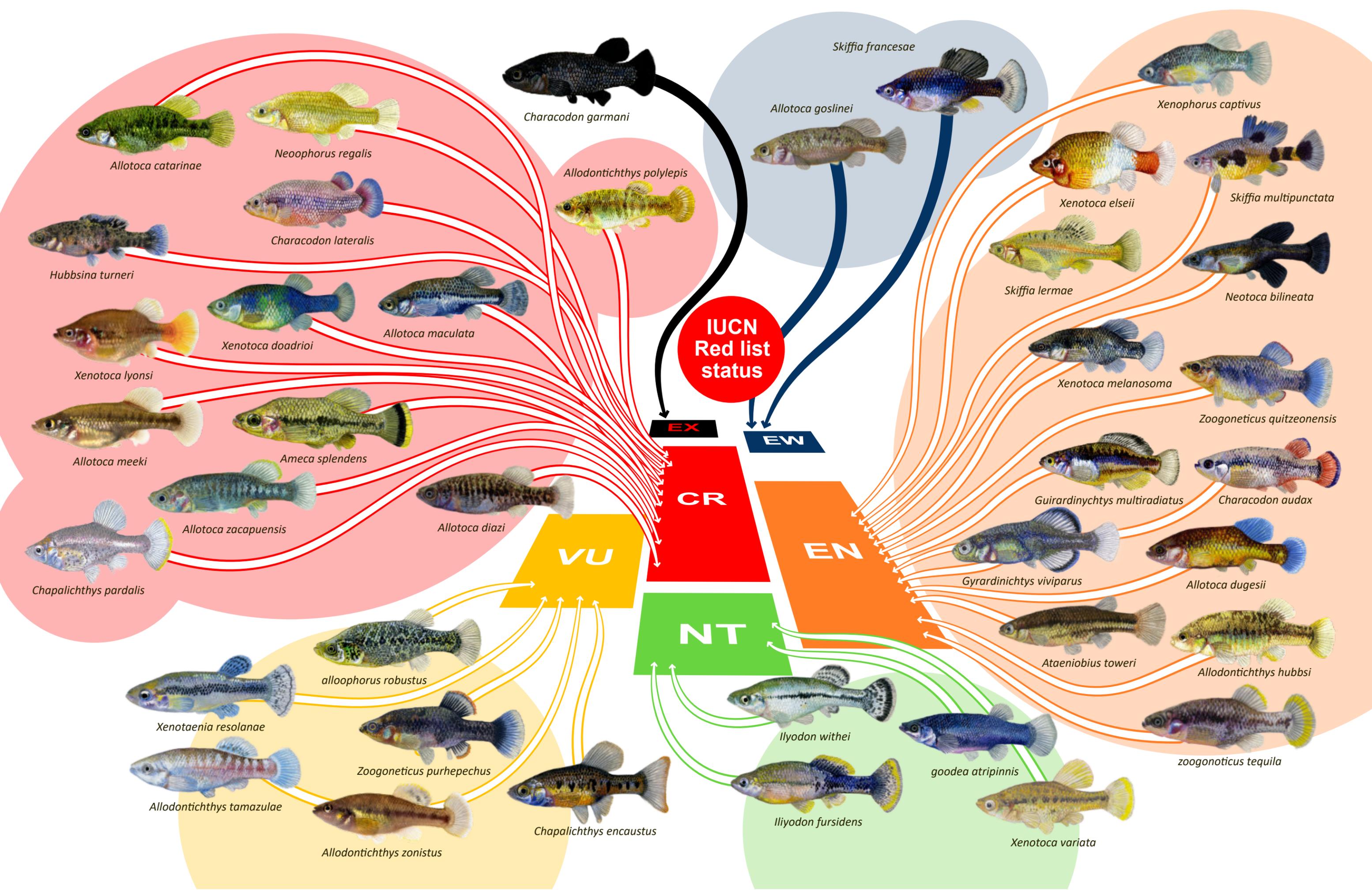
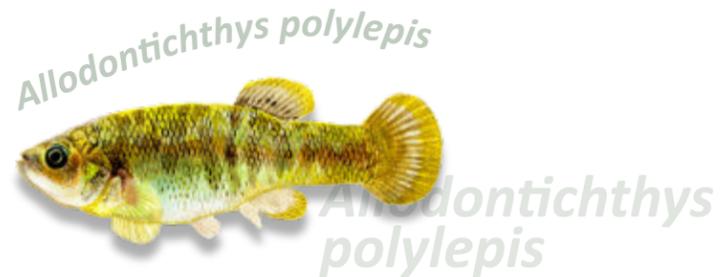




**Action Plan for the
Conservation of Mexico's
Goodeid Fishes
2023 - 2033**







Workshop convened and organised by Universidad Michoacana San Nicolás de Hidalgo (UMSNH), IUCN SSC Freshwater Conservation Committee, Chester Zoo, SHOAL

Funded by Chester Zoo

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Foreword

In seeking to address the global biodiversity crisis occurring in freshwater ecosystems, the International Union for Conservation of Nature/Species Survival Commission (IUCN/SSC) created the Freshwater Conservation Committee (FCC) in 2008. One of the committee's first tasks was to promote the global freshwater fish assessment using Red List criteria, a goal that has been reached this year.

However, we also aim to go beyond risk assessment, so for the last 6 years, the SSC has promoted the Species Conservation Cycle, which aims to generate strategic alliances for the implementation of conservation actions that will lead to the protection of threatened species. Once the assessment of Mexico's 536 freshwater fish species was completed in 2020, around 40% of these were found to be threatened. With 21 extinctions (13 Extinct and 8 Extinct in the Wild) having already occurred, Mexico is the country with the largest number of lost species. Therefore, we reached the conclusion that Mexico should become a global focal point for actions to address the current crisis.

As a result of this, we have promoted the establishment of alliances to develop conservation projects in different regions of Mexico. Considering that Mexico's Goodeidae species are among the most emblematic fishes to inhabit Mexican freshwater habitats, we decided to join this effort to develop and implement a strategic plan that has as its main objective the conservation of this important group of fishes.

Topiltzin Contreras-MacBeath

**Head of the Conservation Biology Research Group at the University of Morelos, México
Co-Chair, Freshwater Conservation Committee, IUCN Species Survival Commission**



Foreword

The Goodeid Working Group (GWG) was founded in 2009, out of concern for the dramatic population declines of many species of Splitfins, and the large-scale loss and deterioration of their freshwater habitats. We wondered how we - at the time, a small group of volunteers with almost no financial resources - could do something to help. Despite of our wish to support the conservation of wild populations, our initial efforts were limited to ex situ breeding of species, and the coordination of international meetings to network, exchange fish, and increase awareness.

From 2014, our hopes for making a contribution to the conservation of these species in the wild started to take shape through habitat surveys, and we felt like our wish to one day change the fate of this group of fishes was becoming ever more tangible. Even when conservation breeding is a proven tool for maintaining sustainable ex situ populations, the only key to successful species conservation is sustainable protection of wild populations. This key can only be provided by dedicated people and organisations, working closely together, with the utmost effort, for a common cause. It is important that all participants are integrated into a living network, where the specialist skills of each one of them contributes their part toward achieving this goal. This network creates projects, implements them, evaluates the outcome, and ensures long-term success.

But what does this have to do with Goodeids? Everything: fourteen years after our foundation, the Goodeid Working Group is now part of such a network, and for the first time ever there is a chance to save this amazing group of fishes for future generations. The Action Plan for the Conservation of Mexico's Goodeid Fishes, or Plan G as we now affectionately call it, is that network: the projects, their implementation and monitoring, and above all, the guarantee for the long-term survival of Mexican Goodeids. In 2009, the GWG dedicated their efforts to a unique group of fishes on the brink of extinction. Fourteen years later, Plan G has brought us together with a whole host of other stakeholders: researchers, conservationists, government bodies, zoos and aquaria, to work for their future. We are able to change the world, and Plan G is one step to do so, so let's do it. Together.

Michael Köck
Cofounder and Chair - Goodeid Working Group



Executive summary

Central Mexico is a region of special interest for the conservation of freshwater fishes. The endemic subfamily Goodeinae, which is mostly found along the Mesa Central, is highly threatened, with the majority of its 40 species are either Critically Endangered or Endangered, 1 is Extinct, and 2 are Extinct in the Wild. High levels of micro-endemicity makes these species particularly vulnerable to extinction, whilst their unique reproductive strategies and adaptations make them highly distinct from an evolutionary perspective. Freshwater environments across their range have been severely altered by anthropogenic activities.

This document is the product of a planning workshop that took place in October 2022, which brought together stakeholders from Mexico, Europe and the U.S.A, including researchers, government bodies, NGOs, conservation organisations, aquarists, zoos and aquaria. The programme of the workshop included introductory presentations on the current status of Mexican Goodeids, successful conservation case studies, an overview of freshwater and threatened species conservation under Mexican law, ex situ Goodeid networks and the challenge of communicating Goodeid conservation to a wider audience. The participants worked together to define the vision and scope for the plan, measures of success, priority species and locations, and to define, strategy lines, goals, actions and targets.

A governance structure was put in place for the ongoing monitoring and evaluation of the action plan, with reporting mechanisms and timeframes agreed, and an administrative team established to oversee the delivery of actions, and coordination of these within the framework of the plan.

The plan has a projected lifespan of ten years. We fully expect the focal species and their habitats to require further conservation efforts beyond this timeframe, and hope that a new plan will be created when that moment arrives, in response to this need. However, it is our hope that this plan will succeed in establishing robust and holistic management structures and processes, partnerships, methodologies, and the implementation and evaluation of successful, replicable case studies, that will lay the foundations for a viable future for Mexico's goodeid fishes.



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Introduction

Mexico is home to some 520 species of freshwater fishes, of which 163 are endemic. Central Mexico has especially high fish species richness and endemism (70%), and is considered by the World Conservation Monitoring Centre as a region of special interest for the conservation of freshwater fishes. The Goodeidae are a family of fishes that is distributed between Mexico and the United States, which includes the subfamily Goodeinae,

which is endemic to Mexico. Its 41 species from 19 genera are mostly found along the Mesa Central. Many of these species are micro endemic to an individual river or spring. This group presents reproductive characteristics that are, amongst fishes, unique to live bearing species: internal fertilisation, matrotrophy, and viviparity.

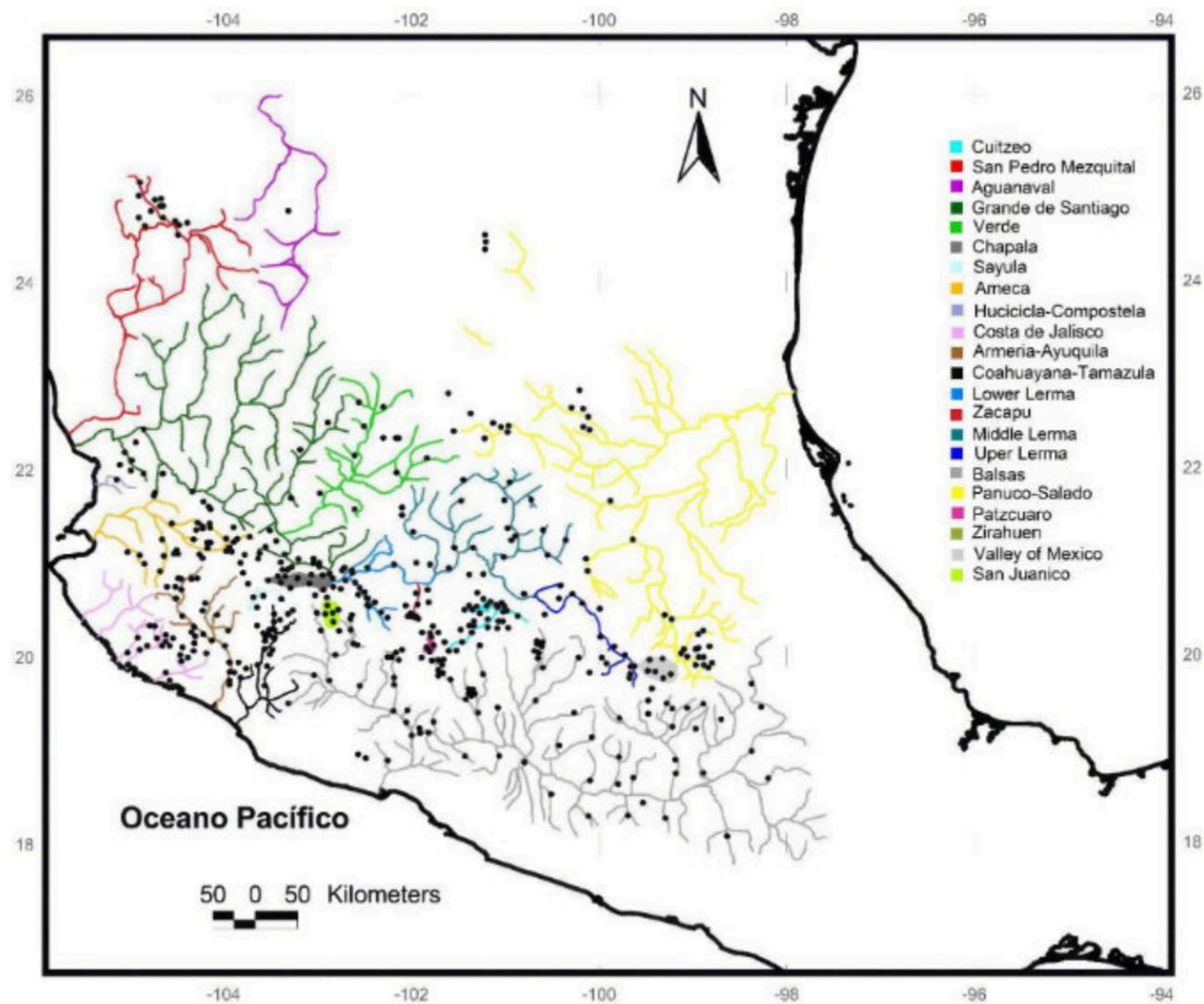


Figure 1. Distribution of the subfamily Goodeinae in Mexico's Mesa Central and adjacent regions. Each point represents a collection locality of at least one species of Goodeidae recorded in ichthyological databases. (Dominguez-Dominguez et al., 2010)

Freshwater environments across the distribution range of the subfamily have been severely altered by anthropogenic activities, including the introduction of exotic species and their parasites, pollution, water extraction, hydraulic and hydropower infrastructure, deforestation, overfishing, urban development, livestock production, agriculture, commercial and industrial development, and tourism and recreation. In the case of the Goodeinae, many species are particularly vulnerable, due to their very limited distribution ranges. The IUCN Red List currently lists nearly three quarters of the 40 species as being either Critically Endangered (13 sp.), or Endangered (14 spp.).

The proposal for a planning workshop for the conservation of Mexico's Goodeid fishes came about as a result of collaborative work between the Michoacán University's Mexico Fish Ark and Chester Zoo in the United Kingdom. Established in 1998, the Fish Ark has received funding and technical support from Chester Zoo since the year 2000. In 2014, this collaboration led to the initiation of the project to reintroduce an Extinct in the Wild Goodeid species, the Tequila splitfin (*Zoogoneticus tequila*), back into its former habitat in the Teuchitlán River in Jalisco State. In the wake of this initiative, both organisations discussed how they could capitalise on this success in order to further support the conservation of Mexican Goodeid species, and to continue developing the role of the Fish Ark as a focal point for these activities. Following on from these discussions, they reached out to the IUCN SSC Freshwater Conservation Committee and to SHOAL Conservation, both of whom expressed a shared interest in Mexican freshwater

conservation, and all four parties agreed to work together toward a planning workshop for the conservation of Mexican Goodeid fishes.

The workshop took place in October 2022, bringing together stakeholders from Mexico, Europe and the U.S.A, including researchers, conservation organisations, zoos, aquaria, and government bodies. Participants were able to attend in-person, or remotely via Google Meets.

Species, Conservation Status and Threats

A comprehensive review of the major threats affecting Mexican freshwater fish species and their habitats is provided by Lyons et al. in *The Status and Distribution of Freshwater Fishes in Mexico* (2020). Following IUCN threat categorisations, the major threats affecting freshwater fishes throughout the country are described as being (from greatest to least number of species threatened): dams & water management/use; agricultural & forestry effluents; invasive alien species; domestic & urban wastewater; livestock farming & ranching; tourism & recreational development; industrial & military effluents; housing & urban development; fishing & harvesting aquatic resources, and; commercial and industrial development.

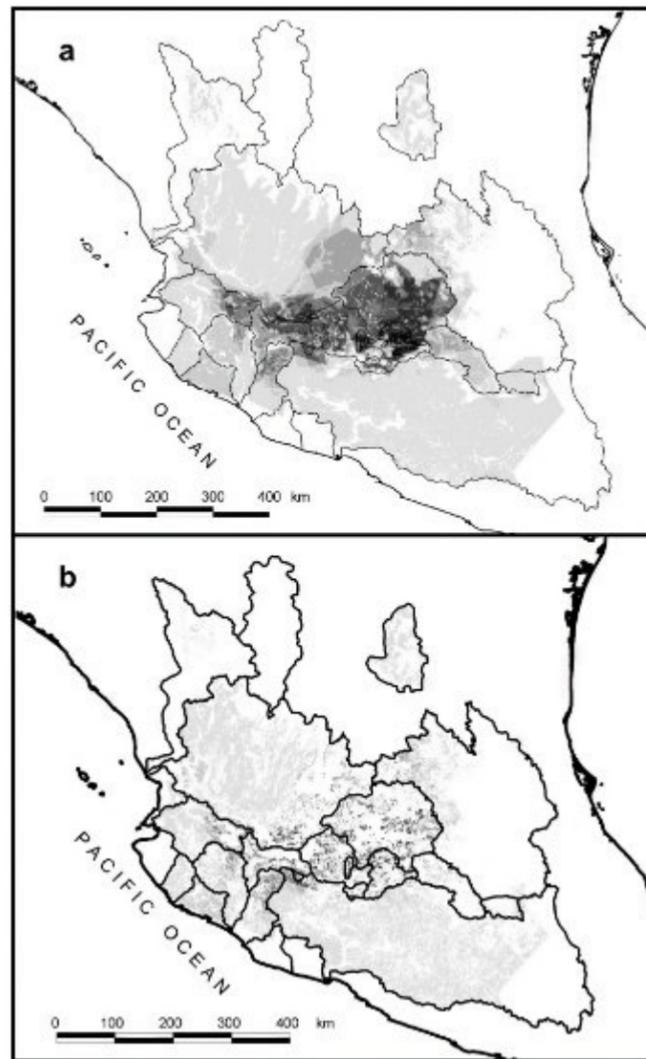


Figure 2. Map of (a) modelled potential goodeine species richness (darker areas represent higher numbers of species; maximum eight) and (b) species richness and transformed habitat. White areas within the distributional range of Goodeines represent original vegetation types transformed to human-related habitat. (Dominguez-Dominguez *et al.*, 2006)

In Table 1, all Goodeine species are grouped according to their IUCN Red List status (with each species Mexican NOM-059 status also shown), and shows which of the above threats affects each species, according to its Red List assessment. Table 2. shows additional threats that are also named in the red list assessment for each species. Generally speaking, Goodeines reflect the pattern of threats that Lyons et al. report across all species of Mexican freshwater fishes, with a few minor differences.

The presence of invasive alien species is the most commonly identified threat in the Red List assessments, affecting all extant Goodeine species, whereas in Lyons et al., this threat is in third place in terms of the number of species affected. Despite this slight difference, the four most common threat categories listed in Lyons et al. (dams & water management/use; agricultural & forestry effluents; invasive alien species; domestic & urban wastewater), are also the four most common threat categories mentioned in the Red List assessments of all Goodeine species.

Tourism & recreational development appears to affect a relatively small number (4) of Goodeine species, when compared with Mexican freshwater

fishes as a whole; however, it should be noted that Recreational activities, which is not mentioned by Lyons et al., is listed as a threat for 17 species. The descriptions provided by IUCN describe the former category as being specifically about development activities (e.g. construction), whereas the latter refers to ongoing, established recreational activities. It may be the case that in Lyons et al., a single category description is used as an umbrella for both categories, which would explain this apparent difference between Goodeines and freshwater fish in the wider sense. Regardless, it should be noted that recreational and tourist use of water bodies where Goodeines occur is an important threat for many species.

The overall pattern of threats indicates that a key issue in regard to the conservation of Mexican Goodeid fishes (and other freshwater species) is the management and protection of the aquatic ecosystems that they inhabit: water use, physical alteration of the habitat and pollution are all factors that are negatively affecting freshwater habitats where Goodeines occur. As well as acting as direct threats in their own right, these factors also jeopardise the resilience of populations in the face of added pressures such as competition or depredation by non-native invasive species.

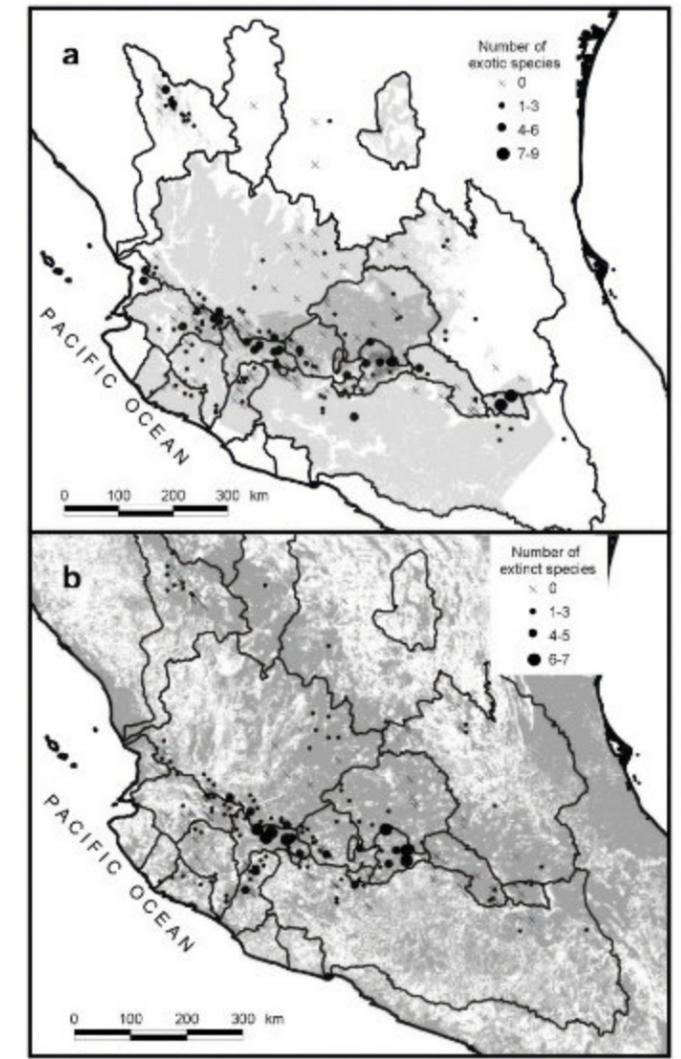
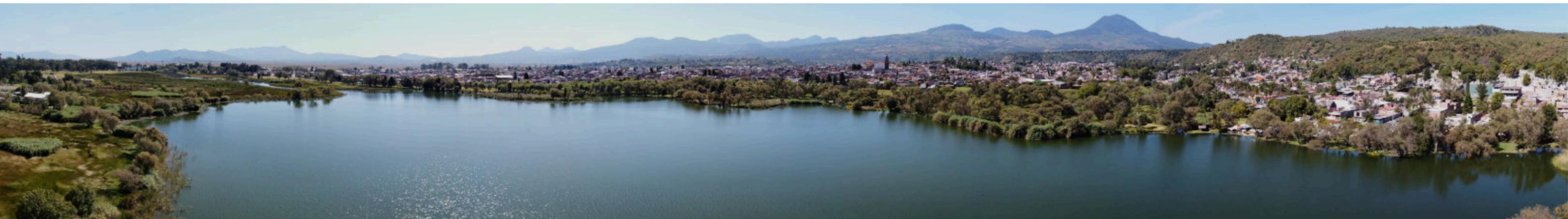


Figure 3. Maps of two disturbance factors for goodeine fishes: (a) incidence of exotic species in goodeine localities (higher goodeine richness represented by darker shades of grey); symbols are numbers of exotic species in each locality and (b) local extinctions of goodeines and three levels of natural vegetation degradation (white, pristine vegetation; light grey, mixture of natural and secondary vegetation; darker grey, completely transformed environments [urban, agriculture, and other deforested areas]; symbols are the number of extinct species in each locality. (Dominguez-Dominguez *et al.*, 2006)



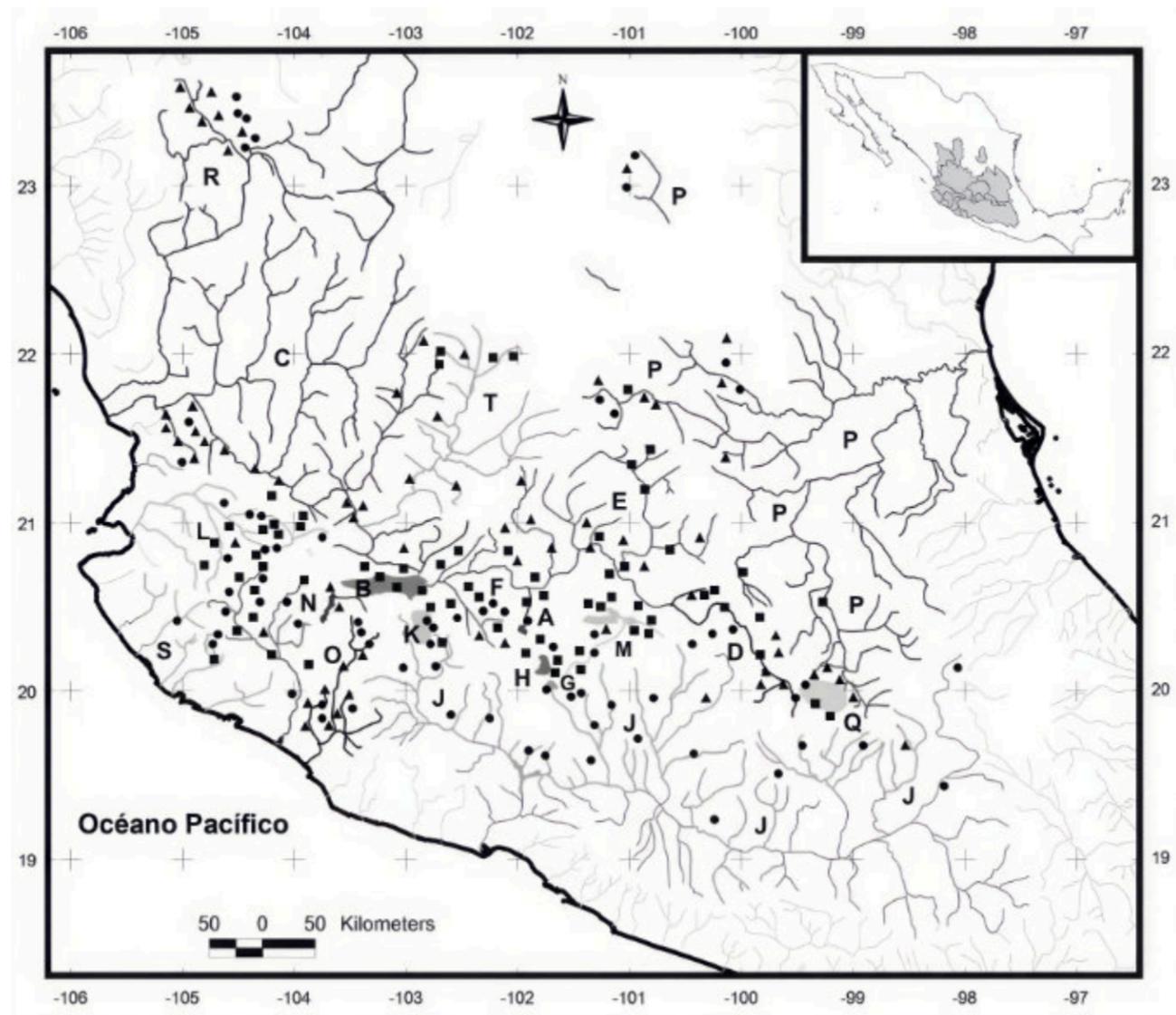


Figure 4. Comparison between historical goodeid distribution records and surveys undertaken between 1999 and 2004: ● locations where new surveys matched historical data; ■ locations where some of the species that had been previously recorded were not found to be present; ▲ locations where none of the species that had been previously recorded were found to be present. The letters indicate regions: A= Zacapu, B= Chapala, C= Santiago, D= Alto Lerma, E= Medio Lerma, F=Bajo Lerma, G=Zirahuén, H= Pátzcuaro, J= Balsas, K= Cotija, L= Ameca, M= Cuitzeo, N= Armería-Ayuquila, O= Coahuylana-Tamazula, P= Pánuco, Q= Valle de México, R= Mezquital, S= Purificación-Marabasco, T= Verde. The same symbol can identify 2 localities, where these are very close to each other, some even overlap. (Dominguez-Dominguez *et al.*, 2008)



Many aquatic systems where Goodeids were recorded are now polluted, but others sustain healthy populations (Topiltzin Contreras).

Table 1. Threat categories named in The Status and Distribution of Freshwater Fishes in Mexico (Lyons *et al.* 2020)

IUCN Red List Status	Species	Mexican protection (NOM-059) status	Population trend	Threat categories 'Status & Distribution of Freshwater Fishes in Mexico'									
				Dams & Water Management/Use	Agricultural and Forestry Effluents	Invasive Alien Species	Domestic & Urban Wastewater	Livestock Farming & Ranching	Tourism & Recreation Develeopment	Industrial & Military Effluents	Housing & Urban Development	Fishing & harvesting Aquatic Resources	Commercial & Industrial Development
EX	<i>Characodon garmani</i>	Not classified	No records since 1890's	x									
EW	<i>Allotoca goslinei</i>	Endangered	No records since 2004		x	x						x	
	<i>Skiffia francesae</i>	Extinct	No records since 2008	x	x	x	x	x				x	
CR	<i>Allodontichthys polylepis</i>	Endangered	Decreasing		x	x							
	<i>Allotoca catarinae</i>	Endangered	Decreasing	x		x	x					x	x
	<i>Allotoca diazi</i>	Endangered	Decreasing	x	x	x	x						
	<i>Allotoca maculata</i>	None	Decreasing	x	x	x	x	x				x	x
	<i>Allotoca meeki</i>	None	Decreasing	x		x							
	<i>Allotoca zacapuensis</i>	Not classified	Decreasing	x	x	x	x	x	x			x	
	<i>Ameca splendens</i>	Endangered	Decreasing	x	x	x	x	x					
	<i>Chapalichthys pardalis</i>	None	Decreasing	x	x		x						
	<i>Characodon lateralis</i>	Endangered	Decreasing	x		x	x		x				
	<i>Hubbsina turneri</i>	Endangered	Decreasing	x	x	x	x	x	x			x	
	<i>Neoophorus regalis</i>	Endangered	Decreasing	x	x	x	x						
	<i>Xenotoca doadrioi</i>	Not classified	Decreasing	x	x	x	x		x				
<i>Xenotoca lyonsi</i>	Not classified	Decreasing	x	x	x	x				x			
EN	<i>Allodontichthys hubbsi</i>	Endangered	Decreasing		x	x	x	x	x		x	x	x
	<i>Allotoca dugesii</i>	Endangered	Decreasing	x	x	x	x	x					
	<i>Ataeniobius toweri</i>	Endangered	Unknown	x	x	x				x			
	<i>Characodon audax</i>	Endangered	Decreasing	x		x	x	x					
	<i>Girardinichthys multiradiatus</i>	None	Decreasing		x	x	x	x			x	x	
	<i>Girardinichthys viviparus</i>	Endangered	Decreasing	x	x	x	x					x	x
	<i>Neotoca bilineata</i>	Endangered	Decreasing	x	x	x	x	x					x
	<i>Skiffia lermoe</i>	Threatened	Decreasing	x	x	x	x						
	<i>Skiffia multipunctata</i>	Endangered	Decreasing	x	x	x	x						
	<i>Xenophorus captivus</i>	Endangered	Decreasing	x		x	x						
	<i>Xenotoca eiseni</i>	Under special protection	Decreasing	x	x	x	x		x			x	
	<i>Xenotoca melanosoma</i>	Endangered	Decreasing	x	x	x	x	x	x				
	<i>Zoogoneticus quitzeoensis</i>	Threatened	Decreasing	x	x	x	x						
<i>Zoogoneticus tequila</i>	Endangered	Increasing	x	x	x	x	x	x					
VU	<i>Allodontichthys tamazulae</i>	Endangered	Decreasing	x	x	x	x	x			x	x	x
	<i>Allodontichthys zonistius</i>	None	Decreasing	x	x	x	x						
	<i>Alloophorus robustus</i>	None	Decreasing		x	x	x				x		
	<i>Chapalichthys encaustus</i>	None	Decreasing			x			x			x	
	<i>Xenotaenia resolanae</i>	None	Decreasing		x	x	x	x					
	<i>Zoogoneticus purhepechus</i>	Not classified	Decreasing	x	x	x	x	x					
NT	<i>Goodea atripinnis</i>	None	Decreasing	x	x	x	x	x				x	x
	<i>Ilyodon furcidens</i>	Threatened	Decreasing	x	x	x	x	x		x			
	<i>Ilyodon whitei</i>	None	Decreasing		x	x	x						
	<i>Xenotoca variata</i>	None	Declining	x	x	x	x	x				x	x

Table 2. Additional threat categories mentioned in IUCN Red List Assessments, but not included in The Status and Distribution of Freshwater Fishes in Mexico (Lyons *et al.* 2020)

IUCN Red List Status	Species	Mexican protection (NOM-059) status	Population trend	Other threat categories (IUCN Red List)												
				Droughts	Annual & perennial non-timber crops	Recreational activities	Other ecosystem modifications	Marine & freshwater aquaculture	Wood & pulp plantations	Problematic species/disease of unknown origin	Logging and wood harvesting	Work & other activities	Volcanoes	Wood & pulp plantations	Renewable energy	
EX	<i>Characodon garmani</i>	Not classified	No records since 1890's													
EW	<i>Allotoca goslinei</i>	Endangered	No records since 2004	x	x											
	<i>Skiffia francesae</i>	Extinct	No records since 2008			x										
CR	<i>Allodontichthys polylepis</i>	Endangered	Decreasing	x												
	<i>Allotoca catarinae</i>	Endangered	Decreasing			x			x							
	<i>Allotoca diazi</i>	Endangered	Decreasing		x											
	<i>Allotoca maculata</i>	None	Decreasing		x											
	<i>Allotoca meeki</i>	None	Decreasing													
	<i>Allotoca zacapuensis</i>	Not classified	Decreasing													
	<i>Ameca splendens</i>	Endangered	Decreasing			x			x							
	<i>Chapalichthys pardalis</i>	None	Decreasing		x	x	x									
	<i>Characodon lateralis</i>	Endangered	Decreasing	x	x	x			x							
	<i>Hubbsina turneri</i>	Endangered	Decreasing			x										
	<i>Neoophorus regalis</i>	Endangered	Decreasing		x											
	<i>Xenotoca doadrioi</i>	Not classified	Decreasing	x	x	x										
<i>Xenotoca lyonsi</i>	Not classified	Decreasing								x						
EN	<i>Allodontichthys hubbsi</i>	Endangered	Decreasing		x		x				x					
	<i>Allotoca dugesii</i>	Endangered	Decreasing		x	x										
	<i>Atoeniobius toweri</i>	Endangered	Unknown		x	x										
	<i>Characodon audax</i>	Endangered	Decreasing													
	<i>Girardinichthys multiradiatus</i>	None	Decreasing		x											
	<i>Girardinichthys viviparus</i>	Endangered	Decreasing		x	x										
	<i>Neotoca bilineata</i>	Endangered	Decreasing	x	x											
	<i>Skiffia lermæ</i>	Threatened	Decreasing	x		x										
	<i>Skiffia multipunctata</i>	Endangered	Decreasing			x										
	<i>Xenoophorus captivus</i>	Endangered	Decreasing		x											x
	<i>Xenotoca eiseni</i>	Under special protection	Decreasing			x						x				
	<i>Xenotoca melanosoma</i>	Endangered	Decreasing	x	x											
	<i>Zoogoneticus quitzeoensis</i>	Threatened	Decreasing	x		x										
<i>Zoogoneticus tequila</i>	Endangered	Increasing			x											
VU	<i>Allodontichthys tamazulae</i>	Endangered	Decreasing		x						x	x	x	x		
	<i>Allodontichthys zonistius</i>	None	Decreasing								x				x	
	<i>Alloophorus robustus</i>	None	Decreasing						x							
	<i>Chapalichthys encastus</i>	None	Decreasing		x											
	<i>Xenotaenia resolanae</i>	None	Decreasing		x											
<i>Zoogoneticus purhepechus</i>	Not classified	Decreasing	x	x	x											
NT	<i>Goodea atripinnis</i>	None	Decreasing		x	x										
	<i>Ilyodon furcidens</i>	Threatened	Decreasing	x	x											
	<i>Ilyodon whitei</i>	None	Decreasing													
	<i>Xenotoca variata</i>	None	Declining		x											x



About the Workshop

Overview of the workshop programme and methodology

The workshop was developed following the CPSG Principles and Steps: Plan for action, promote inclusive participation, use sound science, ensure good design and neutral facilitation, reach decisions by consensus, generate and share outputs quickly, and adapt to changing circumstances.

Day 1 - Introductory presentations

The first day of the workshop was focussed on establishing the background and need for an integrated plan for the conservation of the sub-family Goodeinae. Presentations were delivered on key topics to ensure that all participants

understood the context for the workshop. Topics covered by presentations were:

- Mexican Goodeid diversity, distribution, and threats
- In situ conservation actions currently underway for Mexican Goodeids
- The Mexican government's approach to species conservation
- Ex situ Goodeid networks
- Communicating Goodeid conservation

Day 2 - Top-level planning

During the second day, the format turned toward facilitated discussions, to review and agree on the overarching framework that would guide and inform the planning process. Four working groups



were established, to undertake more detailed planning. The working group themes were based on the four thematic areas proposed in by Contreras-MacBeath, Mejia Mojica and Rivas Gonzales' Theory of change for Mexican freshwater fish (2022): 1. Conservation management; 2. Restoration and reintroductions; 3. Explorations to search for possibly extinct species (for the purposes of the workshop, this was broadened to 'Research'), and; 4. Communication and outreach. Aspects of the plan that were covered on this day were:

- Scope and timeframe for the plan
- Defining the vision
- Where to intervene: prioritising species and threats

Strategy lines and objectives

Day 3 - Strategy lines in detail

During the third day of the workshop, the working groups undertook more focussed planning, with each one looking at their theme more closely, in order to propose the main components of each strategy line: objectives, actions, outputs, timeframes, and indicators.

Day 4: Implementation and governance

On the final day of the workshop, roles, responsibilities and procedures for the plan's governance were proposed:

- Governance structure and responsibilities
- Procedures and timeframes for monitoring and evaluation.

Throughout the workshop, the outcomes of discussions within working groups were regularly shared in whole-group plenaries, so that these could be sense-checked by all participants. A review of the whole plan was undertaken at the end of the workshop, and a final validation review amongst the organising team was held in July 2023.

Participating stakeholder groups

The workshop was attended by 29 stakeholders, representing 20 institutions relevant to the conservation of the subfamily Goodeinae. The complete list of participants is in APPENDIX I.

Academia

- Instituto Politécnico Nacional
- Universidad Autónoma del Estado de Morelos
- Universidad de Guadalajara - Museo de Ciencias Ambientales
- Universidad Michoacana San Nicolás de Hidalgo
- Universidad Nacional Autónoma de México
- Wisconsin University

Government

- Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO)

Gobierno del Estado de Michoacán - Secretaría del Medio Ambiente

Gobierno del Estado de Michoacán - Comisión de Pesca

Municipio de Zacapu

Non-governmental organisations

SHOAL Conservation

Ex situ

Acuario Inbursa

Acuario Michín

Albuquerque BioPark

Chester Zoo

Goodeid Working Group

Haus des Meeres

Xcaret

Zoológico Guadalajara

IUCN Specialist Groups

IUCN CCS Freshwater Conservation Committee



Abstracts of introductory presentations

Conservation of Goodeids: A family at serious risk

Omar Dominguez

Universidad Michoacana San Nicolás de Hidalgo

Mexico is home to 520 freshwater fish species, of which 163 (32%) are endemic. In central Mexico, endemism rises to 70%. The most characteristic groups within this region are Atherinopsidae and Goodeinae. The subfamily Goodeinae, which is endemic to Mexico, is comprised of 19 genera and 41 species. These species possess a number of features and behaviours related to their reproductive biology that distinguish them from other fish: these include internal fertilisation, viviparity, matatrophism (transfer of nutrients from the mother to the embryo) and the presence of an umbilicus-like structure called the trophotaenia. Goodeids display a high degree of genetic divergence between populations. The decline and extinction of these species correlates with areas where key threats to freshwater ecosystems associated with land use change (e.g., agrochemical and industrial pollution, urbanisation, light pollution) are concentrated. The presence of non-native invasive species, including carp, tilapia, bass and poeciliids is also associated with population declines, with at least one non-native species being found at 82% of all sampled localities. More worryingly, climate modelling suggests a positive correlation between climate change, increasing numbers of non-native native fish, and declines in native fish species' diversity. The current red list assessment for the sub-family lists 1 species as Extinct, 1 species as being Extinct in the Wild, 14 species each as being Critically Endangered and Endangered, 4 as Vulnerable and 6 as Least Concern. The Mexican threat classification system (NOM 059) lists 1 species as extinct, 18 as Endangered, 4 as Threatened, and 1 as subject to Special Protection; 16 species are not classified under the Mexican system.



Case Study: reintroduction of the Tequila splitfin (*Zoogoneticus tequila*)

Arely Ramírez García

Universidad Michoacana San Nicolás de Hidalgo

The Teuchitlán River in Jalisco state is reported to have undergone the loss of 20 native fish species, including the Tequila splitfin (*Zoogoneticus tequila*) and the Golden skiffia (*Skiffia francesae*). Factors behind the loss of these species include pollution, physical modification of the river, and the introduction of non-native species. In 2014, the Mexico Fish Ark, in collaboration with international zoos, aquarists, conservation organisations and scientists, began working toward the reintroduction of the-then Extinct in the Wild Tequila splitfin. The project began by establishing and building up an *ex situ* population of the species in ponds in Michoacán University's botanical garden. Research activities were undertaken in the river, including water quality assessments and surveys of native and non-native fish, parasites, zooplankton, phytoplankton and macroinvertebrates, in order to determine the best sites for a possible reintroduction. The springs at the river's headwaters were chosen as the reintroduction site, with 1,500 fish being released into this area. The fish were marked with coloured elastomers in order to facilitate post-release monitoring. A social arm of the project was delivered, with environmental education activities being undertaken with the local community, including workshops in schools, presentations to local people, an exhibition in the visitor centre of the nearby Guachimontones archaeological site, and murals painted around the town. A community environmental action group, 'The Guardians of the River' was established by local people to support conservation activities. In 2018, it was confirmed that the reintroduced population was breeding in situ, effectively proving that this population was now established and self-sustaining.



Case study: the Morelos minnow (*Notropis boucardi*)

Topiltzin Contreras MacBeath

Universidad Autónoma del Estado de Morelos / IUCN SSC Freshwater Conservation Committee

The Morelos minnow *Notropis boucardi*, is restricted to a small system of streams located to the west of Cuernavaca (the capital of Mexico's Morelos state), as well as in an endorheic spring within a protected area called El Texcal. The species is threatened by water pollution and use, associated with the rapid urban growth of the city of Cuernavaca, and by invasive species, including *Oncorhynchus mykiss* (rainbow trout) and *Cyprinus carpio* (common carp). In a period of about 50 years, the species has lost 49% of its distribution. A conservation strategy to protect the remaining wild populations, and to reintroduce the species to areas where it once existed was implemented by the State of Morelos, with the aid of the Biological Research Centre of Morelos State University. Activities have been undertaken to restore the population in El Texcal, and to translocate individuals from that location to the Chapultepec State Protected Area. In both cases, communication and outreach activities were undertaken to build public support for conservation actions, and to bring key stakeholders together in order to engage them in the planning and implementation of these actions. Eradication of invasive species was an important component of conservation actions in both locations, with species such as carp, trout and invasive plants being removed, in order to make the sites safe for the minnow. Additionally, in El Texcal, support from law enforcement enabled the removal of illegal squatters from the site. Both case studies have been successful: in El Texcal, the site is now free of trout, and the invasive plant *Egeria densa* is regularly controlled; the minnow population has increased from around 100 individuals into the thousand. The site, which has now been declared a RAMSAR site, is patrolled by community groups, and is under the management of a Director who oversees conservation and communication activities. In Chapultepec, follow-up monitoring has shown that the population has become established, and monitoring remains an ongoing activity to continue to oversee the development of this population.



The Mexican Government's approach to conservation

Topiltzin Contreras MacBeath

Universidad Autónoma del Estado de Morelos / IUCN SSC Freshwater Conservation Committee

The legal framework of the Mexican government establishes a regulatory hierarchy that begins with the constitution, where key rights and frameworks are established (e.g., the right to a healthy natural environment, the requirement for economic development to consider environmental protection, and the establishment of water bodies as being property of the nation). Underneath the constitution sit the country's laws, with the Ecological Equilibrium and Environmental Protection Law, General Wildlife Law, National Water Law, and Federal Fisheries Law being of relevance to the conservation of freshwater wildlife. Finally, regulations establish technical standards and state and municipal-level legislation for the implementation of the legal framework. Article 1 of The General Wildlife Law states that the sustainable use of wood from forests, and of species whose total lifespan is spent on water, will be regulated by forestry and fisheries laws, except for those species that are considered as threatened. The Forestry and Fisheries Law gives general guidelines and can be modified through the intervention of the Chamber of Deputies and the Senate. The Fisheries Regulation stems from this law. The institutional framework for the implementation of these laws and regulations centres on SEMARNAT (the Mexican Environmental Agency), through liaison with the National Commissions for Water, Protected Areas, Knowledge and the Use of Biodiversity, and forests, as well as the Federal Environmental Protection Agency, National Ecology and Climate Change institute, and the agency for Security, Environment and Energy; these institutions also liaise with government at the State level. The policy framework includes a series of agendas (blue agenda, green agenda, grey agenda) and plans that determine the development and implementation of environmental protections. State environmental spending has fluctuated with the growth of the national economy, but despite this, there has been a marked increase in the creation of protected areas from 127 protected areas, totalling 17.1 million ha at the start of the millennium, to 185 Protected Areas totalling 90.1 million ha (more than three times the size of the UK) in 2022. The National Program for the Conservation of Species At Risk (PROCER) recognises 2,606 at risk species, with national action plans (PACE) having been developed for 51 of these. However, none of them are freshwater fishes.

International Goodeid Ex Situ Networks

Michael Köck

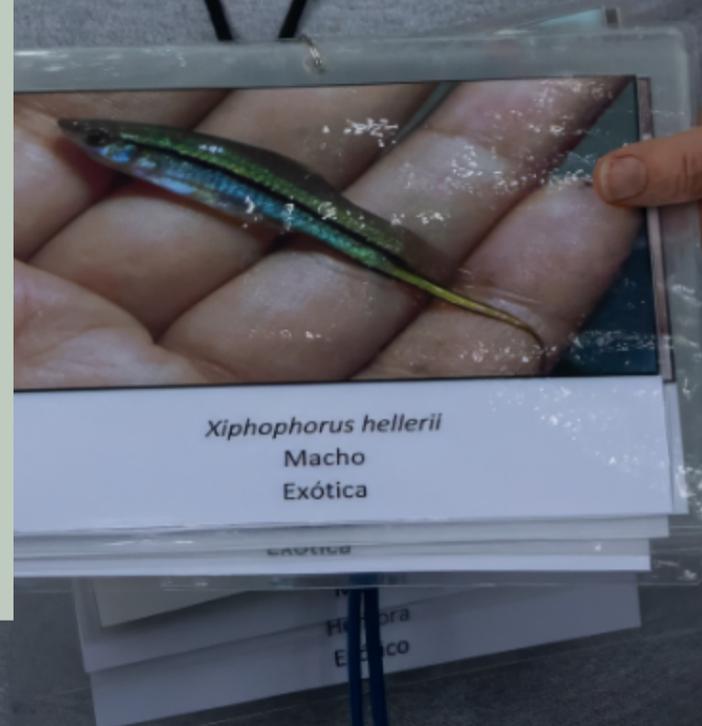
Haus des Meeres/Goodeid Working Group

Early pioneers of keeping Goodeids in aquaria date back to pre- Second World War Germany. During the 1970s and 1980s, collecting and keeping also spread to the UK and US. Collection trips were undertaken by Radda, Daul, Georg, Hinz et al. during the late 70s and into the 80s, whilst Ivan Dibble was importing fish from the US to the UK. With time, regional associations came into being in Germany, France, the Netherlands, UK, USA and Scandinavia. In the world of public aquaria, R. R. Miller and J. Lagenhammer of Detroit's Belle Isle Aquarium were leading figureheads in maintaining and breeding Goodeids, which included establishing the ex situ founder population of Golden skiffia. Goodeids were uncommon in zoos and private collections prior to this for a number of reasons: they were difficult to obtain, were rumoured to be fin-eaters, there wasn't a great deal of knowledge about them, and conservation had not yet become a strong incentive for ex situ management. From the 1990s to the present, our knowledge of the conservation needs of Goodeid fishes and their habitats has grown considerably: in 1995 Harro Hieronymus declared at least 22 species to be "not very rare or common"; in 2011, John Lyons concluded that at least 28 species were endangered. Efforts to marry ex situ populations with species conservation have been led by Ivan Dibble (Hobbyists Aqualab Conservation Project), Jen Nightingale and Colin Grist (Fish and Aquatic Invertebrate Taxon Advisory Group), and Michael Kempkes and Brian Kabbes (Tequila Splitfin Project). The new millennium has seen an increasing growth in interest in Scandinavia, Germany, France, The Netherlands, Austria, UK, Czechoslovakia and Slovakia. In 2004 the Goodeid Study Group was established by Guenter Ellenberg, evolving in 2009 into the Goodeid Working Group, with the goal of promoting collaboration between hobbyists, universities, public aquaria, zoos, museums, and conservation projects in order to maintain aquarium populations of Goodeids whilst assisting in the preservation of remaining natural habitats. In the present day, numerous Goodeid-focussed groups exist on social media, whilst these species are also present within regional plans and population management programs (e.g., EEPs) in the international zoo community.

Communicating Goodeid Conservation

Michael Edmondstone
SHOAL

The challenges surrounding the communication of Goodeid conservation are much the same as those facing communication regarding the conservation of any freshwater fish species: fish aren't fluffy, sexy, cute or obviously charismatic. They are cold-blooded and much more difficult to empathise with than mammals. They are hidden under the surface of rivers which are often murky and difficult to film in. If the stories have never been told, people won't have heard of them, and thus won't care about them. Furthermore, freshwater habitats and species receive a fraction of the conservation funding that goes to terrestrial and marine & coastal ecosystems: from the €745.6 million of funding that was granted by foundations in 2018, freshwater conservation received €13 million, with terrestrial and coastal & marine ecosystems receiving €76 million each. A potential challenge to effective communication is the lack of good quality images of Goodeids in their natural habitats; this is reflected in the limited attention given to fish in natural history documentaries; even documentaries focused specifically on freshwater manage to gloss over fish in favour of elephants and lions. Despite their stories not having been told before, there is opportunity: we can tell compelling stories, and with such a high number of goodeids being threatened with extinction, we have the opportunity to save many species. The reality is, the more freshwater is in the public eye, the higher the chances of securing funding. We must define what communication success would look like and collaborate with initiatives such as The Freshwater Inspire Network (The FIN) in order to communicate freshwater conservation more effectively.



Action Plan for the Conservation of Mexican Goodeid Fishes

Scope

This plan includes all extant species of Mexican Goodeid fishes, throughout their distribution. The timeframe of the plan has been set for 10 years.

Vision

All extant Mexican Goodeid fish species show stable or increasing population trends, their habitats are under conservation management and the threats that affect them have been reduced through the collaborative efforts of all stakeholder groups.

Measures of success

For the purposes of measuring the impact of the actions proposed within the plan, the following indicators will be monitored:

- % of Goodeid species with a stable or increasing population trend.
- % of priority locations under conservation management.
- % of priority locations that have been newly designated as protected areas.

% of threatened (VU, EN, CR, EX) species, for which it is technically deemed necessary, that are protected within managed ex situ populations, and are available for reinforcing or reintroducing wild populations, where needed.

Priority Species

Under the plan, priority actions will be aimed at those species that are:

- Listed as Extinct in the Wild, Critically Endangered or Endangered on the IUCN Red List.
- Vulnerable and Least Concern, if they are present in priority locations*, or are listed under other relevant prioritisation systems, e.g. EDGE**.
- Any that do not currently feature in the Mexican government's list of protected species (Norma Oficial M-059)

*At the time of publication, those species are *Allophorus robustus*, *Chapalichthys encaustus*, *Goodea atripinnis*, *Xenotoca variata*

** At the time of publication, EDGE listed Goodeid species are: *Allodontichthys hubbsi*, *Allodontichthys polylepis*, *Allodontichthys tamazulae*, *Allodontichthys zonistius*, *Allophorus robustus*, *Allotoca catarinae*, *Allotoca diazi*, *Allotoca dugesii*, *Allotoca maculata*, *Allotoca meeki*, *Allotoca zacapuensis*, *Ameca splendens*, *Ataeniobius toweri*, *Chapalichthys pardalis*, *Characodon audax*, *Characodon lateralis*, *Girardinichthys multiradiatus*, *Girardinichthys viviparus*, *Hubbsina turneri*, *Skiffia lermiae*, *Skiffia multipunctata*, *Xenoophorus captivus*, *Xenotaenia resolanae*, *Xenotoca doadrioi*, *Xenotoca eiseni*, *Xenotoca lyonsi*, *Xenotoca melanosoma*, *Zoogoneticus purhepechus*, *Zoogoneticus quitzeoensis*, and *Zoogoneticus tequila*.

Priority locations and associated species

A preliminary list of sites of importance for Mexican Goodeids was drafted. The factors that were taken into account were: number of species present, number of endemic species present, and

conservation status of species present. The locations that were highlighted were the following:

Location	Goodeid species present	IUCN Red List category*
Zacapu Natural Protected Area	<i>Hubbsina turneri</i> *Relict species	CR
	<i>Zoogoneticus quitzeoensis</i>	EN
	<i>Goodea atripinnis</i>	NT
	<i>Allophorus robustus</i>	VU
	<i>Allotoca zacapuensis</i> *Endemic	CR
	<i>Skiffia lermiae</i>	EN
Mintzita Natural Protected Area	<i>Xenotoca variata</i>	NT
	<i>Skiffia lermiae</i>	EN
	<i>Allophorus robustus</i>	VU
	<i>Zoogoneticus quitzeoensis</i>	EN
Rancho El Molino Springs	<i>Goodea atripinnis</i>	NT
	<i>Xenotoca variata</i>	NT
	<i>Skiffia lermiae</i>	EN
	<i>Allotoca diazi</i> *Endemic	CR
La Luz spring	<i>Goodea atripinnis</i>	NT
	<i>Allophorus robustus</i>	VU
	<i>Allophorus robustus</i>	VU
	<i>Zoogoneticus purhepechus</i>	VU
Teuchitlán	<i>Chapalichthys encaustus</i>	VU
	<i>Goodea atripinnis</i>	NT
	<i>Ameca splendens</i> *Endemic	CR
	<i>Zoogoneticus purhepechus</i>	VU
	<i>Zoogoneticus tequila</i>	EN
Teuchitlán	<i>Skiffia francesae</i> *Endemic/ currently EW	EW

Location	Goodeid species present	IUCN Red List category*
San Sebastián	<i>Xenotoca doadrioi</i>	CR
	<i>Xenotoca melanosoma</i>	EN
	<i>Goodea atripinnis</i>	NT
Chiquimitío	<i>Skiffia lermae</i>	EN
	<i>Zoogoneticus quitzeoensis</i>	EN
	<i>Allophorus robustus</i>	VU
Palo verde	<i>Allotoca maculata</i>	CR
Guauchinango area	<i>Allodontichtis polylepis</i>	CR
Streams close to Ameca*	<i>Allotoca goslinei</i> *Currently EW	EW
	<i>Allodontichtis polylepis.</i>	CR
Valle de Mexico	<i>Girardinichthys viviparus</i>	EN
Media Luna and surrounding area	<i>Ataenobius toweri.</i>	EN
El Toboso	<i>Characodon audax</i>	EN
Around Durango	<i>Characodon audax</i>	EN
Ojo de Agua de San Juan	<i>Characodon lateralis</i>	CR
Zempoala	<i>Girardinichthys multiradiatus</i>	EN
Tocumbo	<i>Chapalichthys pardalis.</i>	CR

*A guide to the IUCN Red List categories and criteria can be downloaded here



Strategy lines and actions

Each working group worked separately from the other groups to come up with a proposed action plan for their thematic area. The outputs from each group were reviewed by all participants in whole-group plenary sessions. A period of

additional editorial reviews took place after the workshop, and a final meeting of the organising team to review the plan as a whole, was held in July 2023. The resulting strategy lines, goals, actions, targets, and timeframes for each thematic area are shown below.

Thematic area 1 Conservation management

Strategy line 1.1 Governance

Goal A functional governance structure, with representation from all relevant stakeholder groups, is created and maintained.

Action	Target	Timeframe
1.1.1 Establish governance structure.	Governance structure established.	Y1
1.1.2 Maintain calendar of governance activities.	Governance structure maintained.	Ongoing

Strategy line 1.2 Broad-scale planning

Goal A detailed analysis and plan for Goodeids, plus actors, needs and instruments is available to develop conservation actions.

Action	Target	Timeframe
1.2.1 Develop a first sketch of the biological vision for Goodeids, identifying a conservation goal and priority actions.	First rough sketch completed.	First semester
1.2.2 Further deepen the quality and accuracy of the plan.	A detailed broad-scale plan with prioritized species and actions, partners, and budget, has been created to inform the preparation of the project portfolio and the framework for monitoring the impact of conservation management for the Goodeids.	Y1

Strategy line 1.3 Project Portfolio

Goal A portfolio of projects aimed at the protection of priority species and sites has been developed.

Action	Target	Timeframe
1.3.1 Using the broad-scale plan, prioritise projects for immediate and future implementation.	List of projects to be developed has been established.	Y1
1.3.2 Detailed project planning.	75% of the projects have been developed in detail and are ready for implementation.	Y1-3

Strategy line 1.4 Project implementation

Goal All projects proposed within the project portfolio have been implemented, with many priority projects completed.

Action	Target	Timeframe
1.4.1 Secure resourcing for critical projects.	Resourcing secured for 50% of projects.	Y2-5
1.4.2 Project implementation.	50% of the projects as part of the portfolio (based on the broad scale plan) are under implementation.	Y2-5

Strategy line 1.5 Portfolio monitoring

Goal Mechanisms have been deployed to evaluate the projects and the impact they will generate in the conservation of the Goodeids and their habitat.

Action	Target	Timeframe
1.5.1 Implement monitoring framework.	All active projects under implementation are being monitored.	Y2-5
1.5.2 Conduct mid-term assessment.	All active projects have received mid-term assessment.	Y2-5

Thematic area 2: Research

Strategy line 2.1 Systematics and distribution

Goal The definitive number of Goodeid species in Mexico, and their distribution, are determined.

Action	Target	Timeframe
2.1.1 Establish an agreed taxonomy for the genera <i>Characodon</i> and <i>Xenotexa</i> .	Integrated taxonomy has been defined for the genus.	Y1-5
2.1.2 Confirm presence/absence of possibly extinct species.	Presence/absence confirmed for 4 species (<i>Allotoca goslinei</i> , <i>Allodontichthys polilepys</i> , <i>haracodon garmani</i> , <i>Chapalichthys pardalis</i>) within their potential distribution range.	Y1-5
2.1.3 Update historical and current distribution of all Mexican Goodeid species.	Unified database created, with current information for all species.	Y1-10

Strategy line 2.2 Species' biology

Goal The knowledge base of all species is updated

Action	Target	Timeframe
2.2.1 Assess the current state of knowledge of all 39 species.	Assessment completed for all species.	Y1-2

Strategy line 2.3 Inclusion of species in Mexican protected species list (NOM-059)

Goal All species are included in NOM-059, and their statuses updated following the Método de Evaluación de Riesgo de Extinción

Action	Target	Timeframe
2.3.1 Hold workshop to assess species' status according to available information, and to propose updates to NOM-059 according to the results.	Proposal submitted to SEMARNAT for the inclusion of species or change of threat status.	Y3-7

Strategy line 2.4 Habitat studies

Goal Information is generated to guide the implementation of habitat conservation actions

Action	Target	Timeframe
2.4.1 Determine habitat quality in priority sites (including biotic and abiotic characterisations, and water chemistry parameters).	Habitat quality assessed in priority sites according to IBI, ICA and IBAMA indices.	Y1-5
2.4.2 Determine habitat requirements for species in priority sites.	Habitat availability, use and preference determined for priority sites.	Y1-5
2.4.3 Assess interactions between Goodeids and exotic species.	Competition and/or predation relationships established for species within priority sites.	Y1-5
2.4.4 Undertake threat assessment in priority sites.	Threat assessment undertaken in priority sites.	Y1 & 2
2.4.5 Monitor threats in priority sites.	Threat monitoring is undertaken periodically (monthly during the first year; if no further threats are found, or they have been adequately mitigated, periodicity can be reduced to quarterly for second the second year, and annually thereafter).	Y3-5
2.4.6 Determine the feasibility of species introductions and translocations, in order to guide interventions.	Protocol for reintroductions and translocations created.	Y1-10
2.4.7 Model impacts of climate change on Goodeids.	Potential distribution models established for Goodeids under different climate change scenarios, by means of correlative and mechanistic methods.	Y1-10
2.4.8 Evaluate the impact of xenobiotics (agrochemicals and chemical contaminants of emerging concern) and conditions of environmental deterioration (HABs and cyanotoxins), as well as the effect of climate change on priority species.	Impact of agrochemicals, CPEs and HABs determined for at least seven species of selected Goodeids.	Y1-5



Strategy line 2.5 Husbandry

Goal Information is generated to inform ex situ management and husbandry

Action	Target	Timeframe
2.5.1 Establish research priorities for ex situ management.	Research targets for Y3-10 established.	Y1-2
2.5.2 Undertake husbandry-based research to improve captive welfare.	2 husbandry-related publications drafted and submitted for publication (suggested: 1 on water parameters and 1 on diet) .	Y3-5

Strategy line 2.6 Human dimensions of Goodeid conservation

Goal The human dimensions of Goodeid conservation is defined as an area of practice

Action	Target	Timeframe
2.6.1 Bring together stakeholders with social science, communication, and education/education research expertise to inform human dimensions of Goodeid conservation activities.	Human dimensions of Goodeid conservation working group established.	Y1-4

Strategy line 2.7 Conservation evidence

Goal Lessons learned from actions delivered under the plan are available to inform conservation planning elsewhere.

Action	Target	Timeframe
2.7.1 Monitor, record and communicate results of specific actions implemented under the plan.	Biennial report published and disseminated every two years, detailing case studies and results.	Ongoing



Thematic area 3: Restoration and reintroduction

Strategy line 3.1 Ex situ husbandry

Goal Healthy ex situ populations are maintained as a resource for future reintroductions

Action	Target	Timeframe
3.1.1 Assess current husbandry practices.	Database of current husbandry created. To include - but not limited to - temperature, conductivity, pH, seasonality, outside access, diet.	Y1-2

Strategy line 3.2 Ex situ population management

Goal Long-term backup populations are established and maintained for future reintroductions.

Action	Target	Timeframe
3.2.1 Engage with EAZA in discussions about how to overcome barriers around working with private collections.	Meeting held with EAZA, establishing next steps for building collaborative relationships with private aquarists.	Y1-3
3.2.2 Assess keepers and aquarists' perceptions regarding priority species for ex situ management.	Database species housed by keepers. Created database of keepers, species housed and reproductive success.	Y1-2
3.2.3 Establish conservation priorities for ex situ management.	Global ex situ collection plan published.	Y3-5
3.2.4 Assess current stock within EEP to determine need to bring in new stock.	Information integrated into EEP plan.	Y1-2
3.2.5 Assess EEP to ensure that it is consistent with Goodeid conservation plan.	EEP integrated into conservation plan, including studbook for ex situ priority species.	Y3-5
3.2.6 Update ex situ management guidelines.	Ex situ management guidelines published	Y2
3.2.7 Prioritise and prepare species for introduction into semi-natural sites.	Stocks of priority spp. ready for introduction into ponds - target number TBC according to prioritisation.	Y1-2
3.2.8 Create semi-natural sites holding Goodeids.	5 ponds created in semi-natural conditions.	Y3-5

Field surveys (Diana Caballero).

Strategy line 3.3 In Situ

Goal Priority habitat areas are restored for reintroductions or population reinforcement.

Action	Target	Timeframe
3.3.1 Determine critical sites that are candidates for restoration.	Priority sites selected.	Y1 & 2
3.3.2 Implement activities to restore critical sites.	Restoration activities implemented in priority sites.	Y3-5
3.3.3 Obtain and maintain updated all necessary permits and permissions.	Permits up to date throughout the timeframe of the plan.	Ongoing activity.
3.3.4 Review and update management plans for priority locations that are currently protected.	Management plans for all protected priority sites include provision for the conservation of Goodeid species.	Y3-5
3.3.5 Secure protection for any priority locations that are currently unprotected.	Relevant sites formally protected.	Y10



Thematic area 4: Communication and Outreach

Strategy line 4.1 Outreach and engagement plan

Goal A strategic outreach and engagement plan is created and implemented, incorporating local social dynamics in the codesign of communication campaigns for local, national and international audiences.

Action	Target	Timeframe
4.1.1 Develop a stakeholder diagnostic of priority actors, social dynamics, and relationships in priority locations.	Stakeholder diagnostic for priority localities created.	Y1-2
4.1.2 Collaborate with priority audiences who will be able to add to the total knowledge of Goodeids and their habitats, to gather and disseminate information.	Process in place for gathering information from priority audiences and incorporating this into outreach and engagement activities.	Y1-2
4.1.3 Codesign a communication strategy for local audiences in priority locations.	Communication strategy implemented in priority locations.	Y1-2
4.1.4 Plan a national and international communications campaign, based on experiences and results of activities in priority locations, e.g., messaging, media outlets, dates, collaborators etc.	National and international communication plan prepared and ready to be implemented.	Y3-5
4.1.5 Create content for outreach and engagement activities.	Content created according to the needs of the plan.	Y3-5
4.1.6 Design tools and materials for outreach and engagement activities.	Tools and materials created according to the needs of the plan.	Y3-10
4.1.7 Build communication channels for outreach and engagement activities.	Communication channels built according to the needs of the plan.	Y3-10
4.1.8 Implement outreach and engagements activities, according to communications plan.	Activities implemented, as per the plan.	Y3-10
4.1.9 Evaluate and refine all communication messaging.	Evaluation protocols in place for all outreach and engagement activities.	Y3-10

Mike Baltzer and Michael Edmondstone visiting Omar Domínguez at the Goodeidae conservation facility in Michoacán (Topiltzin Contreras).

Strategy line 4.2 Training

Goal A training programme is developed to strengthen local capacity for the conservation of Goodeids and their habitat.

Action	Target	Timeframe
4.2.1 Create a training programme directed at academics, researchers, and project managers.	Deliver 2 yearly training workshops to academics, researchers, and project managers.	Y3-10
4.2.2 Create teams to respond to the training needs for Goodeid conservation.	Consolidate a team for each of the priority areas of Goodeid conservation.	Y1
4.2.3 Develop training support materials (programmes, promotional material, manuals, etc).	Each team has support material for their training workshops.	Y1-2
4.2.4 Evaluate training activities	Yearly meeting to share and reflect on experiences and achievements; processes implemented to evaluate communication campaigns, capacity building and impact of activities on Goodeid conservation.	Y3-10





Previous page: Many streams and pools that were habitats for Goodeids are now dry (Topiltzin Contreras).



Implementation and governance

Administrative team structure

Chair

Michael Köck

Advisory support

Outreach and Communication

Harmony Patricio
(Re:Wild)

Fundraising

Mike Baltzer
(SHOAL)

Implementation teams

Governance

Paul Bamford (Chester Zoo)

Ex-situ research and husbandry

Becky Goodwin
(Chester Zoo)

Antonio Martínez
(Acuario Inbursa)

Legislation and compliance

Carlos Adolfo Álvarez Echegaray
(SEMARNAT)

María Loraine Palafox
(CONABIO)

Ignacio José March Mifsut
(CONANP)

In situ Research and Restoration

Omar Domínguez
(Michoacán University)

Arely Ramírez García
(Michoacán University)

Eduardo Soto Galera
(National Polytechnic Institute)

Topiltzin Contreras
(Morelos University, IUCN SSC Freshwater Conservation Committee)

Communication and research

Federico Hernández
(Michoacán University)

Eduardo Santana Castellón
(Guadalajara University)

Michael Edmondstone
(SHOAL)



Duties of the Administrative Team:

- Participation in all monitoring and evaluation activities.
- Liaison and communication with the stakeholders responsible for implementation of specific actions.
- Provision of support in sourcing resources for the implementation of the Plan.
- Provision of information and updates on the implementation of actions to the Administrative Team.
- Propose adjustments and adaptive management to the Plan throughout its execution.

Implementation

The Administrative Team's Project Manager will coordinate the consolidation of Implementation Teams, including assigning oversight of strategy lines and actions to each team, in accordance with their theme. The Implementation Teams' first task will be to review their actions and confirm responsible parties, timeframes and resource needs (starting by identifying to what extent actions are already covered by existing human and financial resources), and to establish a final prioritisation of actions.

Monitoring and evaluation

Online update meetings will be held by the administrative team every 6 months. The minutes and outcomes of these meetings will be disseminated via email.

Formal, face-to-face (where possible) monitoring and adaptive management workshops will be held every 2 years. Reporting of these will be via

publication of formal reports on action plan progress.

Implementation Teams will be expected to engage in frequent operational meetings and maintain regular ongoing communication with the Governance Team. It is recommended that each Implementation Team appoint a coordinator to ensure that this happens.

The Administrative Team's Project Manager will establish the calendar for meetings, workshops, and reporting, and will share this with the Implementation Teams to ensure that they are all aware of key dates and deadlines.

Fundraising

The immediate priority for fundraising is for each Implementation Team to develop storylines around the priority actions, and to define budgets in order to inform the funding need.

Implementation Teams will feed their storyline ideas and budgets up to the Administrative Team; Mike Baltzer will advise on how these can be framed into stories for potential funders and will highlight potentially suitable funders. He will also advise the Administrative Team in compiling fundraising needs into an overarching proposal for the plan as a whole.

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Appendices

Appendix I: Participant list

Acuario Inbursa	Antonio Martínez
Acuario Milchín	Luis Robles
Albuquerque BioPark	Patrick Horley
Chester Zoo	Paul Bamford Becky Goodwin
Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO)	Carlos Galindo Leal Loraine Matías Palafox Yosuki Villegas
Freshwater Fishes of Mexico	Juan Miguel Artigas de Azas
Gobierno del Estado de Michoacán - Secretaría del Medio Ambiente	Aglaén Carvajal Alejandro Mijangos
Gobierno del Estado de Michoacán - Comisión de Pesca	Octavio Treviño
Haus de Meeres/Goodeid Working Group	Michael Köck
Instituto Politécnico Nacional	Eduardo Soto Galera
IUCN CCS Freshwater Conservation Committee	Topiltzin Contreras
Municipio de Zacapu	Alfonso Ricardo Suárez Manzano
SHOAL Conservation	Harmony Patricio Michael Edmondstone Mike Baltzer
Universidad Autónoma del Estado de Morelos	Juan Manuel Rivas Norman Mercado
Universidad de Guadalajara - Museo de Ciencias Ambientales	Marcos Gomez

	Arely Ramírez García
Universidad Michoacana San Nicolás de Hidalgo	Federico Hernández Valencia
	Omar Domínguez Domínguez
Universidad Nacional Autónoma de México	María del Carmen Uribe
	Morelia Camacho
Wisconsin University	John Lyons
Xcaret/Asociación Latinoamericana de Parques Zoológicos y Acuarios	Eddie Manzanero
Zoológico Guadalajara	Mayra Cortez



Omar Domínguez presenting at the workshop (Paul Bamford).

Time	Title	Lead	Group format
Thursday 27th October			
14:00	Welcome	M. C. J Ramon Lopez Garcia (Director, Facultad de Biología)	Whole group
14:15	Icebreaker	Paul Bamford (Chester Zoo)	Whole group
14:30	Introductory presentations: Mexican Goodeid diversity, distribution and threats	Omar Dominguez (UMSNH)	Whole group
15:00	Introductory presentations: In situ conservation actions for Mexican Goodeids	Arely Ramirez, (UMSNH) / Topiltzin Contreras McBeath (IUCN/UAEM)	Whole group
16:00	Coffee Break		
16:30	Introductory presentations: The Mexican government's approach to conservation	Topiltzin Contreras McBeath (IUCN/UAEM)	Whole group
16:50	Introductory presentations: Ex situ Goodeid networks	Michael Koeck (Haus des Meeres/Goodeid Working Group)	Whole group
17:10	Introductory presentations: Communicating Goodeid conservation	Michael Edmondstone (SHOAL Conservation)	Whole group
17:30	Q & A	Paul Bamford	Whole group
18:00	Close		
Friday 28th October			
09:00	Welcome: recap of day 1; overview agenda for today	Paul Bamford (Chester Zoo)	Whole group
09:15	Review and validate scope and define timeframe for the plan	Paul Bamford (Chester Zoo)	Whole group
10:00	Where to intervene: prioritising species and threats	Paul Bamford (Chester Zoo)	Whole group
11:30	Coffee Break		

Time	Title	Lead	Group format
12:00	Define vision part 1	Paul Bamford (Chester Zoo)	Whole group
12:30	Working groups: presenting working group themes and dividing participants into their groups	Topiltzin Contreras McBeath (IUCN/UAEM) / Paul Bamford (Chester Zoo)	Whole group/working groups
13:00	Lunch		
14:00	Define vision part 2	Paul Bamford (Chester Zoo)	Whole group/working groups
15:00	Strategy lines and objectives part 1	Paul Bamford (Chester Zoo)	Working groups
16:00	Coffee Break		
16:30	Strategy lines and objectives part 2	Paul Bamford (Chester Zoo)	Working groups
18:00	Close		
Saturday 29th October			
09:00	Welcome: recap of day 2; overview agenda for today	Paul Bamford (Chester Zoo)	Whole group
09:30	Strategy lines in detail part 1	Paul Bamford (Chester Zoo)	Working groups
11:00	Coffee break		
11:30	Strategy lines in detail part 2	Paul Bamford (Chester Zoo)	Working groups
13:00	Lunch		
14:00	Strategy lines and objectives review plenary part 1	Paul Bamford (Chester Zoo)	Whole group
15:45	Coffee break		
16:15	Strategy lines and objectives review plenary part 1	Paul Bamford (Chester Zoo)	Whole group
18:00	Close		

Eduardo Soto presenting at the workshop (Paul Bamford).

Time	Title	Lead	Group format
Sunday 30th October			
09:00	Welcome: recap day of 3; overview agenda for today	Paul Bamford (Chester Zoo)	Whole group
09:30	Governance, oversight and monitoring part 1	Paul Bamford (Chester Zoo)	Whole group
11:00	Coffee break		
11:30	Governance, oversight and monitoring part 2	Paul Bamford (Chester Zoo)	Whole group
12:30	Closing statement	Topiltzin Contreras McBeath (IUCN/UAEM)	Whole group
13:00	Close		



