6.2 Treasures of the Sierra Madre – Mexico's little-known native trout diversity

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Few individuals on our planet do not know what trout and salmon are. They are usually recognised as highly palatable, and often colourful species, and most who know them likely visualize cold, beautiful, pristine, free flowing, alpine or forest streams and rivers as their typical habitats. Many will also know of the remarkable migrations taken by some species, moving from their birth locations in rivers to oceans and then returning to their birthplaces to spawn and die. Some may recognise their importance as prized targets of anglers, particularly fly fishers, who spare no expenses to go after these trophies. Many others who might not be so familiar with the characteristics just mentioned may likely recognise species of this family as the tasty, and usually relatively costly fish found frozen or on ice in grocery stores and fish markets, or in cans, or smoked, or served in restaurants. Their flesh, often pink or rosy-coloured, is prized worldwide.

Cascada de Basaseáchic, Río Mayo. © Joseph Tomelleri

There is no doubt that fishes in this family (Salmonidae) are well known in most of the developed and developing countries of the world and that some have become extremely economically and globally important commercial species that support large-scale recreational as well as wild commercial fisheries, and are massively produced by global aquaculture. At the same time many are also imperilled to some degree.

Before this project, the Red List database contained 140 species of Salmonids. Here we'll focus on the genus *Oncorhynchus,* commonly known as the Pacific salmons and trout, which prior to this project was represented in the Red List by six species. Then, setting aside the many "salmon" of this genus, we'll focus only on trout, specifically those of a large and diverse lineage, best known for one species, the famous rainbow trout (*O. mykiss*). Originally known only from California and other Pacific drainages of the U.S., rainbow trout have long been a prized target of anglers, and the species has been bred in captivity for at least 150 years. High demand for it for both sport fisheries, as well as wild and captive protein production, resulted in it now being established on every continent. It has become not only one of the world's most important recreational fishing species, but also one of the planet's most widely cultured vertebrates. It is effectively global agriculture's "fish version" of the chicken, with global aquaculture production of the species in 2014 reaching 812,940 metric tonnes valued at nearly 4 billion US$ (U.N. Food and Agriculture Organization (FAO) n.d.)

That rainbow trout of global fishery and aquaculture fame is known to be one of about 10 closely related subspecies of what is called the "coastal rainbow" branch of the evolutionary tree of the genus. Most of those are from California, but two native Mexican taxa have long been recognised as part of this lineage, *O. m. nelsoni* (Nelson's trout – recently reviewed by (Ruiz Campos, 2017)) of the northernmost mountains of Baja California, and *O. chrysogaster* (the Mexican golden trout – recently covered by multiple contributors (Ruiz-Luna & Garcia De León, 2016). Recent genetic studies (Abadía-Cardoso et al., 2015) confirm those relationships and reveal, from specimens collected by the bi-national group of researchers known as Truchas Mexicanas (Hendrickson et al., 2003), that Mexico's share of the diversity in this lineage is much greater. At least 10 more, still undescribed species of native trout reside in remote, rugged and isolated corners of the Sierra Madre Occidental extending as far south as the high mountains between Mazatlán and Ciudad Durango. Truchas Mexicanas' fieldwork left no doubt that most share a need for conservation actions to help their often small and fragmented populations persist, and some are critically imperilled (Camarena-Rosales et al., 2006; Hendrickson et al., 2007; Hendrickson & Tomelleri 2019). While their formal descriptions have been delayed for various reasons, recent genetic validation of their distinctiveness, and clear need for recognition of the need for conservation actions on their behalf, led those studying them to petition the IUCN to add them to the Red List while their descriptions are being finalized. That petition was accepted and their assessments were completed as part of this project.

All of the Mexican trout are strikingly beautiful, but just as

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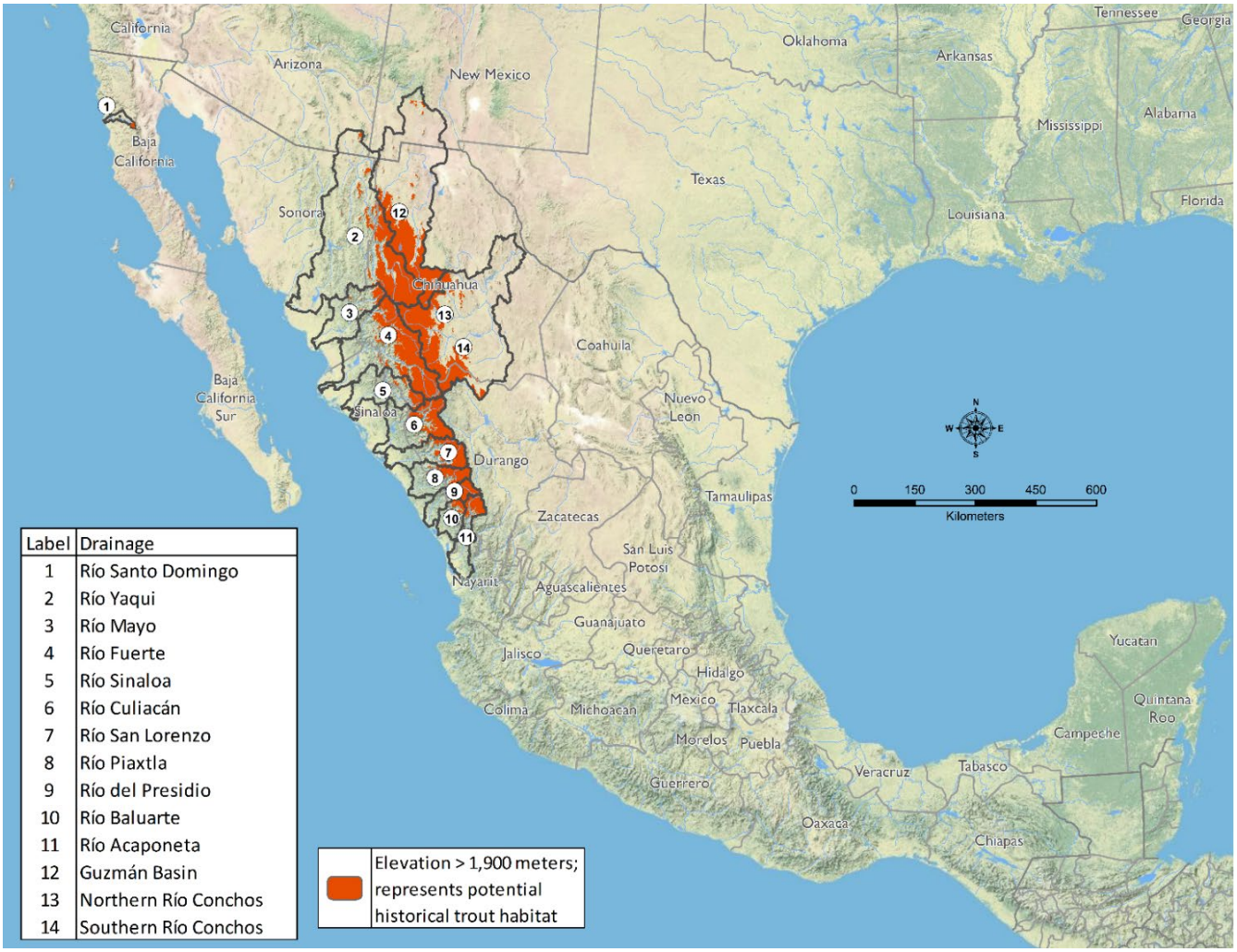

Potential historical distribution of Mexican trout in the Sierra Madre Occidental, as well as major associated river basins.
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Arroyo San Antonio, Río Yaqui (Bavispe subbasin).
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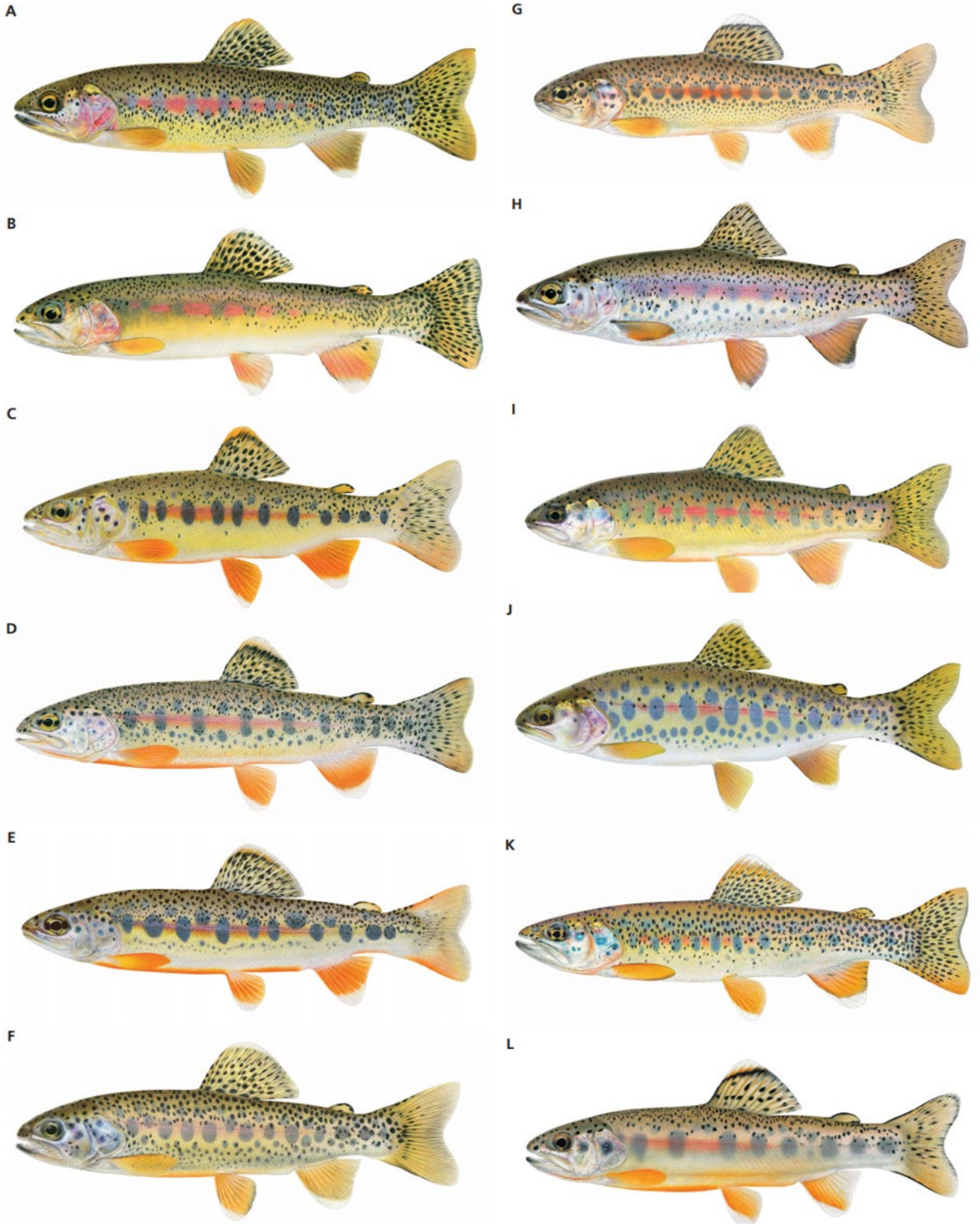
earlier researchers found when describing their U.S. relatives, they can be difficult to describe using classical morphological approaches. However, the recent genetics study confirmed that these new Mexican forms are at least as different from one another as are all of their much more thoroughly studied U.S. cousins, and that likely more of the total genetic variation of the entire genus resides in these Mexican species than is found among all of the U.S. representatives of the genus. This rich genetic diversity of the Mexican species is not just of academic interest – it clearly has great potential value for future genetic improvements of the closely related trout stocks now so important in the global aquaculture industry. However, as their recently assigned Red List categories indicate, the potential economic value of these species is significantly threatened.

These new rigorous conservation assessments were done using the most current data available and should help increase both simple awareness of the existence of these valuable species, as well as their conservation needs. However, they also illustrate that much work remains to be done. In particular, almost nothing is known about the ecology and basic biology of these new species. While it's possible to draw inferences from the rich literature on close relatives in the U.S., we advise caution in doing that for these

species. Many in Truchas Mexicanas who have collected the specimens on which these assessments were made concur that these trout seem ecologically quite different in many ways from those on the other side of the border. Luckily, the Truchas Mexicanas group of researchers has, like the trout, continued to diversify and grow, and some are now tackling researching the needs pointed out here, as illustrated in the important recent book (Ruiz Campos, 2017).

A Mexican Golden Trout caught in the Río Verde, a Río Fuerte basin tributary. © David Neely



Illustrations of Mexican trout: (A) Río Yaqui trout (Bavispe subbasin), (B) Río Mayo trout (Río Candameña), (C) Mexican Golden Trout (Los Loera subbasin of Río Fuerte, Arroyo las Truchas), (D) Mexican Golden Trout (Río Sinaloa basin, Arroyo Rancho en Medio), (E) Mexican Golden Trout (Río Culiacán basin, Arroyo Santa Rosa), (F) Río San Lorenzo trout (Arroyo la Sidra, above the falls), (G) Río Piaxtla trout (Arroyo el Granizo), (H) Río del Presidio trout (Arroyo Nogales), (I) Río Baluarte trout (Arroyo Santa Barbara), (J) Río Acaponeta Trout (Arroyo las Cebollas), (K) northern Río Conchos trout (Arroyo Ureyna), (L) southern Río Conchos trout (Arroyo del Molino).