Zoogoneticus tequila reintroduction project: an international cooperative project

The lab start in 1997


The Fish Ark project
Officially start at 1999


2000

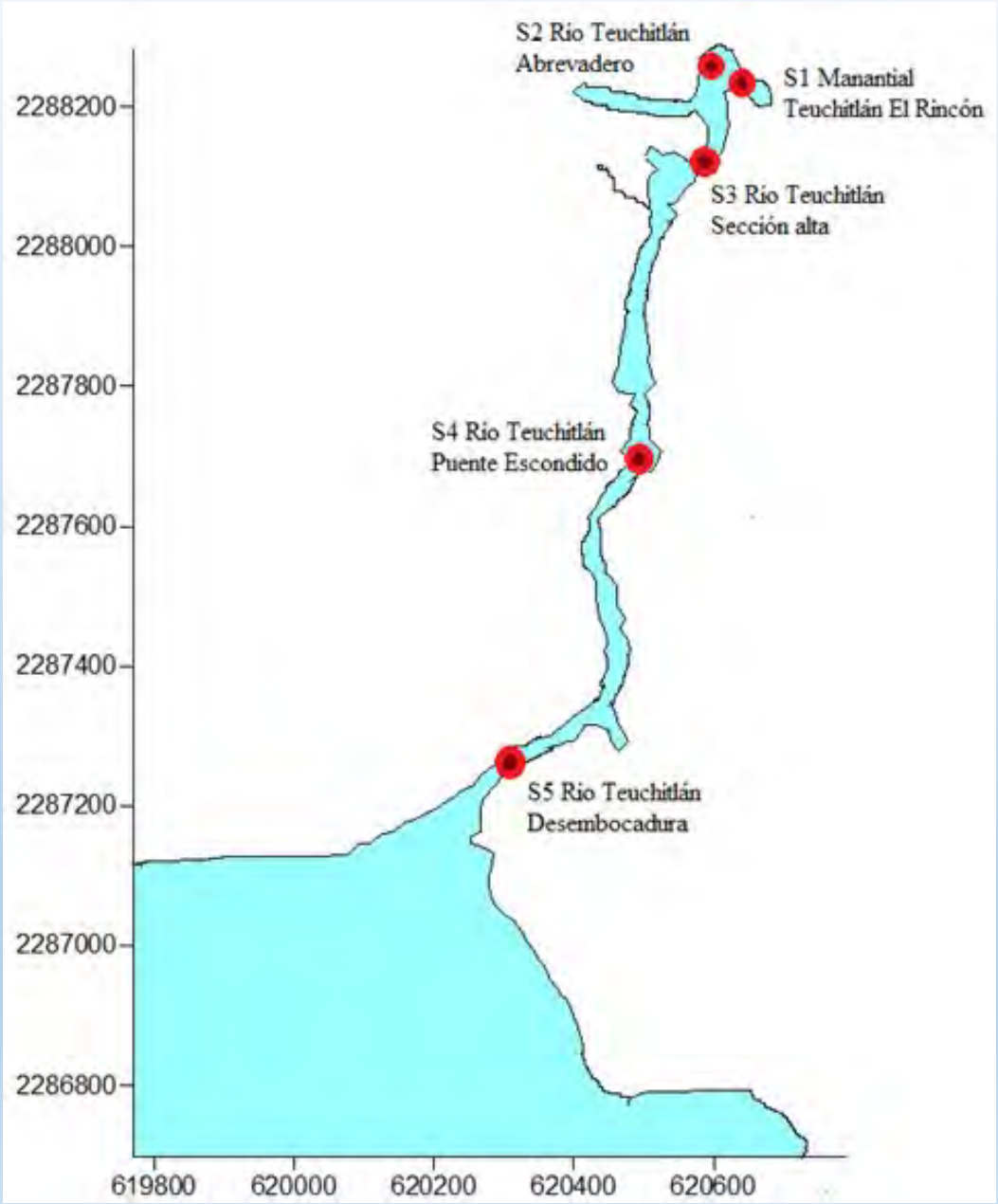

2008
POECILIA SCANDINAVIA
Poecilia
Vereniging levendbarende tandkarpers


2014

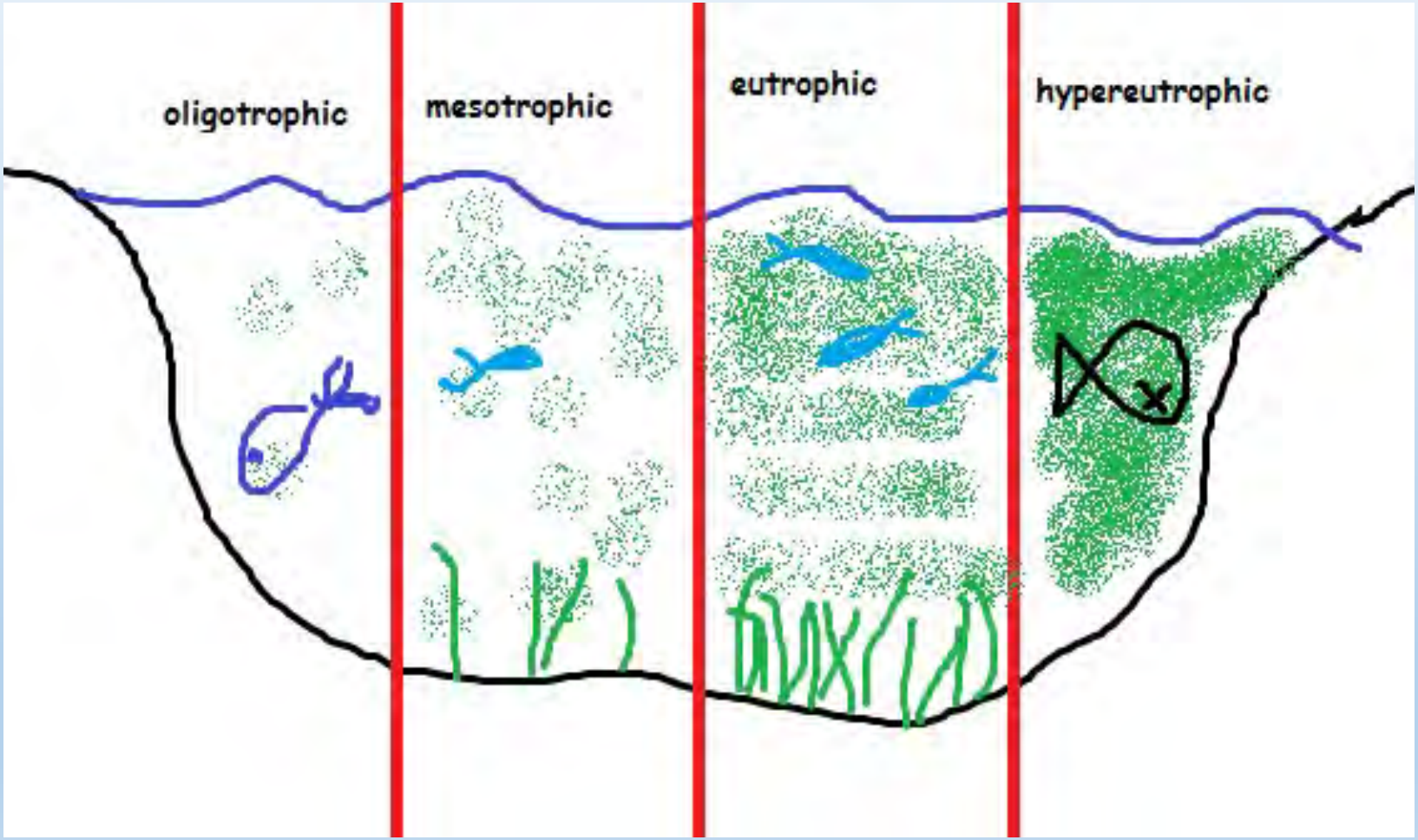
2015, the reintroduction of *Zoogoneticus tequila* was possible thanks' to work and support of the aquarist´s


Unico
Unico

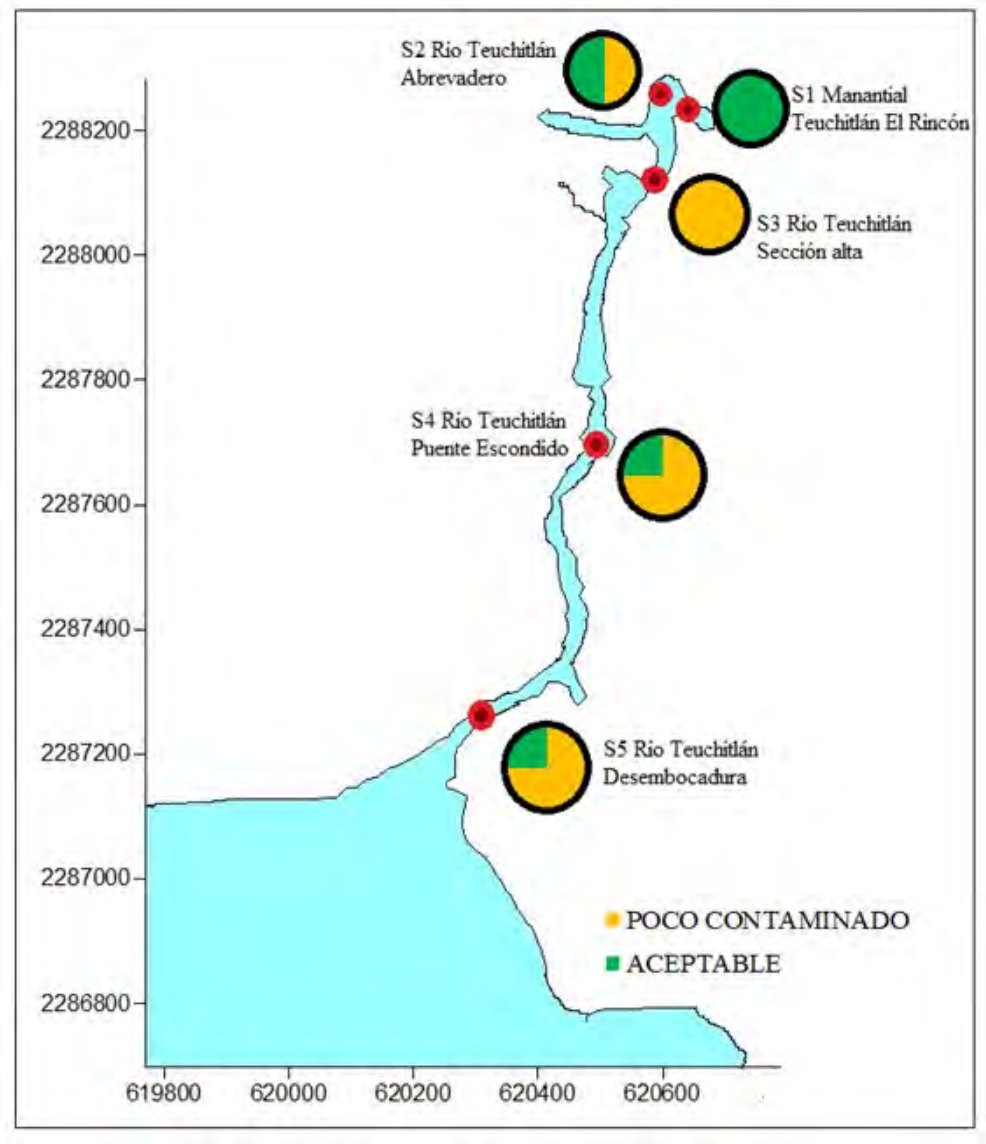
Collection sites



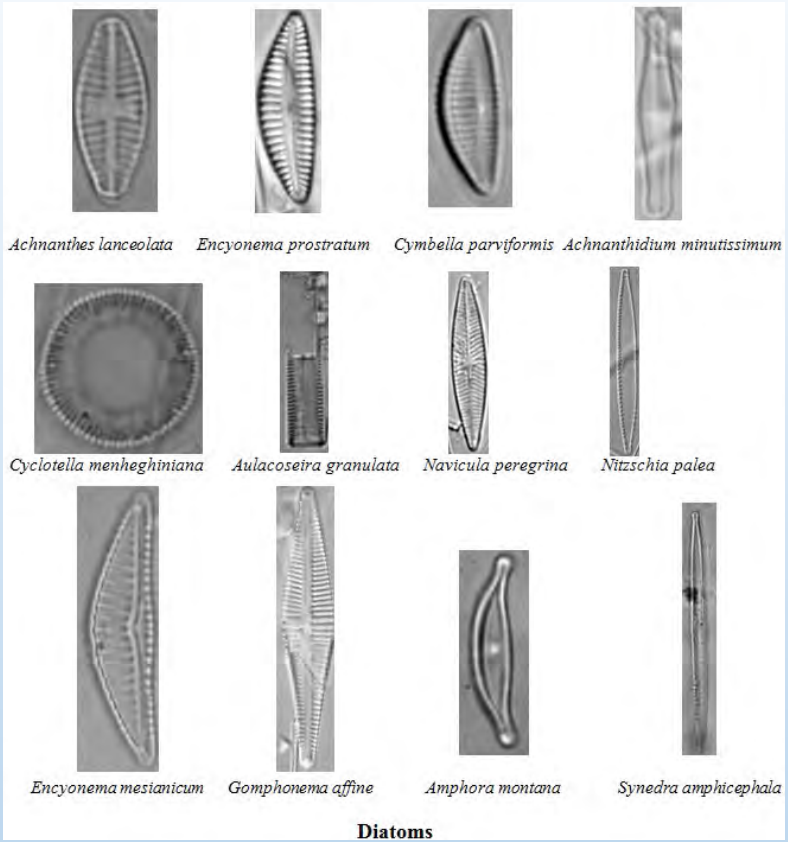
Limnobiological characterization

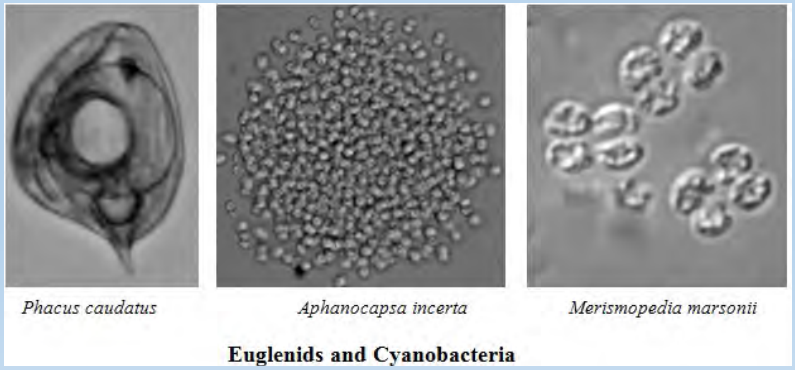


Water quality along the river using 35 Parameters



Phytoplankton community 37 taxa





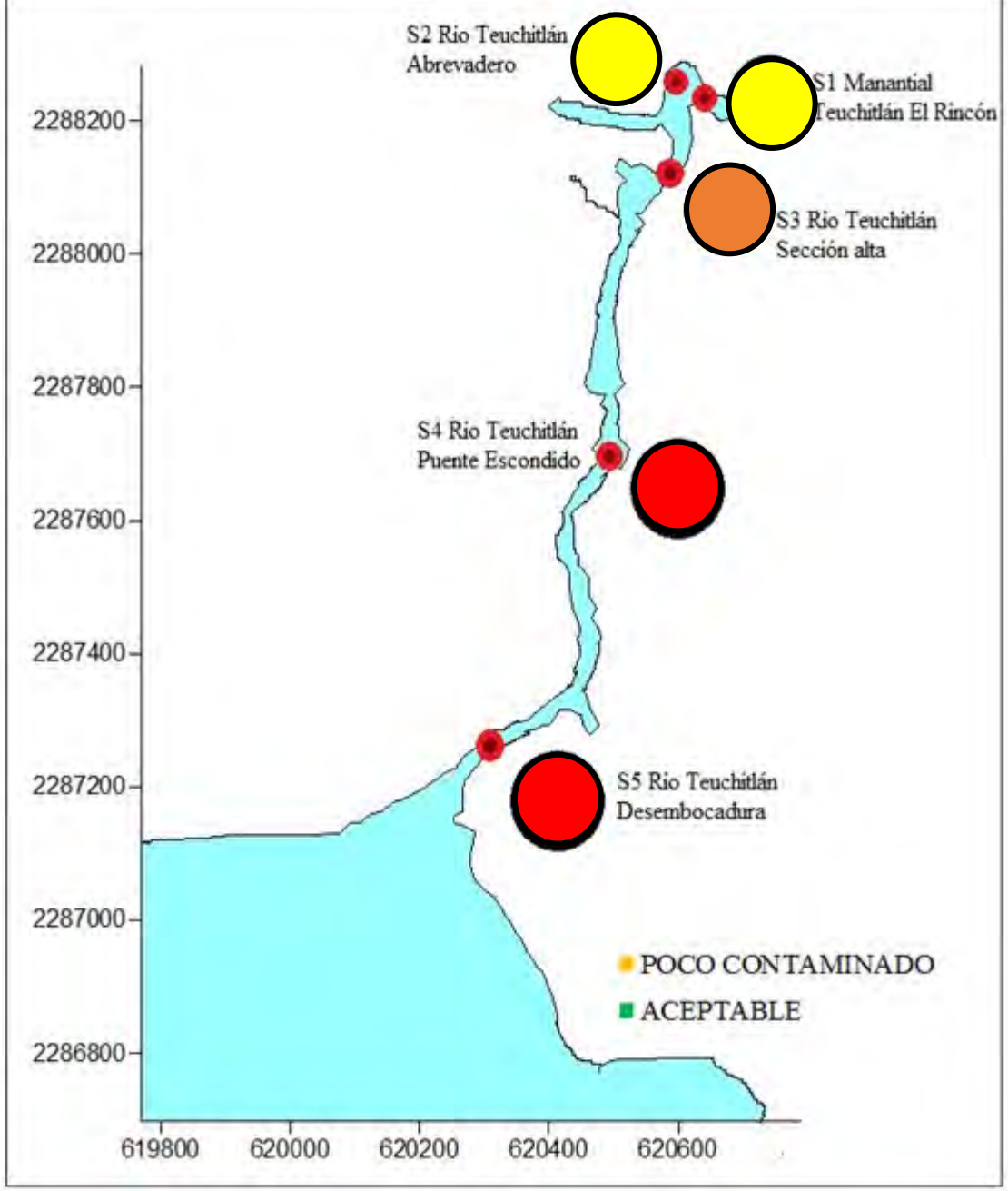
SITE	Phytoplankton	Dominant algal group
S1	< 200 org/mL	Diatoms
S2	< 200 org/mL	Diatoms
S3	< 1000 org /mL	Diatoms Green algae
S4	< 500 org/mL	Green algae Diatoms Blue green algae
S5	< 500 org/mL	Diatoms Green algae
S6	< 200 org/mL	Green algae Diatoms
S7	< 200 org/mL	Green algae
S8	< 500 org/mL	Diatoms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

NYGAARD INDEX

MESOTROPHIC

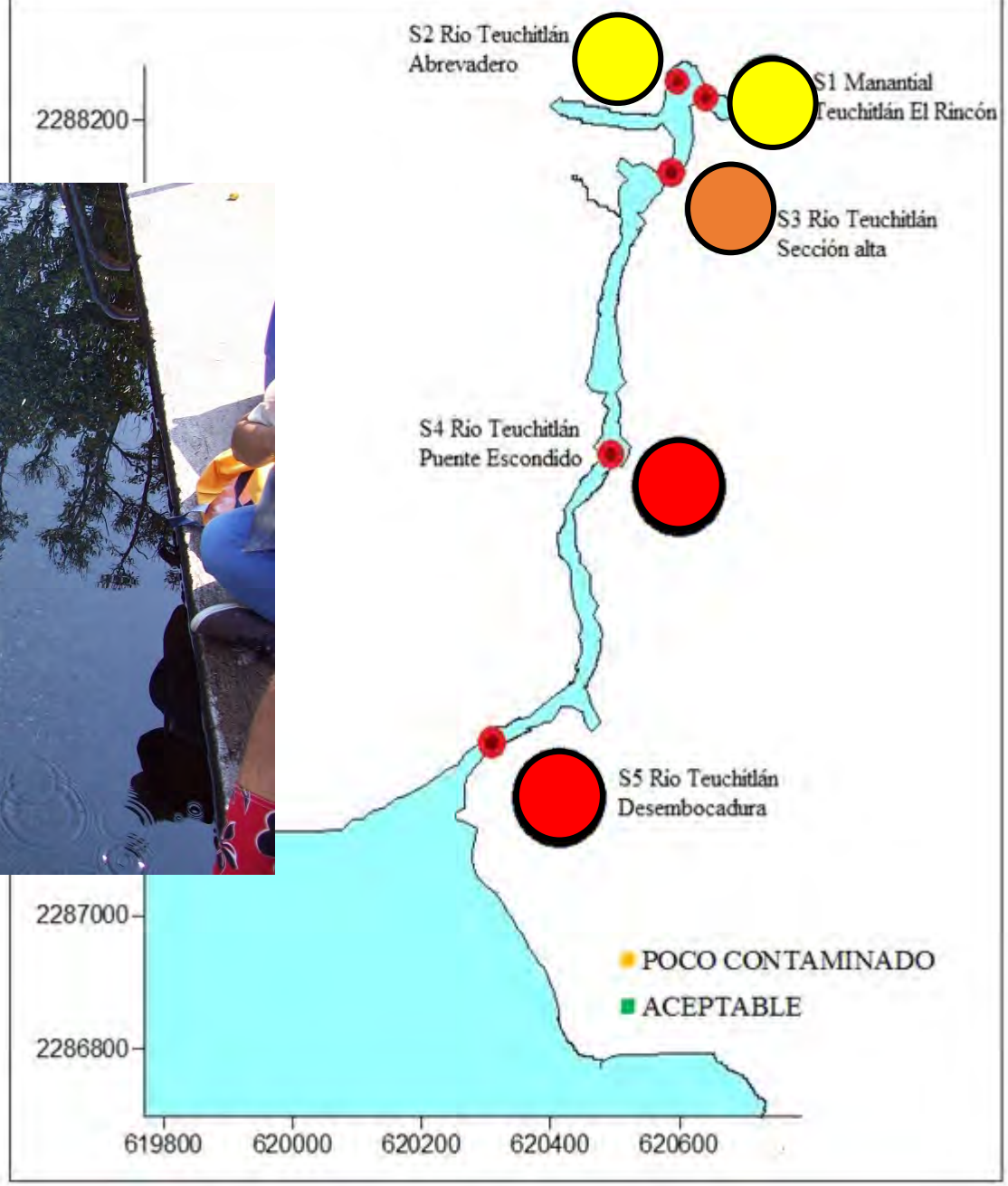
MESOTROPHIC TO EUTROPHIC

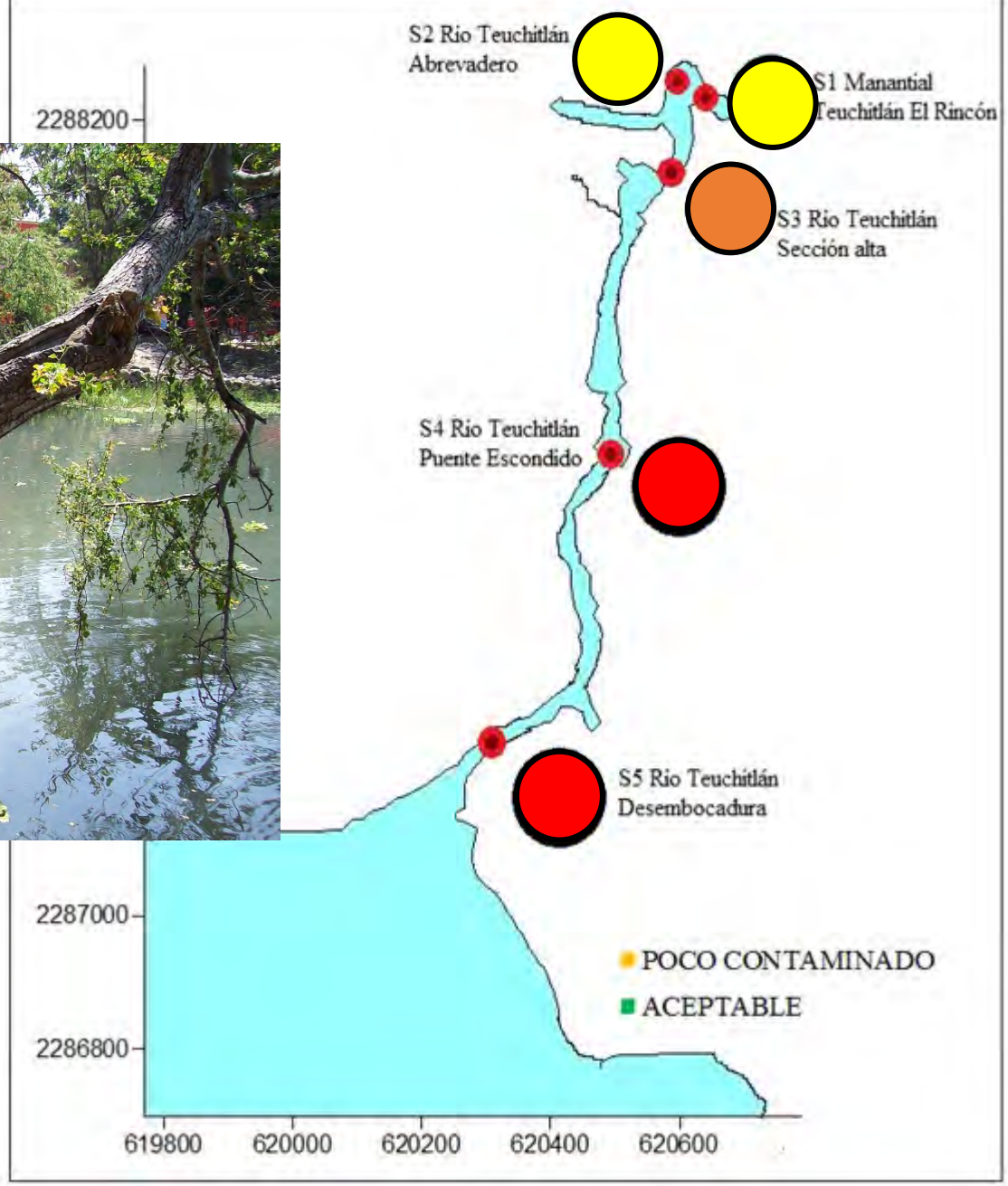
EUTROPHIC



- Algal species and water quality

- Agriculture and domestic water discharge


S2 Rio Teuchitlán
Abrevadero
S1 Manantial
Teuchitlán El Rincón
S3 Rio Teuchitlán
Sección alta
S4 Rio Teuchitlán
Puente Escondido
S5 Rio Teuchitlán
Desembocadura
2288200
2287000
2286800
POCO CONTAMINADO
ACEPTABLE
619800
620000
620200
620400
620600


S2 Rio Teuchitlán
Abrevadero
S1 Manantial
Teuchitlán El Rincón
S3 Rio Teuchitlán
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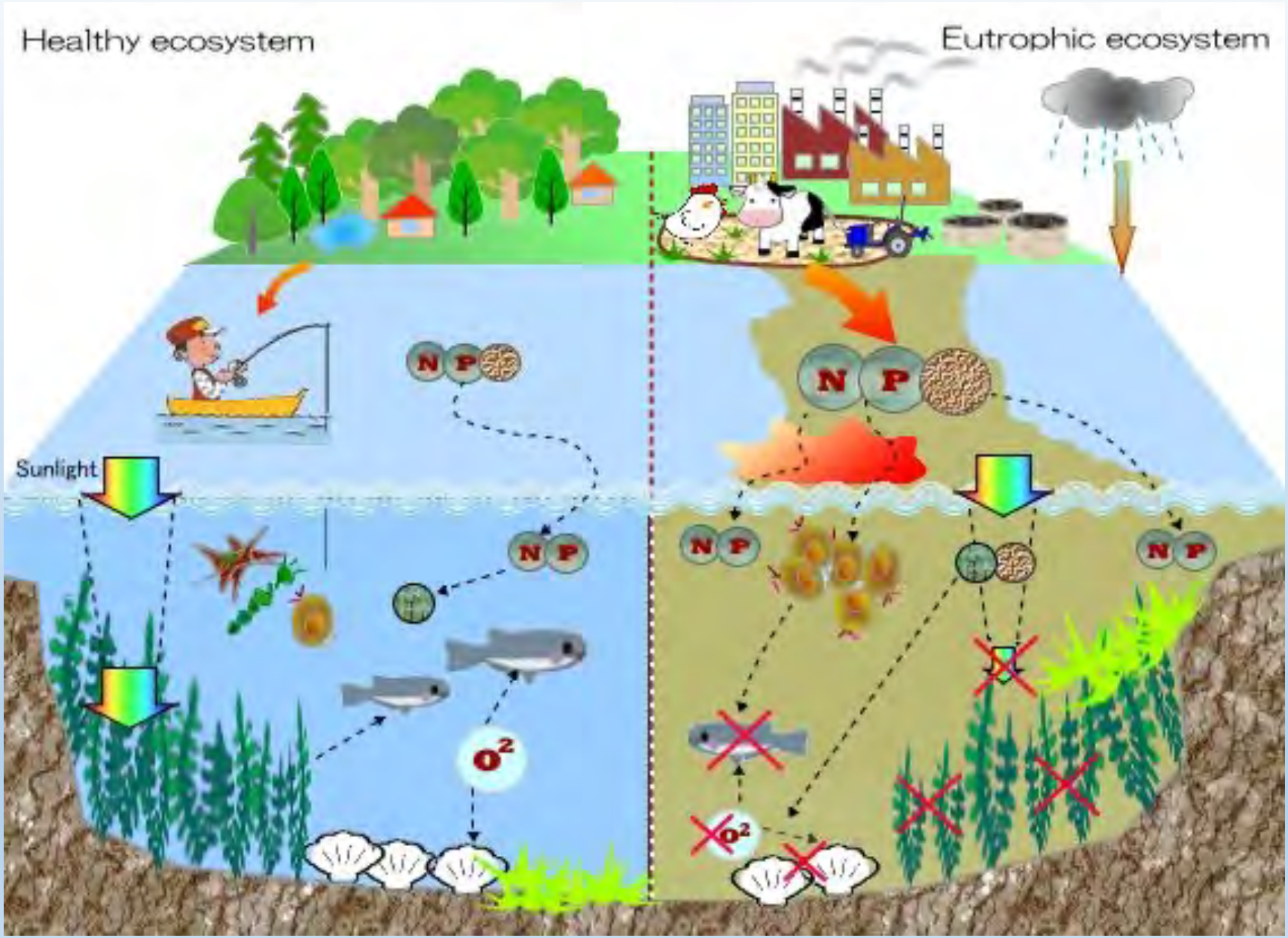
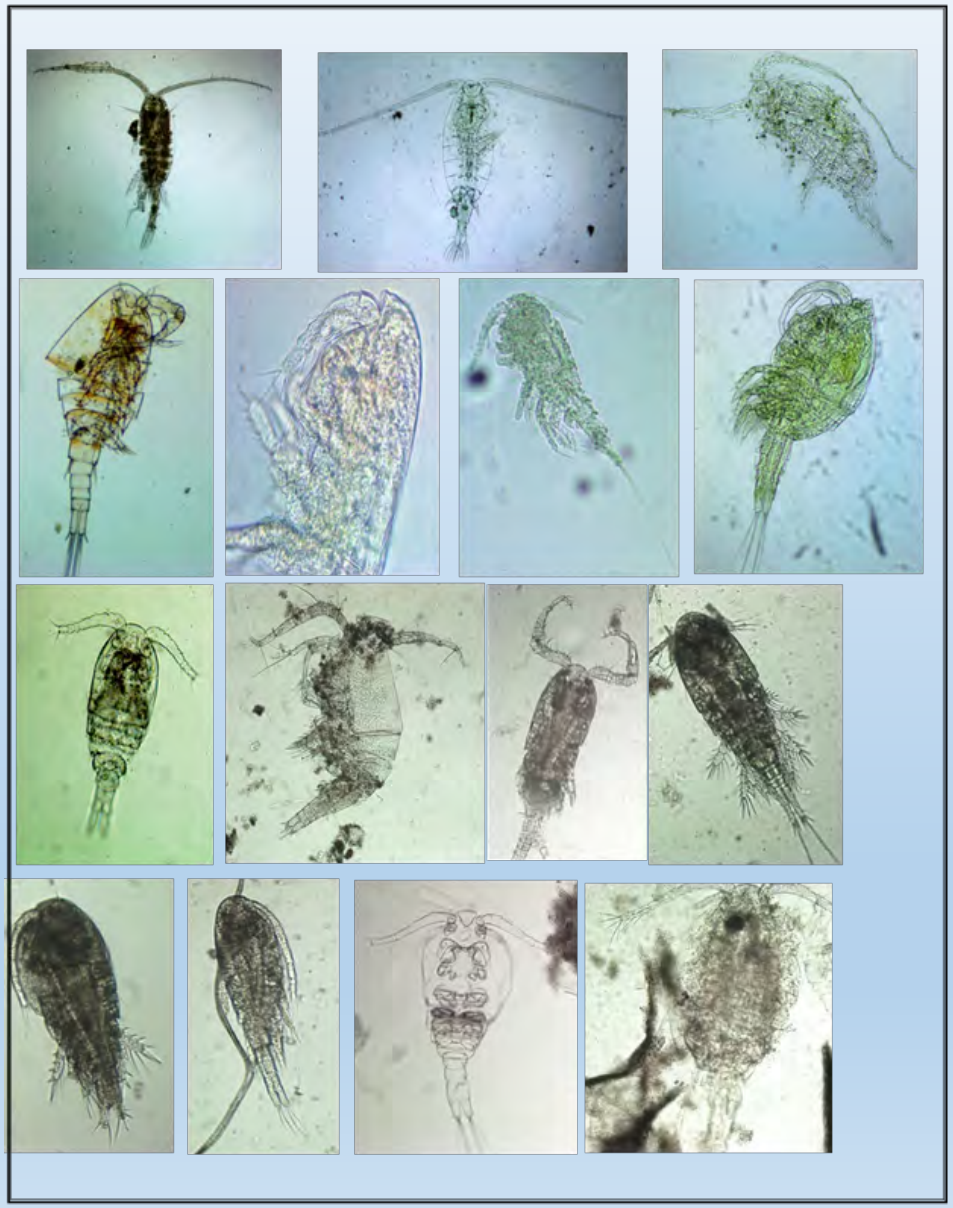

Healthy ecosystem
Eutrophic ecosystem
Sunlight
N P
N P
N P
N P
N P
O2
O2

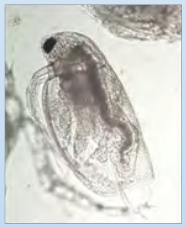
38 Taxa

COPEPODA



ROTIFERA

CLADOCERA

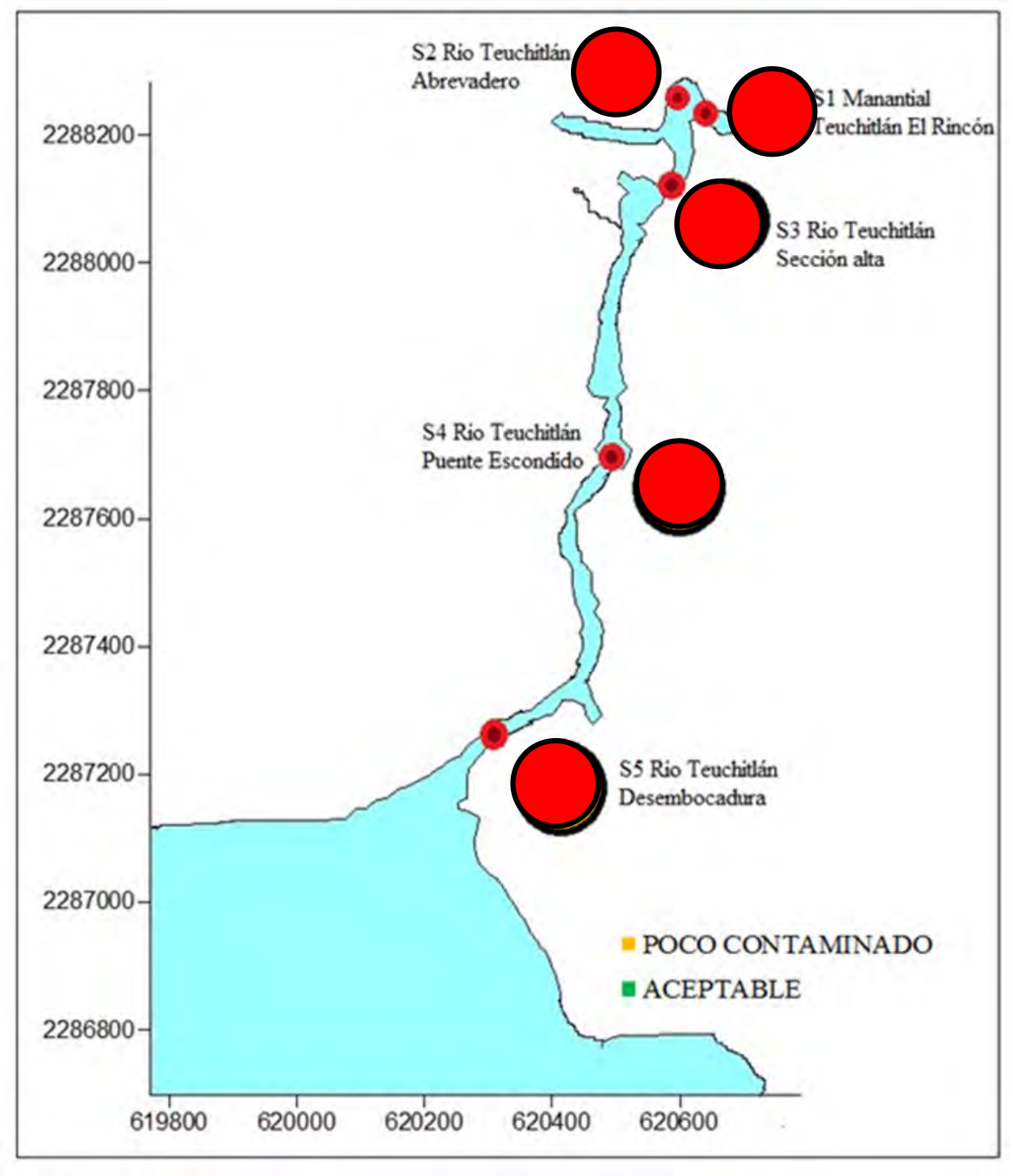


OSTRACODA

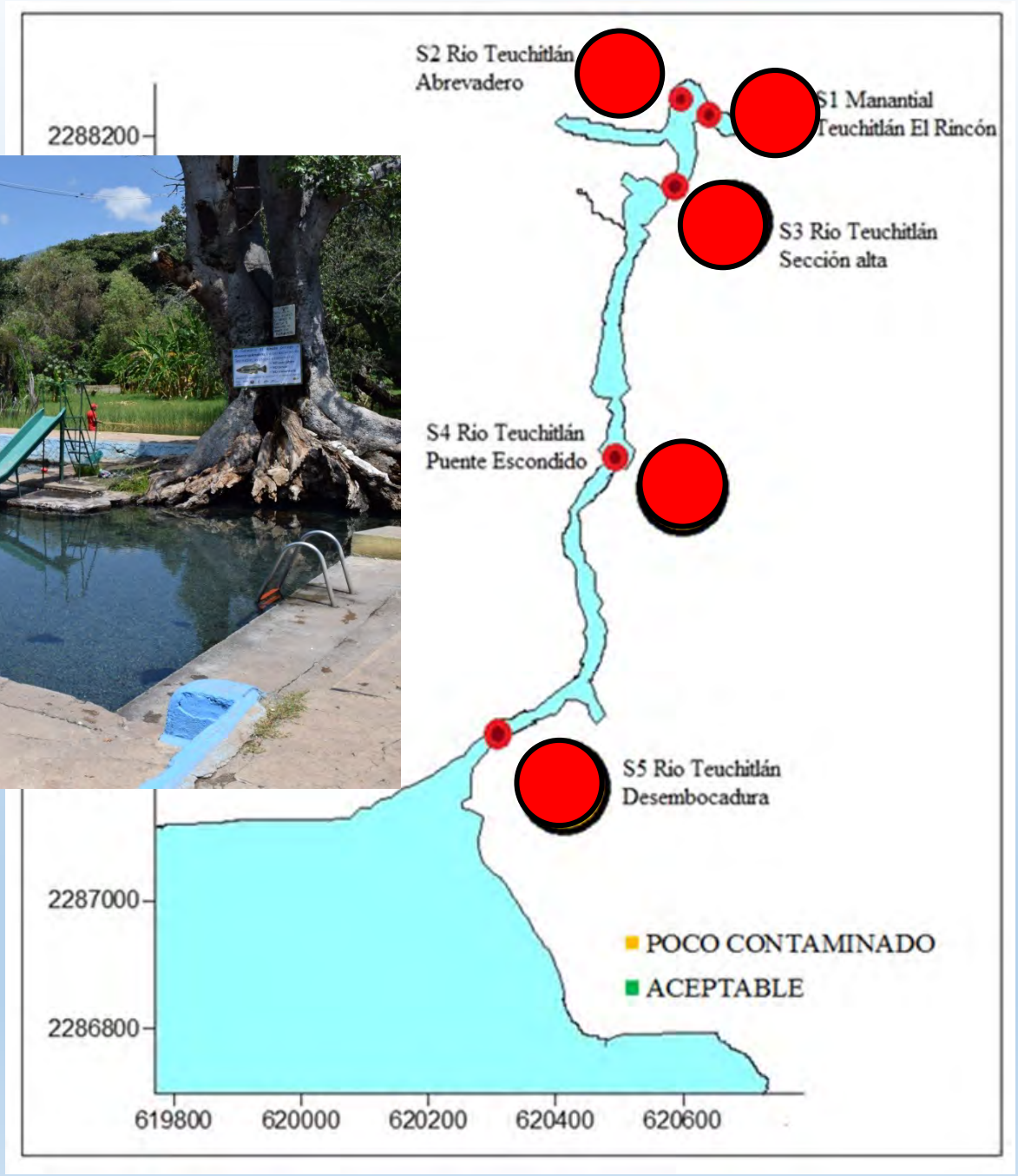
MACROINVERTEBRATES 47 TAXA

IIBAMA Index

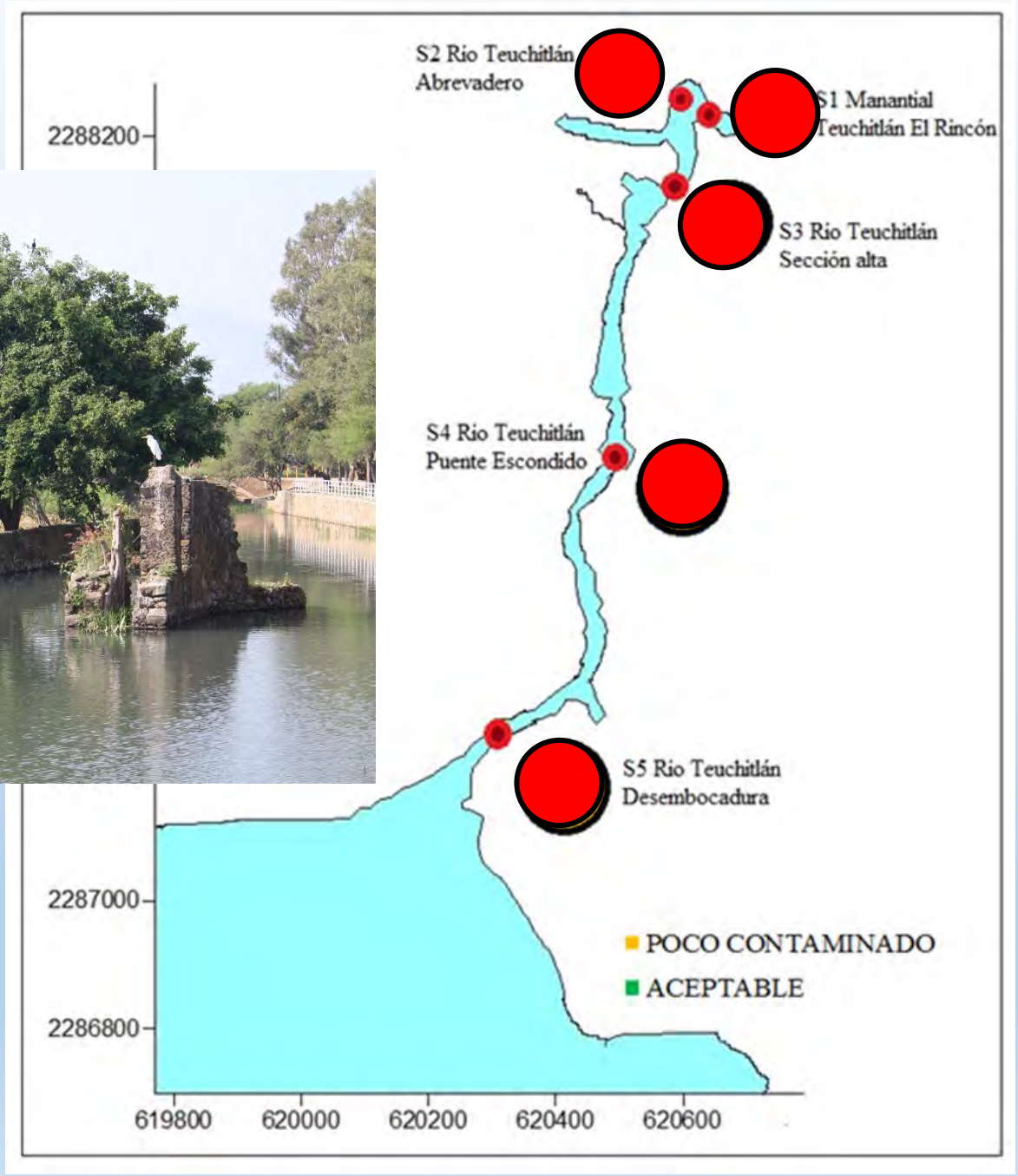
Poor quality



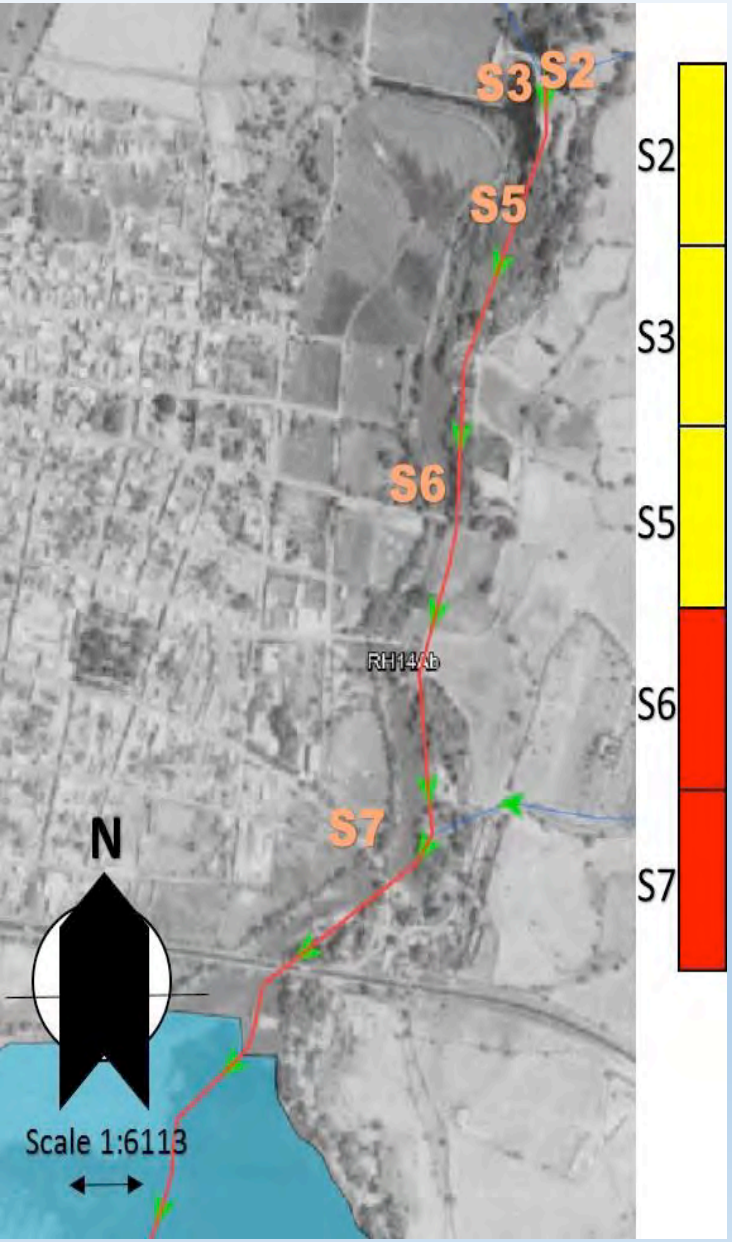
IIBAMA Index



IIBAMA Index



General trend of Integrity Biotic Index (IBI).



excellent

regular

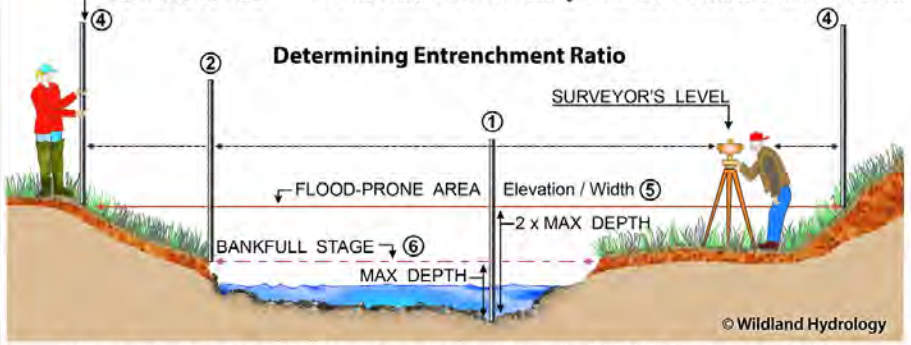
poor

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.



5. Mark the Flood-Prone Area (FPA) locations on each bank. Measure the DISTANCE between the two "FPA" locations.

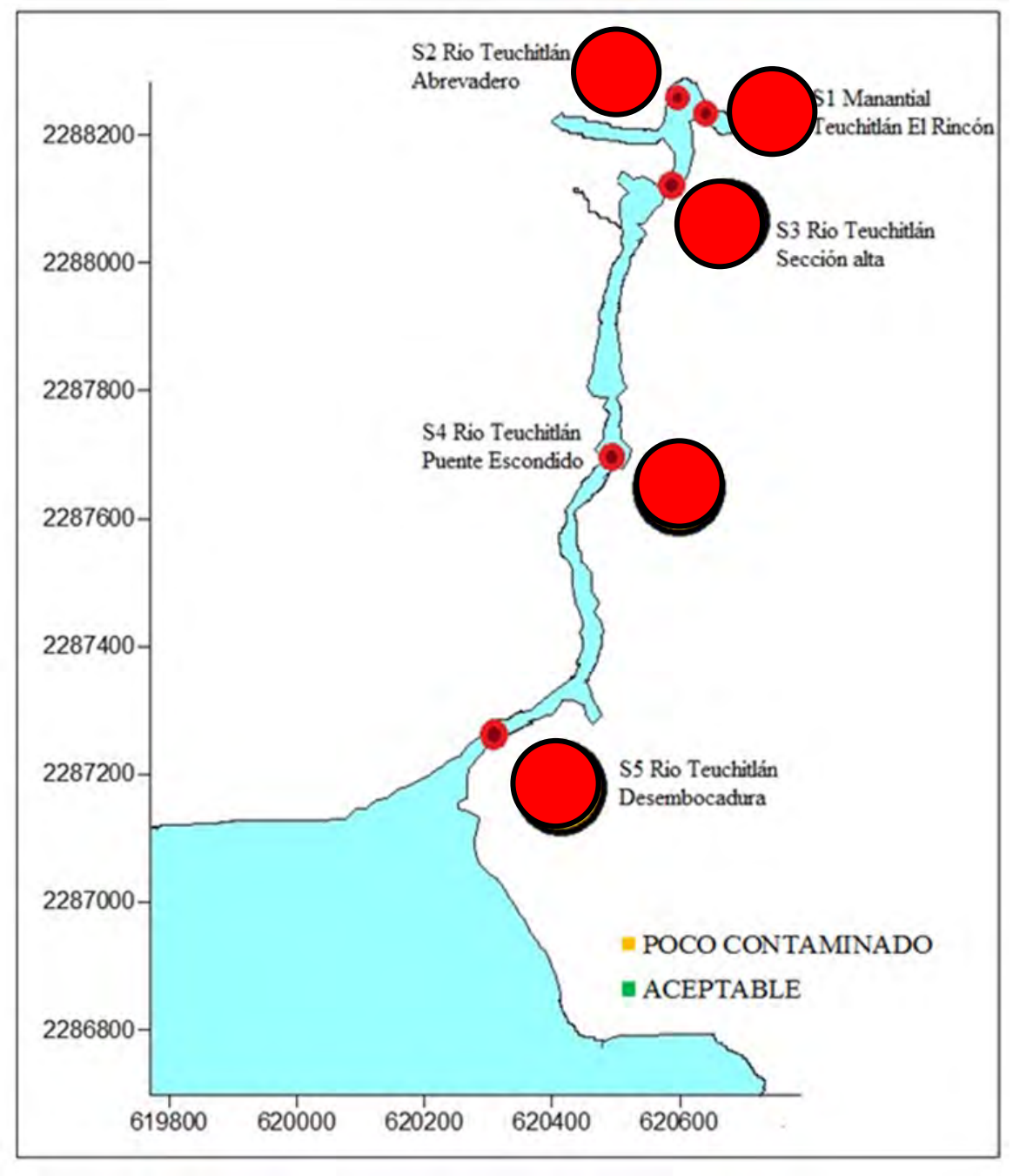
6. Determine the DISTANCE between the two BANKFULL Stage locations.

7. Divide the FPA WIDTH by the BANKFULL WIDTH to calculate the ENTRENCHMENT RATIO.

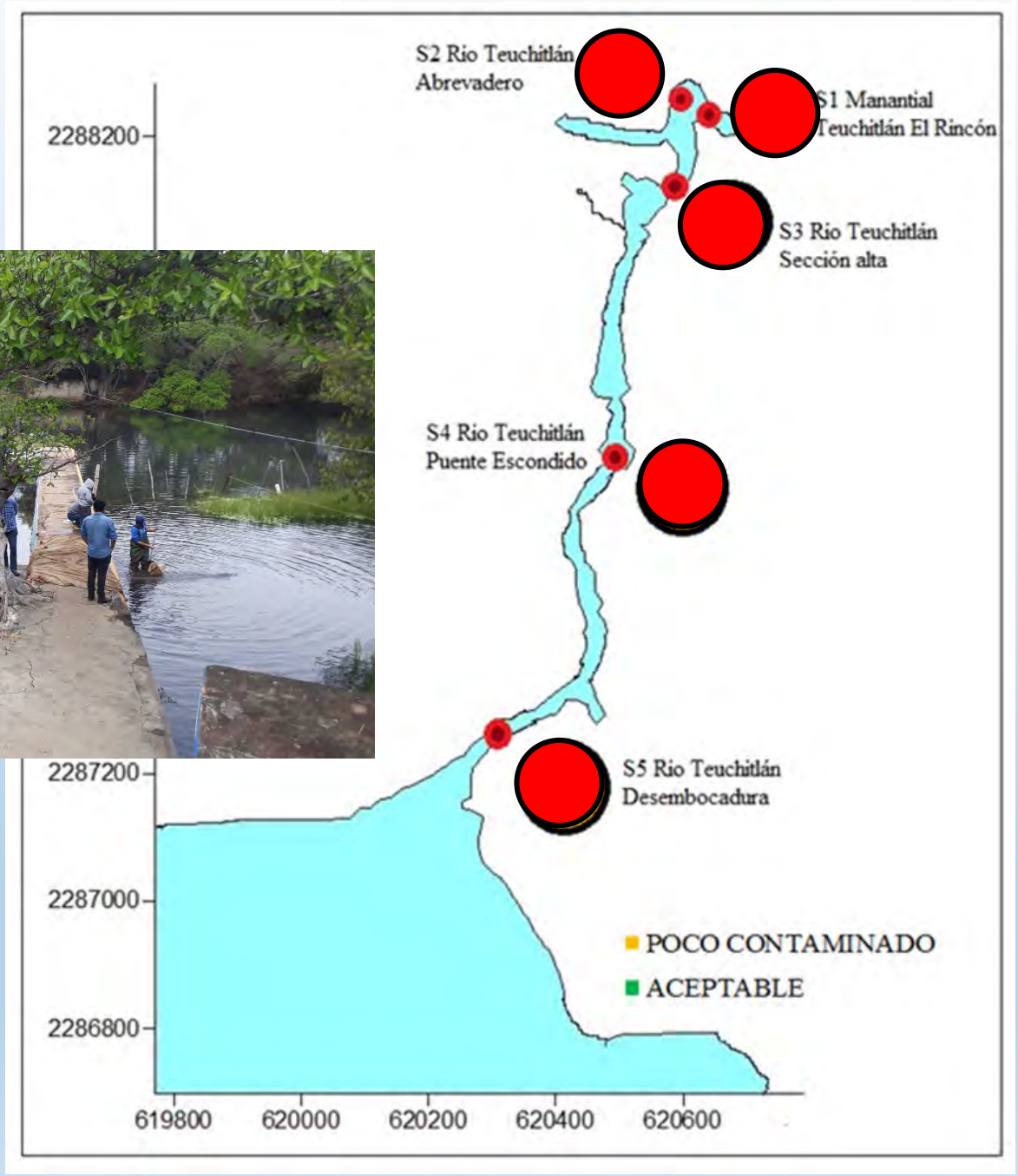
Rosgen 1996

Environmental quality

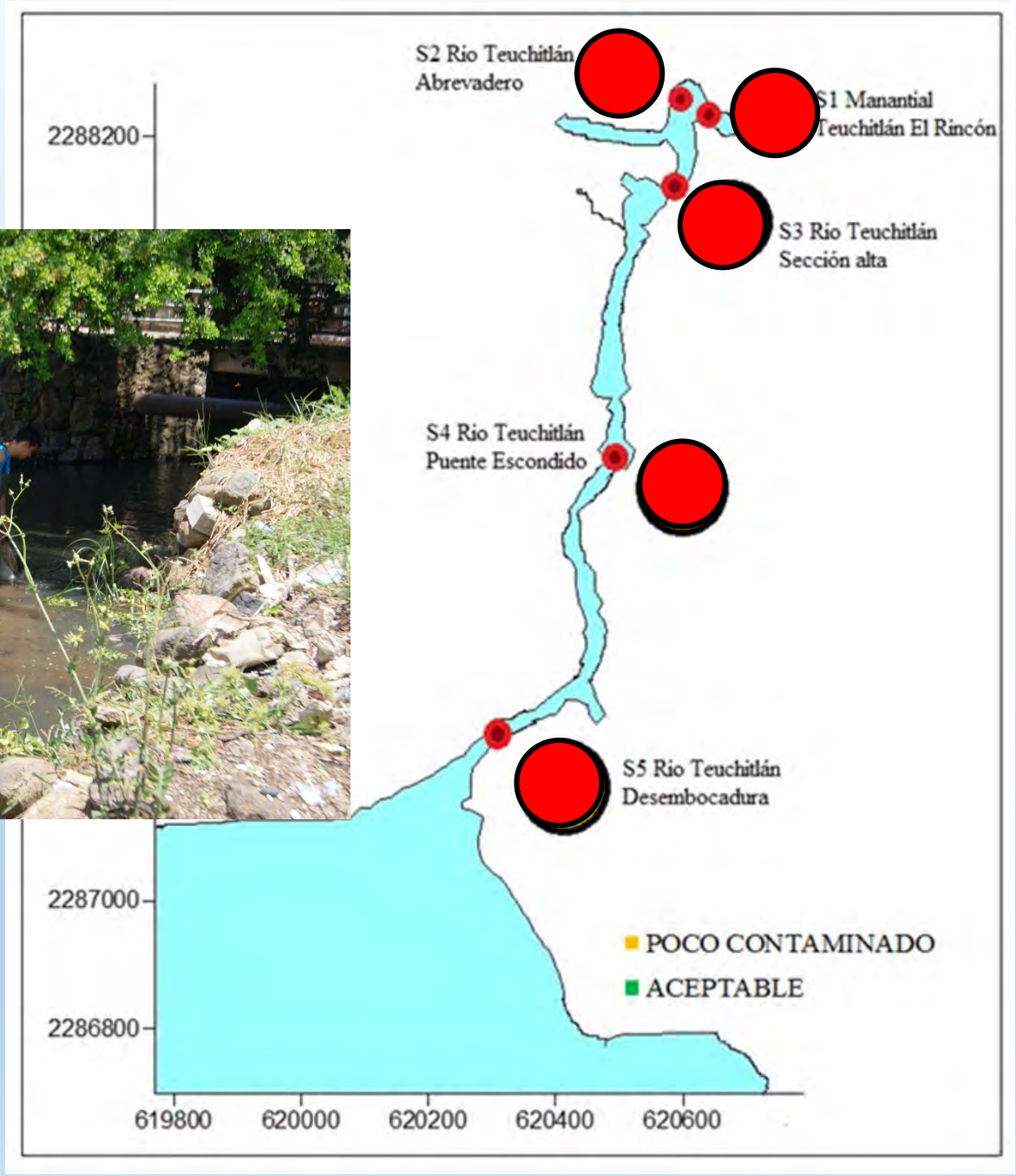
Poor quality



Environmental quality

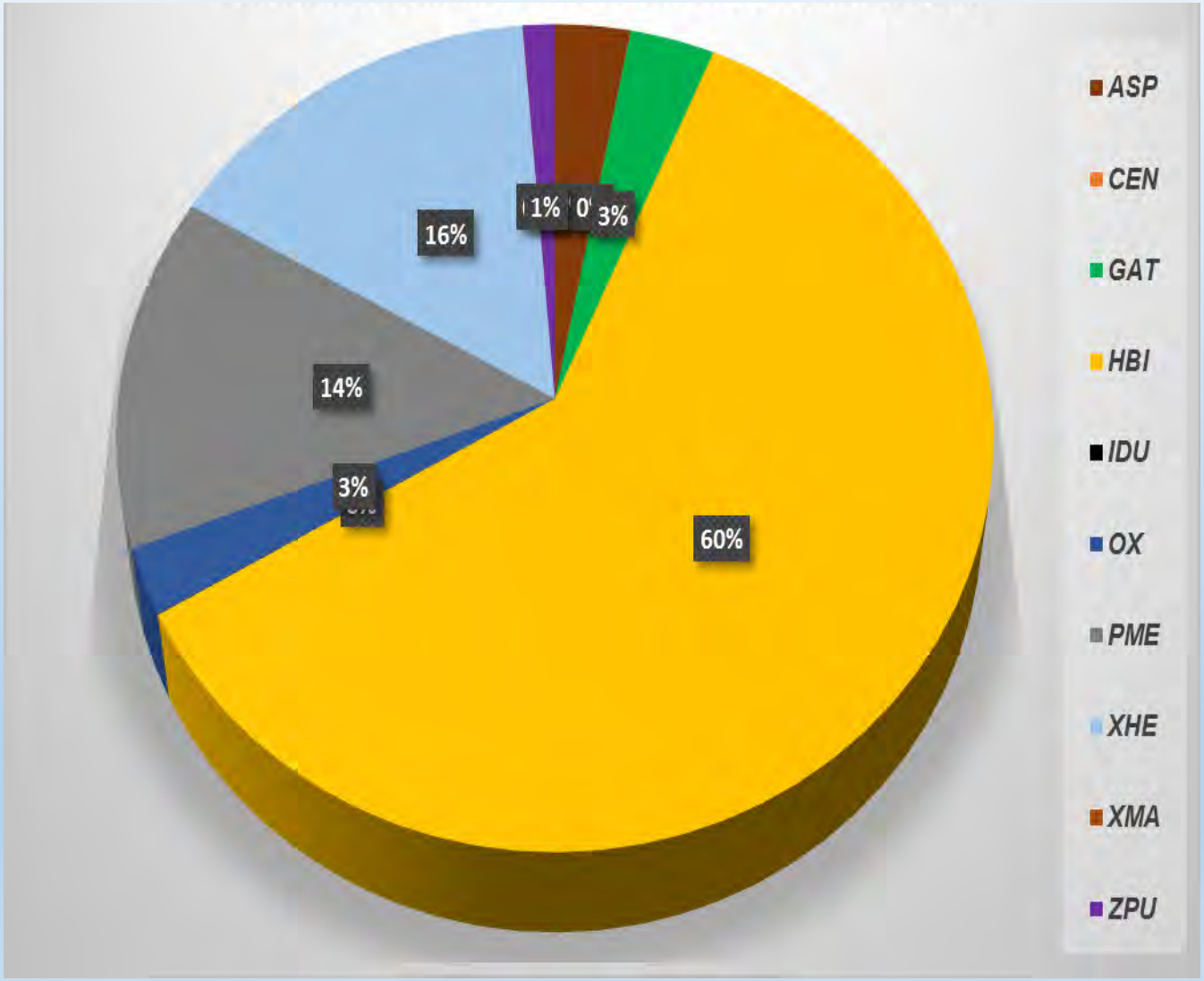


Environmental quality



Abundance of species

90% represented by exotics



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

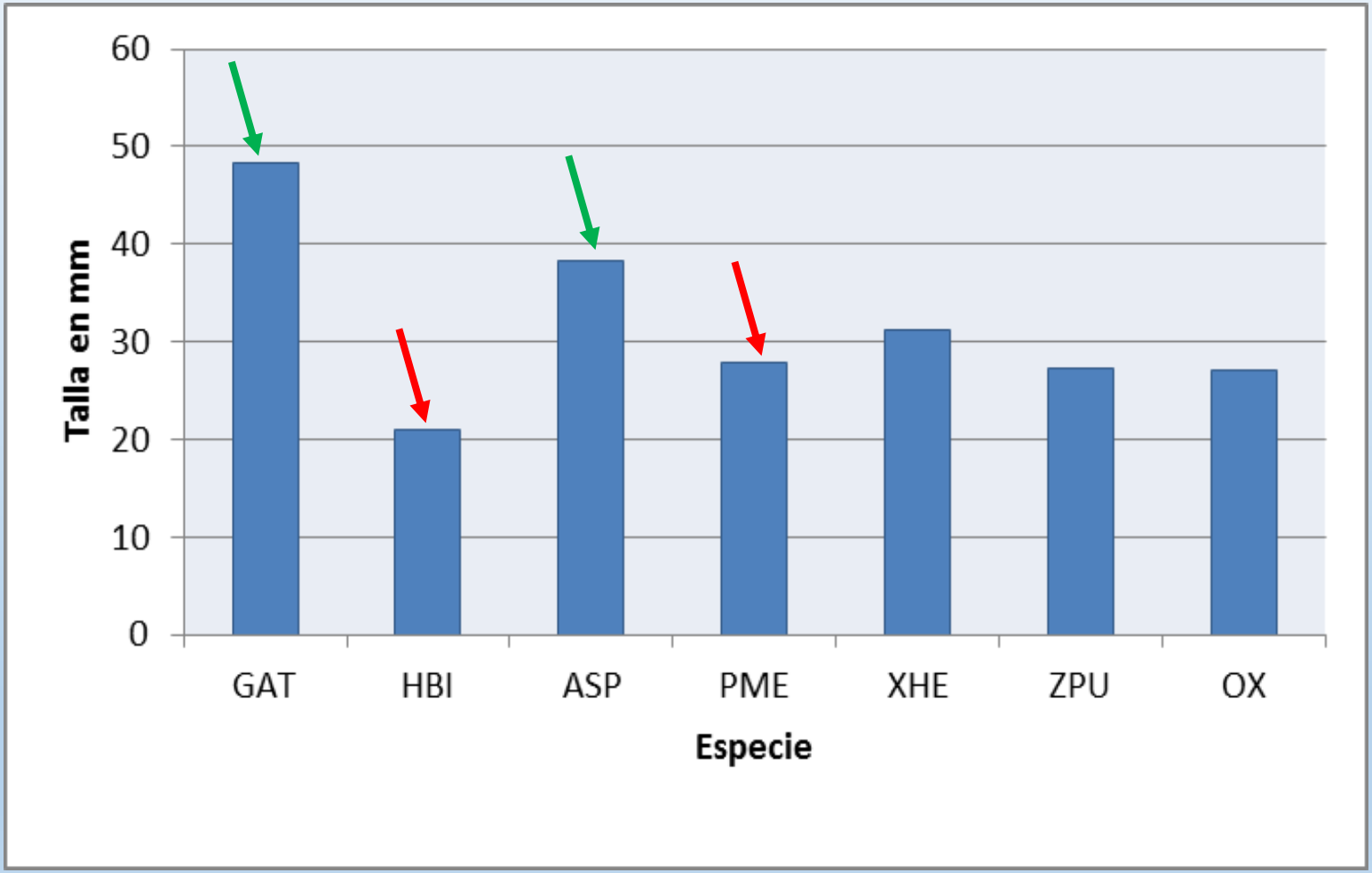
TROPHIC LEVEL (TROPH)

4
TERTIARY CONSUMERS
3
SECONDARY CONSUMERS
2
PRIMARY CONSUMERS
PRIMARY PRODUCERS
1

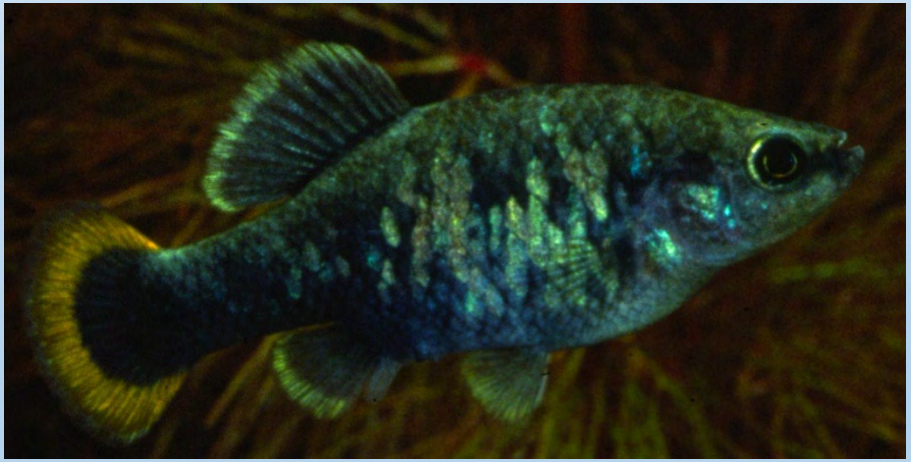
ZPU
PBI
ZTE
ASP
GAT
OX
PM
XHE
TRIC
CHIR
PINS
DIP
HEM
ODO
HYM
HHYM
COL
COP
CLAD
SPIDER
OST
HYAL
DECAP
ACA
GAST
ESC/RP
LEP
MONI
RV
ALG

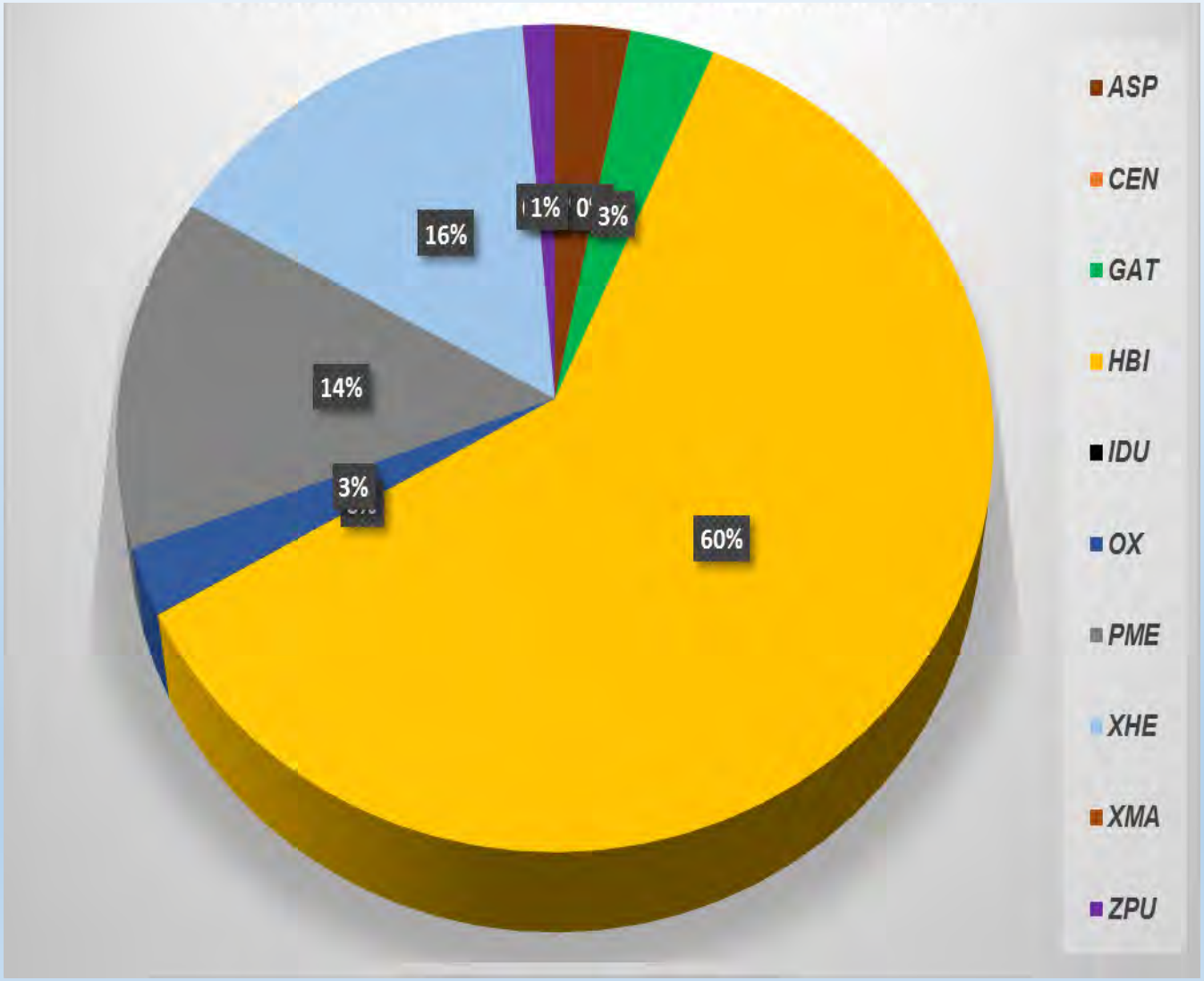
NATIVE FISH
EXOTIC FISH
PREY

First reproduction size

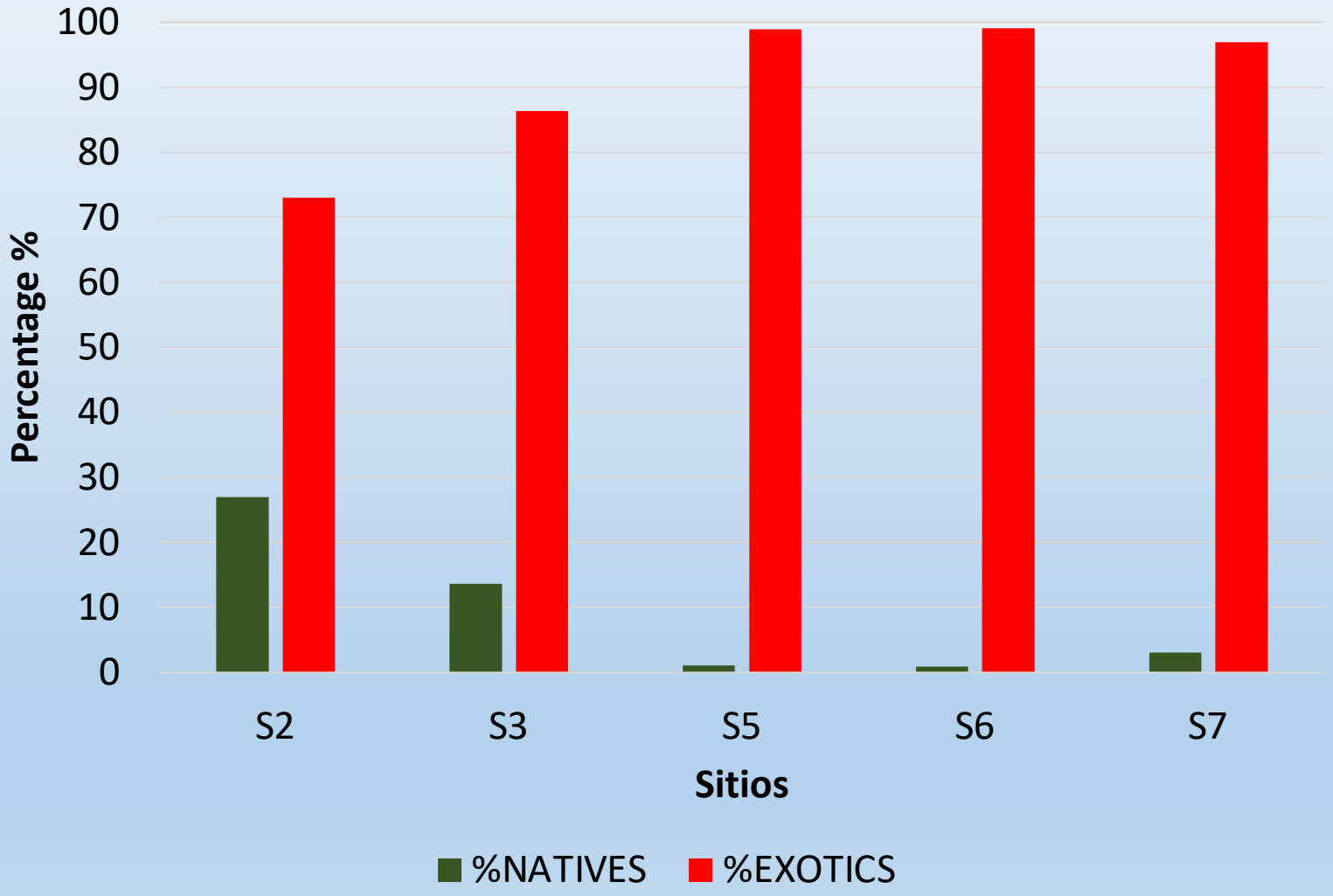


	ASP	GAT	HBI	PME	XHE	ZPU	ZTE
SEXUAL PROPORTION	0.25:4	1:1.3	1:2	0.68:1	1.38:1	0.75:1	1:1.8
FECUNDITY	5	8	6	20	7	6	4




ASP
CEN
GAT
HBI
IDU
OX
PME
XHE
XMA
ZPU
16%
1%
3%
14%
3%
60%

Density of fish community in the different locations



The decision was not easy

-Sites 1 to 3 with the best quality index

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

Were we need to reintroduce?

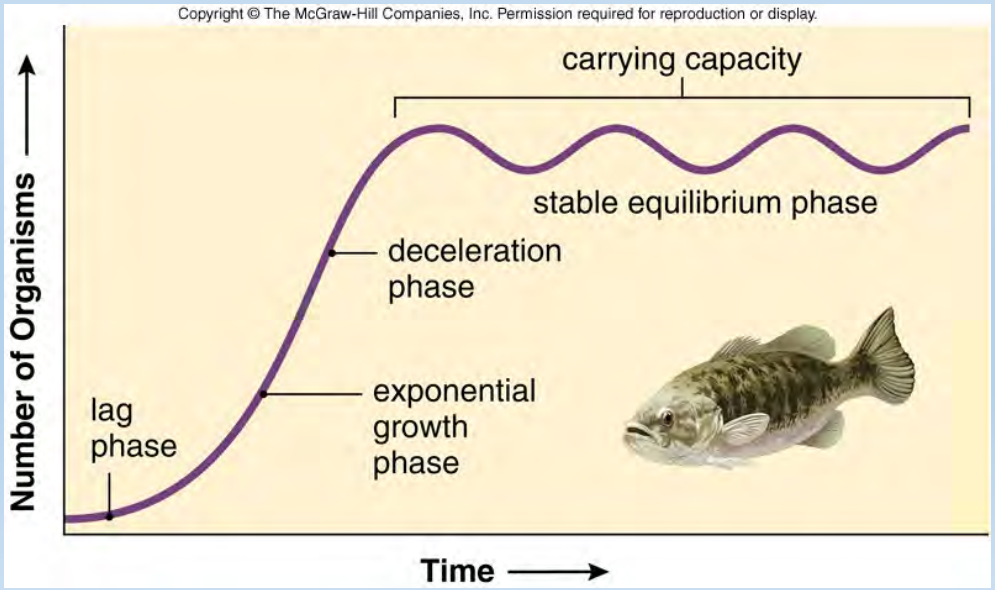
Native *vs.* exotic

VS.

Laboratory experiments

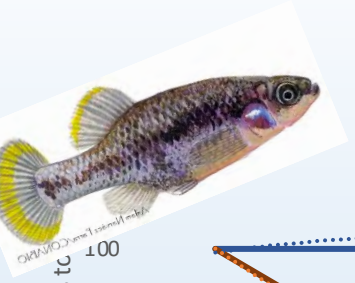
Vegetated vs non-vegetated

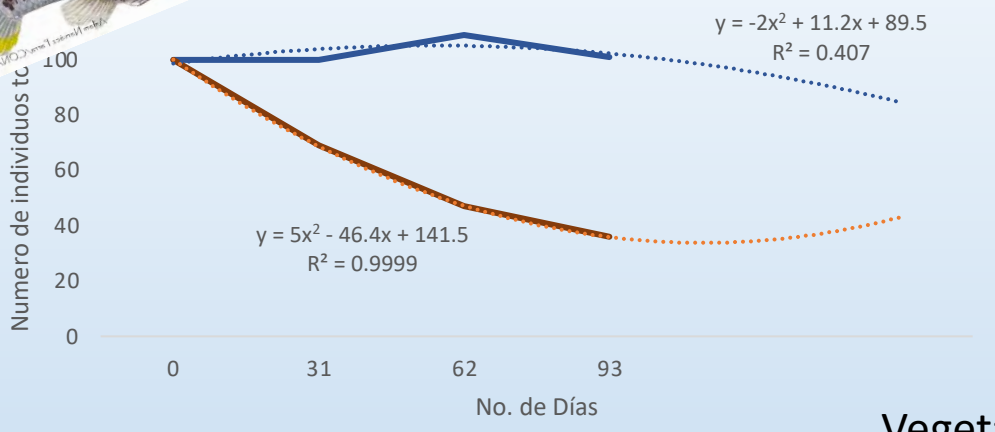
?



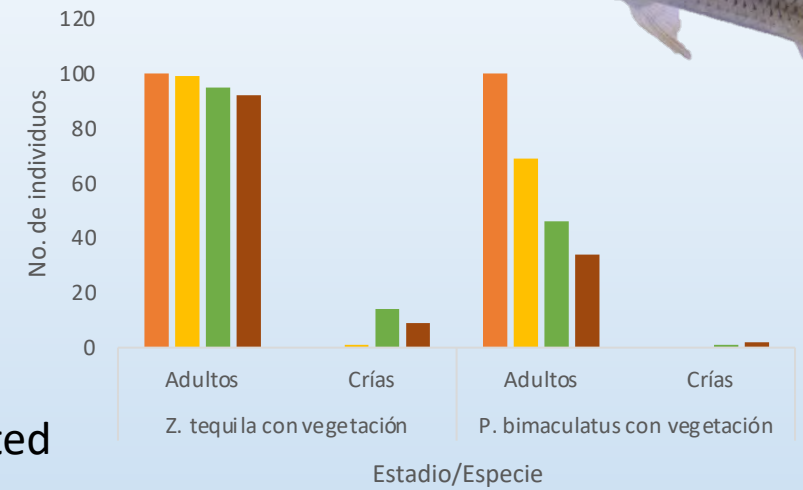
?

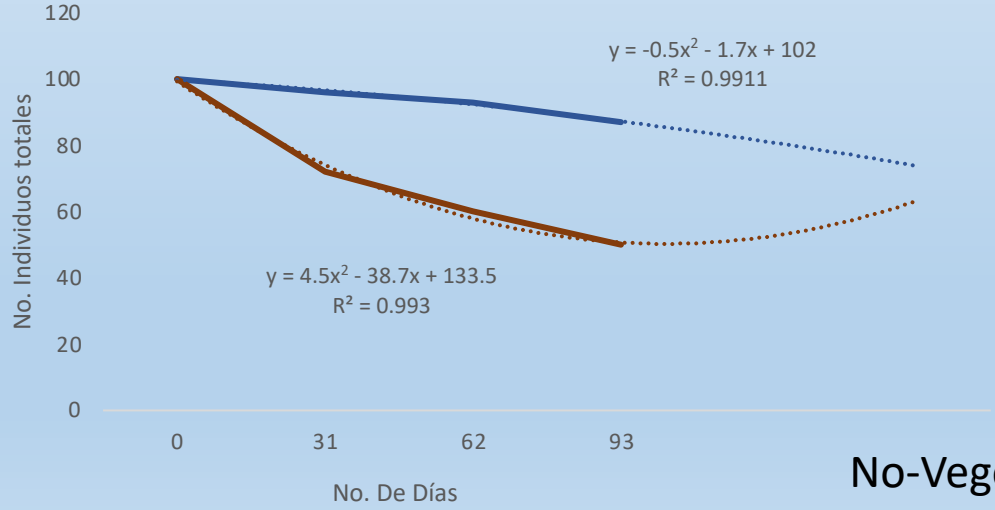
No competition treatment



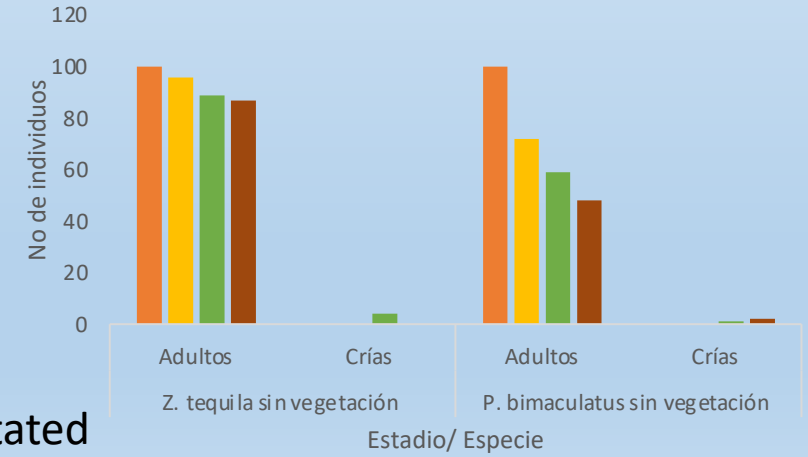


Vegetated

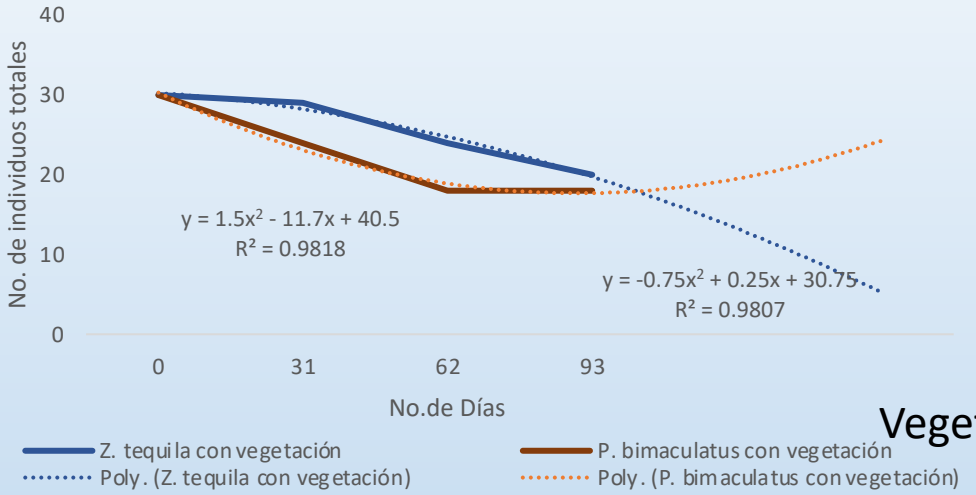


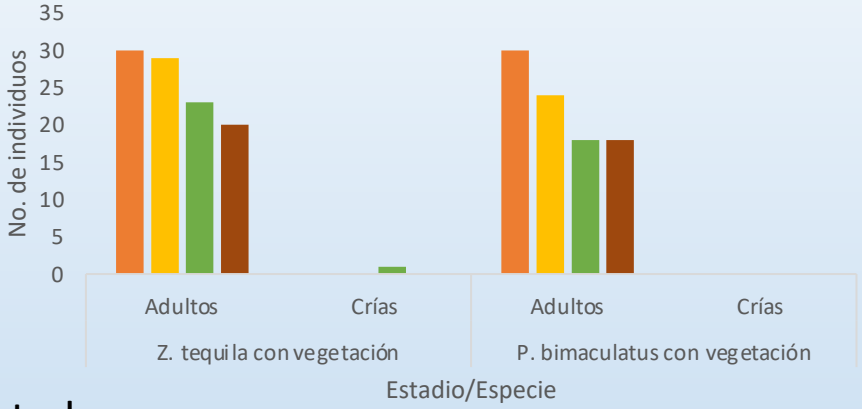


No-Vegetated

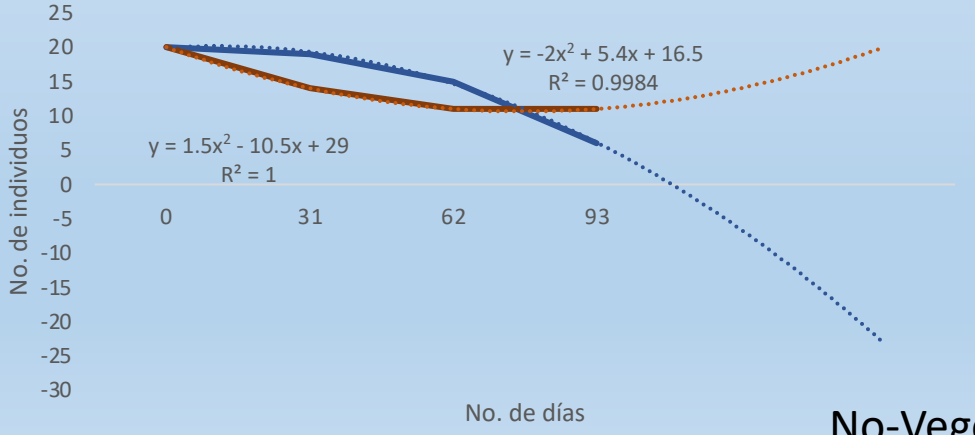


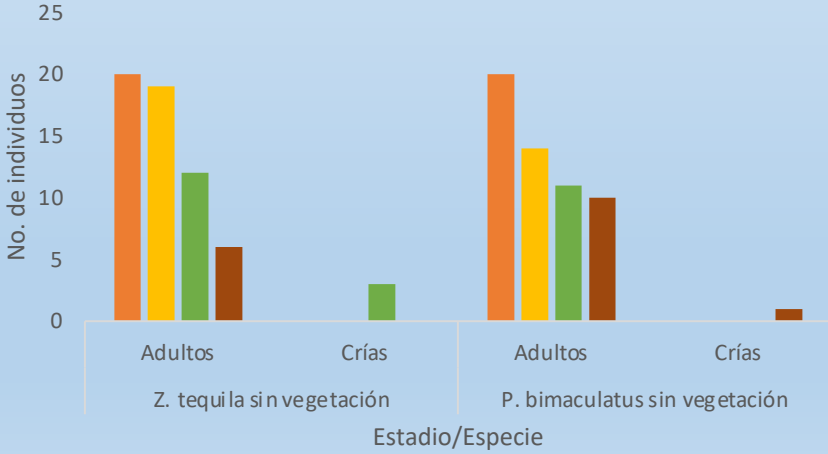
Competition treatment





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

Control of exotic species

Goal: control of the exotic species of the Teuchitlan river

Pseudoxiphophorus bimaculatus

Poecilia sphenops

Oreochromis aureus

Xiphophorus hellerii

Xiphophorus maculatus

Catching fish

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

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

Hydraulic gates

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

PARASITOLOGICAL WORK

The work consisted in two main parts:

- Before reintroduction (prevent parasites introduction)
  - Parasitological survey of *Z. tequila* in Morelia
  - Parasitological survey of fishes from Teuchitlan

- After reintroduction

(possible parasitological problems during the reintroduction)

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

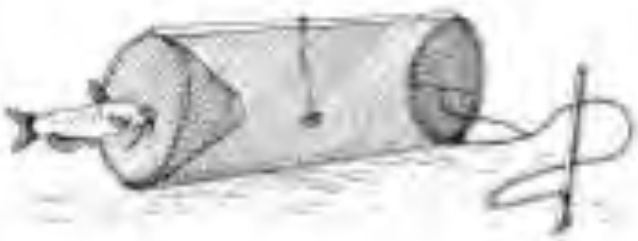
Rustic pond at botanical garden in Morelia city

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 was between 0 – 20%
  - In the rainy season the prevalence was between 40 – 70%.
- It was decided to collect the fish for reintroduction in the dry months of the year.

Parasitological treatment



50 pairs from
Botanical garden

6 pair per five treatment with
stable conditions

Antihelmintic and external parasite : Metronidazol during 48 hours + 48.

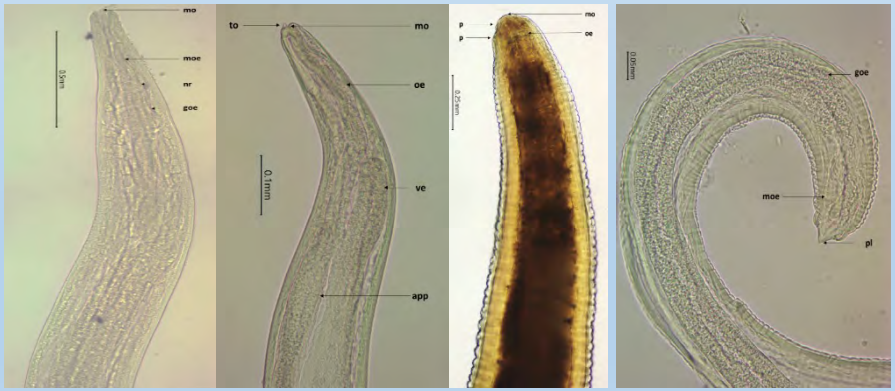
After one week

Antibiotic: Eritromicin and Tetraciclin 48 + 48 hours

- After reintroduction
  - Parasitological survey of fishes from Teuchitlan
    - Health screening of all the fish species in all the species and sites
    - Determine sex, weight and measure
    - Parasitological dissections
    - Characterize the infection

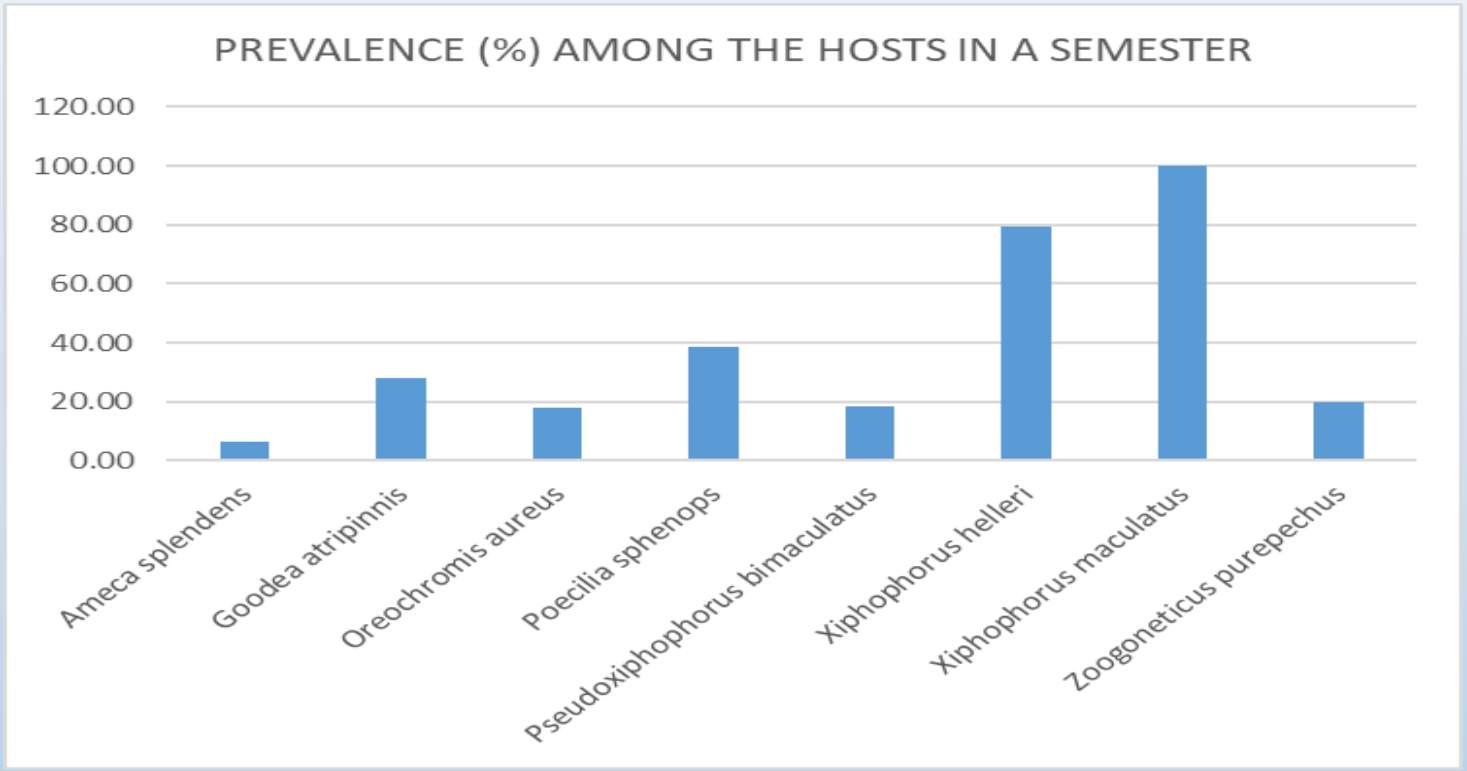
Results

We have recovered 12 taxonomic entities, four nematode, seven platyhelminthes and one acanthocephalan.



Exotic in Mexico

About the hosts (in the last semester of work)



General prevalence among the fish hosts at Teuchitlan.

- 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.

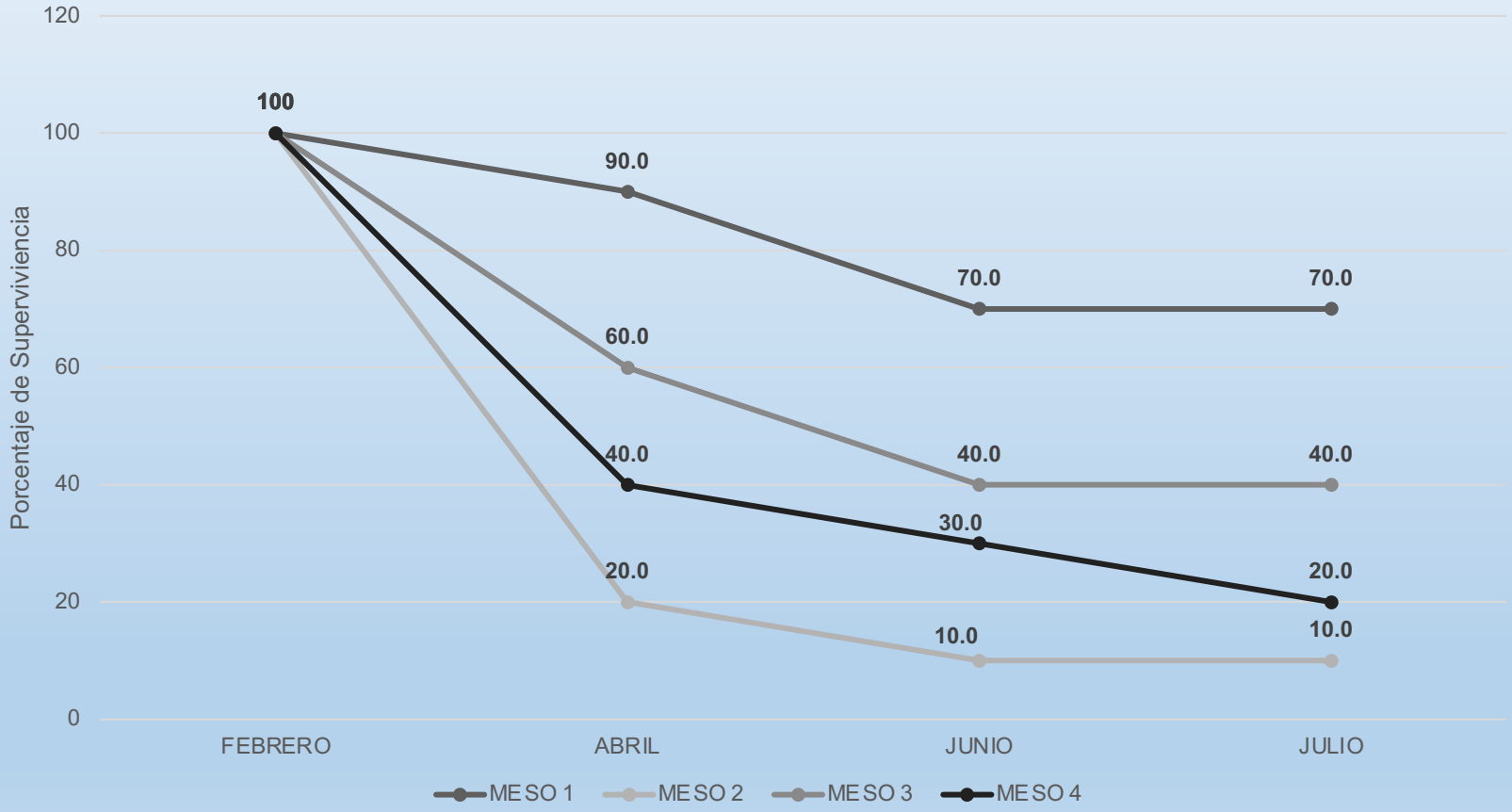
and

- 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).

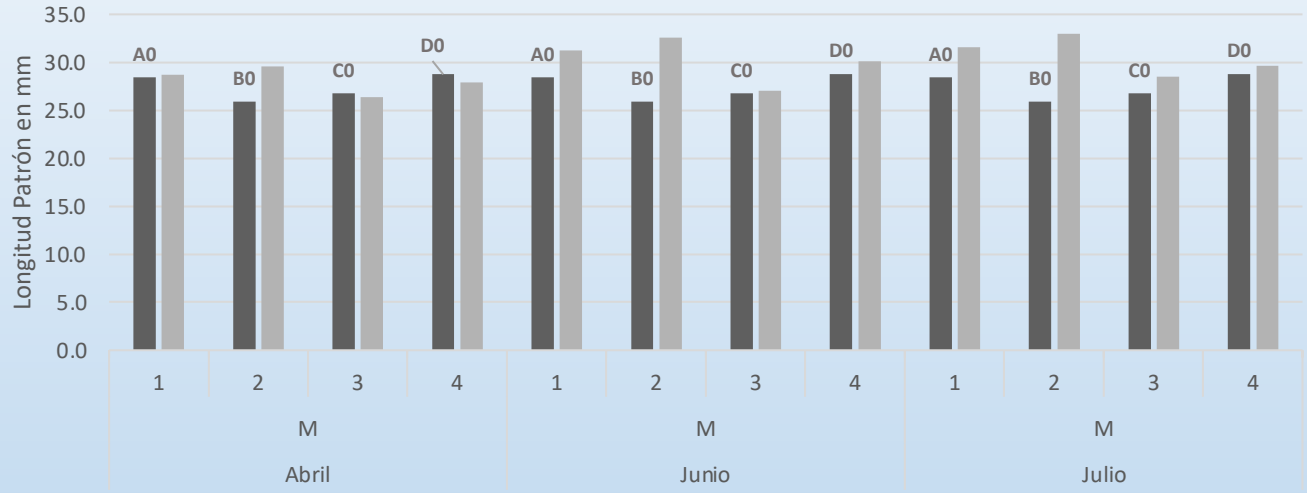
Pre-reintroduction experiments

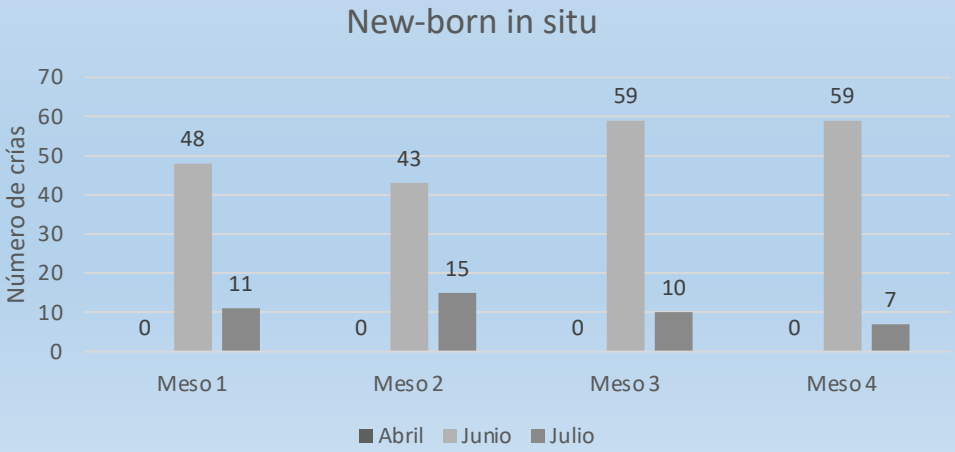
Growth and reproduction *in situ*

Survivorship once re-introduced



Individual growth in semi-controlled conditions





Conclusion

- High mortality at re-introduction (as expected)

But

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

Excellent!

Release tequila…!

not that one…yet

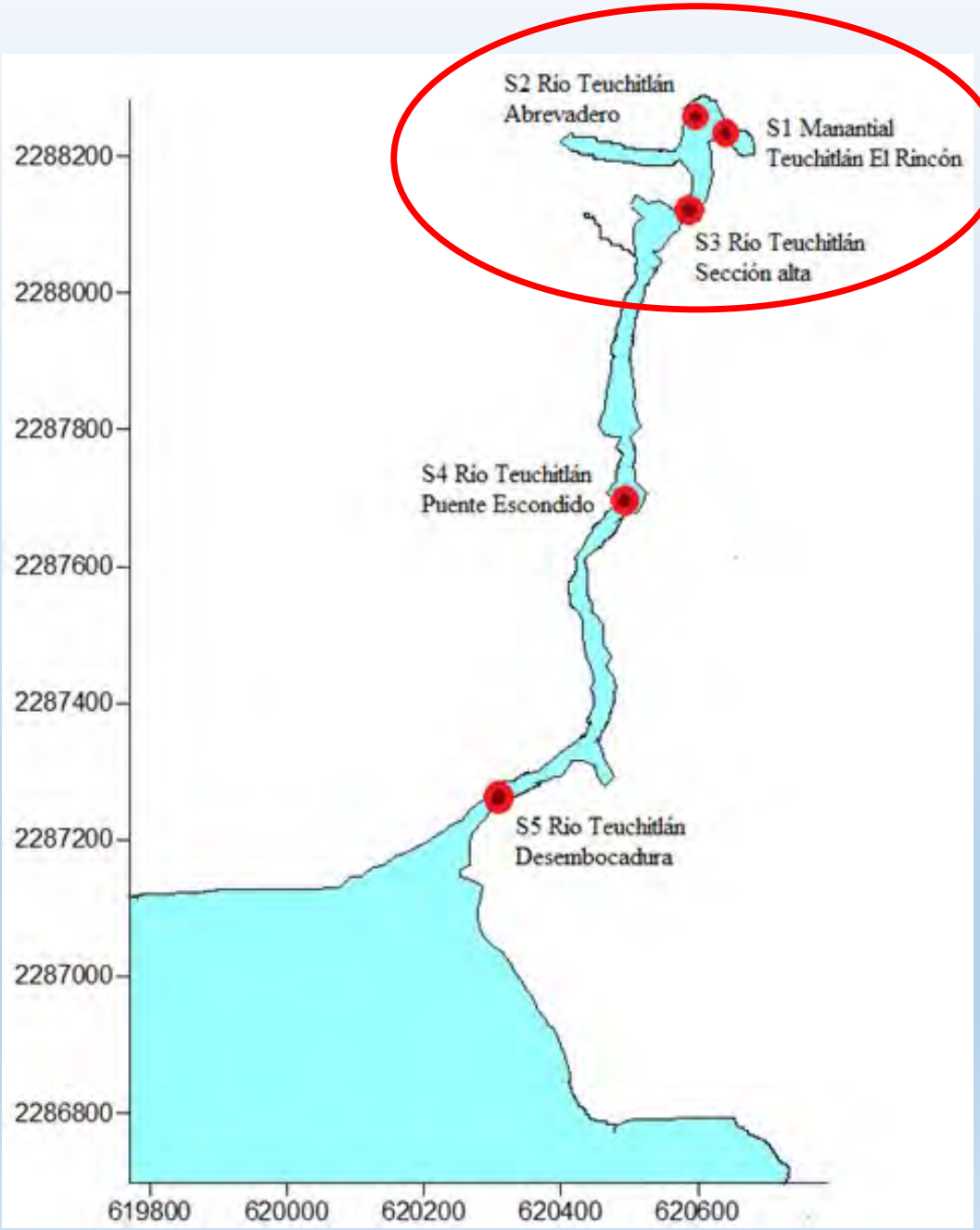
This one…

Reintroduced on November the 1st

Noche de muertos

When the beloved ones come back…

from extinction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Puente Escondido
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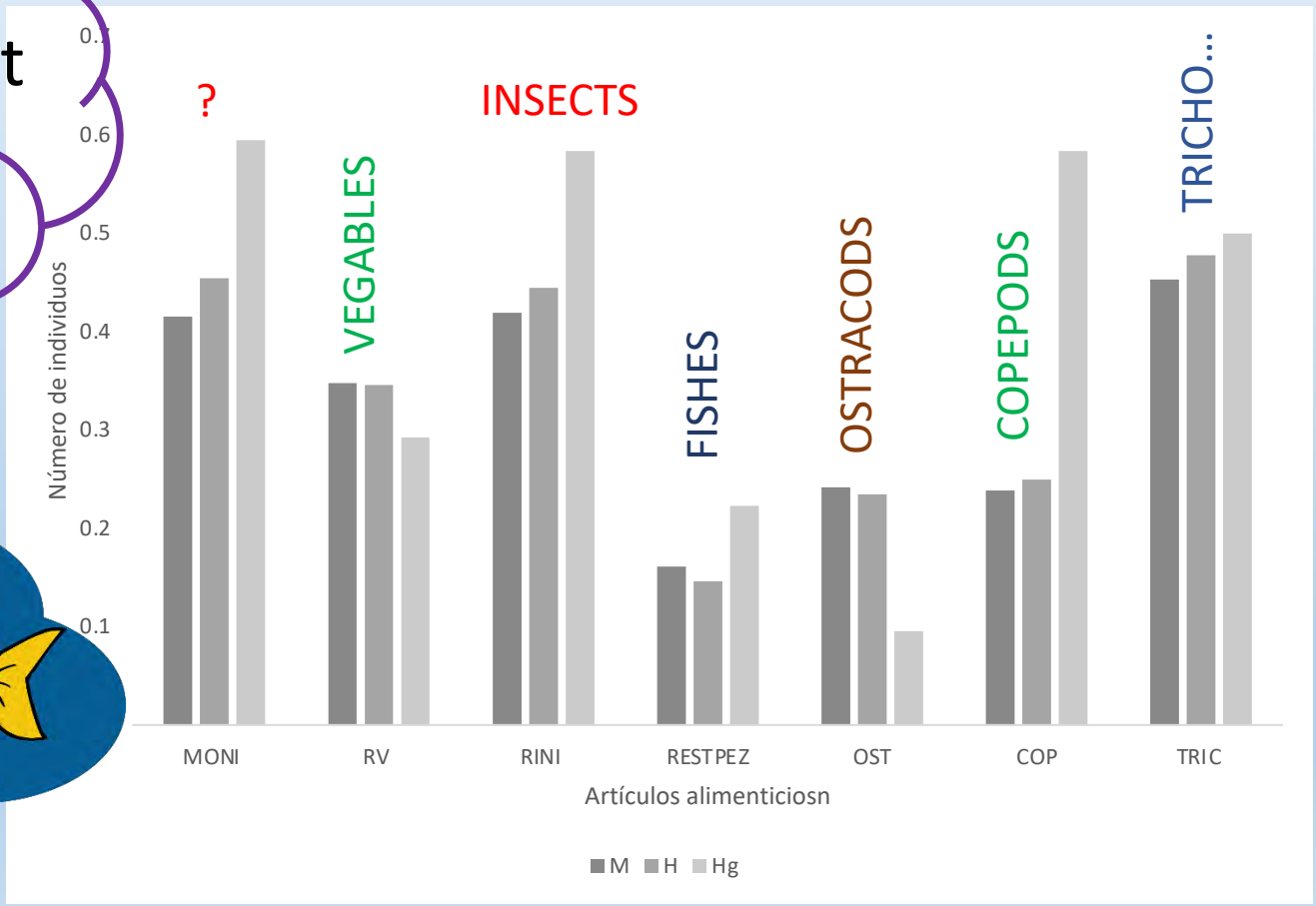
Desembocadura
2288200
2288000
2287800
2287600
2287400
2287200
2287000
2286800
619800
620000
620200
620400
620600


Coca-Cola
Coca-Cola

Catch *in situ* after the first 10 months

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

Aquatic meat and some greens



Whit *Z. tequila* in the wild

Following of the reintroduction process of *Z. tequila* in the Teuchitlán Springs 2019

صندوق محمد بن زايد
للمحافظة على
الكائنات الحية
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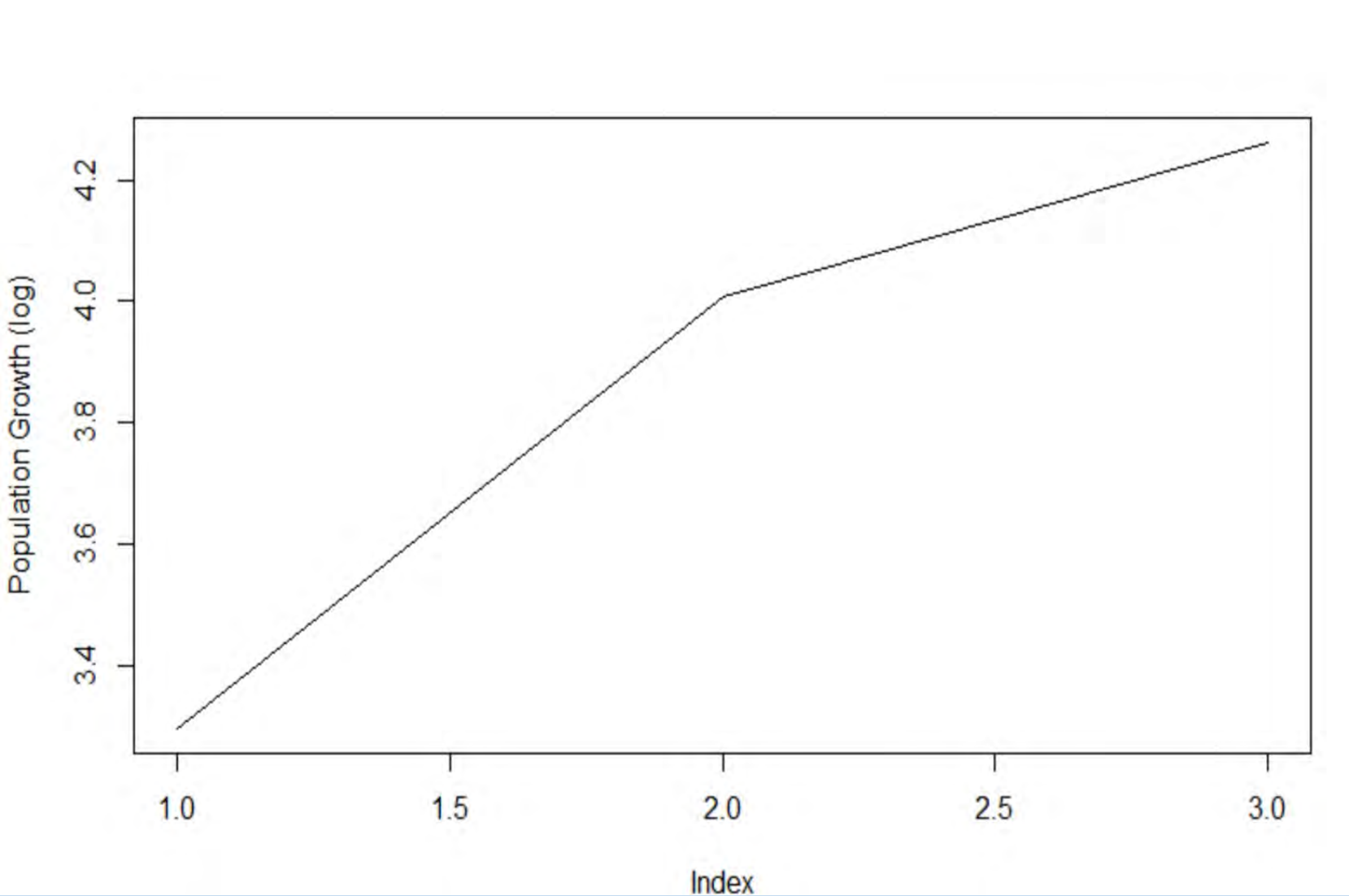
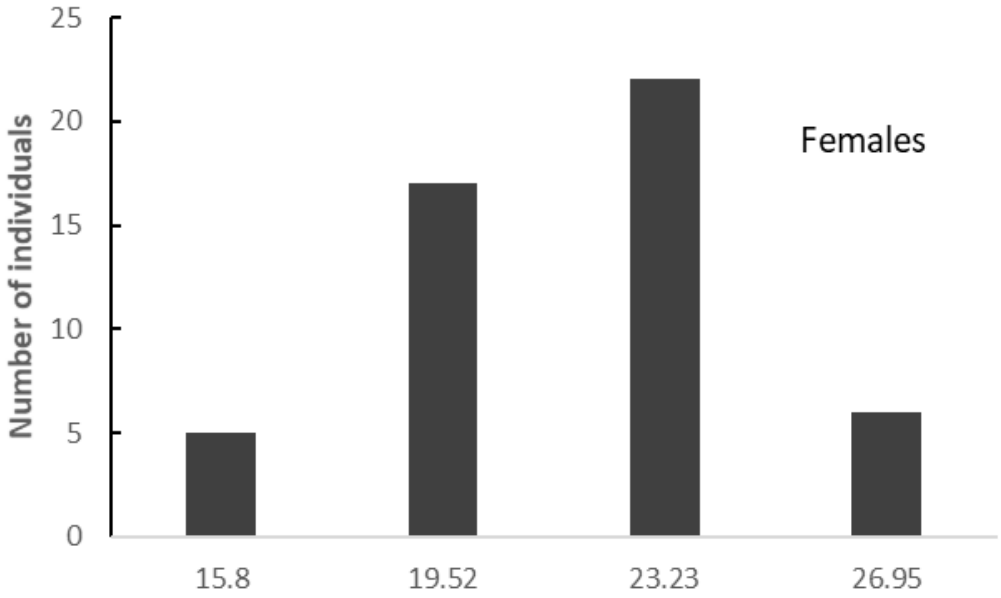
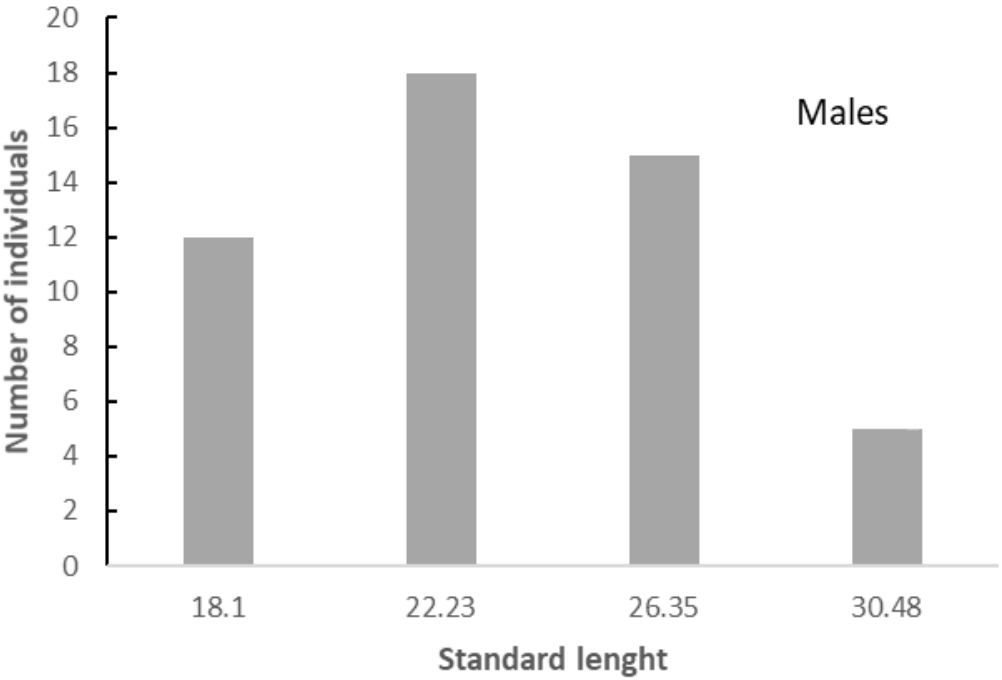
Population growth

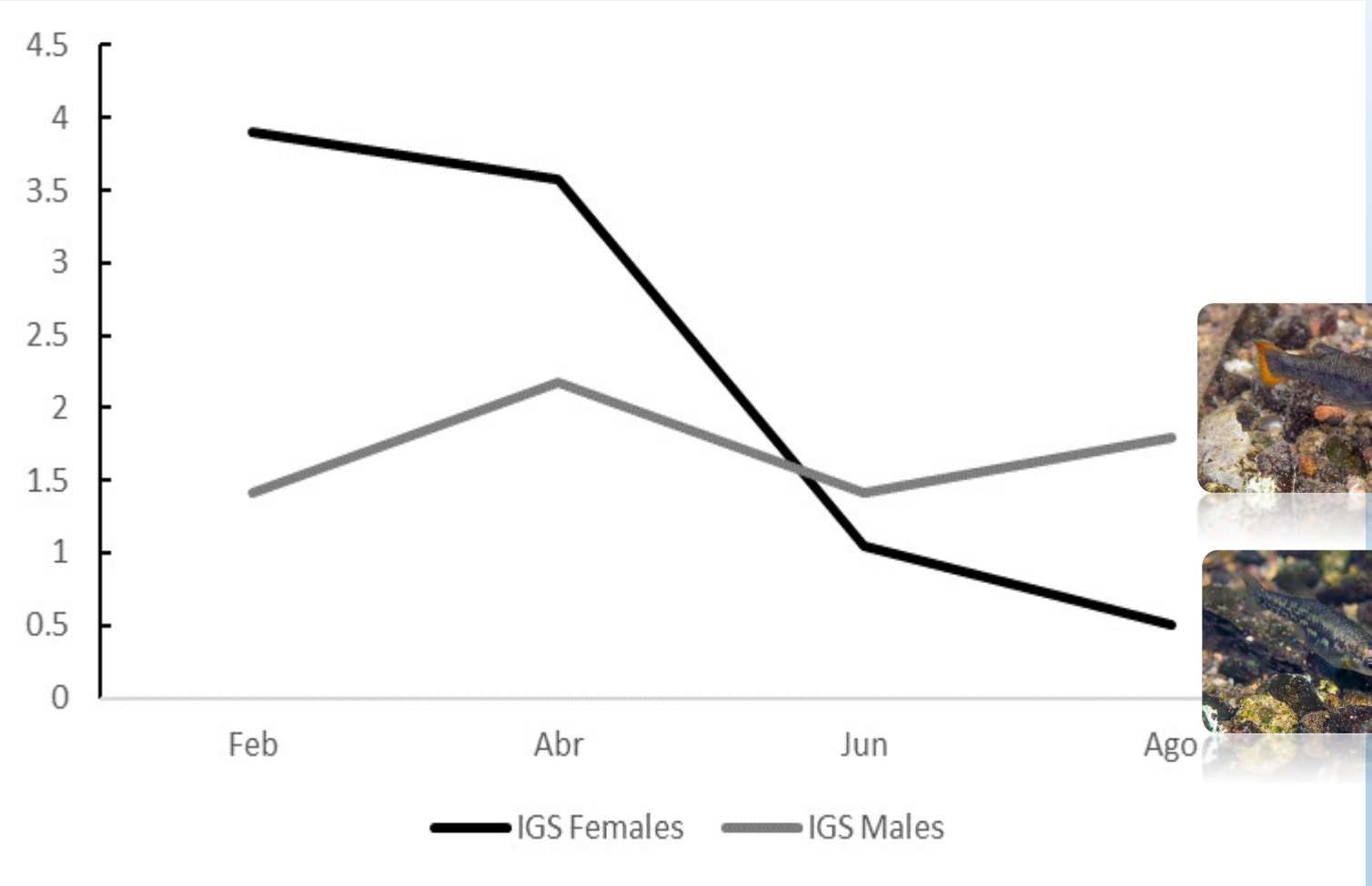


Sizes structure





Reproductive period



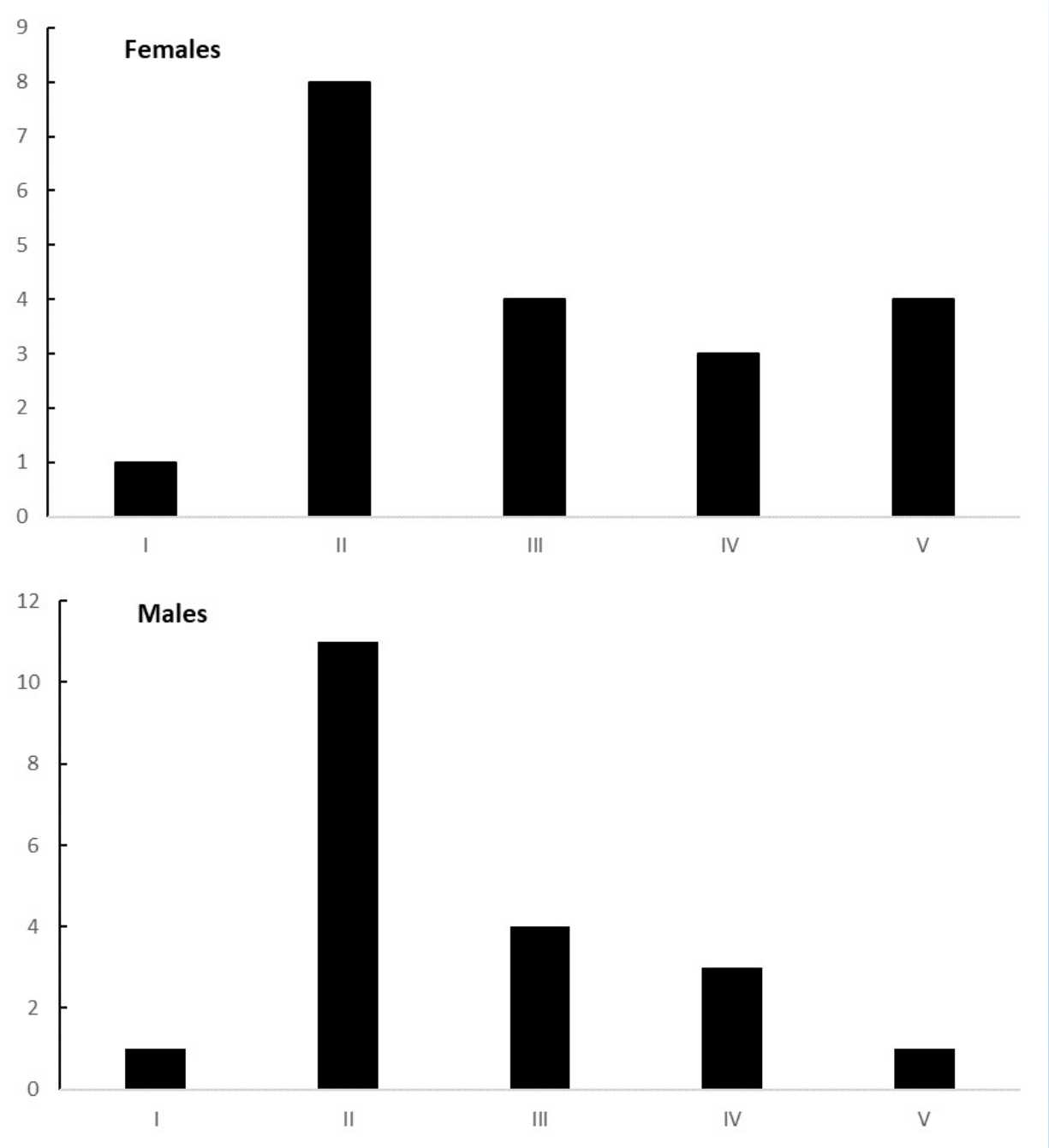
Females present higher gonadosomatic index than males in the two months.

Females are reproducing in small size than males

Maturity size for females at 26.05 mm of SL

Males at 29.39 mm of SL

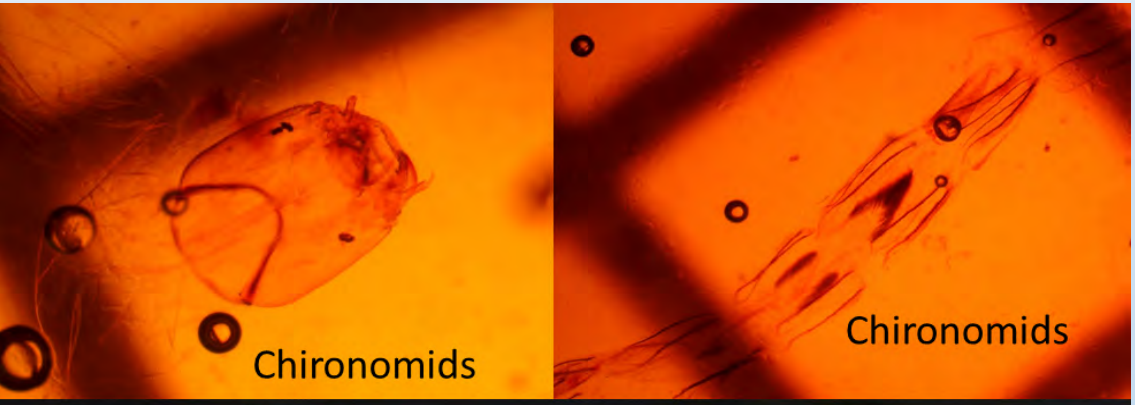
The fertility of *Z. tequila* present a range of four to five embryos per female.

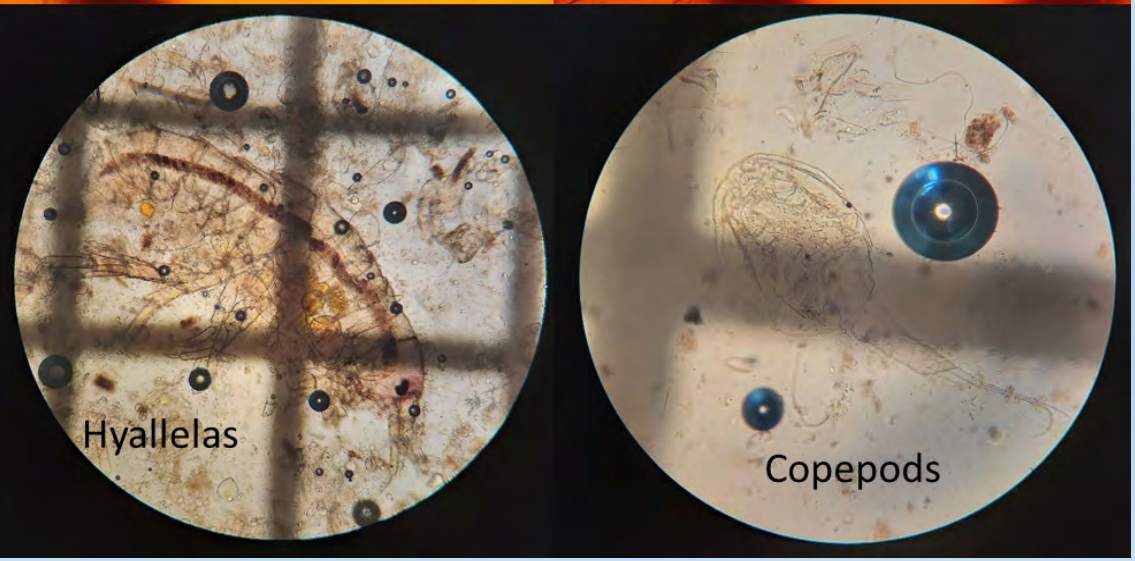


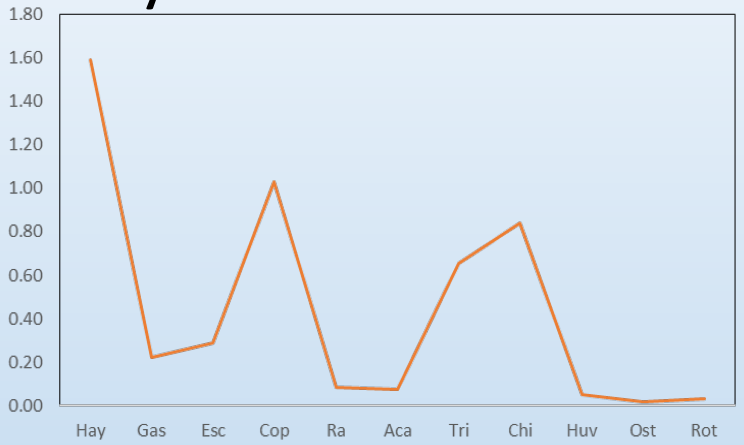
Gonadal stage

FEEDING

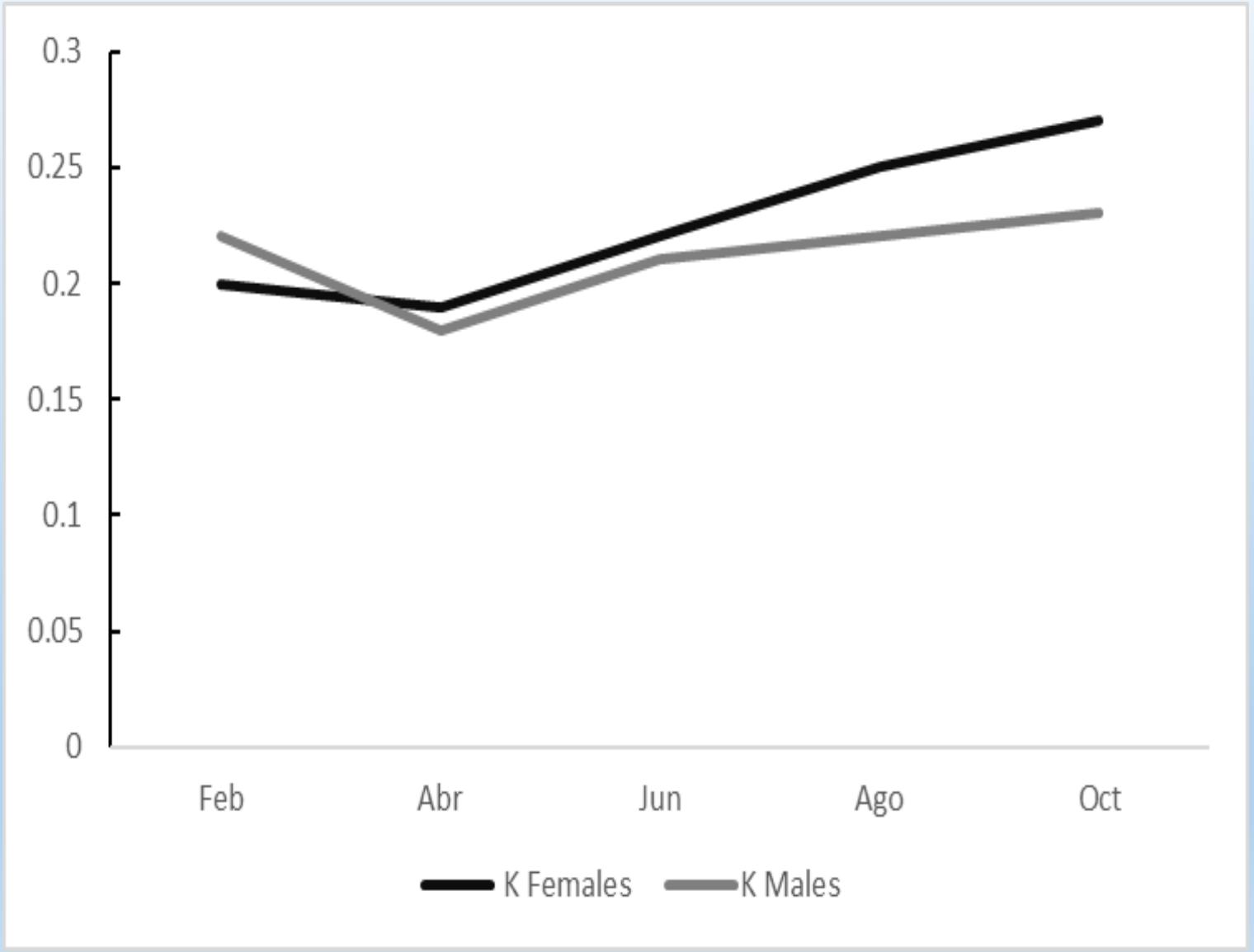
- Their feeding habits are based mainly in:







Condition factor



Conclusions

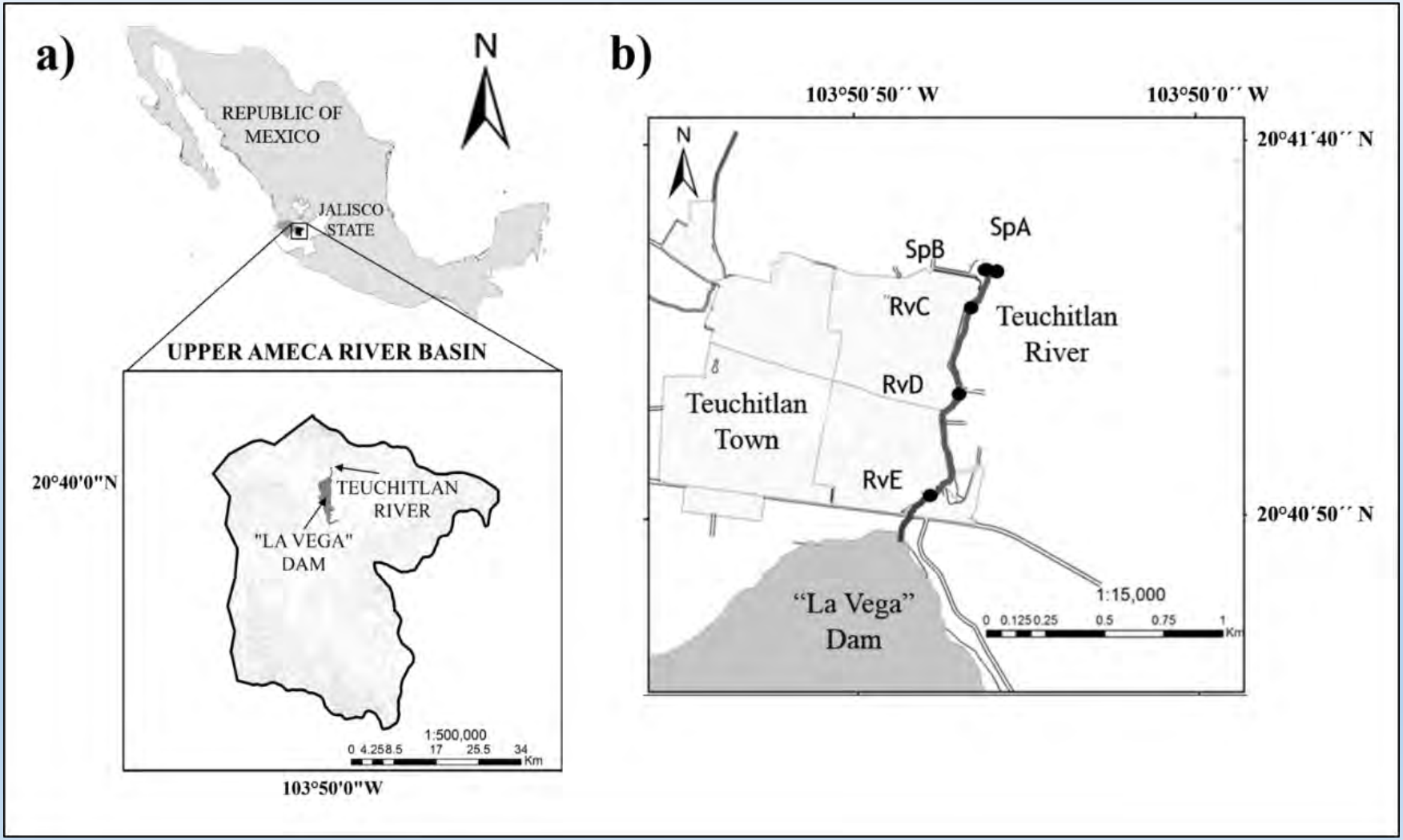
All the individuals captured born in the spring, they are feeding and reproducing in nature.

The population is growing.

After 4 years of population monitoring, we can say that the reintroduction is a success.

Welcome home Zoogy…

Teuchitlan River



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

What we did?

Workshop

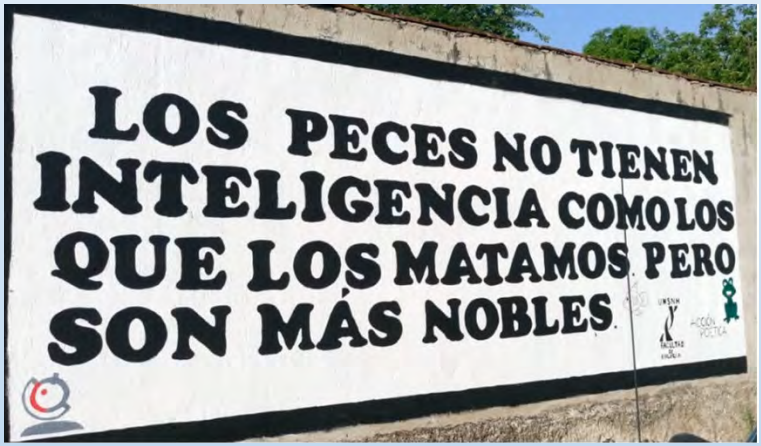
In elemental school and High school

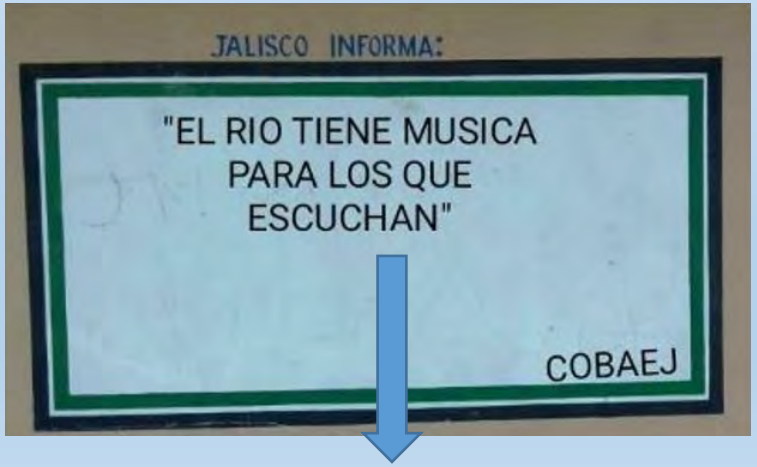
To propose the importance of the conservation of the Teuchitlan River and their species.

564 Students participate

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

Workshop to teachers about sustainability on conservation nature

Communitarian water quality monitoring

12 people from Teuchitlan

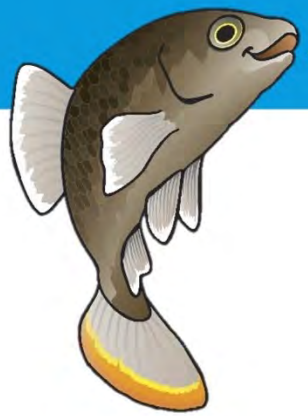
Long term monitoring plan

Environmental education program

Museumgraphic exposition in the Centro nterpretativo Guachimontones “Phil Weigand”

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!!

Teuchitlán

Sala de lectura

La ranita lectora

CHESTER ZOO

CONABIO

Haus des Meeres

GWG Goodeid Working Group

TEUCHITLÁN
GOBIERNO MUNICIPAL 2018 - 2021

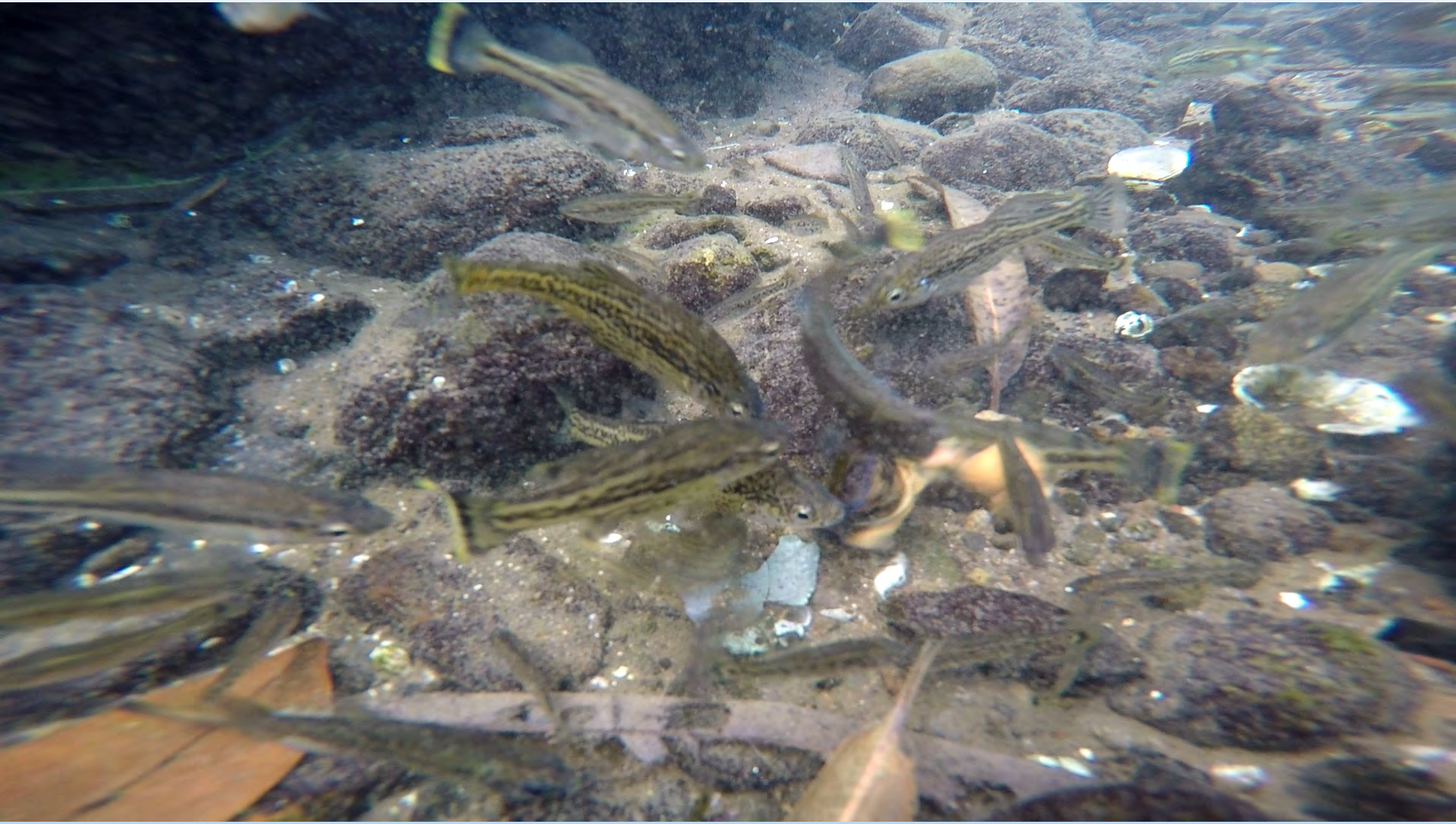
Building capacities
1 PhD students
5 MSc students
11 BSc students

So what?

- Example of success on recovering an extinct species *in situ*
- Recovering native ichtilogical 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**

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

- *Chapalichthys pardalis* reintroduction

Thanks!!

Ictiología y Conservación
Laboratorio de Biología acuática UMNSH

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

GWG Goodeid Working Group

CHESTER ZOO

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

CONABIO

Association BEAUVAL NATURE pour la Conservation et la Recherche

American Livebearer Association Est. 1971

AQUA TERRA ZOO Haus des Meeres

POECILIA SCANDINAVIA

MISSOURI MASC AQUARIUM SOCIETY

British Livebearer Association B. L. A. Est 2002

DELTSCHE GESELLSCHAFT FÜR LEBENDGEBÄRENDE ZAHNKARPFEN e.V. 1973 DGLZ