

A call for global action to conserve native trout in the 21st century and beyond

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Trout and char (hereafter, *trout*) represent some of the more culturally, economically and ecologically important taxa of freshwater fishes worldwide (Kershner, Williams, Gresswell, & Lobón-Cerviá, 2019a). Native to all continents in the Northern Hemisphere (as well as western Mediterranean Africa), trout belong to seven genera (*Oncorhynchus*, *Salvelinus*, *Salmo*, *Hucho*, *Parahucho*, *Brachymystax* and *Salvelthymus*), which are distributed across more than 60 countries (Muhlfeld et al., 2019). Despite their broad importance as indicators of biodiversity in cold-water ecosystems (Haak & Williams, 2013), as well as cultural icons for food and recreation, nearly half of the world's recognised trout species (IUCN,

2018) are imperilled or at risk of global extinction (Muhlfeld et al., 2018, 2019). The root causes of their vulnerability include broad-scale alteration of landscapes and watersheds, dams, overharvest, pollution, interactions with hatchery-bred conspecifics and non-native species. However, emerging threats such as climate change and related problems such as the spread of diseases and parasites pose significant challenges and uncertainties to native trout and their habitats (Kovach et al., 2016; Muhlfeld et al., 2018). Ultimately, conservation of native trout depends on understanding their diversity, a willingness to address threats at their root causes and implementing progressive conservation solutions that

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promote persistence of these iconic species in the face of growing human pressures.

A 2019 international symposium titled “Advances in the Population Ecology of Stream Salmonids V” held in Granada, Spain (<http://www.salmonidsymposium.es>), included a special session entitled, “The Status and Conservation of Trout and Char Worldwide.” The session was followed by an interactive forum for attendees to identify and synthesise issues associated with threats, status and solutions for the sustainability of native trout at local to global scales. The widespread peril of trout inspired an immediate call to action from the scientific community, resource stewards, government regulators and native trout advocates in attendance. Our goal is to ensure that these species and their supporting ecosystems will not merely persist as rare curiosities in far-off places accessible only to scientists and elite anglers, but rather thrive as viable parts of functioning ecosystems. As such, attendees rallied to seek solutions and to introduce a new impetus to raise the global awareness of these iconic fishes and protect, conserve and restore trout and their habitats.

The session presentations and ensuing forum repeatedly focused on a set of three themes: (a) a lack of coordination among or communication about conservation efforts internationally; (b) decentralised or unavailable data concerning current species status assessment and habitat threats and serious gaps in our knowledge about the evolution and ecology of many trout species and lineages; and (c) an absence of globally applied place-based conservation actions. We propose and describe here three critical objectives to address these limitations and uncertainties.

Objective 1: *Establish a global network of scientists and conservationists to share knowledge on the protection and restoration of native trout and their habitats.*

Native trout are increasingly threatened globally by pervasive problems that are often common across international borders. Yet despite this commonality of threats, there remains insufficient coordination of conservation efforts within a province or country, let alone on the continental scale or the range of a species. Several recent projects have gathered expertise and information that might serve as the starting point for organising a global conservation network of scientists and conservationists to conserve, restore and protect these resources. The World of Trout Congress (2016 Bozeman, Montana, USA), the Advances in the Population Ecology of Stream Salmonids V Symposium (2019 Granada, Spain) and the newly published book *Trout and Char of the World* (Kershner, Williams, Gresswell, & Lobón-Cerviá, 2019b), as well as this proceedings volume, provide a wealth of contacts, resources and ideas that would facilitate the establishment of a global conservation network. Such a network should be comprised of people knowledgeable about trout and actions required to ensure their viability. Individual and organisational contact information, relevant literature and the latest conservation actions are represented within the conference programmes and in the resulting publications from the congress and symposium respectively. This information requires careful curation (by an International Steering Committee comprised of key

participants from the Congress and Symposium) on a central website that facilitates document-sharing and communication capabilities as a critical for trout scientists and conservationists internationally (visit www.tu.org/global-trout-network).

Objective 2: *Conduct and update IUCN status assessments for all trout species across the globe.*

Of the 124 recognised species of trout within the *Tree of Life* framework, just over half ($n = 67$) have had their status assessed by the *International Union for Conservation of Nature* (IUCN). Alarming, nearly three quarters (73%) of these species are currently considered to be threatened with global extinction, and four are now extinct (Muhlfeld et al., 2018, 2019). Despite ongoing taxonomic refinements for various species complexes (e.g. Lobón-Cerviá & Sanz, 2018; Trotter, Bisson, Schultz, & Roper, 2018) and the continuing discovery of new species (Hendrickson & Tomelleri, 2019), this level of vulnerability is high compared with other fish taxa assessed by the IUCN (Darwall & Freyhof, 2016; IUCN, 2018).

Reversing these declines will require extensive conservation and policy efforts to protect native trout diversity and ameliorate ongoing threats at local and global scales. Moreover, comprehensive, coordinated and comparable approaches are needed immediately to assess conservation status and to delineate conservation units rangewide, particularly for those data-poor species. The IUCN assessment framework, as well as more regionally applied and detailed approaches (Al-Chokhachy et al., 2018; Muhlfeld et al., 2015), offer potential solutions that could be applied pending available data on status and threats.

Objective 3: *Establish place-based conservation protections for native trout: propose adding “Outstanding Coldwater Rivers” to the World Heritage List.*

Trout universally require clean, cold water and are generally considered to be among the more sensitive fishes to human disturbances (Haak & Williams, 2013, 2015). Populations of native trout occur in some of the most spectacular and iconic habitats found in the world. Examples include Flathead and Pyramid Lakes, Skeena and Dean Rivers, and headwaters within the Sierra Madre (North America); Nalon-Narcea, Severn, Danube and Elbe Rivers (Europe); Sarufutsu, Amur and Koppi Rivers (Asia); numerous headwaters of the peri-Mediterranean region (Africa, Europe and Asia); and locales with species endemic to remote areas such as Elgygytgyn, Sevan and Eisenam Lakes as well as the Ob and Kama Rivers (Asia). Each of these iconic drainages and others like them require assessment for river habitats of sufficient quality to maintain intrinsic aquatic diversity (Williams et al., 2011). Such habitats may serve as refuges against climate change and other human-mediated stressors that pose immediate risks to the persistence of vulnerable trout species and lineages, and as such, they require protection at the highest levels of government.

In 1972, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) adopted protections for global cultural and natural heritage. The Convention noted that cultural and natural heritage worldwide are increasingly threatened with destruction and that losses of this heritage constitute a harmful

impoverishment of the heritage of all the nations of the world. Article 2 of the Convention defines “natural heritage” as consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view, and/or geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation. We propose that the appropriate governments consider adding the most outstanding cold-water rivers to the World Heritage List in order to bring further international attention to these vanishing species and their habitats and to encourage their restoration and protection.

1 | A CALL TO ACTION

As many of the papers within this volume have described, the scientific community has witnessed first-hand the magnitude and tempo of global declines to trout and their habitats. As a result, we urgently call for extensive and coordinated action to protect trout and their ecosystems.

As a first step, a conservation network of scientists and conservationists will promote awareness, communication and ultimately protection. The next step includes conducting and updating IUCN status assessments to adequately identify and, thus, protect ecological diversity of species, ecotypes and major evolutionary lineages, and to inform listing decisions and protections for conservation units across the globe. Finally, this effort will require implementing conservation protections to ensure native trout biodiversity and critical habitats for long-term resiliency, viability and adaptation in the face of rapid environmental change (Healey & Prince, 1995). Ultimately, we believe this effort will result in a thoughtful road map for scientists, conservation practitioners, professional fishery and ichthyological societies, governmental agencies, NGOs and informed anglers to collectively identify challenges and conservation actions. We contend that only by first addressing these threats and needs can we develop effective policies and conservation management strategies to ensure that these valuable fishes will thrive on the landscape well into the future. Should we fail to muster the courage and creativity to address these issues for the sake of valued-species such as trout and char, we certainly will fail to conserve lesser-known species and their supporting ecosystems. The time for thoughtful action is upon us.

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AUTHORS' CONTRIBUTION

All authors contributed equally. D.C.D., A.D., J.E., A.G., R.G., F.J., J.K., J.L.-C., P.M., A.M., P.M., K.M., C.M., K.P., J.R.P., G.U., L.A.V. and J.E.W. conceived and designed the Fresh Perspective and wrote the paper (Perspective). None of the authors performed the field and/or laboratory work, analysed the data and contributed to the facilitation of materials, reagents and/or analysis tools.

DATA AVAILABILITY STATEMENT

Not applicable. This perspective contains no original shared data. All data referenced are previously published in the original cited and referenced sources.

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REFERENCES

- Al-Chokhachy, R., Shepard, B. B., Burckhardt, J. C., Garren, D., Opitz, S., Koel, T. M., ... Gresswell, R. E. (2018). A portfolio framework for prioritizing conservation efforts for Yellowstone cutthroat trout populations. *Fisheries*, 43, 485–496. <https://doi.org/10.1002/fsh.10137>
- Darwall, W. R. T., & Freyhof, J. (2016). Lost fishes, who is counting? The extent of the threat to freshwater fish biodiversity. In G. P. Closs, M. Krkosek, & J. D. Olden (Eds.), *Conservation of freshwater fishes* (pp. 1–36). Cambridge, UK: Cambridge University Press.
- Haak, A. L., & Williams, J. E. (2013). Using native trout restoration to jumpstart freshwater conservation planning in the Interior West. *Journal of Conservation Planning*, 9, 38–52.
- Haak, A. L., & Williams, J. E. (2015). Wild waters for wild trout: Looking to the next 50 years. *International Journal of Wilderness*, 21(1), 1–8.
- Healey, M. C., & Prince, A. (1995). Scales of variation in life history tactics of Pacific salmon and the conservation of phenotype and genotype. In J. L. Nielsen (Ed.), *Evolution and the aquatic ecosystem: Defining unique units in population conservation* (pp. 176–184). Bethesda, MD: American Fisheries Society Symposium 17.
- Hendrickson, D. A., & Tomelleri, J. R. (2019). Native trout of Mexico: Treasures of the Sierra Madre. In J. L. Kershner, J. E. Williams, R. E. Gresswell, & J. Lobón-Cerviá (Eds.), *Trout and char of the world* (pp. 251–278). Bethesda, MD: American Fisheries Society.
- IUCN (International Union for Conservation of Nature). (2018). *The IUCN red list of threatened species, version 2018-1* [online database]. Retrieved from www.iucnredlist.org
- Kershner, J. L., Williams, J. E., Gresswell, R. E., & Lobón-Cerviá, J. (2019a). Introduction: Why trout and char. In J. L. Kershner, J. E. Williams, R. E. Gresswell, & J. Lobón-Cerviá (Eds.), *Trout and char of the world* (pp. 1–14). Bethesda, MD: American Fisheries Society.
- Kershner, J. L., Williams, J. E., Gresswell, R. E., & Lobón-Cerviá, J. (Eds.). (2019b). *Trout and char of the world*. Bethesda, MD: American Fisheries Society.
- Kovach, R. P., Muhlfeld, C. C., Al-Chokhachy, R., Dunham, J. B., Letcher, B. H., & Kershner, J. L. (2016). Impacts of climatic

- variation on trout: A global synthesis and path forward. *Reviews in Fish Biology and Fisheries*, 26, 135–151. <https://doi.org/10.1007/s11160-015-9414-x>
- Lobón-Cerviá, J., & Sanz, N. (Eds.). (2018). *Brown trout: Biology, ecology and management*. West Sussex, UK: John Wiley and Sons.
- Muhlfeld, C. C., Albeke, S. E., Gunckel, S. L., Writer, B. J., Shepard, B. B., & May, B. E. (2015). Status and conservation of interior red-band trout in the western United States. *North American Journal of Fisheries Management*, 35, 31–53. <https://doi.org/10.1080/02755947.2014.951807>
- Muhlfeld, C. C., Dauwalter, D. C., D'Angelo, V. S., Ferguson, A., Giersch, J. J., Impson, N. D., ... Epifanio, J. (2019). Global status of trout and char: Conservation challenges in the 21st Century. In J. L. Kershner, J. E. Williams, R. E. Gresswell, & J. Lobón-Cerviá (Eds.), *Trout and char of the world* (pp. 717–760). Bethesda, MD: American Fisheries Society.
- Muhlfeld, C. C., Dauwalter, D. C., Kovach, R. P., Kershner, J. L., Williams, J. E., & Epifanio, J. (2018). Trout in hot water: A call for global action. *Science*, 360, 866–867. <https://doi.org/10.1126/science.aat8455>
- Trotter, P., Bisson, P., Schultz, L., & Roper, B. (Eds.). (2018). *Cutthroat trout: evolutionary biology and taxonomy*. Bethesda, MD: American Fisheries Society Special Publication 36.
- Williams, J. E., Williams, R. N., Thurow, R. F., Elwell, L., Philipp, D. P., Harris, F. A., ... Sedell, J. R. (2011). Native fish conservation areas: A vision for large-scale conservation of native fish communities. *Fisheries*, 36, 267–277. <https://doi.org/10.1080/03632415.2011.582398>

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