# **Distribution Pattern of Indo-Pacific Humpback Dolphins** (Sousa chinensis) along Coastal Waters of Fujian Province, China

Wu Fuxing,<sup>1,2</sup>Wang Xianyan,<sup>1</sup>Ding Xiaohui,<sup>1,2</sup>Miao Xing,<sup>1</sup> and Zhu Qian<sup>1,2</sup>

<sup>1</sup>Third Institute of Oceanography, State Oceanic Administration, Xiamen 361005, China E-mail: wangxianyan@tio.org.cn and qianzhu@sdu.edu.cn <sup>2</sup>Ocean College, Shandong University (Weihai), Weihai 264209, China

## Abstract

The Indo-Pacific humpback dolphin (Sousa chinensis) is classified as "Near Threatened" by the International Union for Conservation of Nature due to the proximity of much of their habitat to areas of intensive anthropogenic activities. In China, S. chinensis mainly distributes in southeastern coastal waters, especially along the coast of Fujian Province, although most information available for this species is in Xiamen Bay. In this study, we interviewed inshore fishermen along the Fujian coast to collect local ecological knowledge (LEK) of S. chinensis and to explore the historical and current distribution patterns of S. chinensis. In total, 239 experienced inshore fishermen were interviewed at 27 fishing communities. Responses suggested that S. chinensis was distributed widely along the Fujian coast historically (about 30 y ago), and that now, except for Xiamen Bay, there were only sporadic sightings of S. chinensis in Ningde waters, Quanzhou Bay, and Dongshan Gulf by fishermen. Field boat-based surveys conducted in Ningde waters, Quanzhou Bay, and Dongshan Gulf confirmed the existence of S. chinensis in these three regions. S. chinensis in Ningde waters, Quanzhou Bay, and Dongshan Gulf seem to be resident individuals with very small group sizes such that conservation of these groups should be given high priority before they become extinct.

**Key Words:** Indo-Pacific humpback dolphin, *Sousa chinensis*, local ecological knowledge, distribution, inshore fishermen interview, coastal waters of Fujian Province

# Introduction

The Indo-Pacific humpback dolphin (*Sousa chinensis*) is typically found in estuarine areas characterized by major river outflow and turbid water (Ross et al., 1994; Jefferson et al., 2009).

Based on stranding data, Jefferson (2000) hypothesized that there were probably eight different local S. chinensis populations along the southeast Chinese coast. Only five resident populations (i.e., Xiamen, Western Taiwan coast, Peal River Estuary, Leizhou Bay, and Guangxi coast) have been identified and studied (Jefferson & Hung, 2004; Zhou et al., 2007; Zhang & Tang, 2008; Chen et al., 2009) (Figure 1). In addition, Wang et al. (2012) confirmed the existence of S. chinensis in Shantou waters of Guangdong Province (Figure 1). This species was classified by the International Union for Conservation of Nature's (IUCN) (2013) Governance of Natural Resources as "Near Threatened" due to the proximity of much of their habitat to areas of intensive anthropogenic activities. In China, the species was listed as a Grade I National Key Protected Animal in 1988 and in the Chinese Red List of Endangered and Threatened Wildlife and Plants in 1994.

In China, studies on *S. chinensis* have included local ecological abundance surveys (Jefferson, 2000; Jefferson & Hung, 2004; Chen et al., 2006, 2010; Zhou et al., 2007), morphology (Huang et al., 1997; Jefferson, 2000; Han et al., 2003), and genetics of stranded specimens (Chen et al., 2008; Lin et al., 2012). Despite being of conservation concern, the distribution of this species is still unclear. According to occasional stranding reports, this species has been found along the northeast Chinese coast (i.e., Dalian, Liaoning Province; Han et al., 2003).

Fujian Province has a coastal belt extending up to 3,752 km that includes many harbours and estuaries, which provide appropriate habitat for *S. chinensis*. Historically, strandings and wild witness of *S. chinensis* occurred in Shacheng Port, Sanduao waters, Minjiang River estuary, Xinghua Bay, Meizhou Bay, Quanzhou Bay, Xiamen Bay, and Dongshan Gulf (Huang, 1997). Unfortunately, studies on distribution and abundance of *S. chinensis* along the Fujian coast have not been conducted with



Figure 1. Five resident Indo-Pacific humpback dolphin (*Sousa chinensis*) populations (i.e., Xiamen, Western Taiwan coast, Peal River Estuary, Leizhou Bay, and Guangxi coast) along southeast Chinese coast. Pink dolphins denote where humpback dolphins were observed during boat-based surveys, blue lines represent rivers, and green lines demark provinces.

the exception of the Xiamen population. Anecdotal reports, opportunistic sightings, and historical stranding data suggest this species is still distributed in the other waters of Fujian Province (Huang, 2004; Zhou, 2004; Chen et al., 2009; Wang et al., 2012). On 29 November 2011, one *S. chinensis* was stranded in Quanzhou Bay; and on 23 October 2011, another *S. chinensis* was stranded in Luoyuan Bay. These strandings suggested that there may be other local *S. chinensis* populations in Fujian Province in addition to Xiamen Bay.

Local ecological knowledge (LEK) can provide data to augment conservation efforts, especially as related to investigation into the status of rare or possibly extinct species (Turvey et al., 2010a). Although LEK has been rejected by some scientists as "anecdotal," "imprecise," "unsubstantiated," or "inaccurate" (Hobson, 1993; Jhannes, 1993; Gilchrist et al., 2005), there are an increasing number of ecologists and conservation biologists actively employing this technique when working collaboratively with human communities to accumulate a critical mass of information for and support of the value of local knowledge (Berkes, 2004; Brook, 2007). Because LEK is based on experiences over typically long time periods (e.g., 30+ years), this information can provide details on past situations (Ferguson et al., 1998; Moller et al., 2004). As an initial exploratory method to obtain data on species presence, LEK has been used to study the distribution of many species such as terrestrial tortoises (Lambert, 1983; Smith et al., 1999; Anadón et al., 2009), sea turtles (Moore et al., 2010), Yangtze River dolphins (*Lipotes vexillifer*; Turvey et al., 2010a, 2010b), gray whales (*Eschrichtius robustus*; Zhu, 2002), and other marine mammals (Moore et al., 2010).

In the present study, we used interviews with local people to investigate the potential continued existence and suggested historical distribution of *S. chinensis* along the Fujian coast. Also, in locations where *S. chinensis* were still observed by inshore fishermen, we conducted exploratory boat surveys to confirm the presence of *S. chinensis*. The goals of the present study were (1) understanding the potential historical distribution of *S. chinensis* along the coast of Fujian Province; (2) understanding the current distribution and abundance of other undiscovered groups of *S. chinensis* in Fujian Province; and (3) providing baseline data to inform *S. chinensis* conservation.

### Methods

#### Interviews with Inshore Fishermen

Fishermen interviews were conducted in fishing communities (such as fishing ports or villages) along the Fujian coast to collect basic distribution information for S. chinensis. The fishermen were asked about their age, the areas they fished (i.e., the boundaries of their fishing spots), and the number of years they had been fishing. We used the following questions to characterize the presence of S. chinensis: (1) whether they had seen or caught S. chinensis during their tenure of inshore fishing; (2) if dolphins were present, when was their last sighting and in what location; (3) the group size(s) seen in present day; and (4) the locations where they saw dolphins most often, the common group size, and the maximum group size ever seen. All interviews were conducted in person, with each interview requiring about 10 to 15 min.

If the responding fishermen saw *S. chinensis*, they were required to provide a detailed description of their sighting (e.g., white colour, long beak, dorsal fin) without any prompting to test their accuracy for identification of *S. chinensis* and the validity of their responses. Subsequently, photos of *S. chinensis* at different age stages with different body colours (e.g., gray juvenile, speckled subadult, spotted adult, unspotted pink or white individuals, according to Jefferson & Leatherwood, 1997) were shown to all respondents to assist and confirm their identification accuracy. Additionally, maps were also provided for respondents to label their fishing areas and places where they had seen *S. chinensis*.

Other cetacean species, such as false killer whales (Pseudorca crassidens), pantropical spotted dolphins (Stenella attenuata), common bottlenose dolphins (Tursiops truncatus), Indo-Pacific bottlenose dolphins (T. aduncus), and finless porpoises (Neophocaena phocaenoides) also have been reported in Fujian Province (Huang & Liu, 2000a; Huang et al., 2000; Wang et al., 2013), but most of these species have different ecological niches from S. chinensis (Huang & Liu, 2000b; Wang et al., 2013). Only the finless porpoise is common, with a home range along the periphery of where Indo-Pacific humpback dolphins are sighted (Xu et al., 2012; Wang et al., 2013). In order to clarify the distinction between S. chinensis and finless porpoises, we also showed fishermen photos of the latter.

### **Boat Surveys**

From the interview responses, only fishermen in Ningde waters, Quanzhou Bay, and Dongshan Gulf had *S. chinensis* sightings along the Fujian Province coast in recent years. Therefore, to confirm these reported sightings, exploratory boatbased surveys were conducted in these three regions between August 2011 and July 2013, when weather and sea conditions permitted. The survey methodology followed protocols for systematic line-transect surveys conducted in Hong Kong (Jefferson, 2000). The surveys were conducted using 6 to 12 m vessels with open upper decks, allowing for observer eye heights of 3 to 4 m above water level.

When survey efforts began, the boat traveled along the survey lines at a speed of about 6 to 11 km/h, and the primary observer searched for dolphins continuously with  $7 \times 50$  binoculars (Navigator, Germany), scanning the search path ahead of the boat. The data recorder completed data sheets and searched the path with the naked eye, emphasizing the area near the boat. Boat speed, course, and position were obtained from a Garmin VistaHCX handheld Global Positioning System (GPS) unit (Garmin International, Olathe, KS, USA), which operated continuously during surveys. The above data and information on sighting conditions (Beaufort sea state and visibility) were collected regularly (every 10 min). Once a dolphin or a group of dolphins was encountered, individual(s) were then followed to confirm species identification, and photography, sighting time, GPS location, group size, and behavioural information were documented. The dolphins were photographed using a Canon camera (EOS 1D Mark IV, Japan) fitted with a 100 to 400 mm lens.

# Photo-Identification

All field photos were downloaded at the laboratory. Dolphins from every encounter were individually identified by their marks such as spotting patterns, nicks, notches, scars, cuts, and deformities (Jefferson, 2000; Chen et al., 2010). Individuals were classified into six broad age groups-unspotted calf, unspotted juvenile, spotted juvenile, spotted subadult, spotted adult, and unspotted adult-based on their pigment patterns, external morphology, and the size of their body (as described in Jefferson, 2000). In order to determine the affinity of Indo-Pacific humpback dolphins distributed in the coastal waters of Fujian Province, identified S. chinensis individuals in Ningde waters, Quanzhou Bay, and Dongshan Gulf were compared with the Xiamen photo-identification database of S. chinensis preserved in the Third Institute of Oceanography, State Oceanic Administration (TIO, SOA).

# Results

## Interviews

From March 2010 to November 2011, 239 guestionnaires were completed from 27 fishing communities along the coast of Fujian Province, except for Xiamen Bay. Of the 119 interviews for which fishermen provided their age, the range was from 24 to 81 y ( $\overline{\mathbf{x}} = 52.81 \pm 1.04$ ). A majority (89.1%) of the fishermen were older than 40 y. Fishermen spent most of their lives on the sea, and 89.9% were working as inshore fishermen for more than 15 y (range of 10 to 50 y). Age was a strong predictor of whether fishermen had seen S. chinensis, with younger respondents substantially less likely to have seen S. chinensis, while most fishermen older than 50 y had seen S. chinensis during their career (Figure 2). Of the fishermen interviewed (n = 239), a majority (83.7%) had seen S. chinensis in their fishing experience, while only 39 (16.3%) had never seen S. chinensis.



Figure 2. Percentage of fishermen who had seen or not seen S. chinensis according to their different ages

Suggested Distribution of S. chinensis along Fujian Coastal Waters

According to the memories of interviewed fishermen, *S. chinensis* was once distributed in Shacheng Port, Sanduao waters, Luoyuan Bay, Minjiang River estuary, Fuqing Bay, Xinghua Bay, Meizhou Bay, Quanzhou Bay, and Dongshan Gulf along the Fujian coast (30 y ago). However, only fishermen in Ningde waters, Quanzhou Bay, and Dongshan Gulf discussed seeing *S. chinensis* during their fishing activities nowadays (see Figure 3).

*Boat Survey Results* – S. chinensis *in Ningde Waters, Quanzhou Bay, and Dongshan Gulf* Field boat surveys were conducted on 17 d between September 2011 and July 2013 in Ningde waters where *S. chinensis* were still observed by fishermen (Table 1). In total, seven groups of *S. chinensis* were sighted, with group sizes ranging from one to six individuals ( $\overline{\mathbf{x}} = 3.14 \pm 2.11$ ). Only six individuals were identified, with five re-identified on more than one occasion, and two individuals seen on four occasions each. Of the six individuals, one was judged to be a spotted juvenile, one was a spotted subadult, and the other four were spotted adults (Table 1; Figure 4a).

During December 2011 and June 2012, four surveys were conducted in Quanzhou Bay (Table 1). The entire Quanzhou Bay was covered during each survey, but only one spotted adult dolphin was observed (Table 1; Figure 4b). In Dongshan Gulf, 12 surveys were conducted during August 2011 and July 2013, and each survey covered



**Figure 3.** Current distribution pattern of *S. chinensis* (represented by shaded area) in coastal waters of Fujian Province (distribution areas in Ningde waters, Quanzhou Bay, and Dongshan Gulf were suggested by local fishermen; distribution areas in Xiamen Bay were based on boat surveys conducted by TIO, SOA).

Date	Survey location	No. of group	Group size	Accumulated no. of individuals identified
18 to 20 September 2011	Ningde waters	0	0	0
25 to 27 May 2012	Ningde waters	0	0	0
28 May 2012	Ningde waters	1	2	2
29 May 2012	Ningde waters	0	0	2
30 May 2012	Ningde waters	1	6	6
31 May 2012	Ningde waters	1	2	6
1 June 2012	Ningde waters	1	5	6
24 July 2013	Ningde waters	0	0	6
25 July 2013	Ningde waters	1	1	6
26 July 2013	Ningde waters	1	1	6
27 July 2013	Ningde waters	1	5	6
28 and 29 July 2013	Ningde waters	0	0	6
28 December 2011	Quanzhou Bay	0	0	0
29 December 2011	Quanzhou Bay	1	1	1
18 and 19 June 2012	Quanzhou Bay	0	0	1
19 August 2011	Dongshan Gulf	1	2	2
20 to 22 August 2011	Dongshan Gulf	0	0	2
26 and 27 July 2012	Dongshan Gulf	0	0	2
28 July 2012	Dongshan Gulf	1	2	2
29 July 2012	Dongshan Gulf	0	0	2
15 July 2013	Dongshan Gulf	1	2	2
16 to 18 July 2013	Dongshan Gulf	0	0	2

 Table 1. Records of sightings and identified S. chinensis in Ningde waters, Quanzhou Bay, and Dongshan Gulf of Fujian province, China, during surveys from August 2011 to July 2013

the entire gulf. Only two spotted adults were first identified on 19 August 2011, and re-identified on 28 July 2012 and 15 July 2013 (Table 1; Figure 4c). Furthermore, there was no matched identified individual among Ningde waters, Quanzhou Bay, Dongshan Gulf, and Xiamen Bay.

# Discussion

In the present study, we showed that fishermen interviews could provide cost-effective information to provide a better understanding of poorly known details for S. chinensis presence and potential distribution patterns. Such interview results provide reasonable estimates of the historical and current distribution of S. chinensis that can guide studies of population demographics. The inshore distribution of Indo-Pacific humpback dolphins places their distribution range in partial overlap with the localities frequented by inshore fishermen (Parra et al., 2004). S. chinensis presents obvious external characteristics that are easy for fishermen to distinguish from other cetaceans along the studied areas (i.e., finless porpoise [Jefferson, 2000]). Therefore, LEK can be a useful tool to direct additional research for a better understanding of poorly known populations or species that can be relatively easily identified by local people.

Fishermen responses to our interviews implied that the distribution areas of *S. chinensis* along the Fujian Province coast fragmented rapidly. Historically, they might once have been distributed widely along the Fujian Province coast; all fishermen in Shacheng Port, Sanduao waters, Luoyuan Bay, Minjiang River estuary, Fuqing Bay, Xinghua Bay, Meizhou Bay, Quanzhou Bay, and Dongshan Gulf reported encountering *S. chinensis* during their fishing activities about 30 y ago. Currently, only fishermen in Ningde waters, Quanzhou Bay, and Dongshan Gulf still see *S. chinensis* during their fishing activities.

Interview responses were further supported by sighting data collected during boat surveys. Our field surveys conducted in Ningde waters, Quanzhou Bay, and Dongshan Gulf confirmed the existence of S. chinensis in these three regions, although only six, one, and two individuals were identified in Ningde waters, Quanzhou Bay, and Dongshan Gulf, respectively. The overall group sizes of S. chinensis in these three regions seem to be small, and most dolphins documented in these areas were adults; no calves were observed. Furthermore, S. chinensis in these three regions have been exposed to considerable human-induced threats. For example, the following may have contributed to a more narrow range for Indo-Pacific humpbacked dolphins: (1) extensive aquaculture



Figure 4a, b, and c show *S. chinensis* found in Ningde waters, Quanzhou Bay, and Dongshan Gulf, respectively

in Ningde waters; (2) construction of a big bridge across the sea, underwater blasting, and dredging operations within Quanzhou Bay; and (3) oyster and seaweed farming in the Dongshan Gulf. All of these human activities likely increase the potential threats these resident animals face. Conservation of the remaining *S. chinensis* individuals residing in these regions must include effective management of at least these human activities into the future.

Whether migration routes existed between different *S. chinensis* populations in these different regions has been a hotly debated topic for the protection of this species. Probably due to their feeding requirements, *S. chinensis* in Xiamen Bay have seldom been observed beyond the boundary of the Kinmen-Tadan-Wuyu island chain (Huang & Liu, 2000b); the majority of S. chinensis life history, including feeding, breeding, and calf rearing, occurs within the bay (Huang & Liu, 2000b). This was supported by our photo-identification comparison results to some extent as there was no matched identified individual among Ningde waters, Quanzhou Bay, Dongshan Gulf, and Xiamen Bay. Although Quanzhou Bay and Dongshan Gulf are adjacent to Xiamen Bay (both less than 100 km), S. chinensis in these areas are obviously within the linear range of this species, and there are no major barriers between the three areas. The sample size of boat surveys was limited in the present study, therefore, further field investigations on S. chinensis in these regions are clearly needed to verify this question.

The inshore distribution of *S. chinensis* makes them particularly susceptible to the effects of human activities in the coastal zone. In recent years, human activities appear to present the greatest threat to S. chinensis along the coast of Fujian Province. Population-scale extinction of several marine taxa has been identified worldwide (Dulvy et al., 2003). These local or regional extinctions shorten species' geographic ranges, increasing their vulnerability to overall extinction when stochastic events occur (Castellanos-Galindo et al., 2011). In the past 30 y, the shrinking distribution and lower numbers of sightings suggest a critical decline in S. chinensis in Fujian Province. In Ningde waters, Quanzhou Bay, and Dongshan Gulf, this species seems to persist in very small resident groups, with apparent major range contraction or fragmentation. So, conservation of these resident groups should be given high priority before they become extinct.

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## Literature Cited

- Anadón, J. D., Giménez, A., Ballestar, R., & Pérez, I. (2009). Evaluation of local ecological knowledge as a method for collecting extensive data on animal abundance. *Conservation Biology*, 23(3), 617-625. http:// dx.doi.org/10.1111/j.1523-1739-1739.2008.01145.x
- Berkes, F. (2004). Rethinking community-based conservation. Conservation Biology, 18(3), 621-630. http:// dx.doi.org/10.1111/j.1523-1739.2004.00077.x
- Brook, R. K. (2007). Elk–agriculture conflicts in the greater riding mountain ecosystem: Building bridges between the natural and social sciences to promote sustainability (PhD dissertation). University of Manitoba.
- Castellanos-Galindo, G. A., Cantera, J. R., Espinosa, S., & Mejfa-Ladino, L. M. (2011). Use of local ecological knowledge, scientist's observations and grey literature to assess marine species at risk in a tropical eastern Pacific estuary. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 21(1), 37-48. http://dx.doi.org/10.1002/aqc.1163
- Chen, B. Y., Zheng, D. M., Yang, G., Xu, X. R., & Zhou, K. Y. (2009). Distribution and conservation of the Indo-Pacific humpback dolphin in China. *Integrative Zoology*, 4, 240-247. http://dx.doi.org/10.1111/j.1749-4877.2009.00160.x
- Chen, B. Y., Zheng, D. M., Zhai, F. F., Xu, X., Sun, P., Wang, Q., & Yang, G. (2006). Abundance, distribution and conservation of Chinese white dolphins (*Sousa chinensis*) in Xiamen, China. *Mammalian Biology*, 78(2), 156-164. http://dx.doi.org/10.1016/j.mambio. 2006.12.002
- Chen, H. S., Zhai, K., Chen, J. L., Chen, Y. L., Wen, H. J., Chen, S. F., & Wu, Y. P. (2008). A preliminary investigation on genetic diversity of *Sousa chinensis* in the Pearl River Estuary and Xiamen of Chinese waters. *Journal of Genetics and Genomics*, 35(8), 491-497. http://dx.doi. org/10.1016/S1673-8527(08)60067-3
- Chen, T., Hung, S. K., Qiu, Y. S., Jia, X. P., & Jefferson, T. A. (2010). Distribution, abundance, and individual movements of Indo-Pacific humpback dolphins (*Sousa chinensis*) in the Pearl River Estuary, China. *Mammalia*, 74(2), 117-125. http://dx.doi.org/10.1515/ mamm.2010.024
- Dulvy, N., Sadovy, Y., & Reynolds, J. (2003). Extinction vulnerability in marine populations. *Fish and Fisheries*, 4, 25-64. http://dx.doi.org/10.1046/j.1467-2979.2003. 00105.x
- Ferguson, M. A. D., Williamson, R. G., & Messier, F. (1998). Inuit knowledge of long-term changes in a population of Arctic tundra caribou. *Arctic*, 31(3), 201-219. http://dx.doi.org/10.14430/arctic1062
- Gilchrist, G., Mallory, M., & Merkel, F. (2005). Can local ecological knowledge contribute to wildlife management? Case studies of migratory birds. *Ecology and Society*, 10(1), 20. http://dx.doi.org/vol10/iss1/art20/
- Han, J. B., Ma, Z. Q., Wang, P. L., & Dong, Y. (2003). The by-catching Chinese white dolphin in north of Yellow Sea. I. Measurement of morphology and

organs. Fisheries Science, 22(6), 18-20. http://dx.doi. org/10.3969/j.issn.1003-1111.2004.07.006

- Hobson, G. (1993). Traditional knowledge is science. Northern Perspectives, 20(1), 1.
- Huang, Z. G. (1997). Chinese white dolphins in Xiamen, China. Proceedings of a colloquium of development of a management strategy for Chinese white dolphins, Hong Kong Agriculture and Fisheries Department, Hong Kong SAR, PRC.
- Huang, Z. G. (2004). Biodiversity on marine estuarine wetland. Beijing: Ocean Press.
- Huang, Z. G., & Liu, W. H. (2000a). Records of cetaceans in the southern Taiwan straits and along the coast of southern Fujian Province. *Marine Science Bulletin*, 19(3), 52-56. http://dx.doi.org/10.3969/j.issn.1001-6392.2000.03.009
- Huang, Z. G., & Liu, W. H. (2000b). *Chinese white dolphin and other cetaceans*. Xiamen, China: Xiamen University Press.
- Huang, Z. G., Liu, W. H., & Zheng, C. X. (1997). Chinese white dolphin (*Sousa chinensis*) in Xiamen Harbour. I. Appearance and internal organs. *Journal of Oceanography in Taiwan Strait*, 16(4), 473-478.
- Huang, Z. G., Liu, W. H., Zheng, C. X., Li, C. Y., Wang, J. J., & Jefferson, T. A. (2000). Finless porpoises (*Neophocaena phocaenoides*) in the southern coastal waters of Fujian, China. Acta Oceanologica Sinica, 22(5), 100-105. http:// dx.doi.org/10.3321/j.issn:0253-4193.2000. 05.013
- International Union for Conservation of Nature (IUCN). (2013). *IUCN red list of threatened species*. Retrieved 2 May 2014 from www.iucnredlist.org.
- Jefferson, T. A. (2000). Population biology of the Indo-Pacific hump-backed dolphin in Hong Kong waters. *Wildlife Monographs* (No. 144). 65 pp.
- Jefferson, T. A., & Hung, S. K. (2004). A review of the status of the Indo-Pacific humpback dolphin (*Sousa* chinensis) in Chinese waters. Aquatic Manmals, 30(1), 149-158. http://dx.doi.org/10.1578/AM.30.1.2004.149
- Jefferson, T. A., & Leatherwood, S. (1997). Distribution and abundance of Indo-Pacific hump-backed dolphins (*Sousa chinensis*, Osbeck, 1765) in Hong Kong waters. *Asian Marine Biology*, 14, 93-110.
- Jefferson, T. A., Hung, S. K., & Würsig, B. (2009). Protecting small cetaceans from coastal development: Impact assessment and mitigation experience in Hong Kong. *Marine Policy*, 33, 305-311. http://dx.doi.org/10.1016/j. marpol.2008.07.011
- Jhannes, R. E. (1993). Integrating traditional ecological knowledge and management with environmental impact assessment. In J. T. Inglis (Ed.), *Traditional ecological* knowledge: Concepts and cases (pp. 33-39). Ottawa, ON: Canadian Museum of Nature.
- Lambert, M. R. K. (1983). Some factors influencing the Moroccan distribution of the western Mediterranean spur-thighed tortoise, *Testudograecagraeca* L., and those precluding its survival in NW Europe. *Zoological Journal of the Linnean Society*, 79(2), 149-178. http:// dx.doi.org/10.1111/j.1096-3642.1983.tb01164.x

- Lin, W. Z., Chang, L. H., Frère, C. H., Zhou, R. L., Chen, J. L., Chen, X., & Wu, Y. P. (2012). Differentiated or not? An assessment of current knowledge of genetic structure of *Sousa chinensis* in China. *Journal of Experimental Marine Biology and Ecology*, 416-417, 17-20. http:// dx.doi.org/10.1016/j.jembe.2012.02.002
- Moller, H., Berkes, F., Lyver, P. O. B., & Kislalioqlu, M. (2004). Combining science and traditional ecological knowledge: Monitoring populations for co-management. *Ecology and Society*, 9(3), 2.
- Moore, J. E., Cox, T. M., Lewison, R. L., Read, A. J., Biorkland, R., McDonald, S. L., . . . Kiszka, J. (2010). An interview-based approach to assess marine mammal and sea turtle captures in artisanal fisheries. *Biological Conservation*, 143(3), 795-805. http://dx.doi. org/10.1016/j.biocon.2009.12.023
- Parra, G. J., Corkeron, P. J., & Marsh, H. (2004). The Indo-Pacific humpback dolphin, *Sousa chinensis* (Osbeck, 1765), in Australian waters: A summary of current knowledge. *Aquatic Mammals*, 30(1), 197-206. http:// dx.doi.org/10.1578/AM.30.1.2004.197
- Ross, G. J. B., Heinsohn, G. E., & Cockcroft, V. G. (1994). Humpback dolphins *Sousa chinensis* (Osbeck, 1765), *Sousa plumbea* (G. Cuvier, 1829) and *Sousa teuszii* (Kükenthal, 1892). In S. H. Ridgway & R. Harrison (Eds.), *Handbook of marine mammals. Vol. 5: The first book of dolphins* (pp. 23-42). London: Academic Press.
- Smith, L. L., Reid, D., Robert, B., Joby, M., & Clément, S. (1999). Status and distribution of the angonoka tortoise (*Geocheloney niphora*) of western Madagascar. *Biological Conservation*, 91(1), 23-33. http://dx.doi. org/10.1016/S0006-3207(99)00044-0
- Turvey, S. T., Barrett, L. A., Hart, T., Collen, B., Hao, Y. J., Zhang, L., . . . Wang, D. (2010a). Spatial and temporal extinction dynamics in a freshwater cetacean. *Proceedings* of the Royal Society B: Biological Sciences, 277, 3139-3147. http://dx.doi.org/10.1098/rspb.2010.0584
- Turvey, S. T., Barrett, L. A., Hao, Y. J., Zhang, L., Zhang, X. Q., Wang, X. Y., . . . Wang, D. (2010b). Rapid shifting of baseline in Yangtze fishing communities and local memory of extinct species. *Conservation Biology*, 24(3), 778-787. http://dx.doi.org/10.1111/j.1523-1739. 2009.01395.x
- Wang, X. Y., Wu, F. X., Mou, J. F., & Zhu, Q. (2013). Indo-Pacific humpback dolphins (*Sousa chinensis*) assist a finless porpoise (*Neophocaena phocaenoides* sunameri) calf: Evidence from Xiamen waters in China. *Journal of Mammalogy*, 94(5), 1123-1130. http://dx.doi. org/10.1644/13-MAMM-A-064.1
- Wang, X. Y., Miao, X., Wu, F. X., Yan, C. X., Liu, W. H., & Zhu, Q. (2012). Investigation on the distribution of *Sousa chinensis* in the coastal waters between Xiamen and the Pearl River Estuary. *Journal of Oceanography in Taiwan Strait*, 31(2), 225-230. http://dx.doi.org/ 10.3969/J.ISSN.1000-8160.2012.02.011
- Xu, X. R., Chen, B. Y., Wang, L., Ju, J. F., & Yang, G. (2012). The sympatric distribution pattern and tempospatial variation of Indo-Pacific humpback dolphins

and finless porpoises at Shatian, Beibuwan Gulf. Acta Theriologica Sinica, 32, 325-329.

- Zhang, L. F., & Tang, S. M. (2008). Distribution of Chinese white dolphin in the coastal waters of China. *Journal* of Oceanography in Taiwan Strait, 27(1), 79-86. http:// dx.doi.org/10.3969/j.issn.1000-8160.2008.01.014
- Zhou, K. Y. (2004). Fauna sinica mammalia. Vol. 9: Cetacea Carnivora: Phocoidea, Sirenia. Beijing: Science Press.
- Zhou, K. Y., Xu, X. R., & Tian, C. (2007). Distribution and abundance of Indo-Pacific humpback dolphins in Leizhou Bay, China. New Zealand Journal of Zoology, 34, 35-42. http://dx.doi.org/10.1080/03014220709510061
- Zhu, Q. (2002). Historical records of western Pacific stock of gray whale Eschrichtius robustus in Chinese coastal waters from 1933 to 2002 (Paper SC/02/WGW13). Presented to the International Whaling Commission Scientific Committee. Retrieved 10 December 2013 from www.iwcoffice.org.