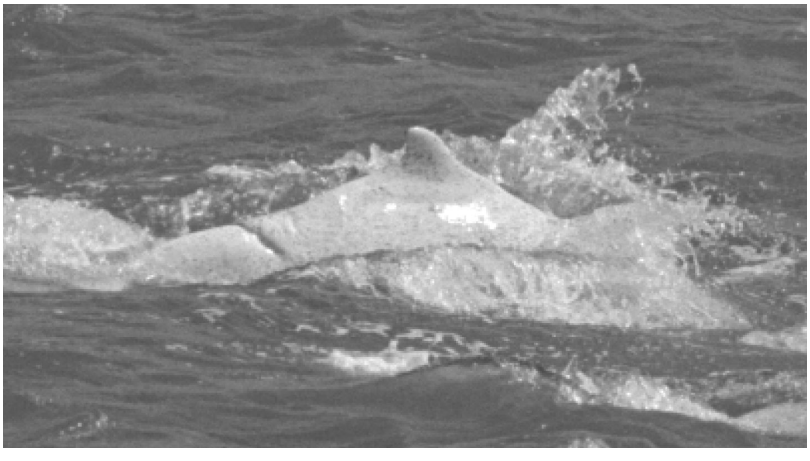
Group Size and Composition—Five of the ten sightings were of groups larger than five humpback dolphins, while the other sightings were of three or fewer dolphins. The group sizes observed were consistent with those reported by Ross et al. (1994), Jefferson (2000), and Ross (2002). Females with young calves were observed only in the larger groups. Most of the grey-coloured dolphins (indicating immature dolphins; see Jefferson, 2000) also were observed in the larger groups. The small groups of one to three dolphins generally were pink (adults) with little spotting. These observations suggest that some form of social segregation may exist.

Assuming that all humpback dolphins observed were different, the total number of individuals (summation of all dolphins in each group sighted) would be between 47 and 70 (best estimate=58); however, a recognizable individual was re-sighted on different survey days, suggesting that multiple sightings of other individuals may also have occurred. Based on photographs of dorsal fins and other distinct body features (e.g., healed wounds), a total of 14 different recognizable individuals were identified and another ten different dolphins, with distinct temporary characters (colour pattern), but no distinguishing long-term, photo-identification marks, were recorded. In addition to these animals, there were up to four calves in one of the groups of dolphins. Therefore, the minimum number of different individuals that were seen over the survey period was 28.

Associations with Seabirds and Feeding—The larger groups of dolphins (> 5) had either little (*Sterna albifrons*), greater crested (*S. bergii*) or common (*S. hirundo*), possibly roseate (*S. dougallii*) terns associated with them while seabirds were not seen near the small groups of dolphins. The nature of the association is unknown, but the seabirds were feeding, and presumably the humpback dolphins were as well; this could not be confirmed, however. On one occasion, feeding was confirmed when one of two humpback dolphins in a small group swam in a tight circle and surfaced with a fish (about 15-20 cm total length) in its mouth before swallowing it (Figure 2b).

Figure 2a. Indo-Pacific humpback dolphins that were observed during a recent exploratory survey of the waters of Western Taiwan (Photo: S-C. Yang)

2b. An Indo-Pacific humpback dolphin with a captured fish (Photo: S-C. Yang)



2c. An Indo-Pacific humpback dolphin with a large healed injury on its caudal peduncle (Photo: S-C. Yang)

Previous Records

The first record of the humpback dolphin from the present-day political boundaries of Taiwan was a specimen that was collected by Robert Swinhoe from the waters of the Chinmen Islands (known historically as Quemoy). This specimen was described and illustrated in great detail by Flower (1870) and represents the type specimen of this species (the syntype in this case because, unfortunately, it was destroyed during World War II [Pilleri, 1979] and was never formally designated the holotype). In more recent times, a humpback dolphin was reported to have live-stranded at low tide on a beach of the Chinmen Islands on 31 March 1995; however, upon further investigation, it was discovered that the animal had become trapped on the shoreward side of a fence net after the tide receded. Therefore, rather than a stranding, this dolphin should be considered a live by-catch of this fishery. After photographs were taken, the animal was released. A second freshly dead specimen from the Chinmen Islands was reported stranded on 28 October 1999. The white coloration, with much black spotting, suggests that it was a subadult. The most recent report was of a dead humpback dolphin found floating just off a beach of the Chinmen Islands on 25 December 2002. Based on its light grey coloration with light speckling, this 202-cm long male was likely either an older juvenile or subadult. From photographs, the animal had many sets of fresh teeth rakes over its entire body and cuts in the flippers, dorsal fin, and rostrum that were consistent with net entanglement. Without more information and examination, however, it is impossible to confirm the cause of death. Many fishers also report frequently seeing humpback dolphins in the waters of the Chinmen Islands, but only on a seasonal basis. The Chinmen Islands are located on the western side of the Taiwan Strait. Due to the close geographic proximity of the Chinmen Islands and Xiamen (formerly Amoy), China, it is very likely that the humpback dolphins reported from the latter region (Jefferson, 2000) also inhabit the waters of the Chinmen Islands.

From the waters of the island of Taiwan, there are two stranding records of humpback dolphins. On 2 August 2000, the carcass of a 247-cm long female humpback dolphin was found at Tungshiau, Miaoli County, in an advanced state of decomposition. Much of the blubber had rendered, and most of the organs were too decomposed for weighing or detailed examination; some of the skin was intact enough to reveal some pigmentation, however. Due to its condition, reliable mass measurements of the animal and its organs could not be obtained. A well-healed linear scar about 12 cm long was found on the right side of the caudal peduncle. The scar tissue extended deep beneath the skin and blubber into the muscle. The vertebral formula of this specimen was 7 C, 12 T, 9 L, 25 Ca (the last, triangular, caudal vertebra was counted as two) for a total count of 53, which is consistent with previous reports (Ross, 2002; Ross et al., 1994), and 18 chevrons were present. On each side of the animal, the first five of the 12 vertebral ribs had capitulae and tuberculae. No floating ribs were found. Also, there were seven sternal ribs on each side. The skeleton of this specimen is in the collection of the National Museum of Natural Sciences (NMNS) of Taichung City under the codes JYW-00-08 and NMNS (T5111). The second specimen reported for insular Taiwan was found on a beach of Taoyuan County on 7 May 2000. It was extremely decomposed, with little soft tissue remaining. The skeleton also was deposited in the collection of the NMNS (but the authors have not yet seen the specimen so have not been able to confirm the species identity and no specimen code was available at the time of writing this paper).

Reported sightings of humpback dolphins from the waters of western Taiwan are rare. On 4 April 2000, six to seven humpback dolphins were seen and photographed outside the break-wall of Wuchi Harbor by the local tour operator (photographs were examined and the species was confirmed by J. Y. Wang and T. A. Jefferson). A newspaper reported that on 2 July 2001, a lone humpback dolphin was swimming about 100 m outside Longfung Harbor (Miaoli County); although the article contained a poor quality photograph of the dolphin, its species identity was unmistakable. In April 2002, the local tour operator of Wuchi Harbor again photographed four to five humpback dolphins swimming just outside the harbor.

Discussion

The findings of our survey confirmed that the Indo-Pacific humpback dolphin is a regular component of the cetacean fauna of western Taiwan and extends the species' range to the eastern side of the Taiwan Strait. Determining the extent of the distribution of humpback dolphins in the coastal waters of western Taiwan requires more extensive survey work (humpback dolphins almost certainly will not be in the waters off eastern Taiwan, where the continental shelf is very narrow and the waters extremely deep, and none have been found during the many research surveys and cetacean-watch tours or in the extensive stranding records). Furthermore, our observations showed that this species does not appear as rare as indicated by previous records. Although the number of dolphins was low, this species was still easily

observable in certain locations. The deficiency of humpback dolphin records from this region is most likely an artifact of the lack of research effort in the waters of western Taiwan, rather than a lack of animals.

The low number of dolphins and their small distribution are of great concern because these waters contain many potential anthropogenic threats to cetaceans. Also, because the humpback dolphin is a nearshore species with a limited home range (Hung, 2000; Hung & Jefferson, 2004), it is susceptible to harmful human activities in and near coastal waters (Leatherwood & Jefferson, 1997; Perrin, 1989; Reeves & Leatherwood, 1994). Evidence of negative effects of human activities on humpback dolphins was observed during our survey. Of the small number of humpback dolphins observed, three of the recognizable individuals had very large healed scars on their caudal peduncles (Figure 2c). In addition, one still had some open scratches with traces of blood. With many bottom-set gill net and trammel-net fishing vessels operating in these waters, the scars are possibly due to incidental interactions with fishing gear, but more information is needed to confirm this hypothesis. The high number of heavily scarred dolphins in the waters of western Taiwan is similar to that found for the Pearl River Estuary population, where human activity is also intense. It was estimated that at least 8.9% of the Pearl River Estuary humpback dolphins had scars caused by human activities (Jefferson, 2000). In western Taiwan, the estimated proportion of dolphins that exhibited serious injuries that are likely caused by human activities was 10.7% (of 28, the minimum number of different individuals that were observed). Although calculating the proportion of injured dolphins requires refinement in the population estimate, the consequences of human activities on humpback dolphins in these waters appear to be substantial. Also, there are other serious, visible threats to cetaceans in western Taiwan. Fish stocks are severely depleted by overfishing. Large bottom trawlers (single and pair) were seen operating just beyond the study area, while many gill nets or trammel nets were set within the survey area. The catch by local boats was very limited, however, and most of the seafood being sold at the fish market of Wuchi Harbor was not captured in Taiwanese waters but, rather, was acquired through trade with fishers of China. Land reclamation was occurring at several locations along the shores of the study region, and industrial development of the shoreline (including the final stages of the construction of Taiwan's first pier dedicated solely for chemical shipments) was apparent. Aquaculture (including culturing of oysters and farming of fish) has grown rampant along the west coast of Taiwan. Unregulated or unscrupulous practices in this industry are becoming an increasing threat to the health of the marine and coastal environment and wildlife. For example, from December 2002 to April 2003, more than 70 black-faced spoonbills (*Platalea minor*) died from botulism poisoning reportedly as a result of eating dead or dying fish that were discarded by Taiwanese fish farmers (the fish were possibly poisoned by the farmers to rid their impoundments of undesirable species in preparation for rearing the next "crop"). The black-faced spoonbill population, numbering only a few hundred, is one of the most threatened birds in the world and is listed as "Endangered" in the World Conservation Union's (IUCN) Red List of Threatened Species (Hilton-Taylor, 2000), so this recent loss has great significance to its continued existence. It is unknown if any cetaceans have been affected directly by aquaculture, but without changes in the practices of this industry in Taiwan, humpback dolphins and other vulnerable species likely face similar problems. With a rough population estimate of humpback dolphins in the coastal waters of western Taiwan being only 140 to 350 individuals (based on assuming the same density along the entire coast of western Taiwan where humpback dolphin habitat may exist—about 400 km—and a distinct, closed population), an understanding of the biology of, and threats to, this population is urgently needed.

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Appendix. A chronological summary of all records of humpback dolphins from Taiwan; several additional groups of humpback dolphins were observed during shipboard surveys in April 2003 (unpublished data)

Date	Approximate location	Number of dolphins	Comments
Mid-summer 1867	Quemoy (=Chinmen Islands)	1 complete + 1 partial skeleton	Collected by Robert Swinhoe; syntype; described by Flower (1870)
31 March 1995	Chinmen Islands	1	Live by-catch; photographed and released
28 October 1999	Chinmen Islands	1	Stranded; freshly dead; subadult
4 April 2000	Wuchi Harbor	6-7	Photographed by local tour operator
7 May 2000	Taoyuan County	1	Species identity not yet confirmed; in the collection of the NMNS
7 August 2000	Near Tungshiau	1	Stranded; decomposed; JYW-00-08 or NMNS T5111
2 July 2001	Longfung Harbor	1	Photographed in shallow water by a journalist (appeared in newspaper article)
April 2002	Wuchi Harbor	4-5	Photographed by local tour operator
23 June 2002	Dadu River	2	Present study
24 June 2002	Dadu River	6-10	Present study
25 June 2002	Dadu River	8-12	Present study
25 June 2002	Fangyuan	15-25	Present study
25 June 2002	Wuchi Harbor	7-10	Present study
26 June 2002	Dajia River	2	Present study
26 June 2002	Daan River	2	Present study
26 June 2002	Tungshiau	1	Present study
26 June 2002	Tungshiau	2	Present study
26 June 2002	Dajia River	3	Present study
25 December 2002	Chinmen Islands	1	Freshly dead; juvenile or subadult; net entanglement?