

# **Population genetics of the fish *Centropomus viridis*, *Centropomus robalito* and *Centropomus nigrescens* in the “La Encrucijada” Biosphere Reserve.**

July, 2025



The College of the Southern Border,  
Tapachula Unit,  
Master of Science in Resources  
Natural and Rural Development

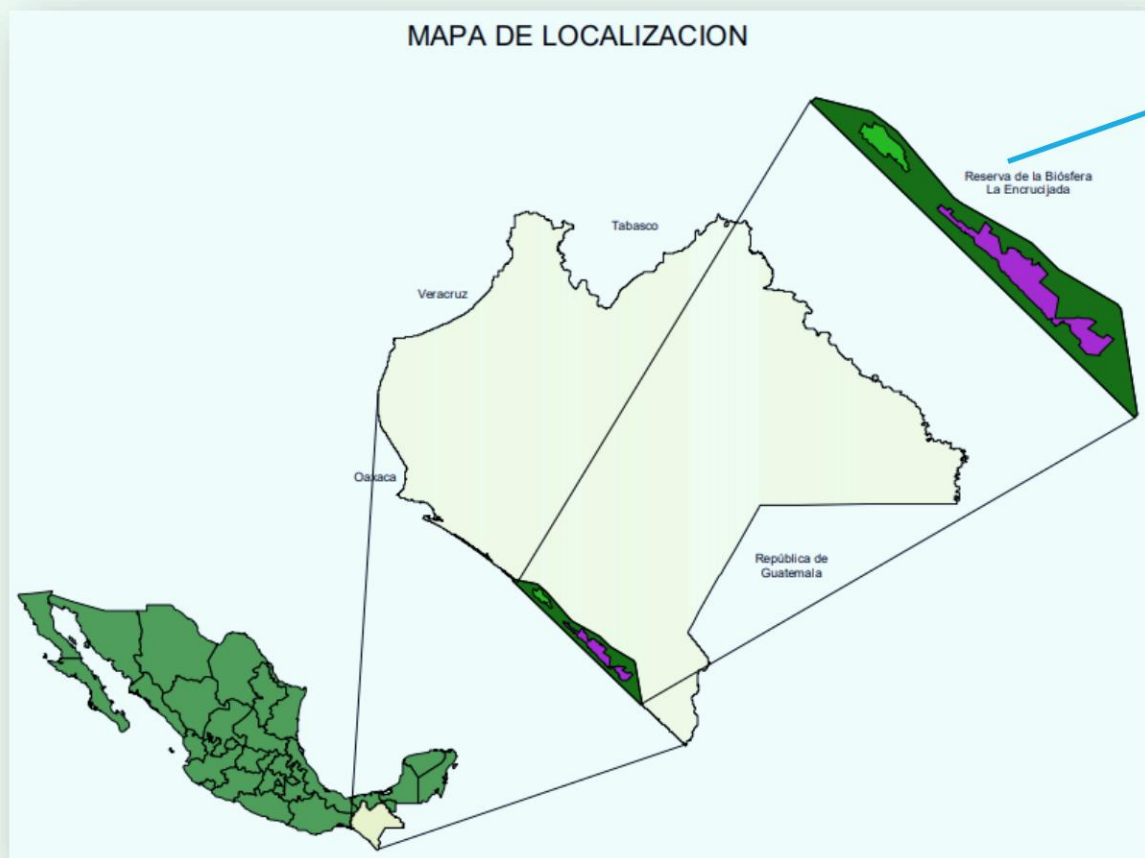
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Yuliesky Garcés Rodríguez

# Introduction

🐟 The La Encrucijada Biosphere Reserve (REBIEN) represents for the state of Chiapas the union of two areas of great economic importance: the Isthmus-Coast and Soconusco.



Pijijiapan, Mapastepec, Acapetahua, Huixtla, Villa Comaltitlán, Huehuetán and Mazatán.

🐟 Considered an area of socio-environmental interest by the diversity of flora and fauna it houses.



Source: CONANP



Source: Edmundo Aguilar



Source: CONANP

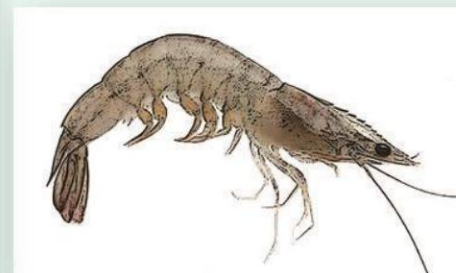


Source: CONANP

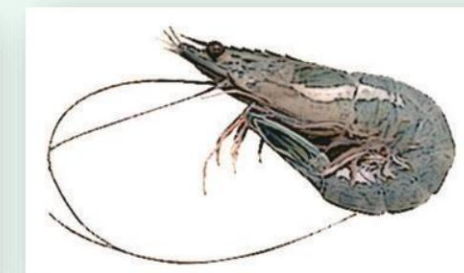
🐟 From REBIEN we can highlight species with great fishing potential, which raise the levels of primary production, thus making it a focal point for its conservation.



White shrimp  
(*Litopenaeus vannamei*)



Blue shrimp  
(*Litopenaeus stylirostris*)



Mulletts  
(*Mugil spp.*)



Snappers  
(*Lutjanus spp.*)



Sea bass  
(*Centropomus spp.*)



The main catch of fishing are:

SCIENCE

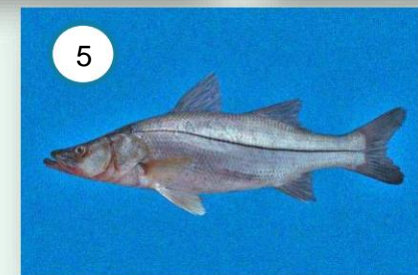
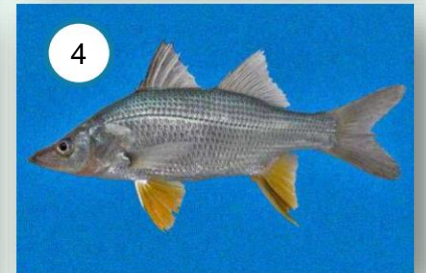
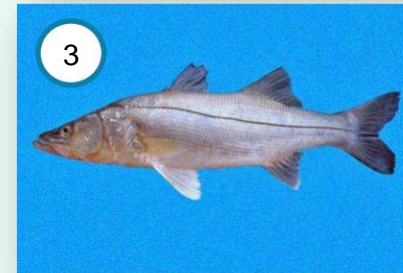
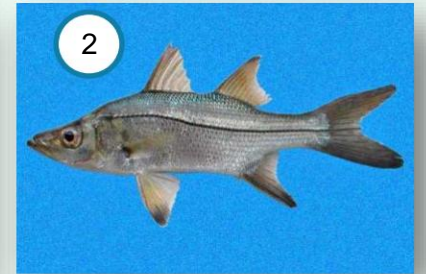
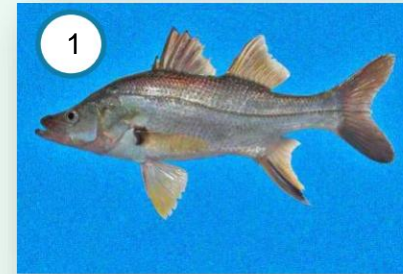
➡ From 2004 to 2009, Gómez-González et al. investigated and listed the ichthyofauna found in REBIEN, listing 153 species.



Source: Jorge Silva

➡ Focusing on the Centropomidae family, the following species were reported:

1. *C. armatus*
2. *C. medius*
3. *C. nigrescens*
4. *C. sea bass*
5. *C. viridis*



Source: STRI

These last three being the most socioeconomically relevant.

# Generalities of the genus *Centropomus*

🐟 **Distribution:** From the US to Brazil, including the Caribbean and Central American coasts.

🐟 **Habitat:** Coastal and estuarine waters.

🐟 **Reproduction:** External, migratory and protandrous, with variable reproductive peaks.

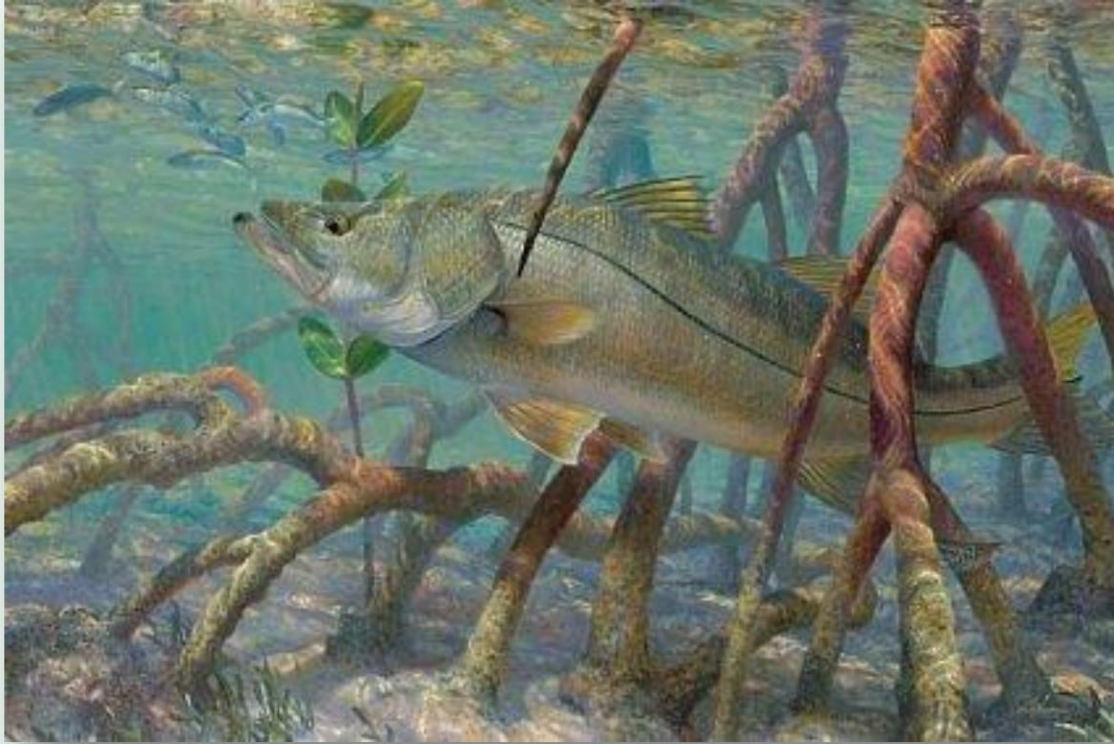
🐟 **Diet:** Carnivorous; consumes crabs, shrimp, mollusks, and small fish.

🐟 **Impact on fishing:** High socioeconomic value; seasonal harvesting affects communities.



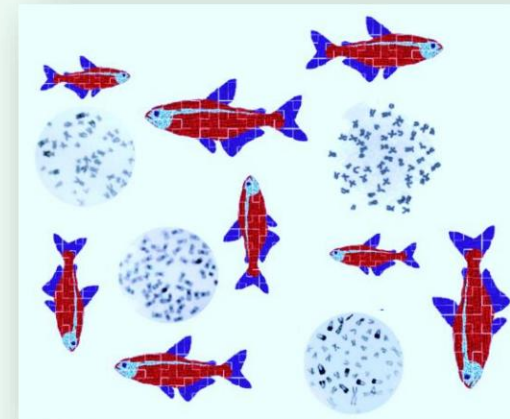
Source: Carlos Estape

➡ Assessing the status of *Centropomus* populations is essential to understanding their genetic and ecological sustainability.



Source: Jesús de la Torre

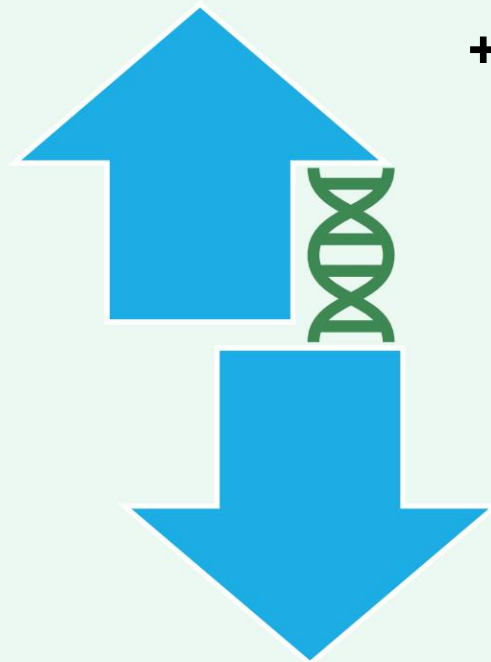
- ➡ One of the main tools for this is the study of **population genetics**.
- ➡ Provides key information to ensure sustainable management and conservation of species.



Source: UDO

# Genetic diversity

- Heritable variations between the individuals of a population and between populations within of a species.

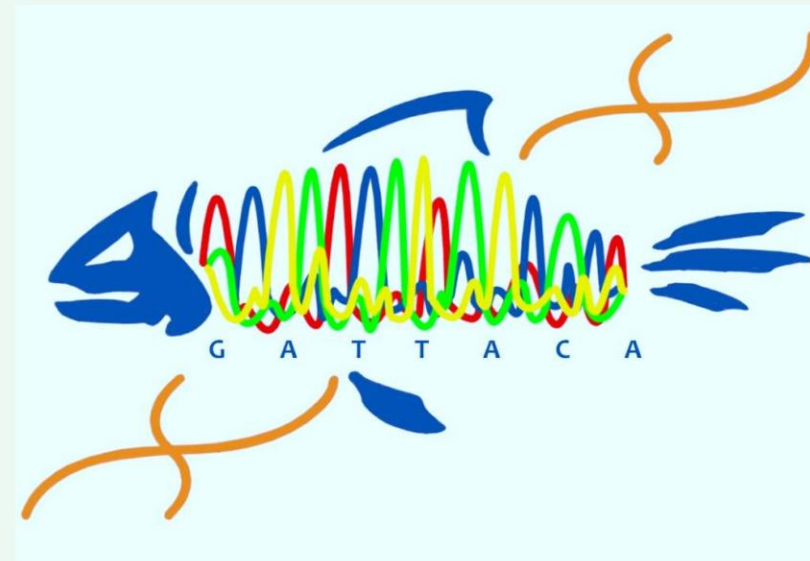


+ probability of surviving

environmental changes

- probability of survival

- Through the analysis of DNA sequences we can measure genetic diversity.

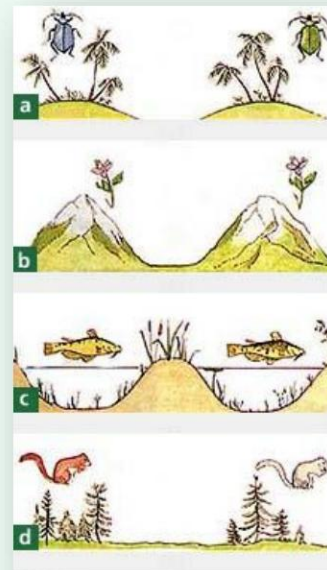


Source: UAF CFOS

# Environmental factors

## Geographical barriers

- Natural obstacles that prevent the movement of individuals.
- They cause reproductive isolation and can lead to speciation.
- They decrease gene flow and genetic variability.



Source:

## Geographical distances

- The greater the distance between populations, the lower the genetic exchange.
- The more genetically similar populations are.
- Causes a genetic gradient based on distance.

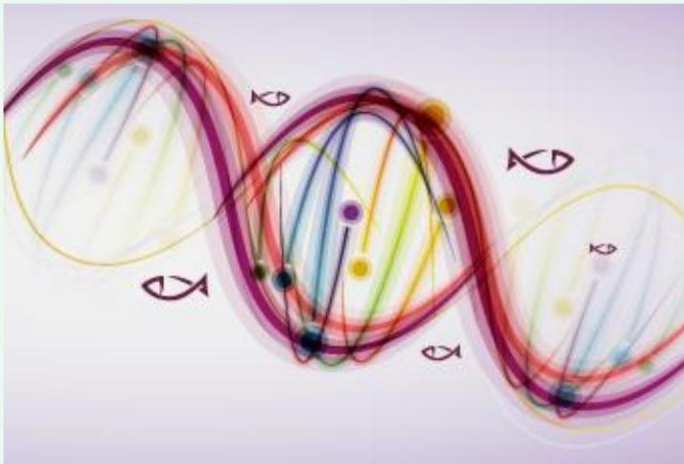


Source: CONABIO

# Molecular Markers

## Mitochondrial

- 🐟 COI is functionally conserved, but presents enough variation to differentiate populations.



Source:

## Nuclear

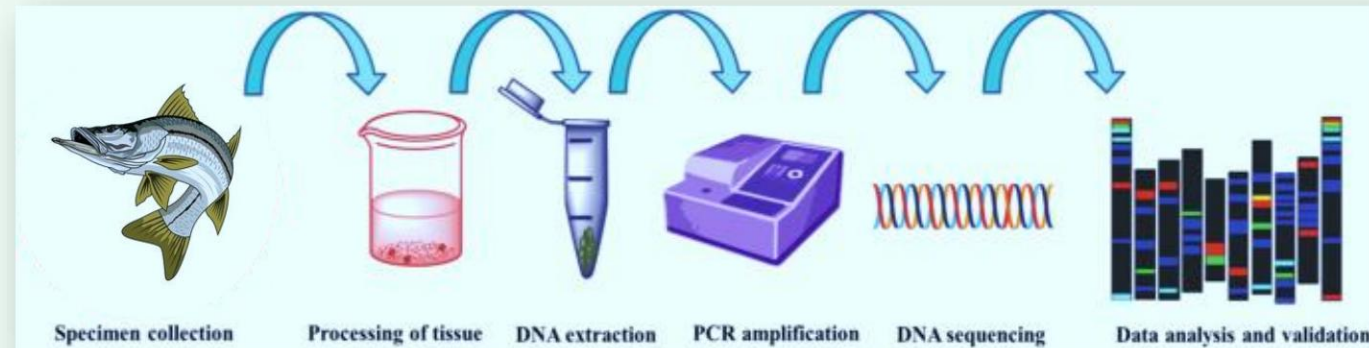
- 🐟 They allow for a more complete analysis of genetic variability. • They are an ideal
- 🐟 complement to mitochondrial DNA in population studies.

## Lehnert (2019)

- Salmon of ecological value and economic.
- Genomic analysis.
- Population decline in the last century.
- High vulnerability.

## Terán-Martínez (2021)

- Snook regional fishery species.
- DNA barcoding (COI).
- Population reduction.
- Impact on fisheries.
- Management implications.



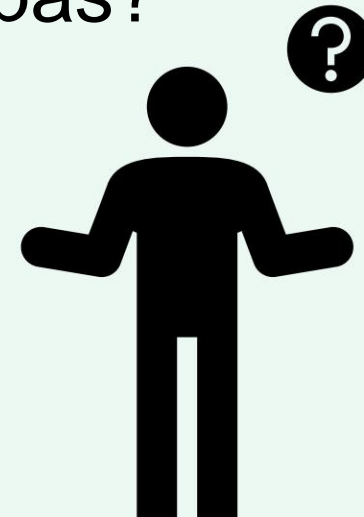
Source: SPRINGER LINK

# Justification

- 🐟 There is no genetic information on sea bass at the local level, which limits its sustainable management.
- 🐟 Factors such as fragmentation, overexploitation and climate change threaten its conservation.
- 🐟 Evaluating its genetic variation is key to designing management strategies that support the well-being of the communities that depend on it.

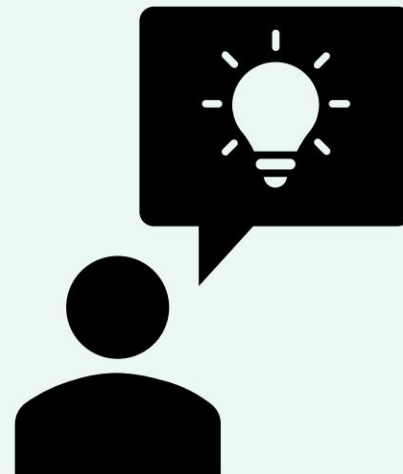
# Research question

What is the genetic variability and population structure of the populations of *Centropomus viridis*, *Centropomus robalito* and *Centropomus nigrescens* reported in the La Encrucijada Biosphere Reserve, Chiapas?



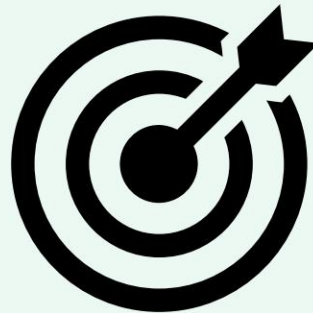
# Hypothesis

Genetic variability and differentiation among populations of *C. viridis*, *C. robalito* and *C. nigrescens* will be influenced by water connectivity and environmental barriers such as habitat fragmentation and geographic distance present in the REBIEN.

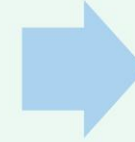
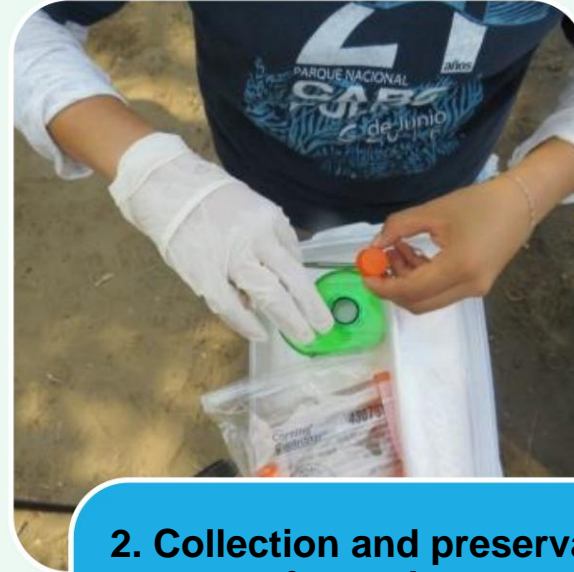


# Aim

- ÿ Estimate the levels of genetic variability, gene flow and intraspecific connectivity of *C. viridis*, *C. robalito* and *C. nigrescens* in the La Encrucijada Biosphere Reserve, Chiapas.



# Methods



## 1. Sampling sites

- Chiapas/REBIEN: \*El Carrizal, Topón, Salto de Agua. • Oaxaca: \*Chacahua (Oax) • SmartFish AC-FIP

## 2. Collection and preservation of samples

- 5–10 specimens per species/site. • Fins in absolute ethanol. • Morphometric data and photographs. • Samples stored at -20°C

## 3. DNA extraction

- Aljanabi and Martínez method (1997) • Quality assessment:
  - \*Nanodrop
  - \*Gel electrophoresis (integrity)

# Methods



GGCTCCAGCATCGATGAA  
 GAGGAAGTAAAAGTCGTA  
 CAAAACTTTTAACACGG  
 TCGGCGGCGCCCGCAAGG  
 CGTGGCAGATCCCCAACG  
 GGCTCCAGCATCGATGAA  
 GATGAAGAACGCAGCGAA  
 TCTGAGTGTTCTTAGCGA  
 CTTGGCTCCAGCATCGAT  
 SATCTCTTGGCTCCAGCAT  
 CTTGGCTCCAGCATCGAT

## 4. PCR and sequencing

- COI and RAG1 markers.
- PCR amplification with specific primers.
- Sanger sequencing (forward and reverse).

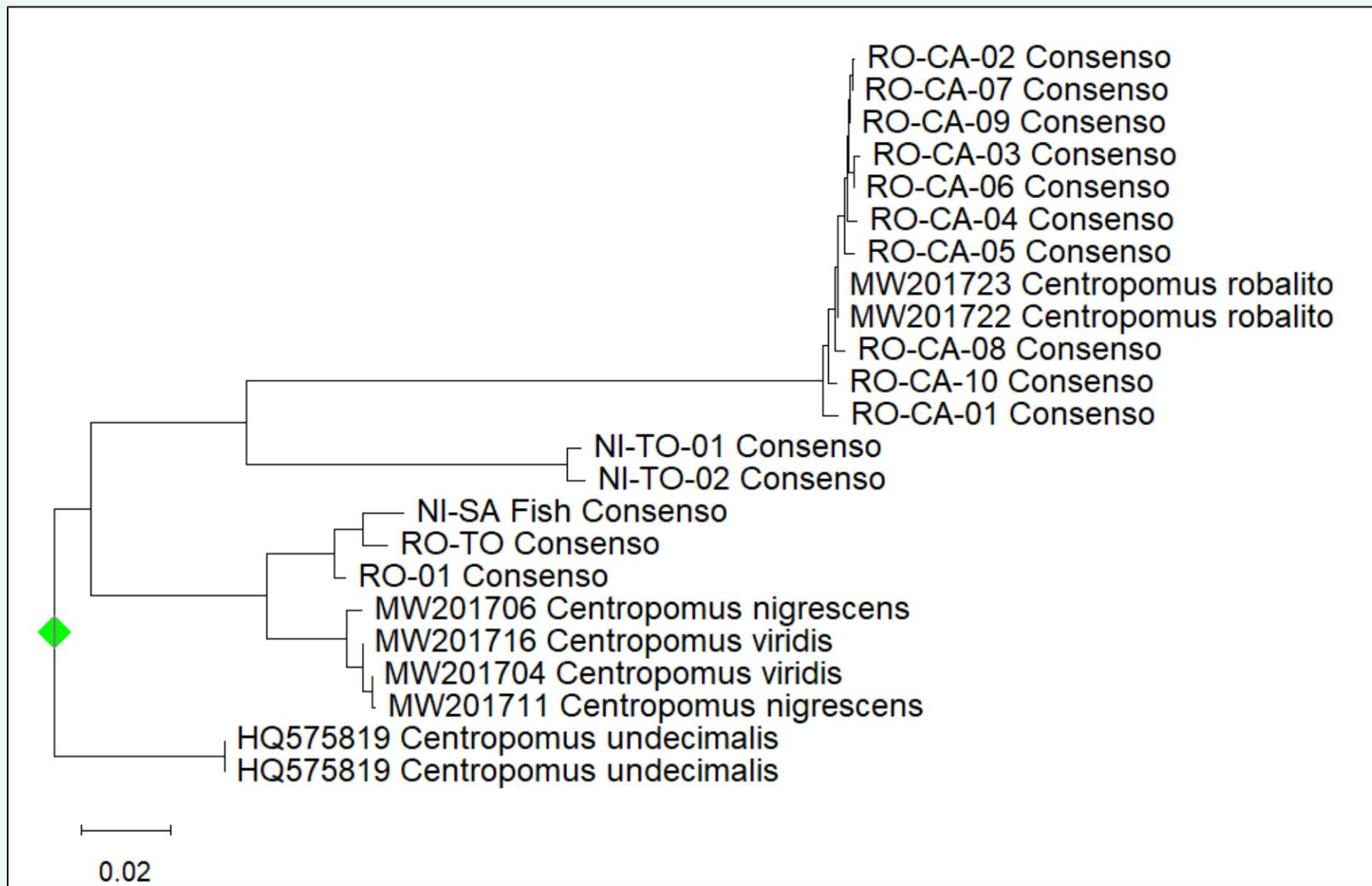


## 5. Bioinformatics and genetic analysis

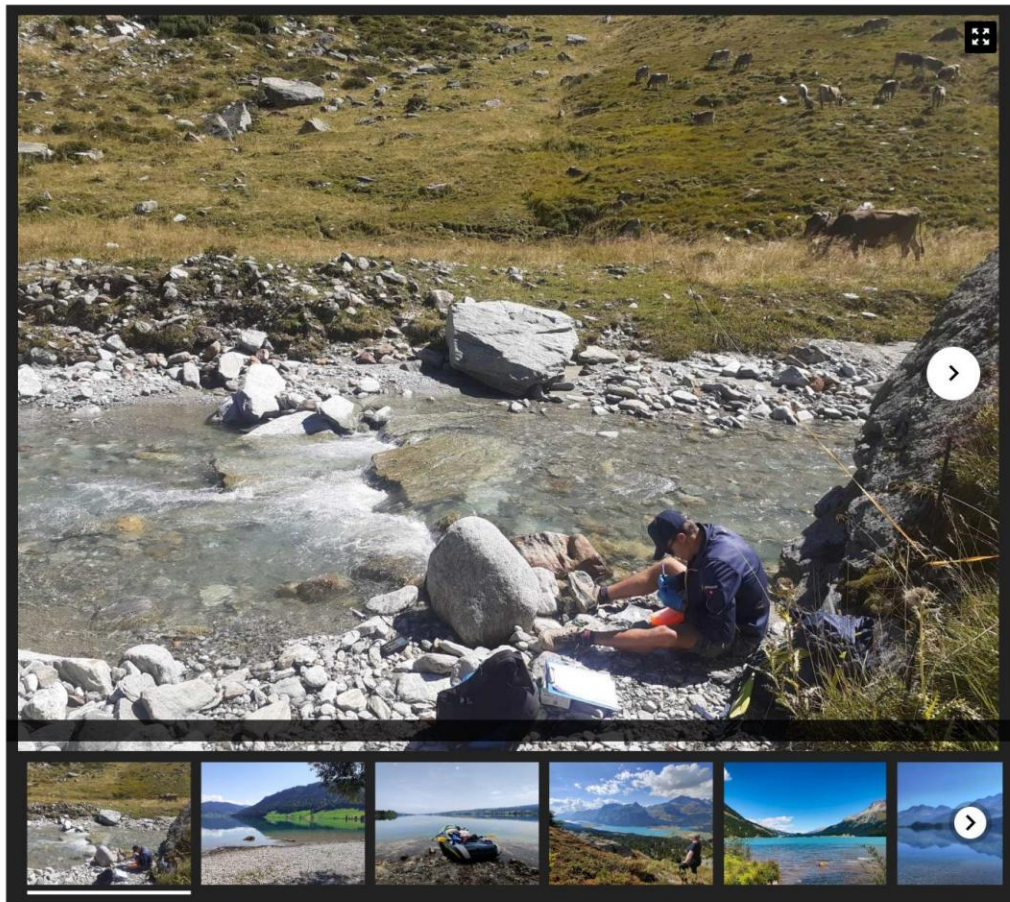
- Assembly and alignment: MEGA X.
- Genetic diversity (# haplotypes, Hd,  $\pi$ ): DnaSP.
- Genetic structure: AMOVA, FST (Arlequin), PCA (adegenet).



- IBD: test of Tablecloth (vegan).
- Haplotype network: PopART method Median-Joining Network.



Genealogy inferred using the Neighbor Joining method from COI sequences of specimens of the genus *Centropomus*, sampled within the La Encrucijada Biosphere Reserve. Key to the specimens: **NI-TO** = *C. nigrescens*, Topón locality; **RO-TO** = *C. robalito*, Topón locality; **RO-CA** = *C. robalito*, El Carrizal locality; **NI-SA** = *C. nigrescens*, Salto de Agua locality.



**ETH** zürich

Environmental DNA

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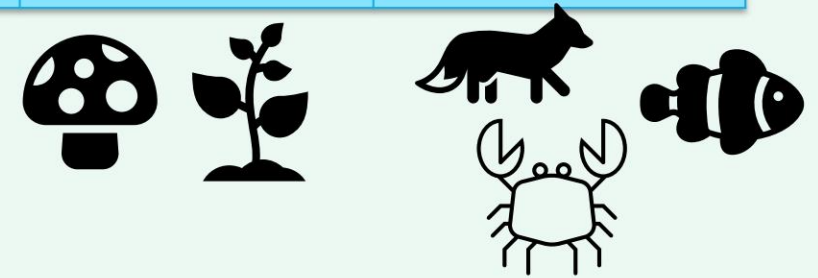
## LeDNA

Global measure of biodiversity by sampling environmental DNA from lakes

# Environmental DNA



Sample code	Name of the lake	Sampling date	Volume filtered	DNA concentration	Concentration of STIs	IOC Concentration
LeDNA240098	Topón, The Crossroads	6/28/2024	17.0	8.91	35.45	49.56



# Thank you!

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- Ana Lizbeth Medina Santos • Georgina  
Guadalupe de la Cruz  
Perez
- Angeles Palomeque • Ramon  
Flores • Vicente Cruz  
Arreola • Mario Ramon Becerra
- Adalberto Arteaga Cruz •  
Yuliesky Garcés Rodríguez

