*Aquatic Mammals* 2014, *40*(4), 368-374, DOI 10.1578/AM.40.4.2014.368

# Short Note

## Habitat Characteristics of the Critically Endangered Taiwanese Humpback Dolphins (*Sousa chinensis*) of the Eastern Taiwan Strait

Lauren E. Dares,[1] Jordan M. Hoffman,[1] Shih Chu Yang,[2] and John Y. Wang[1,3]

[1]*Department of Biology, Trent University, 1600 East Bank Drive, Peterborough, ON, K9J-7B8, Canada*
*E-mail: laurendares@trentu.ca*
[2]*FormosaCetus Research and Conservation Group, 5F-5, #78, Chung-Mei 13 Street, Hualien City, 970, Taiwan*
[3]*CetAsia Research Group, 310-7250 Yonge Street, Thornhill, ON, L4J-7X1, Canada*

The eastern Taiwan Strait population of Indo-Pacific humpback dolphins is also known as the Taiwanese humpback dolphin (*Sousa chinensis*; Osbeck, 1765) and comprises only about 74 individuals (CV = 4%) (Wang et al., 2012). An assessment of this population against the criteria of the *IUCN Red List of Threatened Species* resulted in its classification as "Critically Endangered" (Reeves et al., 2008). Concerns are driven by the presence of a large number of anthropogenic threats from high human densities along the coastal regions adjacent to the waters inhabited by this population. These threats include habitat degradation due to land reclamation, reduction of freshwater flow to estuaries, harmful fishing interactions, air and water pollution, and underwater noise (Wang et al., 2004b, 2007a; Ross et al., 2010; Dungan et al., 2011; Slooten et al., 2013). In general, the Taiwanese population appears to be found year-round in the shallow coastal waters off central western Taiwan (Wang & Yang, 2011), seems to be restricted to waters that are within 3 km of shore, and usually is found in or near areas influenced by other sources of fresh water (Wang et al., 2004a, 2007a, 2007b). Ross et al. (2010) defined "priority habitat" for this population as including waters < 30 m deep (measured relative to the lowest tide of the year) and within 3 km of shore, which was defined as any land that remained dry at the lowest tide of the year. However, descriptive characteristics of the waters inhabited by this population have not been examined in detail. Herein, we outline distance from shore, water depth, sea surface temperature (SST), and salinity as descriptors of suitable habitat for the Taiwanese humpback dolphins based on sightings of these animals. We also present the first report on group sizes for this population, investigate correlation between group sizes and environmental variables, and compare the group size distribution of Taiwanese humpback dolphins with other populations of the species (Figure 1).

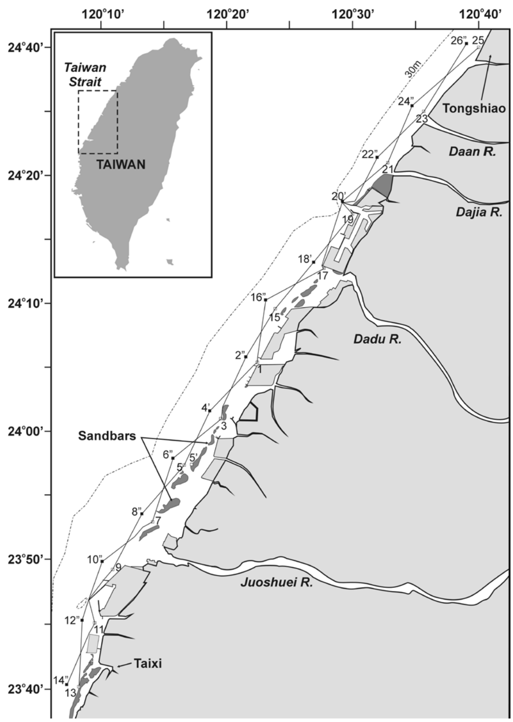


**Figure 1.** Study area for the Taiwanese humpback dolphin (*Sousa chinensis*); the distribution of preset waypoints (black, even numbered and open, odd numbered squares representing offshore and inshore waypoints, respectively) and the zig-zag tracklines between waypoints are shown. Sandbars exposed at the lowest high tide of the year are approximated by dark grey polygons, and thin broken lines mark the 30 m isobaths.

A total of 121 surveys were conducted in the eastern Taiwan Strait from 2007 to 2012. The majority of the surveys were conducted during the summer months (June-August) with the exception of three surveys in early spring (April 2010) and nine in early autumn (September 2008). Surveys were undertaken using a 4.5-m inflatable vessel travelling between 18 to 25 km/h with two observers searching 90º on either side of the bow of the vessel with naked eyes. Two sets of wide, overlapping zig-zag transect lines were followed, each alternating between inshore and offshore waypoints (Figure 1). Distance from shore was measured following the definition of *shore* as outlined in Ross et al. (2010). The main study area covered a linear distance of approximately 110 km from just north of Tongshiao, Miaoli County (N 24º 30'), to south of Taixi, Yunlin County (N 23º 30') (Figure 1).

When Taiwanese humpback dolphins were sighted, the following set of standard information was recorded: SST and water depth (Lowrance HDS-5 GPS/sonar unit), percent salinity (Rixen SM-10), date, time, geographic position (Garmin GPSMAP76 or the Lowrance HDS-5 GPS), and the observers' best estimates of the number of individuals and number of mother-calf pairs present. Locations of dolphin sightings were plotted in *Google Earth 6.0.3* (Google, Inc.), and distances to shore of the sightings were measured to the nearest metre using the ruler function of this software (Figure 2).

A total of 221 humpback dolphin sightings were made during the study period. Sightings were made at a mean distance from shore of 824 ± 471 m (SD), with no Taiwanese humpback dolphins sighted further than 2,721 m from shore (Table 1; Figure 3a). Eight sightings were recorded within 1 m of shore due to the definition of *shore* as exposed land at the lowest tide of the year—these sightings were made during tidal phases when sandbars were submerged but are exposed at low tide. Sightings were made predominantly within 1 km of the shoreline, which

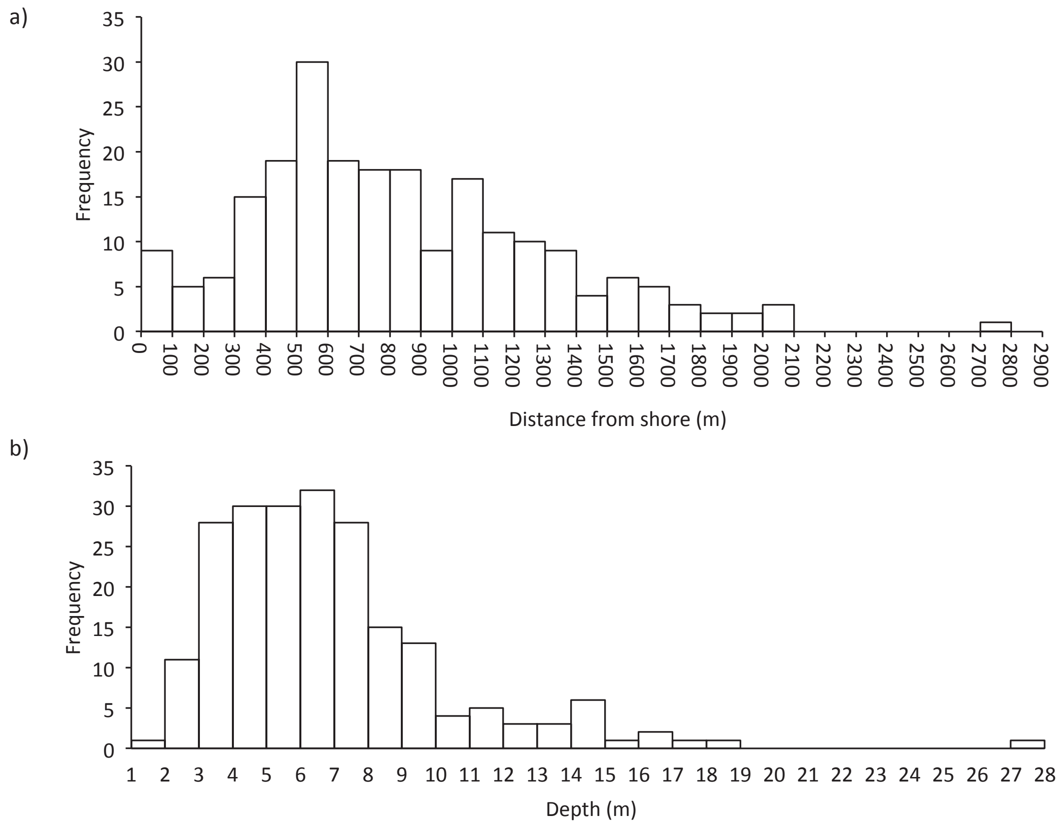


**Figure 2.** Number of sightings of Taiwanese humpback dolphins made in the eastern Taiwan Strait from 2007 to 2012 at different distances from shore (a) and water depths (b), where *shore* is defined as any land mass exposed at the lowest tide of the year (following Ross et al., 2010)

is consistent with the distributions found with other humpback dolphin populations: sightings of South African populations varied widely in distance from shore but were usually within 400 m in Algoa Bay (Karczmarski et al., 2000) to within 2 km in Richards Bay (Atkins et al., 2004); in the Pearl River Estuary, humpback dolphins can occur 10 to 15 km from the nearest shore, but this is an enclosed inshore area with several islands, and the water depth rarely exceeds 30 m (see Jefferson, 2000; Hung, 2008). In the eastern Taiwan Strait, inshore obstructions such as piers and extensive oyster mariculture in some regions may create barriers extending from shore, or natural barriers such as sandbars likely prevent humpback dolphins from accessing some shallower and intertidal waters even closer to shore.

Although related in most cases, it seems that the distribution of humpback dolphins is more likely directly related to water depth and accessibility of shallower waters than proximity to the shoreline itself. Mean depth measured during humpback dolphin sightings was 6.7 ± 2.8 m, with more than half (58%) of sightings being made in waters less than 7 m deep ($Q_1$ = 4.5 m, $Q_3$ = 8.1 m; Table 1; Figure 3b). More than 96% of sightings of Taiwanese humpback dolphins occurred in waters less than 20 m deep, similar to other reports of shallow water preferences by humpback dolphins (Durham, 1994; Corkeron et al., 1997; Karczmarski et al., 1999; Jefferson, 2000; Atkins et al., 2004). These findings are similar to those of Corkeron et al. (1997), in which humpback dolphins inhabiting the Great Barrier Reef region (Australia) were sighted a mean distance of 6.7 km from land, but the mean distance to the nearest shallow area (< 2 m deep at low tide) was only 2.7 km. Taiwanese humpback dolphins have been recorded passing through waters deeper than 30 m while being followed during photographic identification monitoring studies, but these infrequent events have only occurred in well-dredged channels of ports servicing large commercial ships and not offshore (J. Y. Wang, unpub. data) (Table 1).

SSTs measured during sightings varied from 23.2° C in early April to 31.8° C in late July, and salinities varied from 0.4 to 4.1% (Table 1), indicating that the Taiwanese humpback dolphins are found in a wide range of generally warm, brackish conditions. Hung (2008) found habitat utilization of the Pearl River Estuary population of humpback dolphins in Hong Kong waters was linked to prey distributions. The habitat utilization for Taiwanese humpback dolphins may similarly reflect prey distribution rather than physiological or other requirements of the humpback dolphins (Lin et al., 2013). Water depth, SST, and salinity may affect the distribution of humpback dolphins directly or indirectly by influencing the distributions of their prey, which has been observed with other small cetaceans (Heithaus & Dill, 2000; Jaquet & Gendron, 2002; Bräger et al., 2003). Bathymetry (Hooker et al., 2002; MacLeod & Zuur, 2005) and nutrient availability (Stockin et al., 2008) are also important in determining prey distribution, but data on these other parameters were not available for analysis in the present study. Estuaries are some of the most productive habitats in the world (Correll, 1978), and shallower waters (Keller, 1989; Cloern, 1999) and warmer waters (Keller, 1989) often have increased productivity, which in turn is frequently used as a proxy for prey abundance in studies of cetacean habitat characteristics (Redfern et al., 2006; Scott et al., 2010). Taiwanese humpback dolphins have been sighted in inshore habitats of the eastern Taiwan Strait year-round (Wang & Yang, 2011) during surveys conducted in months with recorded minimum temperatures of < 16° C (January-March 2009; Central Weather Bureau, 2009), and average SSTs as low as 14° C have been recorded in these waters during the winter (Tzeng et al., 2002); thus, it is unlikely that this population is restricted by SST alone. Furthermore, fish species identified as prey for other humpback dolphin populations are frequently found in large shoals in areas where fresh and salt water mix (Barros et al., 2004; Parra & Jedensjö, 2013), and humpback dolphins of other populations have often been observed feeding at the freshwater-saltwater interface (Parsons, 1998, 2004; Jefferson, 2000).

The frequency distribution of the number of dolphins in each sighting was right-skewed (Figure 3)

**Table 1.** Summary statistics of mean environmental variables measured during sightings of Taiwanese humpback dolphins (*Sousa chinensis*) during surveys conducted in the eastern Taiwan Strait from 2007 to 2012

| | Depth | SST (ºC) | Salinity (%) | Distance to shore (m) |
|---|---|---|---|---|
| Mean ± SD | 6.9 ± 3.4 | 29.8 ± 1.2 | 3.0 ± 0.6 | 824 ± 471 |
| Minimum | 1.9 | 23.2 | 0.4 | 1 |
| Maximum | 27.1 | 31.8 | 4.1 | 2,721 |
| Median | 6.2 | 29.9 | 3.1 | 735 |
| *n** | 215 | 208 | 161 | 221 |

* Logistical constraints prevented the measurement of environmental variables during some sightings.

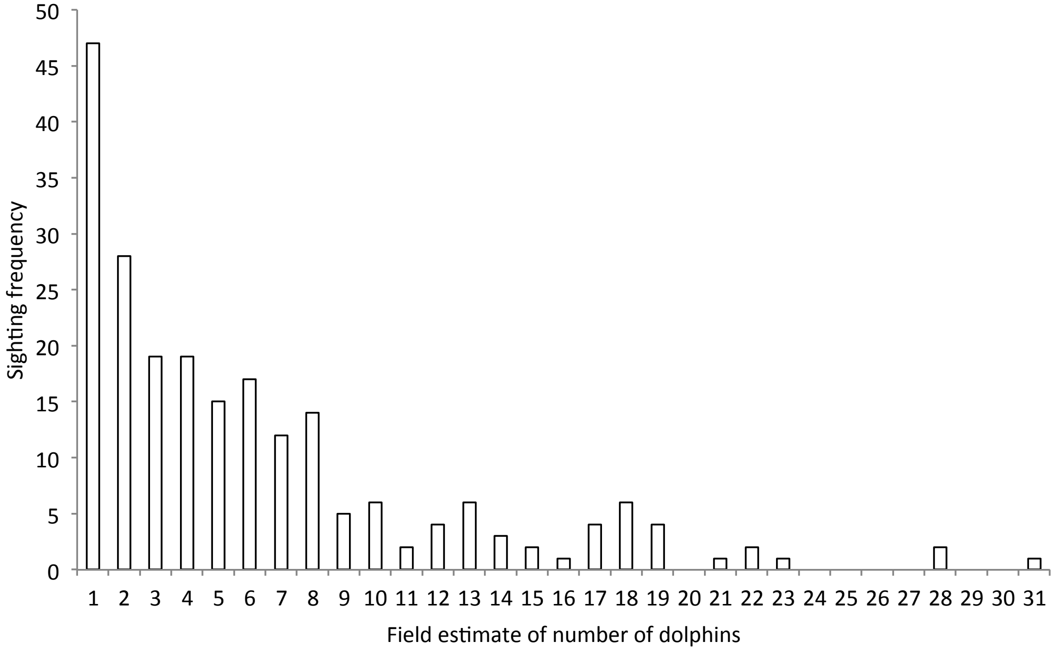


**Figure 3.** Frequency distribution of the best estimates of the number of Taiwanese humpback dolphins observed in the eastern Taiwan Strait during sightings made from 2007 to 2012

with a mean of 6.2 ± 5.9 (SD) and a median of 4. Singletons were the most frequently observed (21%), while groups of two or more humpback dolphins comprised 79% of the sightings (Figure 3). Excluding singletons, group size varied from the most frequently observed two dolphins up to an estimated maximum of 31 (**Note:** Based on photo-identification of individuals, there were at least 41 individuals in this largest group; J. Y. Wang, unpub. data), with a mean of 7.6 ± 5.9 (SD) and a median of 6. Mother-calf pairs were present in more than half (60%) of the sightings with two or more individuals. Investigating the relationships between group size and depth, SST, salinity, and distance to shore (Spearman's rank correlation coefficient) showed no significant correlations ($p > 0.05$ for all tests). The frequency distribution of group size for the Taiwanese population appears similar in shape to reports from other populations, including the high frequency of small group sizes. The frequency of encountering singletons of the Taiwanese population was similar to observations made in South African waters (20% in Durham, 1994; 15.4% in Karczmarski et al., 1999) but was lower than in Hong Kong waters (~30% in Jefferson, 2000). The mean group size of Taiwanese humpback dolphins was also consistent with that reported for humpback dolphins (Jefferson & Rosenbaum, 2014) found in other regions (e.g., Durham, 1994; Jefferson, 2000). However, the largest group of Taiwanese humpback dolphins observed (best field estimate of 31 individuals, which was actually at least 41 individuals based on individual identification using photographs) was larger than reported for most other populations (Durham, 1994; Karczmarski et al., 1999; Zhou et al., 2007; Chen et al., 2010). Frequent observations of small group size may be related to highly fluid social relationships within the Taiwanese population (Dungan, 2011) as individuals do not appear to form stable, long-term groups. Larger groupings may be a result of occasional gatherings that occur during periods of peak abundance of prey species (Finley & Gibb, 1982) or for nonfeeding reasons such as socializing or mating (Baird & Dill, 1996). Group sizes did not appear to be affected by the environmental variables measured in this study, although fewer sightings of individual dolphins in the eastern Taiwan Strait and South African waters when compared to Hong Kong may be a result of differing habitat configurations. Despite taxonomic differences between humpback dolphins in Chinese and South African waters (Mendez et al., 2013; Jefferson & Rosenbaum, 2014), areas inhabited by the Taiwanese, Algoa Bay, and Natal Coast populations are relatively linear (see Durham, 1994; Karczmarski et al., 1999) compared to the large Pearl River Estuary, which contains a number of small islands and extends further inland, possibly contributing to the differences in group size.

In conclusion, the distribution of this population in relatively shallow, inshore, estuarine waters and the group sizes observed were consistent with other populations of humpback dolphins. Group sizes were not influenced by the environmental variables measured in this study, but the spatial distribution of the Taiwanese population is most likely related to the abundance of prey species as estuarine waters are known for high productivity. Humpback dolphin occurrence may also be driven at least in part by certain habitat features that may be preferred while resting, mating, or socializing, and by other physical variables not investigated directly in this study such as bathymetric features (e.g., sea floor slope), productivity, sea floor substrate, and anthropogenic influence. Future studies will focus on investigating behavioural habitat preferences for this population in addition to using remote sensing data and habitat models to describe relationships between humpback dolphin abundance, distribution, and a wider variety of environmental and anthropogenic factors that could not be addressed presently. Better understanding of the factors correlated with the distribution of the Taiwanese humpback dolphins will remain an important area for research to further improve our knowledge about this critically endangered population and to provide guidance and focus efforts to reduce human impacts.

### Acknowledgments

The authors would like to thank S. K. Hung, T. A. Jefferson, S. Javdan, C. C. Araújo, K. A. Wright, E. Nol, K. N. Riehl, and two anonymous reviewers for comments on early drafts of this paper, and S. Z. Dungan, K. N. Riehl, C. C. Araújo, P. F. Fruet, S. K. Hung, V. Ho, P. Chan, and B. A. McLeod for their contributions in the field. Financial support for the projects that resulted in data analyzed in this study was provided by Wild At Heart Legal Defense Association (Taiwan), Matsu Fish Conservation Union, Small Cetacean Fund of the International Whaling Commission, *FormosaCetus* Research and Conservation Group, Ocean Park Conservation Foundation, Hong Kong, Hong Kong Cetacean Research Project, and the Hong Kong Dolphin Conservation Society. The participation of JYW in this work was also supported partially by the Professional Development Fund provided jointly by the Canadian Union of Professional Employees (CUPE) 3908-1 and Trent University. This work was also supported by the Professional Development Funds provided jointly by the Canadian Union of Professional Employees (CUPE) 3908 (Units 1 and 2) and Trent University.

### Literature Cited

Atkins, A., Pillay, N., & Peddemors, V. M. (2004). Spatial distribution of Indo-Pacific humpback dolphins (*Sousa chinensis*) at Richards Bay, South Africa: Environmental influences and behavioural patterns. *Aquatic Mammals*, *30*(1), 84-93. http://dx.doi.org/10.1578/AM.30.1.2004.84

Baird, R. W., & Dill, L. M. (1996). Ecological and social determinants of group size in transient killer whales. *Behavioral Ecology*, *7*(4), 408-416. http://dx.doi.org/10.1093/beheco/7.4.408

Barros, N. B., Jefferson, T. A., & Parsons, E. C. M. (2004). Feeding habits of Indo-Pacific humpback dolphins (*Sousa chinensis*) stranded in Hong Kong. *Aquatic Mammals*, *30*(1), 179-188. http://dx.doi.org/10.1578/AM.30.1.2004.179

Bräger, S., Harraway, J. A., & Manly, B. F. J. (2003). Habitat selection in a coastal dolphin species (*Cephalorhynchus hectori*). *Marine Biology*, *143*, 233-244. http://dx.doi.org/10.1007/s00227-003-1068-x

Central Weather Bureau. (2009). *Monthly climate data*. Retrieved 7 October 2014 from www.cwb.gov.tw/V7e/climate/monthlyData/mD.htm.

Chen, T., Hung, S. K., Qiu, Y., Jia, X., & Jefferson, T. A. (2010). Distribution, abundance, and individual movements of Indo-Pacific humpback dolphins (*Sousa chinensis*) in the Pearl River Estuary, China. *Mammalia*, *74*, 117-125. http://dx.doi.org/10.1515/mamm.2010.024

Cloern, J. E. (1999). The relative importance of light and nutrient limitation of phytoplankton growth: A simple index of coastal ecosystem sensitivity to nutrient enrichment. *Aquatic Ecology*, *33*, 3-16. http://dx.doi.org/10.1023/A:1009952125558

Corkeron, P. J., Morisette, N. M., Porter, L., & Marsh, H. (1997). Distribution and status of hump-backed dolphins, *Sousa chinensis*, in Australian waters. *Asian Marine Biology*, *14*, 49-59.

Correll, D. L. (1978). Estuarine productivity. *BioScience*, *28*(10), 646-650. http://dx.doi.org/10.2307/1307395

Dungan, S. Z. (2011). *Comparing the social structures of Indo-Pacific humpback dolphins (*Sousa chinensis*) from the Pearl River Estuary and Eastern Taiwan Strait* (Master's thesis). Trent University, Peterborough, ON.

Dungan, S. Z., Riehl, K. N., Wee, A., & Wang, J. Y. (2011). A review of the impacts of anthropogenic activities on the critically endangered eastern Taiwan Strait Indo-Pacific humpback dolphins (*Sousa chinensis*). *Journal of Marine Animals and Their Ecology*, *4*, 3-9.

Durham, B. (1994). *The distribution and abundance of the humpback dolphin (*Sousa chinensis*) along the Natal coast, South Africa* (Master's thesis). University of Natal, Durban, South Africa.

Finley, K. J., & Gibb, E. J. (1982). Summer diet of the narwhal (*Monodon monoceros*) in Pond Inlet, northern Baffin Island. *Canadian Journal of Zoology*, *60*(12), 3353-3363. http://dx.doi.org/10.1139/z82-424

Heithaus, M. R., & Dill, L. M. (2002). Food availability and tiger shark predation risk influence bottlenose dolphin habitat use. *Ecology*, *83*(2), 480-491. http://dx.doi.org/10.1890/0012-9658(2002)083[0480:FAATSP]2.0.CO;2

Hooker, S. K., Whitehead, H., Gowans, S., & Baird, R. W. (2002). Fluctuations in distribution and patterns of individual range use of northern bottlenose whales. *Marine Ecology Progress Series*, *225*, 287-297. http://dx.doi.org/10.3354/meps225287

Hung, S. K. (2008). *Habitat use of Indo-Pacific humpback dolphins (*Sousa chinensis*) in Hong Kong* (Doctoral dissertation). University of Hong Kong, Hong Kong.

Jaquet, N., & Gendron, D. (2002). Distribution and relative abundance of sperm whales in relation to key environmental features, squid landings and the distribution of other cetacean species in the Gulf of California, Mexico. *Marine Biology*, *141*, 591-601. http://dx.doi.org/10.1578/AM.30.1.2004.179

Jefferson, T. A. (2000). Population biology of the Indo-Pacific hump-backed dolphin in Hong Kong waters. *Wildlife Monographs*, *144*. 65 pp.

Jefferson, T. A., & Rosenbaum, H. C. (2014). Taxonomic revision of the humpback dolphins (*Sousa* spp.), and description of a new species from Australia. *Marine Mammal Science*, *30*(4), 1494-1541. http://dx.doi.org/10.1111/mms.12152

Karczmarski, L., Cockcroft, V. G., & McLachlan, A. (1999). Group size and seasonal pattern of occurrence of humpback dolphins *Sousa chinensis* in Algoa Bay, South Africa. *South African Journal of Marine Science*, *21*(1), 89-97. http://dx.doi.org/10.2989/025776199784126024

Karczmarski, L., Cockcroft, V. G., & McLachlan, A. (2000). Habitat use and preferences of Indo-Pacific humpback dolphins *Sousa chinensis* in Algoa Bay, South Africa. *Marine Mammal Science*, *16*(1), 65-79. http://dx.doi.org/10.1111/j.1748-7692.2000.tb00904.x

Keller, A. A. (1989). Modeling the effects of temperature, light, and nutrients on primary productivity: An empirical and a mechanistic approach compared. *Limnology and Oceanography*, *34*(1), 82-95. http://dx.doi.org/10.4319/lo.1989.34.1.0082

Lin, T. H., Akamatsu, T., & Chou, L. S. (2013). Tidal influences on the habitat use of Indo-Pacific humpback dolphins in an estuary. *Marine Biology*, *160*(6), 1353-1363. http://dx.doi.org/10.1007/s00227-013-2187-7

MacLeod, C. D., & Zuur, A. F. (2005). Habitat utilization by Blainville's beaked whales off Great Abaco, northern Bahamas, in relation to seabed topography. *Marine Biology*, *147*, 1-11. http://dx.doi.org/10.1007/s00227-004-1546-9

Mendez, M., Jefferson, T. A., Kolokotronis, S-O., Krützen, M., Parra, G. J., Collins, T., … Rosenbaum, H. C. (2013). Integrating multiple lines of evidence to better understand the evolutionary divergence of humpback dolphins along their entire distribution range: A new dolphin species in Australian waters? *Molecular Ecology*, *22*(23), 5936-5948. http://dx.doi.org/10.1111/mec.12535

Parra, G. J., & Jedensjö, M. (2013). Stomach contents of Australian snubfin (*Orcaella hensohni*) and Indo-Pacific humpback dolphins (*Sousa chinensis*). *Marine Mammal Science*, *30*(3), 1184-1198. http://dx.doi.org/10.1111/mms.12088

Parsons, E. C. M. (1998). The behaviour of Hong Kong's resident cetaceans: The Indo-Pacific humpbacked dolphin and the finless porpoise. *Aquatic Mammals*, *24*(2), 91-110.

Parsons, E. C. M. (2004). The behaviour and ecology of the Indo-Pacific humpback dolphin (*Sousa chinensis*). *Aquatic Mammals*, *30*(1), 38-55. http://dx.doi.org/10.1578/AM.30.1.2004.38

Redfern, J. V., Ferguson, M. C., Becker, E. A., Hyrenback, K. D., Good, C., Barlow, J., . . . Werner, F. (2006). Techniques for cetacean-habitat modeling. *Marine Ecology Progress Series*, *310*, 271-295. http://dx.doi.org/10.3354/meps310271

Reeves, R. R., Dalebout, M. L., Jefferson, T. A., Karczmarski, L., Laidre, K., O'Corry-Crowe, G., . . . Zhou, K. (2008). *Sousa chinensis* (eastern Taiwan Strait subpopulation). In International Union for Conservation of Nature (IUCN) (Ed.), *2011 red list of threatened species*. Retrieved 7 October 2014 from www.iucnredlist.org.

Ross, P. S., Dungan, S. Z., Hung, S. K., Jefferson, T. A., MacFarquhar, C., Perrin, W. F., . . . Reeves, R. R. (2010). Averting the baiji syndrome: Conserving habitat for critically endangered dolphins in eastern Taiwan Strait. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *20*, 685-694. http://dx.doi.org/10.1002/aqc.1141

Scott, B. E., Sharples, J., Ross, O. N., Wang, J. Y., Pierce, G. J., & Camphuysen, C. J. (2010). Sub-surface hotspots in shallow seas: Fine-scale limited locations of predator foraging habitat indicated by tidal mixing and sub-surface chlorophyll. *Marine Ecology Progress Series*, *408*, 207-226. http://dx.doi.org/10.3354/meps08552

Slooten, E., Wang, J. Y., Dungan, S. Z., Forney, K. A., Hung, S. K., Jefferson, T. A., . . . Chen, C. A. (2013). Impacts of fisheries on the critically endangered humpback dolphin *Sousa chinensis* population in the eastern Taiwan Strait. *Endangered Species Research*, *22*, 99-114. http://dx.doi.org/10.3354/esr00518

Stockin, K. A., Pierce, G. J., Binedell, V., Wiseman, N., & Orams, M. B. (2008). Factors affecting the occurrence and demographics of Common dolphins (*Delphinus* sp.) in the Hauraki Gulf, New Zealand. *Aquatic Mammals*, *34*(2), 200-211. http://dx.doi.org/10.1578/AM.34.2.2008.200

Tzeng, W. N., Wang, Y. T., & Chang, C. W. (2002). Spatial and temporal variations of the estuarine larval fish community on the west coast of Taiwan. *Marine and Freshwater Research*, *53*, 419-430. http://dx.doi.org/10.1071/MF01136

Wang, J. Y., & Yang, S. C. (2011). Evidence for year-round occurrence of the eastern Taiwan Strait Indo-Pacific humpback dolphins (*Sousa chinensis*) in the waters of western Taiwan. *Marine Mammal Science*, *27*(3), 652-658. http://dx.doi.org/10.1111/j.1748-7692.2010.00422.x

Wang, J. Y., Hung, S. K., & Yang, S. C. (2004a). Records of Indo-Pacific humpback dolphins, *Sousa chinensis* (Osbeck, 1765), from the waters of western Taiwan. *Aquatic Mammals*, *30*(1), 87-194. http://dx.doi.org/ 10.1578/AM.30.1.2004.189

Wang, J. Y., Yang, S. C., & Reeves, R. R. (2004b, February). *Report of the First Workshop on the Conservation and Research of Indo-Pacific Humpback Dolphins,* Sousa chinensis*, of the Waters of Taiwan*. Checheng, Taiwan: National Museum of Marine Biology and Aquarium.

Wang, J. Y., Yang, S. C., & Reeves, R. R. (2007a). *Report of the Second International Workshop on Conservation and Research Needs of the Eastern Taiwan Strait Population of Indo-Pacific Humpback Dolphins,* Sousa chinensis. Checheng, Taiwan: National Museum of Marine Biology and Aquarium.

Wang, J. Y., Yang, S. C., Hung, S. K., & Jefferson, T. A. (2007b). Distribution, abundance and conservation status of the eastern Taiwan Strait population of Indo-Pacific humpback dolphins, *Sousa chinensis*. *Mammalia*, *71*, 157-165. http://dx.doi.org/10.1515/MAMM.2007.032

Wang, J. Y., Yang, S. C., Fruet, P. F., Daura-Jorge, F. G., & Secchi, E. R. (2012). Mark-recapture analysis of the critically endangered eastern Taiwan Strait population of Indo-Pacific humpback dolphins (*Sousa chinensis*): Implications for conservation. *Bulletin of Marine Science*, *88*(4), 885-902. http://dx.doi.org/10.5343/bms.2010.1097

Zhou, K., Xu, X., & Tian, C. (2007). Distribution and abundance of Indo-Pacific humpback dolphins in Leizhou Bay, China. *New Zealand Journal of Zoology*, *34*(1), 35-42. http://dx.doi.org/10.1080/03014220709510061