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1 **Wildlife regulation loopholes in China aggravate depletion of wildlife**
2 **populations**

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19 eTOC blurb: Sung *et al.* identify a loophole in Chinese wildlife trade regulations after
20 legislative changes in 2021. For many animal species, regulations only cover wild
21 specimens, allowing traders to launder wild-caught individuals as captive-bred.
22 Urgent action is needed to tighten legislation and prevent further population declines
23 of affected species.

24 China has committed to develop an ecological civilization and recently taken
25 significant steps to enhance conservation measures including updating the List of
26 National Key Protected Wild Animals and revising the Wildlife Protection Law in
27 2021¹. Conservation has improved by increasing the number of protected species.
28 However, a notable shortcoming undermines the effectiveness for many (87)
29 species, as the regulation applies only to wild specimens and not to captive
30 individuals (Figure 1B; Table S1). Additionally, the Ministry of Agriculture and Rural
31 Affairs similarly regulates many (230) CITES-listed, aquatic species, most that are
32 non-native species to China (Notice No. 491). Given the challenges differentiating
33 wild and captive individuals, these regulation changes allow and incentivize the
34 laundering of wild-caught as captive-bred specimens in trade. The impacts of these
35 regulation amendments on conservation are substantial for two reasons. First, China
36 has one of the world's largest wildlife trade, with a high volume of native and non-
37 native animals traded and farmed^{2,3}. Second, many of the species affected are
38 globally threatened, including 51% of native and 63% of CITES-listed, aquatic
39 species (Figure 1B). Ultimately, the regulation changes exacerbate population
40 declines of many threatened species.

41 Before the regulation amendment in 2021, laundering of wild-caught individuals of
42 protected species was impossible because the trade was regulated regardless of the
43 source (wild-caught or captive-bred). After trade regulation applied only to wild
44 specimens, animal traders and farms were able to fraudulently claim wild-caught
45 animals as captive-bred, essentially laundering wild animals into the trade. This is an
46 obvious shortcoming because, among the species affected, some species cannot be
47 bred at commercial scale—most individuals for sale are wild-caught, such as the Big-
48 headed Turtle (*Platysternon megacephalum*), Humphead Wrasse (*Cheilinus*
49 *undulatus*), Indochinese Box Turtle (*Cuora galbinifrons*) and seahorses
50 (*Hippocampus* spp.).

51 Further, for some species that have been bred successfully, the regulation changes
52 may incentivize animal farms to purchase more wild-caught individuals. The farms
53 supplement their breeding stock with wild-caught individuals when expanding, to
54 avoid inbreeding, maintain genetic diversity and sustain productivity⁴. The regulation
55 amendments heavily impact aquatic species because their farming remains
56 underregulated, in contrast to terrestrial species where farming and trading have
57 been banned since 2020⁵. Critically endangered, aquatic species (e.g., Chinese
58 Giant Salamander [*Andrias davidianus*], and Golden Coin Turtle [*Cuora trifasciata*])
59 have remained rare in the wild despite being successfully bred at large scale in
60 farms to meet market demand. This is likely due to farms themselves buying wild-
61 caught individuals.

62 The revised regulations present significant enforcement challenges to differentiate
63 wild-caught and captive-bred individuals. Some laboratory analyses are useful (e.g.,
64 stable isotope analysis)⁶ for a few species but have not been tested for most
65 species. Further, application of these methods in enforcement is challenging
66 because enforcement agencies lack the necessary training, resources, equipment
67 and expertise to apply these methods. Timely identification of animals' source is
68 impossible. As such, traders can provide an animal farm certificate stating the
69 individual is captive-bred, which is accepted by enforcement agencies and allows the
70 animal to be traded “legally”. This issue mirrors the challenges in regulating
71 Appendix II-listed species of CITES (the Convention of International Trade of
72 Endangered Species of Wild Fauna and Flora), where permits are only required for
73 the international trade of wild-caught specimens, resulting in widespread laundering
74 of wild-caught animals⁷.

75 We used our data on the critically endangered Big-headed Turtle (*P.*
76 *megacephalum*) to exemplify the impacts of the regulation amendments and
77 recommend actions to remediate the impacts. Since the 2021 legislative
78 amendment, trade regulation only applies to wild-caught animals and the
79 responsibility falls on enforcement agencies to prove that a specimen is wild-caught
80 for it to be illegal. This has hampered enforcement—from data collected by the
81 authority that helps identify seized wildlife, the number of seizures of *P.*
82 *megacephalum* in Guangdong Province, China has decreased since 2021 (Figure
83 S1). Further, no successful enforcement actions have been taken in Guangdong
84 Province since February 2022. We suspect that enforcement agencies are less
85 proactive since 2021 due to the challenges posed by the law amendment to prove
86 the origin of traded *P. megacephalum*.

87 Conversely, neighboring Hong Kong Special Administrative Region has stricter
88 regulations for *P. megacephalum*, prohibiting trade and regulating possession of *P.*
89 *megacephalum* irrespective of being wild or captive-bred. This disparity incentivizes
90 smuggling of *P. megacephalum* into China, negatively impacting wild populations.
91 Poaching pressure of *P. megacephalum* has intensified in Hong Kong as evidenced
92 by the two largest seizures within the city in 2022 and 2023⁸. Data from our territory-
93 wide Hong Kong surveys reveal that wild *P. megacephalum* populations have been
94 depleted in over 80% of streams, with only a few populations remaining. Given the
95 escalating poaching pressure, these remnant *P. megacephalum* populations will
96 likely to be extirpated soon if enforcement actions are not strengthened along the
97 trade route.

98 Additionally, large volumes of *P. megacephalum* are being caught and smuggled into
99 China from neighboring countries. For example, over 1000 individuals were seized
100 from both Vietnam and Myanmar in the last decade despite this species being up-
101 listed to CITES Appendix I in 2013⁹. It is worrying that official seizure records
102 indicate the number of *P. megacephalum* seized remained high in Vietnam since
103 2021, while the number confiscated in Guangdong Province, a hotspot for illegal
104 wildlife trade in China¹⁰, decreased (Figure S1). We believe that the recent
105 amendment of the List of National Key Protected Wild Animals leading to ineffective
106 enforcement in China has, in turn, increased the incentive to poach and smuggle
107 wild-caught turtles to China from neighboring regions.

108 The situation with *P. megacephalum*, supported by our data, illustrates the legal
109 loopholes that extend beyond this species to other threatened species. In particular,
110 we believe the shortcomings will significantly impact farmed aquatic species. To
111 close the wild/captive loophole and strengthen regulation, we provide three
112 recommendations:

- 113 (1) Remove the remark “applies to wild populations only” for endangered and
114 critically endangered species listed on the China Red List and IUCN Red List.
- 115 (2) Establish a ‘white list’ for aquatic species that can be farmed following the
116 regulation on farming of terrestrial wildlife⁵. This list must prioritize
117 conservation over the interests of the farming industry.
- 118 (3) Implement stricter regulations on animal farming and intensify inspections,
119 including the use of individual identification, breeding certificates and regular
120 inventory audits.

121 The impact of the legal amendment undermines China’s national policies on
122 becoming an ecological civilization. Urgent legislation amendment is needed to
123 safeguard wildlife populations of threatened species in China and elsewhere. The
124 proposed recommendations will help combat illegal operations dealing with protected
125 wildlife, particularly laundering of wild-caught specimens in trade.

126

127 **SUPPLEMENTAL INFORMATION**

128 Supplemental information includes methods, one table and one figure, which can be
129 found with this article online.

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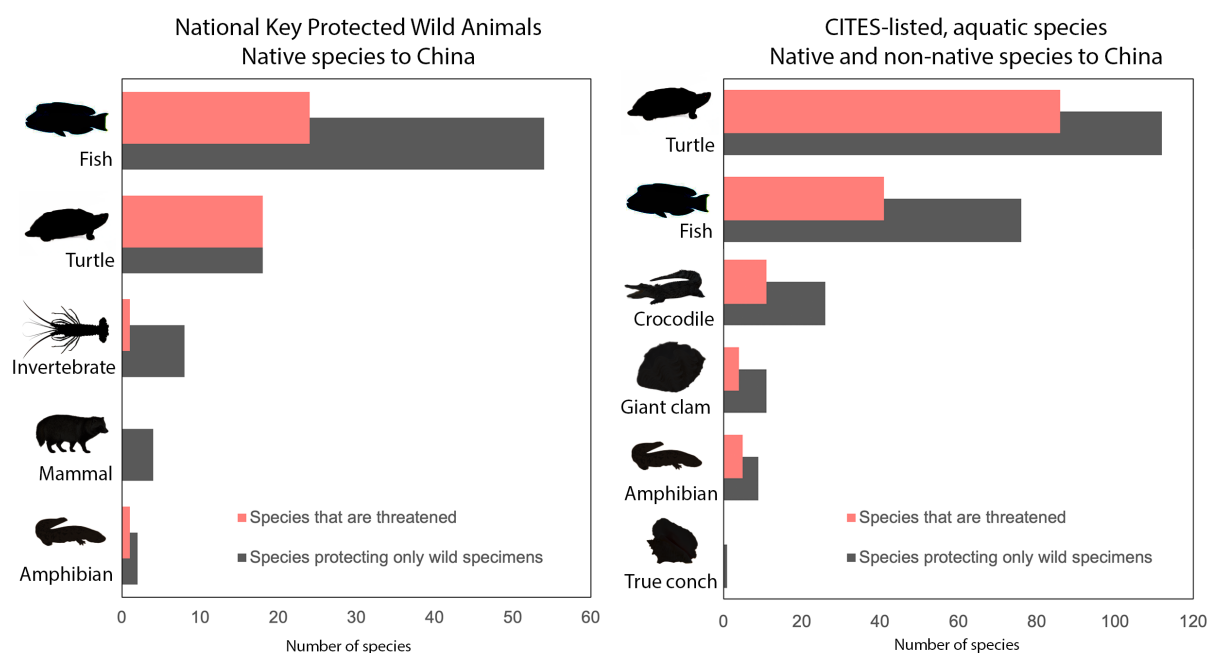
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136
 137 **AUTHOR CONTRIBUTION SECTION**

138 Conceptualization, YHS, SH, MWNL, HTS; Methodology. YHS, SH; Investigation,
 139 YHS, SH, DH; Visualization, YHS, SH; Funding acquisition, YHS, JJF, HTS; Writing
 140 – original draft, YHS, HS, MWNL, JJF, HTS; Writing – review & editing. YHS, SH,
 141 MWNL, DH, JJF, HTS.

142
 143 **FIGURE**



144
 145
 146 **Figure 1. Animal groups affected by the amendment to the List of National Key**
 147 **Protected Wild Animals and regulation of CITES-listed, aquatic species in**
 148 **China.** Number of threatened species (classified as vulnerable, endangered or
 149 critically endangered on the IUCN Red List) affected by the recent amendment of the
 150 List of National Key Protected Wild Animals and regulation of CITES-listed, aquatic
 151 species made by the Ministry of Agriculture and Rural Affairs. Taxonomic groups are
 152 organized by descending number of species for which only wild specimens are
 153 regulated.

154
 155 **DECLARATION OF INTERESTS**

156 The authors declare no competing interests.
 157

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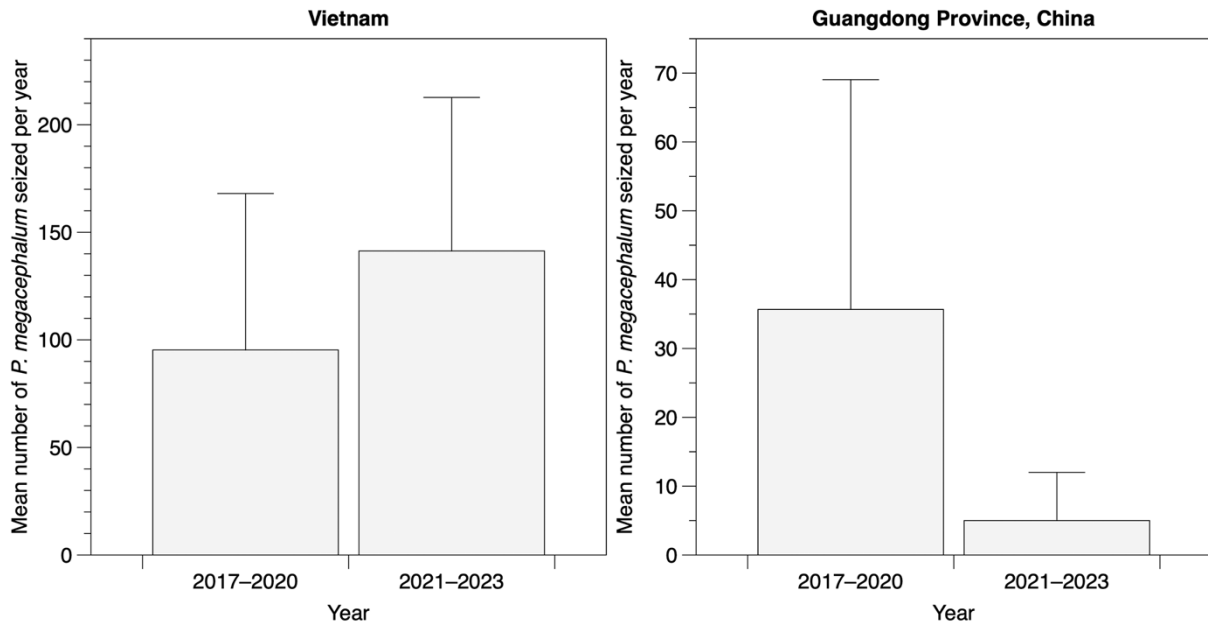
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191 **Supplementary Information**

192 **Wildlife regulation loopholes in China aggravate depletion of wildlife populations**

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194 Hai-Tao Shi

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196 **Figure S1. The number of *Platysternon megacephalum* seized in Guangdong**
197 **Province, China decreased while seizures in Vietnam remained high following**
198 **legislative changes in 2021. Average number of *Platysternon megacephalum* seized in**
199 **Vietnam and Guangdong Province, China before (2017–2020) and after (2021–2023) the**
200 **revision of the List of National Key Protected Wild Animals based on official seizure records**
201 **and our data.**

202

203

204

| Taxonomic group | Species protecting only wild specimens | Species included that are threatened |
|--|---|---|
| <i>List of National Key Protected Wild Animals (native species to China)</i> | | |
| Turtle | 18 | 18 (100%) |
| Amphibian | 2 | 1 (50%) |
| Fish | 55 | 24 (44%) |
| Invertebrate | 8 | 1 (13%) |
| Mammal | 4 | 0 (0%) |
| Total | 87 | 44 (51%) |

CITES-listed species included in amendment (native and non-native species to China)

| | | |
|--------------|------------|------------------|
| Turtle | 108 | 84 (78%) |
| Amphibian | 9 | 5 (56%) |
| Fish | 75 | 40 (53%) |
| Crocodile | 26 | 11 (42%) |
| Giant clam | 11 | 4 (36%) |
| True conch | 1 | 0 (0%) |
| Total | 230 | 144 (63%) |

205 **Table S1. Number of species and proportion of threatened species for which only wild**
206 **specimens are regulated.** Animal groups affected by the recent legal amendment of the
207 List of National Key Protected Wild Animals made by the Ministry of Agriculture and Rural
208 Affairs. Taxonomic groups are organized by descending proportion of species that are
209 classified in threatened categories on the IUCN Red List (vulnerable, endangered or critically
210 endangered) for which only wild specimens are regulated.
211

212 **Supplemental Experimental Procedures**

213 We obtained the list of species affected by the legislative changes, which regulate only wild
214 specimens from two documents: (1) the List of National Key Protected Wild Animals under
215 China's Wildlife Protection Law revised in 2021, and (2) the species list in the announcement
216 (Notice No. 491) on the regulation of CITES-listed species in China by the Ministry of
217 Agriculture and Rural Affairs. In both documents, some groups were listed without specifying
218 individual species (only listed to genus, family or order). For these groups, we referred to the
219 literature (listed below) to determine the number of species within each genus, family, or
220 order.

221

222 For the first list (List of National Key Protected Wild Animals), we referenced the number of
223 species distributed in China for *Hippocampus* spp.^{S1} and *Cuora* spp.^{S2}. For the second list
224 (CITES-listed species), we referred to the literature for the order Crocodylia^{S3}; the genera
225 *Chitra*, *Cuora*, *Cyclemys*, *Pangshura*, *Pelochelys*, Platysternidae, *Podocnemis*, and
226 *Terrapene*^{S2}; *Andrias* spp.^{S4}; the order Acipenseriformes^{S5,S6}; *Hippocampus* spp.^{S7}; and the
227 family Tridacnidae^{S8}. For turtles, several listed species are known to be hybrids and/or
228 invalid, including *Ocadia phillippeni*, *Ocadia glyphistoma*, *Mauremys iversoni*, *Mauremys*
229 *pritchardi*, *Mauremys megaloccephala*, and *Sacalia pseudocellata*^{S2}, so we removed these
230 species from the analysis.

231

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