

# ZACAPU LAKE, A HOT SPOT OF NATIVE FISHES



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Zacapu Lake is one of the most important areas in central Mexico for aquatic fauna conservation. The lake is located in the state of Michoacán, México (Figure 1) and is a remnant of the desiccation and channelization of an older lake of greater area. The lake's surface area encompasses 40 hectares (16 acres), which includes adjoining wetlands. The lake is fed by numerous tributaries forming a refuge for several native species. This lake has about 20 springs of cool water (i.e., 19°C or 66°F), which emerge in the extreme southwest portion of the Zacapu Valley. The largest springs are La Angostura, La Zarcita, and El Ojo de Agua. Some of the springs are used for drinking water and recreation. According to the International Union for Conservation of Nature and Mexican legislation, the lake hosts two threatened and one endangered fish species. It also hosts two endemic fishes whose entire distribution range is limited to this lake. In 2003, Zacapu Lake was declared a Protected Natural Area to legally guarantee its conservation. In 2005, a management plan for the Protected Natural Area was created. However, the health of the aquatic system has been degraded by anthropogenic activities that put at risk the survival of the lake's native species. In addition, the lack of basic knowledge about the biology and ecology of the species that inhabit the lake further increases the problems of conservation of habitat and species. For the following reasons, this Natural Protected Area is critically threatened: more than 50% of the shoreline has been developed, several non-native species have been introduced, and the lake's water level has been dropping.

The lake's native fish fauna includes 13 fish species representing four families (Table 1). However, as in other aquatic systems, there are non-native species in Zacapu Lake such as Common

Carp (*Cyprinus carpio*) and Grass Carp (*Ctenopharyngodon idella*), which are both in the family Cyprinidae. Some of the native species, as well as the Common Carp and Grass Carp, are commercially harvested by local fishermen for the consumption by local people.

However, the actual management plan is not currently in force; the fishermen continue to fish, and there is no real protection of the native species and their habitats. For this reason, The UMNSH Biology Aqua Lab will begin a new conservation project with Omar Domínguez-Domínguez as the principal investigator. The purpose of this project is to evaluate the fish populations. The information obtained by the present project will be compared with a previous study by Moncayo-Estrada (1996) to evaluate whether the 2005



Figure 1. Top: Zacapu Lake. Bottom: Google Earth aerial photo and inset showing approximate location in the state of Michoacán (created by Konrad Schmidt).

Photos by Arely Ramírez-García unless otherwise indicated.

Arely Ramírez-García is an UMNSH PhD student in the program of Biological Sciences. Her research focuses on the ecology of freshwater fish communities, reproductive biology, and trophic ecology in native and exotic fishes and trying to understand possible interactions between them. Her main interest is the conservation and management of the native fish of the Americas.

Omar Domínguez-Domínguez is a UMNSH research professor at the Faculty of Biology. His research focus is on the evolutionary history and conservation of marine and freshwater fishes of the Americas using different tools, such as molecular, biogeographic, taxonomic, and ecologic. His principal interest is understanding the processes and patterns that have shaped the diversity of fishes, and to provide valuable tools for the conservation and management of fish diversity.

Table 1. Summary of the fish species from Zacapu Lake.

English Common Name	Scientific Name	Spanish Common Name	IUCN Red List and/or regional conservation status (Mexican Official Red List NOM-SEMARNAT-2010)	Native or Non-native	Consumed as food
<b>Cyprinidae — Minnows</b>					
Spottail Chub	<i>Algansea tincella</i>	Pulpo del valle	Has not yet been assessed for the IUCN	Native	Yes
Grass Carp	<i>Ctenopharyngodon idella</i>	Carpa herbívora		Non-native	Yes
Common Carp	<i>Cyprinus carpio</i>	Carpa común		Non-native	Yes
Zacapu Shiner	<i>Notropis grandis</i>	Sardina/Carpita zacapence	Has not yet been assessed for the IUCN	Native, Endemic	Yes
<b>Goodeidae — Goodeids</b>					
Bulldog Goodeid	<i>Allophorus robustus</i>	Chegua	Has not yet been assessed for the IUCN	Native	Yes
Zacapu Allotoca	<i>Allotoca zacapuensis</i>	Tiro Catarina	Has not yet been assessed for the IUCN	Native, Endemic	No
Blackfin Goodea	<i>Goodea atripinnis</i>	Tiro	Least Concern IUCN	Native	Yes
Highland Splitfin	<i>Hubbsina turneri*</i>	Cherehuita	Critically Endangered IUCN/ Endangered	Native	No
Olive Skiffia	<i>Skiffia lermæ</i>	Tiro olivo	Threatened, NOM-2010	Native	No
Picote Splitfin	<i>Zoogoneticus quitzeoensis</i>	Burrita/Picote la Luz	Threatened, NOM-2010	Native	No
Jeweled Splitfin	<i>Xenotoca variata</i>	Pintada	Has not yet been assessed for the IUCN	Native	Yes
<b>Atherinopsidae — New World Silversides</b>					
Shortfin Silverside	<i>Chiostoma humboldtianum</i>	Pescado blanco de Zacapu	Has not yet been assessed for the IUCN	Native	Yes
<b>Poeciliidae — Livebearers</b>					
Lerma Livebearer	<i>Poeciliopsis infans</i>	Guapote del Lerma	Has not yet been assessed for the IUCN	Native	No
<p>*<i>American Currents</i> follows the American Fisheries Society's <i>Common and Scientific Names of Fishes from Canada, the United States, and Mexico</i> (Page et al. 2013) which places <i>Hubbsina</i> in the genus <i>Girardinichthys</i>. Some consider it a separate species, others (including UMNSH researchers) don't recognize <i>G. ireneae</i>. If you consider them separate, <i>G. turneri</i> is limited to the endorheic Rio Cuitzeo basin near Morelia and <i>G. ireneae</i> to the Rio Angulo (including Zacapu) subbasin of the middle Lerma basin. UMNSH and some others consider them all to be one species, and they use the old generic name, <i>H. turneri</i>. (John Lyons, Curator of Fishes, University of Wisconsin Zoological Museum.)</p>					

management plan for the Zacapu Lake is helping to preserve the lake environment and its species. If needed, the study will recommend modification to the management plan for use by decision makers.

One of the most important tasks in conservation and natural sciences is the transfer of the knowledge and ideas to society for the sustainable development and conservation of natural resources. The specific goals of the UMSNH study are to: (1) evaluate the health of fish populations in the lake, (2) characterize the limnological (physical, chemical, and biological) attributes of the lake, (3) evaluate the reproductive and feeding ecology of the species, (4) identify the impact of anthropogenic activities in the watershed and in the lake, and (5) develop an environmental education program in order to involve the local people in the preservation of this natural treasure, Zacapu Lake. The overall aim of this project is to collaborate with government and society to provide for the long-term conservation of the Zacapu Lake environment and its species. Our role is to assist in developing a management plan. We hope to instill new attitudes with local fishermen for the long-term sustainability of the lake's fisheries. The project will also train local people and teachers to allow them to implement their own environmental education plans in the schools and the community in general. As a result of the project, the municipal government will have an assessment of the existing

management plan and will have the knowledge to improve it, including guidelines for maintaining the environmental services the lake provides that range from scenic beauty to fisheries to climate regulation. Training in conservation and natural resource management will also be provided.

This project is just beginning, but UMSNH is committed to the conservation of the native fish species of the Zacapu Lake.

#### Literature Cited

- DOF 30/12/2010. "Norma Oficial Mexicana NOM-059-SEMARNAT-2010: Protección ambiental-Especies nativas de México de flora y fauna silvestres-Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio-Lista de especies en riesgo," *Repositorio Digital Especializado*, accessed April 20, 2019, <http://www.monitoreoforestal.gob.mx/repositorioidigital/items/show/447>.
- Moncayo-Estrada, R., 1996. *Estructura y función de la comunidad de peces de la laguna de Zacapu Michoacán, México* (Master's dissertation, Instituto Politécnico Nacional. Centro Interdisciplinario de Ciencias Marinas), Mexico City.
- Page, L.M., H. Espinosa-Pérez, L.T. Findley, C.R. Gilbert, R.N. Lea, N.E. Mandrak, R.L. Mayden, and J.S. Nelson (2013). *Common and Scientific Names of Fishes from the United States, Canada, and Mexico*. Seventh Edition. American Fisheries Society. 394 p.



Figure 2. Left, top to bottom: Zacapu Shiner, Shortfin Silverside, Picote Splitfin, Bulldog Goodeid, Olive Skiffia. Right, top to bottom: Highfin Splitfin, Jeweled Splitfin (pregnant females), Blackfin Goodea, and Arely holding a Grass Carp (photo by Ricardo Valencia Vargas).