Spatio – temporal distribution and interspecific interactions of stygobitic decapods: *Creaseria morleyi, Typhlatya mitchelli* and *T. pearsei* in Yucatan cenotes

Chávez-Solís, Efraín

Mascaró, Maite

Simões, Nuno

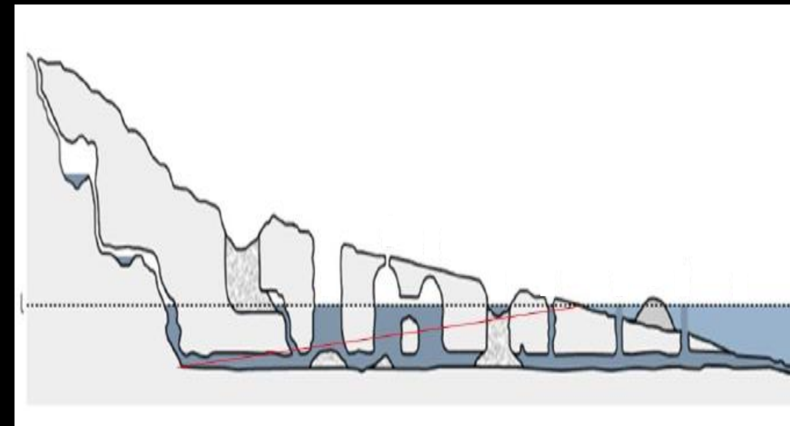
UNAM POSGRADO Ciencias Biológicas

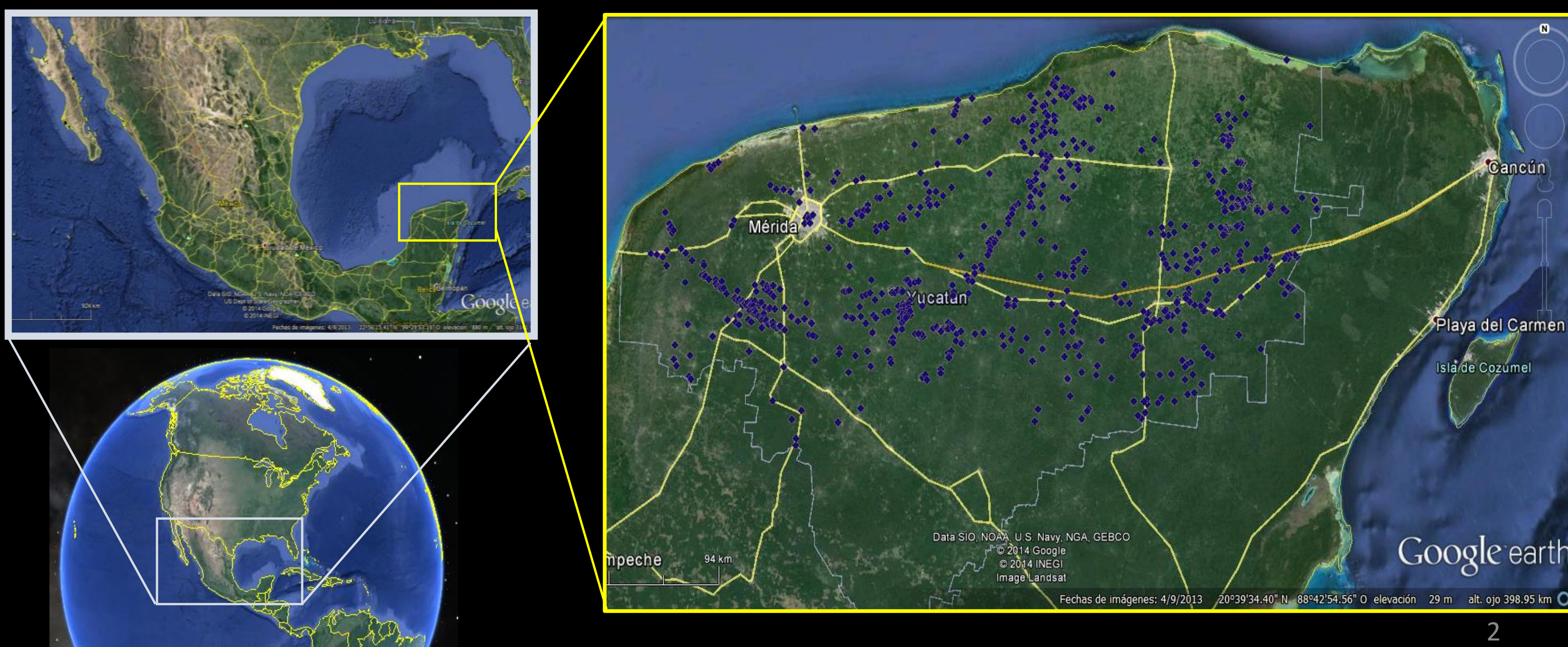
UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO

UNIDAD ACADÉMICA SISAL

Introduction

- Yucatan Peninsula
- 2000+ cenotes (sinkholes).
- Formation process.
- Anchialine ecosystems.

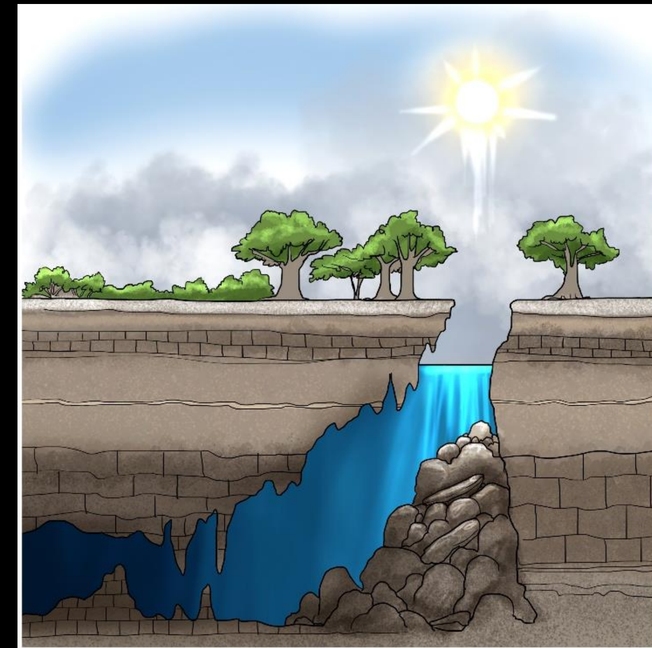




Introduction

Underwater caves

Cenote → Cavern → Cave



Introduction

Cenotes as trophic “Hotspots”

Cenote & Cavern.

- Photosynthesis.
- Lixiviation of allochthonous organic matter.
- Cenote cavern is a high availability zone: trophic “Hotspot”.

Cave

- Chemosynthesis.
- Filtered soil from above the cave.
- Oligotrophic cave systems.

Introduction

- Stygobitic species
- Endemic
  - NOM-059
  - IUCN Red List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Introduction

***Typhlatya pearsei* Creaser 1936**
***Typhlatya mitchelli* Hobbs & Hobbs, 1976**

- Low trophic level
- Filter feeding
- Water column and bottom of cenotes.

***Creaseria morleyi* Creaser 1936**

- Higher trophic level
- Detritivorous and active predator (omnivorous).
- Water column and bottom of cenotes.

Hypothesis

Being that the cenote is greatest entrance of allochthonous matter, the only place with day/night light cycles and photosynthetic production of the whole anchialine ecosystem, it is expected to find stygobitic organisms using this area as a feeding hotspot with a coupled behavior to light occurrence.

Considering that the deposition of external organic material is increased during the rainy season, it is expected to find greater populations of both groups around this period.

General objective

Describe the spatial – temporal distribution, interspecific interactions and population density variations over time of stygobitic decapods of Yucatan cenotes.

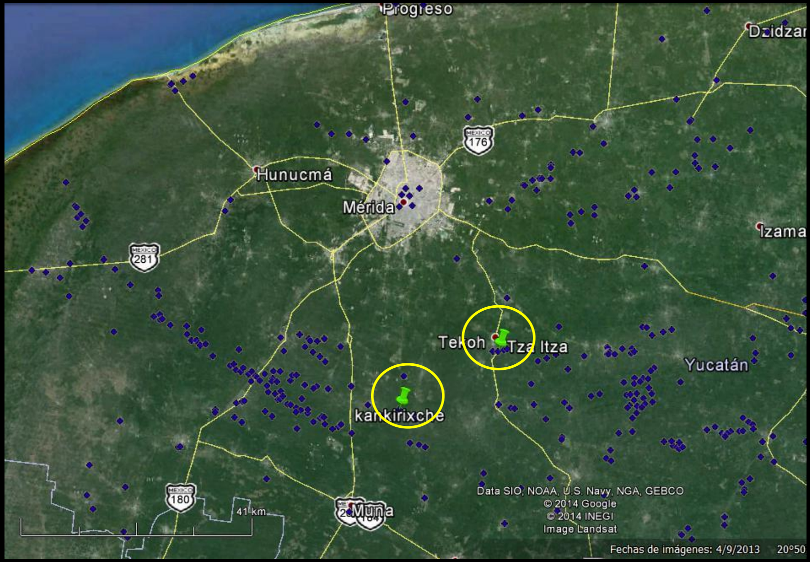
Particular Objectives

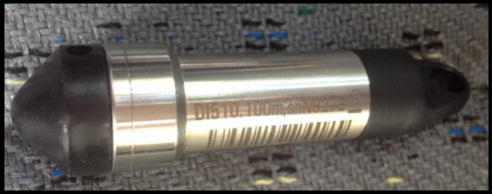
1. Describe the environmental conditions of the cenotes.
2. Describe distributional patterns of stigobionts at the cenote zone.
3. Describe the population densities of Creaseria morleyi, Typhlatya mitchelli and T. pearsei through a period of one year.
4. Confirm trophic interactions.

Methods

Cenote description

1. Kankirixche & Tza Itza.
2. Morphometries.
3. Hydrodynamics.
4. Sediments.
5. Temperature and level of the water.





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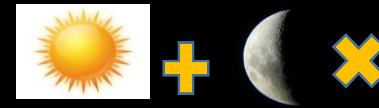
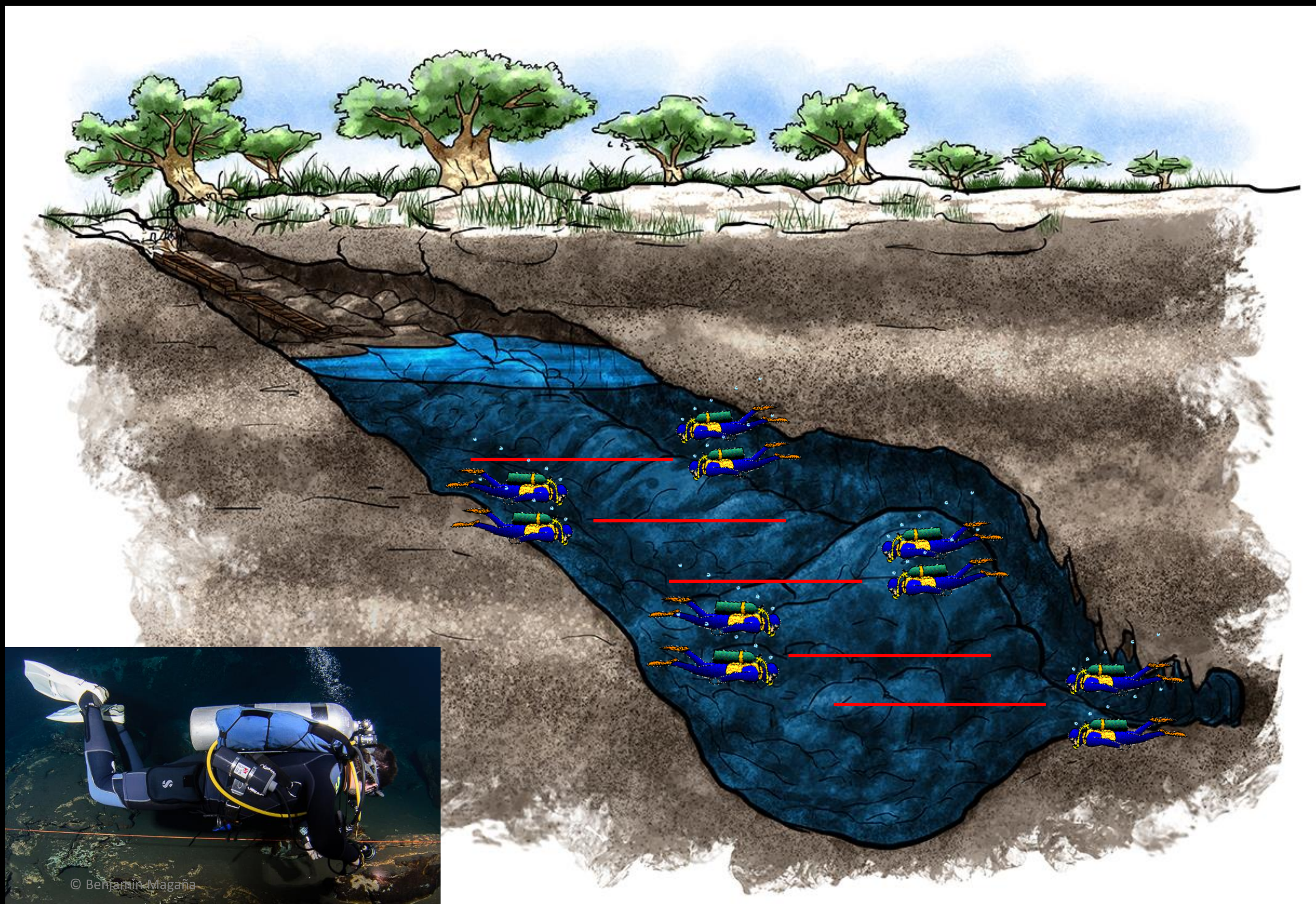


2 days
2 cenotes



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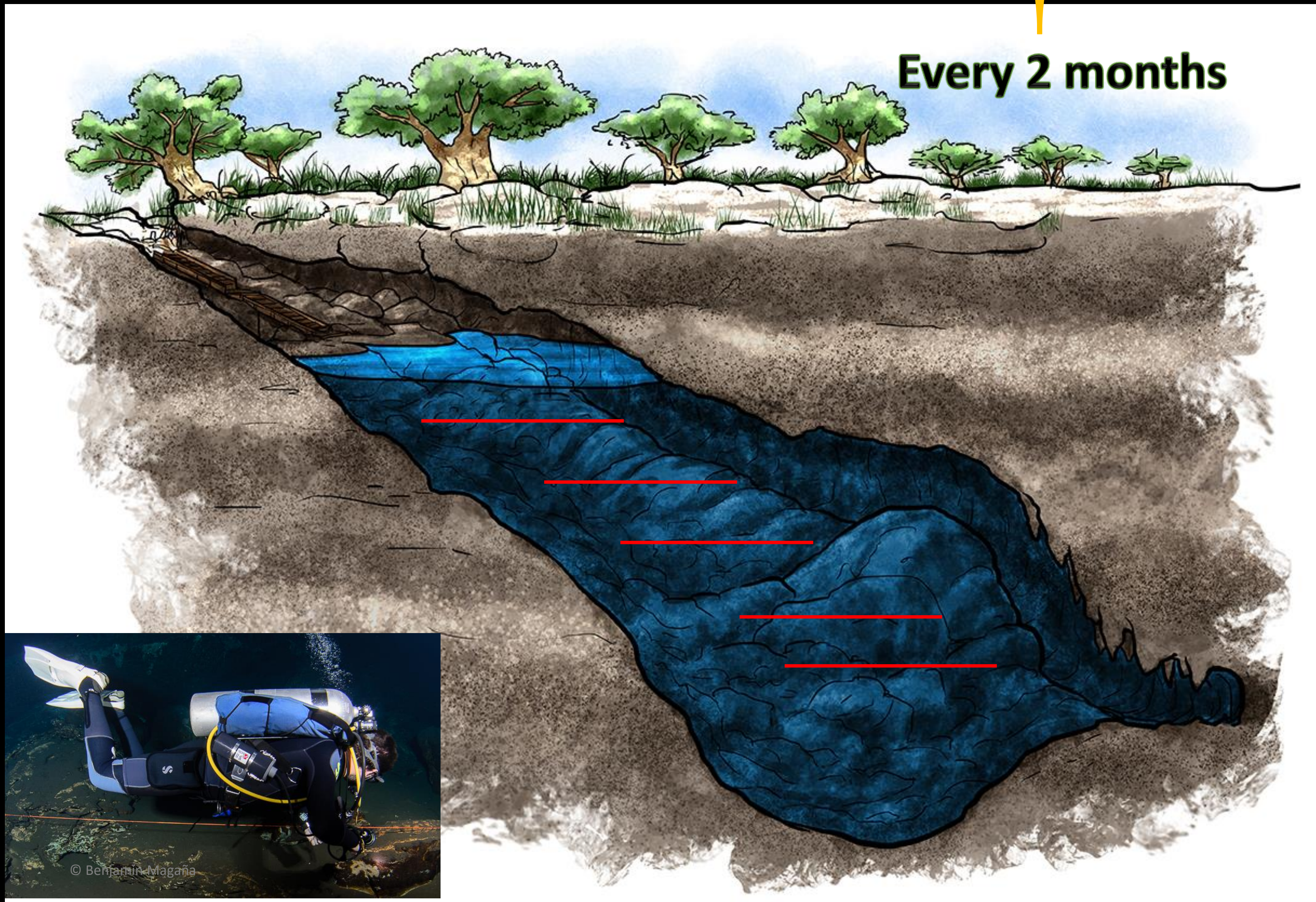
Methods

 +  × 2 days 2 cenotes

Every 2 months



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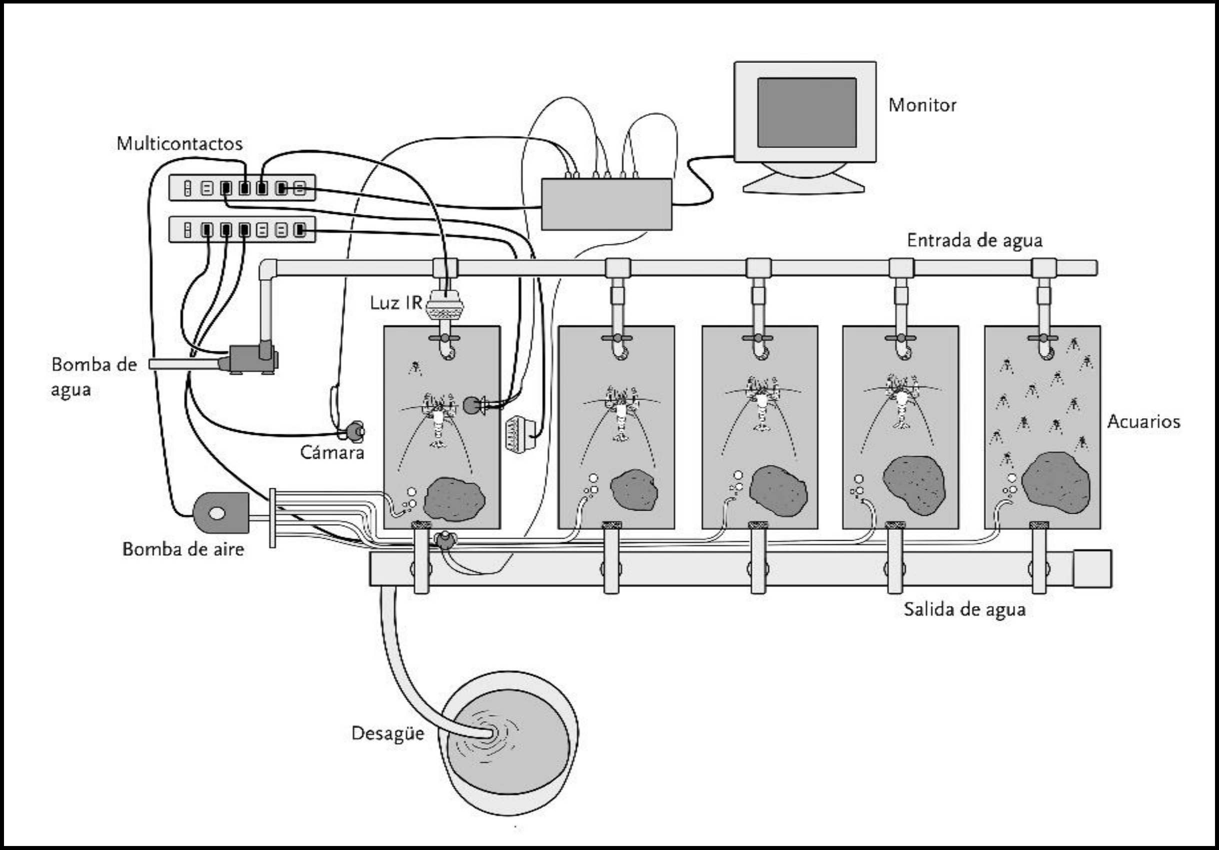
Methods

- Organism aclimatization to laboratory conditions.
- Facing species in confined space.
- Infrared filming.



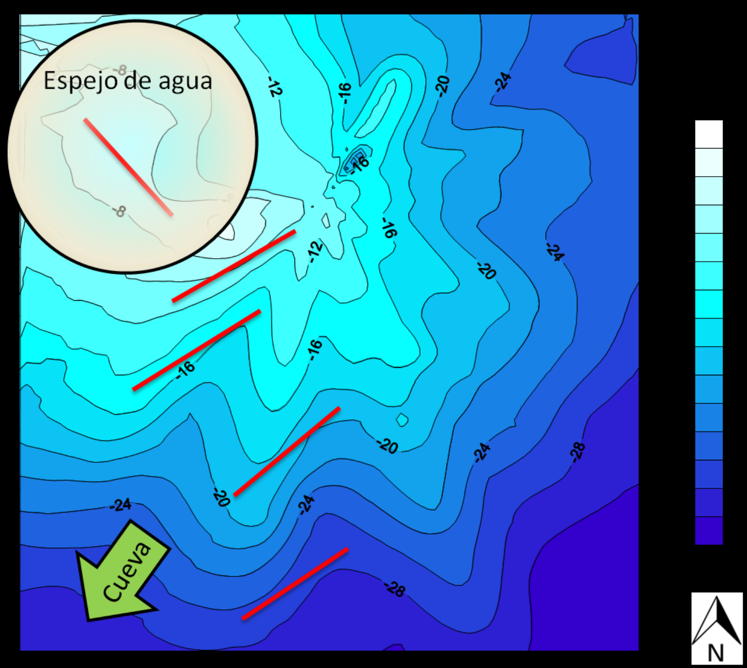
Results

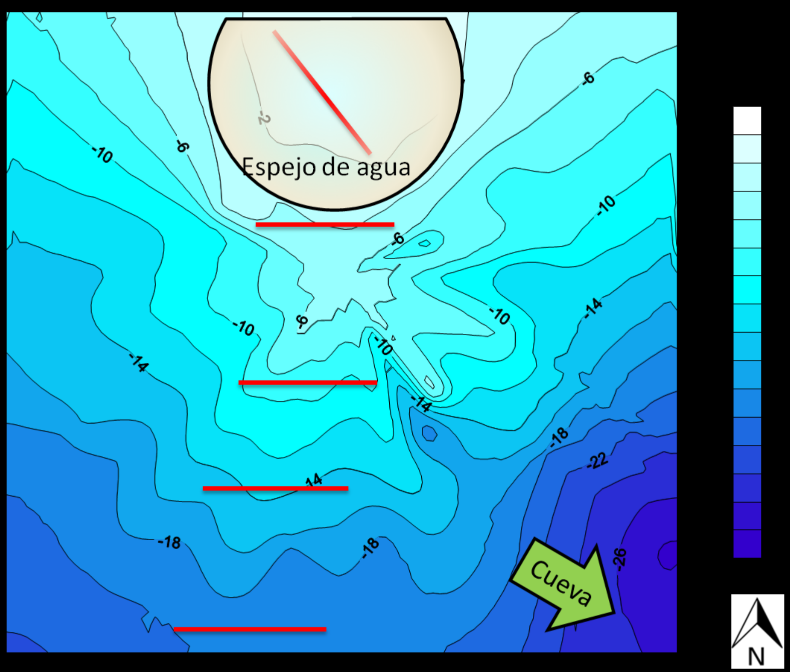
Results

Cenote description

1. Morphometries

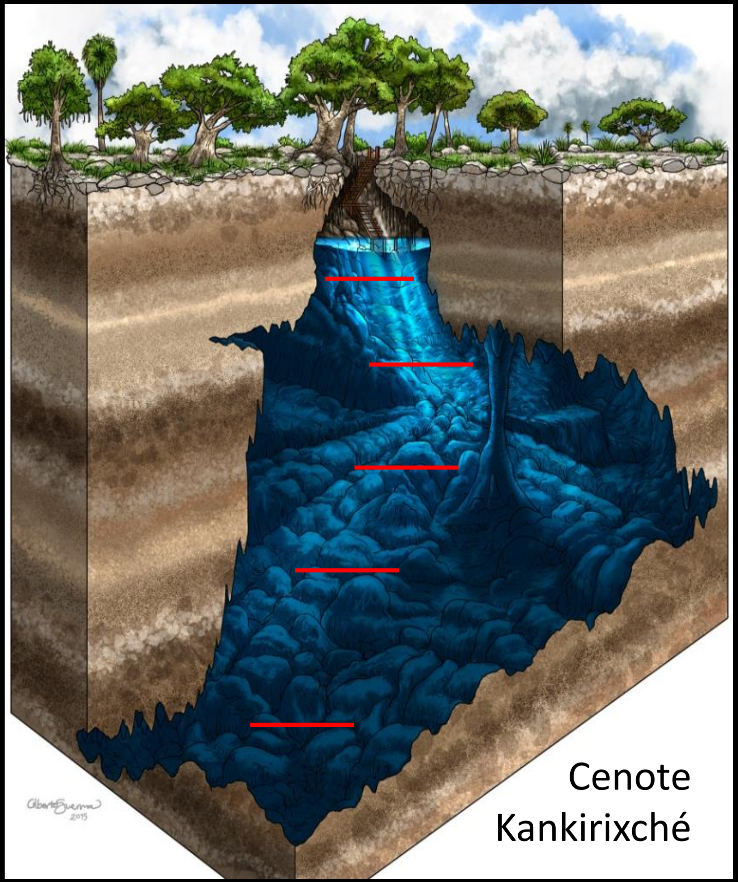
Kankirixché **Tza Itzá**



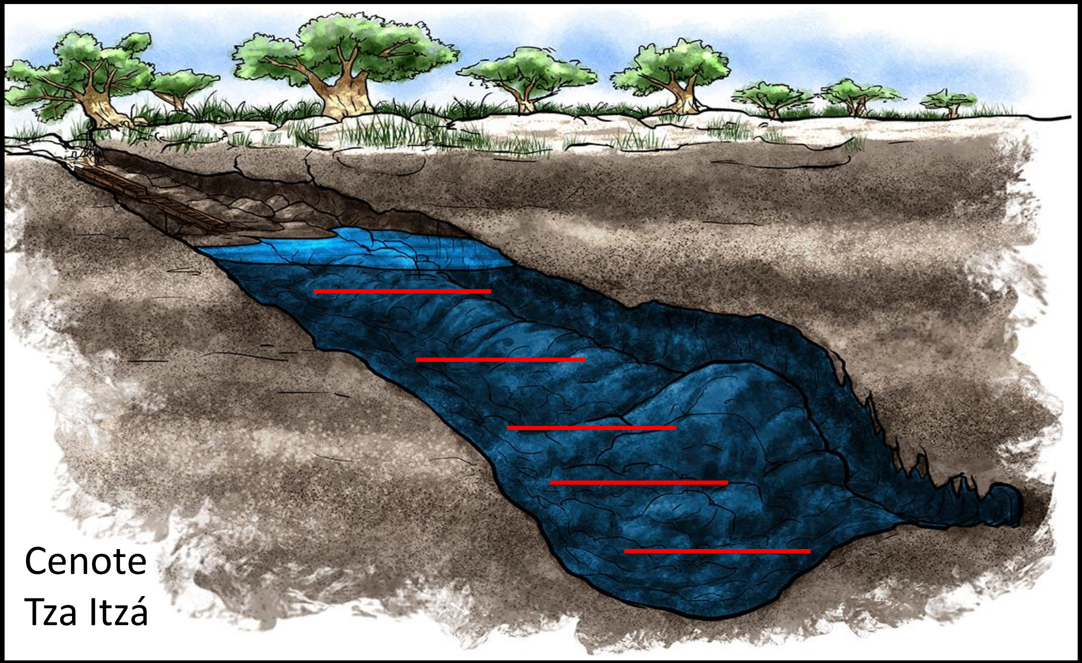


Resultados Morfométricos

Kankirixché



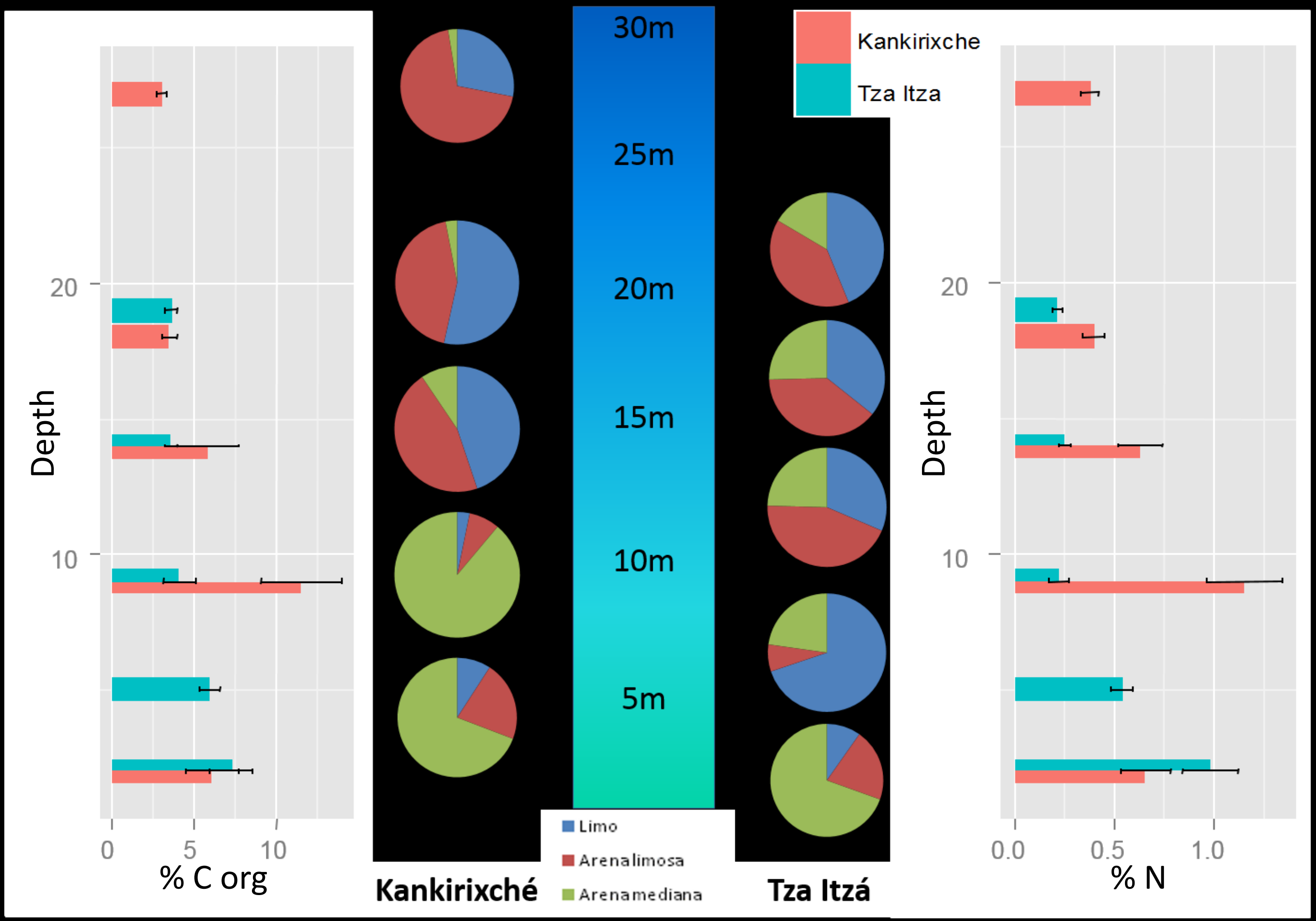
Tza Itzá



Results

Cenote description

1. Sediments



Results

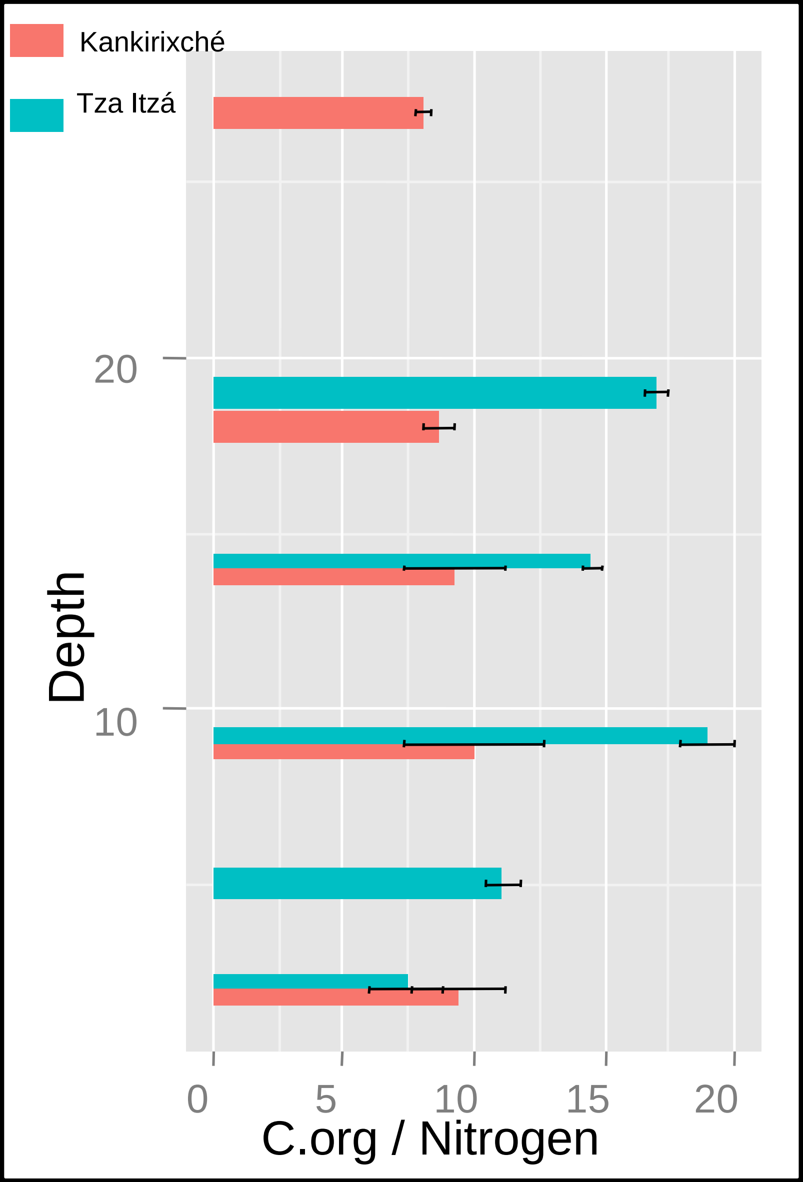
Cenote description

1. Sediments

Corg / N proportions

- Determines the organic origin of sediments.
  - Vascular plants C/N > 20
  - Algae C/N <10

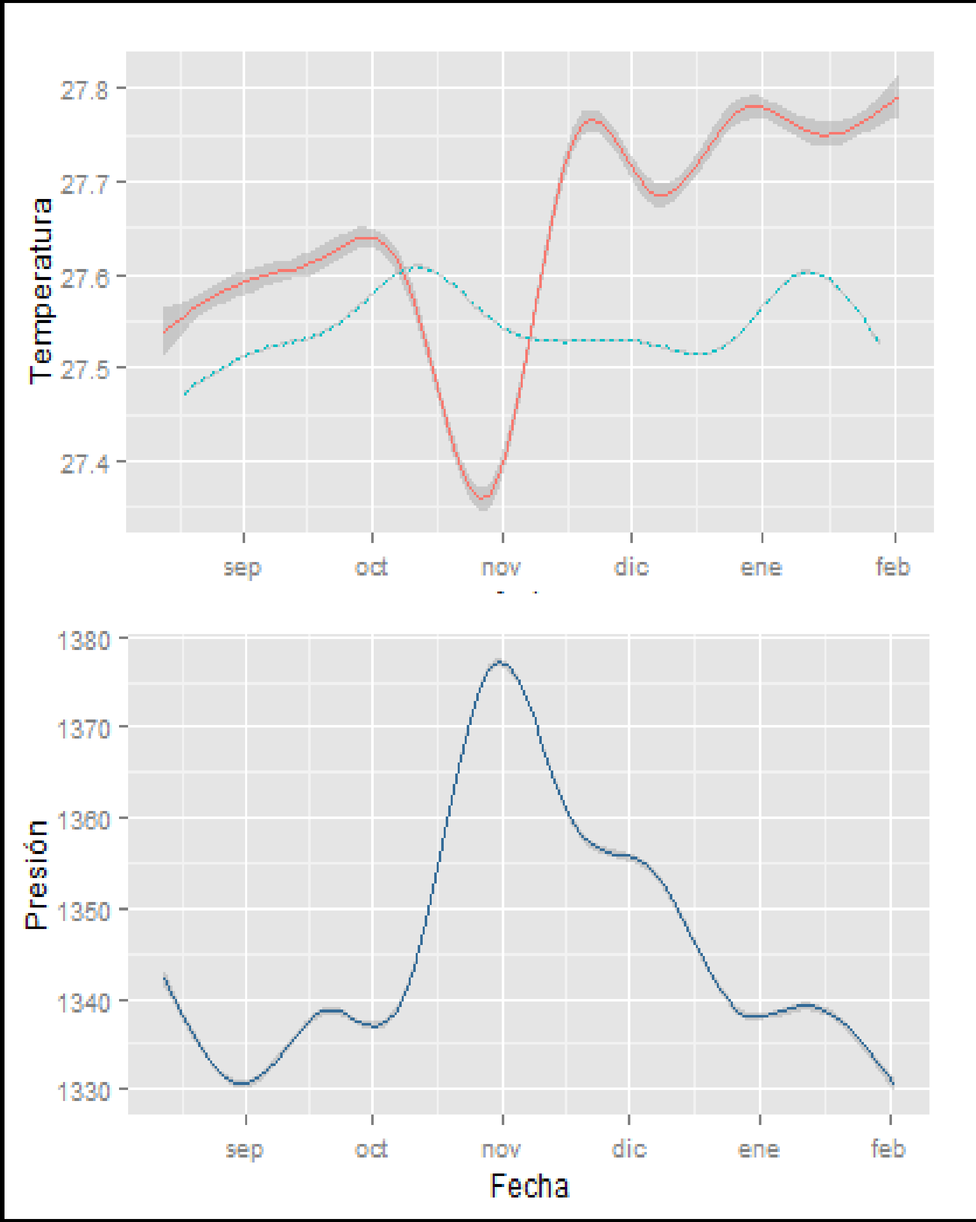
Kankirixche:
terrestrial plants < algas
Tza Itza:
plantas terrestres = algas.



Resultados

Descripción de cenotes

3. Hidrodinámica



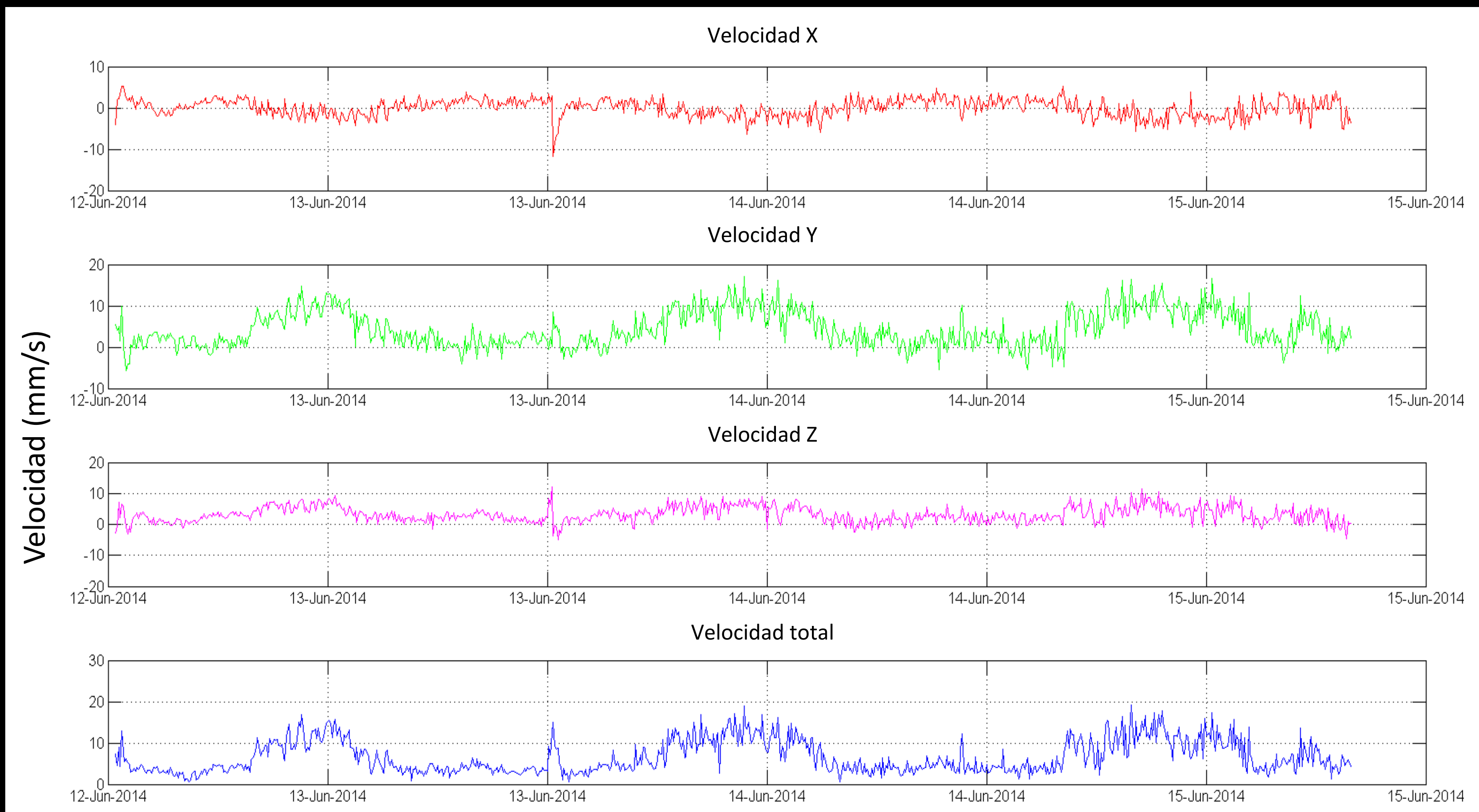
Resultados

Descripción de cenotes

3. Hidrodinámica

Velocidad de corrientes.

Máxima de 18 mm/s = 1.08m/min



Results

Data analysis

- 480 transects
- 6150 *Typhlatya* spp.
- 1550 *Creaseria morleyi*

Id	*Creaseria*	*Typhlatya*	Date	Observer	Light	Cenote
Mín. :	0	0	08/04/2014	Araceli : 30	Día : 240	Kankirixché 240
1er Qu.:	0	3	12/06/2014	Diana: 105	Noche: 240	Tza Itzá 240
Median:	2	10	11/10/2014	Efraín : 240		
Mean:	3.263	12.95	09/09/2014	Nuno : 60		
3er Qu.:	5	20	05/12/2014	Ricardo : 45		
Máx. :	43	89	04/02/2015	Total 480		

Results

Data analysis

Significant variables

“Drop 1” method (Zuur et al. 2009)

Creaseria morleyi

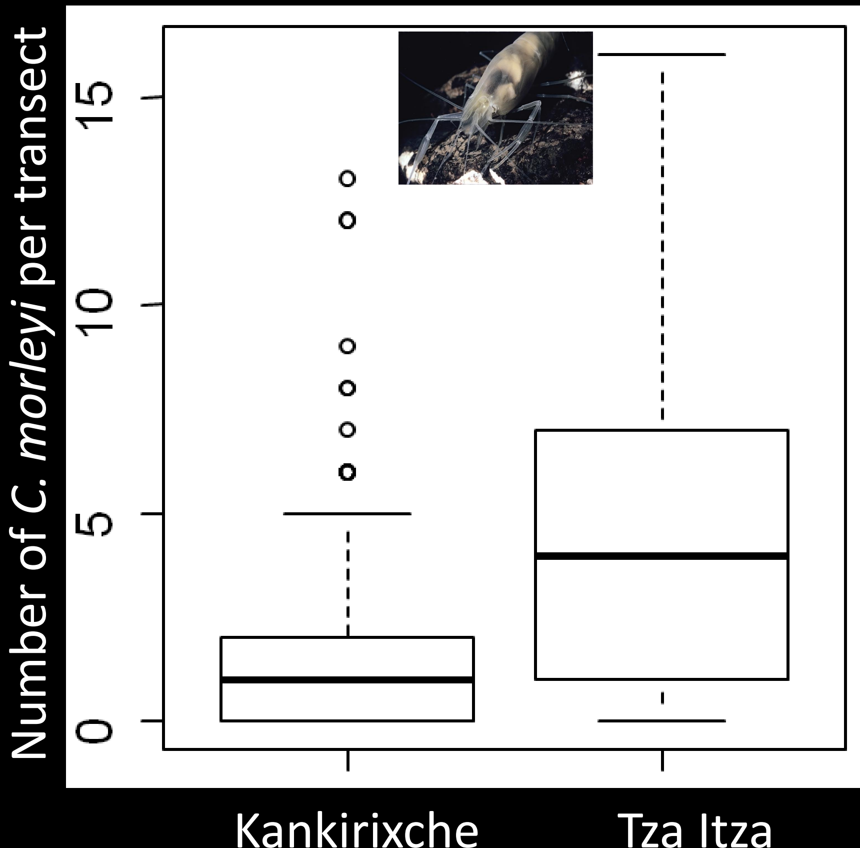
- Cenote
- Light
- Depth
- Month of the year

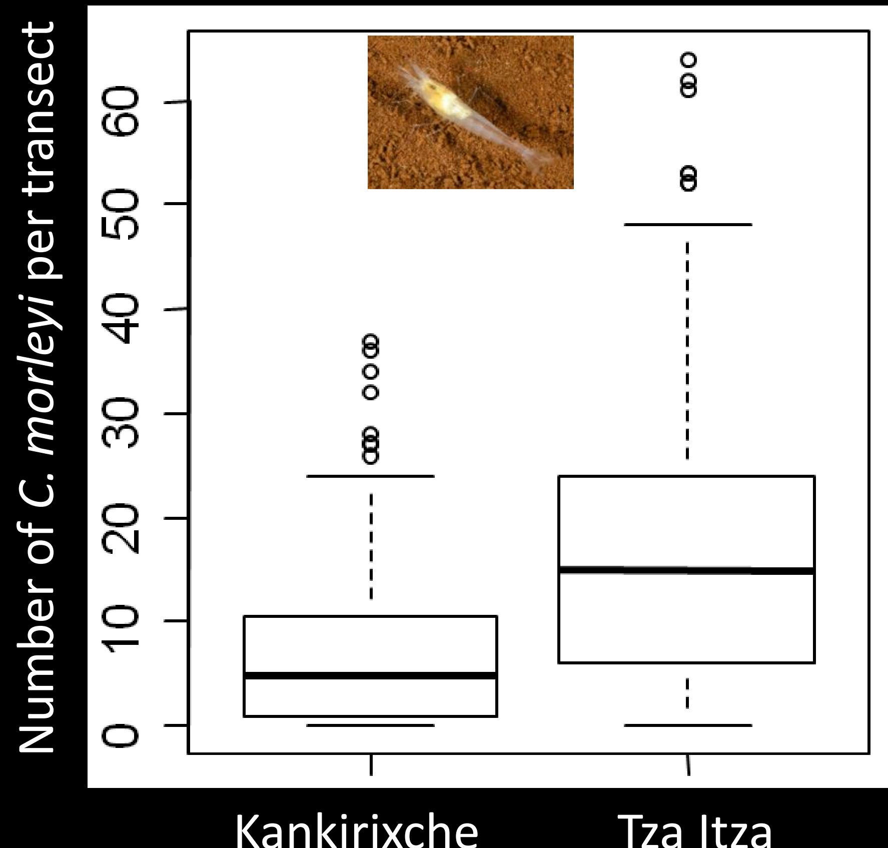
***Typhlatya* spp.**

- Cenote
- Light
- Depth

Results

Cenote densities



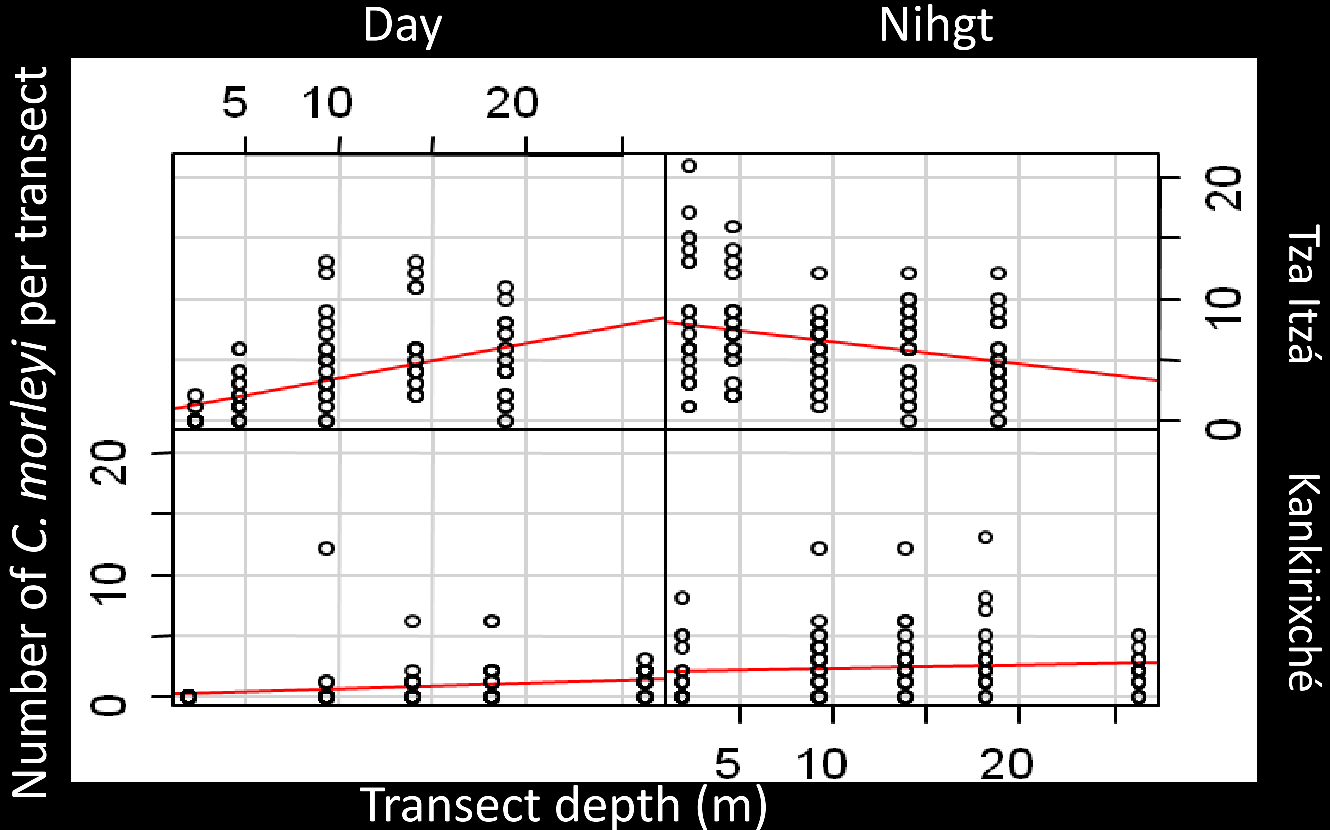


Significantly different

- *Creaseria morleyi* ($t<2.93\times10^{-14}$)
- *Typhlatya* spp. ($t<2\times10^{-16}$).

Results

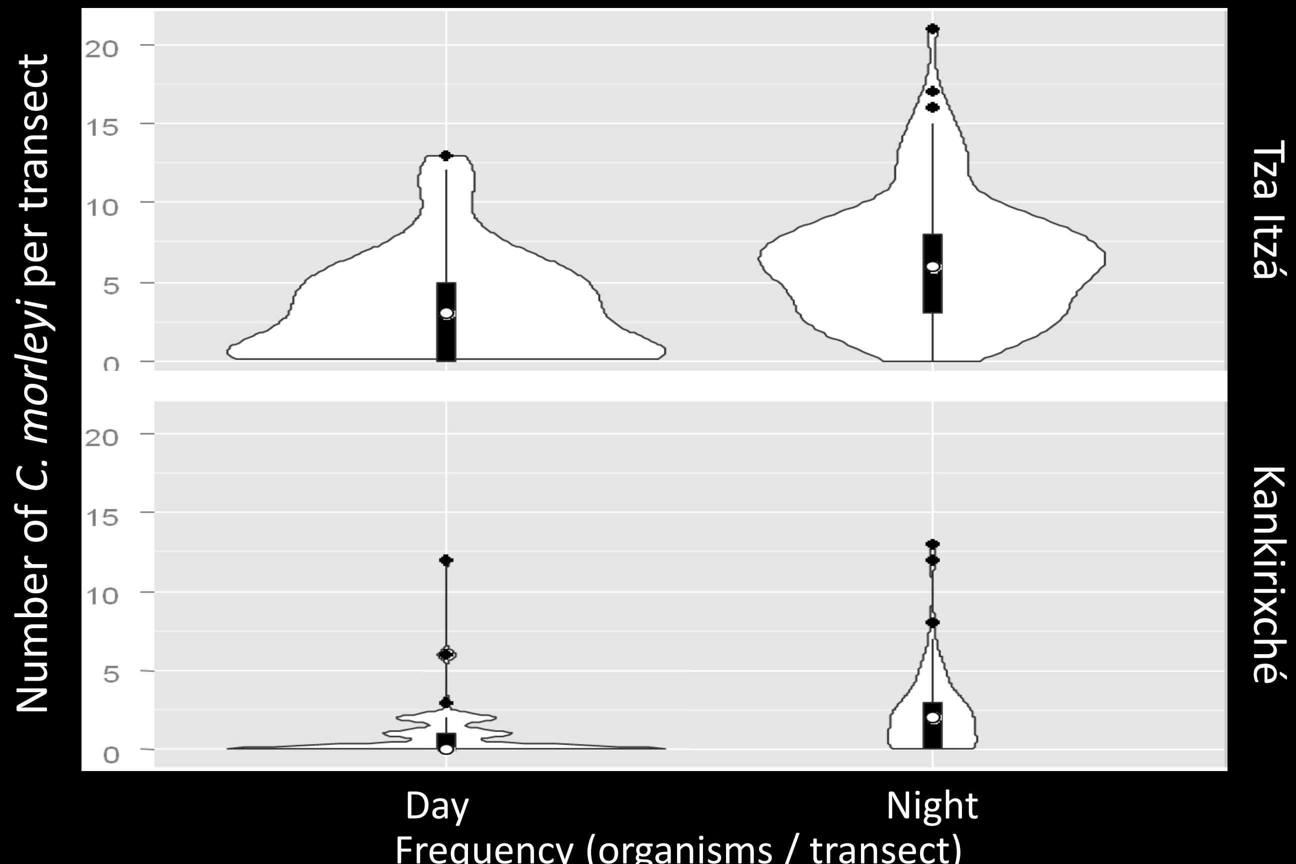
Spatio – temporal use *C. morleyi*



- Shallow distribution different tan expected ($t<9.15\mathrm{x}10^{-4}$).
- Not random distribution along the depth gradient ($t<0.013$).

Results

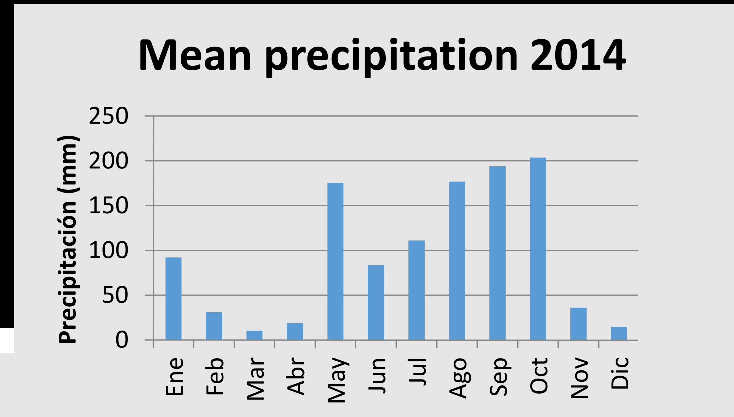
Day night behavior *C. morleyi*

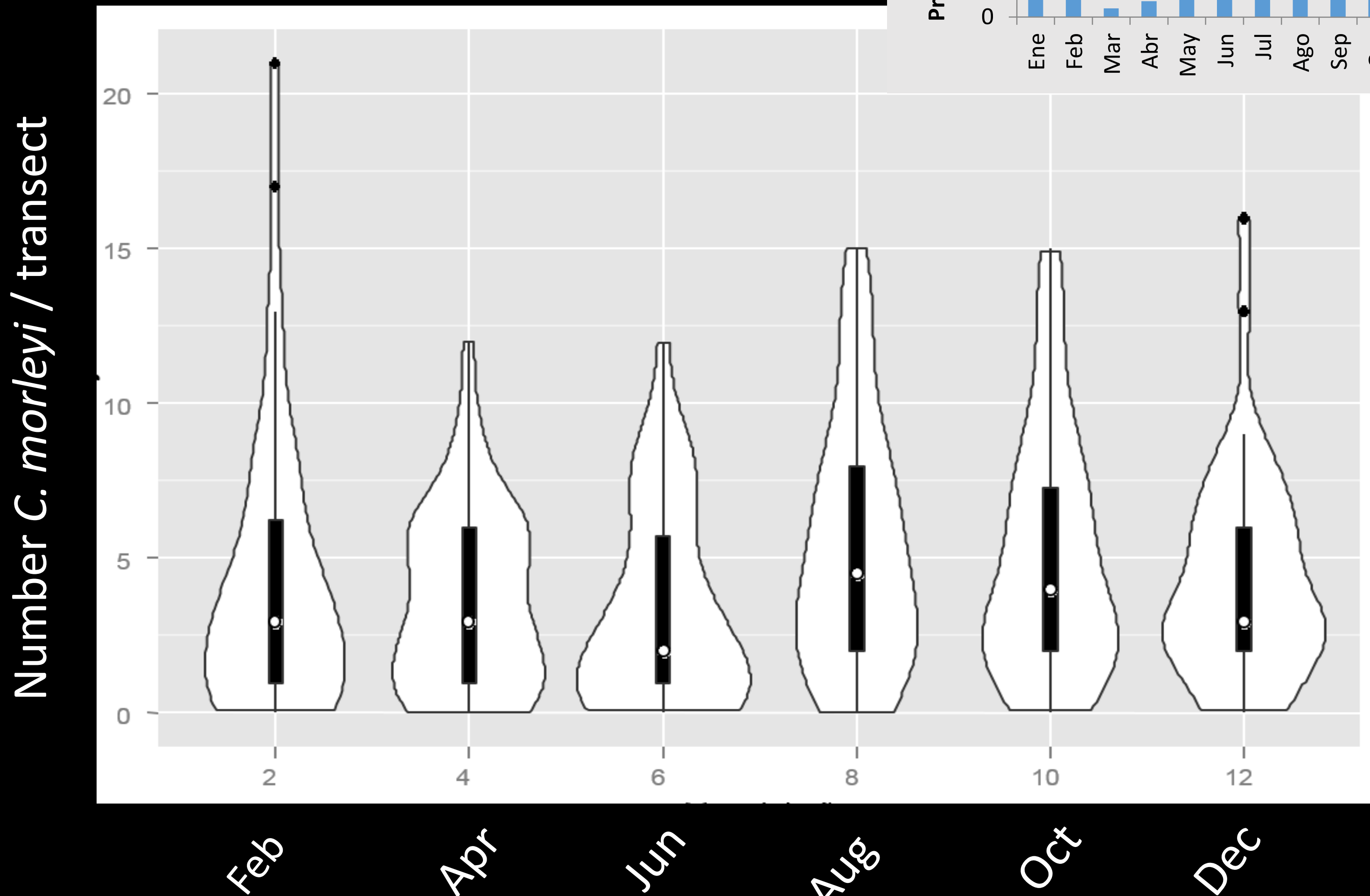


- Day night differences ($t<4.75x10^{-8}$).
- Greater densities in Tza Itzá tan in Kankirixché ($t<0.029$).

Results

Annual densities *C. morleyi*

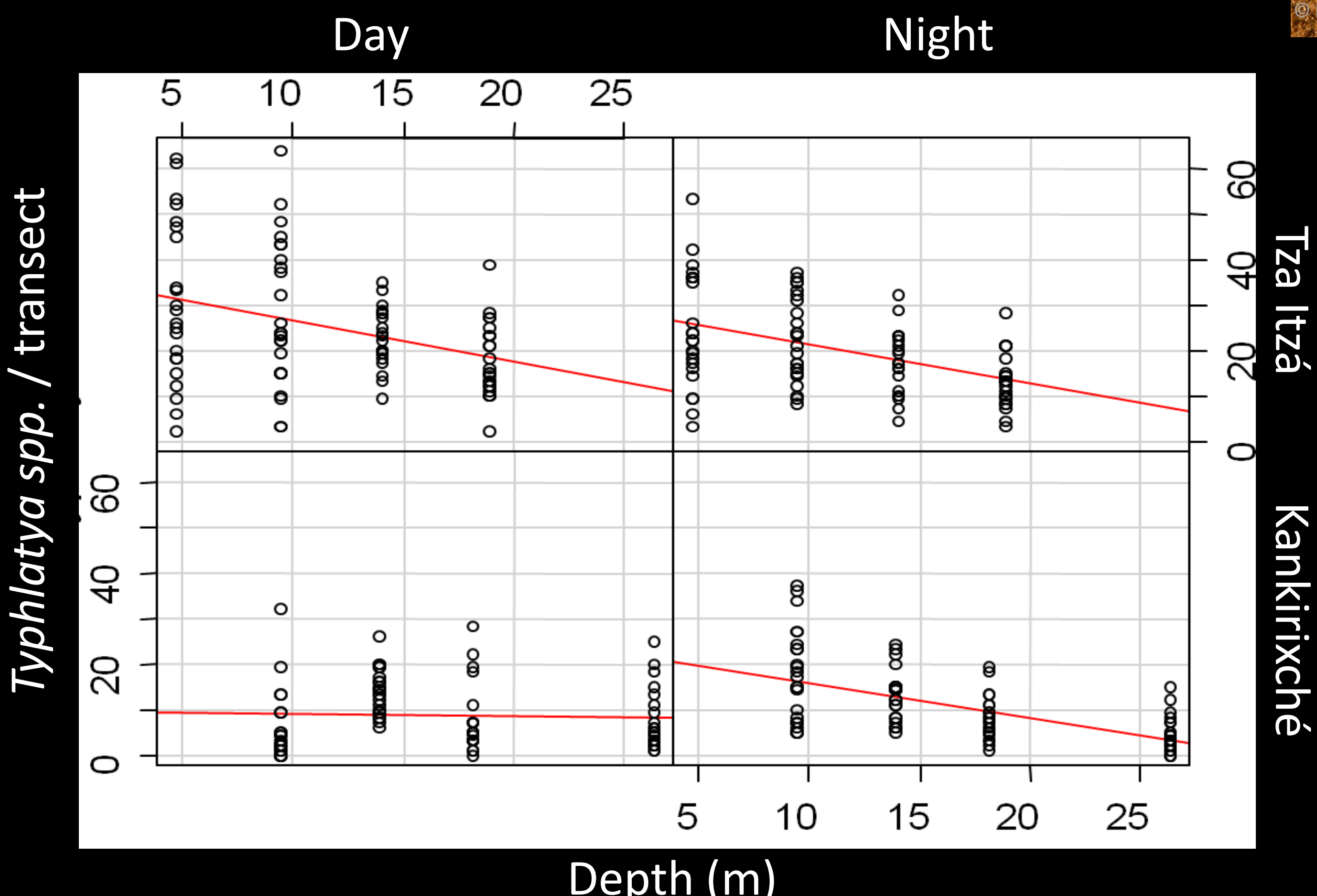




Annual density changes (t<0.018).

Results

Spatio – temporal use *Typhlatya* spp.

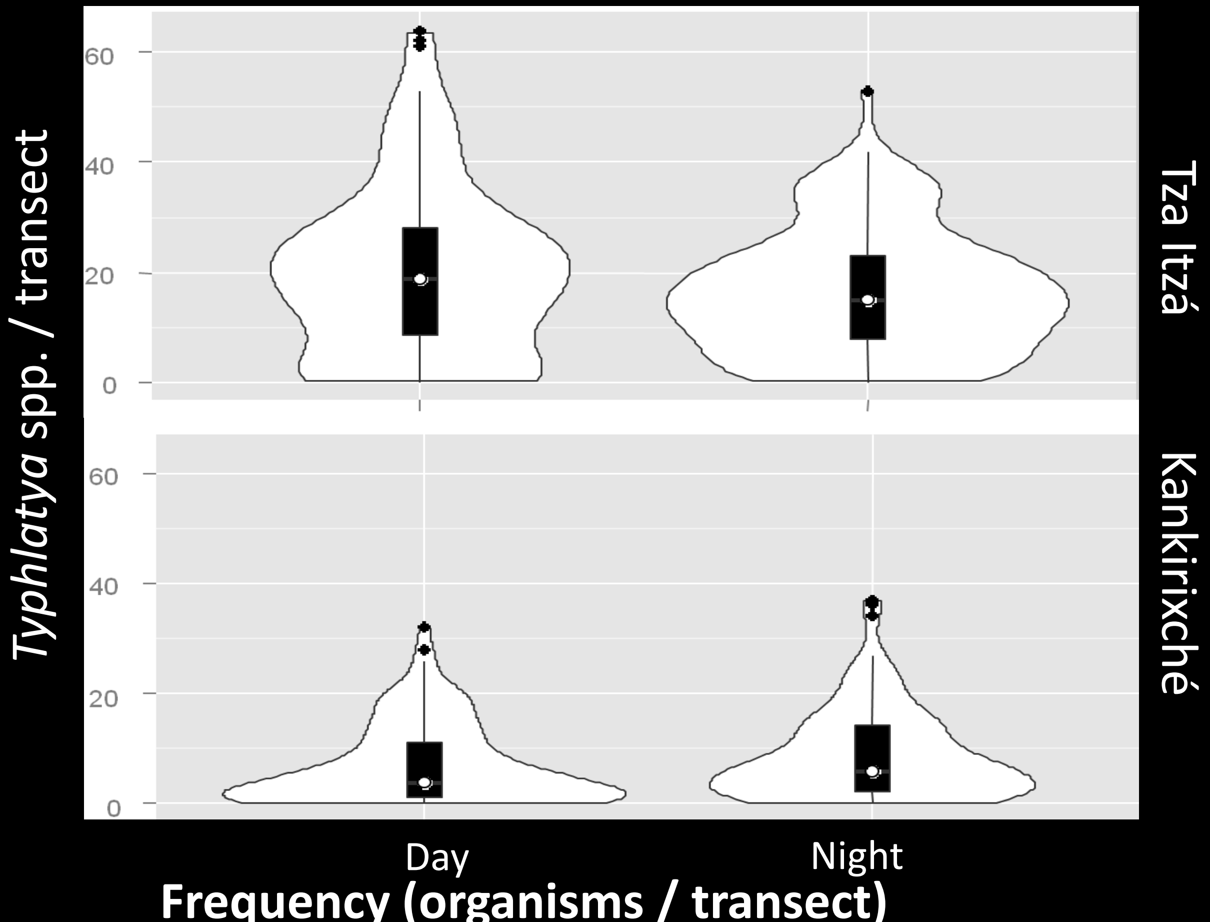


Shallow organisms less tan expected ($t<2x10^{-16}$).

Not random distribution at depth ($t<6.27x10^{-3}$).

Results

Temporal use Typhlatya spp.

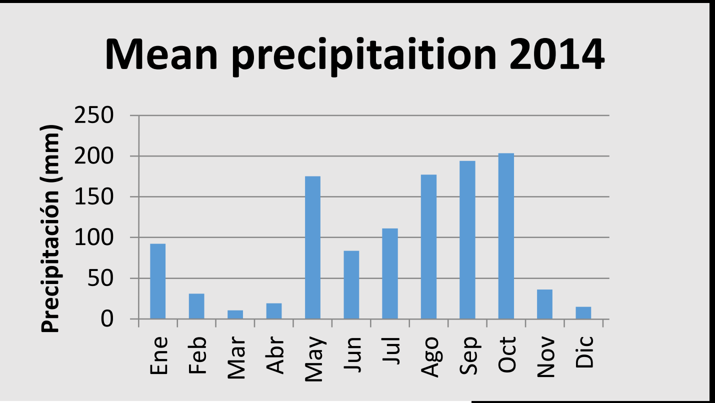


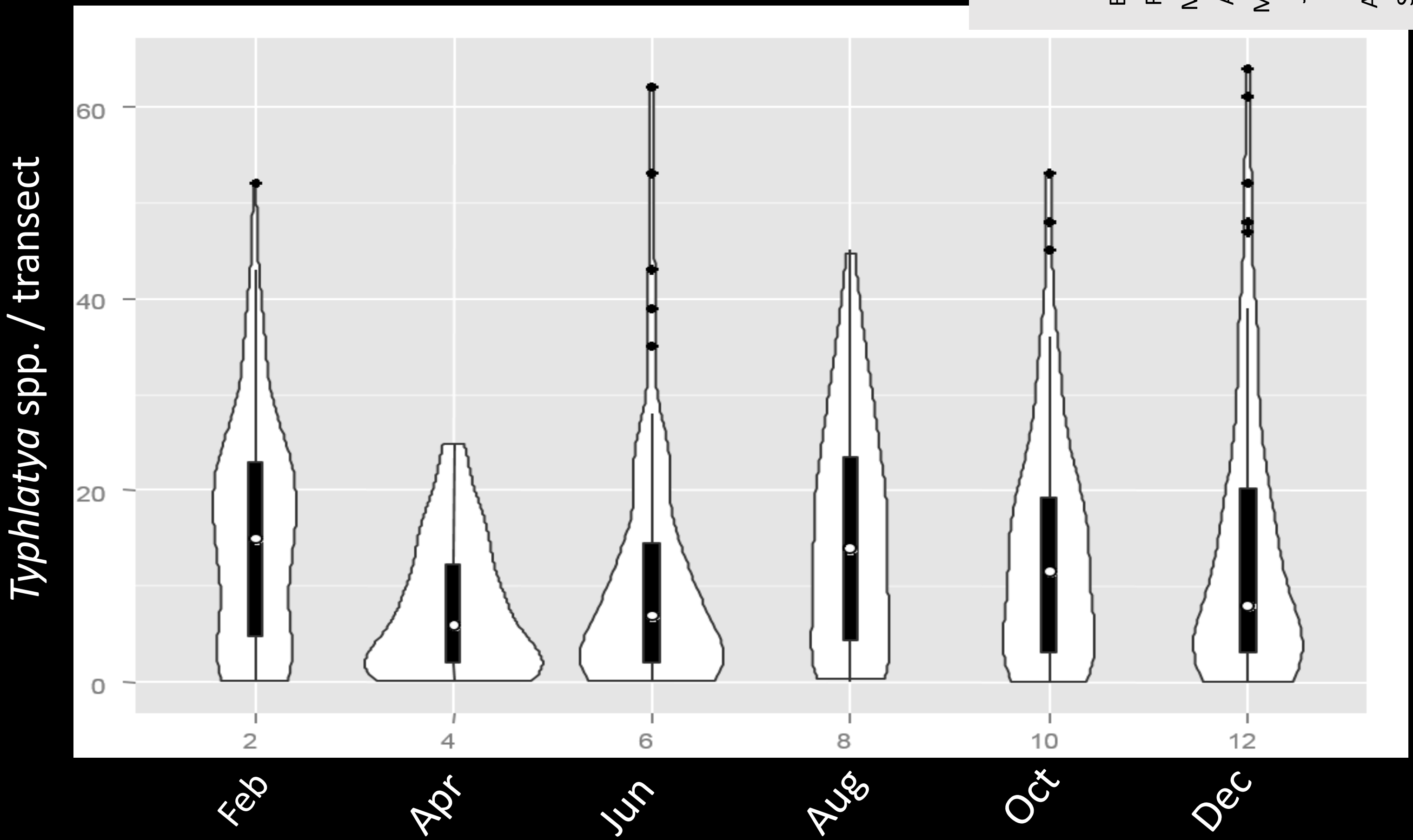
No differences day / night (t<0.0824)

Tza Itzá àt night > Kankirixche night (t<0.0102).

Resultados

Annual densities Typhlatya spp.





No significant differences through the year.

Discussion

- Sediment composition:
  - Allochthonous deposition greater in Tza itza than Kankirixche → greater densities.
  - Corg/N greater in Tza Itza suggests nutritional quality: vascular plants > Algae > Chemosynthetic Bacteria
- *Typhlatya* spp. depth distribution according to available organic C & N.

Discussion

C. Morleyi distribution at depth.

Diel migration to the solar influence zone.

- Prey motivated behavior?
- Ancestral behavior?

Discussion

No Diel behavior *Typhlatya* spp.

Tza Itza greater density during the day ($t<0.010$)

- High predator densities.
- Nightly feeding frenzy.

>

Kankirixche without day night differences.

- Low predator densities.
- Lower resource availability.

Discussion

Annual variations

Creaseria morleyi

- Rainy season as an indicator for biological processes
- Reproduction as a result of a high availability of resources?

Typhlatya spp.

- Stable densities throughout the year.
- Reproduction linked to age, development, random resource availability or environmental signaling?

Conclusions

- First results of these species in terms of cenote, depth, day-night behavior and annual cycles.
- Cenotes behave differently.
- *Creaseria morleyi* has night habits.
- No sufficient evidence to support diel behavior of *Typhlatya* species.
- *Typhlatya* spp. are not under direct sunlight

Conclusions

- Populations of *Typhlatya* in these cenotes are stable year long.
- *Creaseria morleyi* has higher abundances around the rainy season.
- *Creaseria morleyi* is a *Typhlatya* spp. Predator.

Acknowledgements

This work would not have been possible without the support of the CONACyT, PAEP and BecasMixtas scholarships.

¡Muchas gracias!

chavezsolis.efrain@gmail.com