Zoogoneticus tequila reintroduction project: an international cooperative project

The lab start in 1997


The Fish Ark project
Officially start at 1999

First work


2000


2008
POECILIA SCANDINAVIA
ZOOLOGICAL GARDENS
CHESTER
Poecilia
Vereniging levendbarende tandkarpers


2014

Phase 1 (year one and two).

Securing the reintroduction by the biological, ecological and limnologic characterization of the springs of Teuchitlán

-Electrochemical characteristics of the water

- Water and habitat Quality Indexes

-Geomorphologic variables

-Aquatic vegetation

-Plankton community

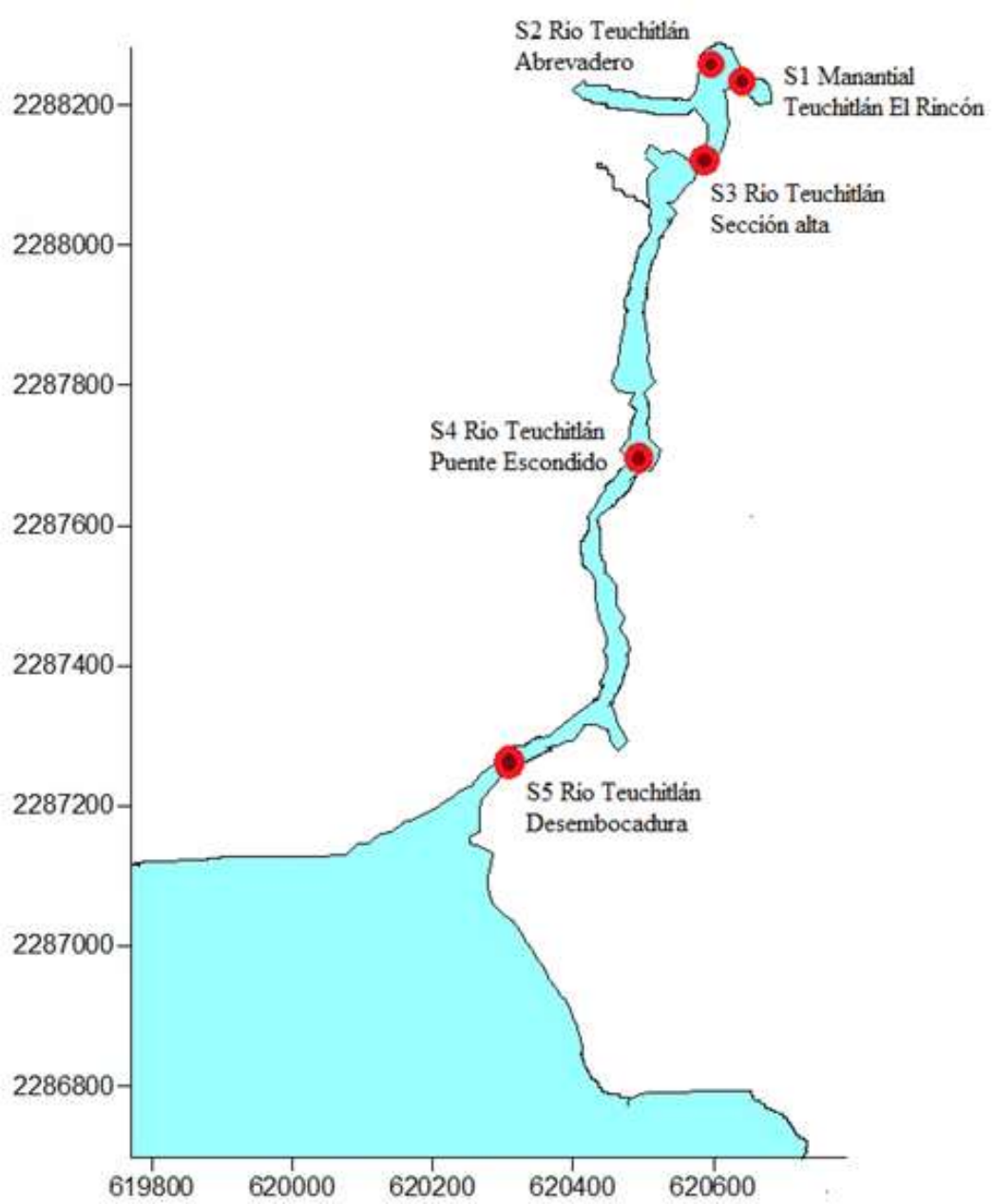
-Fish community structure

-Food chain of the fish community

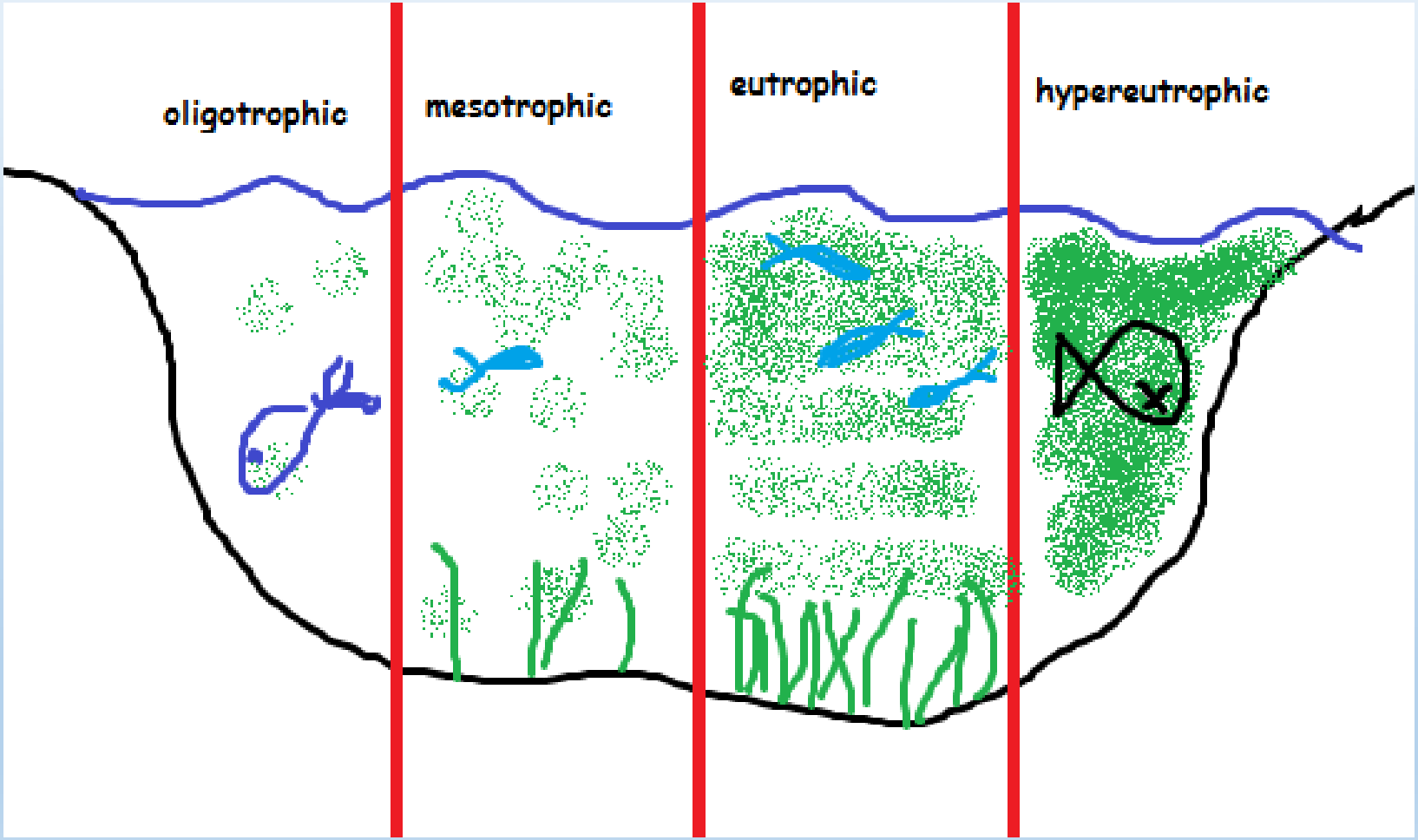
-Growth and reproduction of the fish species

- Parasitological studies

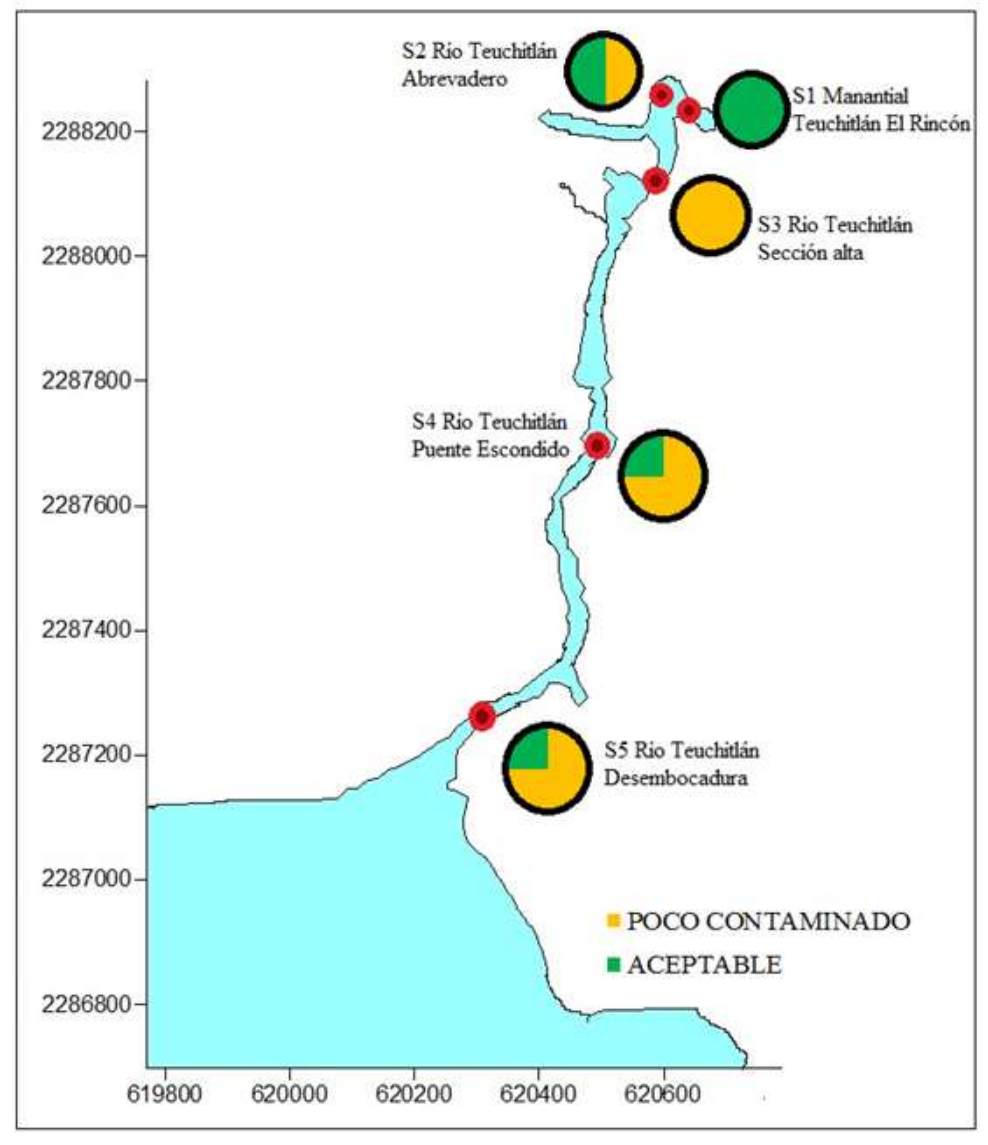
Collection sites



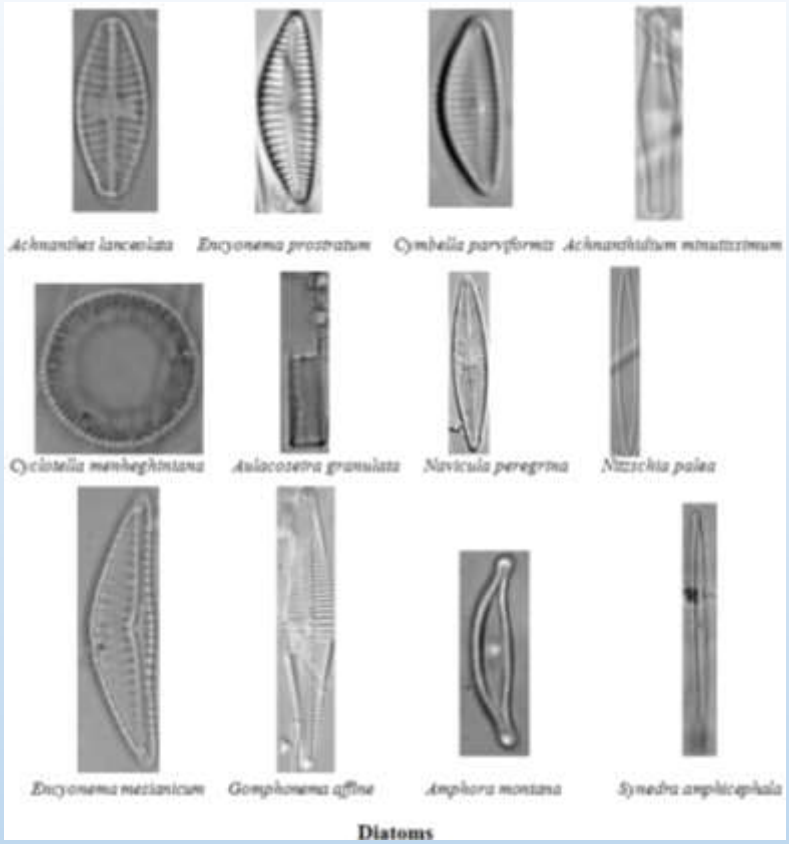
Limnobiological characterization



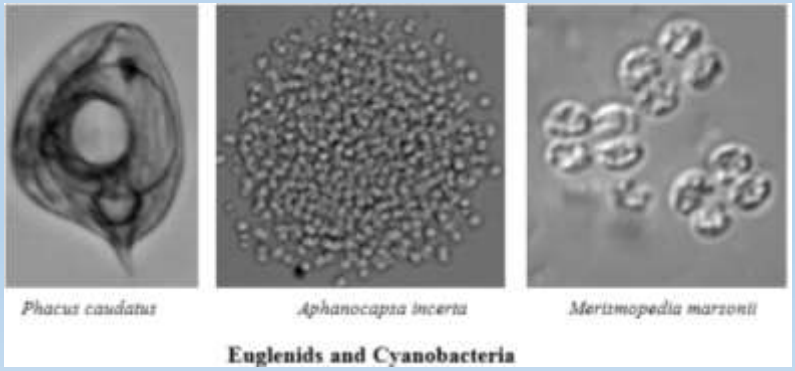
Water quality along the river using 35 Parameters



Phytoplankton community
37 taxa



Diatoms



Euglenids and Cyanobacteria

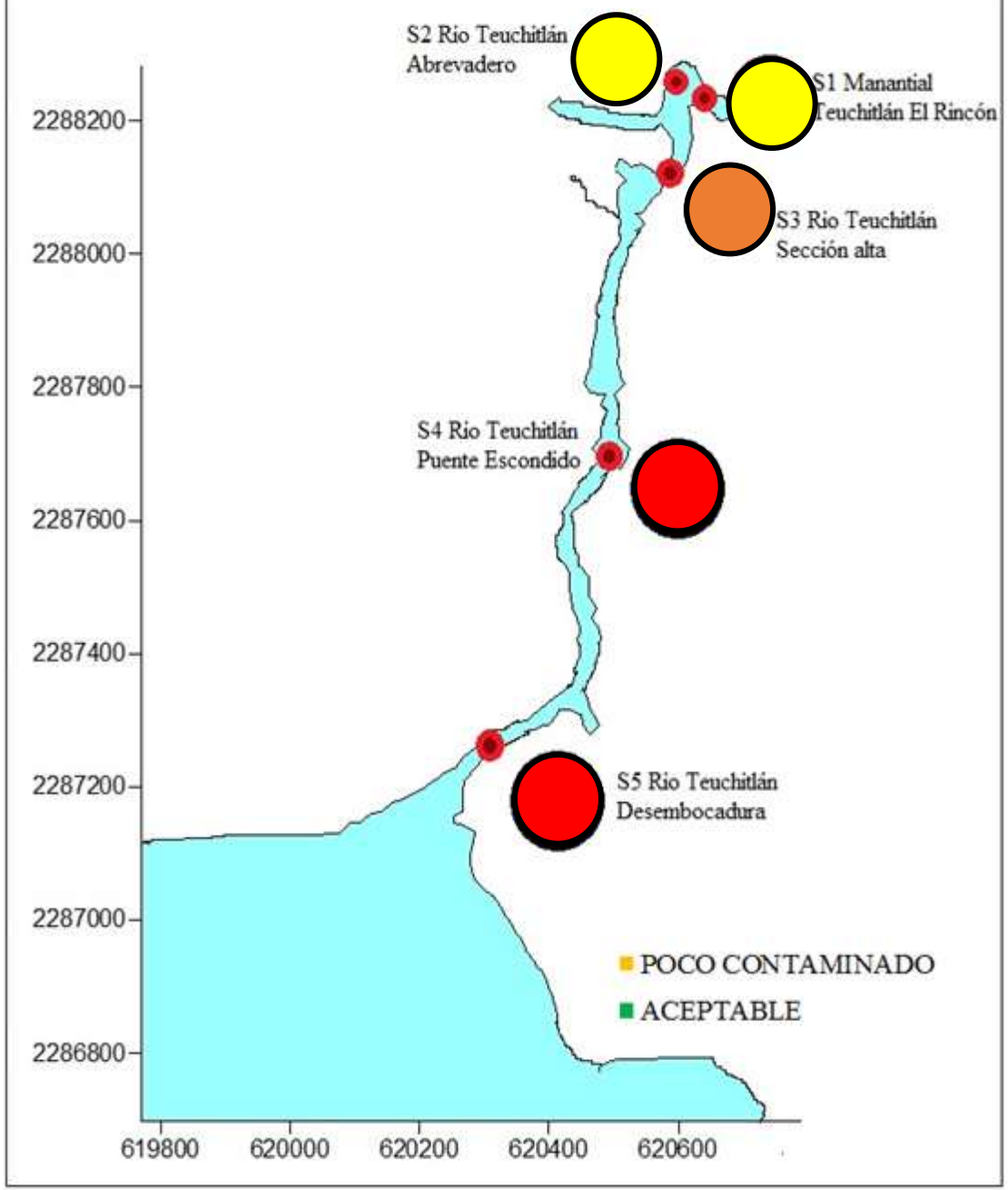
SITE	Phytoplankton	Dominant algal group
S1	< 200 org/mL	Diatoms
S2	< 200 org/mL	Diatoms
S3	< 1000 org /mL	Diatoms Green algae
S4	< 500 org/mL	Green algae Diatoms Blue green algae
S5	< 500 org/mL	Diatoms Green algae
S6	< 200 org/mL	Green algae Diatoms
S7	< 200 org/mL	Green algae
S8	< 500 org/mL	Diatoms
S9	> 1000 org/mL	Green algae, Diatoms, Blue Green algae, Euglenoids

NYGAARD INDEX

MESOTROPHIC

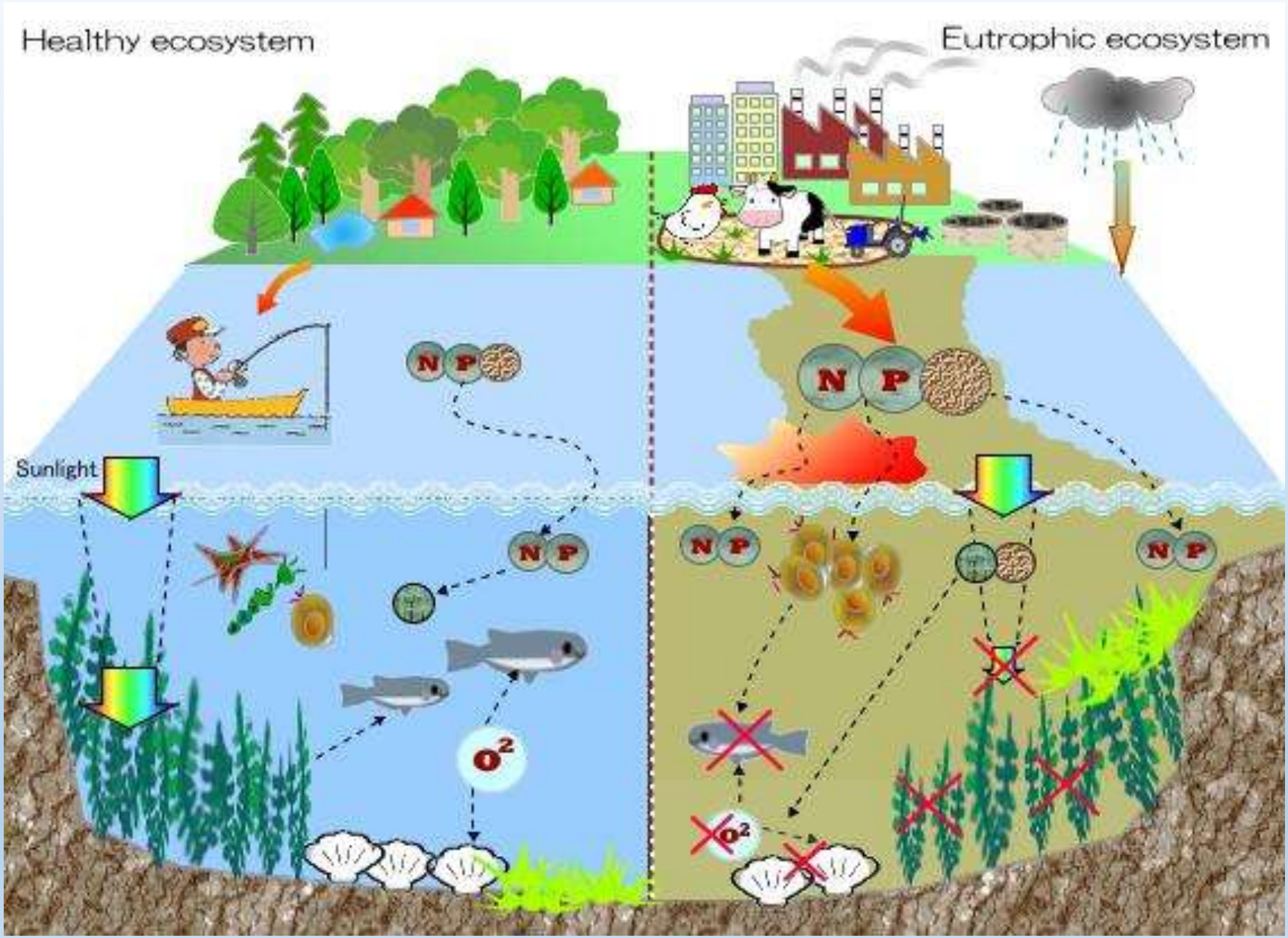
MESOTROPHIC TO EUTROPHIC

EUTROPHIC



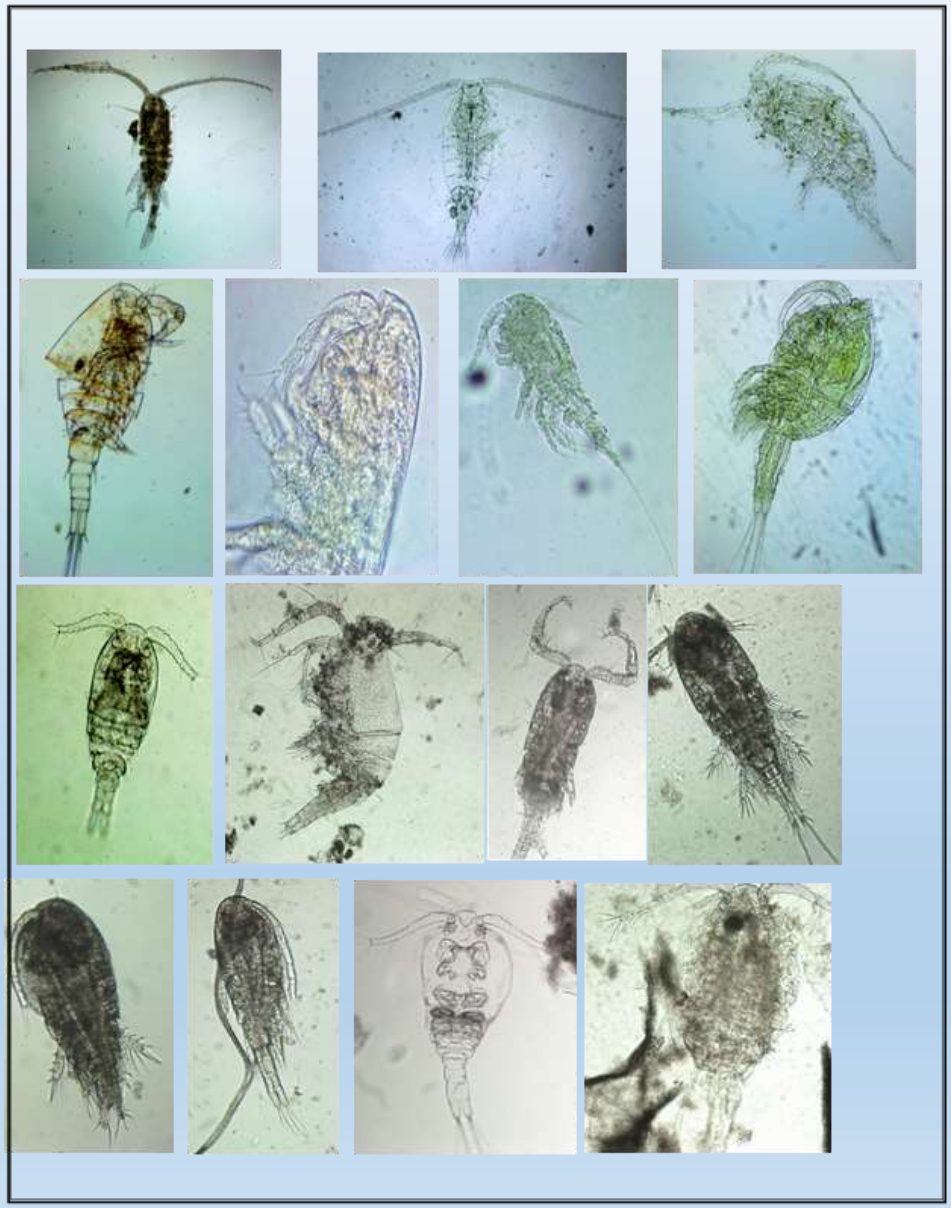
- Algal species and water quality

- Agriculture and domestic water discharge


Healthy ecosystem
Eutrophic ecosystem
Sunlight
N
P
O2

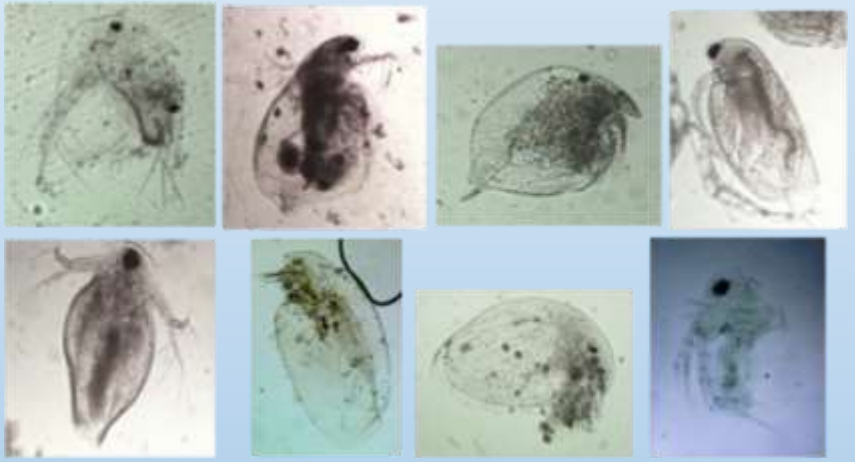
38 Taxa

COPEPODA



ROTIFERA

CLADOCERA

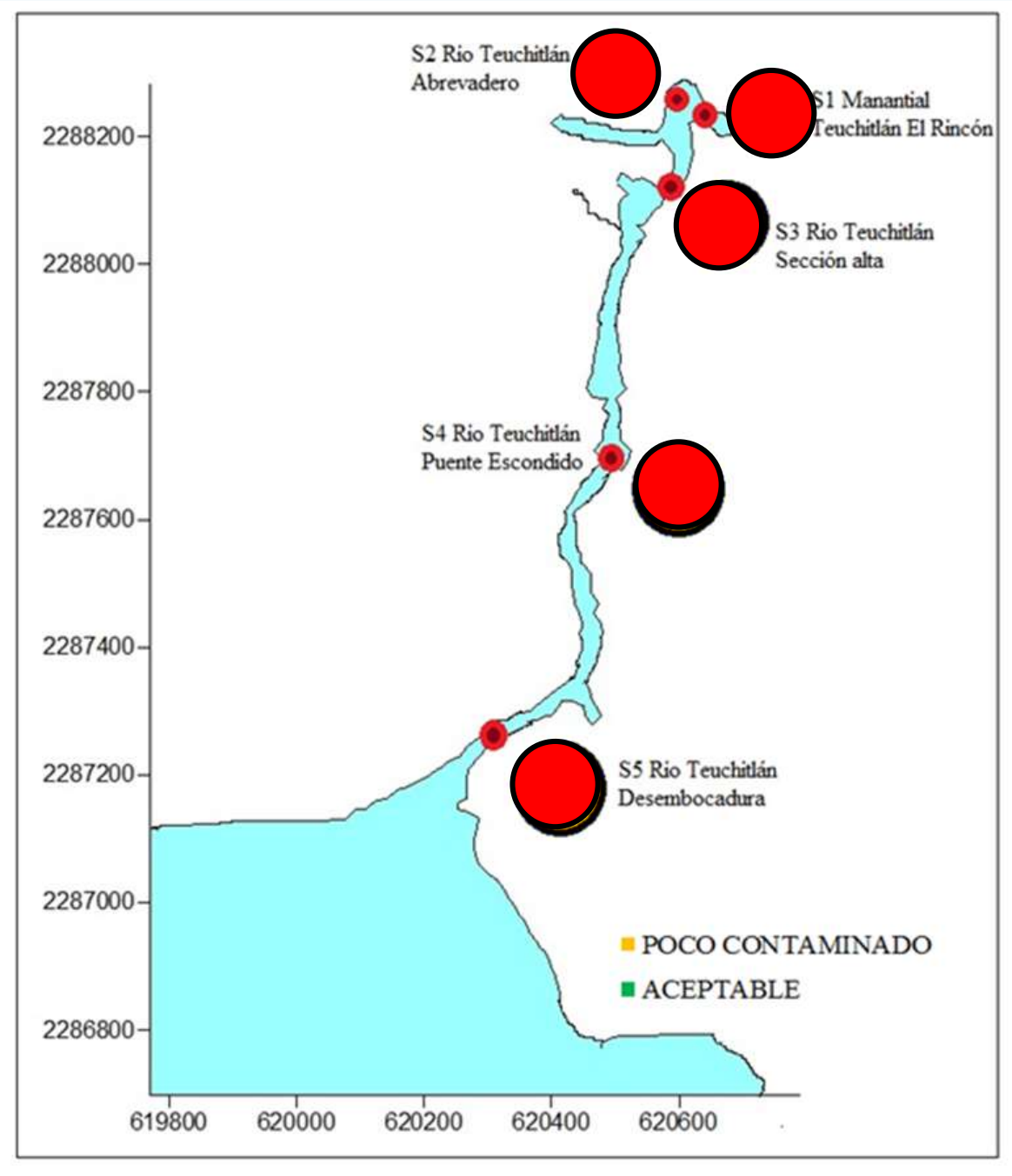


OSTRACODA

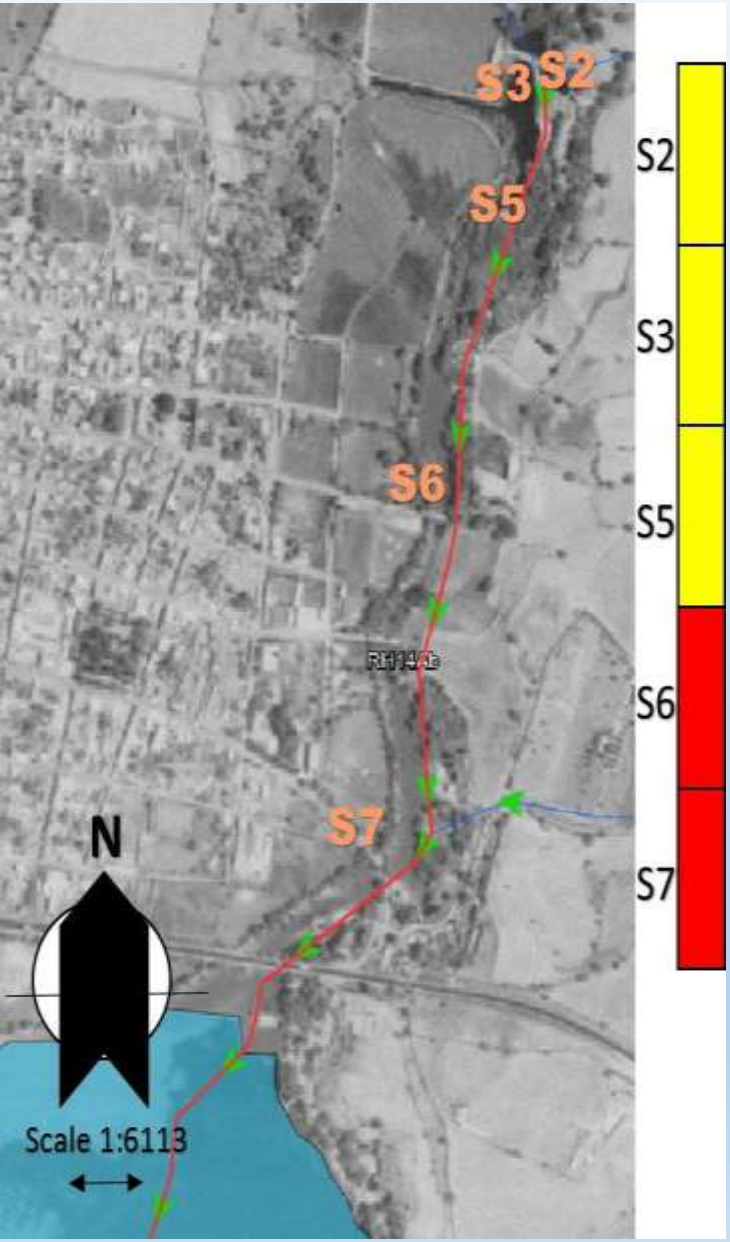
MACROINVERTEBRATES 47 TAXA

IIBAMA Index

Poor quality



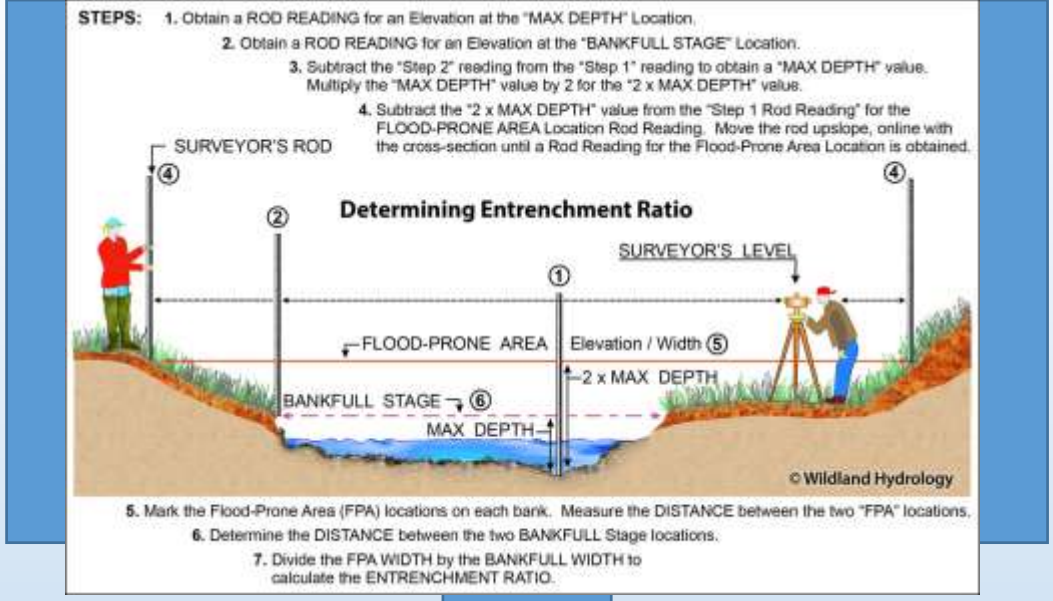
General trend of Integrity Biotic Index (IBI).



excellent

regular

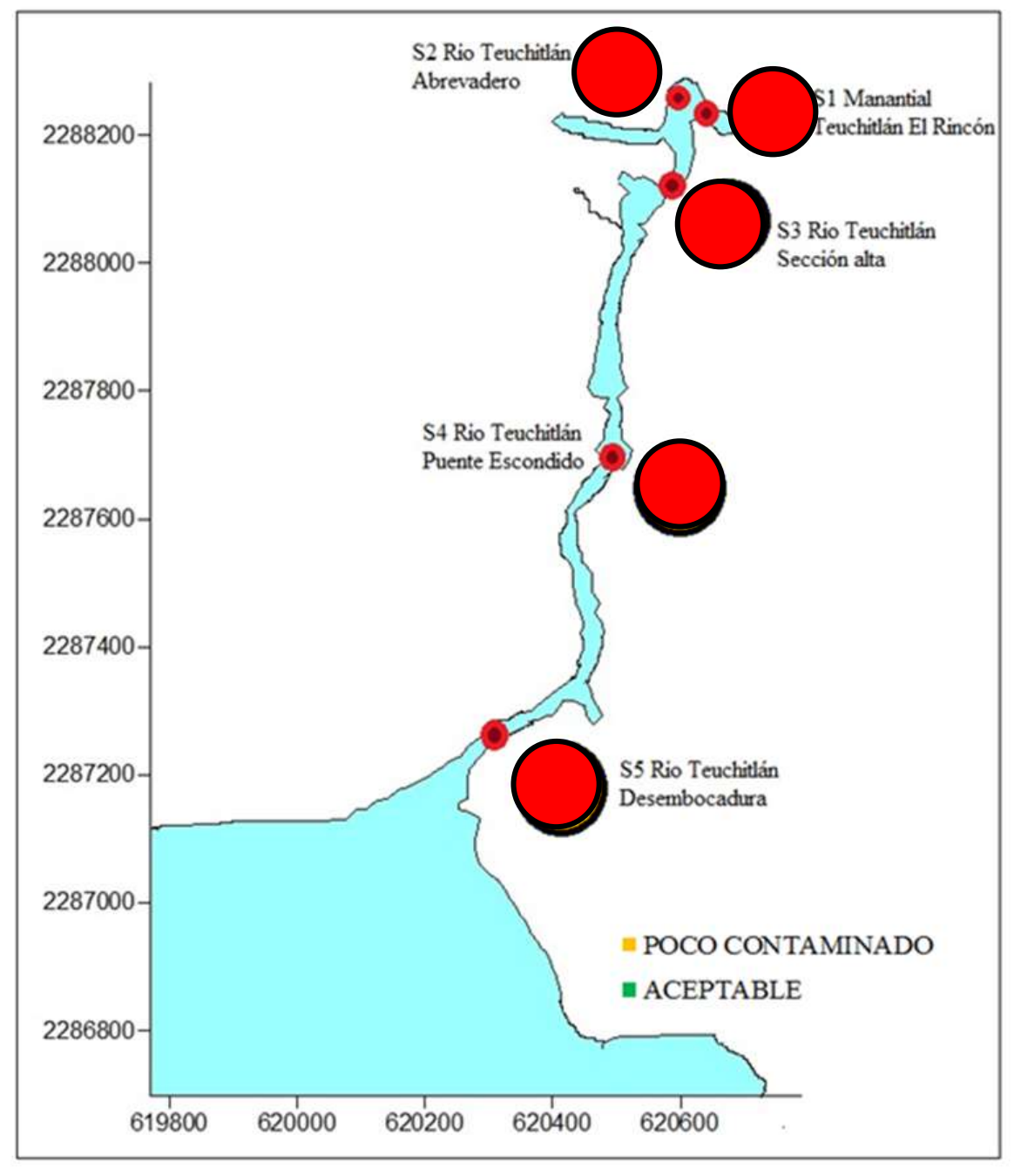
poor


STEPS:
1. Obtain a ROD READING for an Elevation at the "MAX DEPTH" Location.
2. Obtain a ROD READING for an Elevation at the "BANKFULL STAGE" Location.
3. Subtract the "Step 2" reading from the "Step 1" reading to obtain a "MAX DEPTH" value. Multiply the "MAX DEPTH" value by 2 for the "2 x MAX DEPTH" value.
4. Subtract the "2 x MAX DEPTH" value from the "Step 1 Rod Reading" for the FLOOD-PRONE AREA Location Rod Reading. Move the rod upslope, online with the cross-section until a Rod Reading for the Flood-Prone Area Location is obtained.
SURVEYOR'S ROD
Determining Entrenchment Ratio
SURVEYOR'S LEVEL
FLOOD-PRONE AREA
Elevation / Width ⑤
2 x MAX DEPTH
BANKFULL STAGE ⑥
MAX DEPTH
© Wildland Hydrology
5. Mark the Flood-Prone Area (FPA) locations on each bank. Measure the DISTANCE between the two "FPA" locations.
6. Determine the DISTANCE between the two BANKFULL Stage locations.
7. Divide the FPA WIDTH by the BANKFULL WIDTH to calculate the ENTRENCHMENT RATIO.

Rosgen 1996

Environmental quality

Poor quality



S1: Spring “El Rincon”

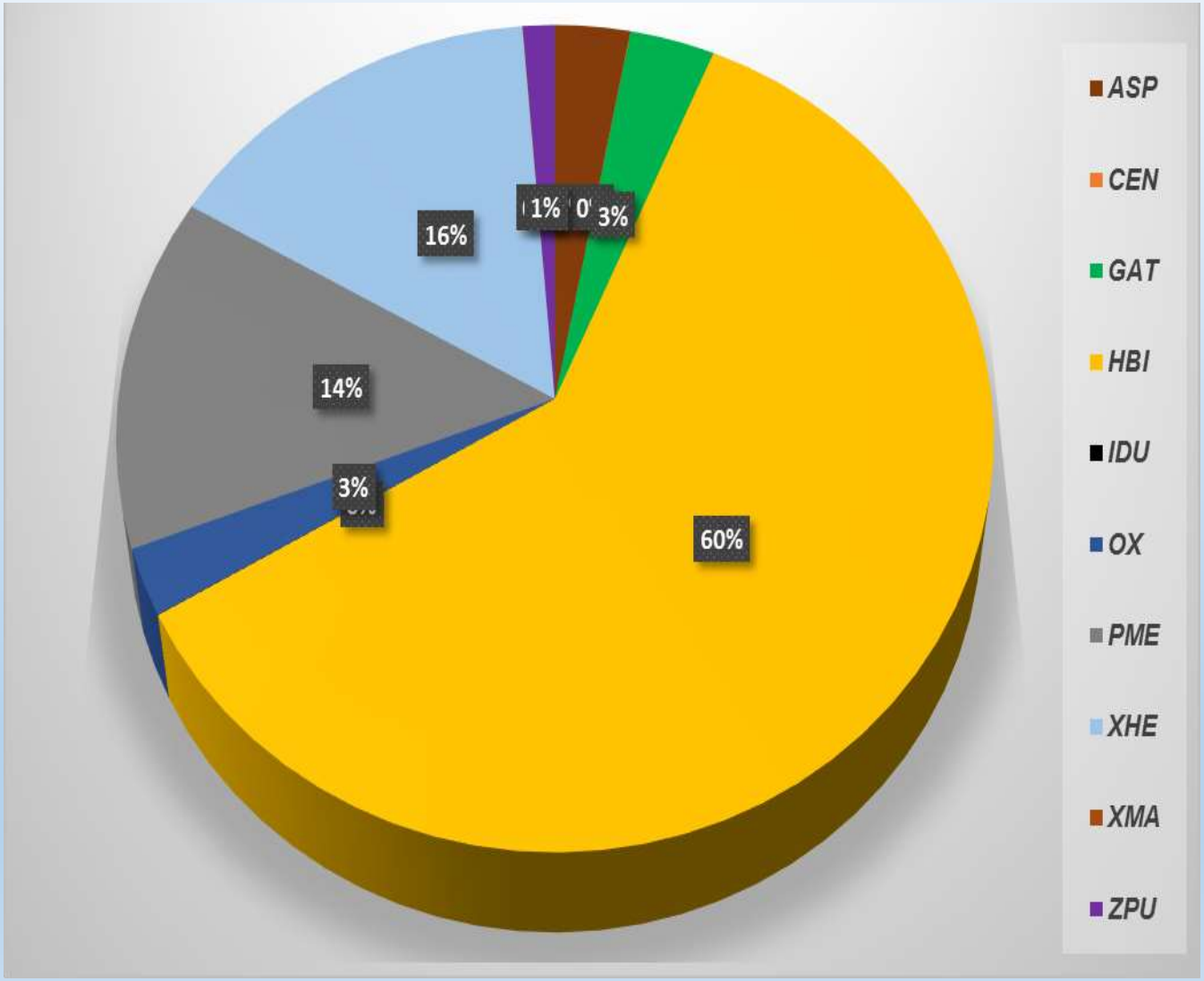
Aquatic park

Pool

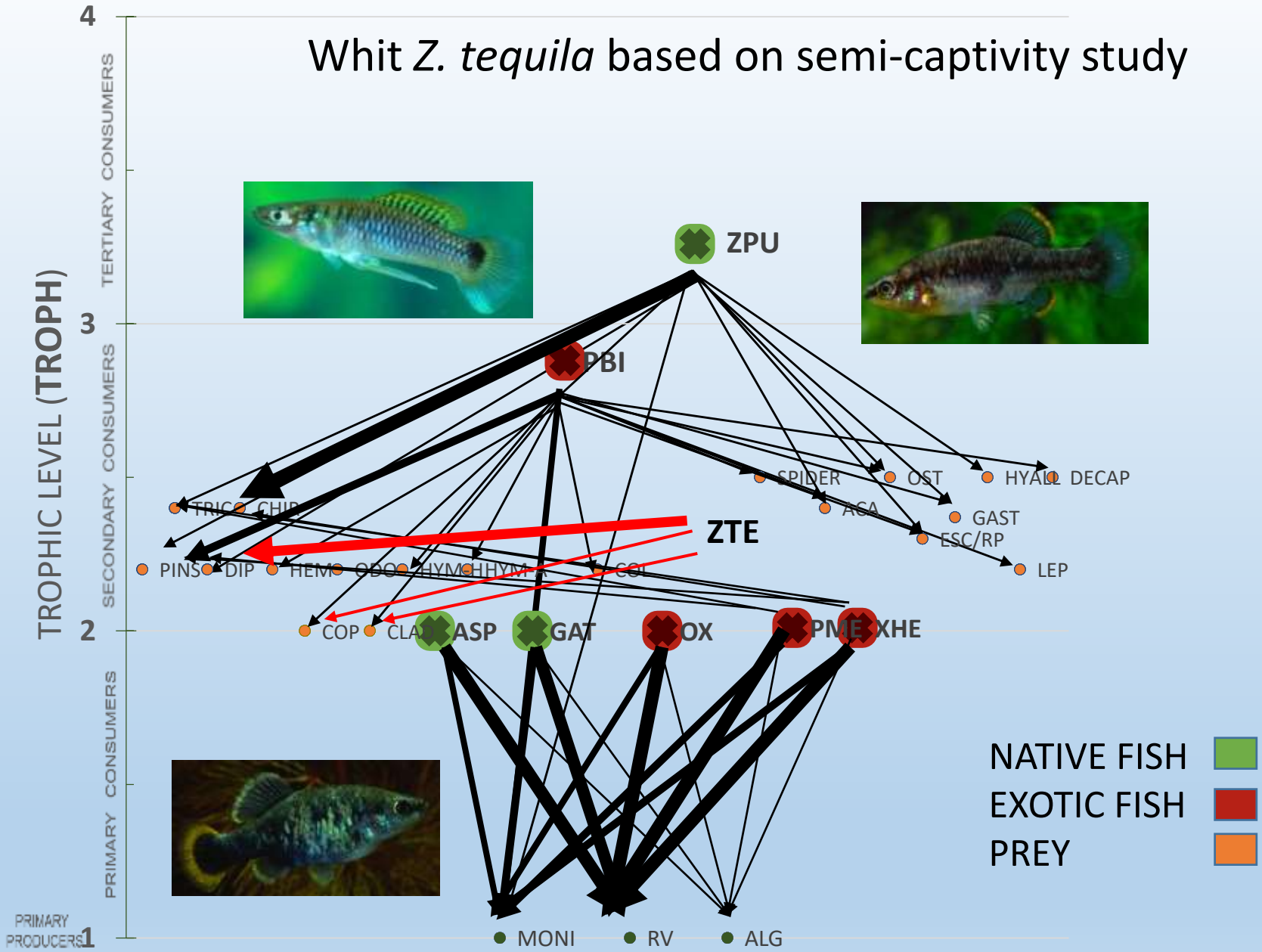
No aquatic vegetation

Abundance of species

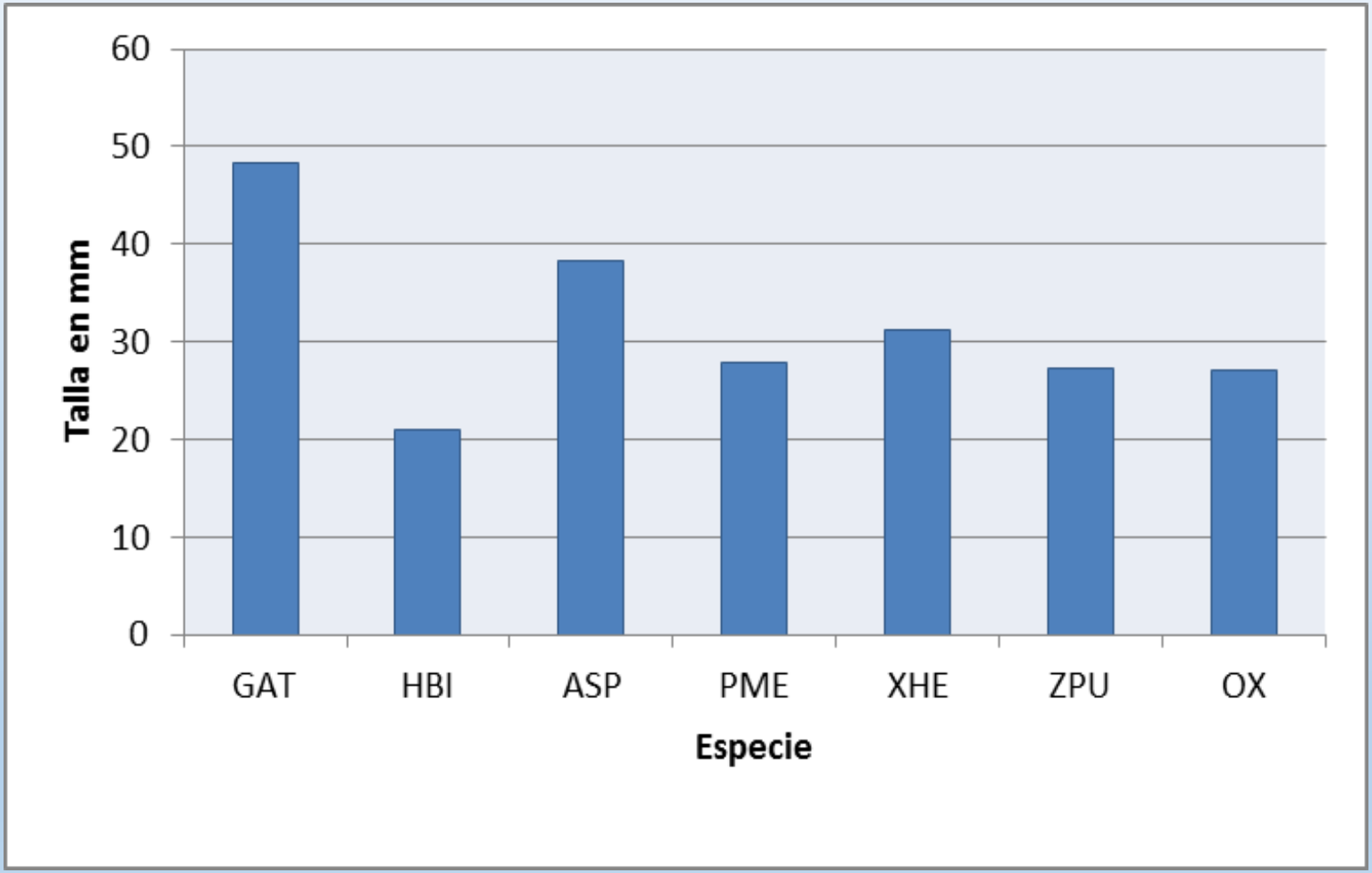
90% represented by exotics



Whit *Z. tequila* based on semi-captivity study

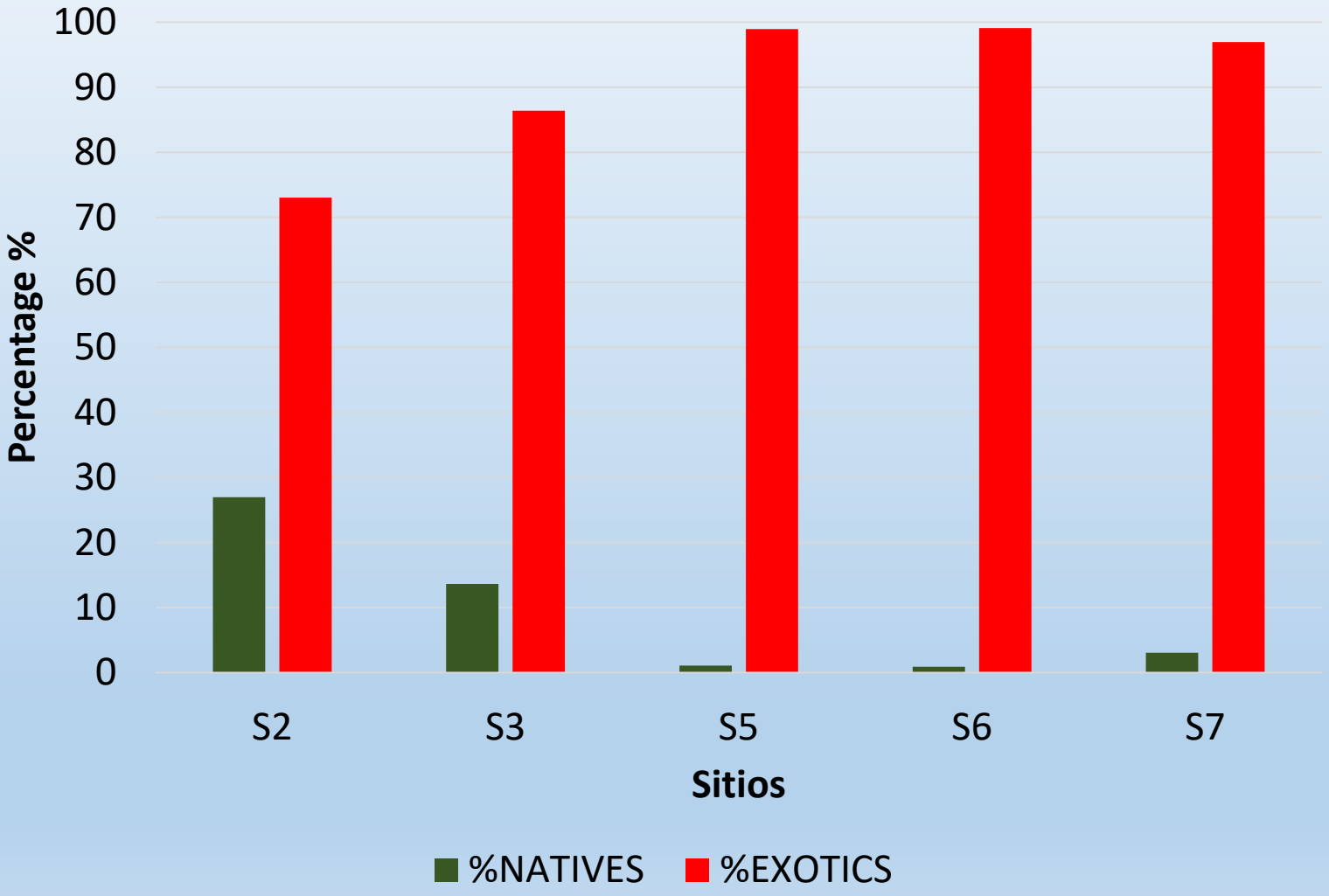


Minimum reproduction size



	ASP	GAT	HBI	PME	XHE	ZPU	ZTE
SEXUAL PROPORTION	0.25:4	1:1.3	1:2	0.68:1	1.38:1	0.75:1	**1:1.8**
FECUNDITY	5	8	6	20	7	6	**4**

Density of fish community in the different locations



The decision was not easy

-Sites 1 to 3 and 8 with the best quality index

-The most invertebrates diverse (potential food) sites are the poorest quality index places

Were we need to reintroduce?

Control of exotic species

Goal: control of the exotic species of the Teuchitlan river

Pseudoxiphophorus bimaculatus

Poecilia sphenops

Oreochromis aureus

Xiphophorus hellerii

Xiphophorus maculatus

A. Fishing art

Net chinchorro

Tramp, Naza

Electroshock

Catching fish

The extraction was made principal in the site 1 and 2, where we reintroduction the *Z. tequila* and “El anillo”

Site “El anillo”

This was the first control of exotics species

B. Hydraulic gates

We elaborated hydraulic gates that regulates the flow of water and the entrance of the exotic species to the pools.

We made different events of extraction of exotic species

Number of organisms captured in “El anillo”. The number corresponds to 1 hour of capture.
In italics the weight.

Species	Nasa	Chinchorro	Electro	Total
Pseudoxiphophorus bimaculatus	48	2	15	65
	123	*1.24*	*20.427*	*143.35*
Poecilia sphenops	19	21	16	56
	39.7	*23.66*	*10.27*	*43.06*
Xiphophorus helleri	1	0	2	3
	0.63	*0*	*0.309*	*0.94*
Orechromis aureus	18	20	33	71
	not available			
Weight /grs	163.3		22.522	398.82 g.
Average/1 hr				195

Collection of organisms in the sites 1 y 2

Species	Sitio 1	Sitios 2	Total
Pseudoxiphophorus bimaculatus	513	665	1178
	355.05	550.83	926.88
Poecilia sphenops	40	26	66
	32.12	17.31	49.43
Xiphophorus hellerii	73	85	158
	44.51	46.46	76.72
Orechromis aureus	3	1	4
	3.42	1.20	4.62
Captured organisms			**1406**
weight total			1057.65/g

Conclusions

- In the site one and two were the extraction of exotic species, in those sites we made the reintroduction *Z. tequila.*
- It will be very difficult the eradication of the exotic species, but we can have a control of their populations.
- We recommend the extraction have to continue in a long period. But with the participation of local people

PARASITOLOGICAL WORK

The work consisted in two main parts:

- Before reintroduction
  - Parasitological survey of *Z. tequila* in Morelia
  - Parasitological survey of fishes from Teuchitlan

- After reintroduction

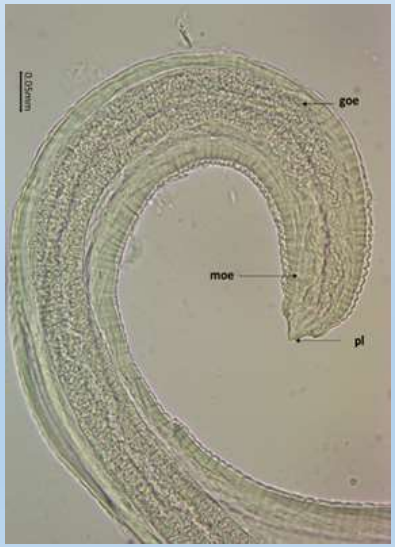
- Before reintroduction
  - Parasitological survey of *Z. tequila* in Morelia
    - Health screening

Rustic pond at botanical garden in Morelia city

The examination period:

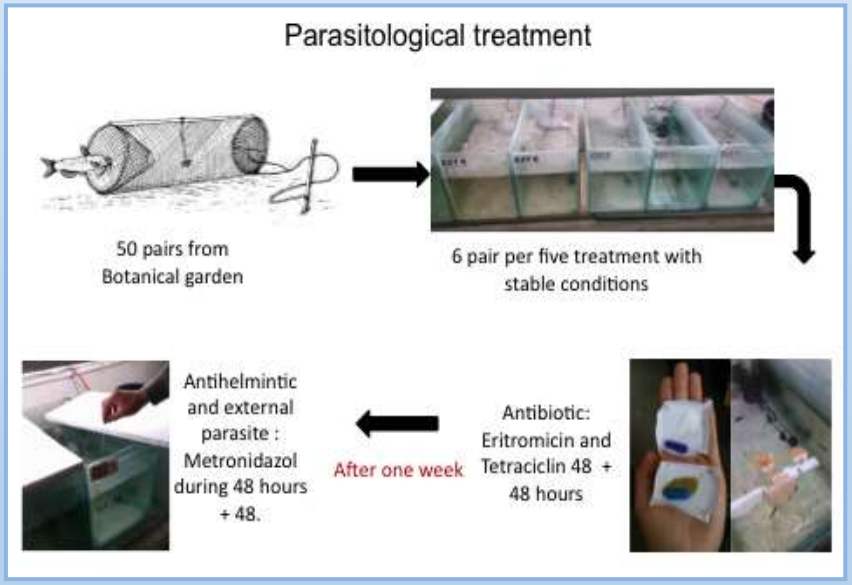
- two taxa of parasites were found
  - *Lernaea cyprinacea*
  - *Spiroxys* sp Larva).

- Seasonally the infection has important changes.
  - In the dry season the parasitic prevalence were since 0 – 20%
  - In the rainy season the prevalence were since 40 – 70%.
- It was decided to collect the fish for reintroduction in the dry months of the year.



- It was necessary to establish a deworming treatment prior to reintroduction.
- An experiment to test the resistance of the species and effectiveness of different drug in the parasites was performed, observing the prophylactic treatment recommended for aquarium fish based on erythromycin, tetracycline and metronidazole.
  - Dose was with a 100% (prophylactic treatment) and replicas made with dilutions to the 75%, the 50% and the 25% plus an untreated replica as control.
- Survival and presence of parasites was evaluated

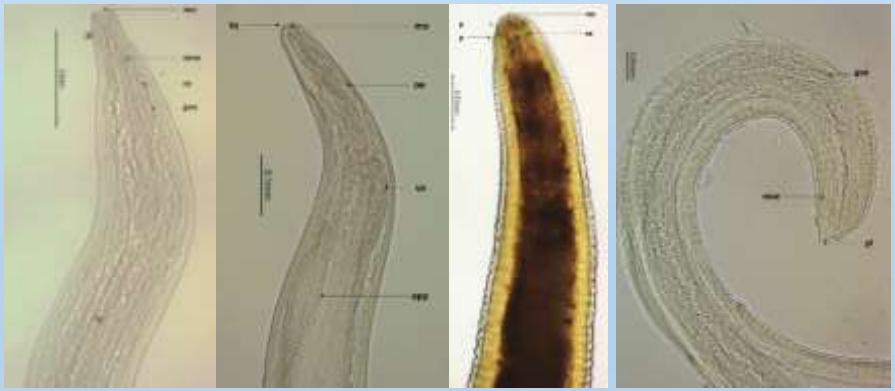
The dose made with the dilution to the 50% presented an efficiency of 100% survival and deworming effectiveness for both sexes.



- After reintroduction
  - Parasitological survey of fishes from Teuchitlan
    - Health screening of all the fish species in the springs an river
    - Determine sex, weight and measure
    - Parasitological dissections
    - To characterize the infection
  - Not more than 30 fish of each species were collected from each site (five sites).
  - The fish were dissected according with the specialized literature.
  - Results are:

Results

We have recovered 12 taxonomic identities, four nematoda, seven platyhelminthes and one acanthocephalan.



NEMATODA
Rhabdochona mexicana
Contracaecum sp
Eustrongylides sp
Spiroxys sp

PLATYHELMINTHES
Diplostomum compactum
Posthodiplostomum minimum
Clinostomum complanatum
Glossocercus auritus
Centrocestus formosanus
Saccocoelioides lamothei
Botriocephaus acheilognathi

ACANTOCEPHALA
Arhythmorhynchus brevis

Exotic in Mexico

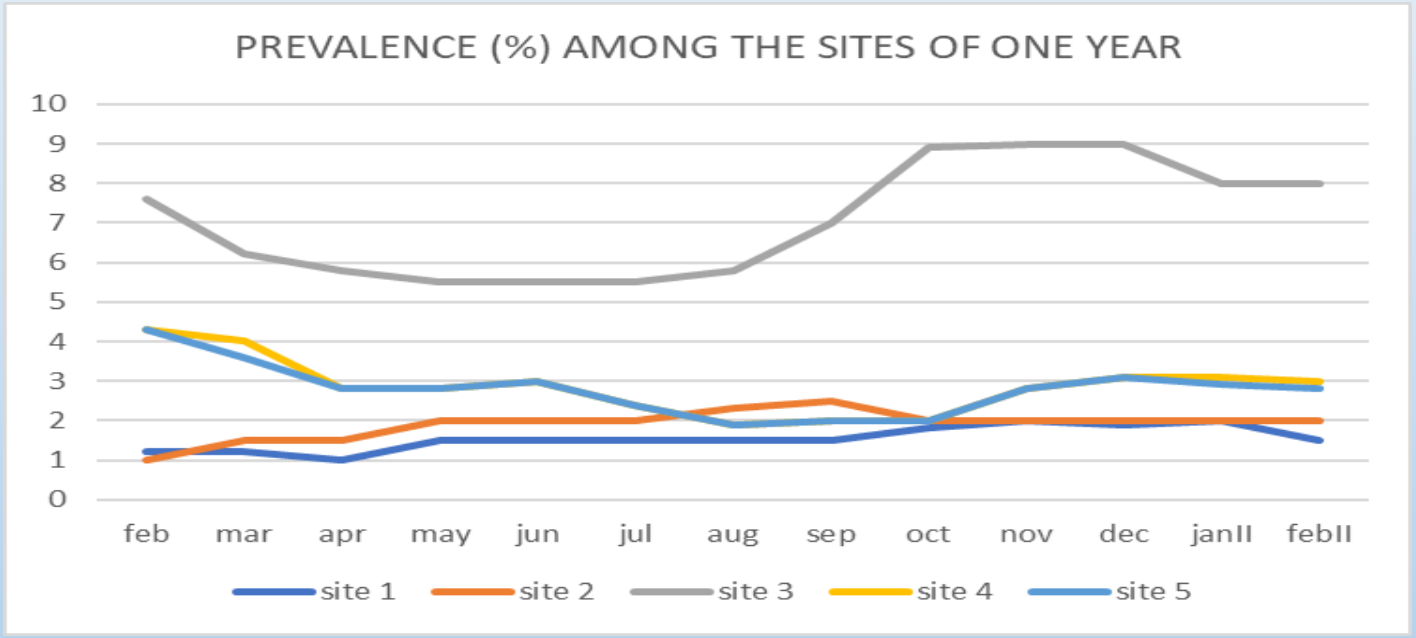
Characterization of the infection

Parasite	Stage	Habitat	Prevalence	Abundance	Average intensity
NEMATODA					
Rhabdochona mexicana	Adult	si	1.48	0.03	2.27
***Contracaecum* sp**	Larva 3	m	0.80	0.07	8.47
***Eustrongylides* sp**	Larva 3	m	2.92	0.08	2.89
***Spiroxys* sp**	Larva 3	g	0.13	- --	1.63
PLATYHELMINTHES					
Diplostomum compactum	Metacercaria	me	0.67	0.01	1.93
Posthodiplostomum minimum	Metacercaria	l	0.10	- --	1.50
Clinostomum complanatum	Metacercaria	m	0.07	- --	0.75
Glossocercus auritus	Metacestode	si	0.18	0.00	1.00
Centrocestus formosanus	Metacercaria	gi	11.39	9.66	84.84
Saccocoelioides lamothei	Adult	si	- --	- --	0.04
Botriocephaus acheilognathi	Adult	li	0.33	0.01	2.45
ACANTOCEPHALA					
Arhythmorhynchus brevis	Cystacanth	m	0.10	- --	1.00

Abbreviations: **si** = small intestine, **m** = muscle, **g** = gonads, **me** = mesenteries, **l** = liver, **gi** = gills and **li** = large intestine.

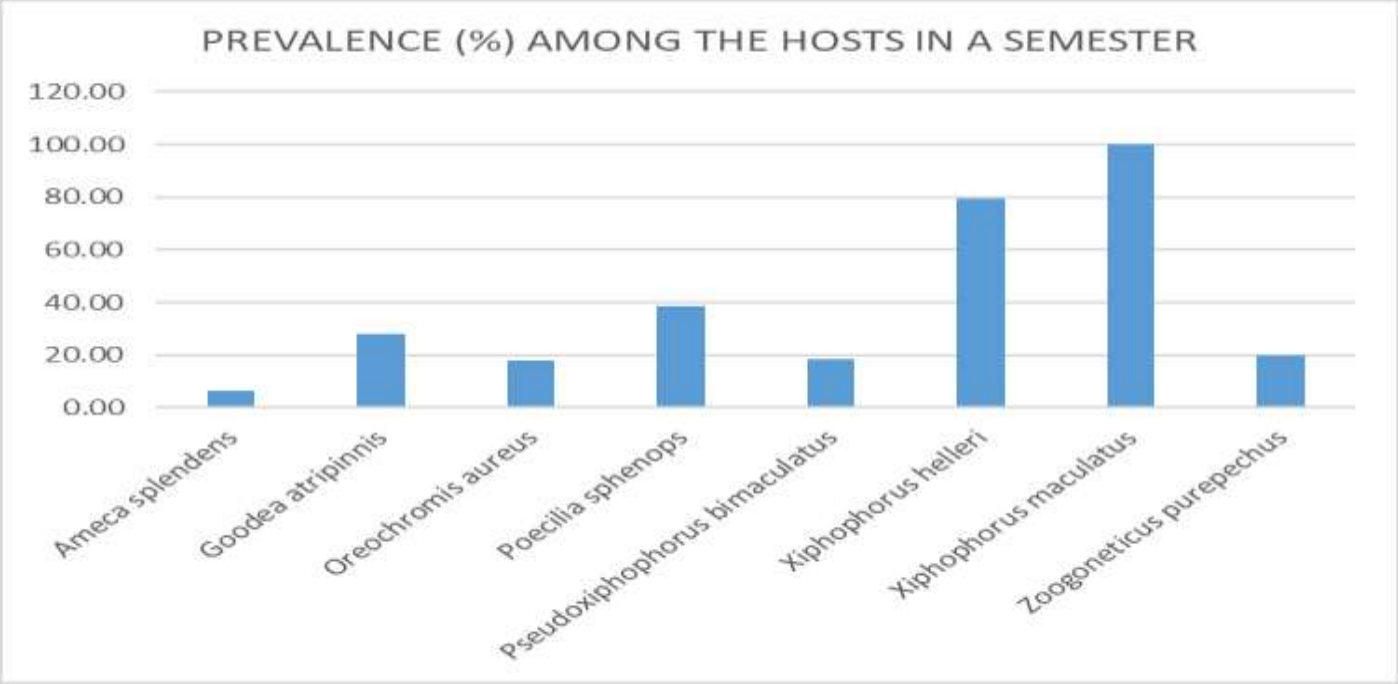
Note: **Prevalence** = percentage, **Abundance** = number of helminths among the fish surveyed population and **Average intensity** = number of helminths among the parasitized fish population.

Respect to the sites at the field work (in the last year of work)



Graphic about one year of general prevalence among the sites at the springs (site 1) and the river (sites two to five). Note: janII and febII are 2018 and the other ones are 2017.

About the hosts (in the last semester of work)



Graphic about one semester (September 2017 – February 2018) of general prevalence among the fish hosts at the spring and Teuchitlan river.

Conclusions

- We found/stablished a deworming treatment specifically for *Z. tequila*.
- We were able to take *Z. tequila* without parasites from Morelia to Teuchitlan.
- we determined that population of parasites in the spring and river was not a risk for the reintroduced fish.

and

- We determined that the best sites (with the lowest values of parasitic infections) were the sites 1 and 2 (the spring and the beginning/upper part of the river).

SUCCESS IN THE REINTRODUCTION OF THE TEQUILA SPLITFIN (ZOOGONETICUS TEQUILA) IN ITS NATIVE ENVIRONMENT

Mama, I'm coming home

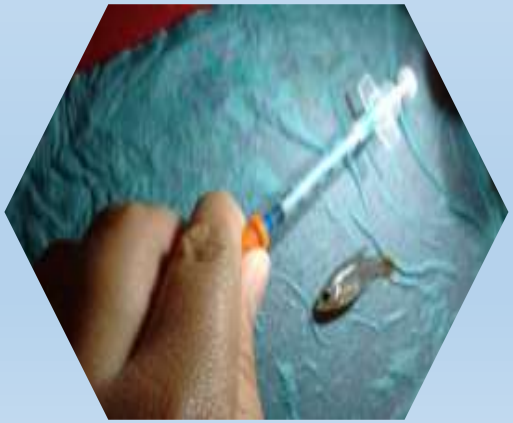
- Ozzy Osbourne -

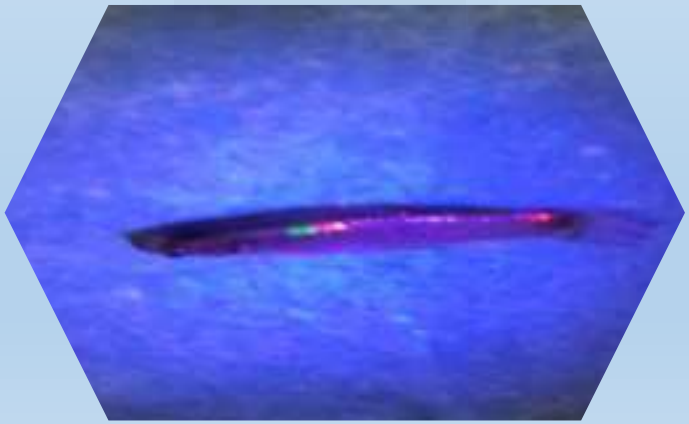
Native *vs.* exotic

VS.

Laboratory experiments

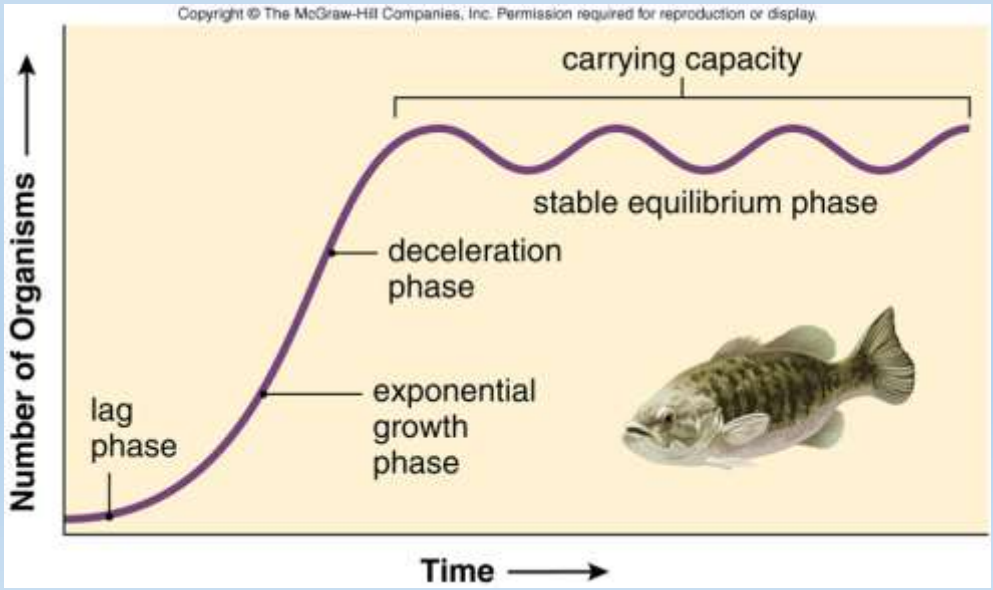
Laboratory experiments





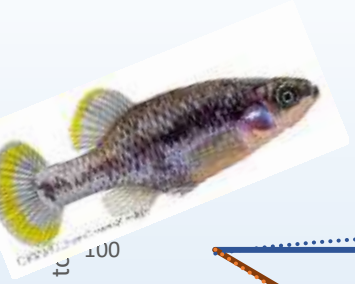
Vegetated vs non-vegetated

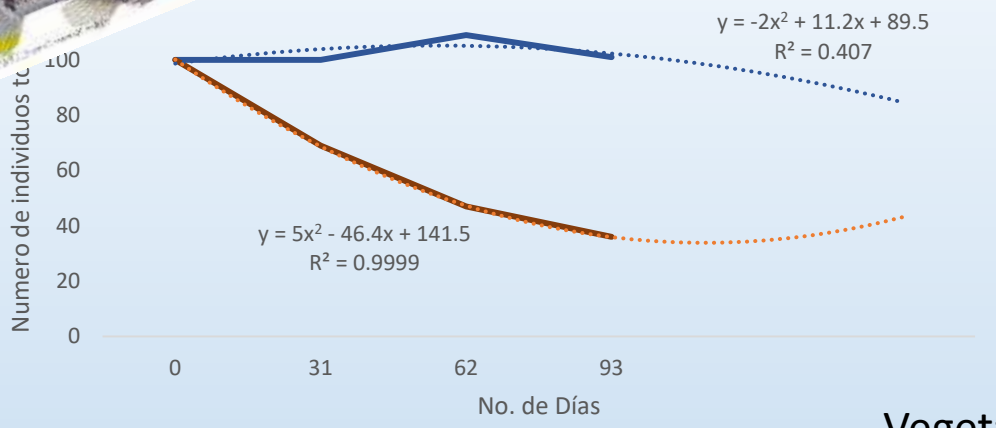
?



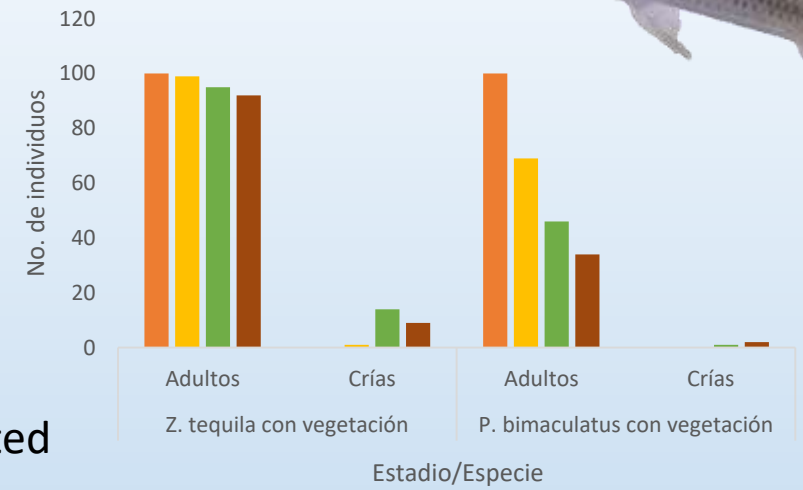
?

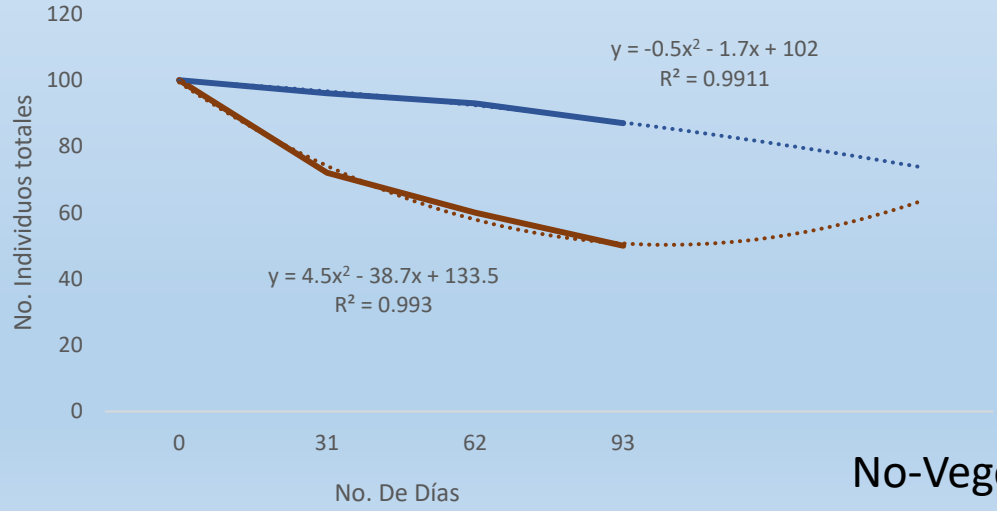
No competition treatment



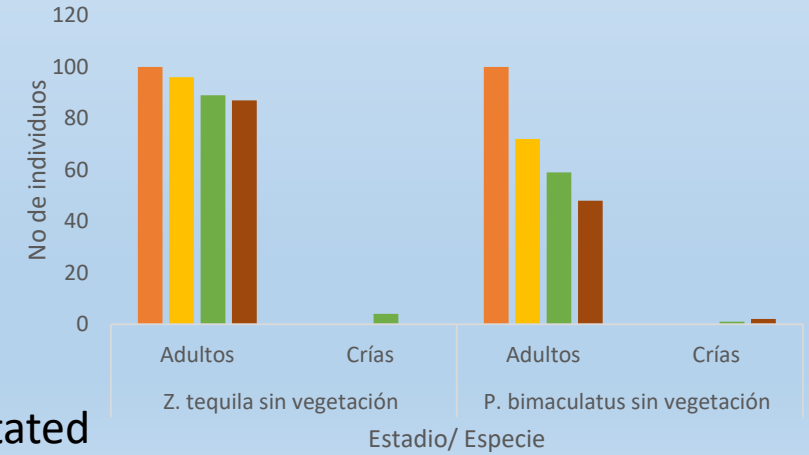


Vegetated

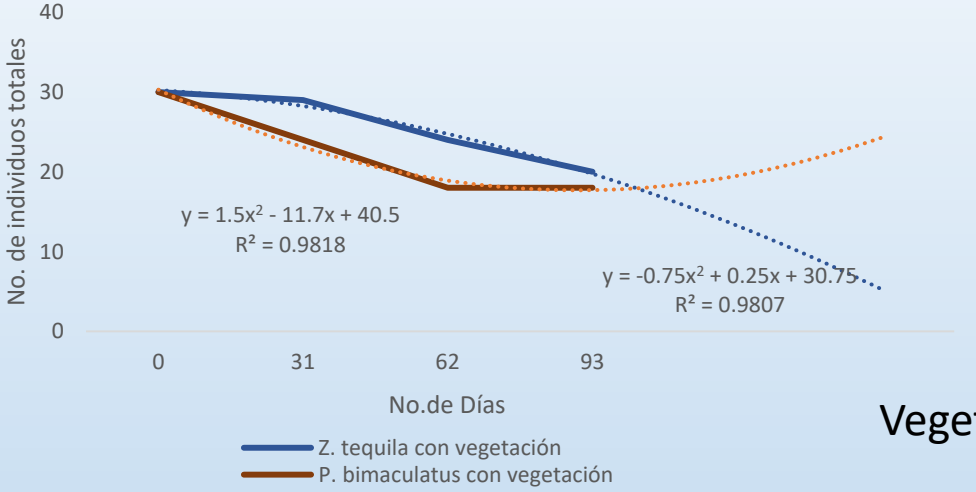


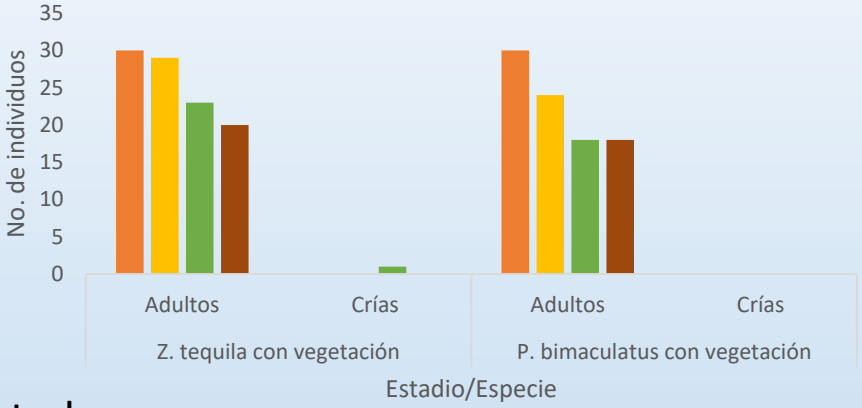


No-Vegetated

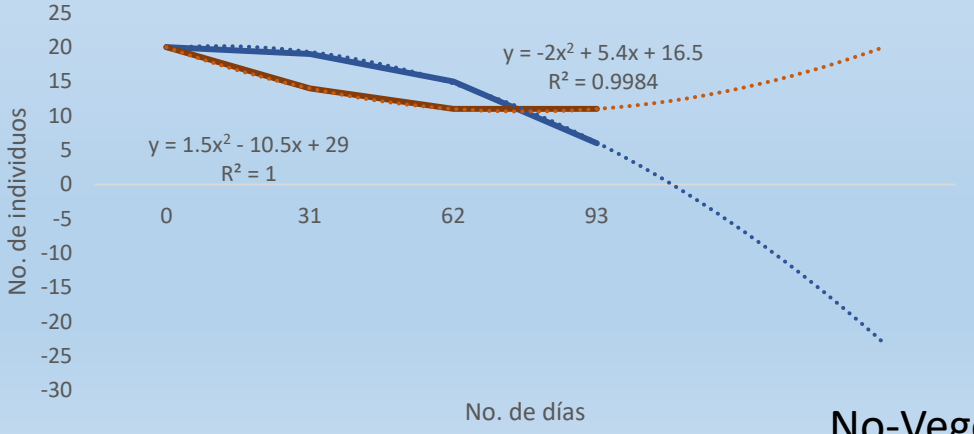


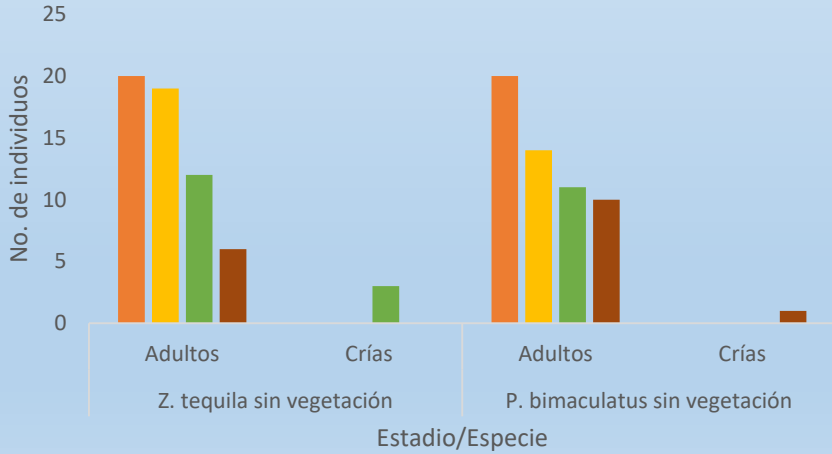
Competition treatment





Vegetated





No-Vegetated

Conclusion

- The heterogeneity (physical) of the sistem does affect the population growth of bot species

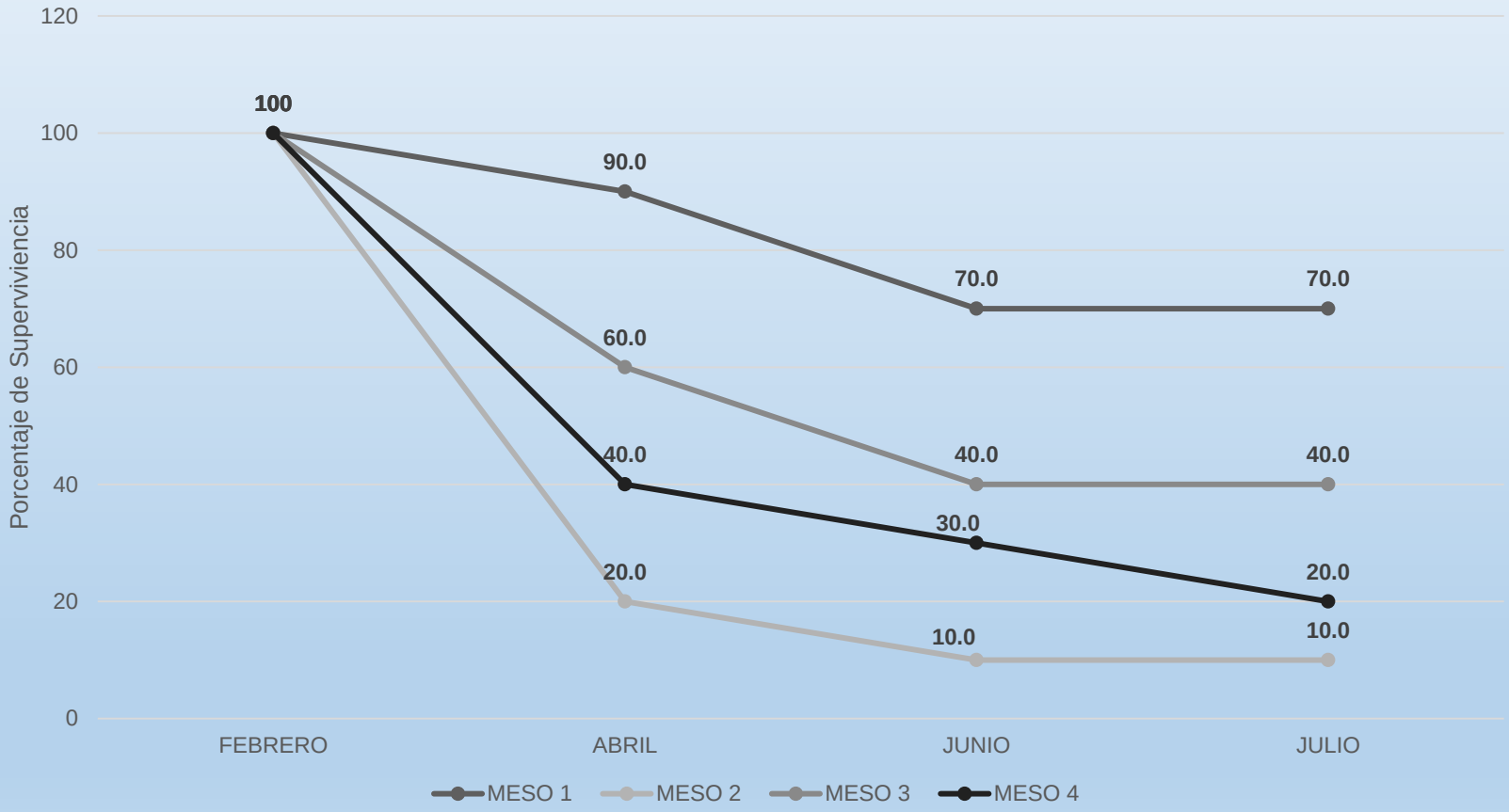
But

- When bot species cohabit the native presents a decrease in population

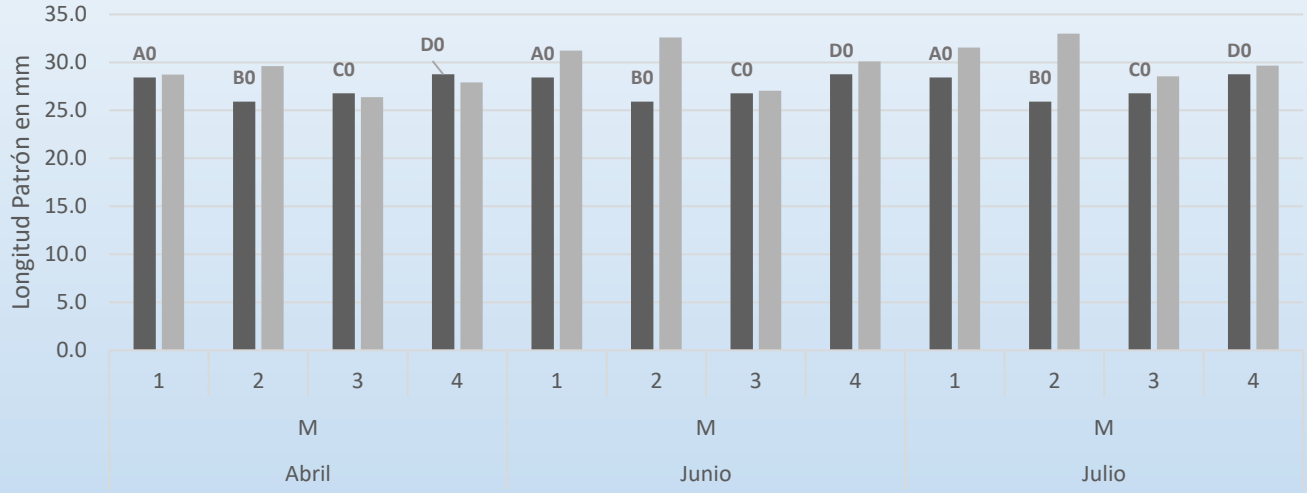
- Then…let is put some (500 individuals) in semi-control conditions in Teuchitlán River in sites (e.g. site 1; manantial) where water quality is better and les abundance of exotic species

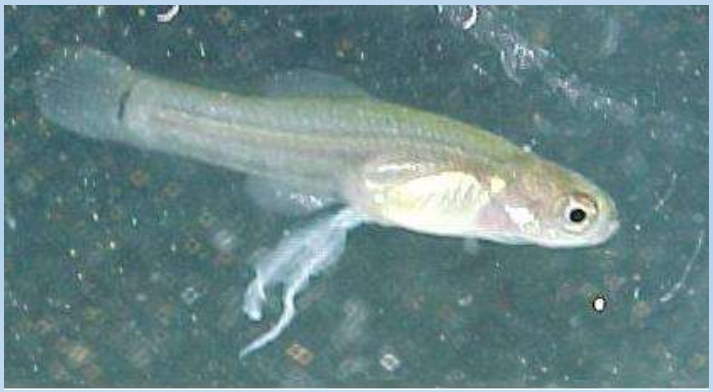
Growth and reproduction *in situ*

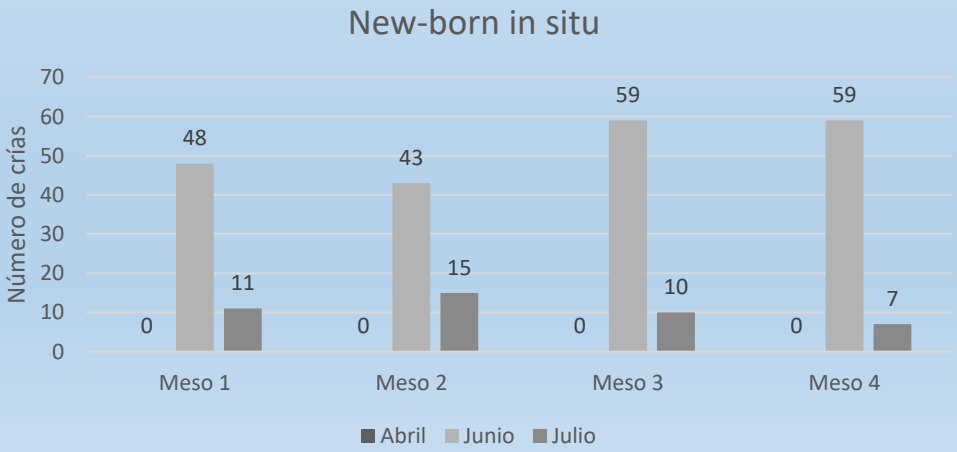
Survivorship once re-introduced



Individual growth in semi-controlled conditions







Conclusion

- High mortality at re-introduction (as expected)

But

- Once stablised reproduction and new-born individuals *in situ* are present.

Excelent!

Release tequila…!

not that one…yet

This one…

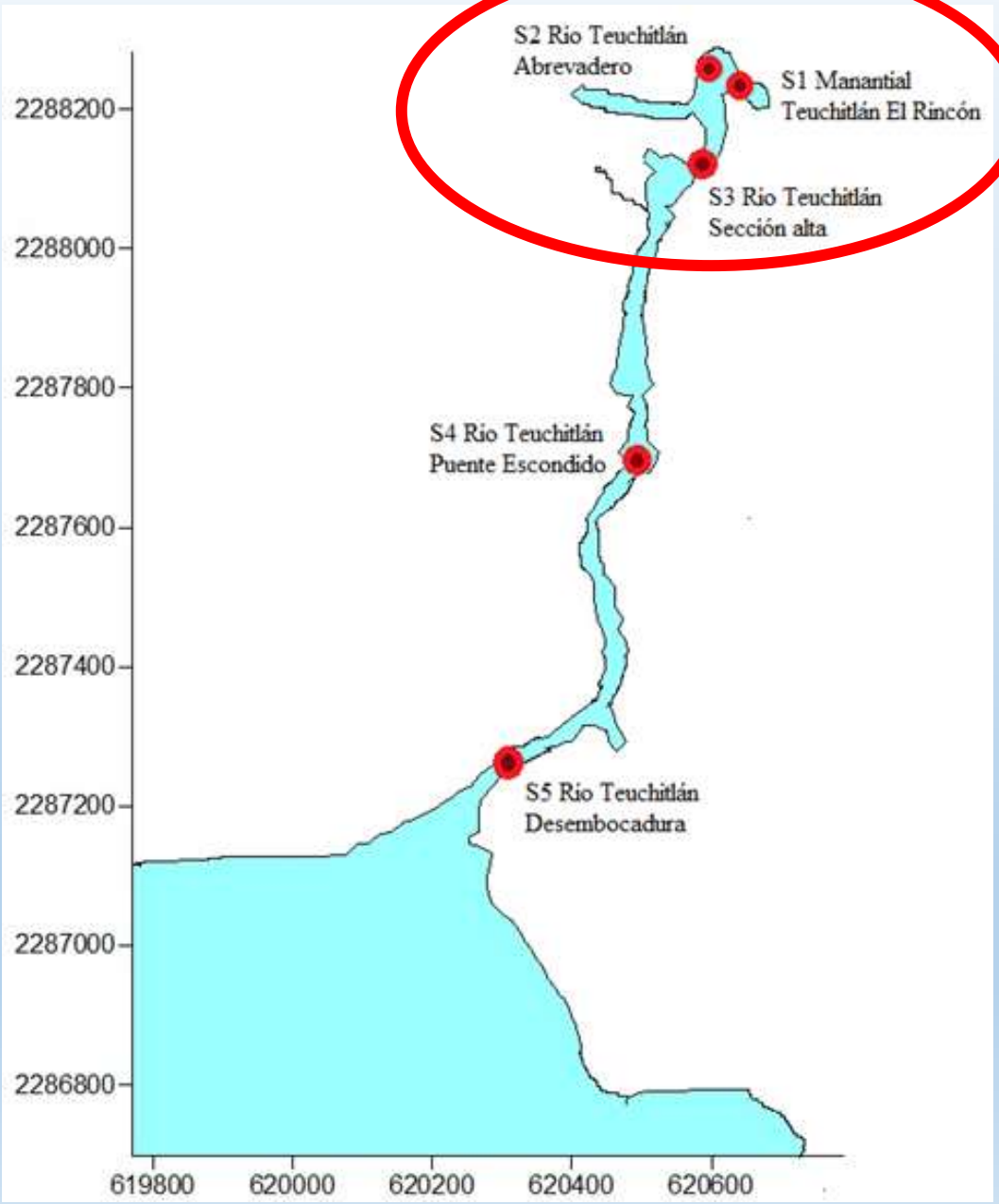
Reintroduced on November the 1st (2015)

Noche de muertos

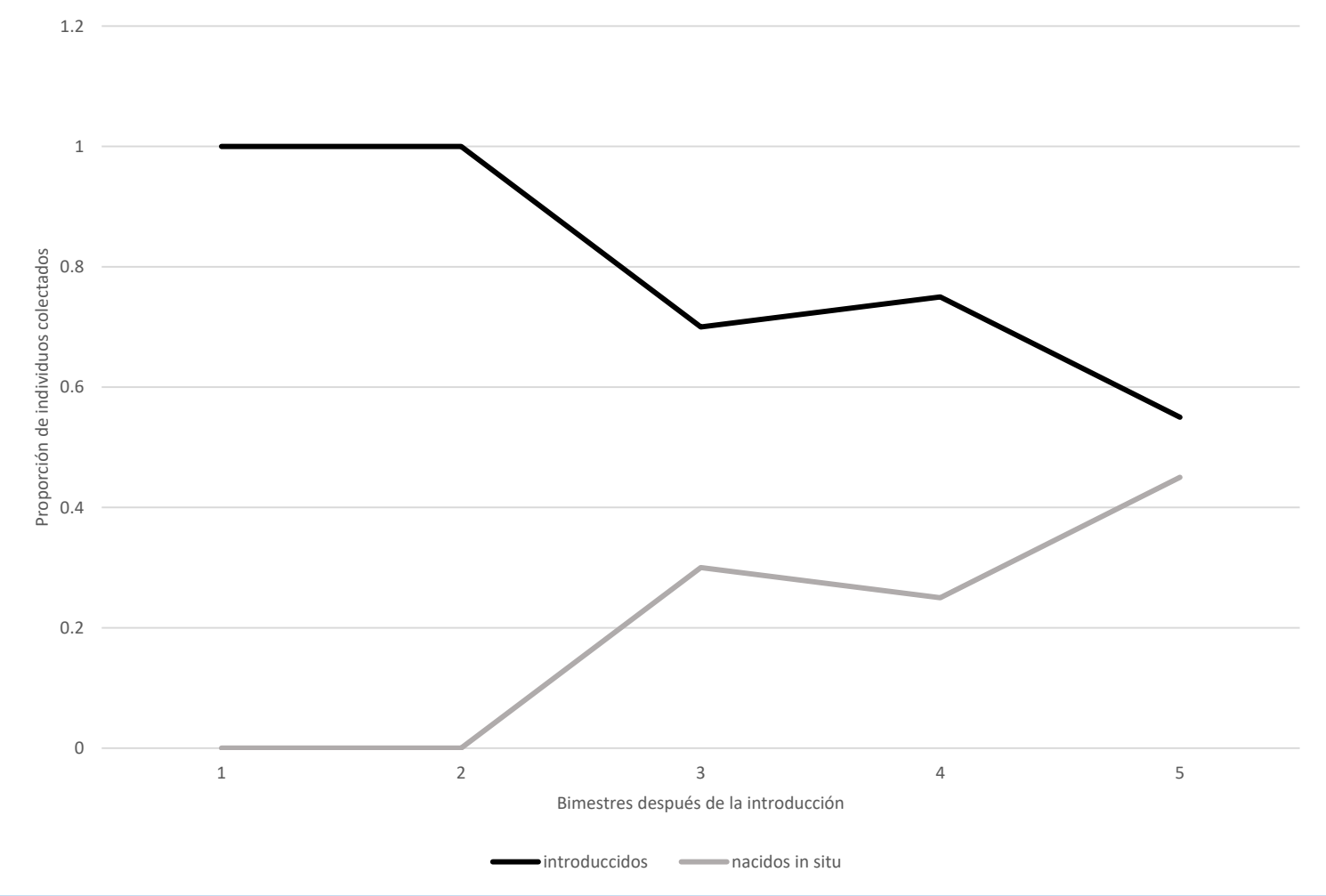
When the beloved ones come back…

from extinction

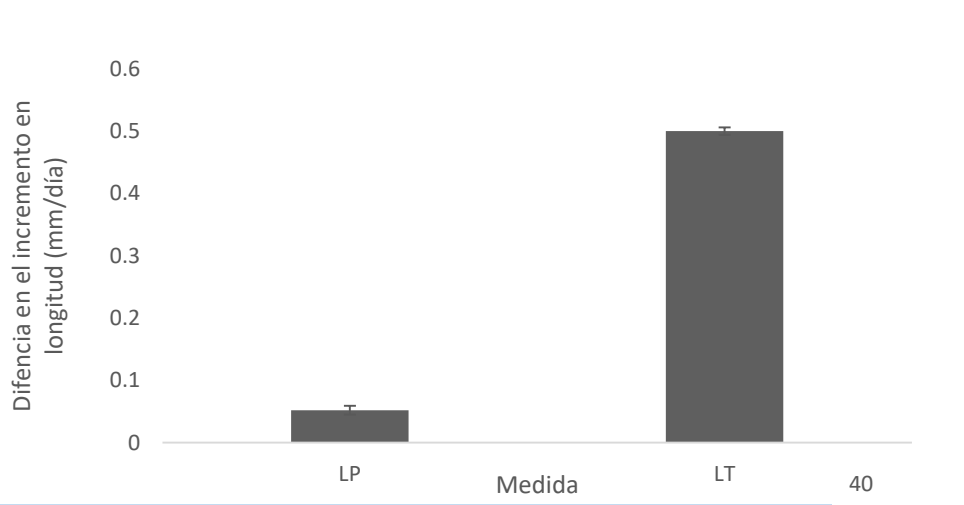
Collection sites

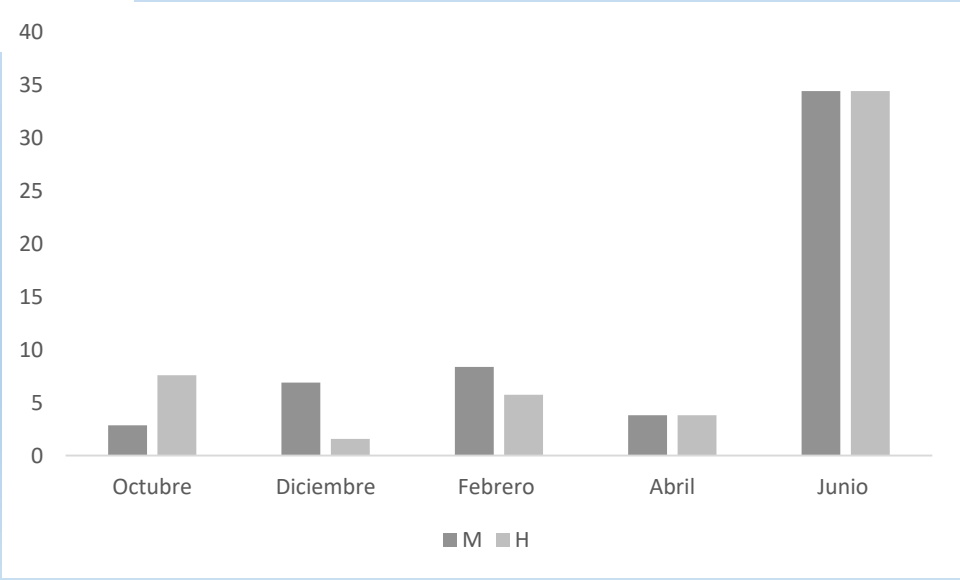


Catch *in situ* in the first 8 months



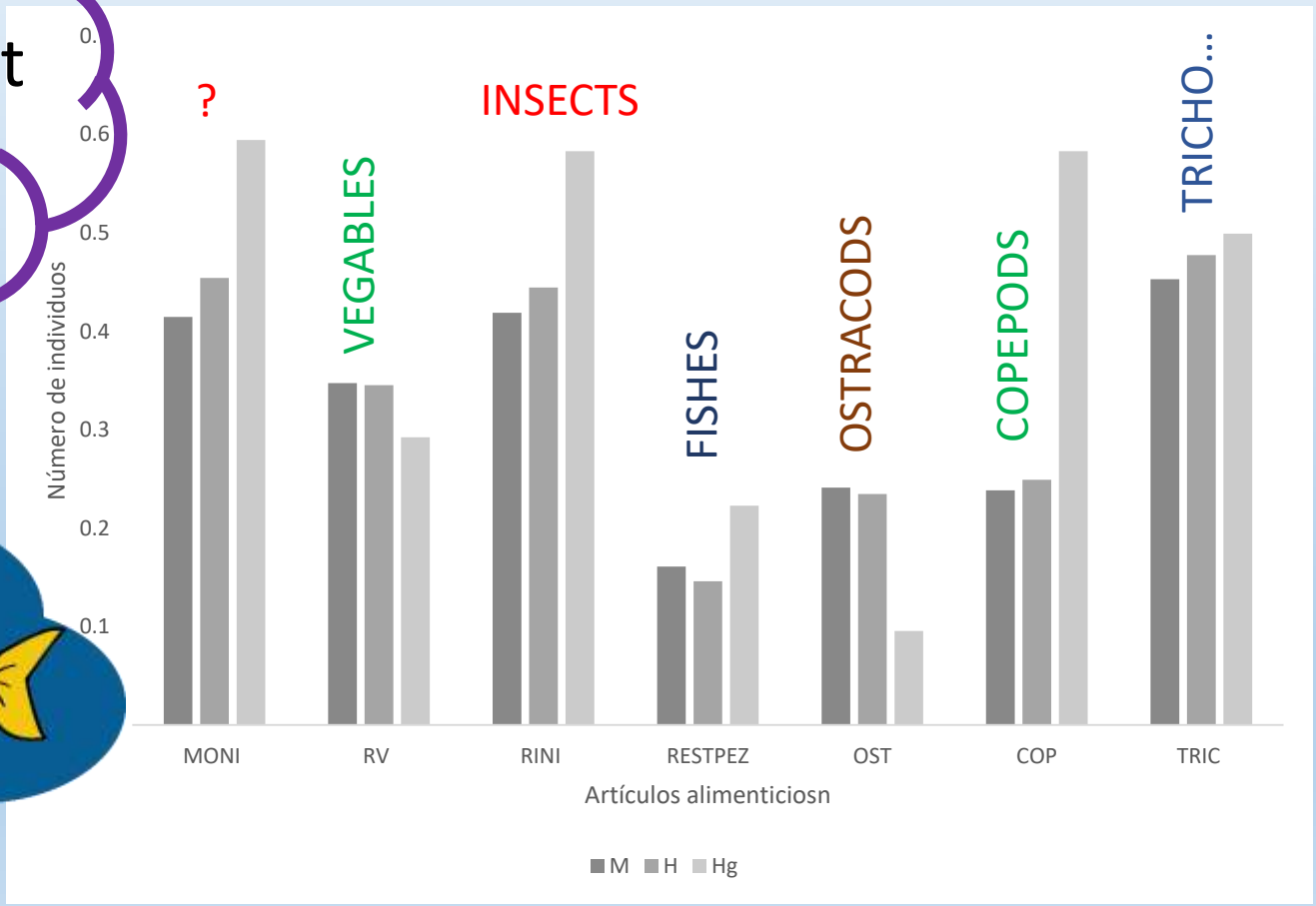
Mean growth and sexual maturity *in situ*





What do you eat *Z. tequila* in the Teuchitlán river?

Aquatic meat and some greens



Welcome home…

So what?

- Example of success on recovering *in situ* an extinct species *in situ*
- Recovering native ictilogical diversity
- Big step in recovering ecological process and biodiversity at local scale

- Overall, success from a collaborative work for and by a common goal

- **Conserve the world**

Conservation of Goodeids and Co-Occurring Fishes in Central Mexico
Universidad Michoacana de San Nicolas de Hidalgo

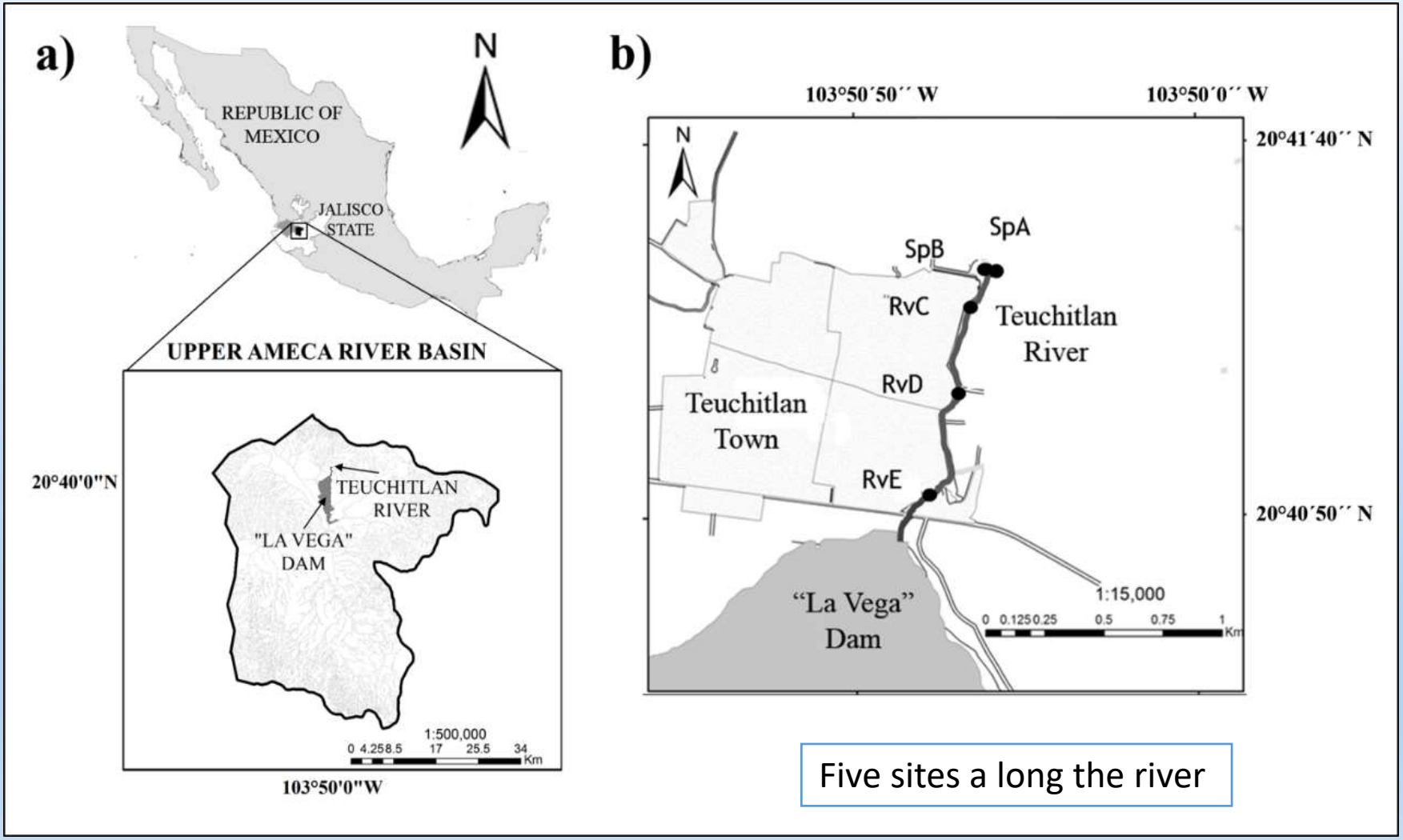
"Environmental education strategy to the conservation of *Zoogoneticus tequila* in the Teuchitlan River "

Speaker:

Biol. Federico Hernandez Email: kiauil@gmail.com.

November, 2018

Teuchitlan River



Five sites a long the river

Introduction

Before and after the re-introduction of *Z. tequila*, we stablished an strategy on environmental education for the local community

What did we?

Activity 1: Workshops

In elemental school and High school
To propose the importance of the conservation of the Teuchitlan River and their species.

Students participate 564

Activity 2: Action Poetry

The walls of Teuchitlan were painted by students of high school
The walls have messages about conservation of the nature

The river has music to whom can listening

Activity 3: Workshop to teachers about sustainability on conservation nature

The topics were:
Sensibility,
Environmental theory,
Educative model and
another.

Communitarian water quality monitoring

12 people from Teuchitlan

Long term monitoring plan

Environmental education program

Activity 4: Exposition museumgraphic in the Centro Interpretativo Guachimontones “Phil Weigand

We made workshops about Zoogy

Activity 5: Action plan to the conservation of native species with the local community and government authorities

Conservemos limpio nuestro río

Hola soy Zoogy, y te invito a que asistas el próximo 20 de noviembre a la plaza de Teuchitlán, habrá muchos talleres donde podrás aprender y divertirte ¡¡No faltes!!

Ven y conoce las especies de Teuchitlán.

Ameca splendens

Zoogoneticus purhepechus

Goodea atripinnis

Zoogoneticus tequila

Este atento a las demás convocatorias, ¡¡habrá mas eventos!!

TEUCHITLAN

Building capacities

1 PhD students

5 MSc students

11 BSc students

What next in Teuchitlan “we hope”

- Follow reintroduction of *Z. tequila*
- Continuing with reintroduction of *N. amecae*
- Start the *S. francesae* reintroduction

Other conservation project

- Zacapu lake conservation

- *Chapalichthys pardalis* reintroduction

Thanks!!

Project “Reintroducción de *Zoogoneticus tequila* al río Teuchitlán y sus manantiales”

Ictiología y Conservación
Laboratorio de Biología acuática UMNSH

GWG Goodeid Working Group

CHESTER ZOO

صندوق محمد بن زايد للمحافظة على الكائنات الحية
The Mohamed bin Zayed SPECIES CONSERVATION FUND

CONABIO

Association

American Livebearer Association

AQUA TERRA ZOO
Haus des Meeres

BEAUVAL NATURE
pour la Conservation et la Recherche

POECILIA SCANDINAVIA

MISSOURI MASC AQUARIUM SOCIETY

British Livebearer Association
B. L. A.
Est 2002

DGLZ

Thanks Zoogy colective

Teuchitlán
Trabajo, Historia y Fe
H. Ayuntamiento de Teuchitlán Jalisco.

Sala de lectura
La ranita lectora

TEUCHITLÁN
GOBIERNO MUNICIPAL 2018 - 2021