PHOTO: HAITAO SHI

China's plan to protect the Asian giant softshell (*Pelochelys cantorii*) focuses on captive breeding.

Edited by **Jennifer Sills**

China's turtles need protection in the wild

In Chinese mythology, giant softshell turtles are important symbols of longevity and strength. The two extant species, the Yangtze giant softshell (*Rafetus swinhoei*) and the Asian giant softshell (*Pelochelys cantorii*), are among the largest and rarest freshwater turtles in the world (*1*–*3*). After the death of a female *R. swinhoei* during artificial insemination in 2019, there is only one male left in captivity (*2*). The status of *P. cantorii* is less publicized, but this species is also disappearing (*3*). There are 15 adult *P. cantorii* kept in captivity in China, and the Chinese conservation plan for the species focuses on their captive breeding (*4*). However, based on China's past record, conservation efforts that exclude habitat protection will likely provide no benefit to wild populations.

A singular focus on conservation in captivity guarantees there will be no place for reintroduction of *P. cantorii* into the wild [as occurred in the case of the Yangtze alligator (*Alligator sinensis*) (*5*)]. So far, the farming of other turtles in China has been little help to wild populations. Paradoxically, this approach increases poaching because captured animals can be sold to breeders (*6*). Breeding programs also result in genetically compromised individuals of reduced conservation value, as exemplified by the mass release of farmed Chinese giant salamanders (*Andrias davidianus*), which provided few benefits and likely introduced new threats to the native population (*7*). Three sites have bred *P. cantorii* from wild-caught individuals, but they have not demonstrated a sustainable breeding program. The origin of most captive turtles is unknown because they were bought in markets or seized from smugglers (*3*, *4*).

Thirteen reserves were designed to protect *P. cantorii* in southern China, but just six are staffed and only half of those have recorded the presence of *P. cantorii* in recent years (*3*). The effectiveness of the reserves is questionable given that they have been constantly flooded since the construction of hydroelectric dams, destroying the essential sand banks habitat the turtles use to bask and nest (*8*). After losing the Baiji dolphin (*Lipotes vexillifer*) (*9*) and Chinese paddlefish (*Psephurus gladius*) (*10*), the Chinese government banned all fishing in the Yangtze river system for 10 years (*11*). China should expand this strict fishing ban to all rivers and prohibit dams within turtle reserves to protect their habitats. Furthermore, the reserves should be adequately supported and effectively managed. We may fail to save *R. swinhoei*, but we can save other giants in the wild rivers of China if we do not focus exclusively on breeding programs.

Jian Wang[1], James F. Parham[2], Haitao Shi[3]*
[1]College of Life Science and Technology, Honghe University, Mengzi 661199, China. [2]Department of Geological Sciences, California State University, Fullerton, CA 92834, USA. [3]Ministry of Education Key Laboratory for Ecology of Tropical Islands, College of Life Sciences, Hainan Normal University, Haikou 571158, China.
*Corresponding author. Email: haitao-shi@263.net

REFERENCES AND NOTES

1. P. C. H. Pritchard, *Chelon. Conserv. Biol.* **4**, 5 (2001).
2. H. Liu, X. Li, C. Zhang, *Science* **364**, 1144 (2019).
3. X. Hong *et al.*, *Chelon. Conserv. Biol.* **18**, 68 (2019).
4. Ministry of Agriculture and Rural Affairs of the People's Republic of China, "Action Plan for the Rescue of *Pelochelys cantorii* (2019–2035)" (2019); www.moa.gov.cn/nybgb/2019/201912/202004/t20200410_6341174.htm [in Chinese].
5. S. Lu *et al.*, *Croco. Special. Group Newsl.* **34**, 29 (2015).
6. H. Shi *et al.*, *Conserv. Biol.* **21**, 5 (2007).
7. F. Yan *et al.*, *Curr. Biol.* **28**, R590 (2018).
8. D.-M. Ruan *et al.*, *Chin. J. Zool.* **36**, 42 (2001) [in Chinese].
9. S. T. Turvey *et al.*, *Biol. Lett.* **3**, 547 (2007).
10. H. Zhang *et al.*, *Sci. Total Environ.* **710**, 136242 (2020).
11. Z. Mei *et al.*, *Science* **367**, 1314 (2020).

COMPETING INTERESTS

J.W. and H.S. receive funding from the National Natural Science Foundation of China (31401983 and 31772486, respectively).

10.1126/science.abg3541

Social distancing remains key during vaccinations

A global effort to develop vaccines against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) began early in 2020. In mid-December, the U.S. Food and Drug Administration approved emergency use authorization for two vaccines that successfully concluded their phase 3 trials (*1*), and vaccine distribution in the United States began shortly afterwards. As vaccinations progress, the public must continue to social distance, limit large gatherings, wear masks, and engage in other non-pharmaceutical interventions (NPIs) to curb the spread of COVID-19.

Both the Pfizer/BioNTech and Moderna vaccines use mRNA technology and require two doses administered 3 and 4 weeks apart, respectively, to reach the full 90 to 95% efficacy (*2*). In light of limited supply, the Centers for Disease Control and Prevention has provided preliminary guidance indicating that vaccination should be prioritized first for health care workers and long-term care facility residents, then for other essential workers, and next for people at higher risk for severe illness (*3*). Subsequently, vaccination will reach most sectors of the population, though inoculation of children under 16 has yet to be recommended.

Globally, vaccination uptake over the coming year could prevent disease for the sizeable portion of the population that has yet to be infected with SARS-CoV-2 and move the world to a post-pandemic

Corrected 5 February 2021. See full text.

phase; however, this potential benefit of averted infections, hospitalizations, and deaths depends considerably on societal maintenance of NPIs during vaccine deployment. Relaxing NPIs before attaining adequate distribution would enable infection of many more people before their vaccination than would occur if NPIs were to be maintained or increased. Locally, relaxation of NPIs increases the reproduction number, R_t, which enables greater transmission of the virus and a larger overall attack rate. These changes lead to a faster and larger accumulation of infections that could greatly outpace vaccination distribution efforts. Thus, maintaining NPIs throughout the upcoming SARS-CoV-2 vaccination campaign is essential for maximizing the health benefit. In the coming months, public health messaging is critically needed to encourage continued compliance with NPI control measures.

Marta Galanti[1], Sen Pei[1], Teresa K. Yamana[1], Frederick J. Angulo[2], Apostolos Charos[3], David L. Swerdlow[2], Jeffrey Shaman[1]*
[1]Department of Environmental Health Sciences, Mailman School of Public Health, Columbia University, New York, NY 10032, USA. [2]Medical Development and Scientific/Clinical Affairs, Pfizer Vaccines, Collegeville, PA 19426, USA. [3]Patient Health Impact, Pfizer Vaccines, Walton Oaks, Tadworth, KT20 7NS, UK.
*Corresponding author. Email: jls106@cumc.columbia.edu

REFERENCES AND NOTES

1. U.S. Food and Drug Administration, "COVID-19 vaccines" (2020); www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/covid-19-vaccines.
2. C. Zimmer, J. Corum, S.-L. Wee, "Coronavirus vaccine tracker," *The New York Times* (2020).
3. Centers for Disease Control and Prevention, "How CDC is making COVID-19 vaccine recommendations" (2020); www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations-process.html.

COMPETING INTERESTS

Pfizer Inc. reviewed this manuscript and approved the decision to submit the manuscript for publication. F.J.A., A.C., and D.L.S. own Pfizer stock. J.S. and Columbia University disclose partial ownership of SK Analytics. J.S. has done paid consulting work for Business Network International and receives funding from Pfizer Inc., National Science Foundation grant DMS-2027369, and a gift from the Morris-Singer Foundation.

10.1126/science.abg2326

Disinfection spreads antimicrobial resistance

During the COVID-19 pandemic, the use of disinfectants, alcohol-based hand sanitizers, and antiseptic hand wash has surged. As a precaution, many authorities have also increased chlorine dosage in wastewater disinfection to achieve a free chlorine residual concentration greater than 6.5 mg/liter (*1*), despite evidence that a free chlorine residual of just above 0.5 mg/liter can completely inactivate human coronavirus (*2*). These chemicals can reach aquatic and terrestrial environments through direct discharge of wastewater into receiving waters. Disinfection protocols put in place to prevent COVID-19 should be limited to the minimum required to kill severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and weighed against their potential to increase antimicrobial resistance (AMR).

Disinfectants facilitate the bacterial acquisition of AMR, potentially the biggest global health challenge next to the COVID-19 pandemic (*3*). For example, antiseptic ingredients quaternary ammonium compounds (*4*), triclosan (*5*), chlorhexidine (*6*), and ethanol (*7*); chlorine-based disinfectants (*8*); and disinfection by-products (*9*) can promote the spread of AMR through mutation or horizontal gene transfer. Thus, current increases in disinfection practices may pose an environmental and public health risk by accelerating the spread of AMR.

Unlike human viruses, which cannot independently reproduce and rarely survive in the environment, bacteria can proliferate and persist, conceivably inheriting AMR over generations. The health of humans and animals is inextricably connected to the environment, potentially creating a cycle of AMR dissemination. Indeed, humans and animals can acquire AMR from the environment through food (*10*), water (*11*), and air (*12*).

From the One Health perspective, a robust risk assessment is necessary to evaluate the environmental and public health risks of increased disinfection and its role in mediating the spread of AMR, particularly in the long term. To reduce the release of disinfectants into the environment, policies should be enacted to reduce unnecessary fomite disinfection, reduce the chlorine load to maintain a free chlorine residual of just above 0.5 mg/liter (*2*), and dechlorinate treated effluent before discharge. These approaches may be critical to protecting the public from future health threats by slowing down the dissemination of AMR.

Ji Lu and Jianhua Guo*
Advanced Water Management Centre, The University of Queensland, St Lucia, Brisbane, QLD 4072, Australia.
*Corresponding author.
E-mail: j.guo@awmc.uq.edu.au

REFERENCES AND NOTES

1. J. Wang *et al.*, *Environ. Pollut.* **262**, 114665 (2020).
2. X. W. Wang *et al.*, *J. Virol. Methods* **126**, 171 (2005).
3. J. O'Neill, A.R. Board, Eds., "Tackling drug-resistant infections globally: Final report and recommendations" (Review on Antimicrobial Resistance, 2016).
4. M. Tandukar *et al.*, *Environ. Sci. Technol.* **47**, 9730 (2013).
5. J. Lu *et al.*, *Environ. Int.* **118**, 257 (2018).
6. M. Wand *et al.*, *Antimicrob. Agents Chemother.* **61**, e01162-16 (2017).
7. S. J. Pidot *et al.*, *Sci. Transl. Med.* **10**, eaar6115 (2018).
8. M. Jin *et al.*, *ISME J.* **14**, 1847 (2020).
9. D. Li *et al.*, *Environ. Sci. Technol.* **50**, 3193 (2016).
10. T. P. Van Boeckel *et al.*, *Science* **365**, eaaw1944 (2019).
11. A. F. C. Leonard *et al.*, *Environ. Int.* **114**, 326 (2018).
12. J. Li *et al.*, *Environ. Sci. Technol.* **52**, 10975 (2018).

COMPETING INTERESTS

J.L. was funded by the Advance Queensland Industry Research Fellowship (grant no. RM2020001500). J.G. was funded by the Australian Research Council (grant no. FT170100196).

10.1126/science.abg4380

China's turtles need protection in the wild

Jennifer SillsJian WangJames F. ParhamHaitao Shi

Science, 371 (6528), • DOI: 10.1126/science.abg3541