

Review

Sea turtle demand in China threatens the survival of wild populations

Liu Lin,¹ Songhai Li,² Min Chen,^{3,4} James F. Parham,⁵ and Haitao Shi^{1,*}

SUMMARY

Sea turtles are an important umbrella species in marine ecosystems. The populations of all five species of sea turtles in China have dropped sharply due to massive illegal trade and habitat loss. The fast-growing demand for sea turtle displays from Chinese aquariums and private individuals has led to a large-scale illegal trade domestically and internationally. Captive sea turtles are also frequently kept in harsh environments with severe injuries and high mortality rates. Sea turtles have only recently been upgraded from level II to level I on the “List of Wildlife under Special State Protection”, this protection level has therefore not matched the real status of sea turtles over the past three decades. The additional collusion between the government and business corporations encourages illegal trade. We argue that the commercial use of sea turtles must be completely prohibited to guarantee their future survival in Chinese waters.

INTRODUCTION

Sea turtles are an umbrella species of marine ecosystems, as they fulfill important roles in coastal and marine habitats by contributing to the health and maintenance of coral reefs, seagrass meadows, estuaries, and sandy beaches (Bjorndal and Jackson, 2003). There are seven extant species of sea turtles, five of which are found in China, the green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), loggerhead turtle (*Caretta caretta*), olive ridley turtle (*Lepidochelys olivacea*), and leatherback turtle (*Dermochelys coriacea*) (Chan et al., 2007). As a result of overexploitation and habitat loss, sea turtles are a classic example of a broadly distributed group that has historically suffered population decreases, which have motivated worldwide conservation efforts since the 1950s (Mazaris et al., 2017). All sea turtle species have been included in Appendix I of the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES) since 1981, which strictly prohibits the killing, transportation, and trade of these animals. In China, the five native sea turtle species were initially listed under level-II protection on the “List of Wildlife under Special State Protection” in 1989, and were not upgraded to the top level of protected animals (level I) until 2021. This lack of sufficient protection combined with an increased demand for live sea turtles for display has led to a major threat to the survival of sea turtle populations in the region.

A SHARP DECLINE IN SEA TURTLE POPULATIONS IN CHINESE WATERS

Sea turtles were once abundant in Chinese waters, with nesting beaches distributed throughout Fujian, Guangdong, Guangxi, and Hainan provinces (Chan et al., 2007; Mou et al., 2013). However, around 30 years ago, sea turtles were over-harvested to the point that they have now been largely extirpated from the region. It was reported that over 30,000 sea turtles were harvested from the South China Sea between 1959 and 1988 (Cheng, 1998; Wang, 1993), and almost all nesting beaches have been lost due to habitat degradation and poaching of nesting females or their eggs (Chan et al., 2007; Cheng, 1998; Mou et al., 2013). The last nesting beach for sea turtles in mainland China is the Huidong Sea Turtles National Nature Reserve in Guangdong. In the 1980s, over 100 sea turtles came ashore each year to lay eggs in this reserve (Zhang, 1996), but none have been recorded since 2018. Limited nesting still occurs on a few beaches of the Paracel Islands (Xisha Islands) in the South China Sea (Wang et al., 2019).

HIGH DEMAND FOR SEA TURTLE DISPLAYS TRIGGERS ILLEGAL TRADE

Despite the rapidly declining populations of wild sea turtles, they are increasingly present in Chinese aquariums. The aquarium industry is expanding rapidly in China (Liu et al., 2010), with the total number of aquariums nationwide exceeded 200 in 2019 and the number of ocean-themed parks doubling in just

¹Ministry of Education Key Laboratory for Ecology of Tropical Islands, Key Laboratory of Tropical Animal and Plant Ecology of Hainan Province, College of Life Sciences, Hainan Normal University, Haikou 571158, China

²Marine Mammal and Marine Bioacoustics Laboratory, Institute of Deep-sea Science and Engineering, Chinese Academy of Sciences, Sanya, 572000, China

³School of Life Sciences, Institute of Eco-Chongming, East China Normal University, 500 Dongchuan Road, Shanghai 200241, China

⁴Yangtze Delta Estuarine Wetland Ecosystem Observation and Research Station, Ministry of Education & Shanghai Science and Technology Committee, Shanghai, 202162, China

⁵Department of Geological Sciences, California State University, Fullerton, CA 92834, USA

*Correspondence: haitao-shi@263.net

<https://doi.org/10.1016/j.isci.2021.102517>



a few years (from 53 to 107 during 2015–2019) (China Cetacean Alliance, 2019; Yu, 2019). Because sea turtles are charismatic and popular animals, the growing number of aquariums has created an increased demand for sea turtles for display (Wang et al., 2019). In 2018, a national survey of captive sea turtles revealed 194 aquariums, or 92% of the country's total, displayed 2,024 live turtles. Among the turtles on display were 1,829 Green Turtles (90.4%), 150 Hawksbill Turtles (7.4%), 42 Loggerhead Turtles (2.1%), and 3 Olive Ridley Turtles (0.15%). Of the displayed turtles, 77.1% were purchased, 17.8% were rescued, 4.2% were donated by citizens, and 0.8% were confiscated. Just 25.7% of the displayed turtles had legal permits of purchase and display, while 3.1% were in the process of obtaining permits, 2.1% had other supportive documents, and the rest were of unknown status. Additionally, some of these aquariums deliberately concealed the real number of captive sea turtles they had in their possession (National Aquatic Wildlife Conservation Association, 2019).

In addition to the aquariums, there are many undisclosed facilities or private individuals that keep large numbers of sea turtles in China. For example, a single turtle farm in southern China had more than 400 sea turtles in captivity. This farm was accused of illegally selling sea turtles to aquariums and private individuals. The owner claimed that their juvenile sea turtles were bred in captivity, but genetic paternity studies by us (L. Lin and H.T. Shi) show that they originated from wild populations. Another farm we surveyed had more than 5,000 sea turtles suggesting that existing surveys have significantly underestimated the scale of the sea turtle trade.

The scale of sea turtles held illegally is also reflected by the number of turtles confiscated or released. According to our investigation of public online reports, at least 607 live turtles and 704 whole specimens (preserved or stuffed) were confiscated by Chinese law enforcement during 2015–2020 (see Table S1), and at least 2411 rescued sea turtles were officially released during 2011–2020, many of which had been confiscated (see Table S2). Many other sea turtles were released illegally in religious rituals. Buying for ritual release has become very popular in the past decade, further fueling a large black market (Gong et al., 2017). Sea turtles are often the target ritual animals in southern coastal areas of China. For example, a Buddhist group in Hainan illegally released at least 83 sea turtles in eight private ceremonies in 2015–2018 (see Table S3). Therefore, the official national survey mentioned above underestimates the actual number of sea turtles being removed from the wild, and further efforts must be made to evaluate the actual status of these species.

The large demand for sea turtles, combined with weak enforcement of wildlife laws, has made China a major market and destination of illegal trade (CITES Secretariat, 2019; Gomez and Krishnasamy, 2019). The last survey of China's sea turtle trade showed that, during 2000–2008, a total of 2,054 individual animals (257 per year) were confiscated (Lam et al., 2011), while the number we recorded during 2015–2020 (219 per year, 1,311 in total) indicates that the rampant illegal trade in sea turtles is continuing. Most traded sea turtles originated from fishermen who captured turtles directly or purchased them from dealers in Southeast Asian countries, threatening the wild populations in Chinese waters and adjacent areas such as the Coral Triangle region (Gaillard et al., 2020; Lam et al., 2011).

POOR CONDITIONS IN CAPTIVITY CREATE A DEMAND FOR EVEN MORE TURTLES

Concerns about the high mortality rate of display animals due to poor captivity management are a long-standing issue. Such critiques either implicitly or explicitly evoke the unpleasant history of zoos as wildlife menageries designed primarily for public entertainment, including notorious cases of animal abuse and the exploitation of captive wildlife for profit (Minteer and Collins, 2013). Many Chinese aquariums provide poor conditions for captive animals, with injuries and diseases occurring frequently (China Cetacean Alliance, 2019; Yu, 2019). Government surveys have revealed that sea turtles are no exception, with 55.9% of them kept in crowded conditions in water less than 1-meter deep (National Aquatic Wildlife Conservation Association, 2019). Sea turtles kept in these conditions develop behavioral abnormalities, disease, and high mortality (Arena et al., 2014; Chen, 2020b; see Figures 1 and 2). The lack of dedicated reptile veterinarians in China has exacerbated this problem. As a result, there is a constant demand for new sea turtles to replace dead turtles in aquariums, thereby creating a demand for even more turtles. Given the absence of law enforcement and supervision, illegal trade is an easy source to replenish lost wildlife (Yu, 2019).

WEAK PROTECTION LEVELS AND LAW ENFORCEMENT FOSTER EXPLOITATION

The Chinese government issued the "List of Wildlife under Special State Protection" (WSSP) in 1989 to protect endangered wild animal species native to the country. Animals protected at WSSP level I are more



Figure 1. Overcrowded green sea turtles (*Chelonia mydas*) in captivity (photo: Liu Lin)

strictly protected than those at level II are. In the 1989 WSSP, all five native sea turtle species were listed under level-II protection, despite the fact that they have been given the highest possible status by CITES (Appendix I) since 1981. The WSSP was finally revised in 2021 and all sea turtles were upgraded to level I. This is an important development because the intensity of law enforcement is directly correlated with whether and how a species is listed in the WSSP (Gong et al., 2020). According to “Regulations of the People’s Republic of China on the Protection of Aquatic Wildlife,” any institution or individual who needs to capture, trade, transport, or raise animals under level-I protection must (1) obtain a permit from the provincial wildlife protection department and then (2) obtain a final permit from the state council. These two layers of bureaucracy provide extra security against the inappropriate issuing of permits.

Unfortunately, for 32 years (1989–2021), sea turtles were given level-II protection. For a species under level-II protection, only the first (local) permit is required. It is not only easier to obtain a local permit for the level-II species, but there is also the opportunity for collusion between local governments and businesses that deal in wildlife, such as aquariums (Chen, 2020a; Yu, 2019). The directors of many aquariums serve as the chairperson or vice-chairperson of conservation associations at all levels in China (China Cetacean Alliance, 2019). Aquarium directors are also the primary organizers of many important conservation conferences, public activities, or release activities and have received substantial positive coverage from the media for their putative conservation efforts. Local administrative departments often regard aquariums as designated rescue units and so provide display and breeding licenses to them at will (Yu, 2019). Such “wildlife rescue centers,” actually buy wild sea turtles illegally or keep rescued turtles for financial gain (National Aquatic Wildlife Conservation Association, 2019). In 2020, a large illegal trade chain was broken that had spanned the entirety of China and sold over 500 sea turtles, most of which were distributed to aquariums (Wang and Zuo, 2020). In this case, aquariums illegally purchased sea turtles without legal status, while local government not only left the problem unattended but also quietly supported this activity. Such historically weak legal protection and law enforcement has led to the additional exploitation of sea turtles in China.

RECOMMENDATIONS

Raising the protection level of sea turtles from level II to level I is a huge improvement as it provides the strictest legal support for sea turtle protection. However, the upgraded level cannot fully guarantee the future of wild sea turtles, as exemplified by the Asian giant softshell turtle (*Pelochelys cantorii*), which is on the edge of extinction in Chinese waters despite having been protected at WSSP level I since 1989 (Wang et al., 2021). Regarding the current sea turtle displays and illegal trade, stricter and more efficient law enforcement is crucial. The commercial use of sea turtles, as live turtles or as wildlife products, must be completely prohibited. Simultaneous monitoring of market trends and trade routes must also occur (Lam et al., 2011). It is necessary to establish an effective mechanism to coordinate relevant law enforcement departments, such as customs, market supervision, and public security departments, to solve the issues of separated management that has confounded wildlife protection in China (Gong et al., 2020). The



Figure 2. One captive green sea turtle (*Chelonia mydas*) with both rear flippers badly bitten by other turtles (Photo: Haitao Shi)

display and breeding of all sea turtles must be carefully registered, recorded, marked, and identified by applying traceable marking systems and strict supervision (Wang et al., 2019). The laws and regulations must standardize rescue activities, encourage qualified non-profit organizations to participate in turtle rescue, and ensure release after recovery. Furthermore, the establishment of a large-scale sea turtle nature reserve in the South China Sea, including a special law enforcement team to monitor this area, needs to be a priority to help curb illegal harvesting (Gaillard et al., 2020).

SUPPLEMENTAL INFORMATION

Supplemental information can be found online at <https://doi.org/10.1016/j.isci.2021.102517>.

ACKNOWLEDGMENTS

This work was supported by the National Natural Science Foundation of China [31960101, 31772486] and the Natural Science Foundation of Hainan Province of China [319MS048]. We are grateful to T. Zhang, D.Q. Li and D.H. Chen for their assistance with data collection and graphical abstract.

AUTHOR CONTRIBUTIONS

H.T.S. and L.L. conducted the field work and data collection, designed, and wrote the manuscript. S.H.L., M.C., and J.F.P. designed and wrote the manuscript. All authors reviewed and edited subsequent drafts and gave final approval for submission.

DECLARATION OF INTERESTS

The authors declare no competing interests.

REFERENCES

- Arena, P.C., Warwick, C., and Steedman, C. (2014). Welfare and environmental implications of farmed sea turtles. *J. Agr. Envir. Eth.* 27, 309–330. <https://doi.org/10.1007/s10806-013-9465-8>.
- Bjorndal, K.A., and Jackson, J.B.C. (2003). Roles of sea turtles in marine ecosystems: reconstructing the past. In *The Biology of Sea Turtles Vol II*, P. Lutz, J. Musick, and J. Wyneken, eds. (CRC Press), pp. 259–273.
- Chan, K.F., Cheng, I., Zhou, T., Wang, H.J., Gu, H.X., and Song, X.J. (2007). A comprehensive overview of the population and conservation status of sea turtles in China. *Chelon. Conserv. Biol.* 6, 185–198.
- Chen, J.M. (2020a). The governance dilemma and its solutions of illegal wildlife trade on the perspective of a community of life (in Chinese). *For. Res. Man.* 6, 15–21.
- Chen, W.P. (2020b). Eight sea turtles were illegally sold to Guizhou Province, 5 rescued, but 3 died due to improper raising (Guiyang Daily). <http://www.gywb.cn/system/2020/08/07/030638340.shtml>.
- Cheng, I.J. (1998). The problems of sea turtle conservation in China. *Sichuan J. Zool.* 17, 74–75.
- China Cetacean Alliance (2019). Ocean Theme Parks: A Look inside china's Growing Captive Cetacean Industry, Second Edition. <http://chinacetaceanalliance.org/wp-content/uploads/2019/06/19-CCA-Report-English-FINAL.pdf>.
- Gaillard, D., Yeh, F.C., Lin, L., Chen, H.Q., Zhang, T., Luo, S.J., and Shi, H.T. (2020). Lost at sea: determining geographic origins of illegally traded green sea turtles (*Chelonia mydas*) rescued on Hainan Island, China. *Wildl. Res.* 48, 55–63. <https://doi.org/10.1071/WR19127>.
- Gomez, L., and Krishnasamy, K. (2019). A Rapid Assessment on the Trade in Marine Turtles in

Indonesia, Malaysia and Viet Nam (TRAFFIC). <https://www.traffic.org/site/assets/files/12524/se-asia-marine-turtle-trade.pdf>.

Gong, M.H., Wang, J.Y., Zhang, L., and Liu, G. (2017). Thinking about the supervision of animal release (in Chinese). *Sichuan J. Zool.* 36, 227–231.

Gong, S.P., Wu, J., Gao, Y.C., Fong, J.J., Parham, J.F., and Shi, H.T. (2020). Integrating and updating wildlife conservation in China. *Curr. Biol.* 30, 915–919. <https://doi.org/10.1016/j.cub.2020.06.080>.

Lam, T., Ling, X., Takahashi, S., and Burgess, E.A. (2011). Market Forces: An Examination of Marine Turtle Trade in China and Japan (TRAFFIC East Asia). http://www.trafficchina.org/sites/default/files/traffic_species_reptiles_0.pdf.

Liu, Q.Y., Zhang, L.M., and Mi, N. (2010). On the spatio-temporal distribution and trends of marine theme parks in China (in Chinese). *Comm. Res.* 393, 168–171.

Mazaris, A.D., Schofield, G., Gkazinou, C., Almpandou, V., and Hays, G.C. (2017). Global sea turtle conservation successes. *Sci. Adv.* 3,

e1600730. <https://doi.org/10.1126/sciadv.1600730>.

Minteer, B.A., and Collins, J.P. (2013). Ecological ethics in captivity: Balancing values and responsibilities in zoo and aquarium research under rapid global change. *Ilar J.* 54, 41–51. <https://doi.org/10.1093/ilar/ilt009>.

Mou, J.F., Tao, C.H., Ding, X.H., Wu, F.X., Miao, X., Wang, X.Y., and Zhu, Q. (2013). Investigations on the distribution of sea turtle species in the coastal water of China (in Chinese). *J. Oceanogr.* 32, 238–242.

National Aquatic Wildlife Conservation Association (2019). Investigation report on the current status of sea turtles in Chinese aquariums. In World Turtle Day Promotion and International Seminar on Sea Turtle Conservation, May 23, 2019, Penglai, Shandong Province, China.

CITES Secretariat (2019). Status, scope and trends of the legal and illegal international trade in marine turtles, its conservation impacts, management options and mitigation priorities. In Eighteenth (18th) Meeting of the CITES Conference of the Parties (Geneva, August 2019), Document CoP18 Inf. 18.

Wang, Y.M. (1993). Achievement and perspective of the researches on South China sea turtle resources and protection in China (in Chinese). *Chin. J. Ecol.* 6, 60–61.

Wang, J., Parham, J.F., and Shi, H.T. (2021). China's turtles need protection in the wild. *Science.* 371, 473. <https://doi.org/10.1126/science.abg3541>.

Wang, B., and Zuo, Y. (2020). From Fishermen to Aquariums, This Black Industry Chain Has Harmed More than 500 Sea Turtles (Xdkb.net). <http://www.xdkb.net/p/198323.html>.

Wang, J., Guo, R., Yangyuan, X.Y., Zhang, Y., Jia, Y.Y., Liu, M., Jin, J.M., Ji, L., and Zhang, J.Q. (2019). Threatened status and recommendations on sea turtle conservation in China (in Chinese). *Chin. J. Wildl.* 40, 1070–1082.

Yu, P. (2019). The aquarium cannot be left to mess (in Chinese). *Guangxi Qual. Sup. Guid. Period.* 2, 10.

Zhang, J.Q. (1996). Harbor national nature reserve and the ecological and biological characteristics of sea turtles (in Chinese). *Chin. Biosph. Res.* 4, 3–5.