Individual morphology as a predictor of diet in the recovering haplochromine cichlids of Mwanza Gulf, Lake Victoria

Leo A.J. Nagelkerke[a]

[a] *Wageningen University & Research, Aquaculture & Fisheries Group, Wageningen, The Netherlands*

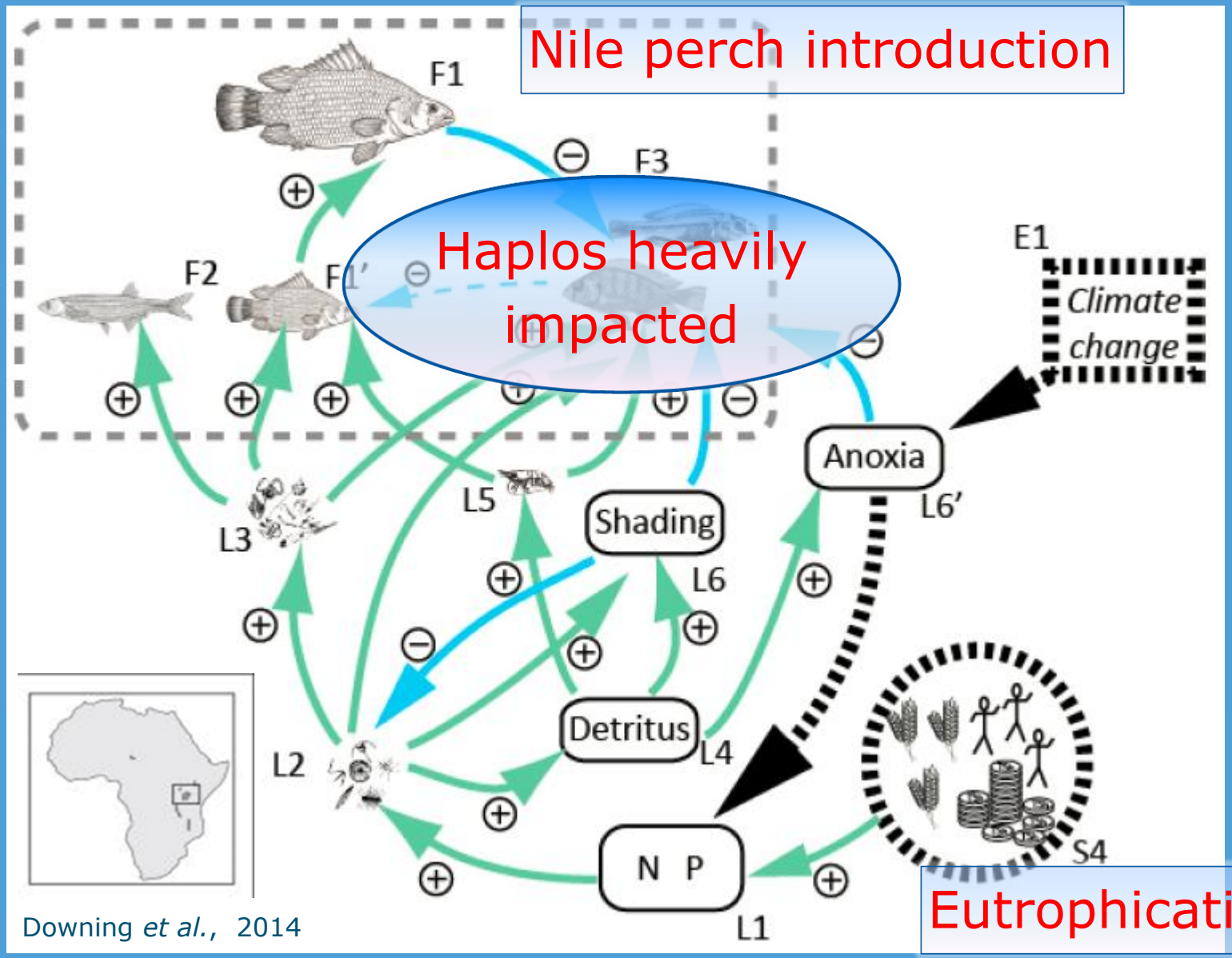
African Great Lakes Conference 2017, 2–5 May, Entebbe, Uganda

WAGENINGEN UNIVERSITY & RESEARCH

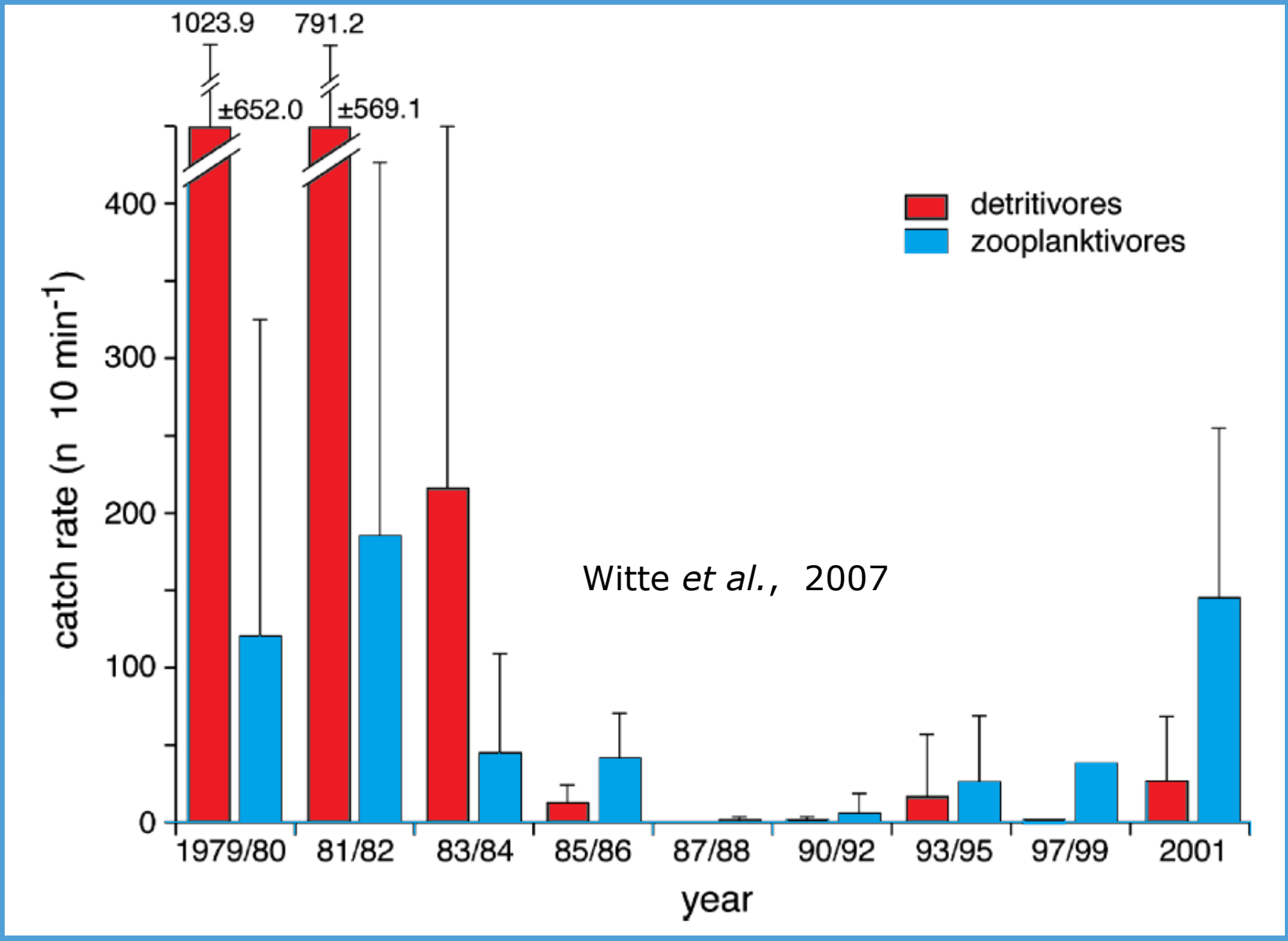
AFRICAN GREAT LAKES CONFERENCE 2017

NIOO

Major ecological changes in Lake Victoria



Some haplos bounce back...



...but have changed

Evol Ecol (2013) 27:253–267
DOI 10.1007/s10682-012-9596-9

ORIGINAL PAPER

Adaptive responses in resurgent Lake Victoria cichlids over the past 30 years

Jacco C. van Rijssel · Frans Witte

ORIGINAL ARTICLE

doi:10.1111/evo.12561

Fast adaptive responses in the oral jaw of Lake Victoria cichlids

Jacco C. van Rijssel,[1,2,3,4,5] Ellen S. Hoogwater,[1] Mary A. Kishe-Machumu,[1,6] Elize van Reenen,[1] Kevin V. Spits,[1] Ronald C. van der Stelt,[1] Jan H. Wanink,[1,7] and Frans Witte[1,2]

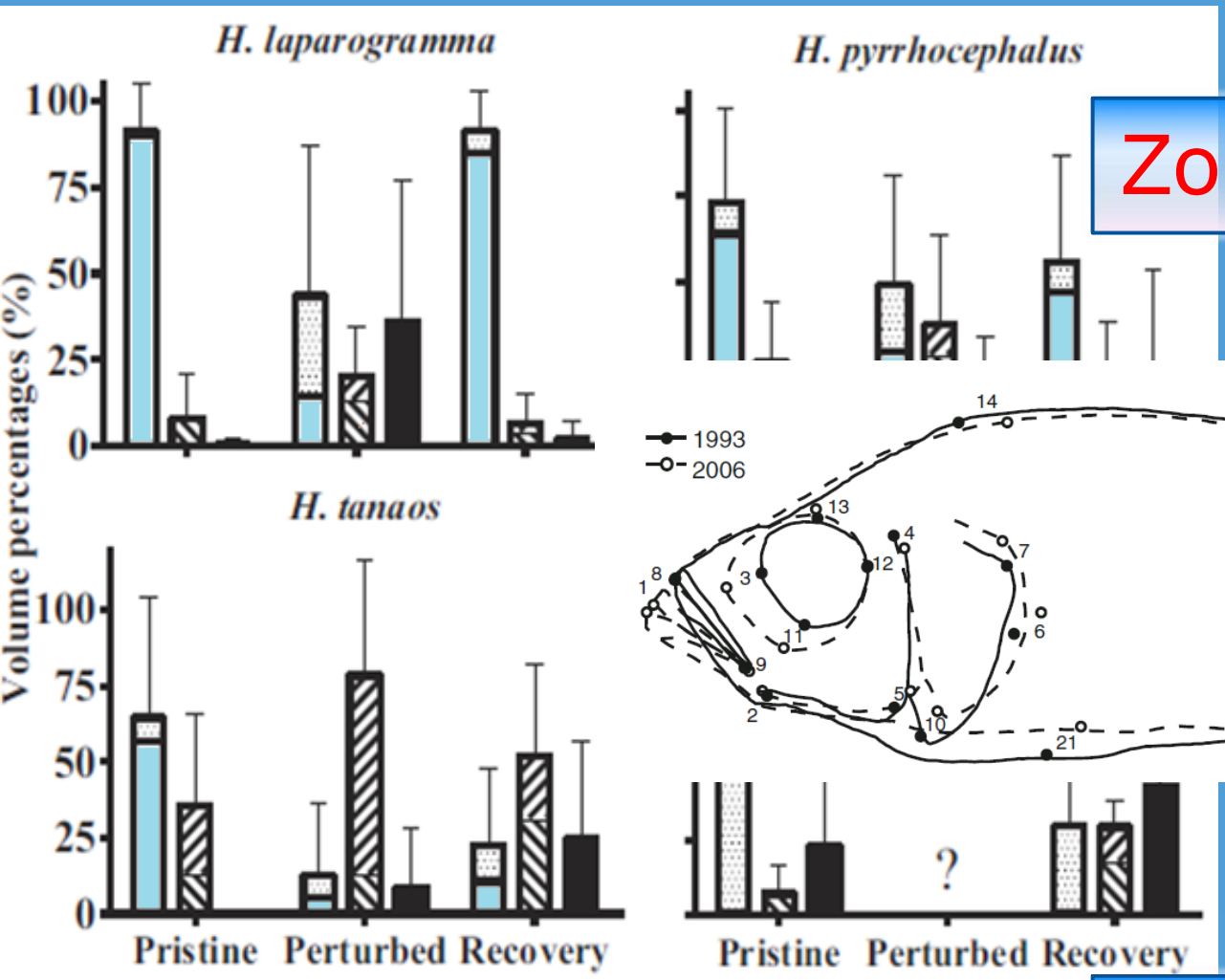
Hydrobiologia (2017) 791:175–191
DOI 10.1007/s10750-016-2790-y

ADVANCES IN CICHLID RESEARCH II

Changing ecology of Lake Victoria cichlids and their environment: evidence from C^{13} and N^{15} analyses

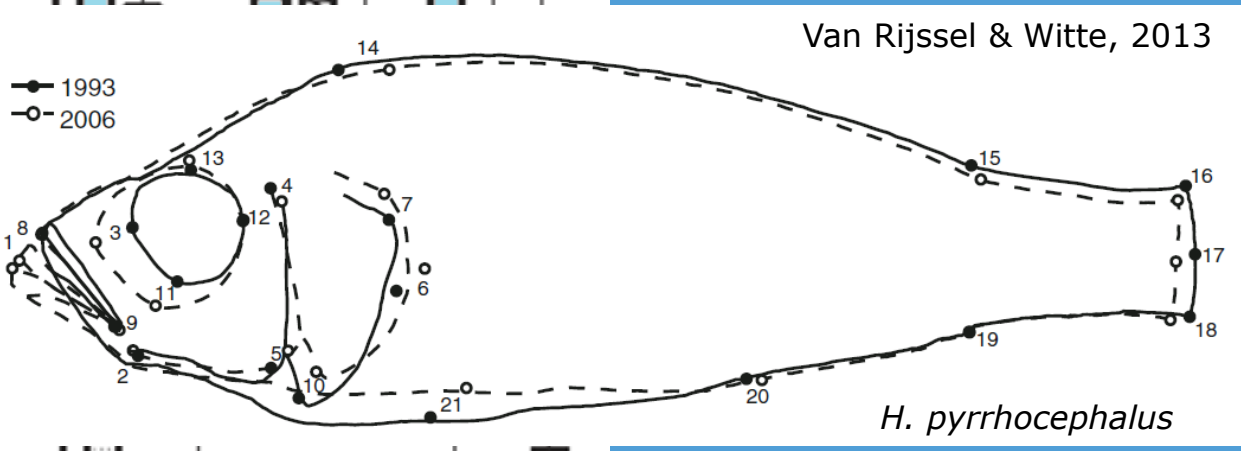
Jacco C. van Rijssel · Robert E. Hecky · Mary A. Kishe-Machumu · F. Witte

...in diet and morphology



Van Rijssel *et al.*, 2015

Zooplanktivores



Van Rijssel & Witte, 2013

Detrivores

WAGENINGEN
UNIVERSITY & RESEARCH

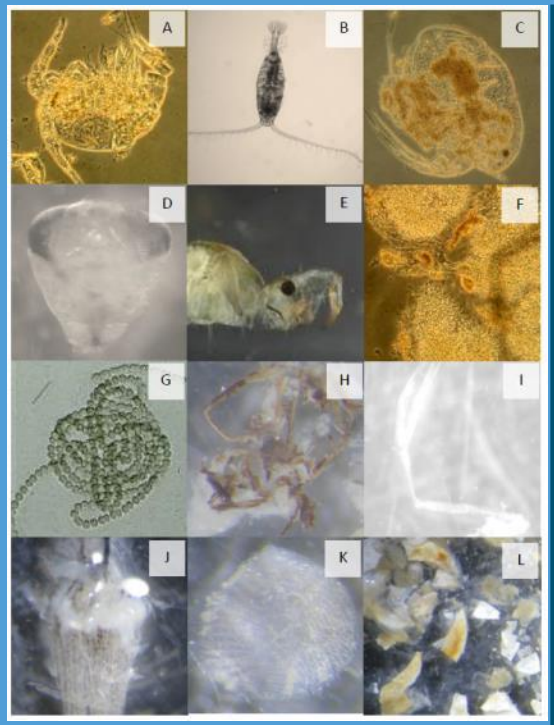
Food-fish model, *s.* Sibbing & Nagelkerke (2001)

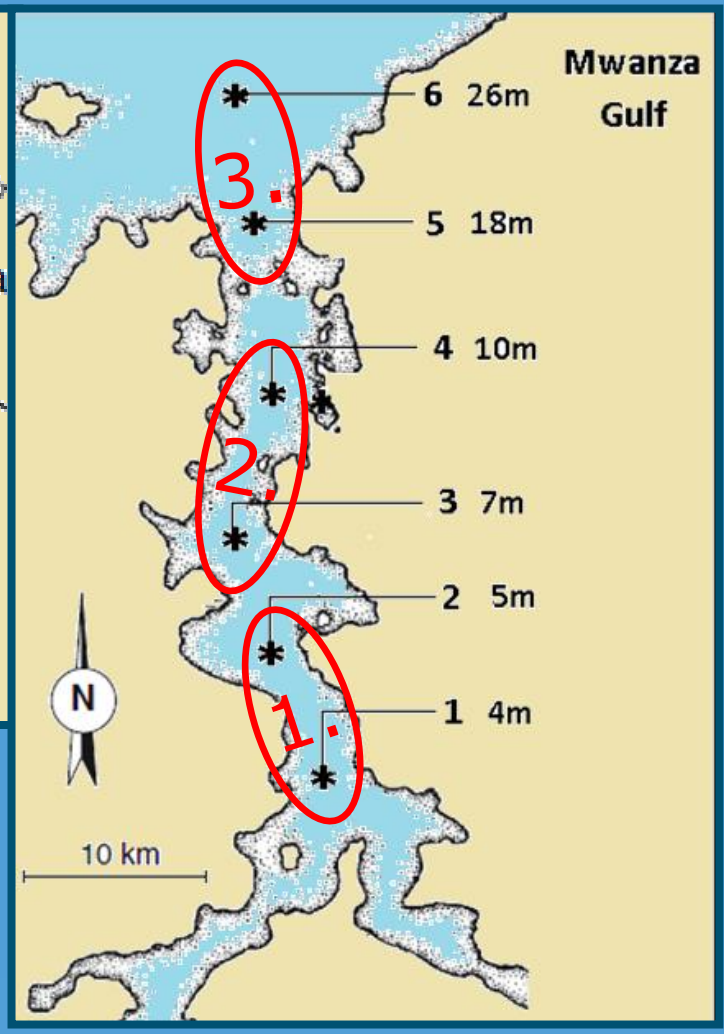
To what extent are diets predictable from individual functional morphology?

Profile	Anal fin area	Body depth	Caudal peduncle depth	Eye diameter	Gill arch resistance
Macrophytes	0	0	0	0	0
Seeds	0.5	0	0	0	0
Detritus/substratum	0.5	0	0	0	0
Zooplankton townet	-1	-1	-1	0	2
Zooplankton pump	0	0	0	1	2
Macro-crustaceans	0	0	0	0	0
Larvae/worms	0.5	0	0	0	0
Macro-insects	1	0	1	0	-0.5
Mollusks	0.5	0	0	0	0
Fish pursuit	-2	-2	-2	0	-2
Fish ambush	2	0	2	0	-1

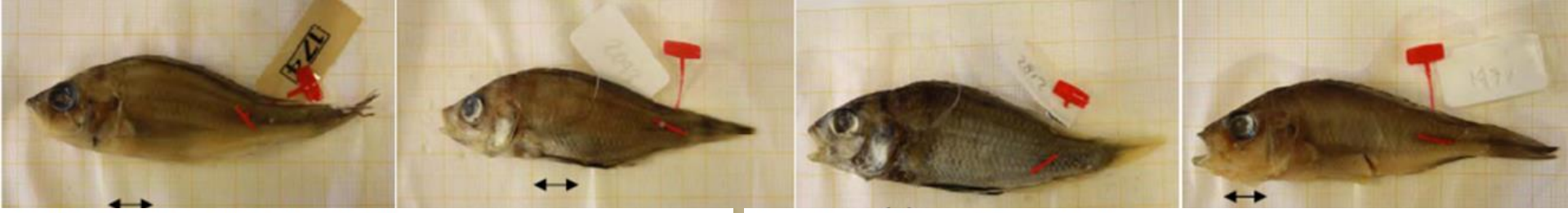
WAGENINGEN
UNIVERSITY & RESEARCH

Materials and methods





- Experimental gillnets and trawling
- surveys 2009 – 2011
- 50 km transect, all seasons
- 17 feeding-related traits measured in 152 haplos
- Stomach analysis



***Haplochromis* sp. "broken bar"**

Yssichromis pyrrhocephalus
Witte & Witte-Maas, 1987

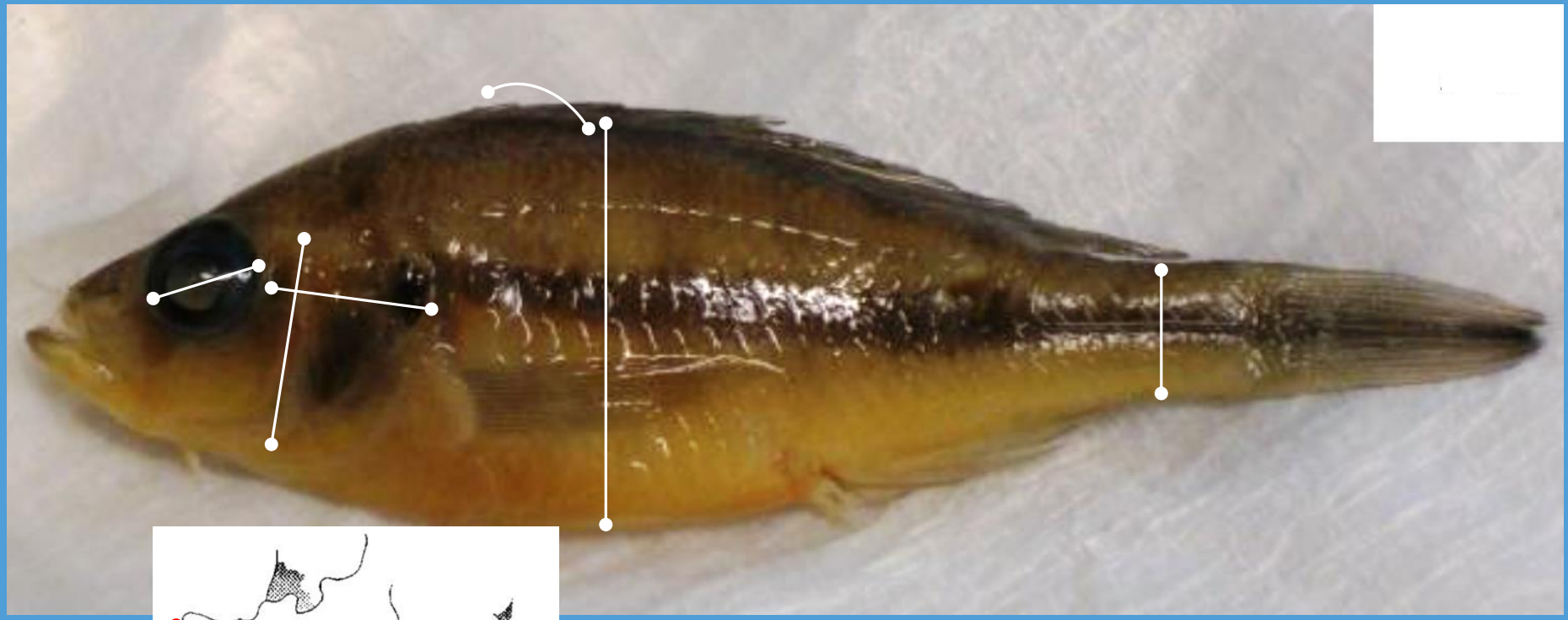
Foto © Josefin Bornlin

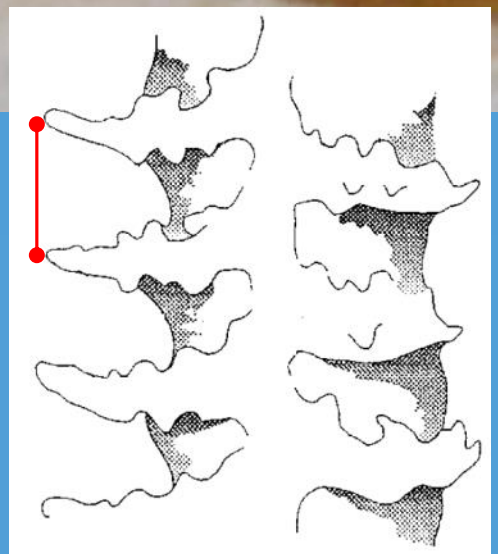
Haplochromis sp. "broken bar" hane.

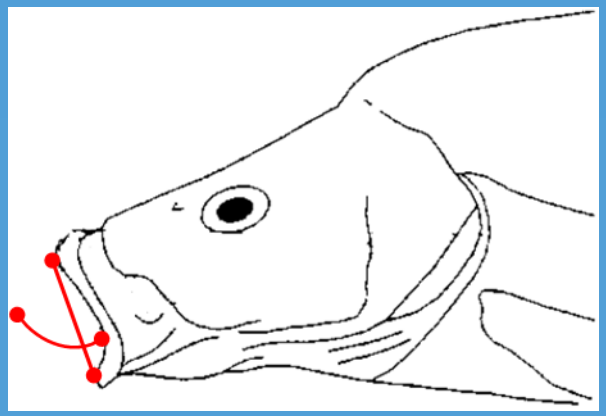
Foto © Michael Persson

Limited to ‘detrivores’ and ‘zooplanktivores’ using trophic group key

Measuring functional morphology

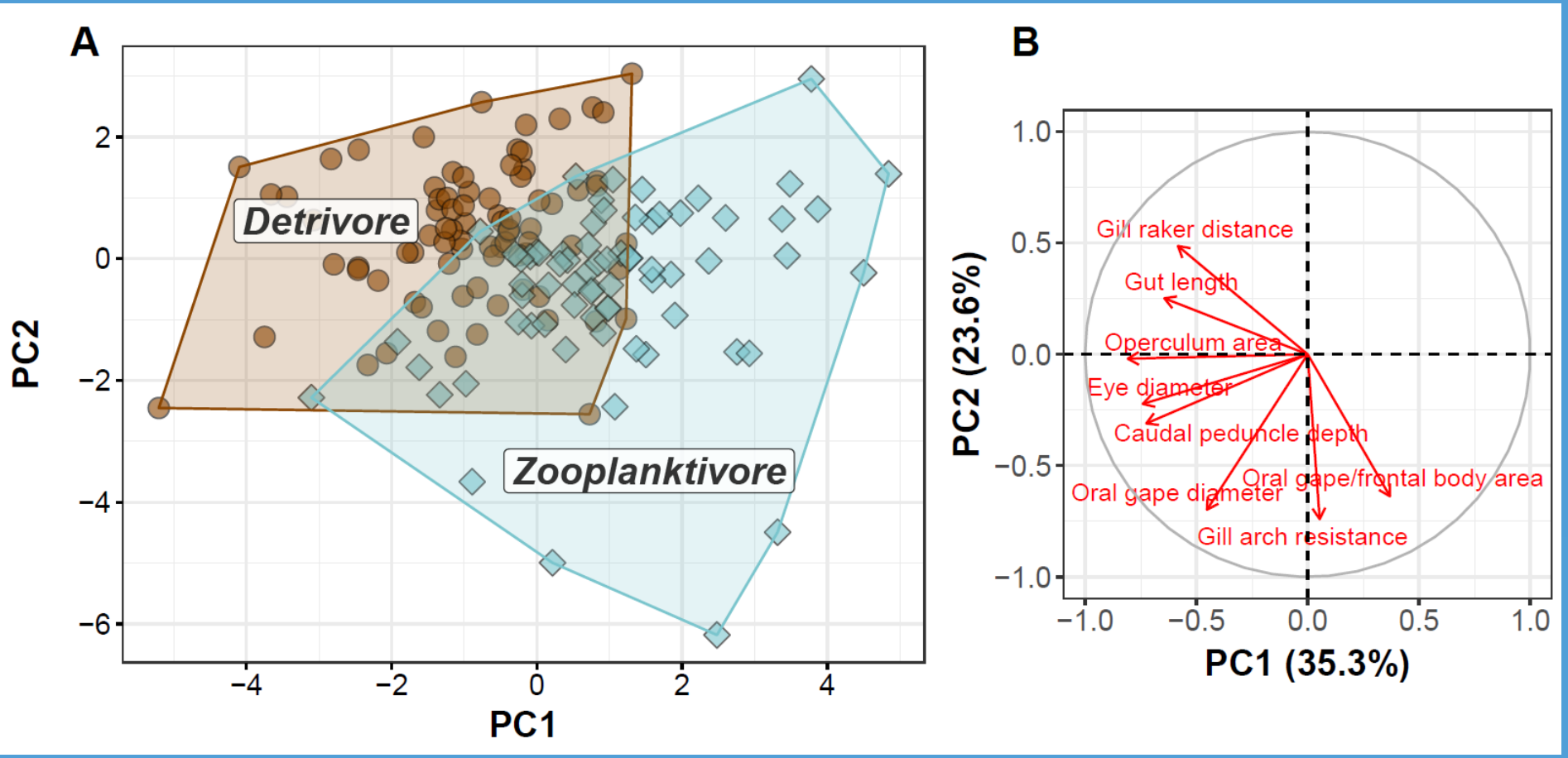






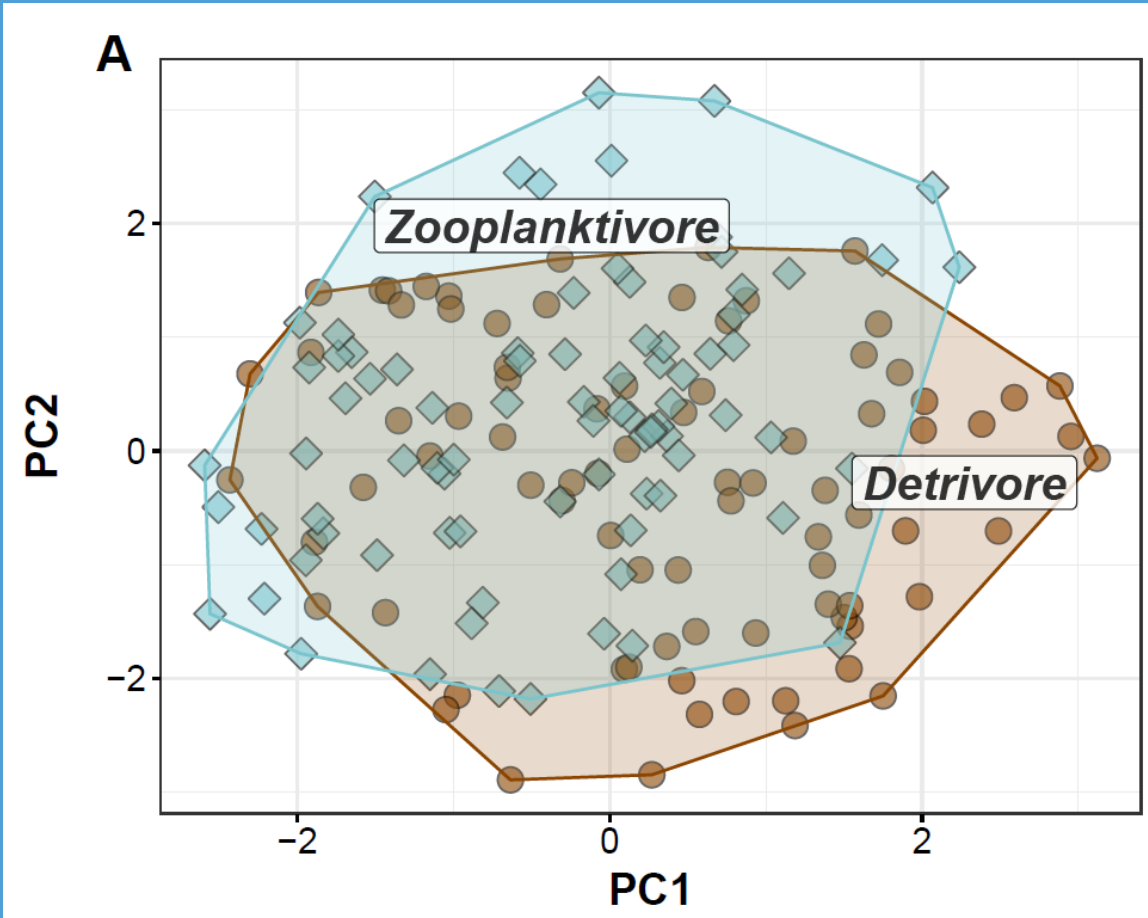
Morphological differentiation

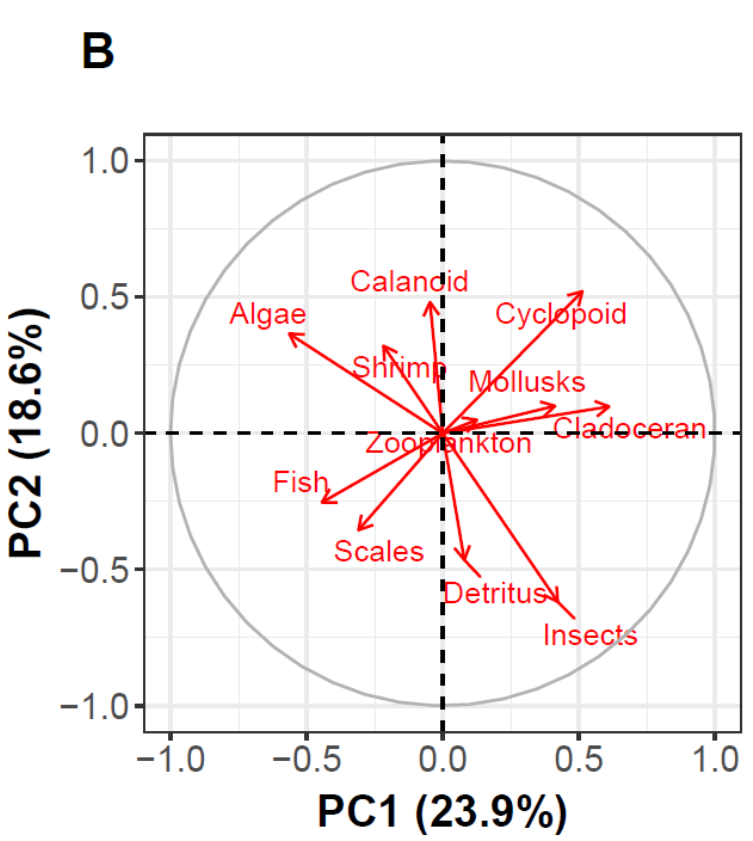
- Consistent functional morphological differences between groups



Individual diets

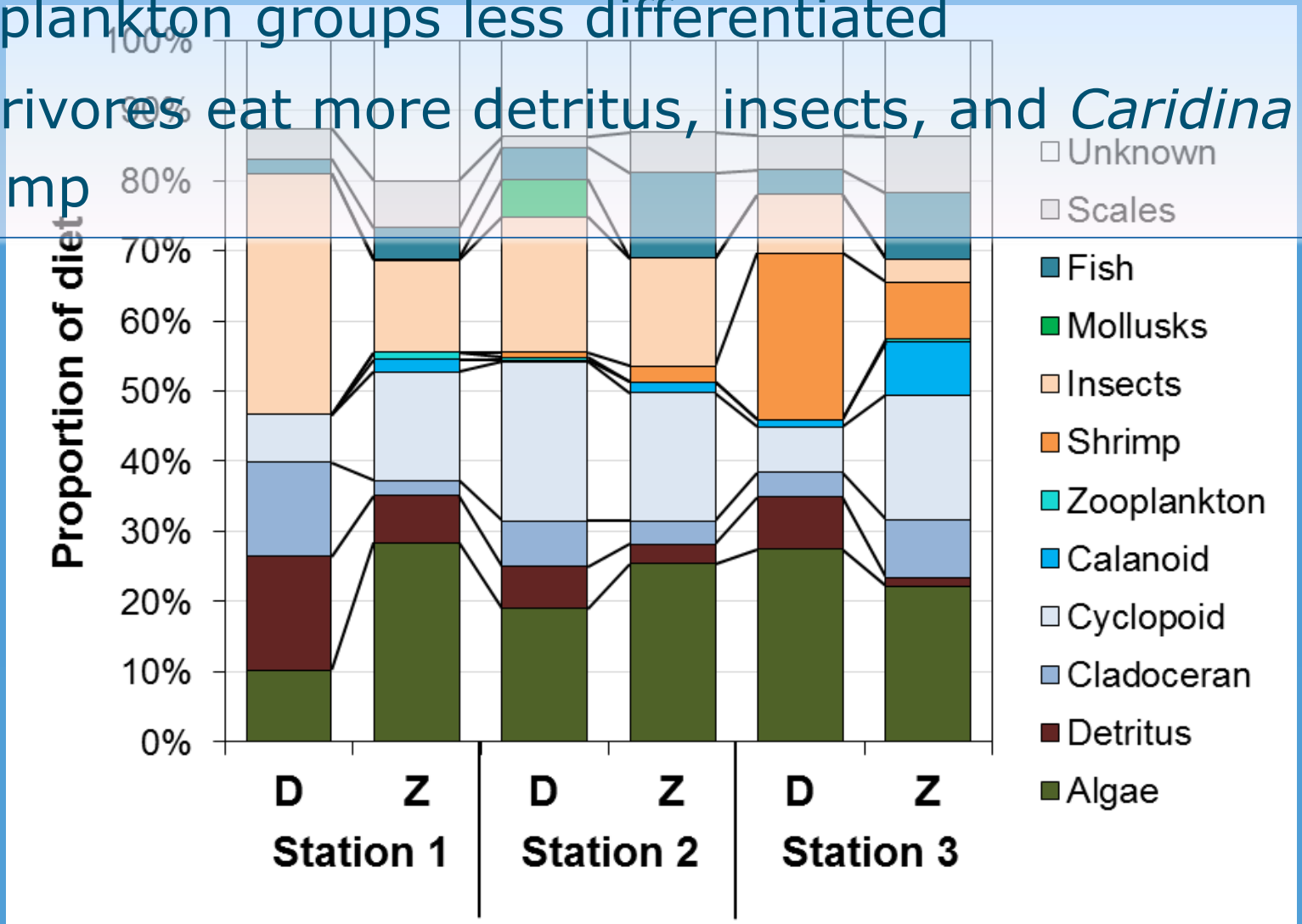
- Zooplanktivores predicted to be better at zooplankton
- Detrivores predicted to be better at insects and detritus



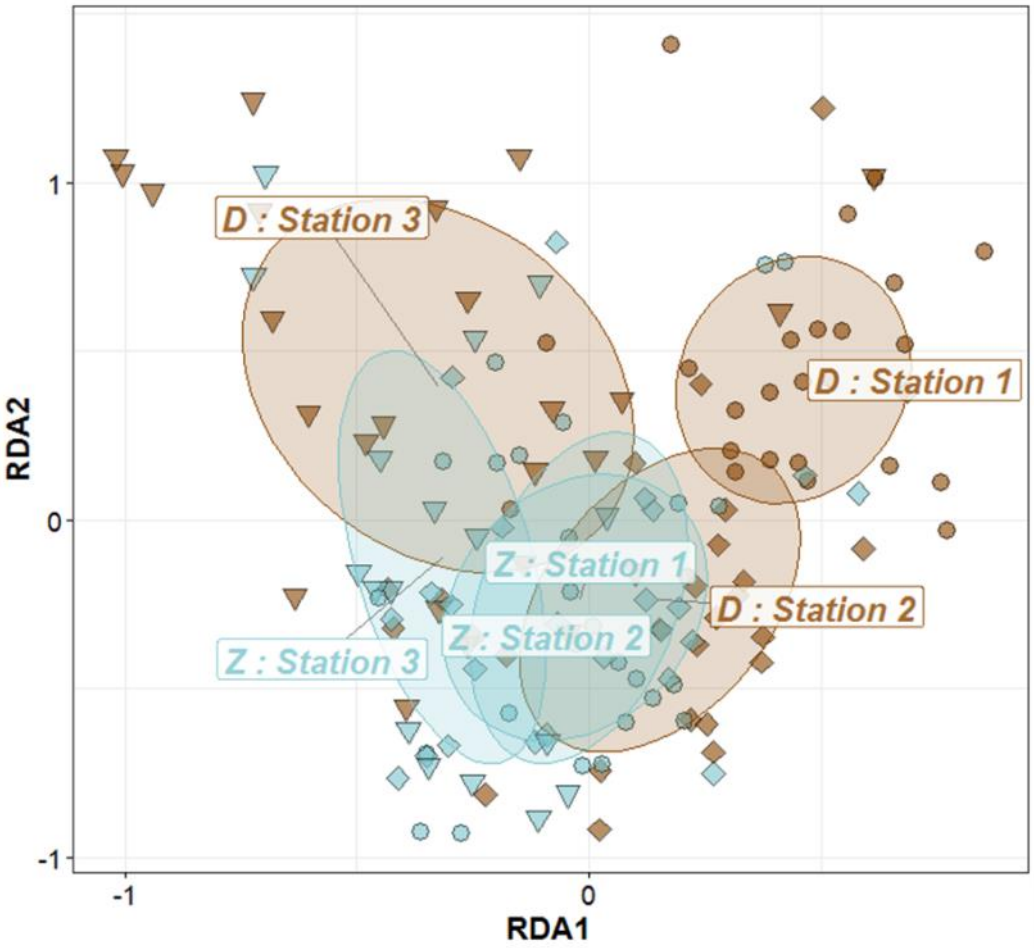


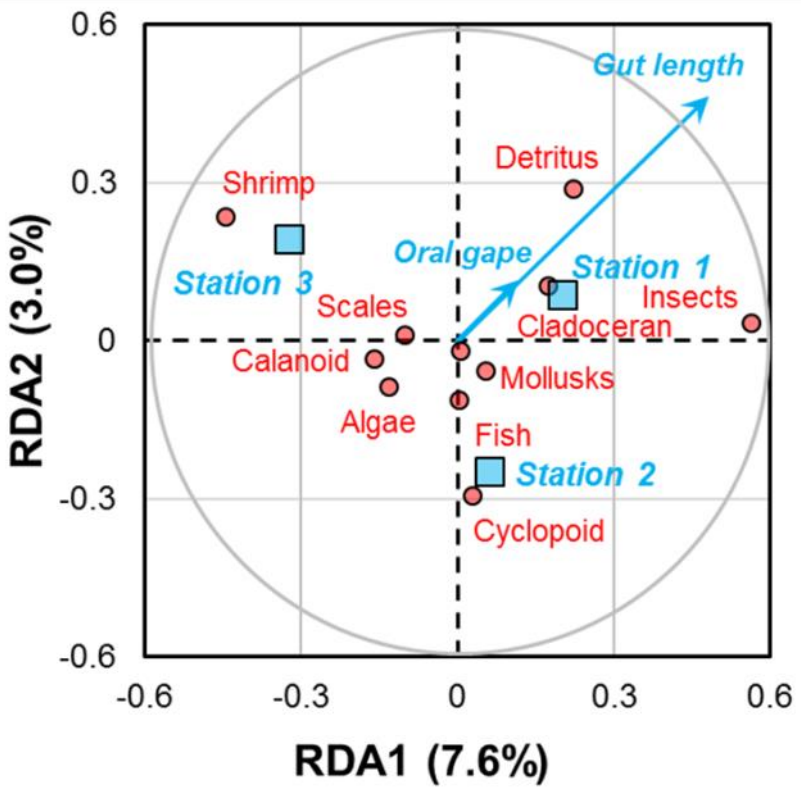
Actual diets

- Zooplanktivores eat more calanoids: rest of zooplankton groups less differentiated
- Detrivores eat more detritus, insects, and *Caridina* shrimp



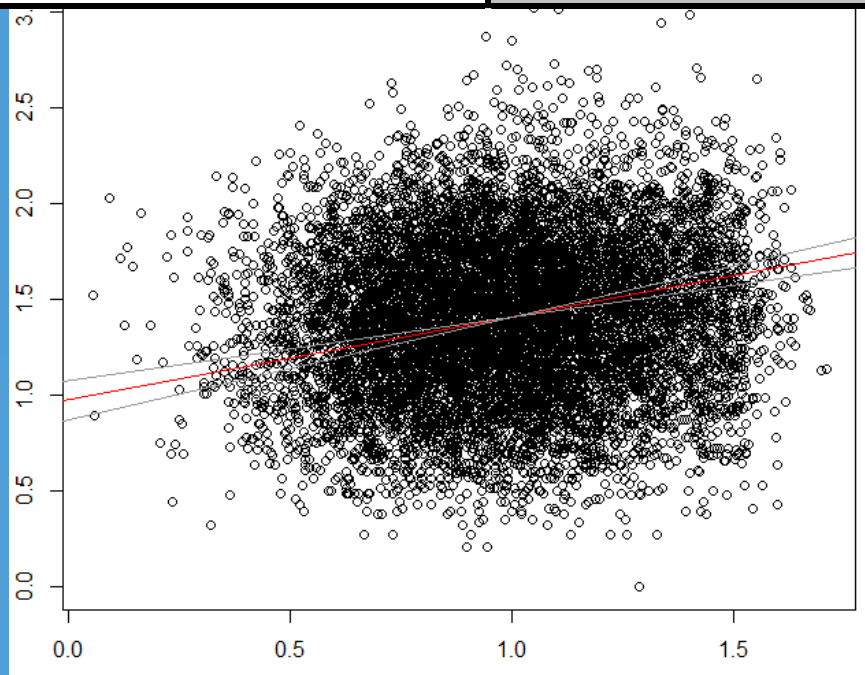
Both morphology and station determine diet, especially for detrivores





Ecomorphological interpretation significantly enhances predictive power of morphology

p-value / Mantel-statistic	Morphology	Predictions	Diet
Morphology		0.000	0.845
Predictions	0.329		0.002
Diet	-0.049	0.081	



WAGENINGEN
UNIVERSITY & RESEARCH

Conclusions

- Detrivorous and zooplanktivorous haplochromines also differ in morphological traits related with feeding
- Differences between both groups are overall as expected, but with a lot of individual variability
- The environment (station) also has a strong influence on diet, especially in detrivores
- **Trophic interpretation of morphology enhances its predictive power**

WAGENINGEN
UNIVERSITY & RESEARCH

Thank you for your attention!

Many thanks to:

- Ilse Cornelissen
- Rara Diantari
- Jeroen Demmer
- Eva Stam
- **All the people at TAFIRI (Mwanza & dar es Salaam**)

WAGENINGEN
UNIVERSITY & RESEARCH