Fishes from the Land of Trucha de Tierra Caliente

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It was very hot and dry, and I was worn out. For two hours, we'd been picking our way over and around the boulders along the edges of the Río Ayuquila in the Sierra de Manantlan Biosphere Reserve of West Central México. The temperature had to be in the 90s, and the desert-like breezes kept me constantly thirsty. My water supply was almost gone, my feet were developing some nasty blisters, and it was only mid-morning. Obviously, my pre-trip training, which had consisted mainly of sitting at my desk and grumbling at the Wisconsin winter, had been inadequate.

Suddenly, from the middle of the river, Arturo sang out the magic word, "*Trucha!*" He held up the cast net that he had been diligently throwing among the rapids as we moved upstream, revealing a frantically struggling glint of silver. I broke into a stumbling run across the slippery rocks of the river to help Arturo secure the fish before it escaped. After a few tense moments, we had the fish safely enclosed in a smaller net and we could study our prize. After years of anticipation and preparation, I finally held my first large specimen of *Agonostomus monticola*, the "trucha de Tierra Caliente" or "Trout of the Fiery Lands." With a name like that, how could I help but be excited?

Over the next few days, as we worked our way up the Río Ayuquila and the Arroyo Manantlan, one of its tributaries (Figs. 1 and 2), I saw over 70 more truchas. We measured, weighed, tagged, and released all of them (front cover photo), in the hopes that they would be recaptured later, providing information on growth, distribution, and movement. This effort was part of an ongoing study by Sonia Navarro of the Laboratorio Natural Las Joyas, University of Guadalajara, on the ecology and fishery of *A. monticola* in the Sierra de Manantlan Biosphere Reserve. Sonia is the aquatic specialist in the laboratory and, along with my colleagues Salvador Garcia, Luis Ignacio Iniquez, Daniel Schneider, and Eduardo Santana, we had worked together and became good friends during a survey of the aquatic resources of the Reserve four years earlier.

During that survey, we had become intrigued with the trucha. Although it was the species most prized by local fishermen, and important to local people as food, we'd seen truchas at only three of the 22 locations that we'd sampled. Moreover, even when present in good numbers, truchas had proven very difficult to catch. One of my most frustrating memories from the survey was a site with hundreds of juvenile truchas where three of us spent four hours sampling with seines and dip nets and caught only one small individual. Thus, when Sonia decided to undertake a detailed study of the trucha, one of our concerns was whether or not she'd be able to catch enough fish to learn anything.

Our fears proved unfounded. Sonia abandoned seines and dip nets and used cast nets instead (Fig. 3). She recruited Victor Rodriguez, a very knowledgeable and skillful local fisherman, to help her and her field assistants Arturo Arechiga, Claudia Torres, and Sarahy Contreras in capturing truchas. Together they averaged about 20 adult truchas per day. This was a bit better than our capture rate during the early survey, which was a whopping one trucha in eight days. In hindsight, the success of cast nets was no surprise, as the trucha de tierra caliente is not a true trout (Salmonidae), but rather a mullet (Mugilidae). Cast nets are the gear of choice the world over for catching mullets in shallow water.

The trucha has a wide range, occurring throughout Middle America. On the Pacific side, it is found in rocky

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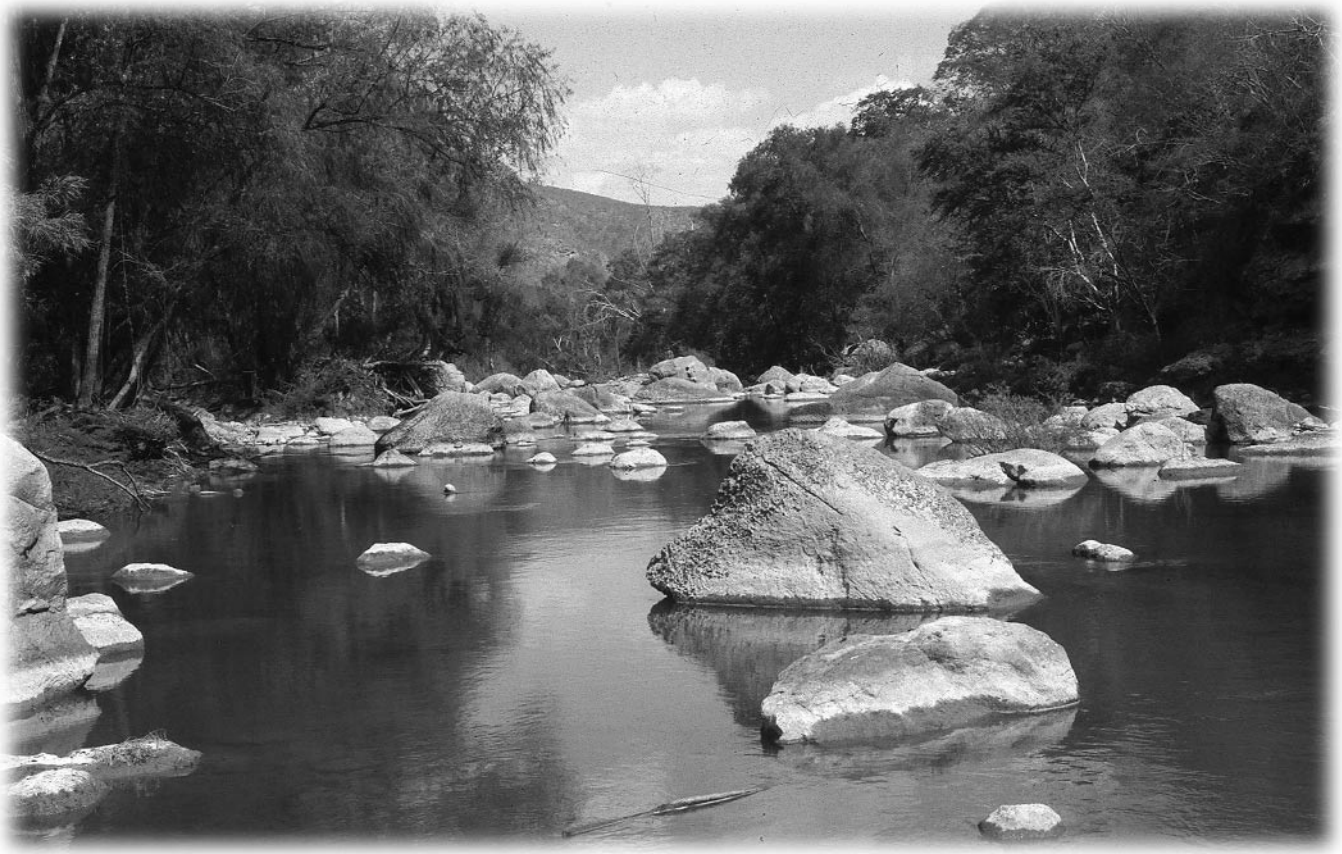

Fig. 1.
The Río Ayuquila, along the northeastern flank of the Sierra de Manantlan, Jalisco.

rivers from Sonora and Baja California, México, to northern Columbia. On the Atlantic side, it occurs from México to Venezuela, as well as in the West Indies and the southern tip of Florida. *Agonostomus monticola* goes by different names in different parts of its range: e.g., "trucha" in México, "dajao" in Puerto Rico and Panama, "sabalete montanero" in Nicaragua, "tepemechin" in Honduras, El Salvador and Costa Rica, and "mountain mullet" in Florida. Scientific nomenclature is nearly as varied. Over the past 100 years, ichthyologists have described several different "species" of *Agonostomus* from Middle America and the Caribbean. Currently, however, these taxa are all considered part of a single morphologically variable species, *A. monticola*.

Despite occupying such a large area, and despite being eagerly sought by fishermen throughout its range, the trucha is poorly known to scientists. For example, much remains to be learned about the reproductive biology of *A. monticola*. In some populations, mature adults appear to undergo a migration down river to the ocean, or to a point in the river or estuary just above the ocean, where they spawn. The actual spawning act has never been observed. It's unclear whether these trucha die after spawning or whether they return to their river homes and survive to spawn in future years. In other populations, downstream spawning migrations have not been documented, although they might occur. In any case, by some process, eggs or newly hatched larvae end up in estuaries or in the ocean. Larvae spend an unknown amount of time there before metamorphosing into juveniles and ascending into fresh water in large groups. Trucha remain in fresh water until they reach spawning age, when the reproductive cycle begins anew.

Only limited information is available on other aspects of the biology of *A. monticola*. The trucha is omnivorous in food habits, with a very broad diet. Items reported from trucha stomachs include aquatic and terrestrial insects, shrimp, small fish, algae, and freshwater sponges. Truchas have been known to bite hooks baited with a piece of avocado. The preferred habitat of truchas seems to be deep pools or runs at the base of rapids or waterfalls. Truchas are strong swimmers and often occupy areas of heavy current. Little else is known about the ecology of the species.

Like all mullets, *A. monticola* is skittish, darting around frantically and often jumping out of the water at the slightest hint of danger. This behavior makes the trucha difficult to observe in the wild, and nearly impossible to keep in captivity.

Fig. 2.
Sarahy Contreras recording data along the Arroyo Manantlan, one of the larger tributaries of the Río Ayuquila in the Sierra de Manantlan.

However, the Sierra de Manantlan has several other fishes, particularly in the families Poeciliidae and Goodeidae, that have excellent potential for the aquarium hobbyist. In our study of the trucha, as well as during our previous survey, we were able to collect information about these other species. Several of them are endemic—that is, they are found nowhere else in the world but the region of the Sierra de Manantlan, located about 30 miles inland from the Pacific on the border of the Mexican states of Jalisco and Colima. A few of the fishes of the Sierra de Manantlan have shown up in rare occasions in the United States or Europe, but generally they are unknown to the average aquarist.

My top choice for the aquarium among Sierra de Manantlan fishes is the dwarf molly, *Poecilia chica*. This fish is found only in the Marabasco, Purificación, and Cuitzmala basins, short river systems that drain into the Pacific Ocean from the southwestern slopes of the Sierra de Manantlan and the Sierra de Cacoma, located just to the north. *Poecilia chica*'s specific name is the Spanish word for "small," reflecting this molly's diminutive maximum size, usually 35-45 mm total length (TL). Breeding males are beautiful, with dark blue coloration on the dorsal surface and the head and tail regions, orange-red flecks on the flanks, and light blue in the ventral area. The dorsal fin is distinctly marked with dark blue and orange. Unfortunately, my description is from memory, because my slides of this species never came out. I often observed *P. chica* in high densities in small, shallow, slow-moving pools, so it should do well in tanks. A livebearer, it should also be fairly easy to breed in an aquarium.

Three other poeciliids—Pacific molly, *Poecilia butleri*; golden livebearer, *Poeciliopsis baenschi*; blackspotted livebearer, *Poeciliopsis turneri*—occur in the Sierra de Manantlan; while not as colorful as *P. chica*, they should also do well in aquaria and be easy to breed. *Poeciliopsis turneri* is endemic to the Purificación and Marabasco basins, and *P. baenschi* is thus far known only from Pacific slope rivers between Puerto Vallarta and Colima, México. Most records of this species are from the Sierra de Manantlan Biosphere Reserve. *Poecilia butleri* is more widespread, occurring in lowland streams along the Pacific coast of México and Guatemala.

Three members of the Goodeidae occur in the Sierra de Manantlan. Like the poeciliids, they are all livebearers and seem well adapted to life in an aquarium. The bandfin

Fig. 3. Arturo Arechiga throwing a cast net into the Río Ayuquila.

splitfin, *Allodontichthys zonistius* (Fig. 4), is a bottom dweller, preferring rocky riffles. It rarely exceeds 80 mm TL. Its sides have a rich brown and yellow-gold coloration and are strongly barred. It occurs only in the Río Ayuquila/Armeria system, along the northern and eastern flanks of the Sierra de Manantlan.

The leopard splitfin, *Xenotaenia resolanae*, the only member of its genus, is another Sierra de Manantlan endemic. It occurs only in the Purificación and Marabasco basins. Habitat degradation and pollution have eliminated this species from the locality where it was first captured and described, and it now occurs only in small headwater creeks, where it is sometimes the only fish present. A small but robust species, *X. resolanae* has numerous chocolate-brown spots on an orange-brown body.

The goldbreast splitfin, *Ilyodon furcidens* (Fig. 4) is the jack of all trades in the Sierra de Manantlan. It is the most widespread and most numerous fish in the region, occurring in a wide range of habitats, and tolerating a wide range of environmental conditions. It is found throughout west-central México, and its biology has been studied in detail in streams south of the Sierra de Manantlan in Colima. It is also the Sierra de Manantlan goodeid most likely to be encountered in pet stores in the United States, although it is by no means easily found. A species highly variable in appearance, *I. furcidens* generally has an olive-yellow body overlain with gray or brown stripes or spots.

Cichlid fanciers will find something of interest among Sierra de Manantlan fishes. Three cichlids occur in the region, but only one, the redside cichlid, *Cichlasoma istlanum* (Fig. 5), is native. *Cichlasoma istlanum* is a small (less than 150 mm TL) but colorful species found in large rivers along the west-central coast of México. Large males are particularly attractive, with a green head and nuchal hump, an orange ventral surface, and light blue spots on the flanks.

The two other cichlids—blue tilapia, *Oreochromis aureus,* and redbreast tilapia, *Tilapia rendalli* (Fig. 6)—are originally native to Africa and the Middle East. Several species of tilapias were brought into México for aquaculture about 30 years ago; many escaped or were deliberately released and then established populations in the wild. Both *O. aureus* and *T. rendalli* are common in large rivers around the Sierra de Manantlan, and they are important for food. *Oreochromis aureus* is the largest freshwater fish that we encountered in the Sierra de Manantlan, with large specimens exceeding a pound in weight and 250 mm in length. Their large circular

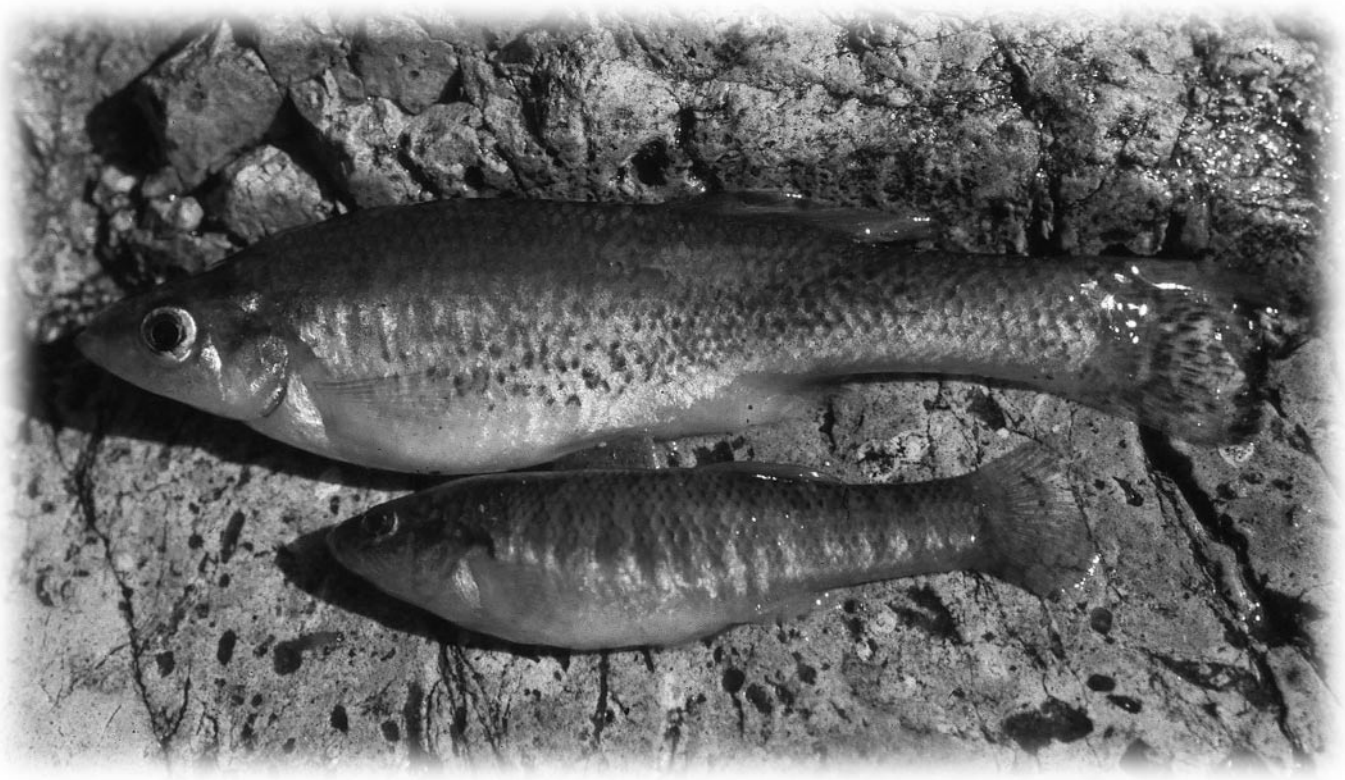

Fig. 4.
Two Sierra de Manantlan goodeids.
Top: *Ilyodon furcidens*.
Bottom: *Allodontichthys zonistius*.

pit nests are conspicuous features of sand bottom pools in the Río Ayquila and Río Marabasco. Adult males are silver with dark spots and a bright red edge to their tail and dorsal fin. *Tilapia rendalli* is a smaller species, usually not exceeding 200 mm TL in our samples. It is not as colorful as *O. aureus*, but it is nonetheless a handsome fish. Because of their widespread use in aquaculture, both *O. aureus* and *T. rendalli* should be available to aquarium hobbyists in the United States.

Four other species occur in the Sierra de Manantlan: banded tetra (*Astyanax aeneus*); west Mexican redhorse (*Scartomyzon austrinus*); Lerma catfish (*Ictalurus dugesi*); and spotted goby (*Sicydium multipunctatum*). *Astyanax aeneus* does well in captivity and is sometimes available in the United States, although it is an aggressive species that is probably not desirable in a community tank. *Sicydium multipunctatum* occurs sporadically along the Pacific slope, from central México to Honduras. A benthic algae scraper, it would probably make an excellent aquarium species, although I doubt it has ever been available to hobbyists. *Scartomyzon austrinus* and *Ictalurus dugesi* (Fig. 7) are southern representatives of common and widespread North American families. They are found only in central and northern México. Both reach a large size (over 200 mm TL), but, like their many close relatives to the north, should do well in tanks when small. However, neither species has yet made an appearance in United States pet shops.

Studying fishes in the Sierra de Manantlan has been very different from what I'm used to in the United States, but in a very positive way. In the Sierra de Manantlan, even the most tedious aspects of field work take on an air of adventure owing to the beauty, remoteness, and unfamiliarity of the region and its fauna. I have particularly enjoyed the friendliness and generosity of the local people in the Sierra de Manantlan. Although very poor by United States standards, they, nonetheless, have been willing to share what they have, going so far as to loan us their houses, help carry our equipment, and invite us to eat in their homes when we sampled particularly remote locations.

Fishermen whom we encountered along rivers would often offer us part of their catch, which proved to be an excellent way to get specimens of some of the larger, more elusive species. As these fishermen were usually offering us part of their food for the next few days, I always wanted to pay them for their fish. This lead to an interesting phenomenon that I termed "reverse bargaining," a type of bargaining that you will never see in Mexican markets. Initially, we would ask the fishermen if we could purchase some of their fish. Typically, they would offer us any and all of the fish we wanted for free. We would counter with an offer to pay what we

Fig. 5.
Head of breeding male *Cichlasoma istlanum*.

estimated that they might get for their catch if they were to sell it in town. They would insist that that was a ridiculously high price and counter with what was truly a ridiculously low price. We would go back and forth like this for several minutes, our group gradually agreeing to pay less, and the fishermen grudgingly agreeing to accept more. Finally, we'd settle on a price, typically less than $0.50 U.S. for two or three fish.

I was first introduced to the Sierra de Manantlan by Eduardo Santana, a friend from graduate school. Eduardo is the head of the Fauna (animal studies) Section of the Laboratorio Natural Las Joyas. The Laboratorio was established to help guide the management of the Sierra de Manantlan Biosphere Reserve. In a biosphere reserve, unlike in other types of reserves or national parks, the people are not forced to leave but, instead, are integrated into the functioning and management of the reserve ecosystem. Such a model of reserve operation is unfamiliar to most Americans, but is gaining in popularity in Latin America. In many instances, it is the only viable way to protect important ecosystems in less developed nations.

It's possible, perhaps probable, that none of the fishes of the Sierra de Manantlan will ever we widely available or popular in the aquarium trade. Nonetheless, the long term success or failure of the Sierra de Manantlan Biosphere Reserve has important implications for freshwater aquarium enthusiasts everywhere. Tropical aquatic habitats, the ultimate source of most aquarium fishes, are being degraded, and in many cases eliminated, at an alarming rate. Prompt action is needed to protect those areas that remain relatively undisturbed. If the Biosphere Reserve concept is successful in conserving the aquatic fauna of the Sierra de Manantlan, then the Sierra de Manantlan can serve as a model and inspiration for similar reserves in other areas of México and in other tropical nations. Such a model is urgently needed if many valuable tropical aquatic habitats are to persist beyond the 21st century.

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Fig. 6.
The three cichlids that occur in the Sierra de Manantlan.
Top: *Tilapia rendalli*. Middle: *Cichlasoma istlanum*.
Bottom: *Oreochromis aureus* (breeding male).

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Fig. 7.
Ictalurus dugesi, the catfish of the Sierra de Manantlan.

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The “trucha de tierra caliente,” or mountain mullet, Agonostomus monticola. A recently attached tag is visible high on the flank of the fish. Photograph by John Lyons.

trucha de tierra caliente

“trout of the fiery lands”

Agonostomus monticola (Bancroft, 1836)

Family: Mugilidae

Although largely unfamiliar to most native fish enthusiasts, the predominantly marine and brackish water mullet family(Mugilidae) contains four species that occur in North American fresh waters. The mountain mullet ranges from southern U.S. (North Carolina to Texas), México, Central America, and the West Indies south to Columbia and Venezuela. Juveniles, subadults, and adults inhabit fresh waters, whereas larvae are found in the ocean. In tropical regions, the mountain mullet is one of the few species able to ascend headwater streams (hence its name). The striped mullet, Mugil cephalus, enters fresh waters along the Atlantic coast from Nova Scotia to Brazil. The white mullet, Mugil curema, has a more tropical distribution; it enters fresh waters along both the Atlantic and northern Gulf coasts from Massachusetts to Brazil. The hognose mullet, Joturus pichardi, enters upland streams in the Papaloapan drainage of Central Mexico.