

# The importance of temporal scales for the evaluation of phytoplankton diversity in tropical lakes: Lake Dom Helvécio, Southeast Brazil as a case-study

#Barbosa, F. A. R.; C. F. Barros; F. Garcia; V. R. Faria



# Summary

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- # Tropical freshwater biodiversity constraints
- # Strategies for more comprehensive samplings in the tropics
- # Middle Rio Doce Lake System major features
- # Integrating phytoplankton data at distinct time scales to assess diversity
- # Concluding remarks

# Introduction

- # Despite evident progress in microscopic techniques and taxonomic knowledge freshwater biodiversity within tropical regions remains poorly known
  - ⇒ Largely due to financial constraints since mostly located within developing countries
  - # It is necessary the definition of strategies that can facilitate sampling of higher species number along with increasing the knowledge on major organisms forming each aquatic community.
  - ⇒ It is also mandatory to consider the optimisation of scarce financial resources.
  - # We intent to contribute to overtaking these difficulties through the analysis of data collected from Lake Dom Helvécio, integrating the research programme at site # 4 of Brazil-LTER.

## Objective

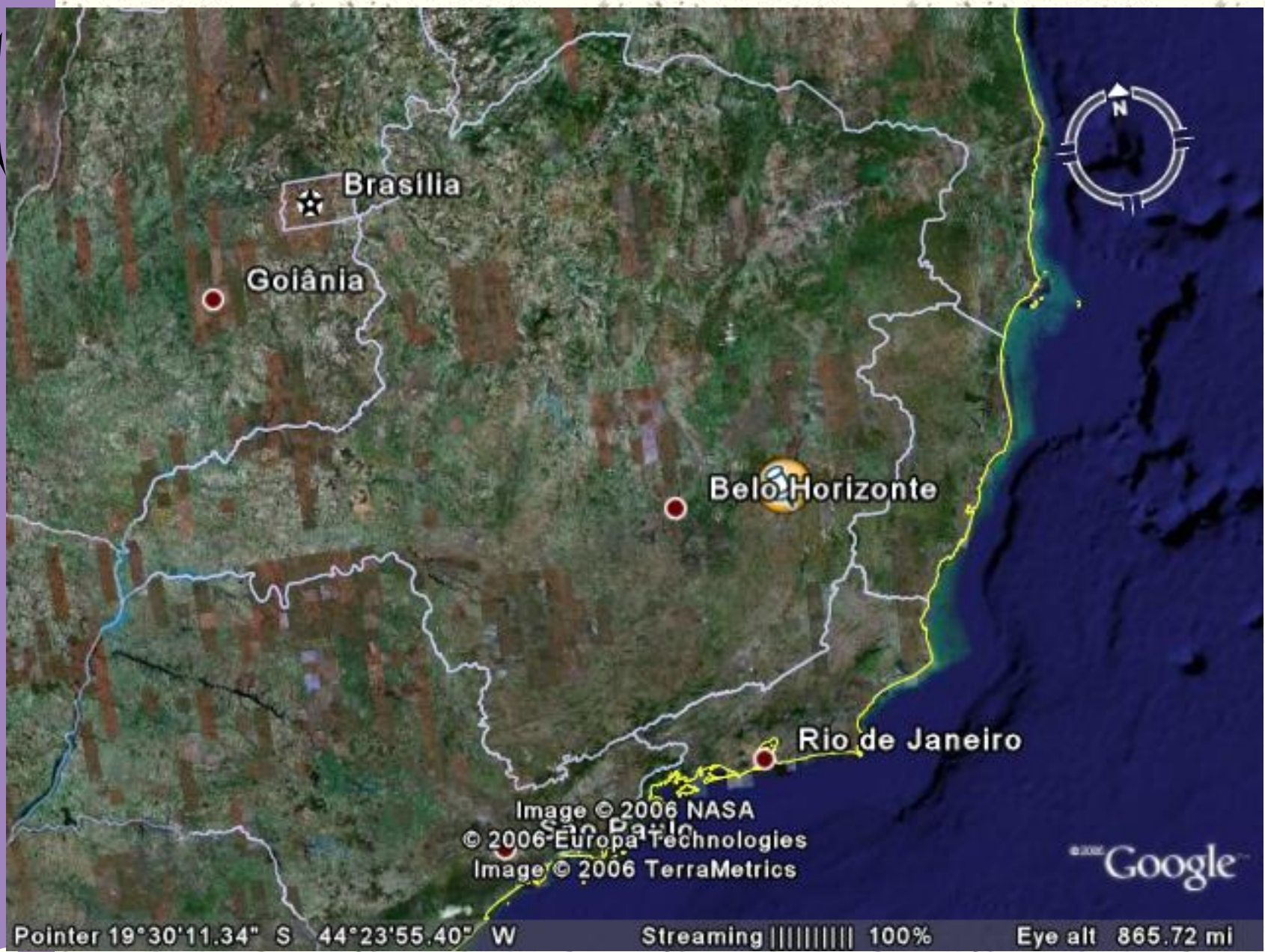
To verify how samplings conducted at distinct time scales can influence the perception and understanding of phytoplankton diversity



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Pointer 18°30'01.99" S 51°59'16.64" W Streaming ||||| 100% Eye alt 4071.80 mi





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Pointer 19°47'05.93" S 42°36'22.50" W elev 977 ft Streaming ||||| 100% Eye alt 26439 ft

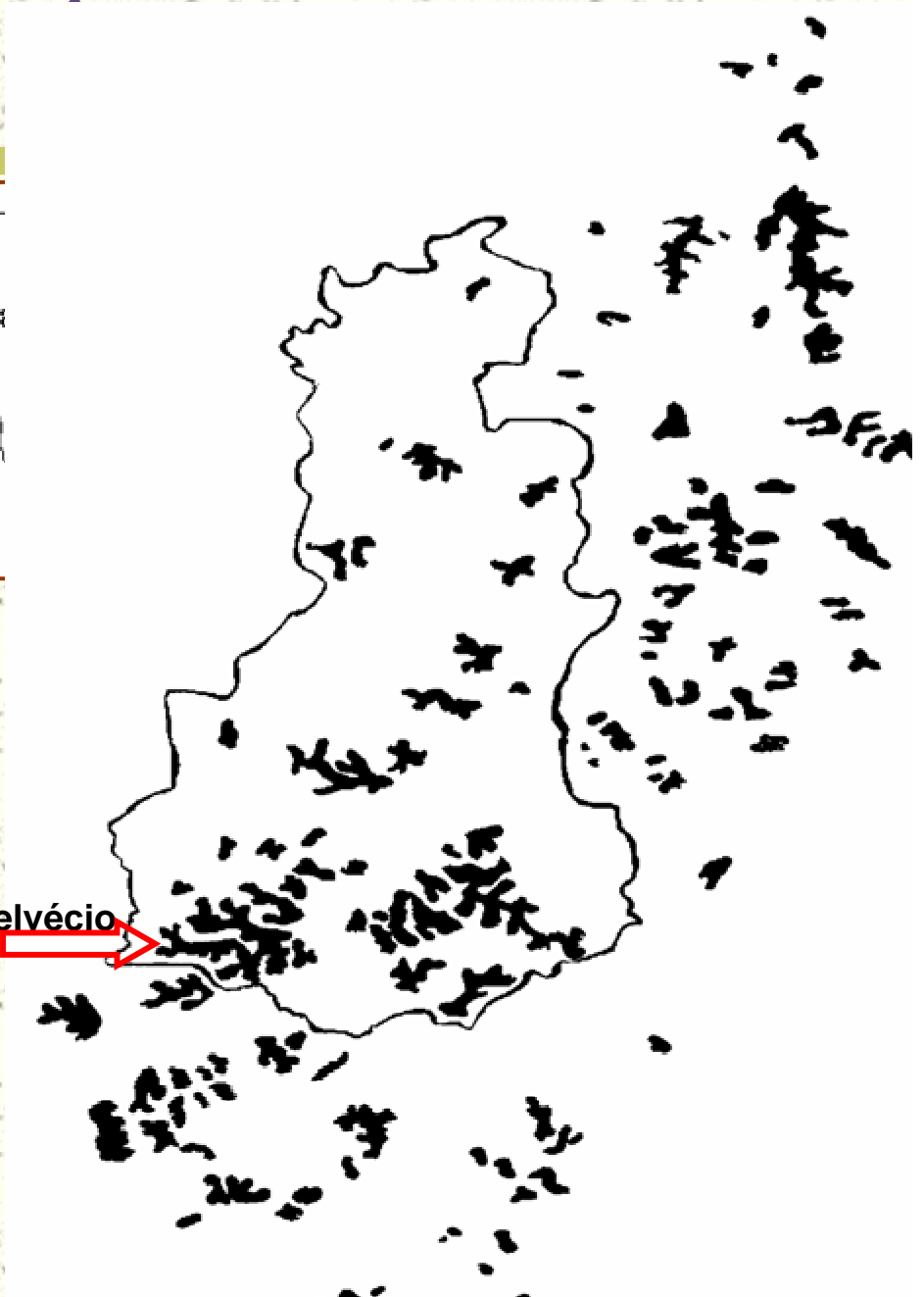
# Study

## *Rio Doce State Park*

- the largest remnant of Atlantic Forest in Minas Gerais (36,000 ha)
- surrounded by *Eucalyptus* and 29 municipalities.
- 1/3 of the middle Rio Doce lacustrine system;
- Local climate: tropical semi-humid, temperature ~ 25°C;
- Main Threats: Deforestation; mining; siderurgy, untreated sewage; exotic species.

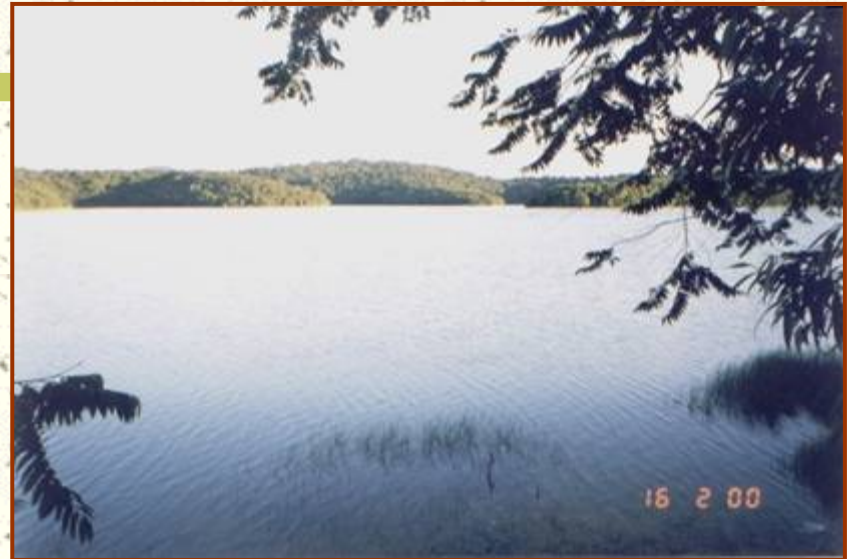


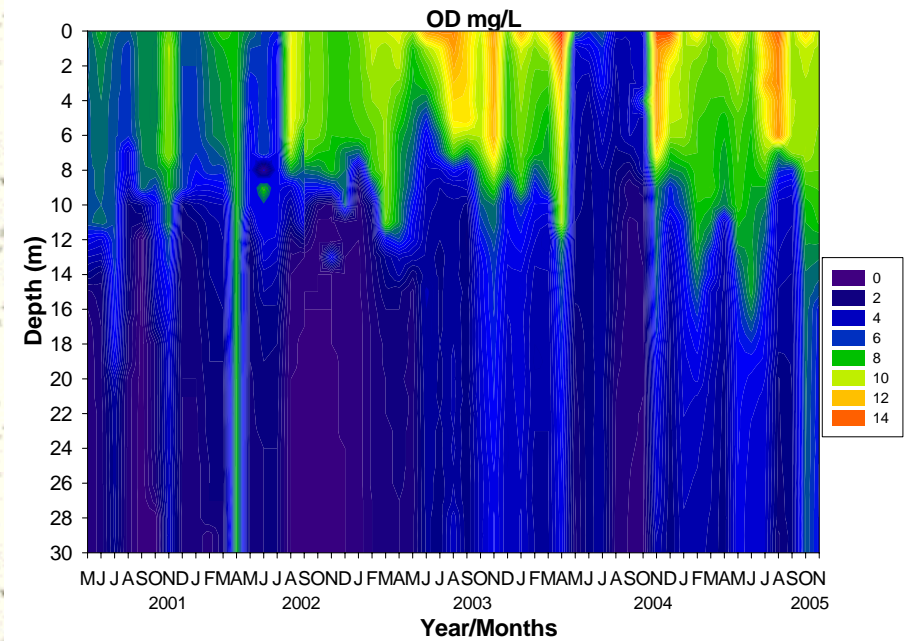
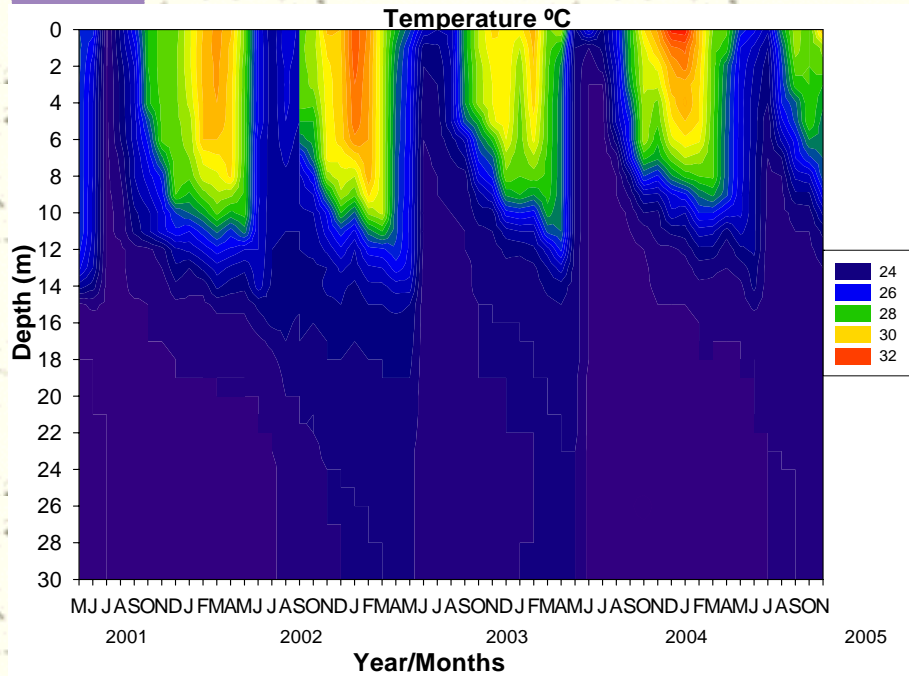
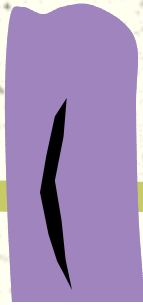
Dom Helvécio



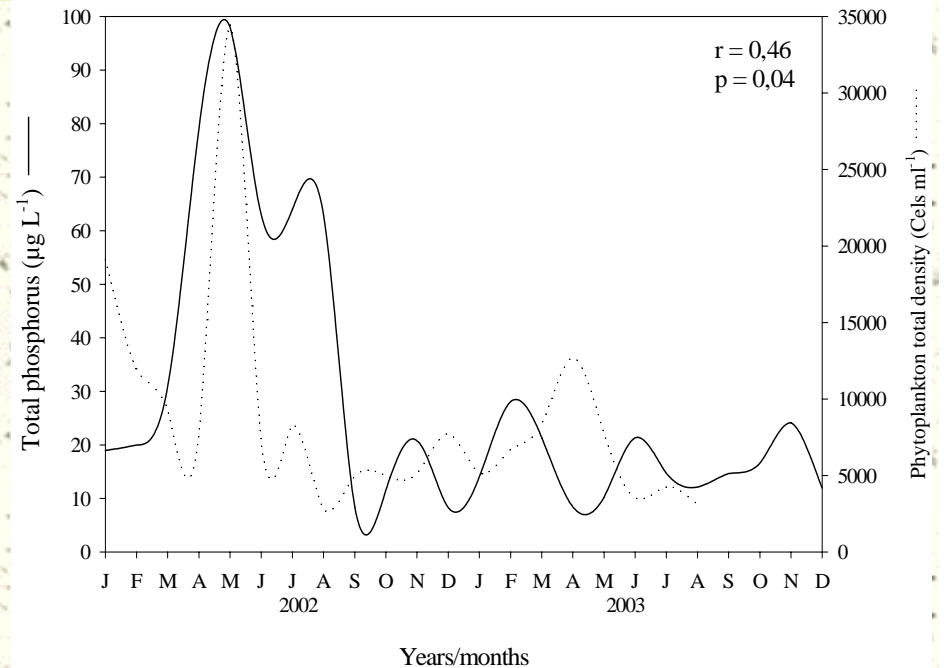
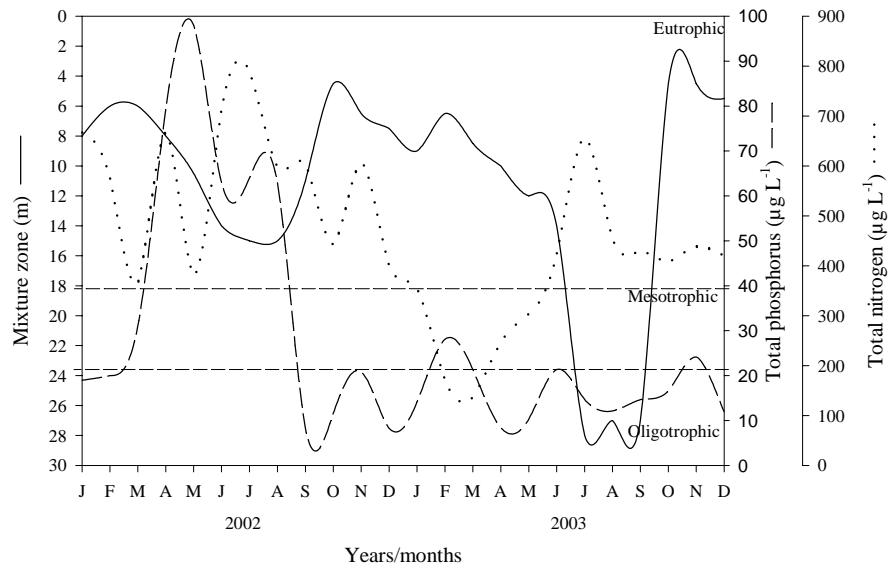
# Lake Dom Helvécio

- The largest (6.8 km<sup>2</sup>) and deepest lake of the system (32.5 m)
- Dendritic and oligotrophic
- Warm-monomictic; stratifying from Sep-April





Depth/time diagrams of water temperature and dissolved oxygen concentrations at Lake Dom Helvécio between May 2001 and Nov 2005.



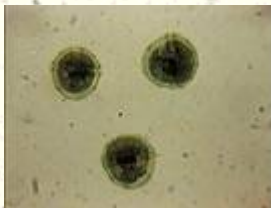
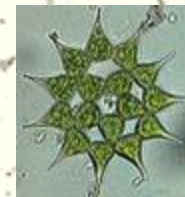
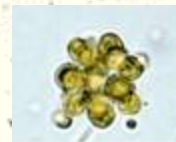
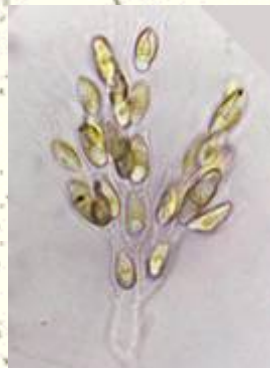
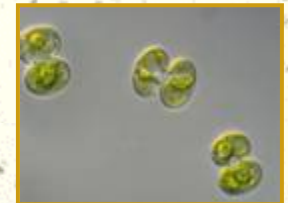
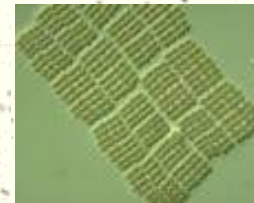
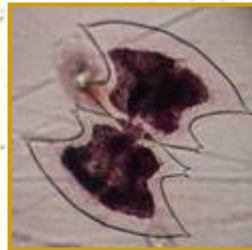
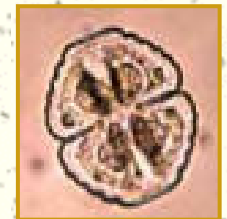
**Monthly variation of depth of mixing zone and total P and total N in Lake Dom Helvécio.**

**Traced lines show limits between trophic states according to total P concentrations (Salas & Martino, 1991).**

**Total P concentration and phytoplankton density in Lake Dom Helvécio, southeast Brazil.**

# Phytoplankton: 267 species

Dominant algae: Desmids!



# Zooplankton: 213 species

Dominant group: Copepods (*Thermocyclops minutus*)



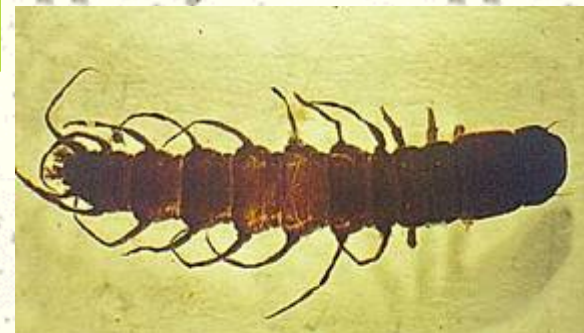
# Aquatic Macrophytes: 63 species

More representative Family: Cyperaceae!



# Benthic Macro-Invertebrates: 62 taxa

More representative Family: Chironomidae

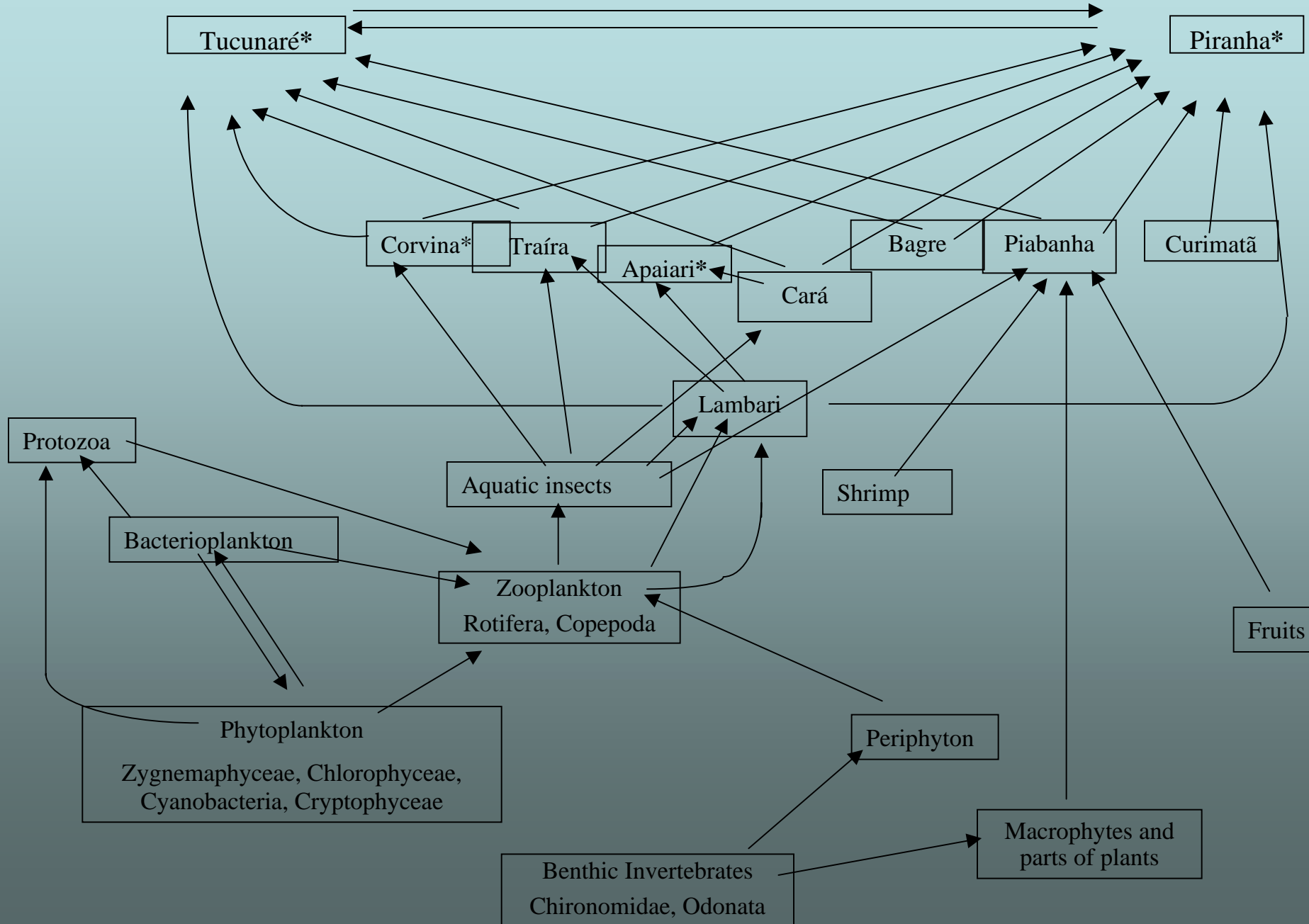


# Fishes: 27 species

More representative Families: Characidae and Cichlidae!



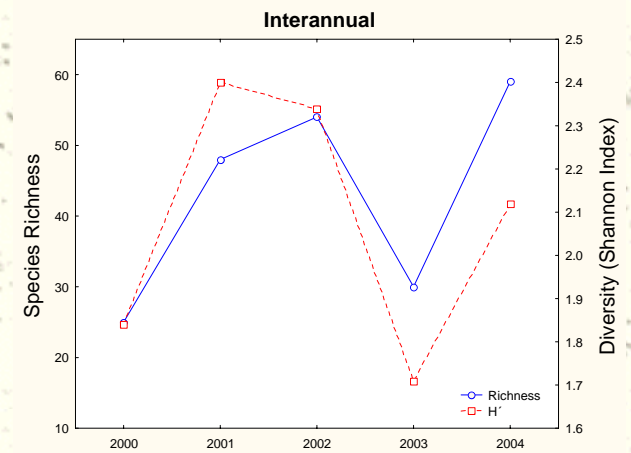
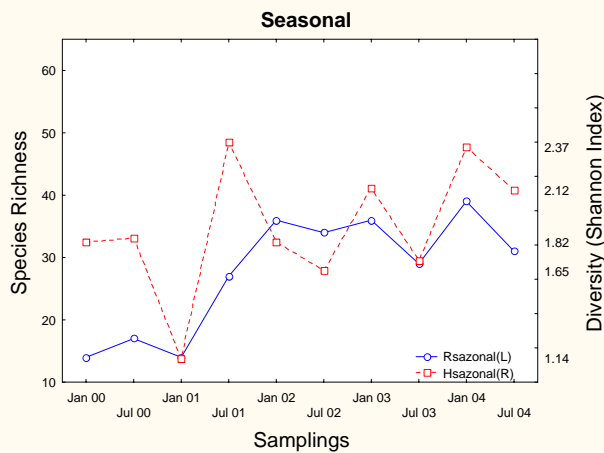
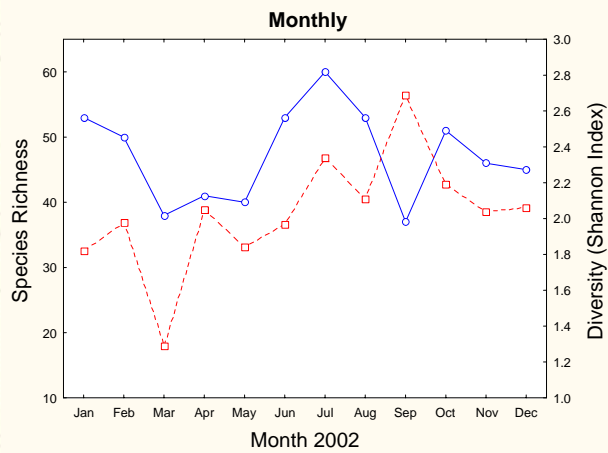
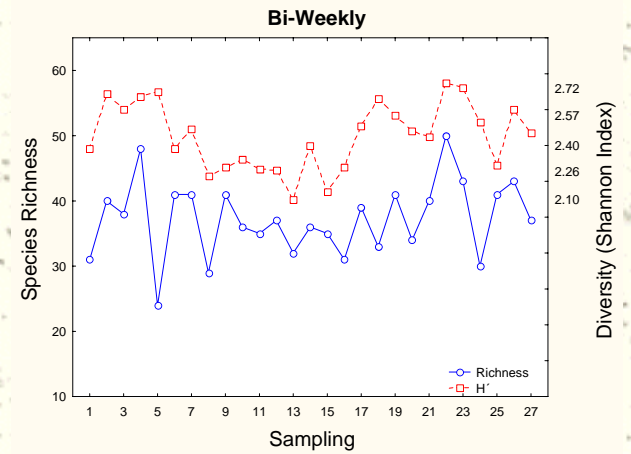
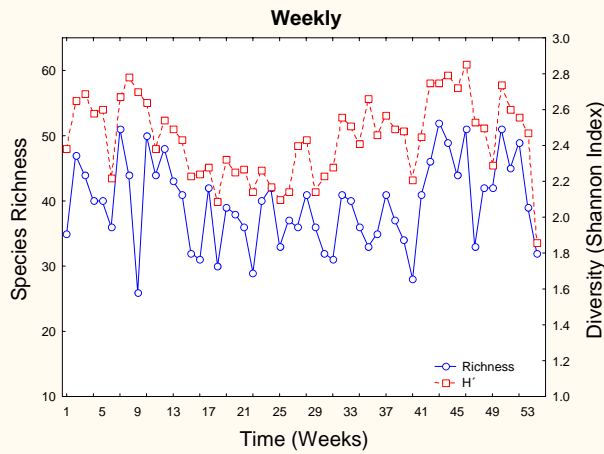
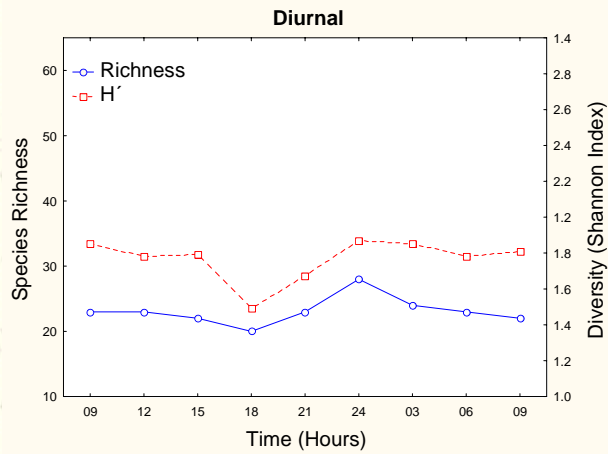
# Lake's Dom Helvécio trophic food-web



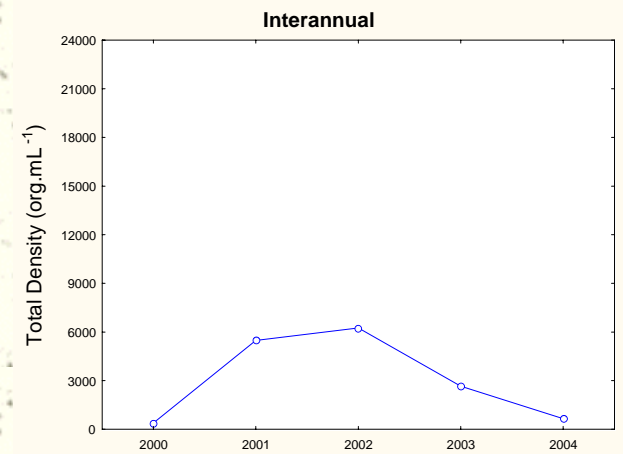
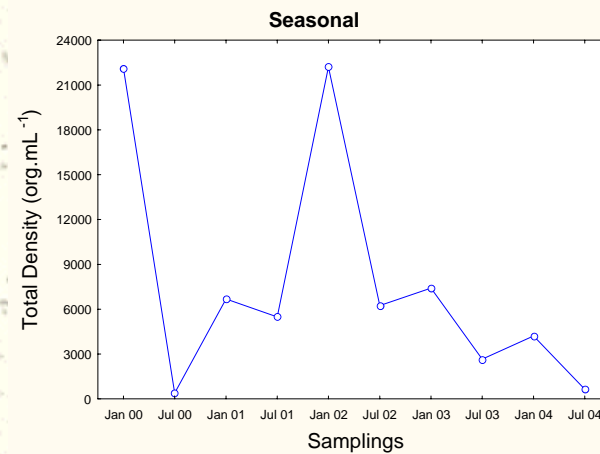
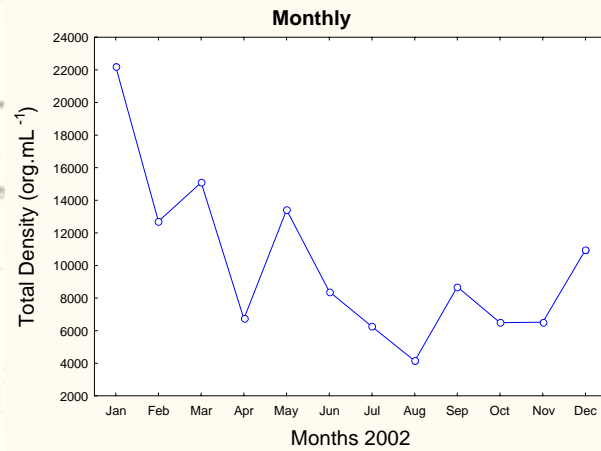
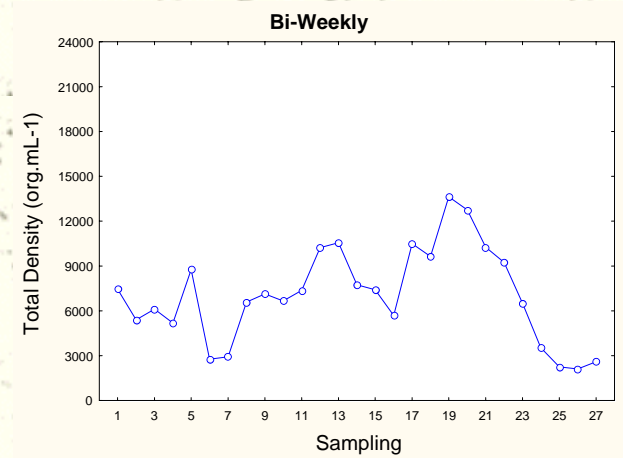
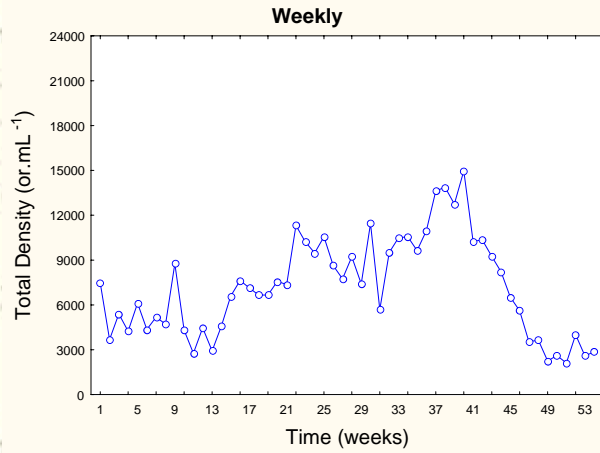
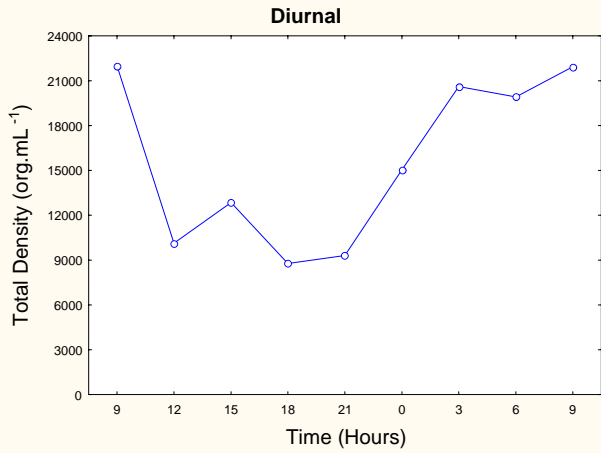
# Methods

- **Phytoplankton data: total density (cells/ml)**  
**species richness (average and accumulated)**  
**diversity (Shannon Index)**
- **Time scales of samplings: daily (every 3 hours)**  
**weekly**  
**bi-weekly**  
**monthly**  
**seasonally (6 months)**  
**inter-annually**

# Richness and Diversity

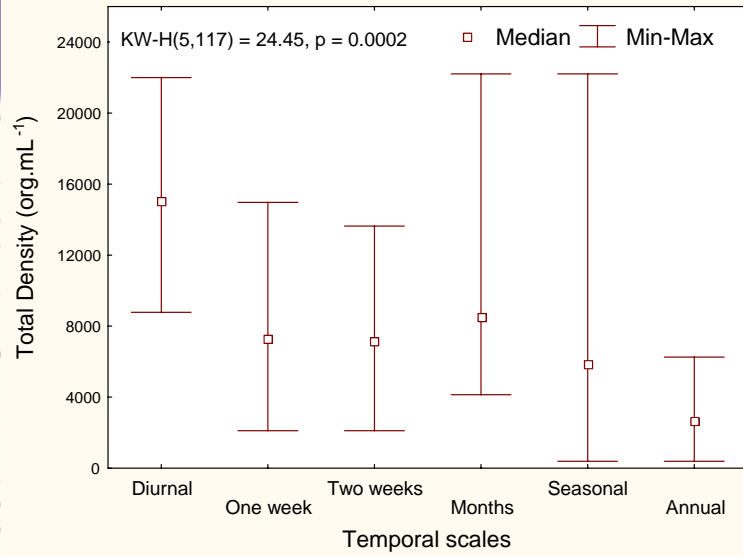


# Density

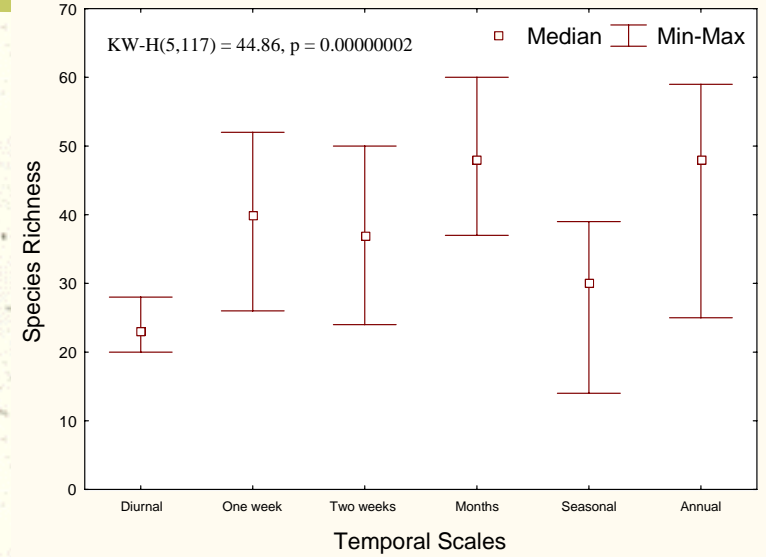


# Time scales and perception of natural oscillations

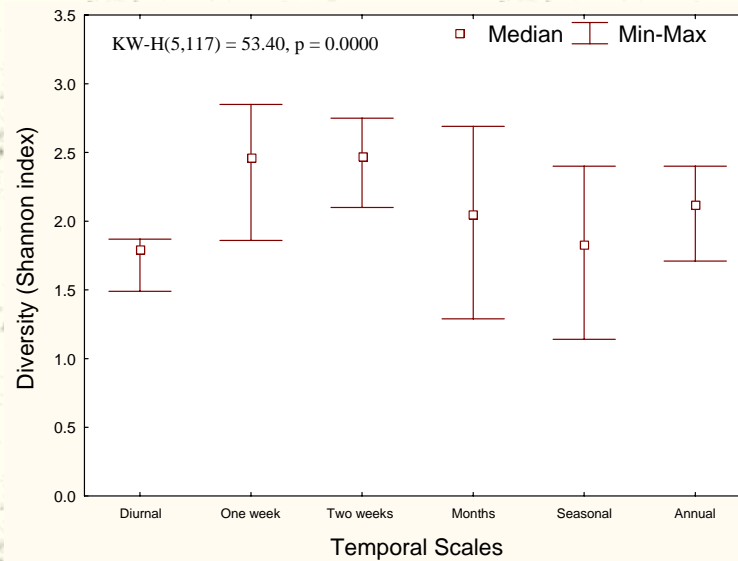
## Density



## Species Richness

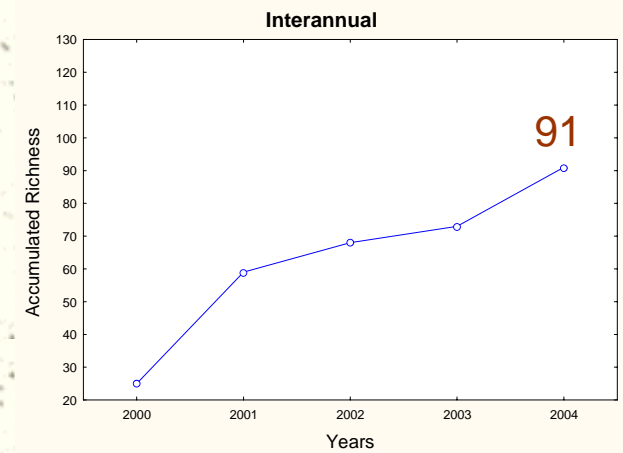
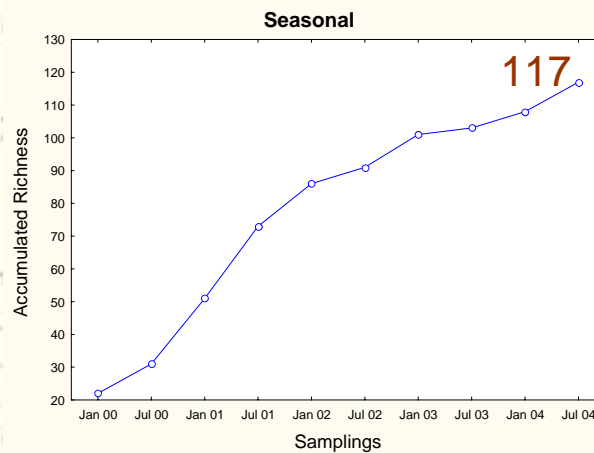
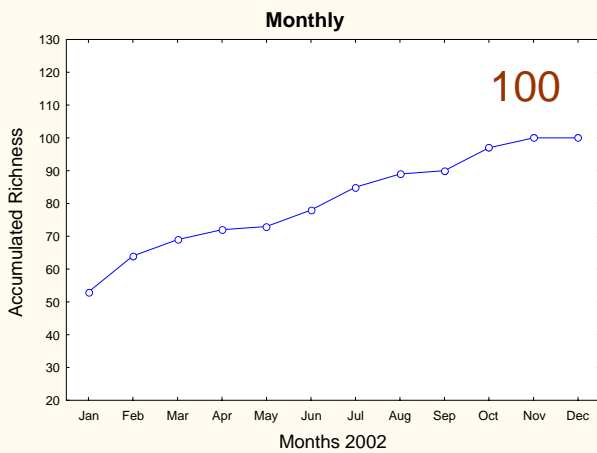
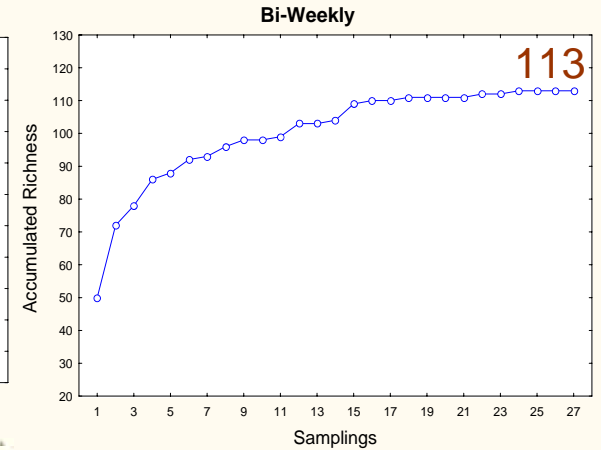
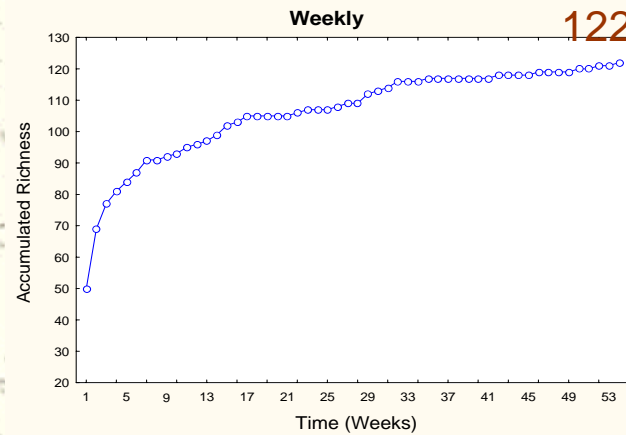
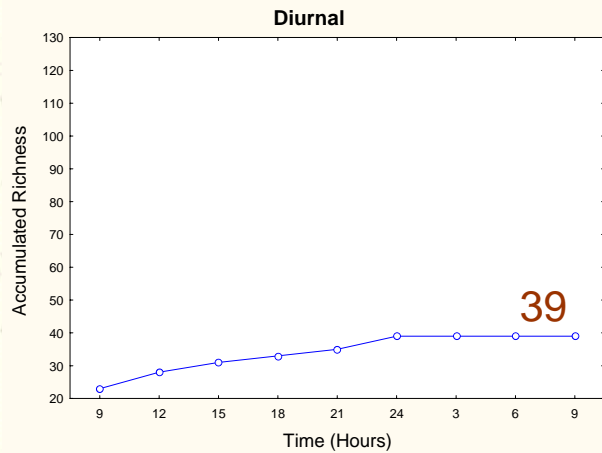


## Diversity



# Time scales and Richness perception

The accumulated species richness varied between 39 (diurnal samplings) and 117 species (seasonal samplings).



# Remarks

## Diurnal sampling

insufficient data to represent phytoplankton diversity;  
low costs

⇒ Likely to render underestimates due to the concentration of samplings under specific environmental conditions of a particular chosen day.

## Weekly, bi-weekly, and monthly sampling

More realistic analysis of phytoplankton diversity since include wider range of environmental conditions and responses of this community to these changes.

⇒ Time consuming; costs of sampling are much higher.

# Remarks

## ★ Seasonal sampling (dry/rainy periods)

allow for a realistic phytoplankton diversity since cover the two most representative environmental conditions - stratification and mixing periods.

⇒ allow for detection of the extreme conditions and comparatively at lower costs.

## # Annually samplings

time between samplings too long to assess diversity

⇒ To allow for comparisons samplings would represent the same phase of the hydrological cycles (subjectivity?)

# Conclusions

- ⇒ LTER data provide the possibility of comparisons between distinct time scales
- ⇒ These findings are particularly important for tropical developing countries considering the possibility of reducing time/costs necessary to guaranteeing samplings, identification, counting, and interpretation of the recorded results.
- ⇒ Short/intermediate time scales studies must consider an intensification of sampling!