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The changing ecosystem of East Africa’s Mare Nostrum:

Using ichthyology collections to identify the changes in the Lake Victoria region.

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Nikol Kmentová
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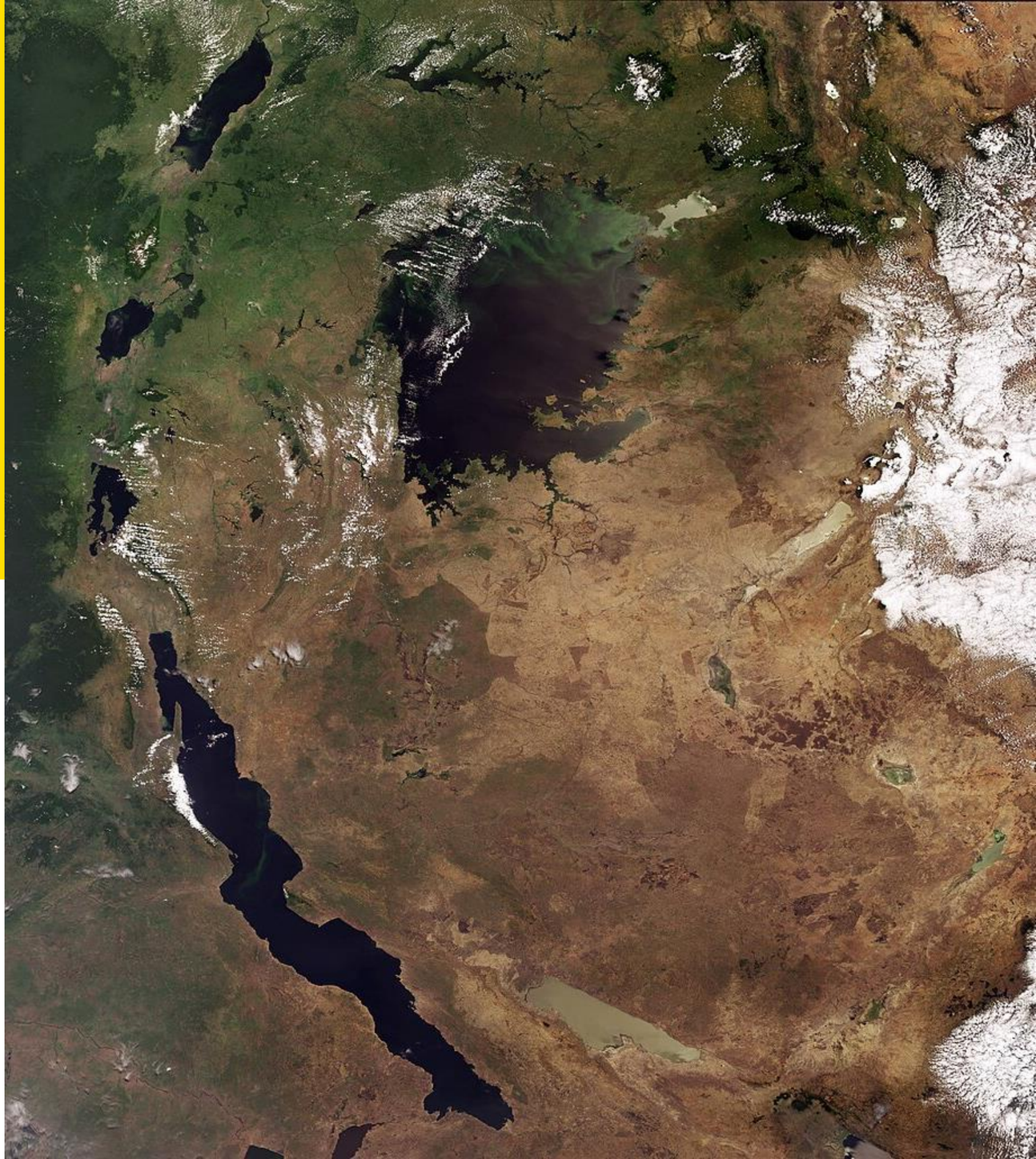
Laban Musinguzi
Jos Snoek

Fishbase symposium 02.09.24

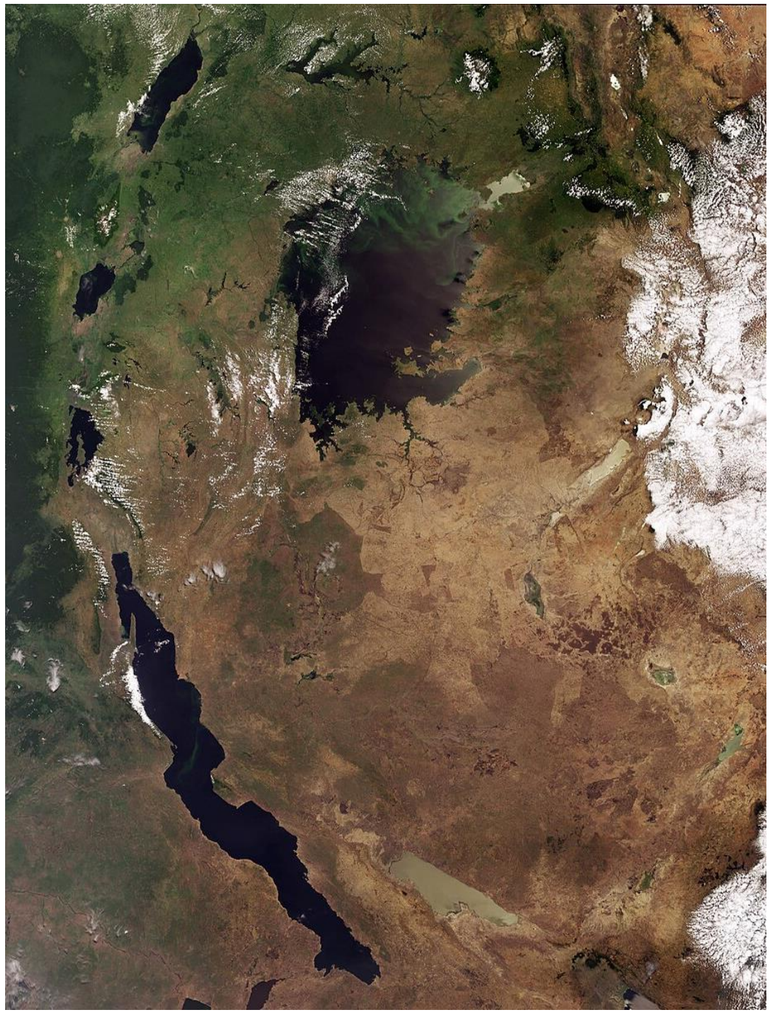


East Africa's Mare Nostrum

Fish fauna of the East African Great Lakes

Genereally poor and homogeneous fish diversity

- Often wide-spread species
- Rather homogenous across the region
- Several fisheries-target species



Hyperdiverse cichlid flocks

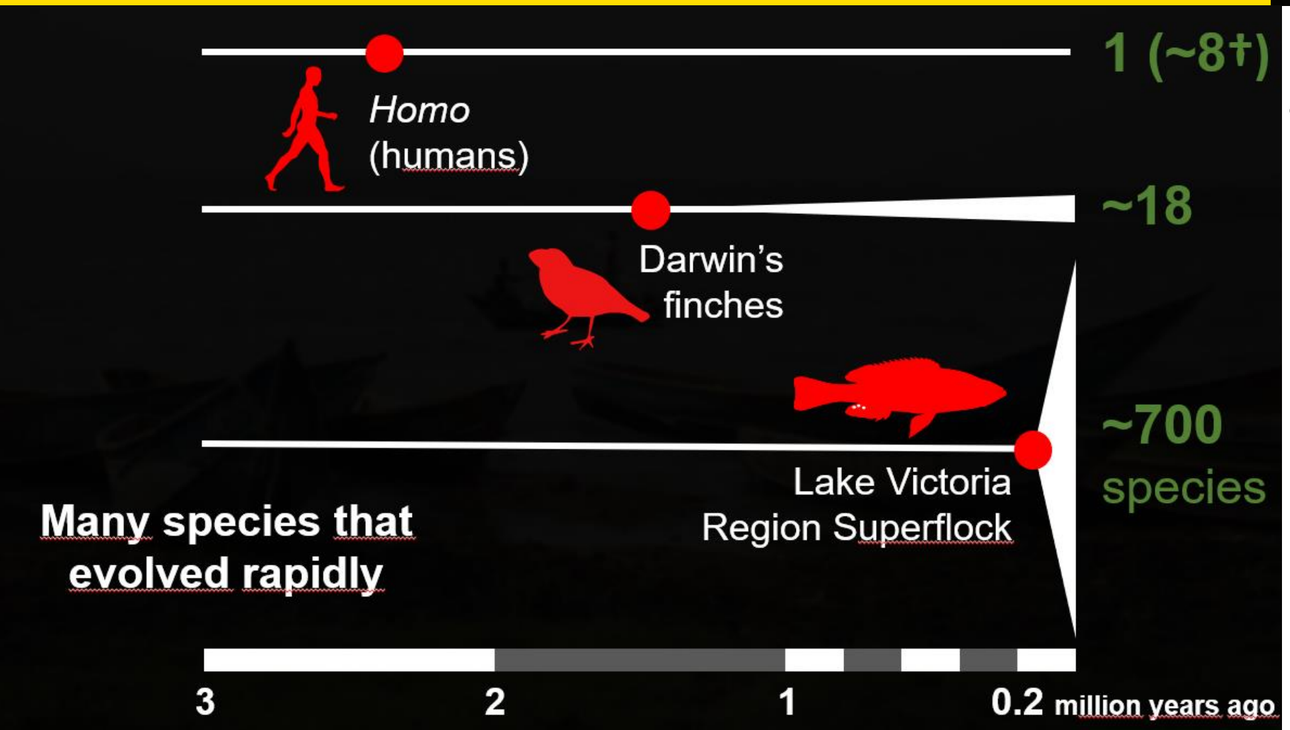
- Intra-lacustrine speciation
- Highest vertebrate diversity on earth
- *Haplochromis* radiations

A. *Haplochromis* radiation

- **Revision of the Lake Edward *Haplochromis***
  - Hitherto little studied
  - Traditional morphometric study using ‘eco-trophic groups’
  - Based on the ‘genera’ (sensu Greenwood)

Nathan Vranken

A. *Haplochromis* radiation



- **Revision of the Lake Edward *Haplochromis***
  - Hitherto little studied
  - Traditional morphometric study using 'eco-trophic groups'
  - Based on the 'genera' (sensu Greenwood)
- **Diversification in LVR *Haplochromis***
  - Extremely fast evolutionary divergence
  - Many instances of hybridisation
  - Traditional genomic techniques fail to reconstruct phylogeny
  - Need for a whole genome approach

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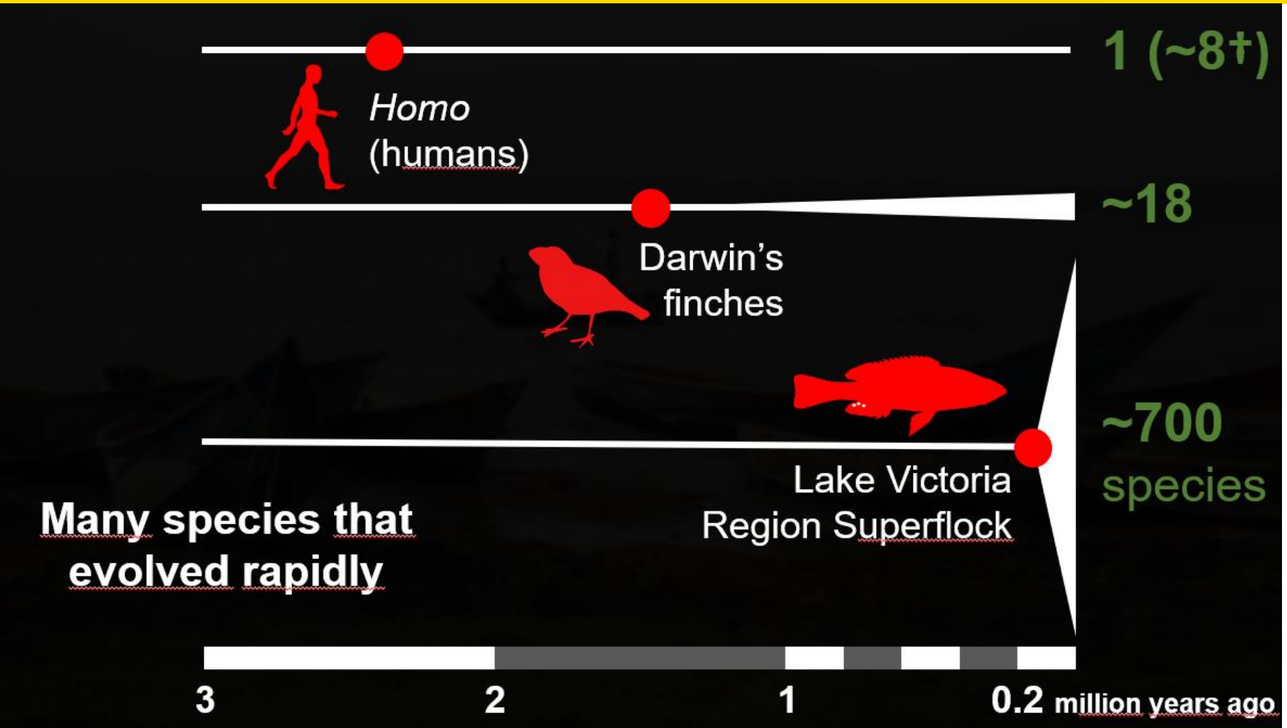
A. *Haplochromis* radiation



- **Whole-genome phylogeny of LVR *Haplochromis***
  - Revealed three separate radiations
  - But can we quantify whether this is convergence?

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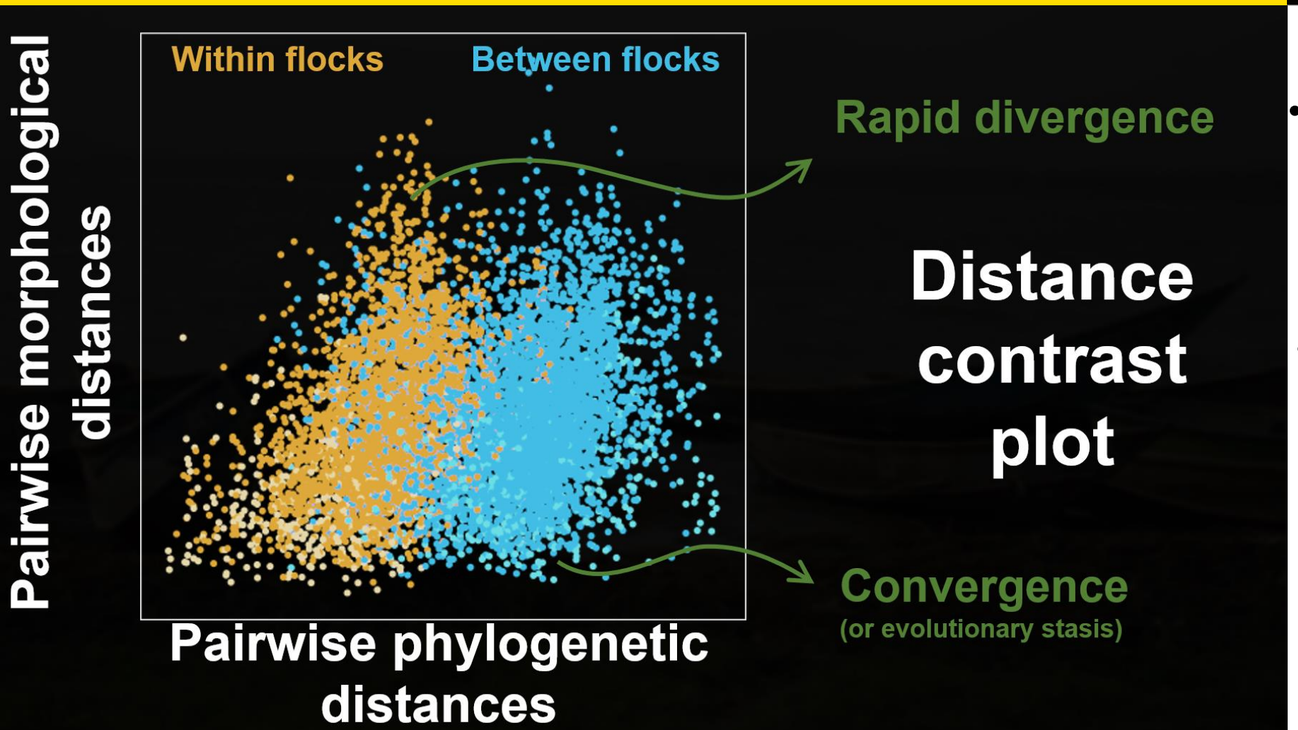
Albert flock
~15 species
Victoria flock
~600 species
Kivu-Edward flock
~90 species
Lake Victoria
Region Superflock (LVRS)
Similarity evolved largely independently
Phylogenetic tree
IQ-tree from whole
genome sequences
LVRS
Albert
Kivu &
Edward
Victoria
A. fuelleborni
A. sp. 'chipwa'
A. angustifrons
A. sp. 'bathymelas'
A. sp. 'romanulus'
A. gracilior
A. pharyngalis
A. dolorosa
A. paludinosa
A. bloyeti
A. flavijosephi
A. burtoni

A. *Haplochromis* radiation



- **Whole genome phylogeny of LVR *Haplochromis***
  - Revealed three separate radiations
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- **Comparing morphological and genetic differences**
  - Rapid divergence within flocks
  - Convergence between flocks
    - Both were larger than expected compared to a null-model

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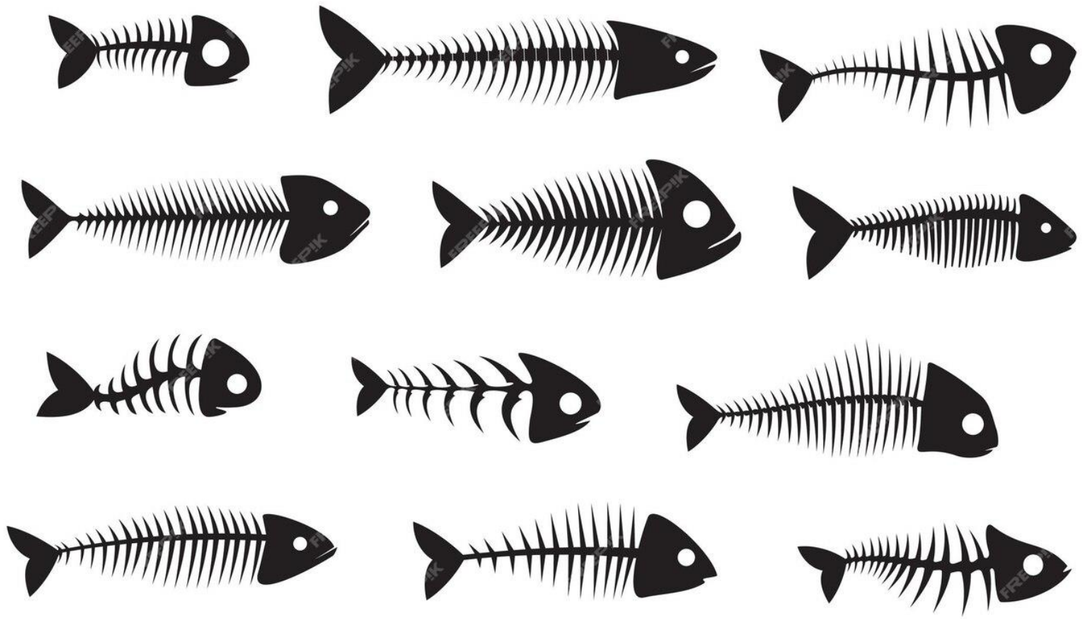
B. The changing ecosystem of Lake Victoria


Nile perch
(Lates niloticus)



- **Largest extinction event in the 20th century**
  - Up to half of the *Haplochromis* species from LV extinct since the 1980s
  - What is the cause of this decline?
    - Invasive species (Nile Perch, Nile Tilapia,…)
    - Or eutrophication?

B. The changing ecosystem of Lake Victoria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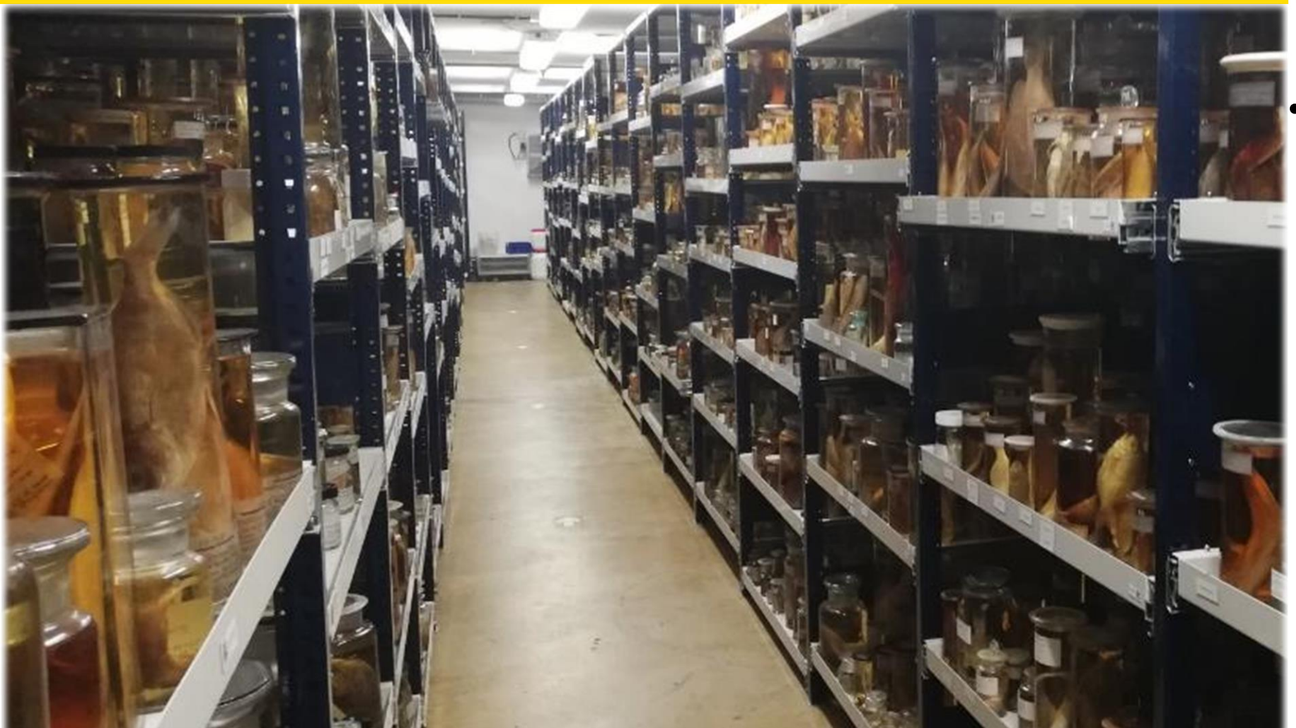

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- **Collection research:**
  - Do different stressors affect community structure differently?
  - Fish community structure difficult to reconstruct using collections.

B. The changing ecosystem of Lake Victoria


Nile perch
(*Lates niloticus*)


Lamproglena monodi


Cichlidogyrus

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  - What is the cause of this decline
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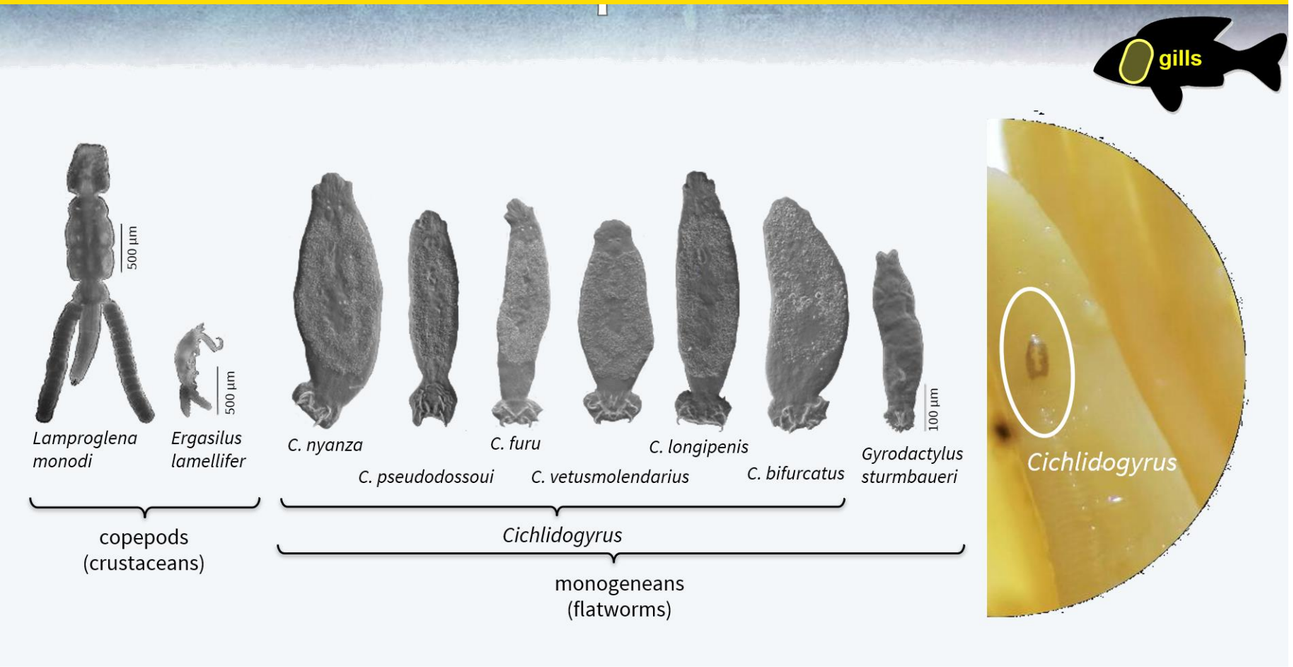
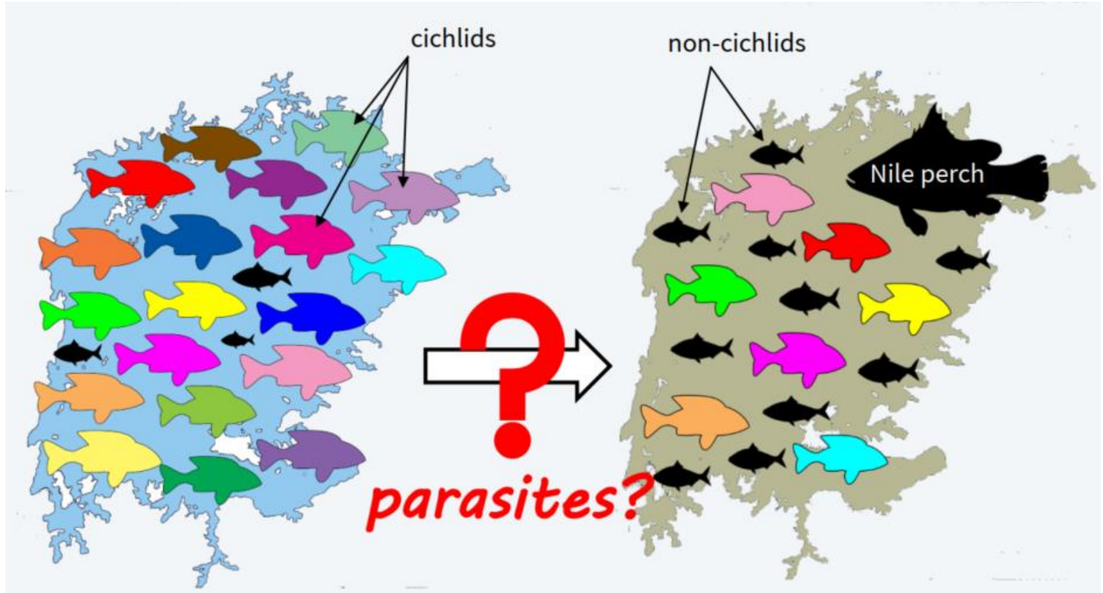
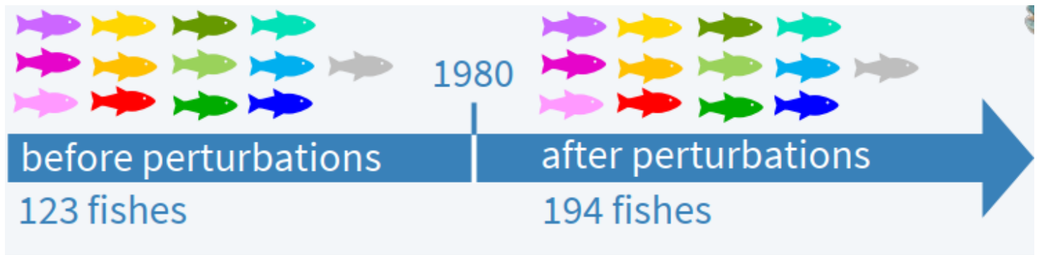
  - Parasites of fishes in collections provide community data of ecosystems

T. Gobbin
(UHasselt/RBINS)

B. The changing ecosystem of Lake Victoria





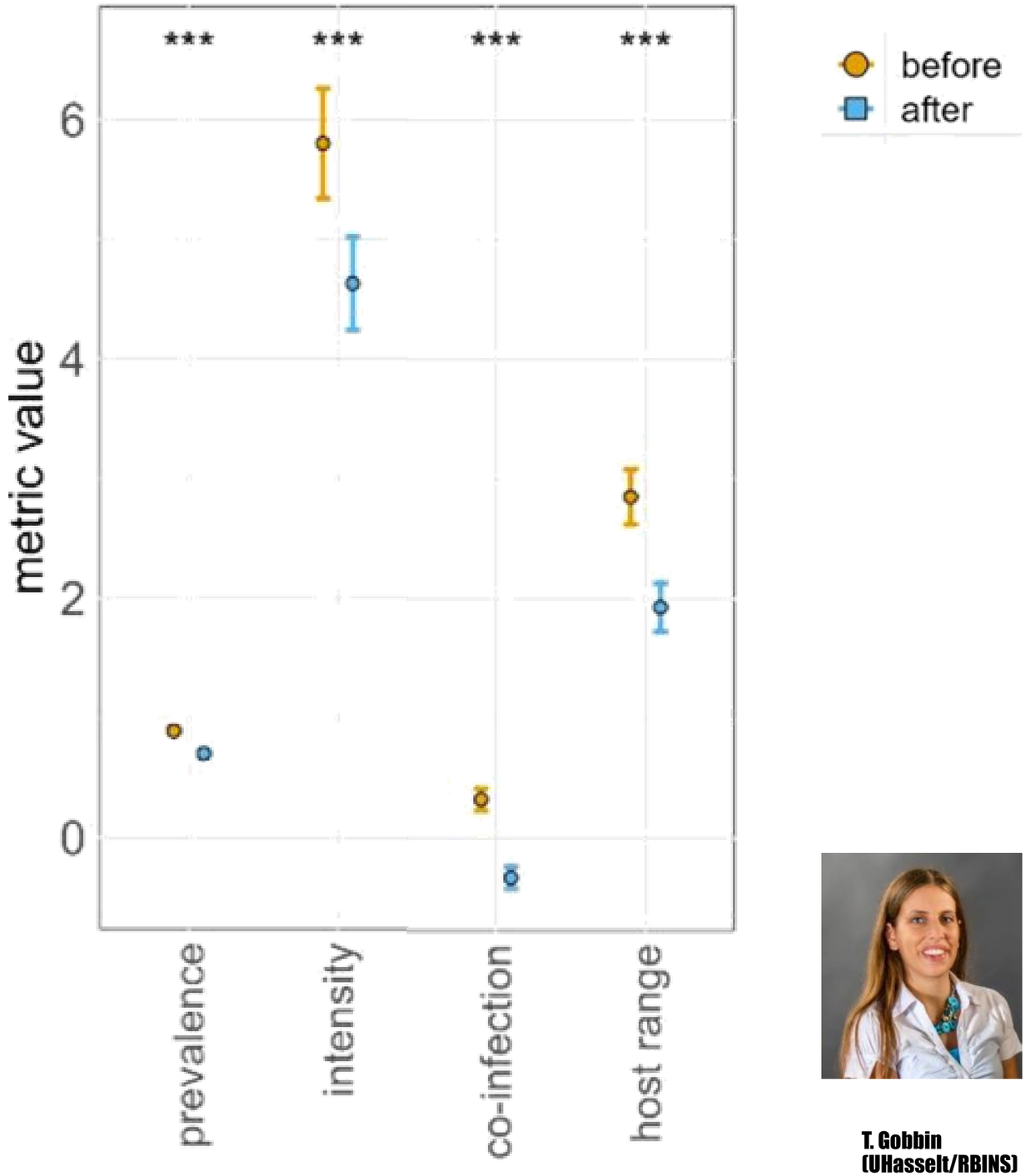


- **Collection research:**
  - How has community sutrure changed in this lake since the ecosystem turnover
  - Parasites of fishes in collections provide community data of ecosystems

T. Gobbin (UHasselt/RBINS)

B. The changing ecosystem of Lake Victoria

- **How did the changes in Lake victoria affect parasite community structure?**
  - Fewer fish were infected
  - Fish were infected by a lower number of parasites
  - Co-infections became less frequent
  - Parasite species infected less host species



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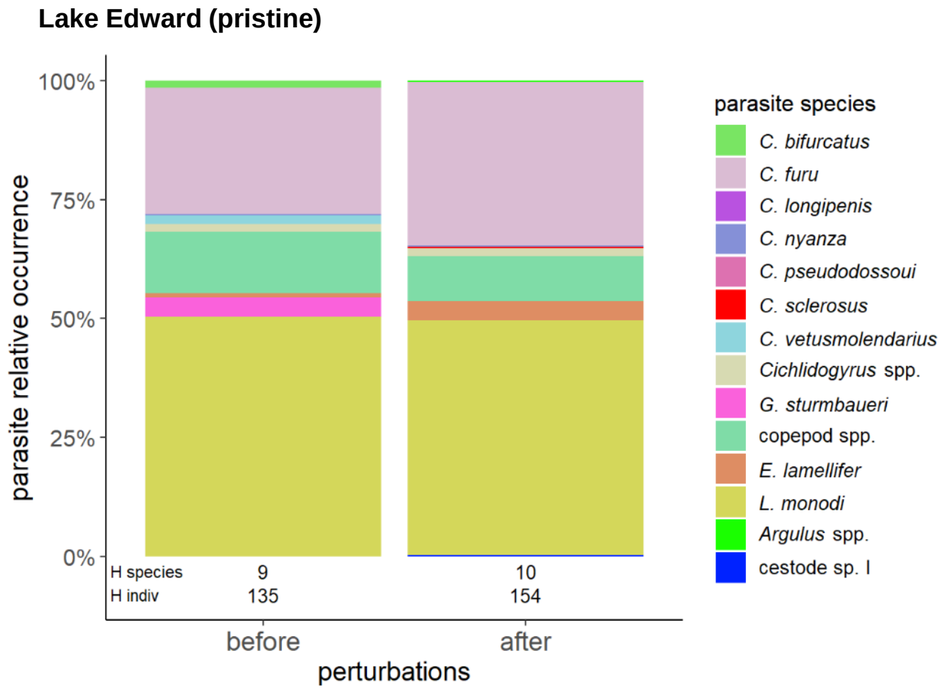
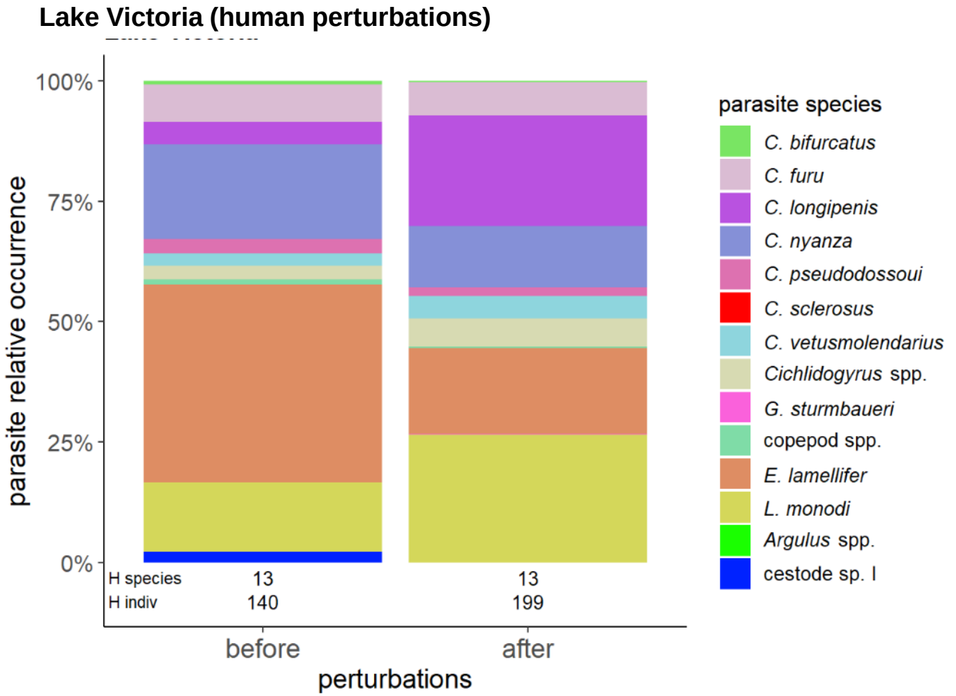
- **But is this due to human influence?**
  - Yes, because these changes were not observed in a nearby ‘pristine’ lake





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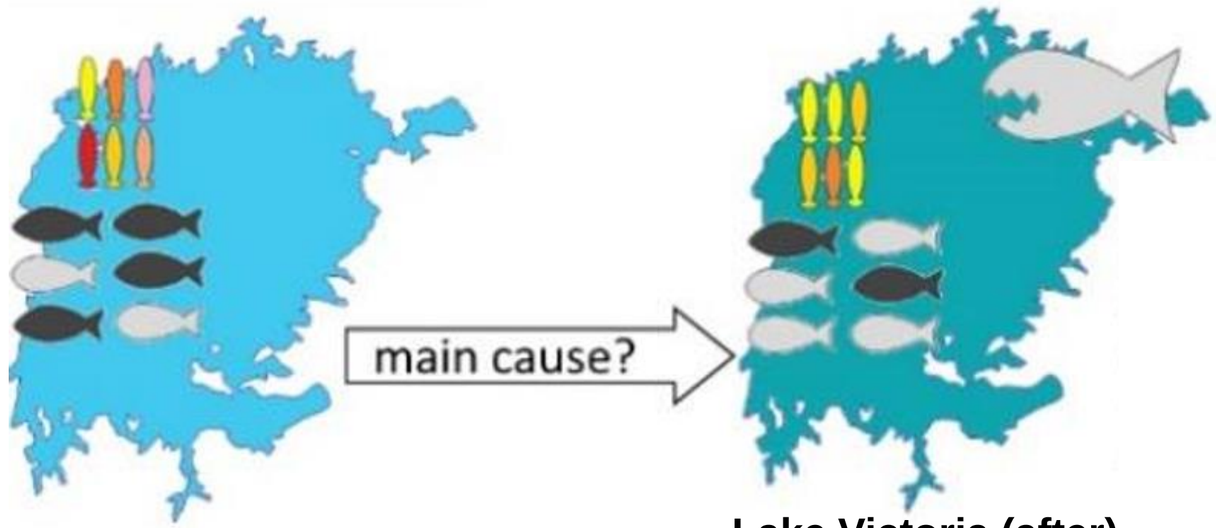
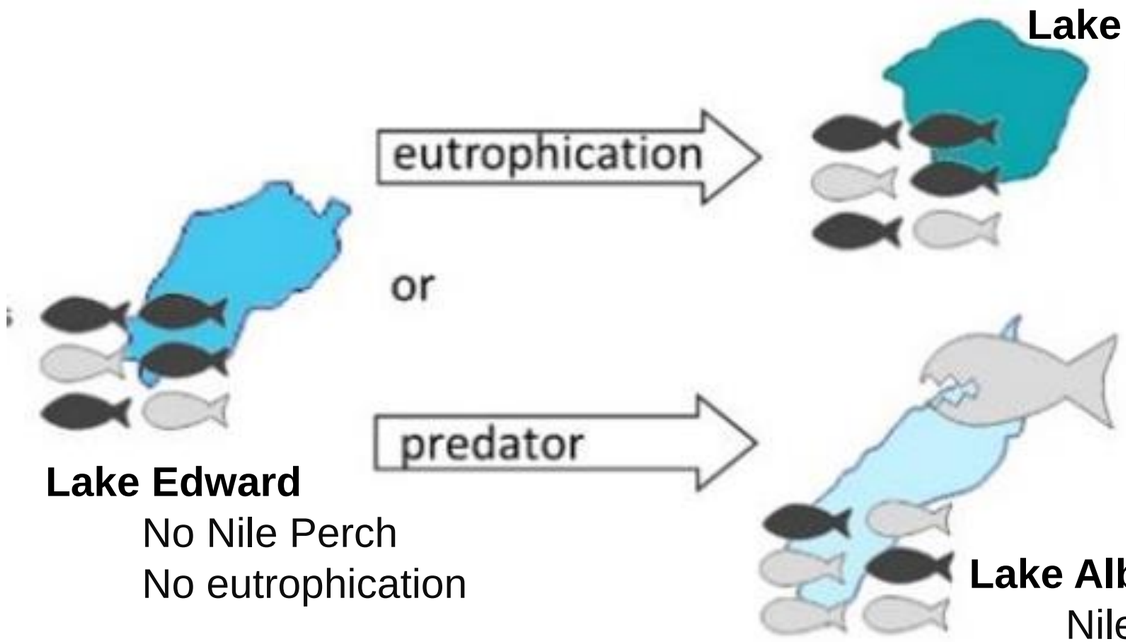


Lake Victoria (before)
No Nile Perch
No eutrophication

Lake Victoria (after)
Nile Perch
Eutrophication

- **But is this due to human influence?**
  - Yes, because these changes were not observed in a ‘nearby’ pristine lake
- **What caused the changes in parasite community structure?**
  - Space for time approach



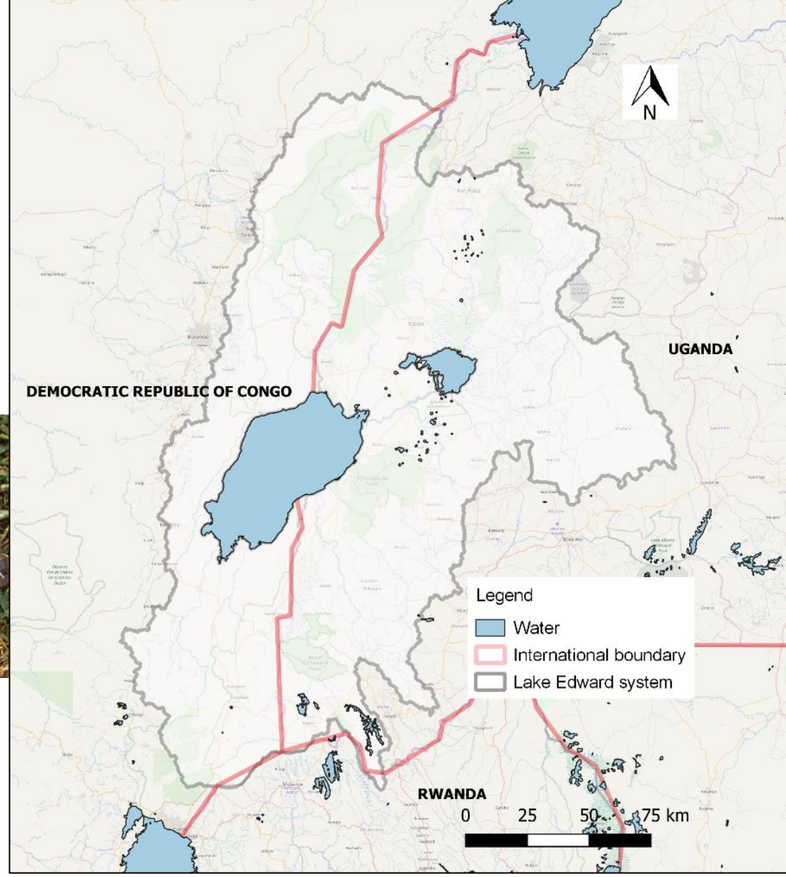
Lake George
No Nile Perch
Eutrophication

Lake Edward
No Nile Perch
No eutrophication

Lake Albert
Nile Perch
No eutrophication

C. The changing ecosystem of the Lake Victoria Region

Oreochromis niloticus



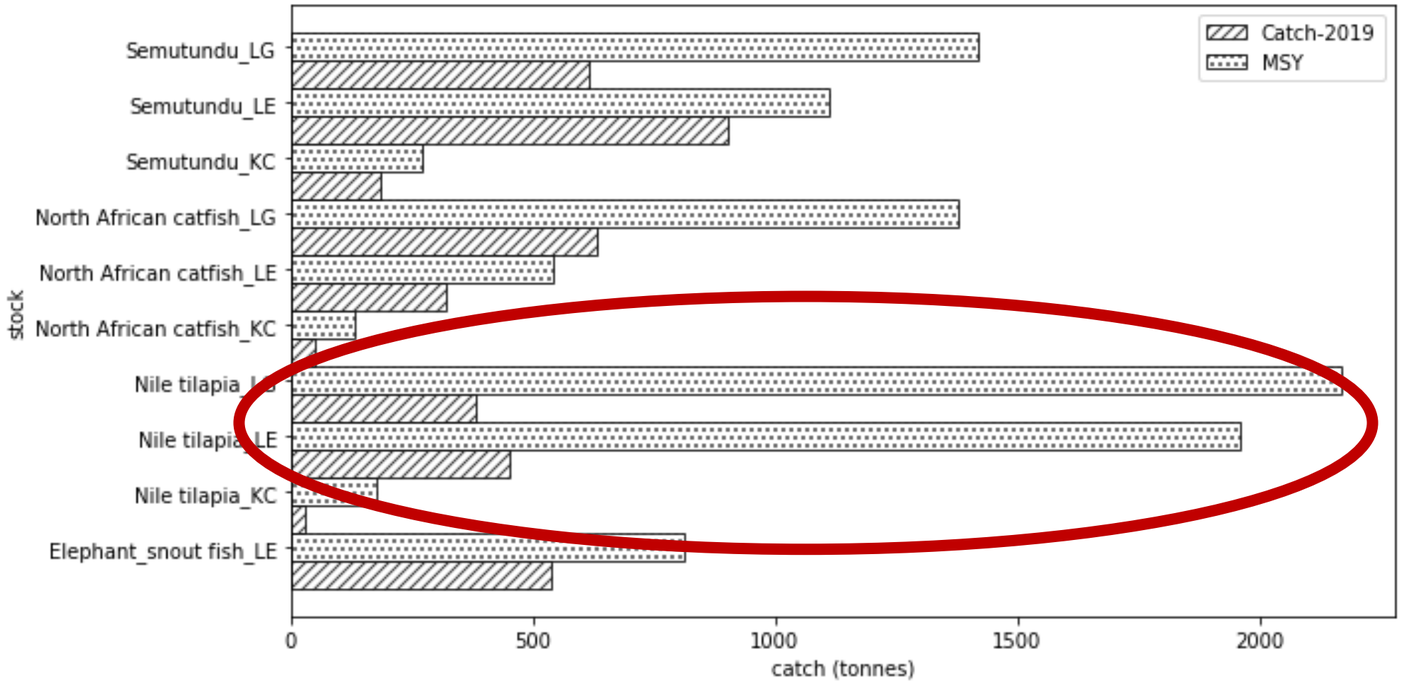


Fig. 2 Estimates of MSY in relation to observed catches in 2019 for stocks in lakes Edward (LE), George (LE) and the Kazinga channel (KC).

- **Drastic decrease of *O. niloticus* in lakes Edward and George**
  - Shift from a Nile tilapia fishery to a multi species fishery
  - Smaller sized *O. leucostictus* more abundant

L. Musinguzi

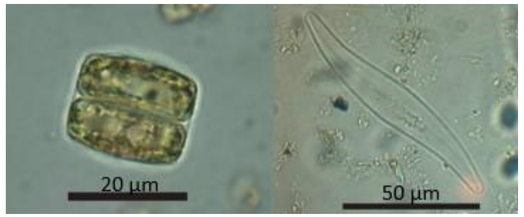
C. The changing ecosystem of the Lake Victoria Region

Oreochromis niloticus

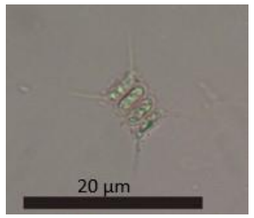
Oreochromis leucostictus

- **Niche overlap between *O. niloticus* and *O. leucostictus*.**
  - 1950 vs. 2020
  - Is niche overlap getting larger?
  - Do niches overlap more where both species are invasive?
  - Different Great Lakes provide different contrasts

- **Focuss on Diatoms**
  - Species-level identifications
  - Hard parts resistant to digestion

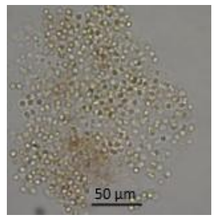


Diatoms

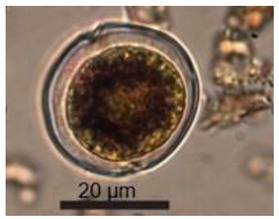


Chlorophytes

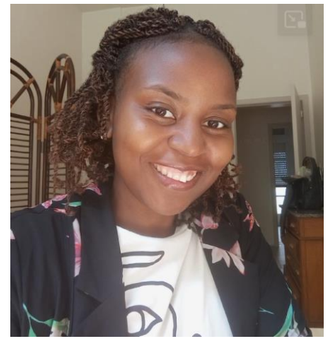
Euglenophytes



Cyanobacteria



Dinoflagellates



N. Nzigire

Thank you

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AFRICA museum

UHASSELT
KNOWLEDGE IN ACTION

Fishbase symposium 03.09.24

A. The *Haplochromis* radiation

Distance contrast plot

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