The Australian government is grappling with ways to control carp.

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Biocontrol of invasive carp: Risks abound

Introduced common carp (*Cyprinus carpio*) infest many Australian waterways and dominate their ecosystems (*1*). To reduce carp numbers and aid native species recovery, the Australian Government has proposed the release of cyprinid herpesvirus 3 (CyHV-3; koi herpesvirus) (*2*). This virus, presumed to be absent from Australia, can devastate farmed carp (*3*, *4*). Because of its economic impact, the World Organization for Animal Health requires notification when the virus is identified (*5*). Safety concerns have been raised over the release of CyHV-3, including potential infection of threatened native fish and environmental damage due to decomposing carp (*4*, *6*). However, our knowledge of CyHV-3 pathogenesis, carp biology, and Australian river ecology suggests that a more likely problem is low efficacy.

Resistance-conferring genetic polymorphisms have been described in carp (*7*). CyHV-3 virulence also shows strong environmental dependence: Disease develops at 16° to 28°C, whereas temperatures above 30°C block infection and lead to immunity (*8*). Infected carp seek out warm water refuges, which are abundant in Australian rivers (*9*). The high fecundity of carp may then allow rapid repopulation of any depleted waterways by immune or genetically resistant individuals. Moreover, there is little published evidence that Australian carp are currently free of the virus: Genetic analysis indicates that CyHV-3 was infecting carp elsewhere before their introduction into Australia, and the lack of recorded CyHV-3–associated mass carp deaths in Australia may simply reflect a lack of environmental cofactors. Of note, CyHV-3 monitoring in Japanese rivers since 2004, when there was mass carp death in Lake Biwa, has shown a continued high prevalence of infection without obvious ill-effects (*10*).

Before a costly and irreversible large-scale CyHV-3 release, further assessments should provide convincing evidence that the virus is not already present in Australia and that, through contained, small-scale field trials, it can achieve sustainable reductions in free-living Australian carp populations without harming native ecosystems. We also support development of alternative approaches, such as release of daughterless fish, for long-term control of invasive carp populations (*11*).

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Waterbirds targeted in Iran's wetlands

Millions of migratory birds arrive each autumn at Fereydunkenar International Wetland (FIW) in Iran due to its rich ecosystem (*1*). FIW comprises 5427 ha located in the southern Caspian Sea and includes Fereydunkenar, Sorkhrud, and Azbaran lagoons, which are designated as Wetlands of International Importance in the Ramsar Convention on Wetlands (*2*). However, an estimated 3000 of these birds are currently being killed daily by local hunters in FIW (*3*) to sell at the local market, facilitated by the recent adoption of more efficient type of net (*1*).

This could have catastrophic effects on the species that depend on this ecosystem. For example, the last remaining individual of the western population of the Critically Endangered Siberian crane (*Leucogeranus leucogeranus*) (*4*) winters in the FIW each year, where it is not protected (*5*). Of the three Siberian cranes that entered FIW in 2007, two were killed (*6*).

Despite the global importance of the FIW to Critically Endangered species, Iran's Department of the Environment has thus been unable to curb the illegal activities that threaten this ecosystem. Armed locals show a great deal of resistance to wildlife rangers in the FIW when they attempt to enforce existing laws to curtail hunting (*7*). To bring poaching under control, the Iranian government should increase police presence and enforcement in the area and introduce new national legislation to control trade in endangered species at local markets. In addition, the international community (particularly the UN Convention on Biological Diversity) should pressure Iran to enforce such laws by imposing fines on the government if migratory birds are killed.

Finally, experience has shown the

effectiveness of engaging with local communities to gain support for conservation efforts. Iranian authorities have used this strategy to address poaching of the critically endangered Asiatic cheetah *Acinonyx jubatus venaticus*, which only lives in Iran (*8*). To raise awareness in local communities, the Department of the Environment developed educational programs, held training workshops, and distributed literature highlighting the value of the Asiatic cheetah (*9*). As a result, the rate of cheetah mortality by local people reduced substantially (*10*). As in the case of the cheetah, if local communities realize the importance of these migratory birds, they will likely work to conserve them.

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Shifting sands could bring invasive species

In their Letter "Greenland: Build an economy on sand" (17 November 2017, p. 879), M. Bendixen *et al.* suggest that Greenland develop a sand export industry. Bendixen *et al.* caution that implementation of sand extraction methods must minimize adverse impacts on local environments, but they do not touch on the potential for a substantial consequence of a new export trade: the introduction of non-native invasive organisms to Greenland.

In the Perspective that prompted Bendixen *et al.*'s Letter ("A looming tragedy of the sand commons," 8 September 2017, p. 970), A. Torres *et al.* discuss the need to evaluate the full spectrum of environmental impacts and cascading effects of extractive sand mining, including the transfer of invasive species, to minimize unintended consequences. The delivery of non-native biota deserves particular attention when initiating new or expanded export/import industries serviced by maritime transportation. Shifts in export of bulk commodities like sand may be especially potent as a source of new invasions.

Commercial ships that move bulk cargo often discharge large volumes of foreign-sourced ballast water and organisms to exporting ports (*1*) and carry biofouling organisms on their underwater surfaces (*2*). As a result, shipping is a leading source of coastal invasions worldwide (*3*). Port infrastructure and development may also facilitate invasions (*4*). Although vessels are increasingly subject to regulations to reduce shipborne invasions, the efficacy of these measures remains unknown (*5*). Hence, the potential effect of large increases in maritime activity on invasion dynamics at high northern latitudes is a growing concern (*6*).

These concerns should not prevent new or increasing maritime trade. However, particularly when wholly new infrastructure may be required, all stakeholders should collaborate to develop and implement innovative and comprehensive invasion prevention strategies.

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†The views expressed herein are those of the author and are not to be construed as official or reflecting the views of the Commandant or of the U. S. Coast Guard.

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TECHNICAL COMMENT ABSTRACTS

Comment on "The whole-soil carbon flux in response to warming"

Jing Xiao, Fangjian Yu, Wanying Zhu, Chenchao Xu, Kaihang Zhang, Yiqi Luo, James M. Tiedje, Jizhong Zhou, Lei Cheng

In a compelling study, Hicks Pries *et al.* (Reports, 31 March 2017, p. 1420) showed that 4°C warming significantly enhanced soil CO_2 production in the 1-meter soil profile, with all soil depths displaying similar temperature sensitivity (Q_{10}). We argue that some caveats can be identified in their experimental approach and analysis, and that these critically undermine their conclusions and hence their claim that the strength of feedback between the whole-soil carbon and climate has been underestimated in terrestrial models.
Full text: dx.doi.org/10.1126/science.aao0218

Response to Comment on "The whole-soil carbon flux in response to warming"

Caitlin E. Hicks Pries, C. Castanha, R. Porras, Claire Phillips, M. S. Torn

Temperature records and model predictions demonstrate that deep soils warm at the same rate as surface soils, contrary to Xiao *et al.*'s assertions. In response to Xiao *et al.*'s critique of our Q_{10} analysis, we present the results with all data points included, which show Q_{10} values of >2 throughout the soil profile, indicating that all soil depths responded to warming.
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