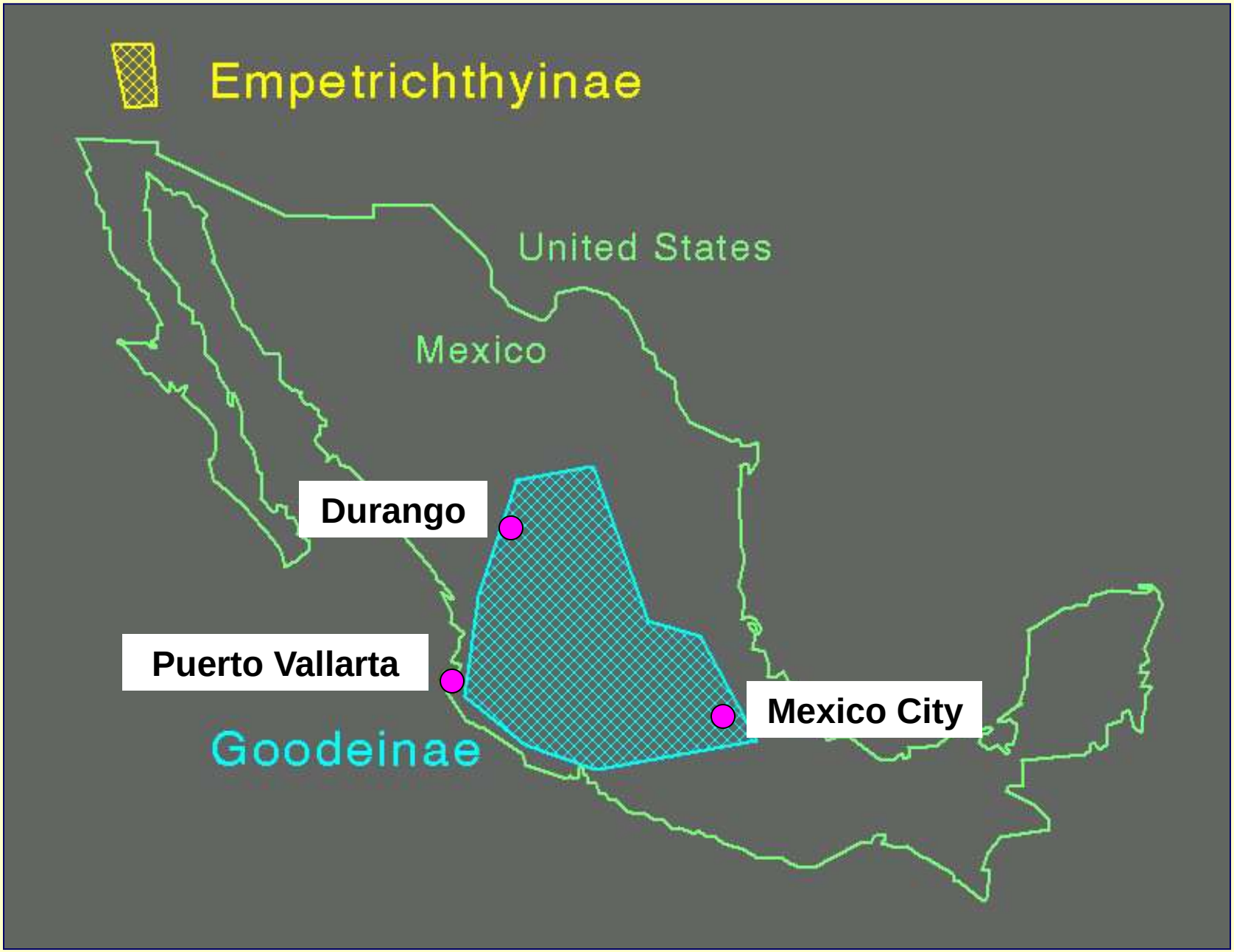
Can Mexican Goodeids Survive?

Sorting Goodeids from La Mintzita Springs, Michoacán

Dr. John Lyons, University of Wisconsin Zoological Museum

Mexican Goodeids – an Endemic Subfamily



In Mexico, a generalized Goodeid ancestor

Fossilized *Tapatia occidentalis*, Barranca de Santa Rosa, Jalisco; from Pliocene Epoch, at least 2.6 million years BP

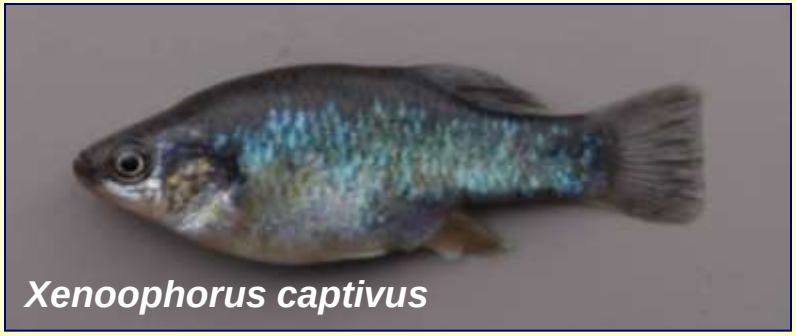
gave rise to a rich modern fauna: ~40 species

Evolutionary and ecological diversification

Manantlán Stream, Jalisco

Lake Pátzcuaro, Michoacán

Amado Nervo Springs, Durango



Goodeid country: geologically active, mountainous, many movement barriers

Colima Volcano, Colima

Juanacatlán Waterfall, Santiago River, Jalisco

Ayuquila River Canyon, Jalisco

Orizaba Peak, Veracruz

Result: most species isolated, small ranges

Goodeid country: most densely populated and developed area of México; seasonally arid


Mexico City


Tamazula Sugar Mill, Jalisco


Estorax River, Querétaro


Cuzalapa River, Jalisco

Goodeid threats – 1: Water quantity

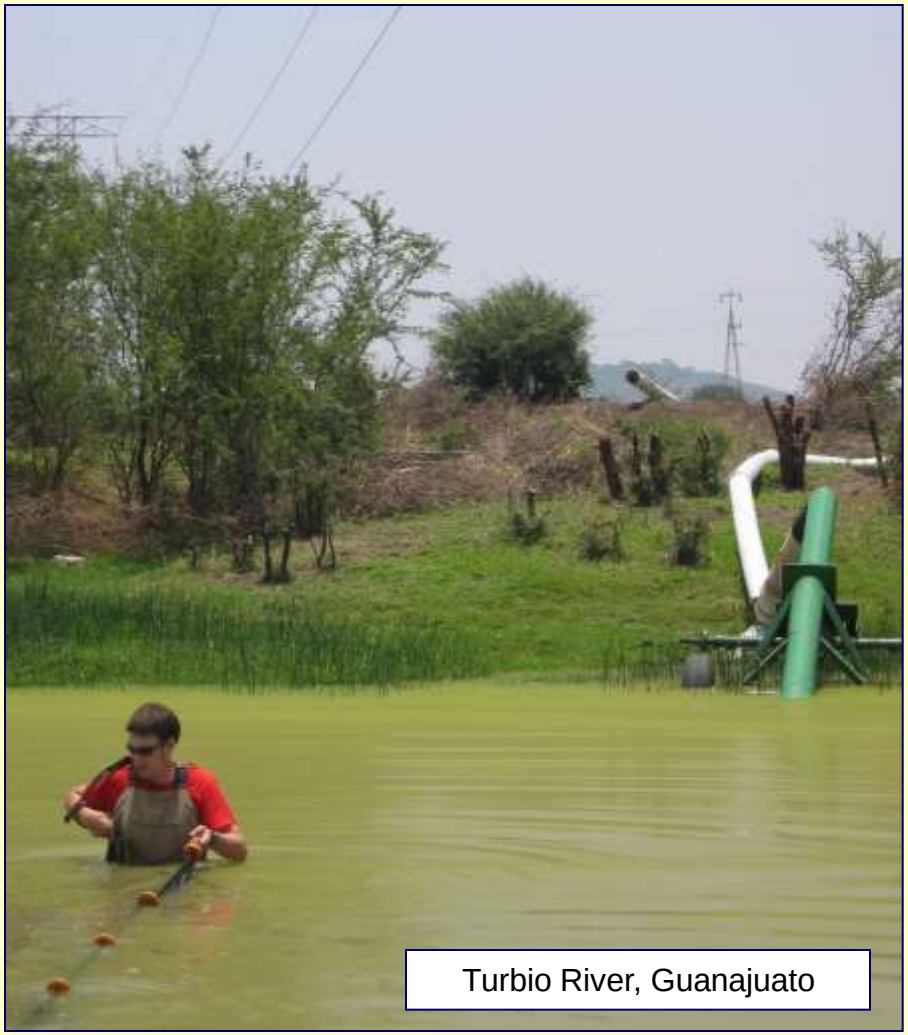
Lake Chapala, largest natural lake in Mexico (420 square miles), during normal (1990) dry season

Lake Chapala, 1991 drought; 40% decline in surface area; 60% decline in volume

Goodeid threats – 2: Water quality

Lerma River, México

Ayuquila River, Jalisco



Turbio River, Guanajuato

Goodeid threats: Non-native species

Tilapia (*Oreochromis and Tilapia* species)

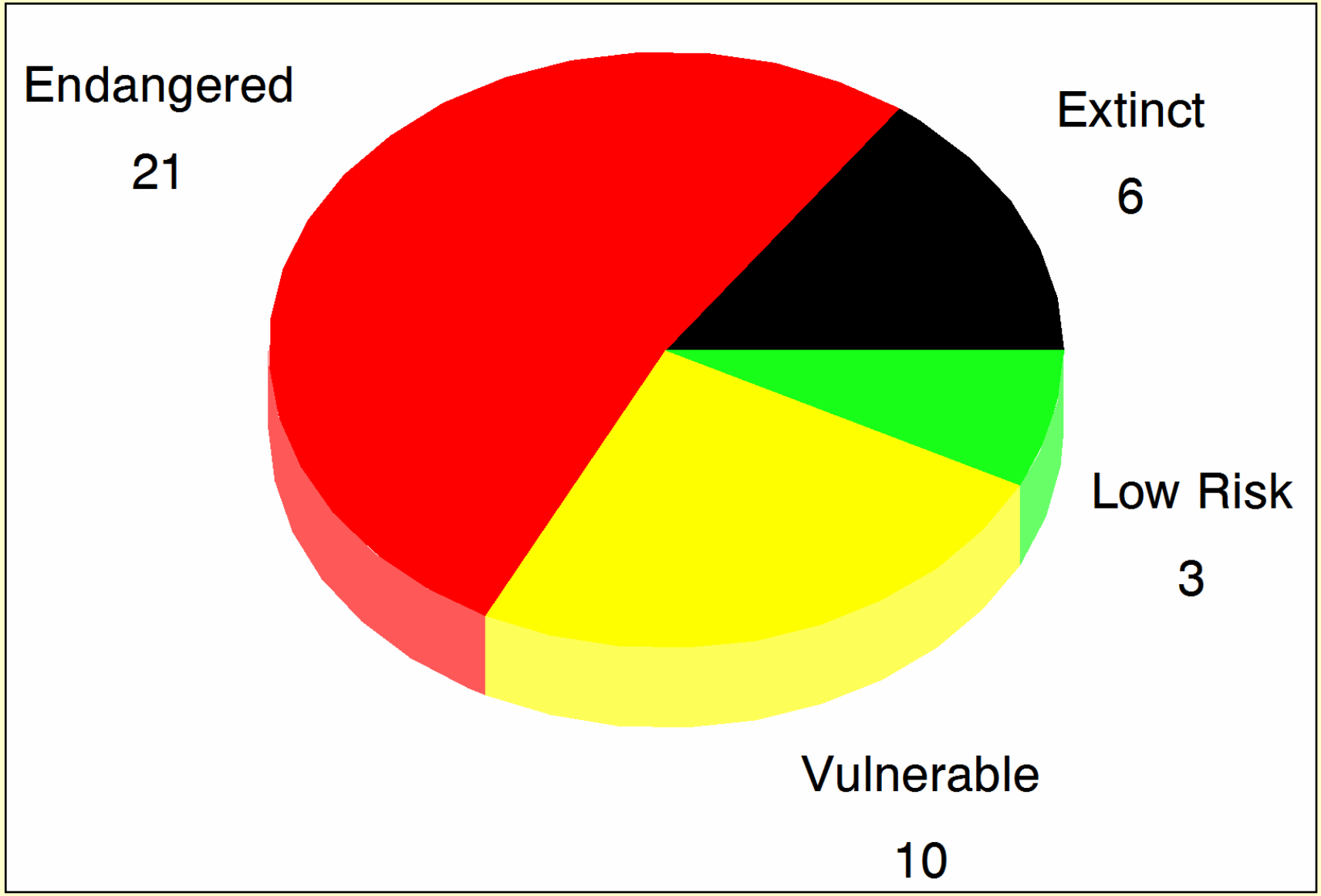
Rainbow trout
(*Oncorhynchus mykiss*)

And many, many more

Common carp (*Cyprinus carpio*)

Platyfish (*Xiphophorus variatus*)

Goodeid Species Status in the Wild 2015:



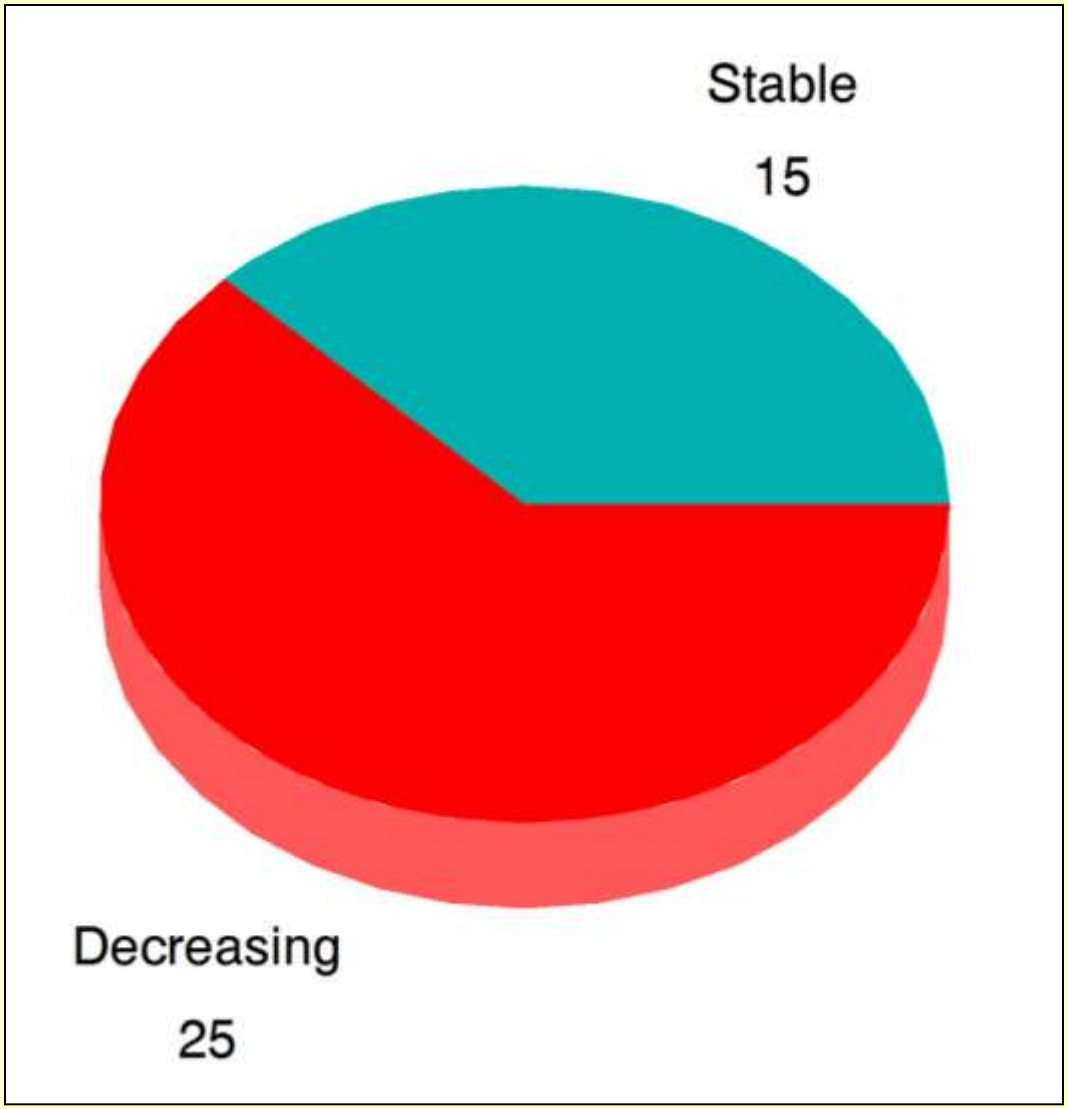
3 extinctions since 2000. Goodeids in trouble!

Some endangered Goodeids locally abundant

Goodeids in La Luz springs, Michoacán

But limited to a few small, vulnerable habitats

Goodeid trends 2000-2015:



Most species in decline

The good, the bad, and the ugly…

The Good (kind of):

Butterfly goodeid *Ameca splendens* – new populations

The Bad:

Balsas allotoca *Allotoca regalis* – habitat and exotics

Zirahuén allotoca *Allotoca meeki* – bass attacks

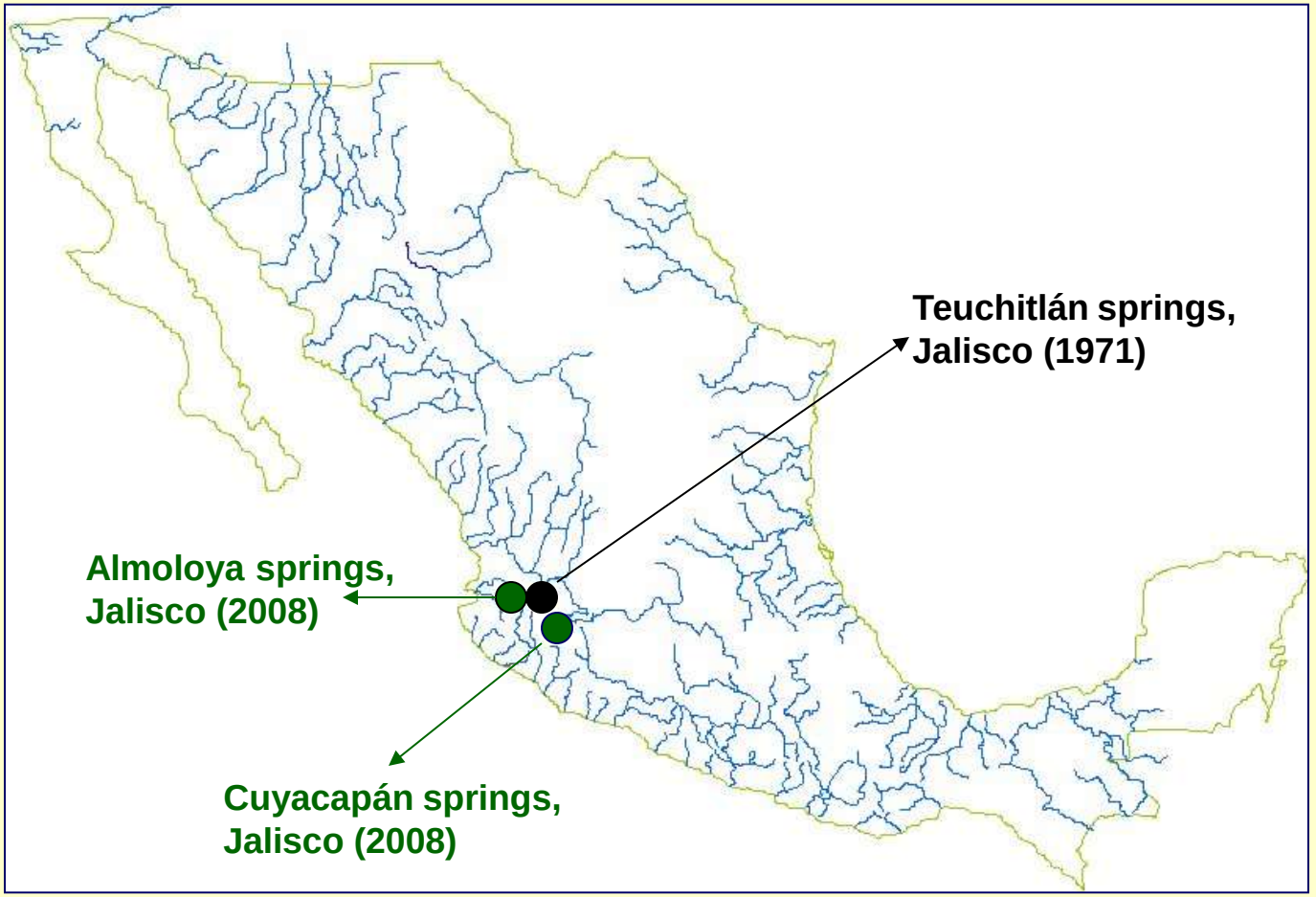
The Ugly:

Finescale goodeid *Allodontichthys polylepis* – extinct?

Banded allotoca *Allotoca goslinei* – extinct?

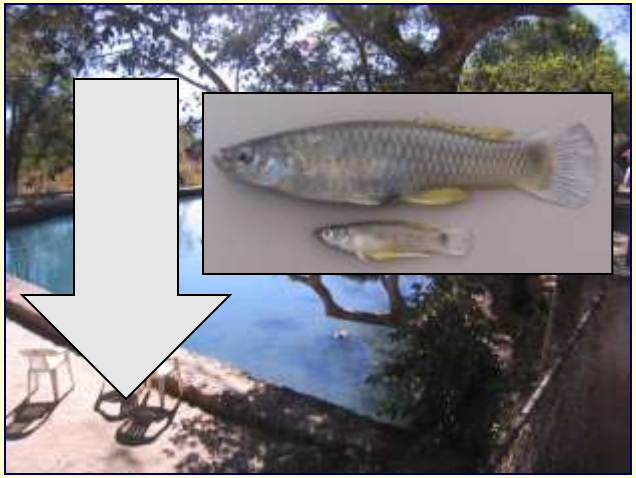
Crescent zoe *Zoogoneticus tequila* – extinct?

The Good?: *Ameca splendens* (Endangered)



Ameca splendens habitats – 2008-2015

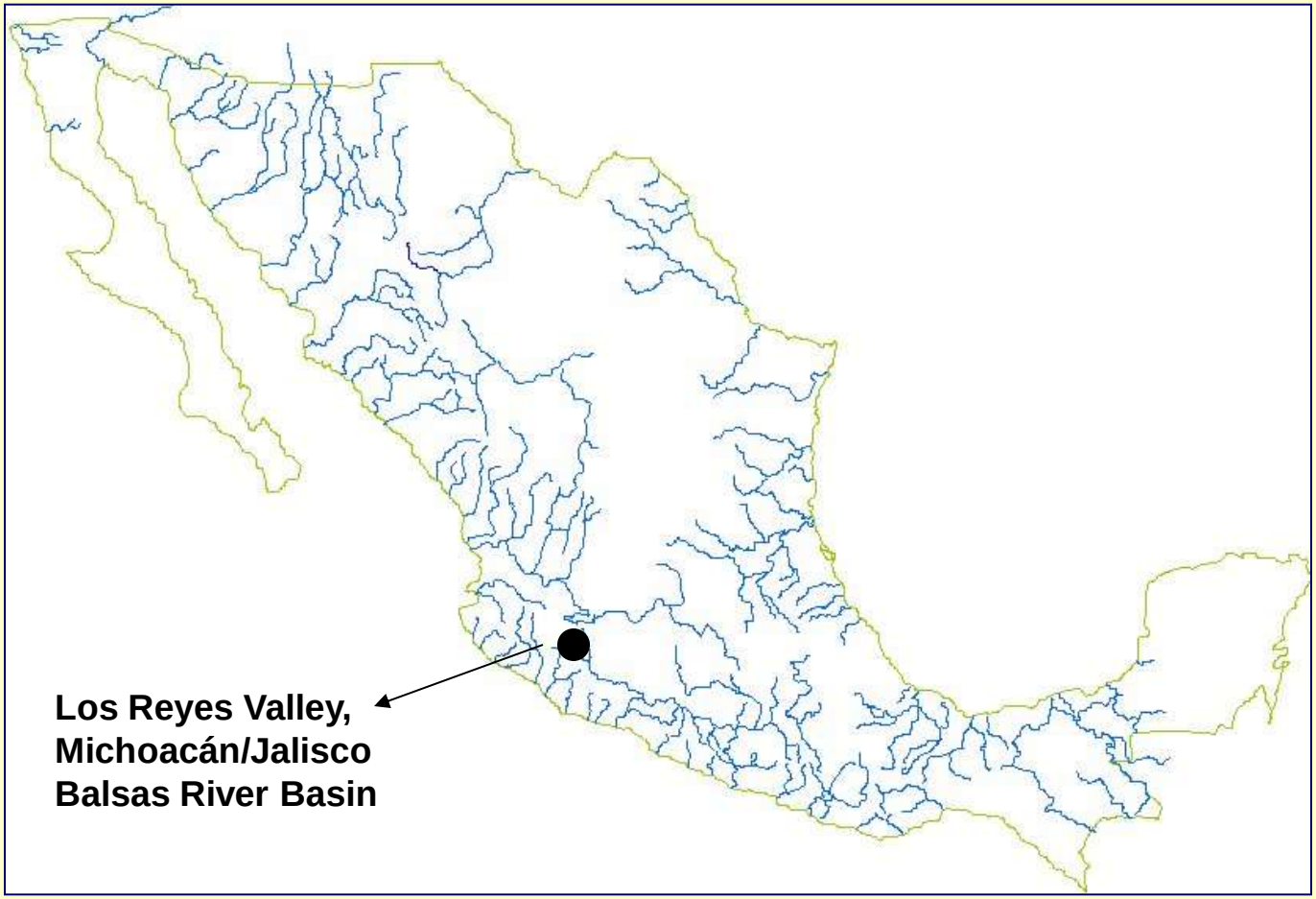
Teuchitlán springs



Almoloya springs

Cuyacapán stock tank

The bad: *Allotoca regalis* (Endangered)



Range shrinking rapidly

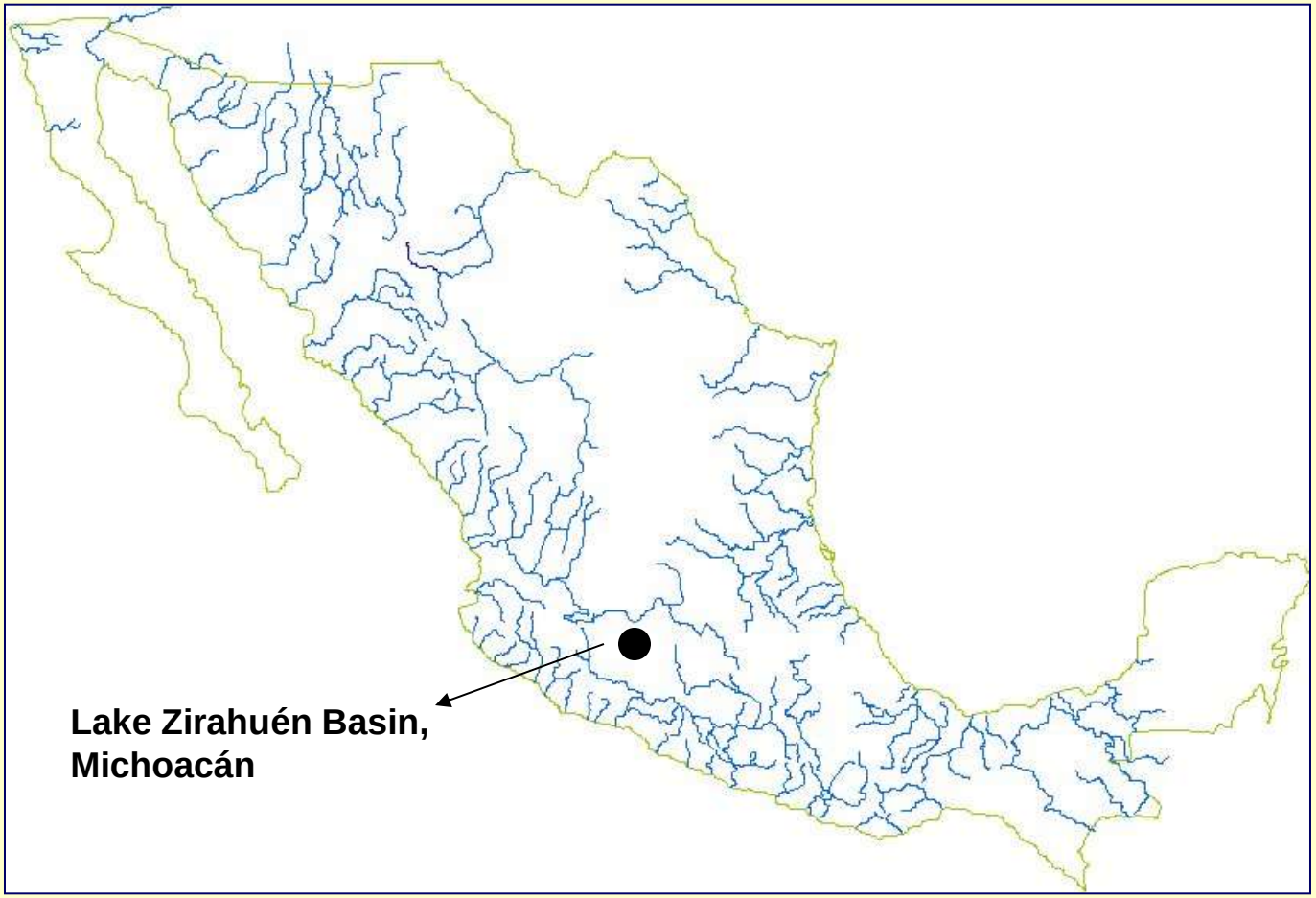
1980 – 5 areas; 2000 – 3 areas; 2010 – 1 area

Los Reyes Stream, Michoacán – present in 2002, gone by 2008; caused by habitat modifications/diversions for irrigation

Quitupán River, Jalisco – present in 2004, gone by 2010; caused by exotic swordtail *Xiphophorus helleri?*

Huatarillo Stream, Michoacán – present in 2010; last remaining locality, small numbers

The bad: *Allotoca meeki* (Endangered)



Introduced predator drives drastic decline

Originally: Lake Zirahuén and tributaries

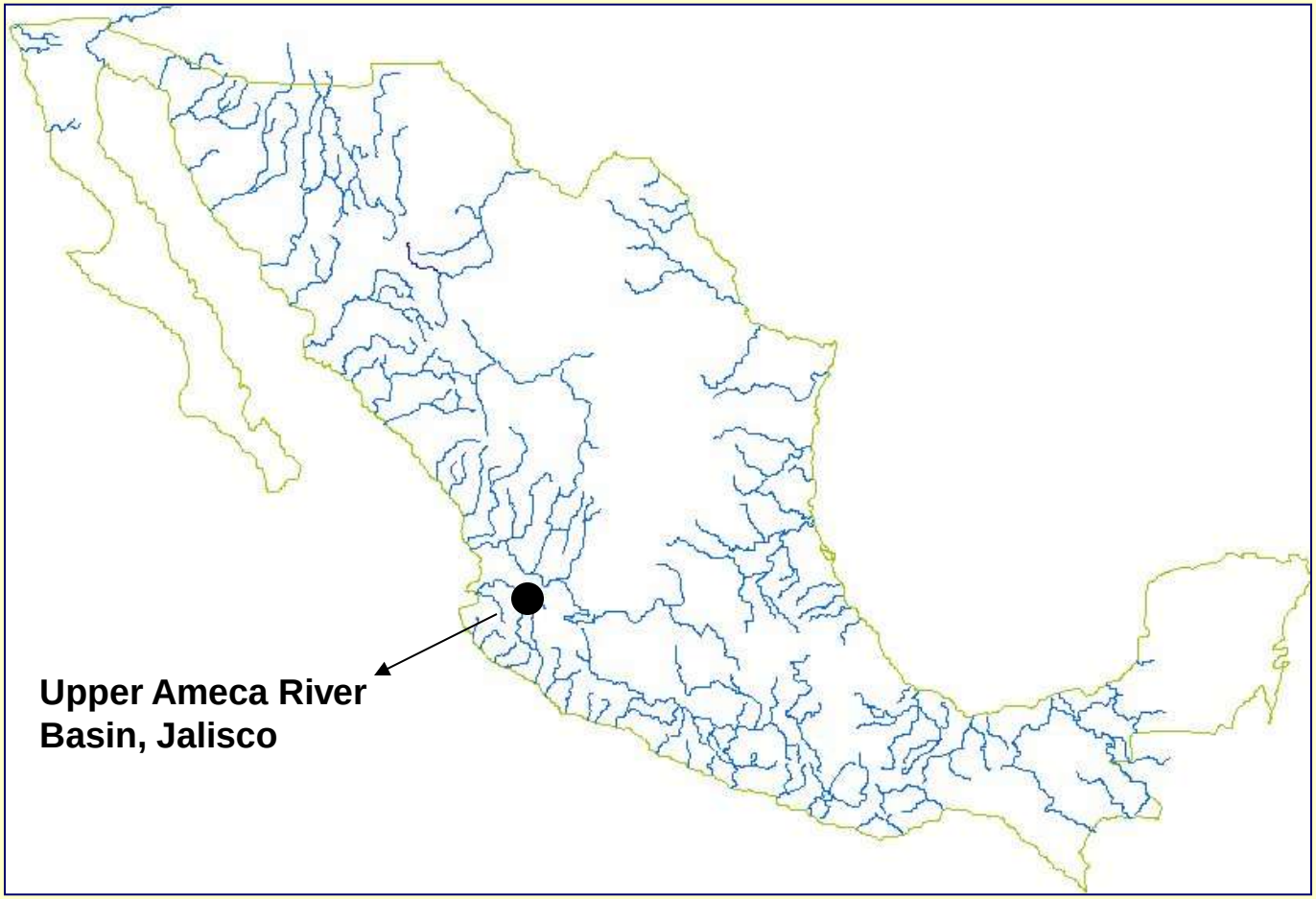
Mid 1980s, largemouth bass (*Micropterus salmoides*) enter Lake Zirahuén

By 1990s, limited to isolated Lake Opopeo

Mid 2000s, largemouth bass enter Lake Opopeo

By 2011, limited to Lake Opopeo outlet; rare

The ugly: *Allodontichthys polylepis* (Extinct: 2001)



Water diversions, groundwater pumping, plus natural drought have spelled doom

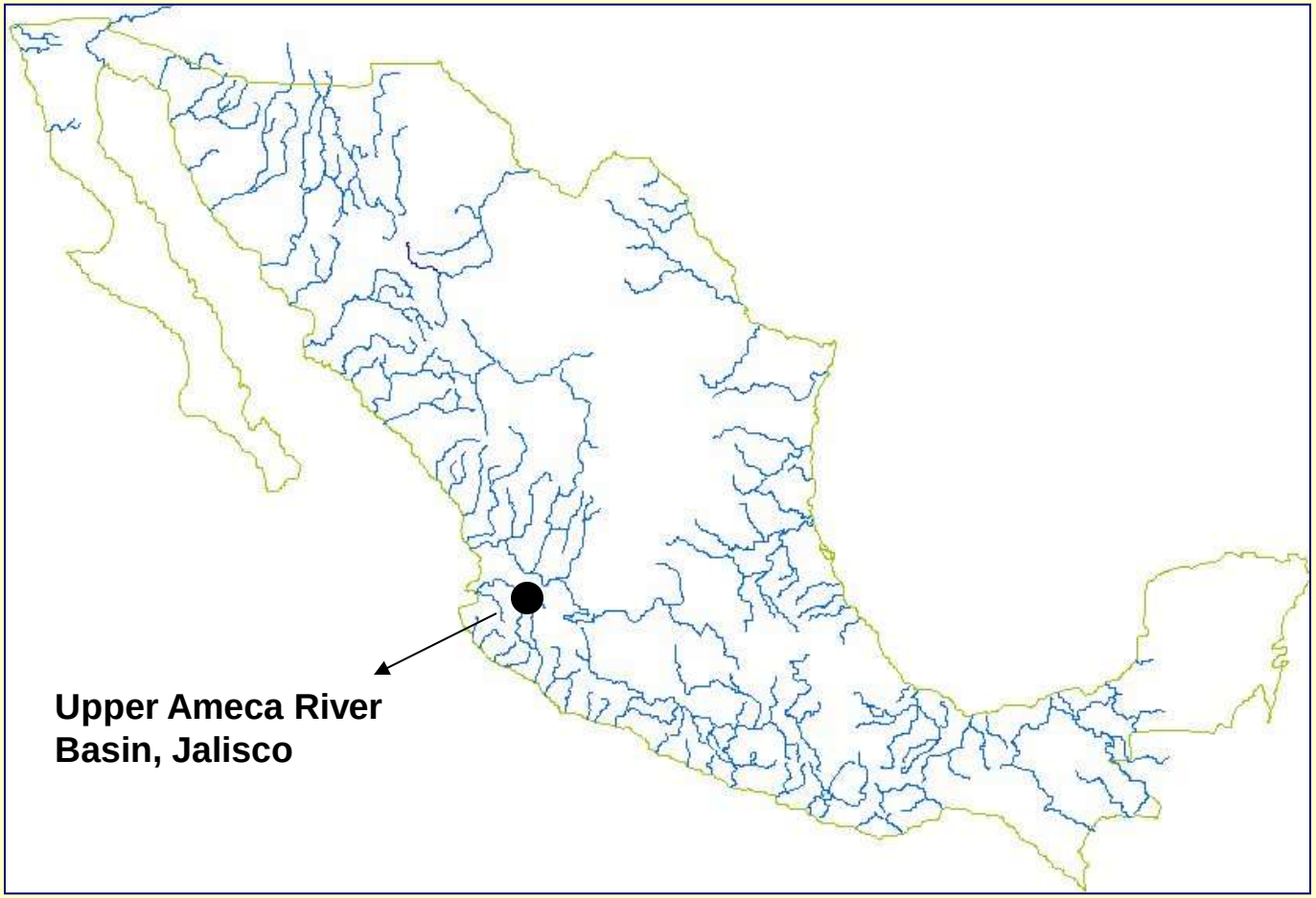

De la Pola River

A riffle dweller. Human water use reduced stream flow, riffle habitats, and populations. A 2001 drought finished the species.

Known from only three streams. Last confirmed capture in 2000. None in 2002, 2004, 2006, and 2008 surveys.


Diabolos Stream

The ugly: *Allotoca goslinei* (Extinct 2005?)



Driven extinct by a non-native competitor
(Ironically, another livebearer)

Allotoca goslinei **was known from only one location, the tiny Potrero Grande Stream, Jalisco….**

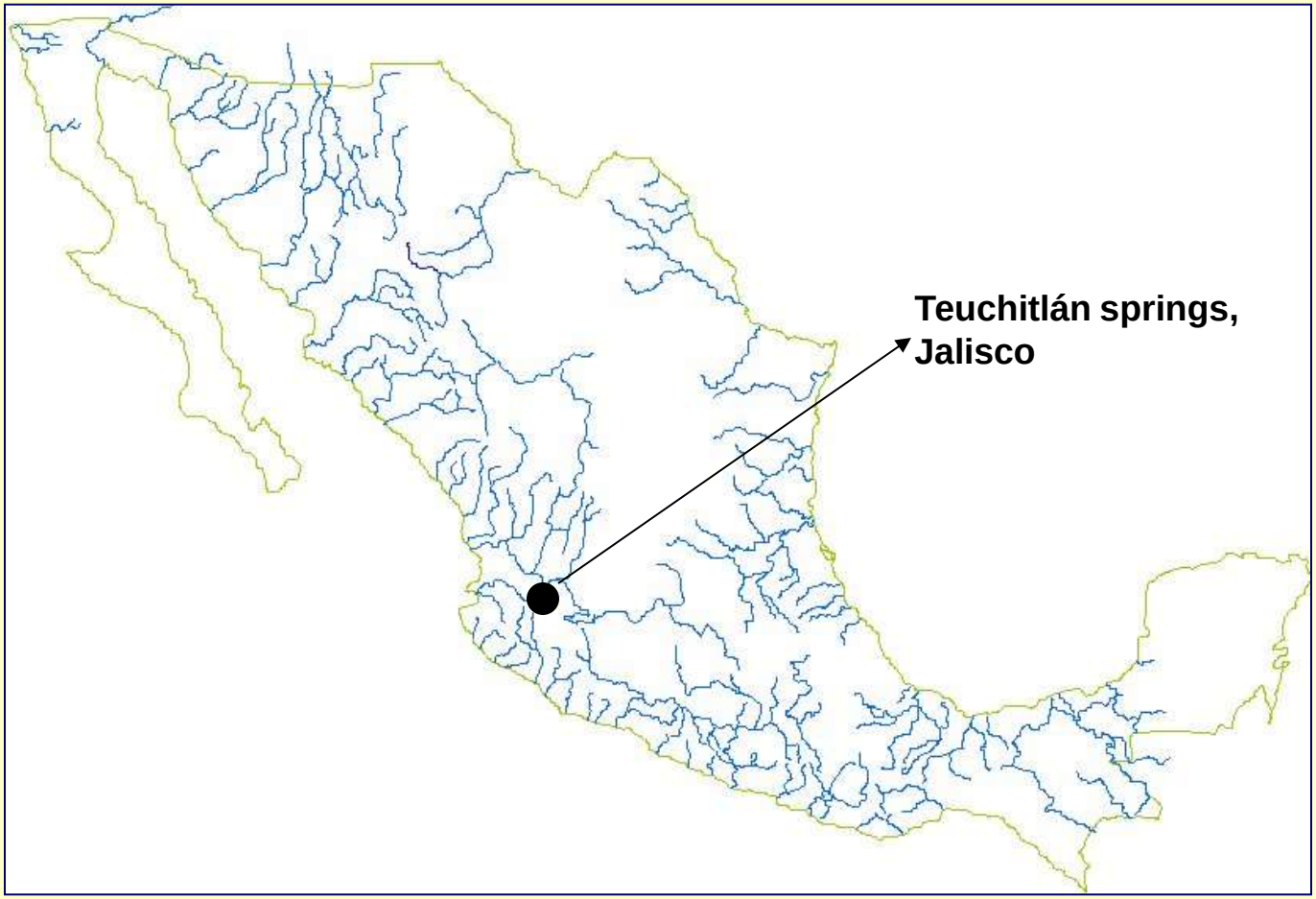
Xiphophorus helleri **(green swordtail) invaded the stream between 2000 and 2004….**

And *Allotoca goslinei* was quickly eliminated

Year	*Allotoca goslinei*	*Xiphophorus helleri*
2000	90	0
2004	7	120
2006	0	298
2007	0	259

Catch in standard 200-meter-long electrofishing survey

The Ugly: *Zoogoneticus tequila* (Extinct 2012?)



Zoogoneticus tequila: Habitat loss

As of 2008 limited to a tiny spring; 50 fish?

Drought in 2011-2012 dried the spring. Upon refilling *Heterandria bimaculata* invaded; <u>NO FISH</u> in 2015

Conserving Goodeids

1) Protect best remaining habitats for each species

“Spring” species easiest; small habitats an advantage

La Angostura springs, Lake Zacapu, Michoacán

- ***Alloophorus robustus***
- ***Allotoca zacapuensis***
- ***Goodea atripinnis***
- ***Girardinichthys ireneae***
- ***Skiffia lermae***
- ***Xenotoca variata***
- ***Zoogoneticus quitzeoensis***

Examples of other key spring/small lake habitats:

Los Negritos (La Alberca) Lake, Michoacán

Chapalichthys encaustus
Xenotoca* cf. *variata

Durango Valley springs, Durango

Characodon audax
Characodon lateralis

Hacienda San Sebastian Stock Tank, Jalisco

"Xenotoca"* cf. *eiseni
"Xenotoca" melanosoma

Spring protection has many other benefits; easy sell

e.g., drinking or livestock water, recreation

Cupatchiro Springs, Michoacán, is protected as a municipal water supply, helping conserve:

Alloophorus robustus

Goodea atripinnis

Skiffia multipunctata

Zoogoneticus purepechus

But keeping out non-native species very difficult; "exotics" are the biggest threat to most springs

The Cupatchiro Springs already have:

Common carp (*Cyprinus carpio*)
Rainbow trout (*Oncorhynchus mykiss*)
Tilapia (*Oreochromis aureus*)
Guppy (*Poecilia reticulata)*

Protecting “Riverine” Goodeid Habitats Challenging

Need a watershed approach

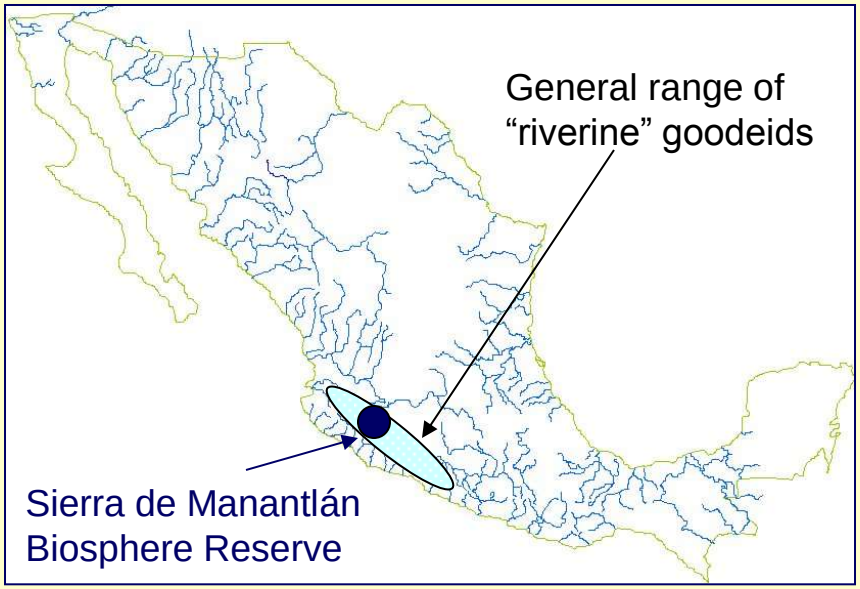
Allodontichthys hubbsi

Tamazula River, Jalisco

Xenotaenia resolanae

Cuzalapa River, Jalisco

Existing reserves only cover some species



Sierra de Manantlán Biosphere Reserve protects:

Allodontichthys zonistius
Ilyodon furcidens
Xenotaenia resolanae

No reserves protect:

Allodontichthys hubbsi
Allodontichthys tamazlulae
Ilyodon whitei

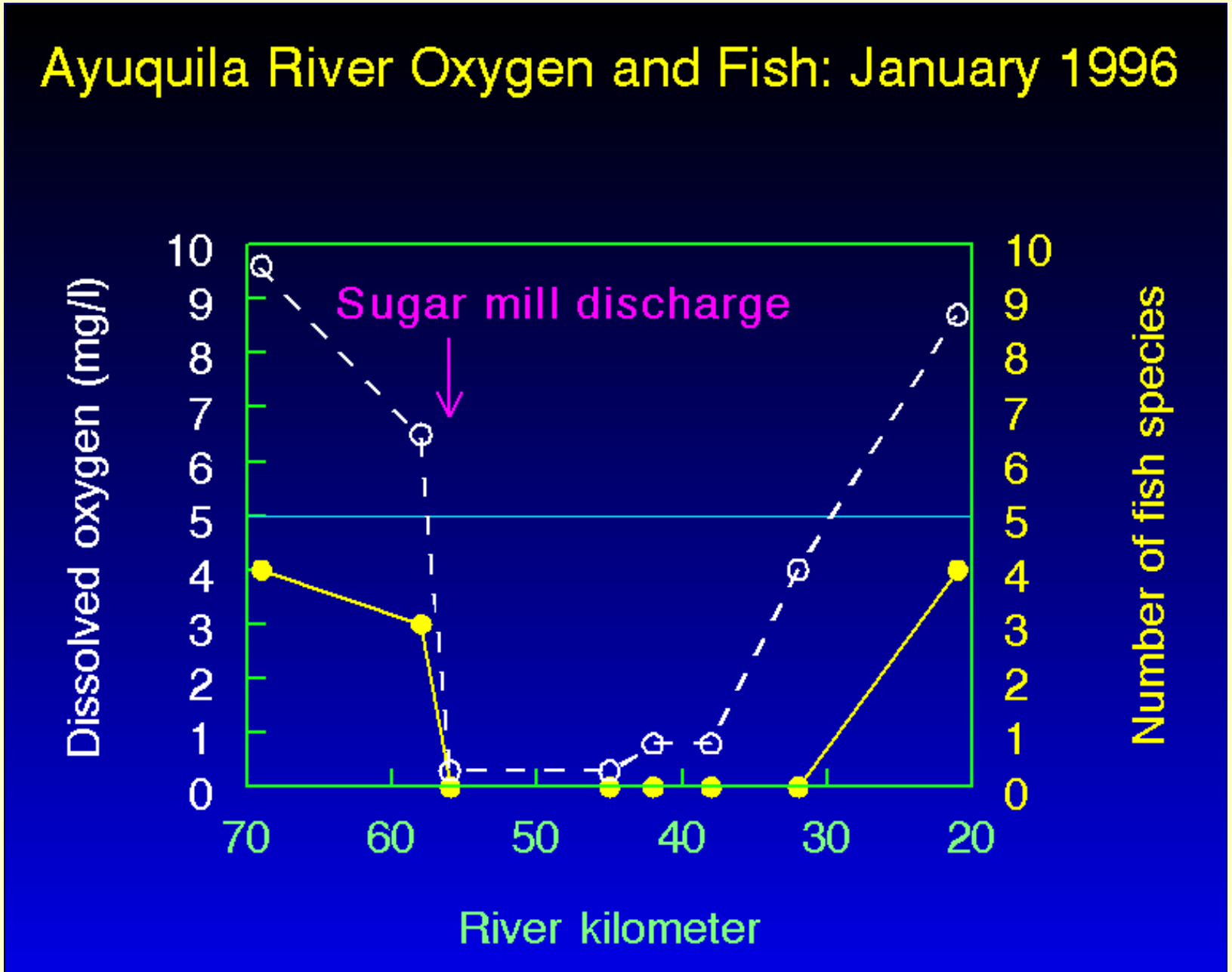
Conserving Goodeids

2) Restore key degraded habitats (where practical)

Ayuquila River, Jalisco, example

Pre 1999

25 km of the river below the sugar mill was fishless

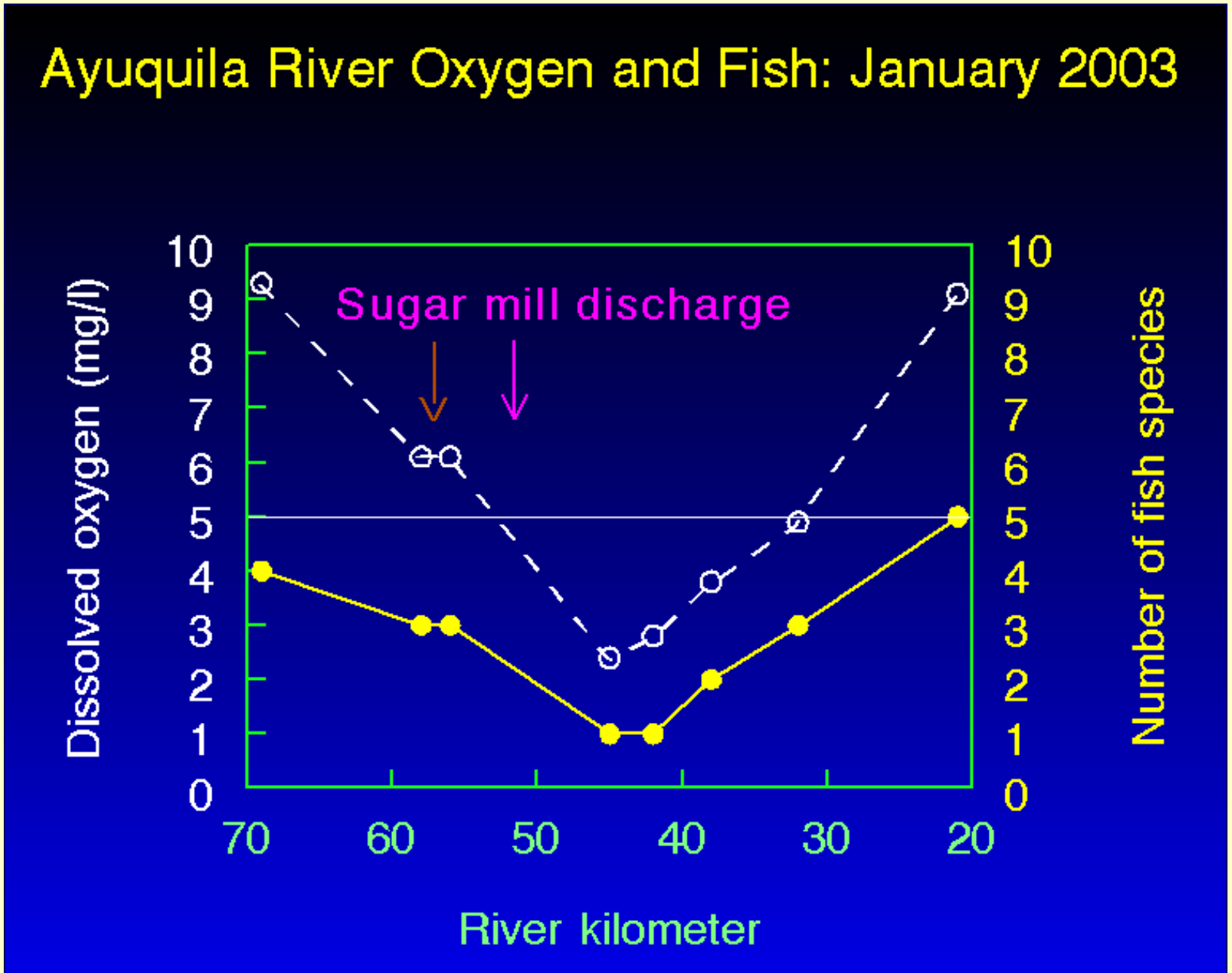


1999: Sugar mill wastes diverted to irrigation canals

Passing for about 8 km through canals allows some solids to settle out, some breakdown of wastes; results in less-polluted discharge to river

Post 1999

Partial treatment of discharge – partial fish recovery



Ilyodon furcidens has re-colonized river below mill

But as water quality improved, exotics expanded

and Goodeid numbers were reduced

Conserving Goodeids

3) Establish and maintain captive breeding colonies

“Fish Ark” Facility Universidad Michoacana de San Nicolas Hidalgo, Morelia, Michoacán, plus others in development

Tanks of individual hobbyists and public aquariums in the U.S. and Europe

***i.e.* YOU!**

Most urgent needs for captive rearing:

Extinct in the wild:

Allodontichthys polylepis, Allotoca goslinei, Skiffia francesae, Zoogoneticus tequila

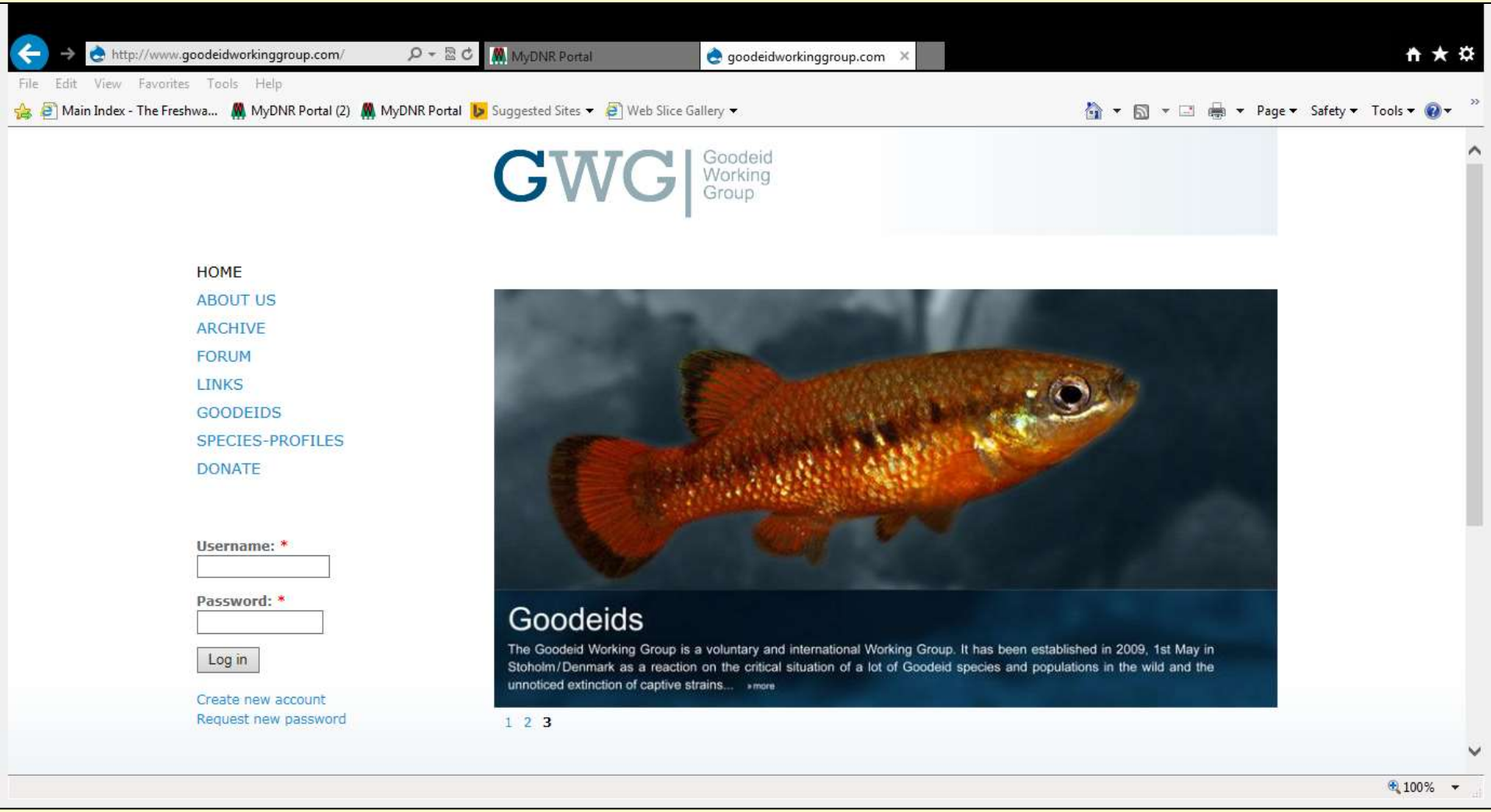
Critically endangered in the wild:

Allotoca maculata, Allotoca meeki, Allotoca zacapuensis, Characodon audax, Characodon lateralis, Girardinichthys ireneae, Girardinichthys viviparus, Neoophorus regalis, Xenoophorus captivus

Allotoca maculata, Magdalena Lake, Jalisco

But ALL Goodeids warrant captive rearing!

Where to Go for Information and Fish: Goodeid Working Group (GWG)



http://www.goodeidworkinggroup.com/

Summary and Conclusions

1) Wild Goodeids are in serious trouble; most species are endangered and in serious decline

2) Primary threats are water quantity, water quality, and especially non-native species

3) Conservation requires protection, restoration, and *captive rearing*

4) CLA members and hobbyists in general can play a key role in captive rearing through the GWG

Questions?

Sunrise over Lake Pátzcuaro, Michoacán