

Captive rearing and breeding are unlikely to save China's critically endangered sea turtles

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China has committed to restoring populations of critically endangered sea turtles but is focused on conservation methods with minimal evidence of efficacy. China's National Wildlife Protection Law should be modified to reduce the emphasis on artificial breeding and release.

Despite the fact that some previously threatened sea turtle populations have recovered in the past decade, many populations still face critical population declines around the world¹. For example, in China, sea turtles have become extremely rare because of prolonged pressures from capture and habitat loss². Rather than addressing these root causes of declines, China has focused conservation efforts on large-scale captive rearing and breeding.

Captive rearing, also known as 'head-starting', involves hatching and raising turtles in captivity until they reach a larger size before releasing them into the wild, with the goal of increasing early juvenile survival rates. This approach, which was once popular in many countries, has largely been abandoned because it requires substantial monetary investment but contributes little to sea turtle recovery³. Notably, in two major head-starting programmes in North America that ran between the 1950s and the 1990s, none of the head-started hatchlings were documented to return to successfully nest^{4,5}. The targeted sea turtle populations only began to recover when policymakers shifted their focus to addressing primary threats by protecting nesting beaches and foraging habitats as well as implementing bycatch prevention methods⁶.

Whereas head-starting begins after natural breeding and nesting, captive breeding begins with wild-caught adults, which are subjected to a full breeding cycle – including mating, egg-laying, incubation and juvenile rearing – in an artificial environment. This approach mirrors livestock farming, and aims to mass-produce offspring and subsequently release them to mitigate population deficits. Releasing captive-bred hatchlings into the wild is potentially even more detrimental than captive rearing of naturally born hatchlings, because turtles bred in captivity live in crowded, artificial conditions that lack natural elements such as sunlight, diurnal cycles, temperature fluctuations and predators⁷. Consequently, they will lose the ability to adapt to the natural environment upon release. Additionally, the artificial breeding of sea turtles remains exceedingly difficult; thus far, only first-generation breeding has been achieved. This difficulty means that captive breeding programmes will require the ongoing capture of wild adult turtles.

Despite this evidence that captive rearing and breeding are ineffective as primary conservation tools for sea turtles, these approaches are still promoted in many regions, including China, Indonesia, Thailand, the Netherlands and the Cayman Islands. The programmes receive substantial financial investments and extensive media coverage⁸ (Supplementary Note 1). An example of a programme that receives a large amount of national conservation funding in China is the captive rearing and breeding programme at the Huidong National Sea Turtle Nature Reserve in Guangdong. Over 65,000 captive-reared green turtles (*Chelonia mydas*) have been released in this reserve since 1987, but none of them have been documented as returning to nest. With the continuous decline and eventual disappearance of wild nesting turtles coming ashore, managers shifted focus to the captive breeding of green turtles in the reserve in 2017. This reserve has collected about 300 wild adult turtles from various regions in China, constructed large enclosures, and built artificial beaches; the breeding programme now produces about 2,000 hatchlings annually, and aims to achieve an annual artificial breeding output of 10,000 sea turtle hatchlings by 2029 (ref. 9).

Chinese authorities mistakenly believe that mass-breeding endangered animals artificially can compensate for declines in wild populations. Specifically, the current (2022) version of the National Wildlife Protection Law encourages captive breeding: rule 25 of the law stipulates that the state supports the captive breeding of key protected wildlife, and rule 26 encourages government departments to carry out the release of captive-bred wildlife into the wild¹⁰ (Supplementary Note 2). Between 2016 and 2020, more than 190 billion captive-bred aquatic animals were released in China, at a cost of more than 50 billion RMB (US \$747 million)¹¹. Mandates for captive breeding and release are also written into the sea turtle conservation action plan (2019–2033)¹², and incorporated into the government's conservation policies, including the 'Aquatic Wildlife Protection Law' and the 'Stock Enhancement & Release Policies'. This focus has led to numerous ocean parks, aquariums and zoos illegally trading sea turtles in the name of restoring and breeding sea turtles².

Sea turtles were classified as 'National Class I Key Protected Wildlife' (the highest level of protection) in China in 2021, so they should have strict and comprehensive protection. Because captive breeding promotes increased illegal capture from wild populations, China's focus on captive breeding as a conservation tool is conceptually flawed. Further, captive breeding diverts attention from the actual threats to these threatened populations.

If China is truly committed to restoring its endangered sea turtle populations, the clause "encouraging the artificial breeding of key protected wildlife species" should be removed from the National Wildlife Protection Law as soon as possible, at least with respect to sea turtles, and it should also be eliminated from the policies of relevant departments, provinces and cities. Captive breeding of sea turtles is scientifically

unjustified as a primary tool for restoring populations, so this practice should be strictly regulated rather than nationally supported.

We propose a fundamental shift in China's sea turtle conservation approach: habitat restoration, adult protection and community co-management should be prioritized, and captive breeding should be strictly regulated as a supplementary measure. Some of China's current sea turtle conservation measures – such as combating the illegal sea turtle trade, enforcing an annual three-and-a-half-month fishing ban during the nesting season, and protecting sea turtle nesting sites – are likely to be more effective and should be sustained and further reinforced. If China is to achieve its stated sea turtle restoration goals, stringent action must be taken against illegal activities that involve the sale of wild sea turtles and their eggs (purportedly for breeding purposes), including trade from neighbouring countries. Second, many aquariums, marine parks, zoos and farms maintain large numbers of wild sea turtles with unknown origins, and most of these transactions lack proper legal documentation. Future measures must prevent their sale, ownership and transfer. Other actions include establishing a marine national park with sea turtles as the flagship species to enhance the integrity of the ecological environment within the protected area; strengthening scientific research to provide targeted and feasible theoretical foundations and practical guidance for conservation; and increasing the intensity of publicity efforts.

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Competing interests

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Additional information

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