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Austrian
Development Cooperation

SUSFISH
Sustainable Management of Water and
Fish Resources in Burkina Faso



University of Natural Resources
and Life Sciences, Vienna
Department of Water, Atmosphere
and Environment

"Fish Assemblages and Habitat Use in the Upper Nakambe catchment, Burkina Faso"

Composed by
Paul Meulenbroek Bakk.techn.

Academic Supervisors

Ao.Univ.Prof. Dipl.-Ing. Dr.nat.techn. Stefan SCHMUTZ
Dipl.-Ing. Dr. nat.techn. Andreas H. MELCHER

IHG – Institute of Hydrobiology and Aquatic Ecosystem Management,
WAU – Department of Water, Atmosphere and Environment, BOKU

Conclusions

- Combination of fishing methods cause of limitations and exclusive species
- Roeflection Curve, 15 habitat site are enough to catch 95% of the species
- Temperature effects abundance and species richness (Reservoir, shading)
- Spatial differences
- Different habitat use of species

Introduction



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Methods



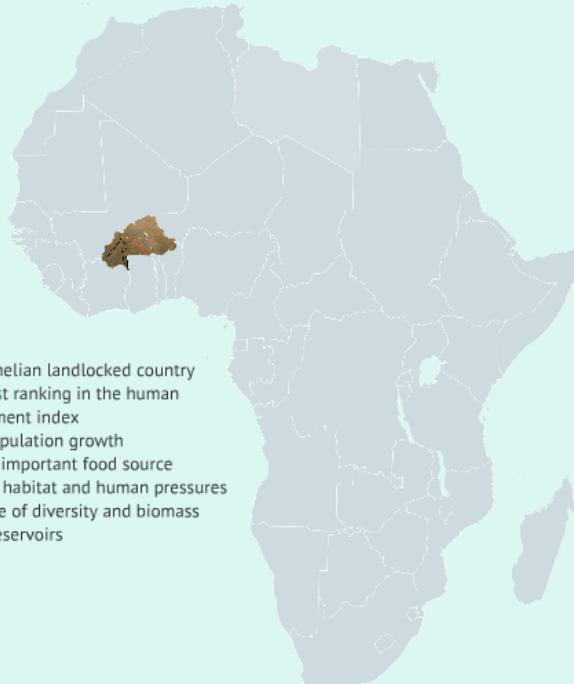
Results



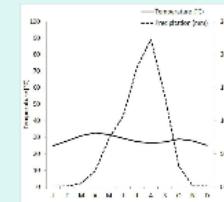
Discussion



Introduction



- sub Sahelian landlocked country
- fifth last ranking in the human development index
- Fast population growth
- Fish as important food source
- Loss of habitat and human pressures
-> decline of diversity and biomass
- 1400 reservoirs

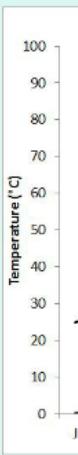


Overall Goals:

- gain knowledge on **habitat use of fish** in general and for key species in the Upper Nakambe catchment and
- to **compare the conducted methods** (traditional cast net fishing and electric fishing).

The specific objectives are:

- 1) to analyze fish assemblages and their **spatial distribution**
- 2) to discuss the appropriate **fishing method** and make recommendations for further fish sampling activities in Burkina Faso,
- 3) to quantify the available habitat conditions,
- 4) to assess the effect of habitat parameter on species richness and abundances,
- 5) to analyze habitat use of **four key species** namely *Laheo cubie*, *Chelæthiops bibie*, *Bagrus bajad* and *Lates niloticus* and their populations structure.



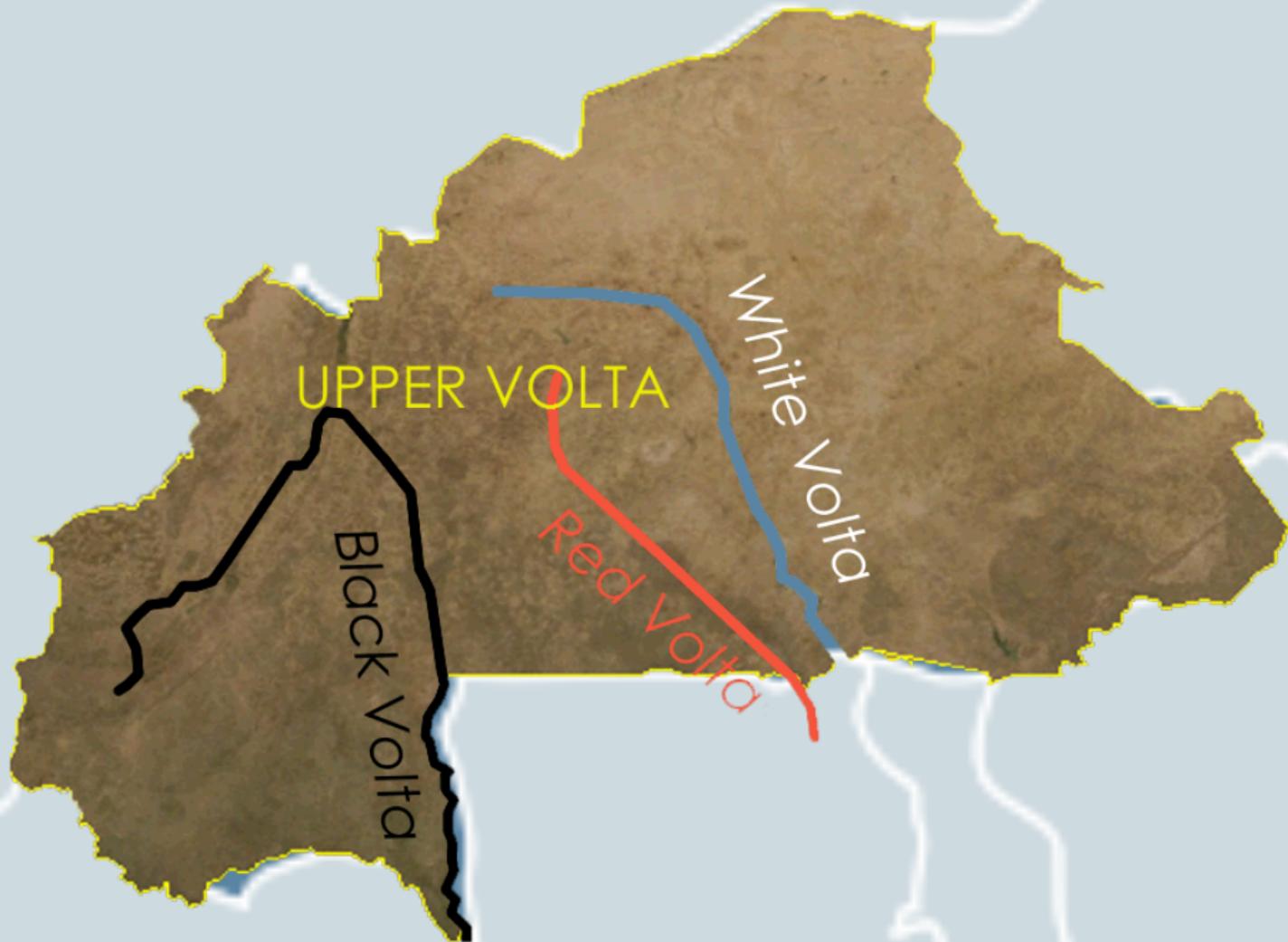
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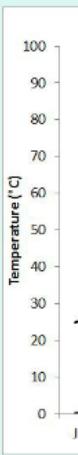
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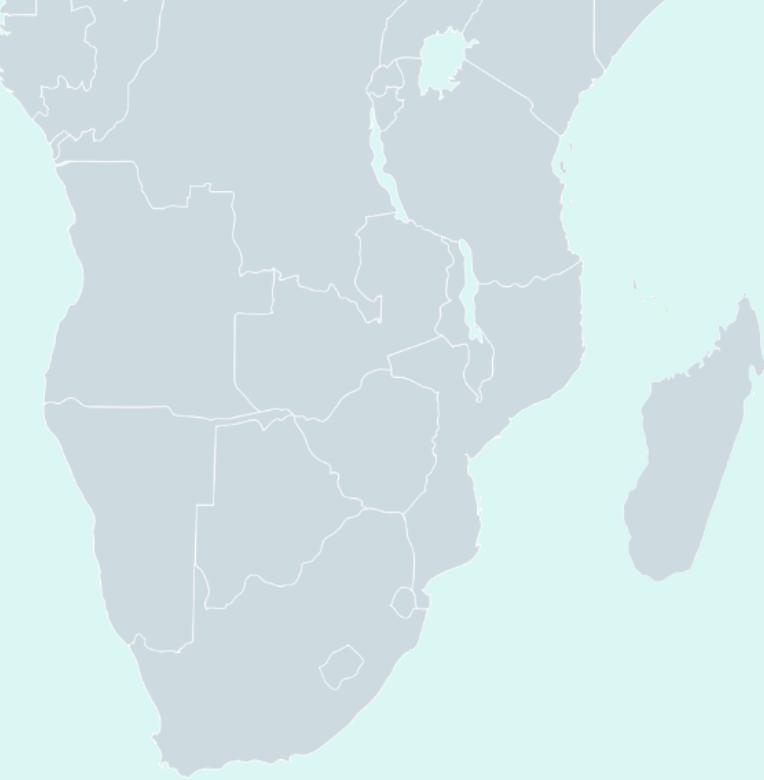
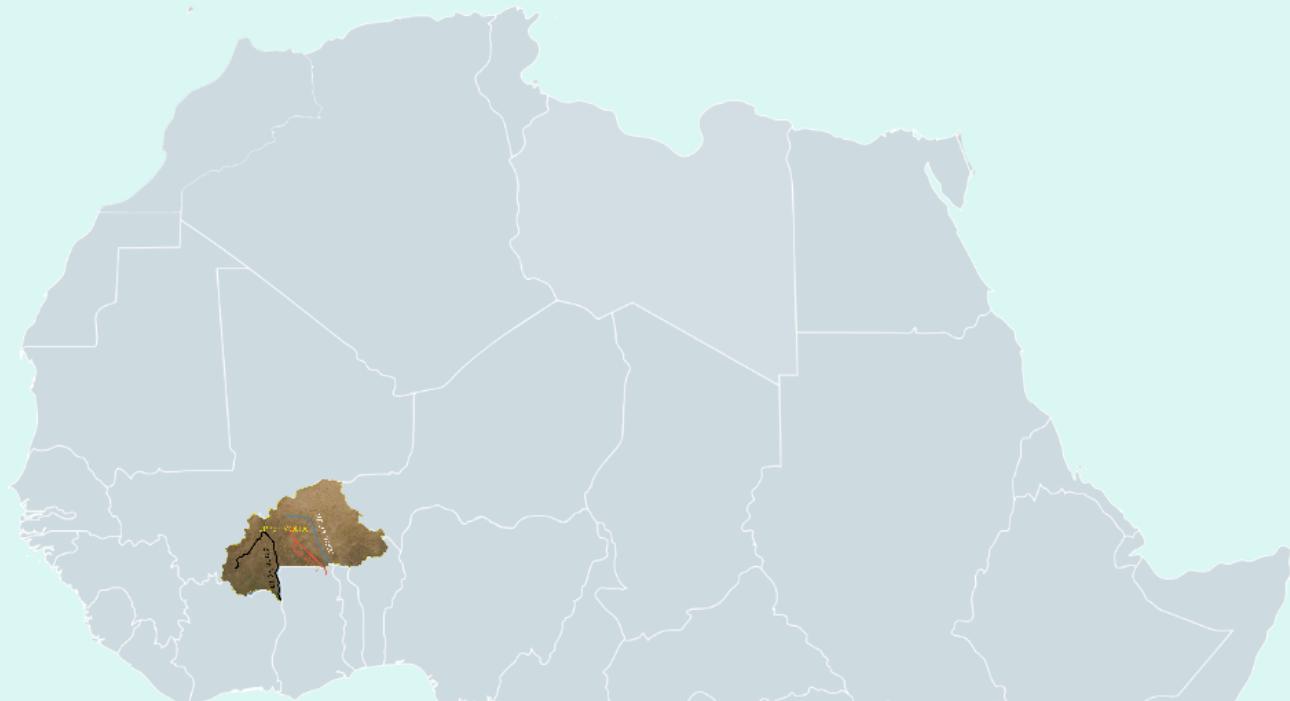




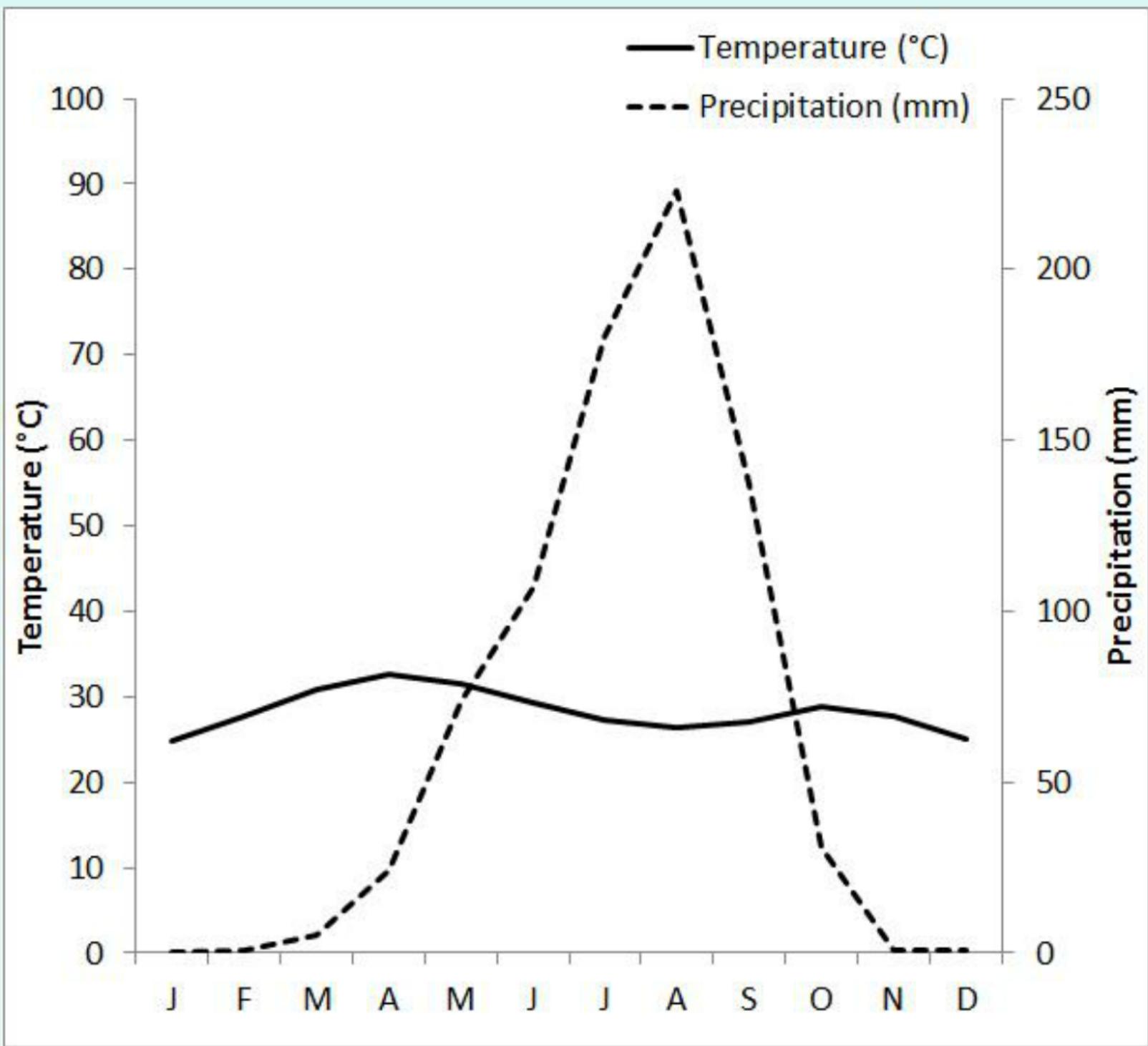
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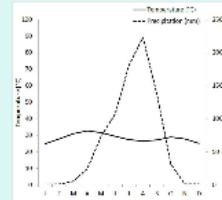
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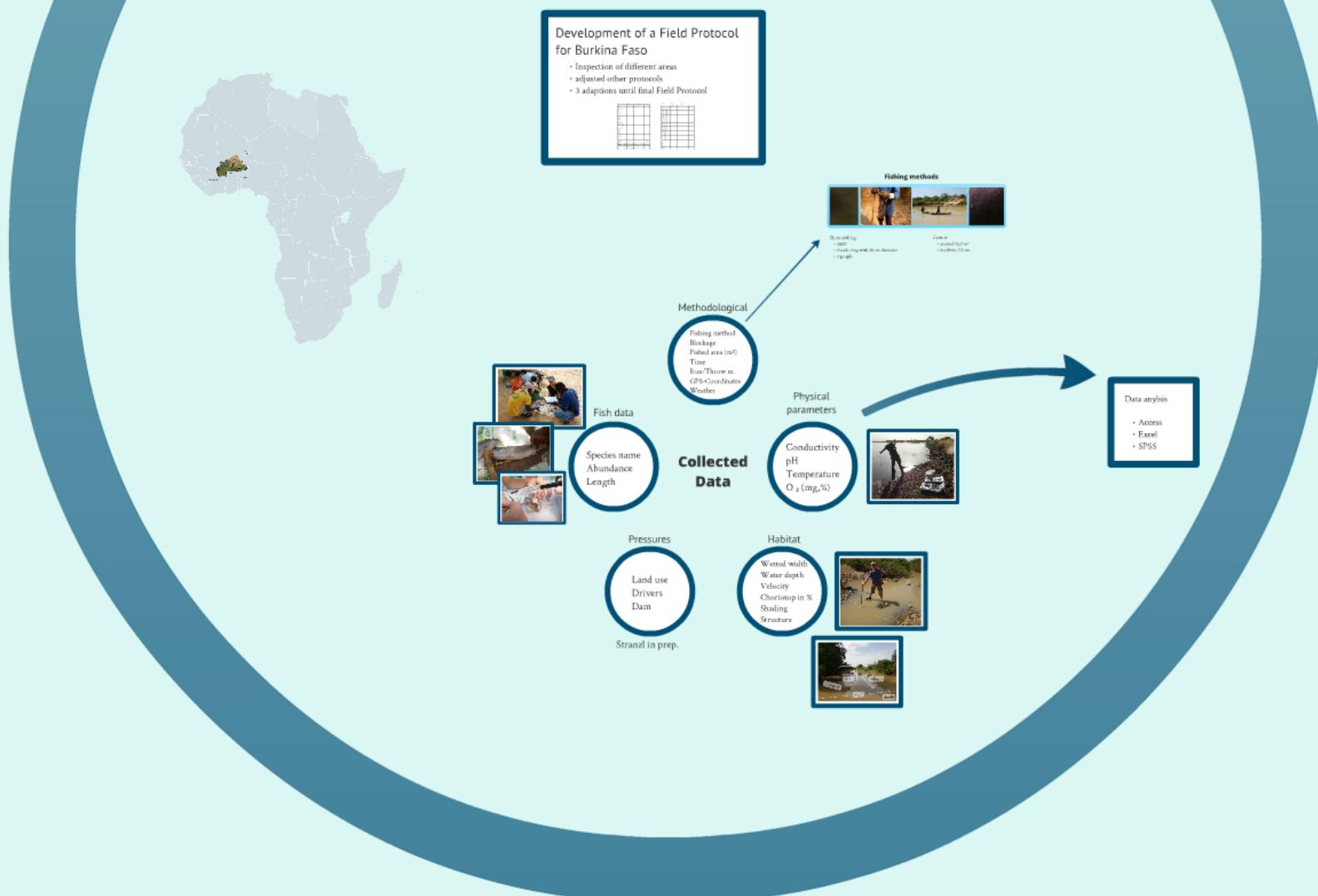
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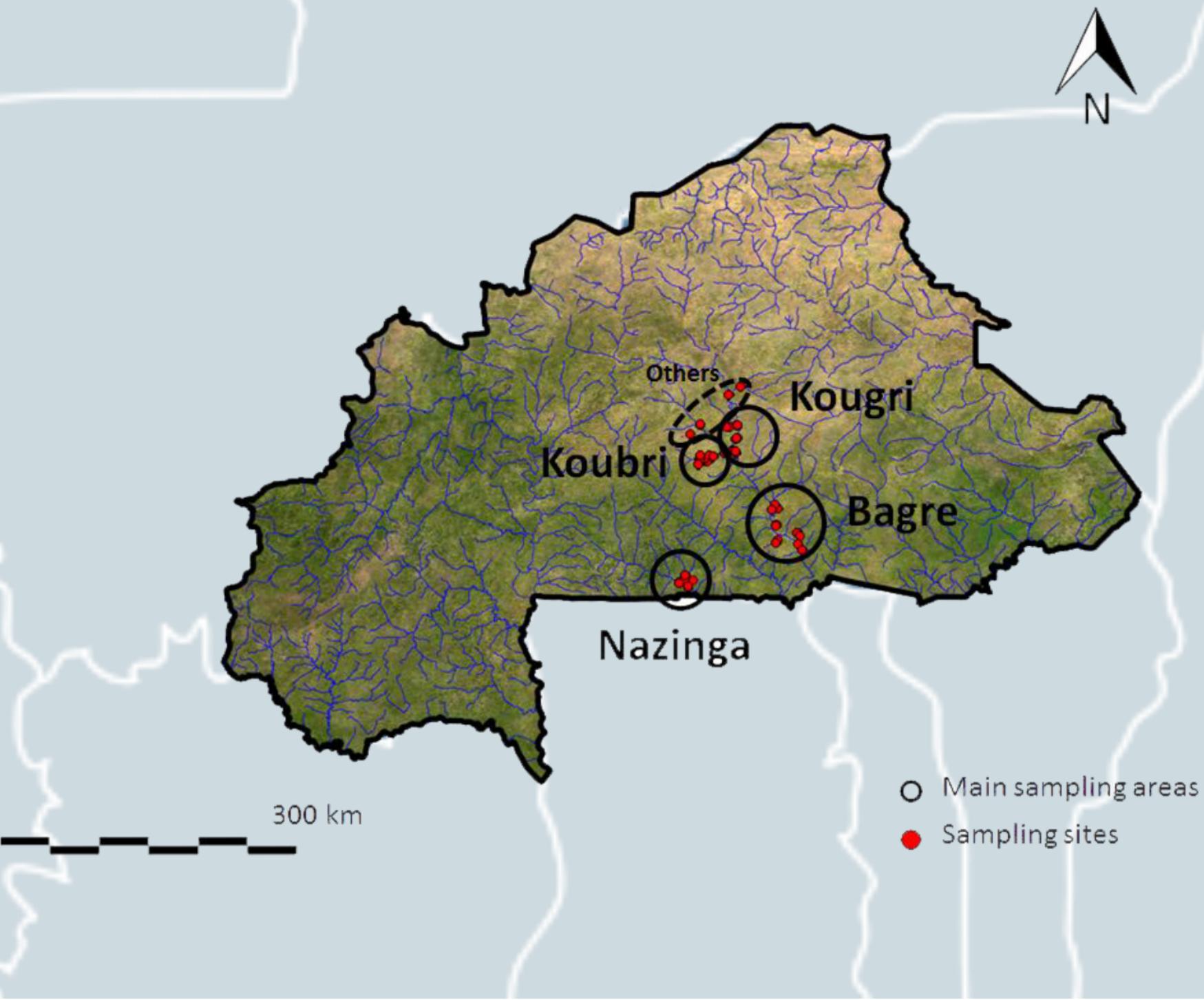
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Methods









Development of a Field Protocol for Burkina Faso

- Inspection of different areas
- adjusted other protocols
- 3 adaptions until final Field Protocol

| Site Protocol | Site Name | Date (dd/mm/yyyy) | | | | | |
|------------------------|-----------|-------------------|----|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Location | | | | | | | |
| Season | | | | | | | |
| Water | | | | | | | |
| DPS Location (N/E) | | | | | | | |
| DPS Core depth | | | | | | | |
| Sampling location | | | | | | | |
| Water type | | | | | | | |
| Water flow | | | | | | | |
| Phytoplankton | | | | | | | |
| Wheather | | | | | | | |
| Sampling method | | | | | | | |
| Water type | | | | | | | |
| Water depth (m) | | | | | | | |
| Bottom water depth (m) | | | | | | | |
| Conductivity (µS/cm) | | | | | | | |
| pH | | | | | | | |
| Dissolved O2 | | | | | | | |
| DsO2 | | | | | | | |
| DsO2mg | | | | | | | |
| Prochlorococcus | | | | | | | |
| Spirulina | | | | | | | |
| Microcystis | | | | | | | |
| Chlorophyll a | | | | | | | |
| Chlorophyll b | | | | | | | |
| Chlorophyll c1 | | | | | | | |
| Chlorophyll c2 | | | | | | | |
| Chlorophyll d | | | | | | | |
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| Chlorophyll k | | | | | | | |
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| Chlorophyll dd | | | </ | | | | |

| Site Protocol | | Site Name..... | | Date (dd/mm/yy) | | | | |
|-------------------------------|------------|----------------|----------------|-----------------------|----------------|----------------|--------------|-----------|
| Habitat | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Description | | | | | | | | |
| Writer | | | | | | | | |
| GPS-point (N/E) | | | | | | | | |
| GPS-Coordinat | | | | | | | | |
| Run/Throw nr. | | | | | | | | |
| Start time | | | | | | | | |
| End time | | | | | | | | |
| Photo nr. | | | | | | | | |
| Weather | | | | | | | | |
| Fishing method | | | | | | | | |
| Blockage | | | | | | | | |
| Water type | | | | | | | | |
| Fished area (m ²) | | | | | | | | |
| Distance bank (m) | | | | | | | | |
| Secchi depth (cm) | | | | | | | | |
| Conductivity (µS/cm) | | | | | | | | |
| pH | | | | | | | | |
| Temperature (°C) | | | | | | | | |
| O ₂ (%) | | | | | | | | |
| O ₂ (mg) | | | | | | | | |
| Probe nr. | | | | | | | | |
| Landuse | | | | | | | | |
| Impact | | | | | | | | |
| Shading (%) | | | | | | | | |
| Structure | | | | | | | | |
| Dam | | | | | | | | |
| CATEGORIES | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| weather | sun | cloud | rain | wind | | | | |
| fishing method | 1 aggregat | 2 aggregat | gill net | cast net | longline | Nasse fishing | commercial | |
| blockage | net | electric | barrier | | | | | |
| water type | reservoir | running | con sidarm | dead sidarm | pond | Dissipation | channel | |
| Landuse | savanna | rice | agriculture | livestock | settlements | roads | forest | protected |
| | 9 cotton | 10 vegetables | | | | | | |
| structure | tree | xylal | rock | waterpants | reed | outwashed bank | | |
| impact | fishing | sandmining | water abstract | deforestation | channalisation | invasiv plant | nutrient inp | riprap |
| dam | upstream | downstream | between | free flowing | | | | |

Development of a Field Protocol for Burkina Faso

- Inspection of different areas
- adjusted other protocols
- 3 adaptions until final Field Protocol

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|------------------------|-----------|-------------------|----|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Location | | | | | | | |
| Season | | | | | | | |
| Water | | | | | | | |
| DPS Location (N/E) | | | | | | | |
| DPS Core depth | | | | | | | |
| Sampling location | | | | | | | |
| Water type | | | | | | | |
| Water flow | | | | | | | |
| Phytoplankton | | | | | | | |
| Wheather | | | | | | | |
| Sampling method | | | | | | | |
| Water type | | | | | | | |
| Water depth (m) | | | | | | | |
| Bottom water depth (m) | | | | | | | |
| Conductivity (µS/cm) | | | | | | | |
| pH | | | | | | | |
| Dissolved O2 | | | | | | | |
| DsO2 | | | | | | | |
| DsO2mg | | | | | | | |
| Prochlorococcus | | | | | | | |
| Spirulina | | | | | | | |
| Microcystis | | | | | | | |
| Chlorophyll a | | | | | | | |
| Chlorophyll b | | | | | | | |
| Chlorophyll c1 | | | | | | | |
| Chlorophyll c2 | | | | | | | |
| Chlorophyll d | | | | | | | |
| Chlorophyll e | | | | | | | |
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| Chlorophyll aa | | | | | | | |
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| Chlorophyll bc | | | </ | | | | |

Methodological

- Fishing method
- Blockage
- Fished area (m^2)
- Time
- Run/Throw nr.
- GPS-Coordinates
- Weather

Fish data

- Species name
- Abundance
- Length



Collected Data

Physical parameters

- Conductivity
- pH
- Temperature
- O₂ (mg,%)



Pressures

- Land use
- Drivers
- Dam

Stranzl in prep.

Habitat

- Wetted width
- Water depth
- Velocity
- Choriotop in %
- Shading
- Structure



Fishing methods



Electrofishing

- 500V
- Anode ring with 30 cm diameter
- 3 people

Castnet

- around 15,2 m²
- meshsize 2,5 cm

Methodological

- Fishing method
- Blockage
- Fished area (m^2)
- Time
- Run/Throw nr.
- GPS-Coordinates
- Weather

Fish data

- Species name
- Abundance
- Length



Collected Data

Physical parameters

- Conductivity
- pH
- Temperature
- O₂ (mg,%)



Pressures

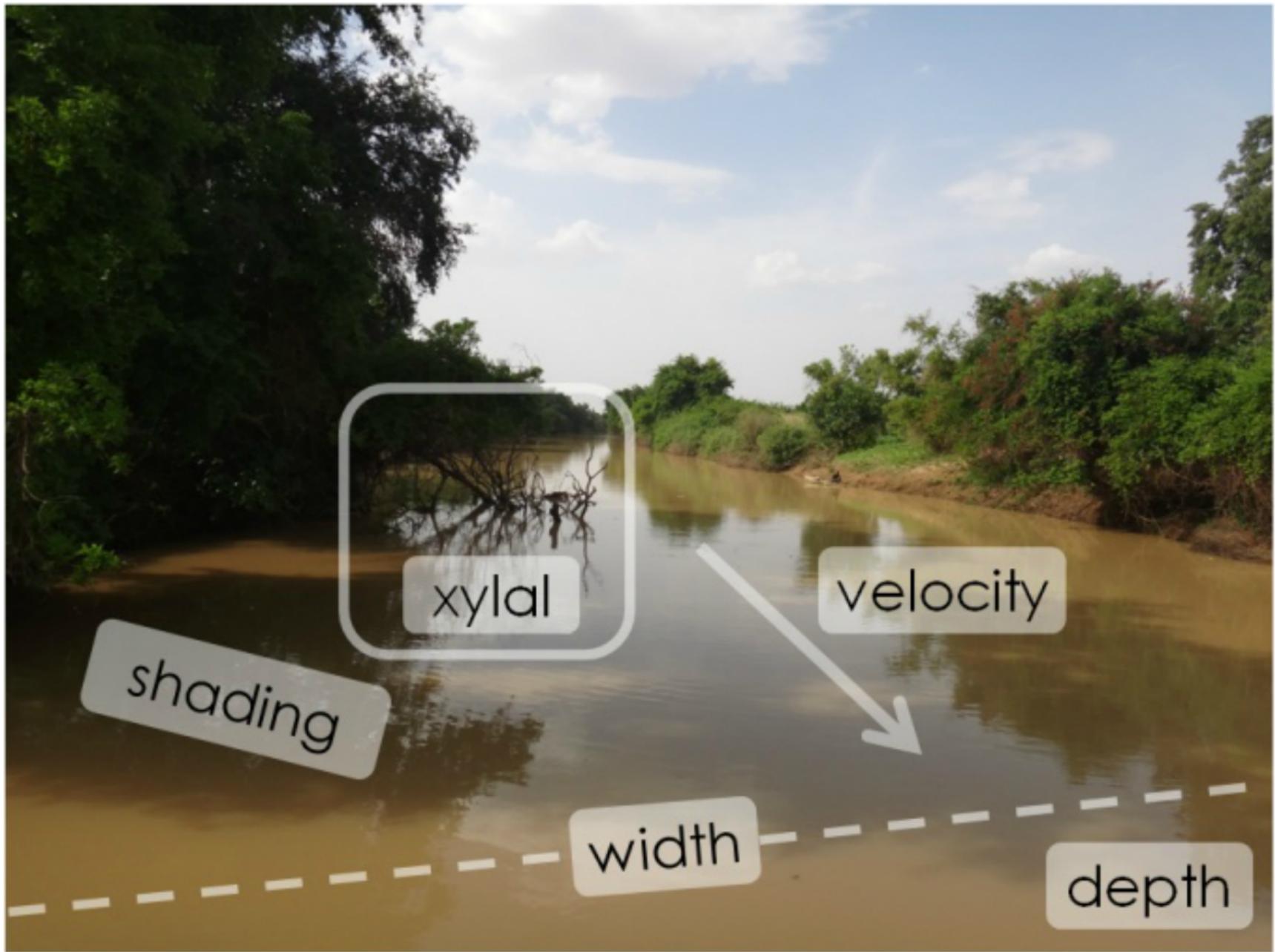
- Land use
- Drivers
- Dam

Stranzl in prep.

Habitat

- Wetted width
- Water depth
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Methodological

- Fishing method
- Blockage
- Fished area (m^2)
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Collected Data

Physical parameters

- Conductivity
- pH
- Temperature
- O₂ (mg,%)



Pressures

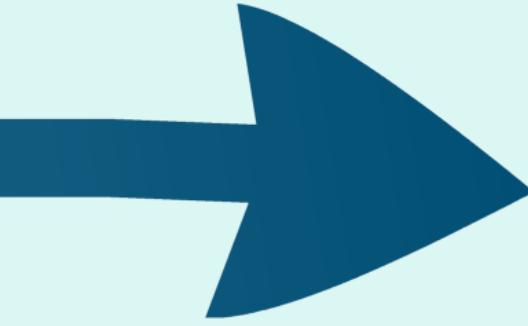
- Land use
- Drivers
- Dam

Stranzl in prep.

Habitat

- Wetted width
- Water depth
- Velocity
- Choriotop in %
- Shading
- Structure

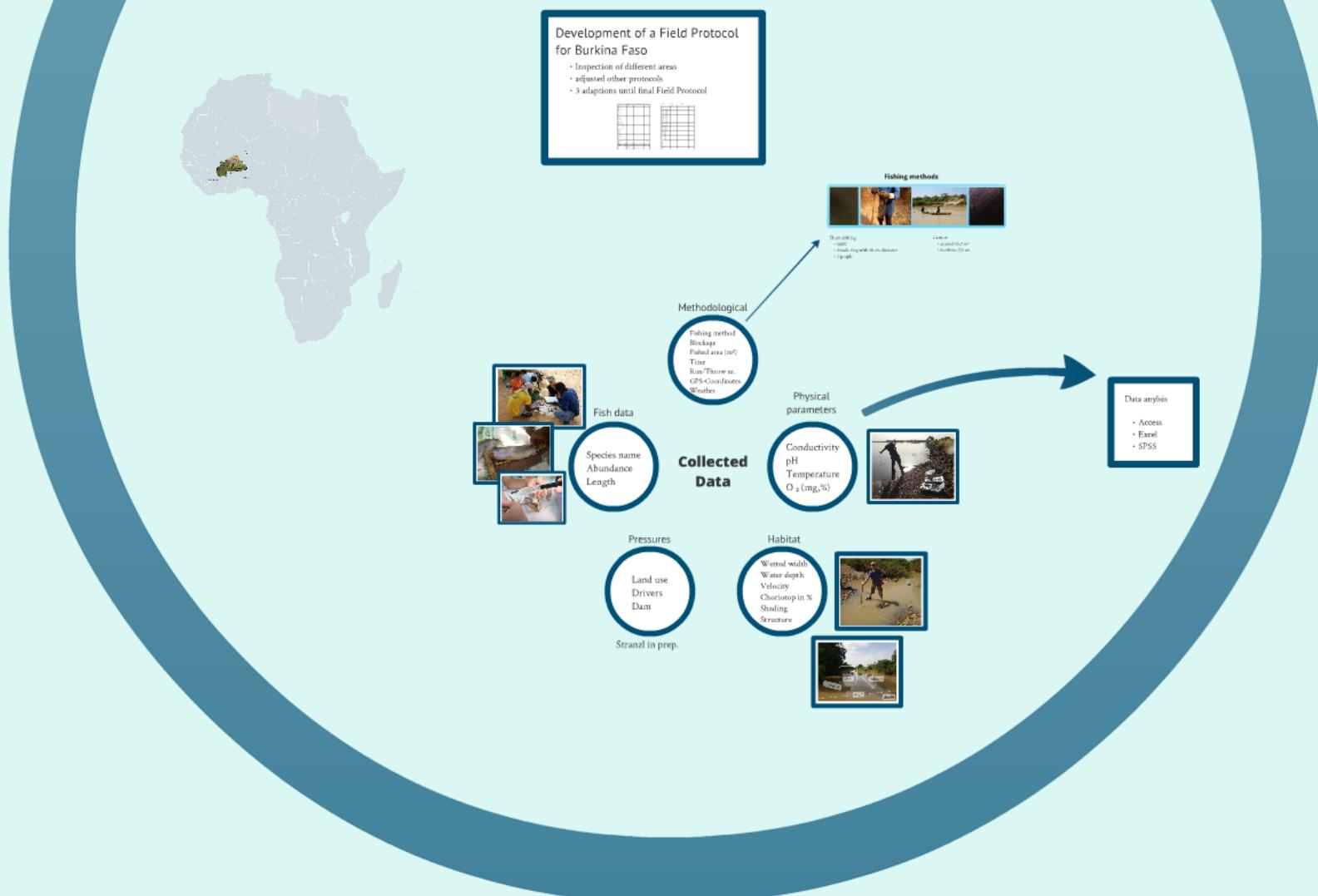




Data analysis

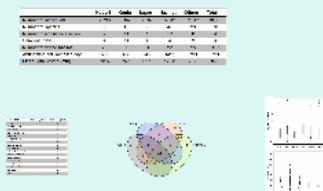
- Access
- Excel
- SPSS

Methods



Results

Fish asssemblages

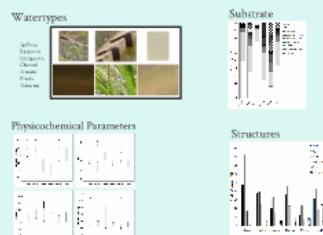


Methods

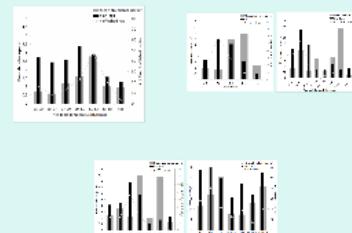


Habitat

Available Habitat conditions



Habitat use at community level



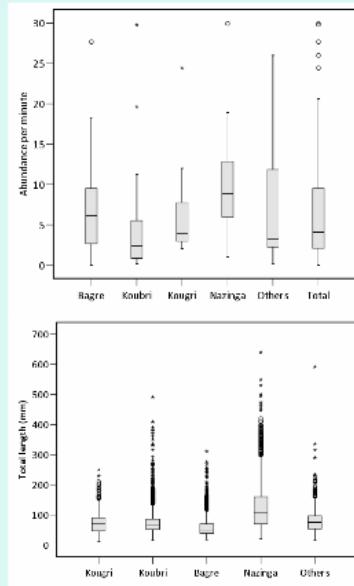
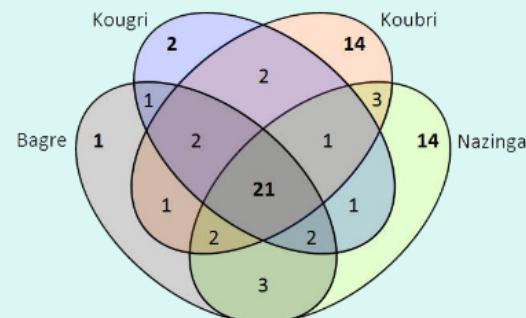
Habitat use and population structure for selected species



Fish assamblages

| | Kougri | Koubri | Bagre | Nazinga | Others | Total |
|-----------------------------|--------|--------|-------|---------|--------|--------|
| Number of individuals | 2,738 | 5,040 | 2,567 | 5,643 | 2,347 | 18,335 |
| Number of species | 33 | 45 | 33 | 47 | 33 | 70 |
| Number of exclusive species | 2 | 11 | 1 | 12 | 0 | 26 |
| Sampling days | 4 | 11 | 4 | 4 | 3 | 26 |
| Number of fished habitat | 23 | 53 | 34 | 22 | 25 | 157 |
| Abundance per sampling day | 685 | 458 | 642 | 1411 | 799 | 799 |
| Mean Total length (mm) | 73.5 | 76.1 | 61.1 | 123.8 | 78.8 | 86.9 |

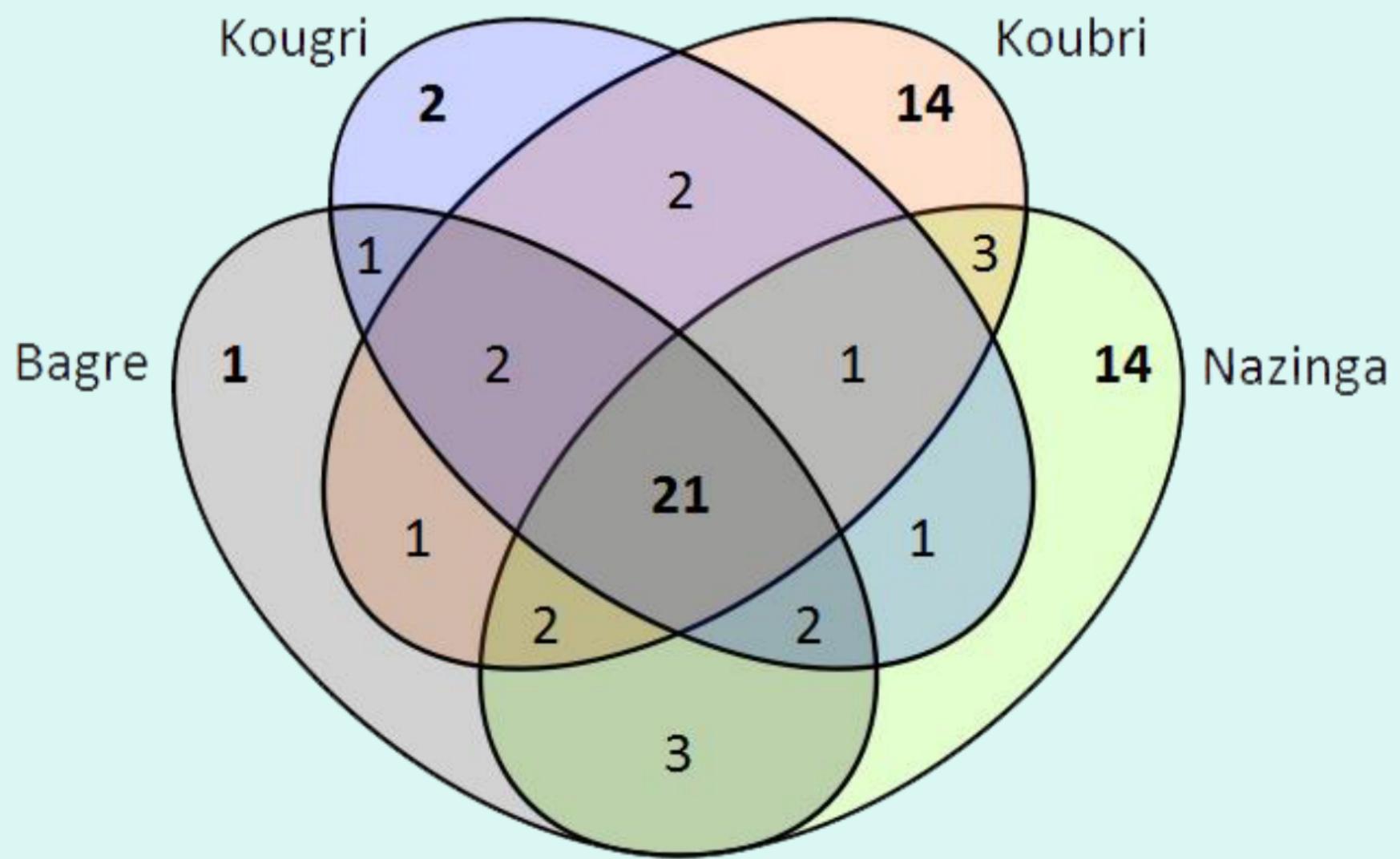
| Family (N=16) | Number of genera | Number of species |
|------------------|------------------|-------------------|
| Alestidae | 5 | 12 |
| Anabantidae | 1 | 1 |
| Bagridae | 1 | 2 |
| Centropomidae | 1 | 1 |
| Cichlidae | 5 | 7 |
| Citharinidae | 1 | 1 |
| Clariidae | 2 | 3 |
| Clariotidae | 2 | 3 |
| Cyprinidae | 4 | 14 |
| Distichodontidae | 1 | 1 |
| Malapteruridae | 1 | 1 |
| Mochokidae | 1 | 8 |
| Mormyridae | 6 | 11 |
| Polypteridae | 1 | 1 |
| Protopteridae | 1 | 1 |
| Schilbeidae | 2 | 3 |
| Total | 35 | 70 |

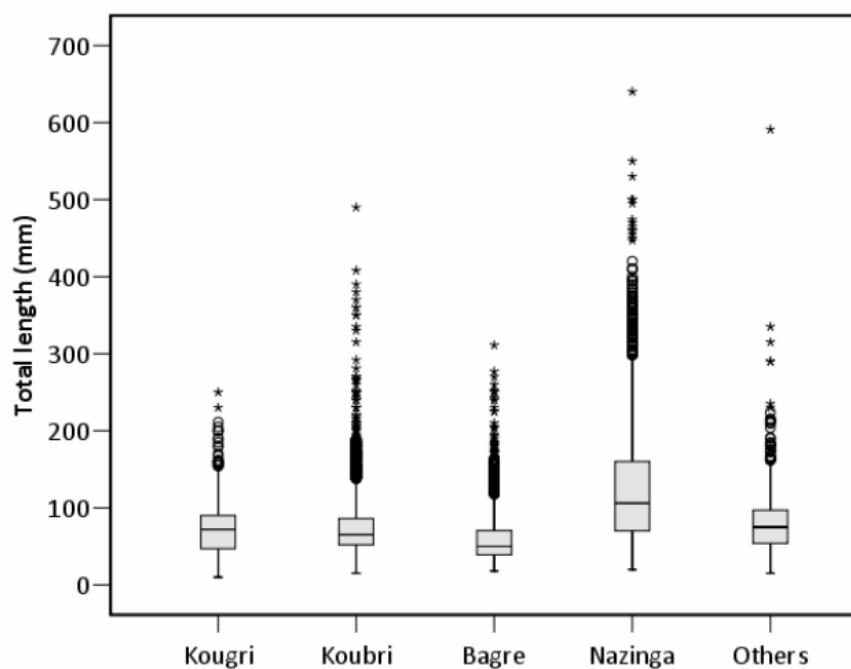
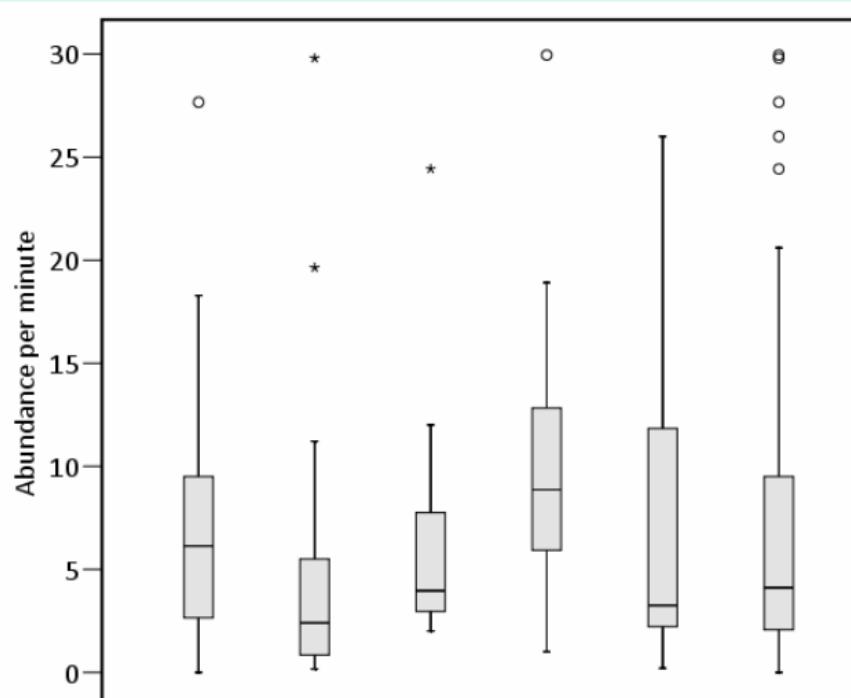


Fish assamblag

| | Kougri | Koubri | Bagre | Nazinga | Others | Total |
|-----------------------------|--------|--------|-------|---------|--------|--------|
| Number of individuals | 2,738 | 5,040 | 2,567 | 5,643 | 2,347 | 18,335 |
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| Family (N=16) | Number of genera | Number of species |
|------------------|------------------|-------------------|
| ALESTIDAE | 5 | 12 |
| ANABANTIDAE | 1 | 1 |
| BAGRIDAЕ | 1 | 2 |
| CENTROPOMIDAE | 1 | 1 |
| CICHLIDAЕ | 5 | 7 |
| CITHARINIDAE | 1 | 1 |
| CLARIIDAЕ | 2 | 3 |
| CLAROTEIDAE | 2 | 3 |
| CYPRINIDAE | 4 | 14 |
| DISTICHODONTIDAE | 1 | 1 |
| MALAPTERURIDAE | 1 | 1 |
| MOCHOKIDAE | 1 | 8 |
| MORMYRIDAE | 6 | 11 |
| POLYPTERIDAE | 1 | 1 |
| PROTOPTERIDAE | 1 | 1 |
| SCHILBEIDAE | 2 | 3 |
| Total | 35 | 70 |

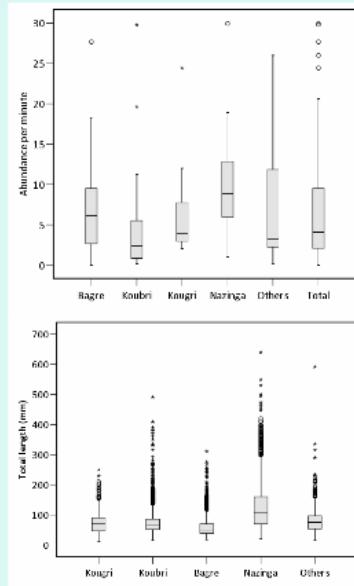
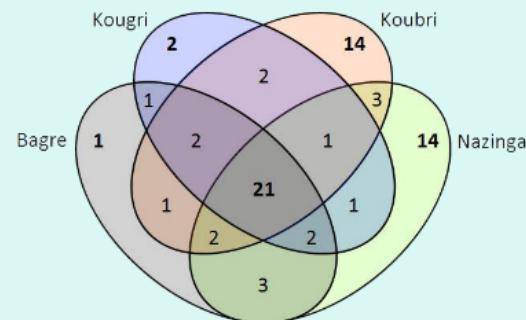




Fish assamblages

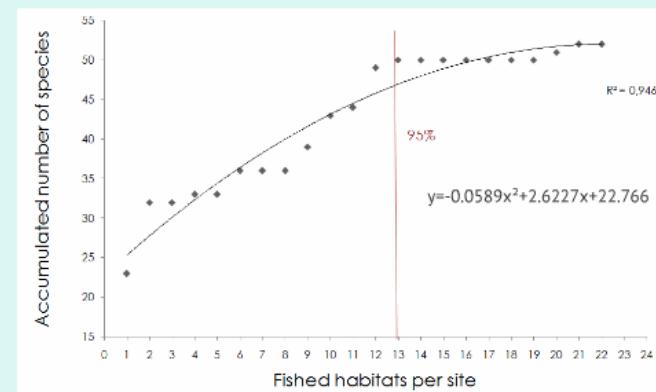
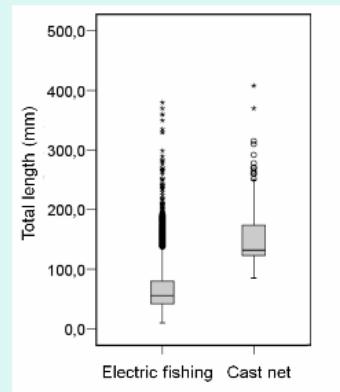
| | Kougri | Koubri | Bagre | Nazinga | Others | Total |
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| Clariidae | 2 | 3 |
| Clariotidae | 2 | 3 |
| Cyprinidae | 4 | 14 |
| Distichodontidae | 1 | 1 |
| Malapteruridae | 1 | 1 |
| Mochokidae | 1 | 8 |
| Mormyridae | 6 | 11 |
| Polypteridae | 1 | 1 |
| Protopteridae | 1 | 1 |
| Schilbeidae | 2 | 3 |
| Total | 35 | 70 |

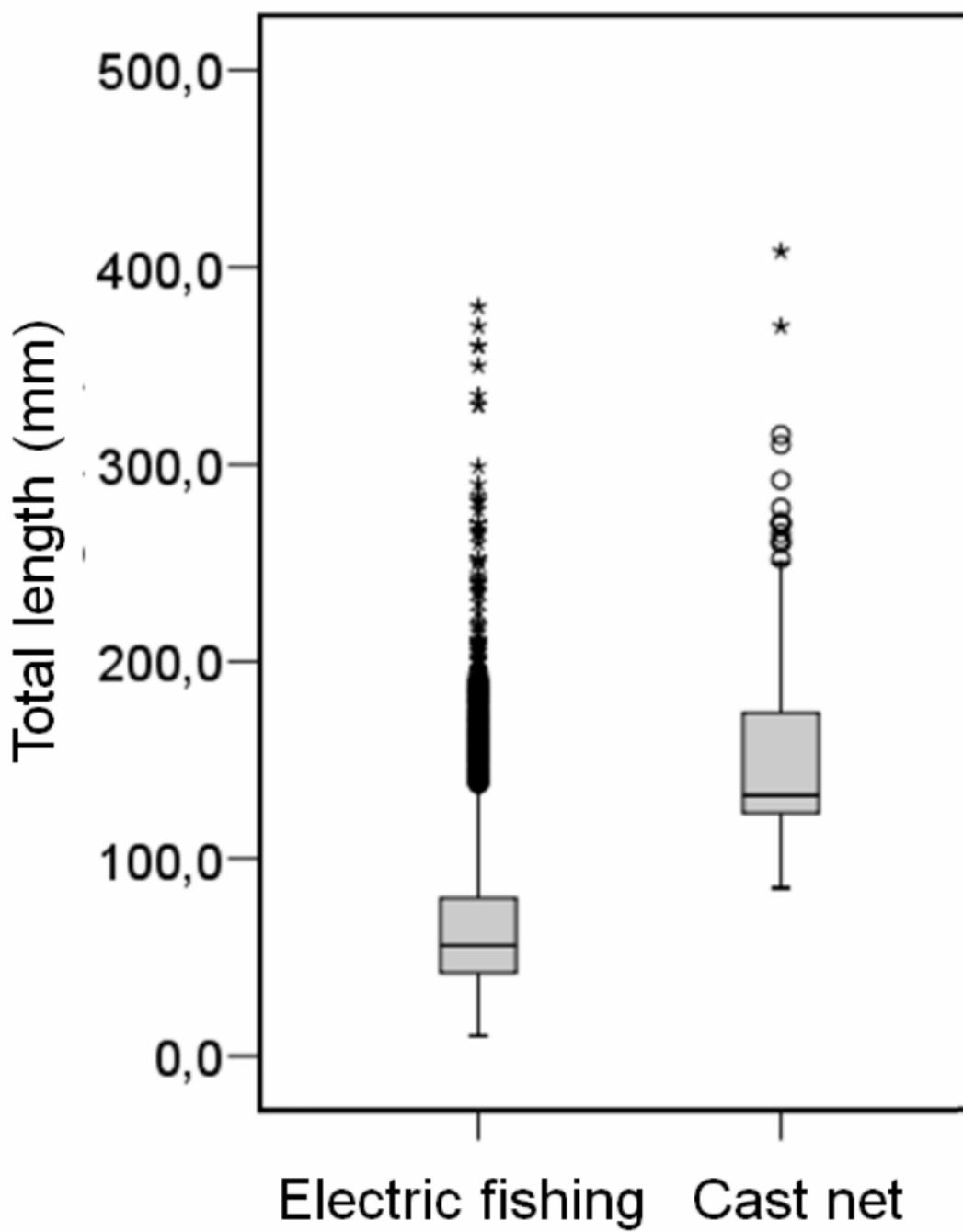


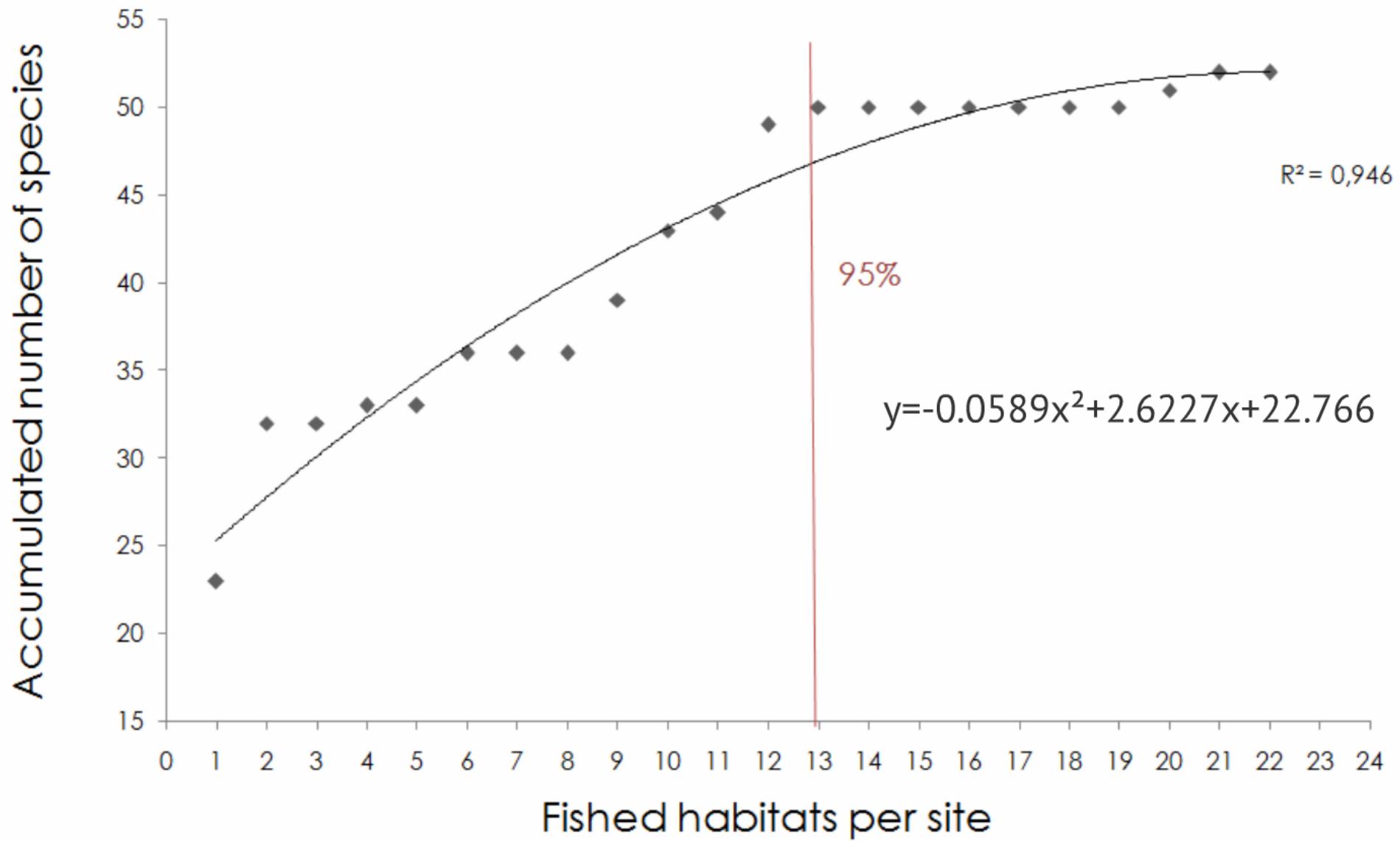
Methods

| | Electric | Cast net |
|---------------------------------------|-----------|-----------|
| Number of individuals | 8822 | 9199 |
| Number of species | 66 | 61 |
| Exclusive species | 18 | 11 |
| Mean total length (mm) | 66.95 | 106.5 |
| Time (minutes) | 815 | |
| Captures /min | 11 | |
| Throws | | 666 |
| Captures /throw | | 14 |
| Area (m ²) | 12343 | 10131 |
| Number of fished habitat | 93 | 54 |
| Average per habitat | 9 minutes | 15 throws |
| Average per habitat (m ²) | 132.72 | 187.6 |



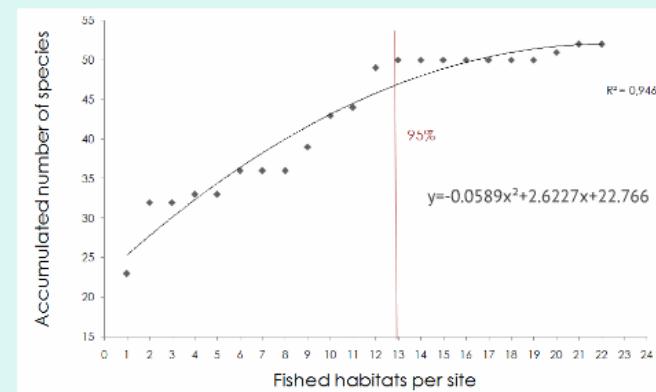
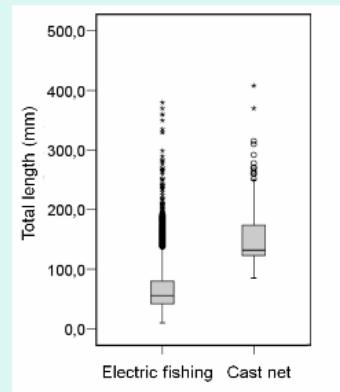
| | Electric | Cast net |
|---------------------------------------|-----------|-----------|
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Methods

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| Number of individuals | 8822 | 9199 |
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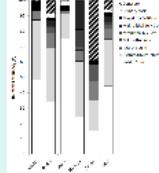
Habitat

Available Habitat conditions

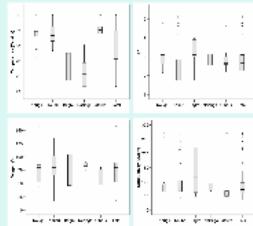
Watertypes



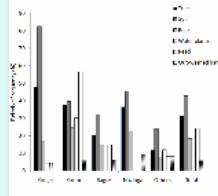
Substrate



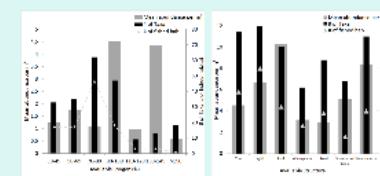
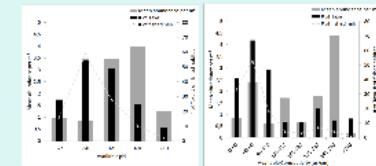
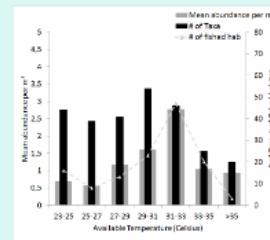
Physicochemical Parameters



Structures

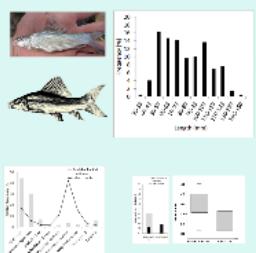


Habitat use at community level

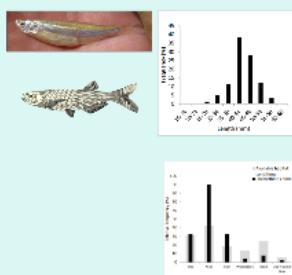


Habitat use and population structure for selected species

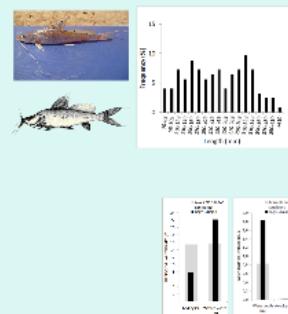
Labeo Cubie



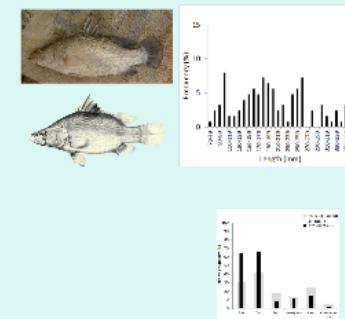
Chelaethiops bibie



Bagrus bajad



Lates niloticus



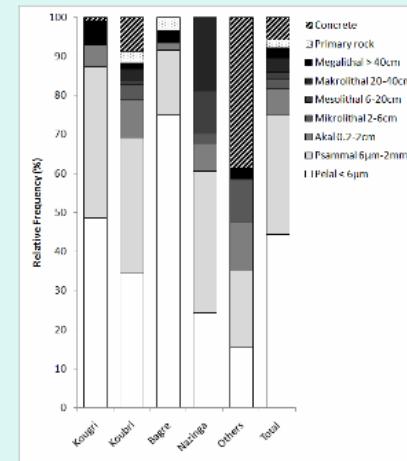
Available Habitat conditions

Watertypes

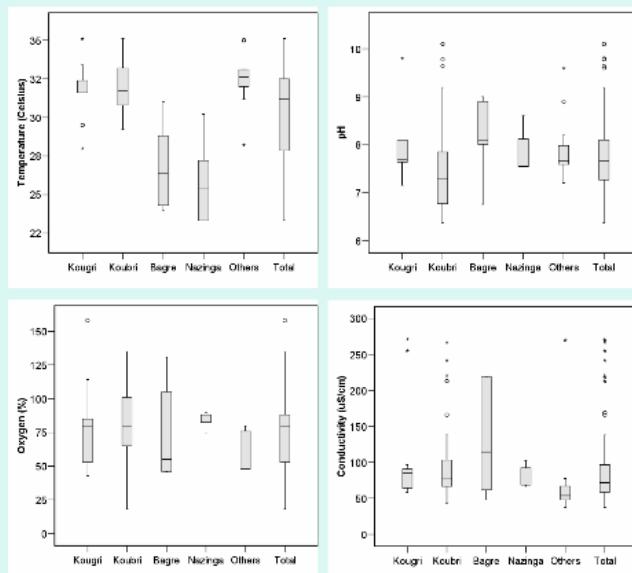
Spillway
Reservoir
Dissipation
Channel
Streams
Ponds
Sidearms



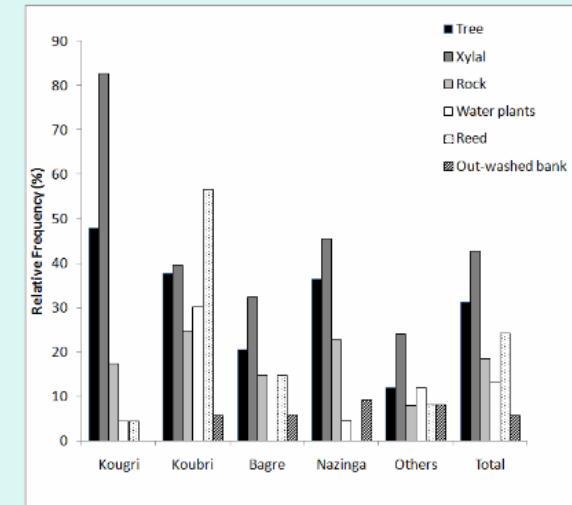
Substrate



Physicochemical Parameters



Structures



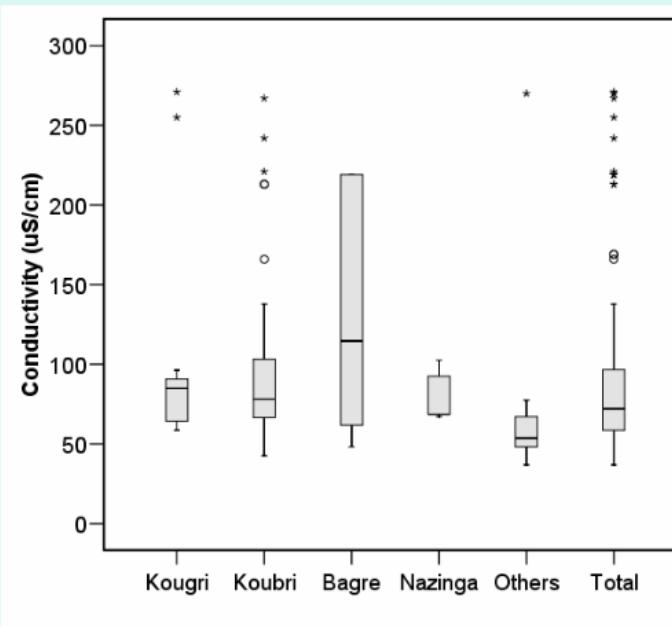
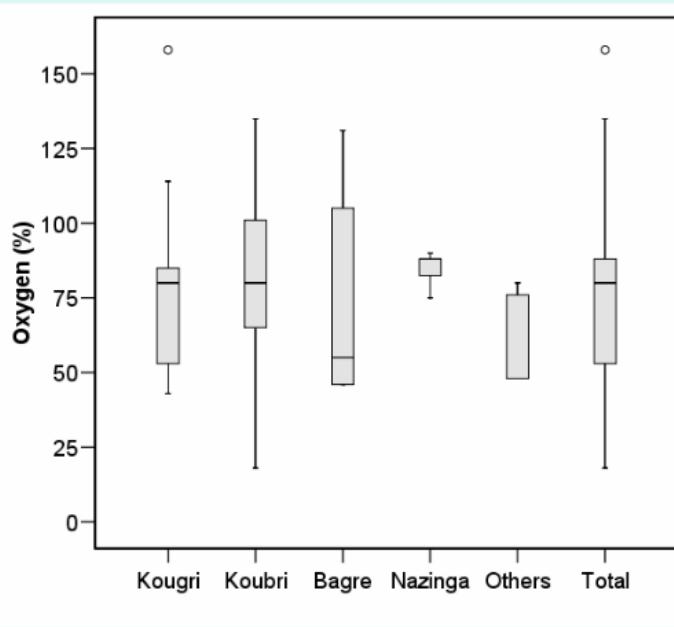
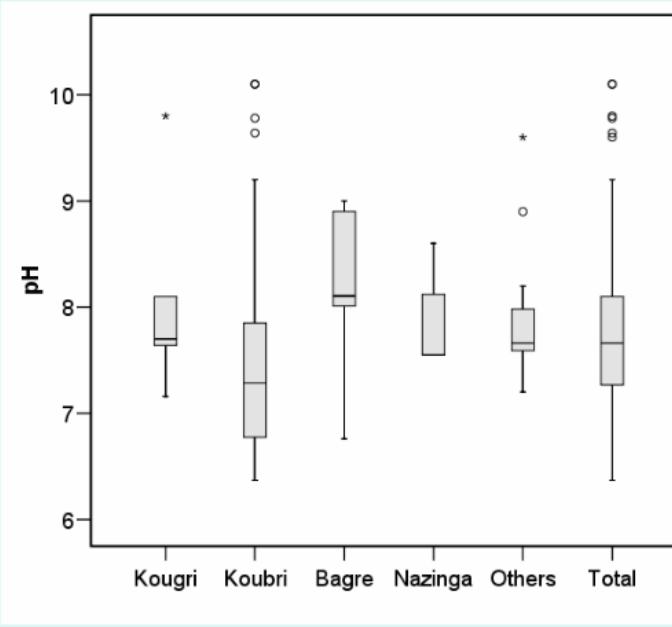
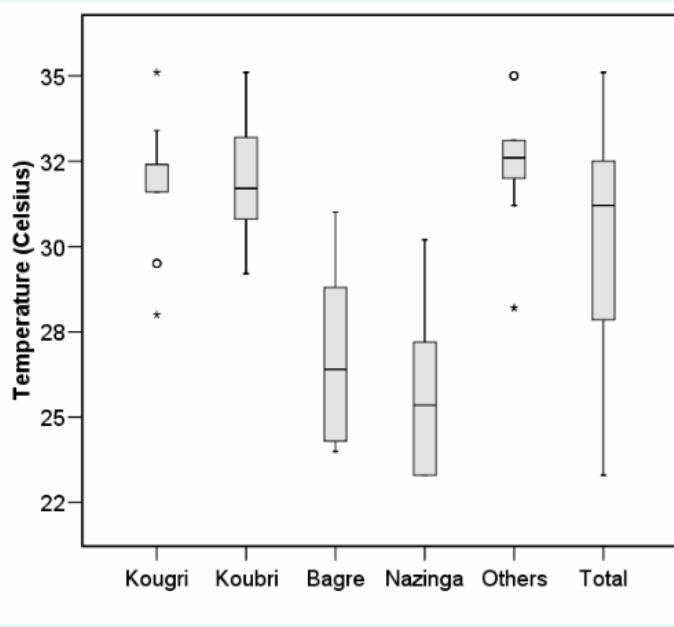
Watertypes

Spillway
Reservoir
Dissipation
Channel
Streams
Ponds
Sidearms

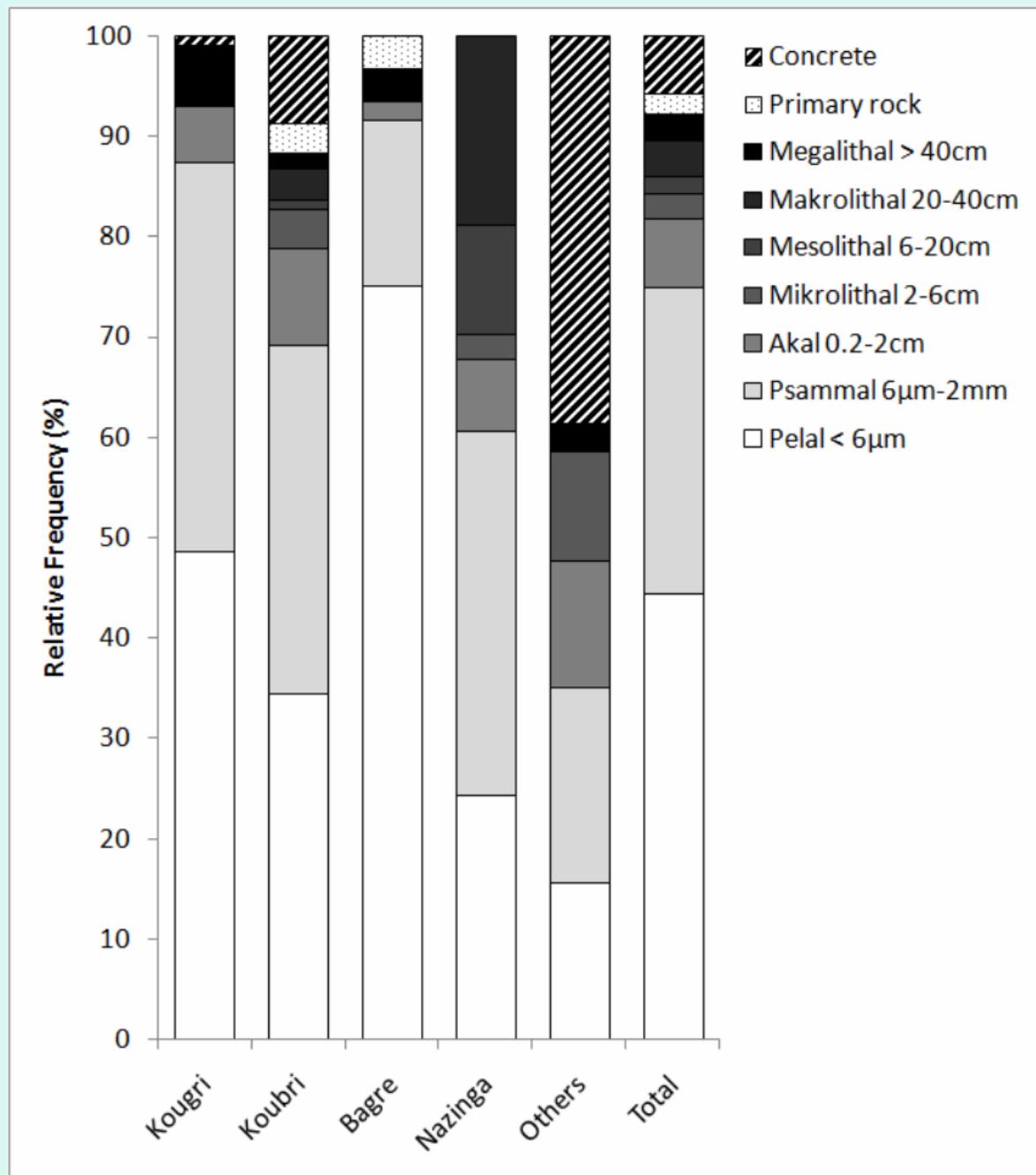


Physicochemical Parameters

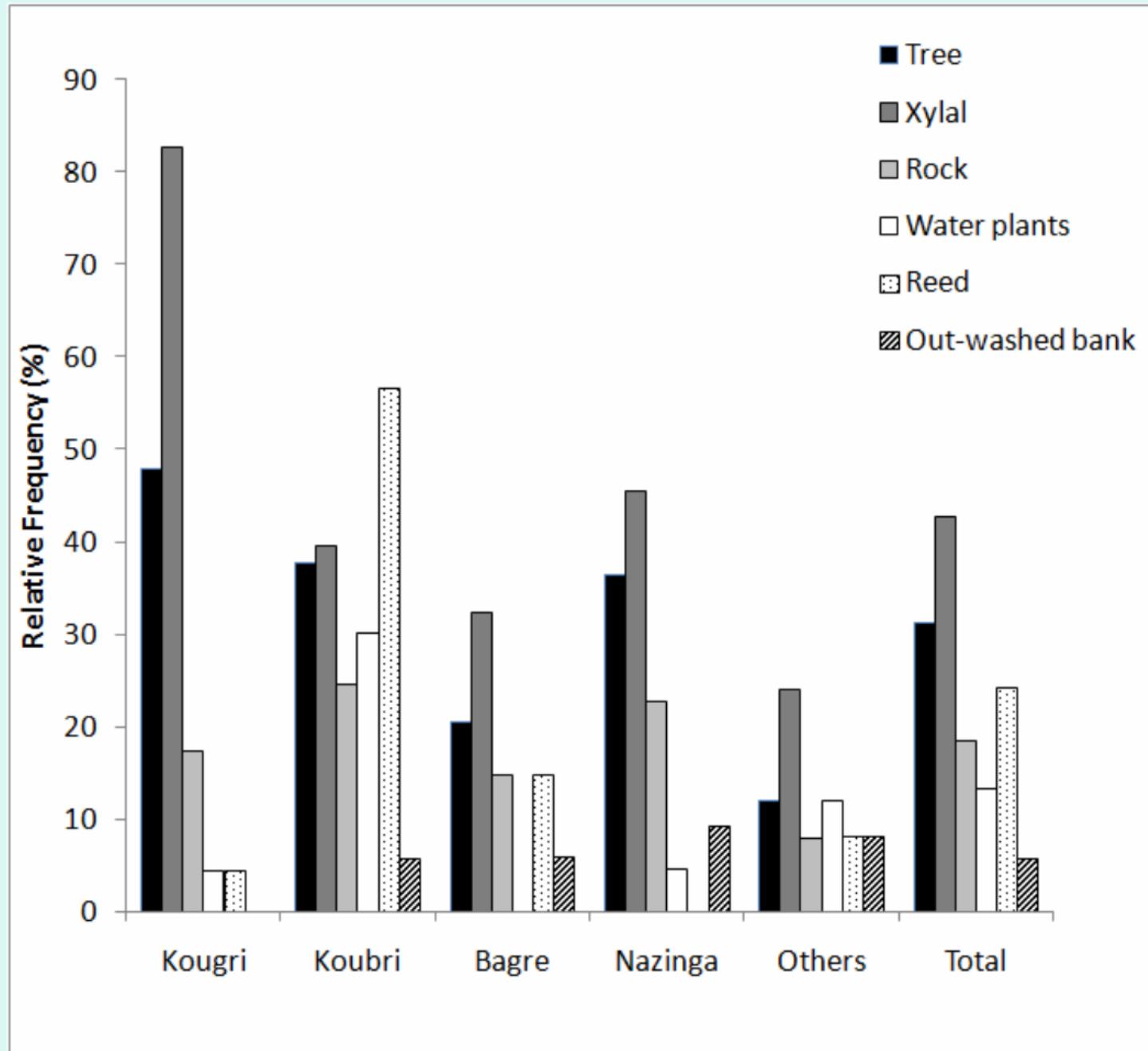
Physicochemical Parameters



Substrate



Structures



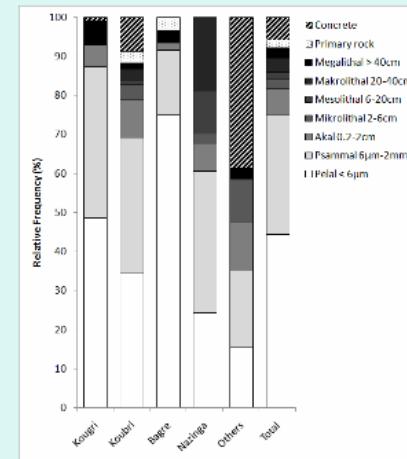
Available Habitat conditions

Watertypes

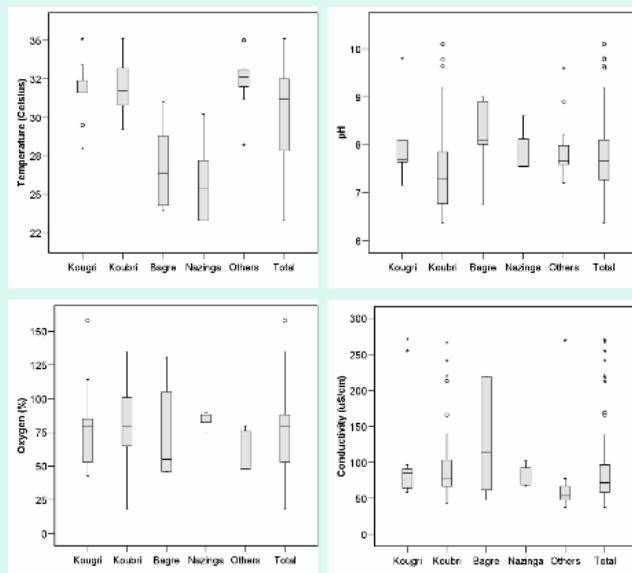
Spillway
Reservoir
Dissipation
Channel
Streams
Ponds
Sidearms



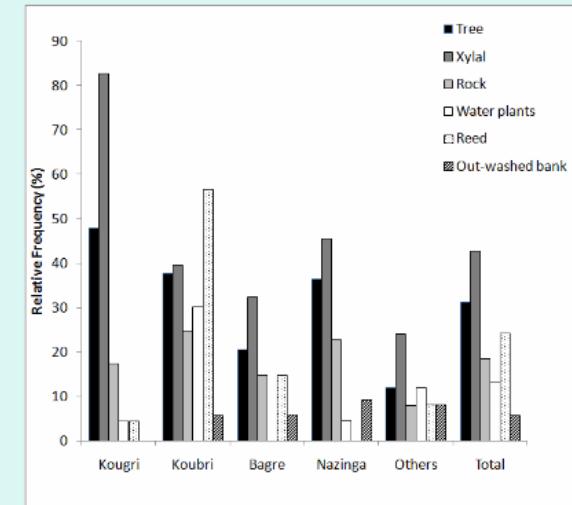
Substrate



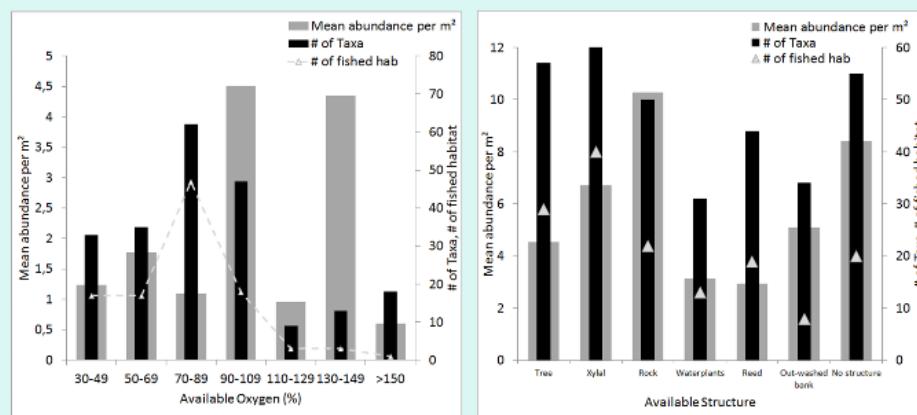
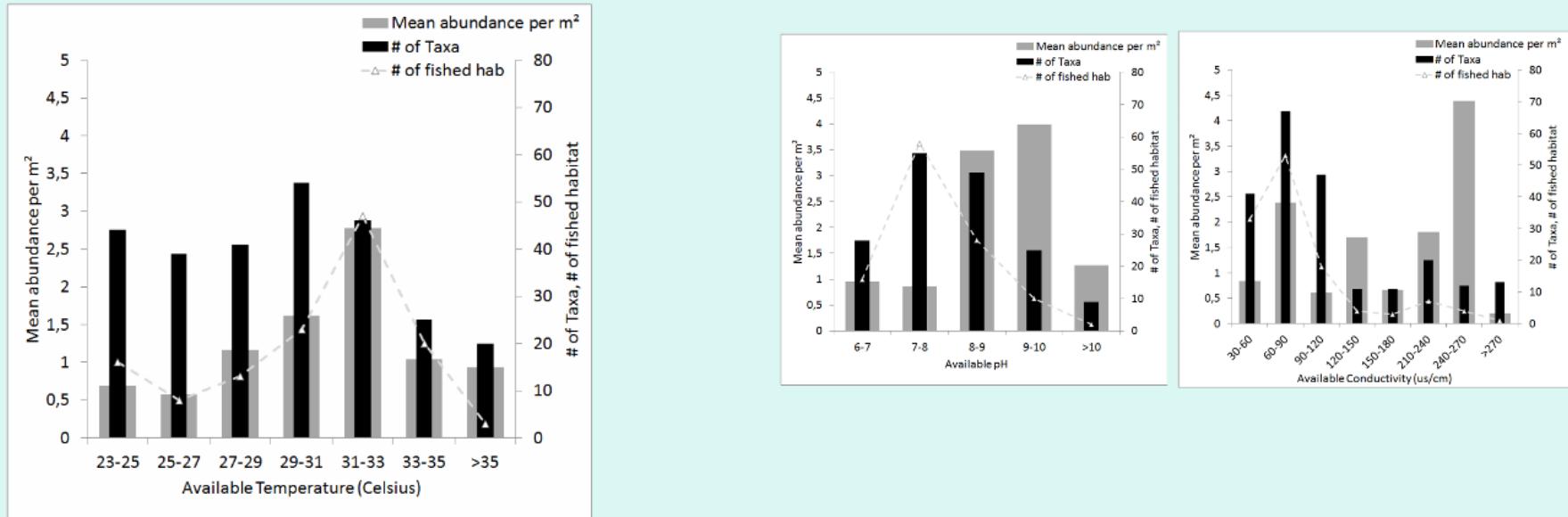
Physicochemical Parameters

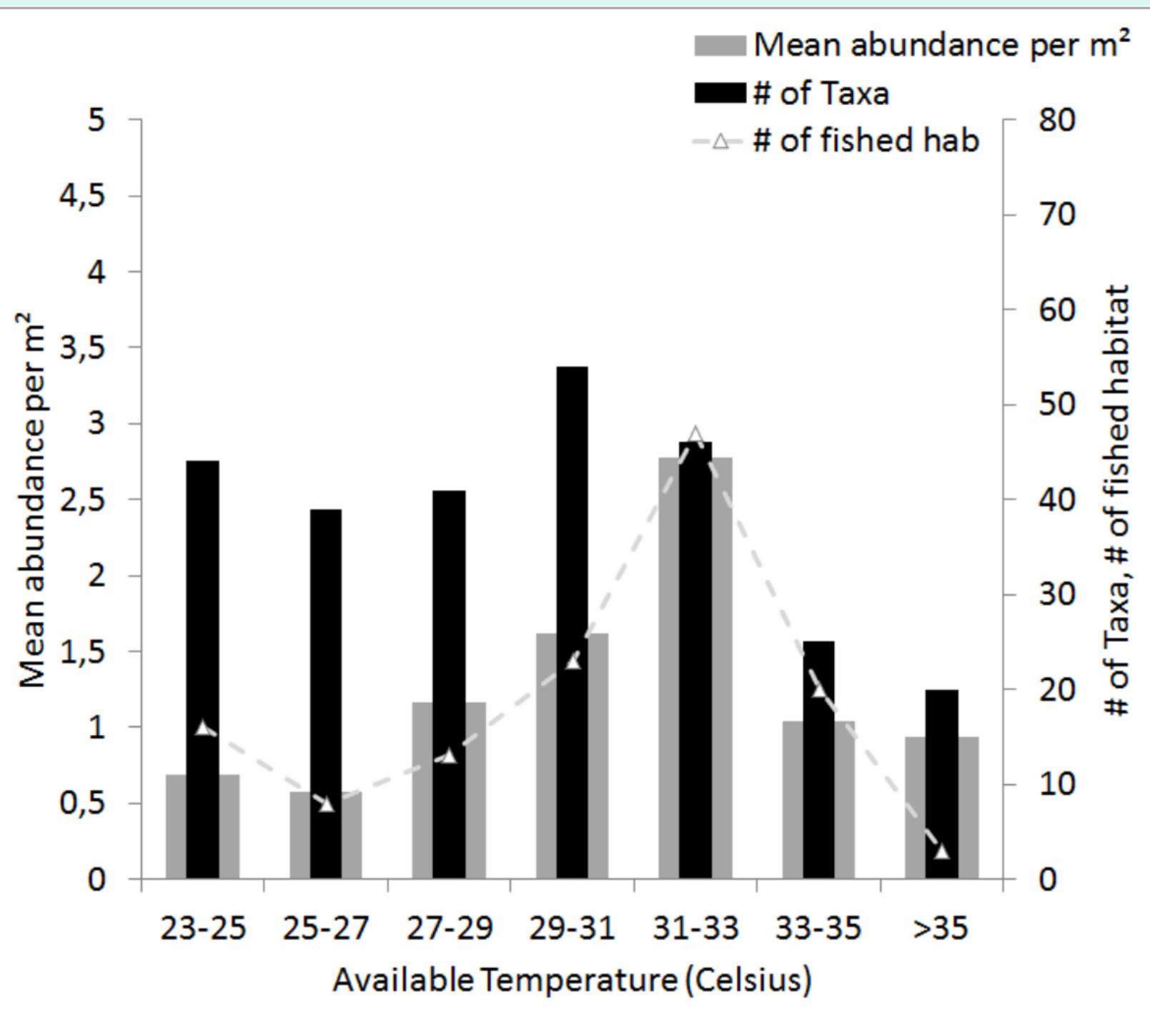


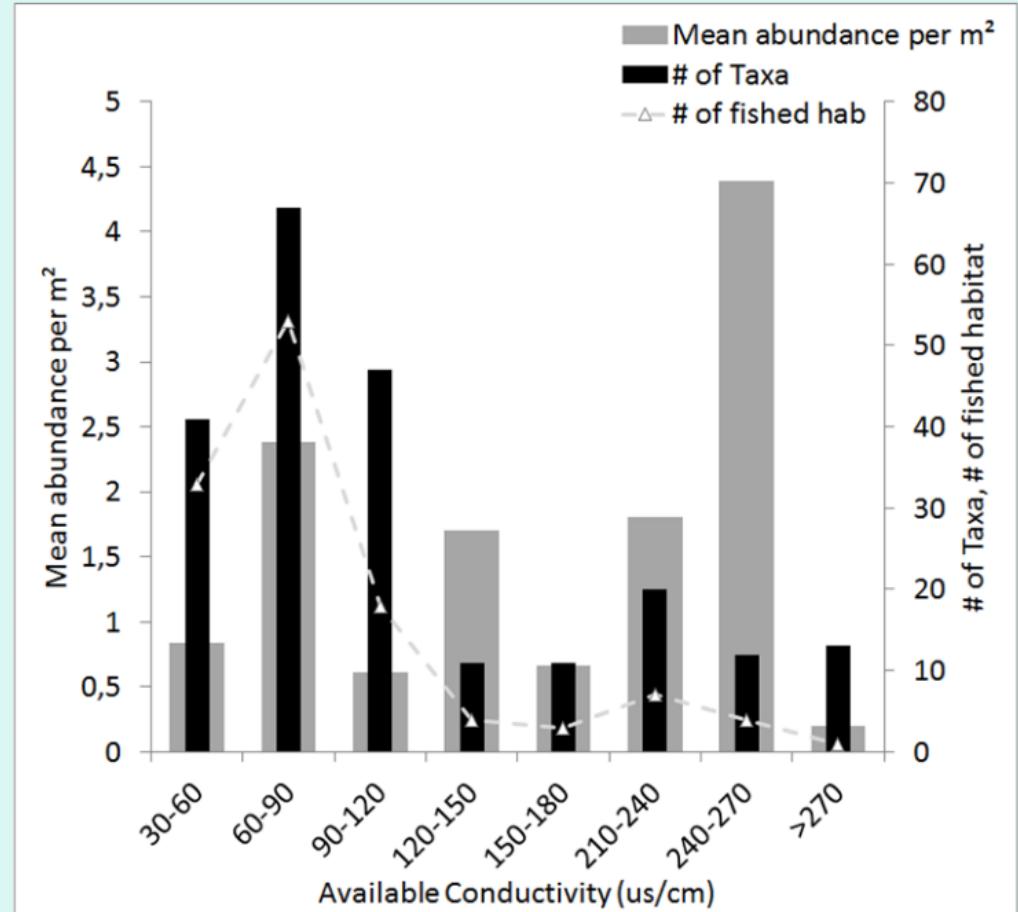
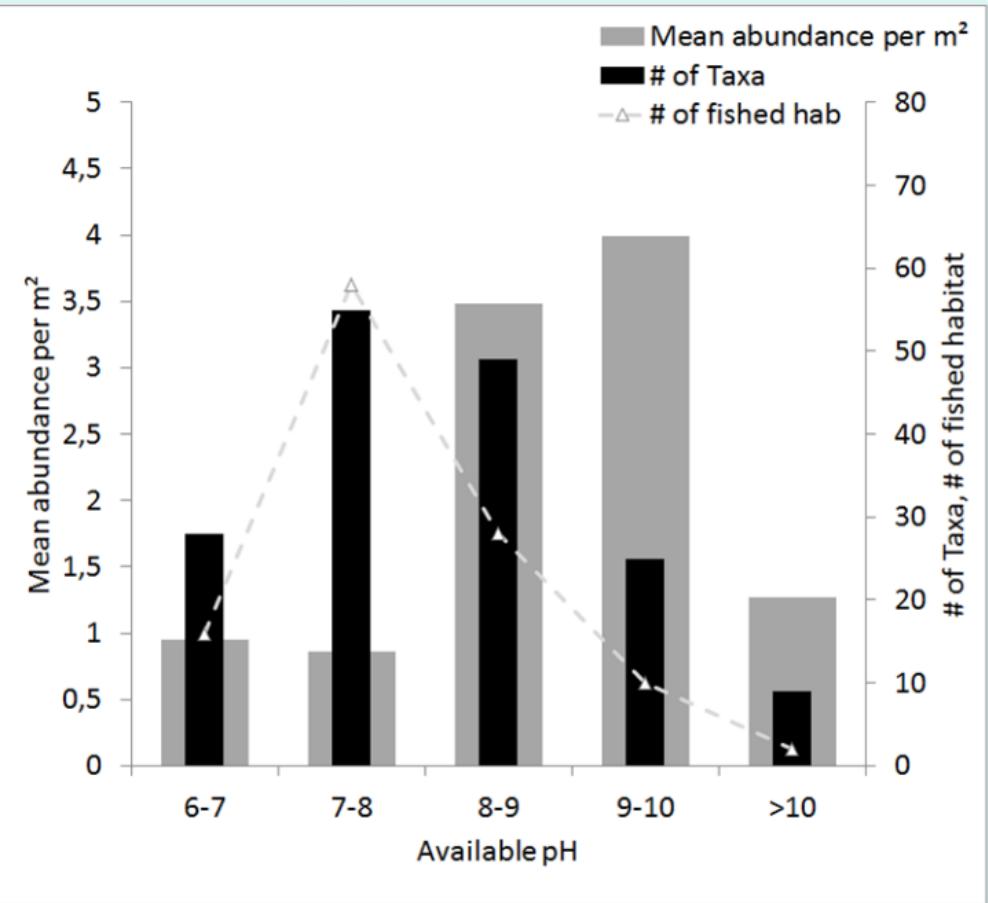
Structures

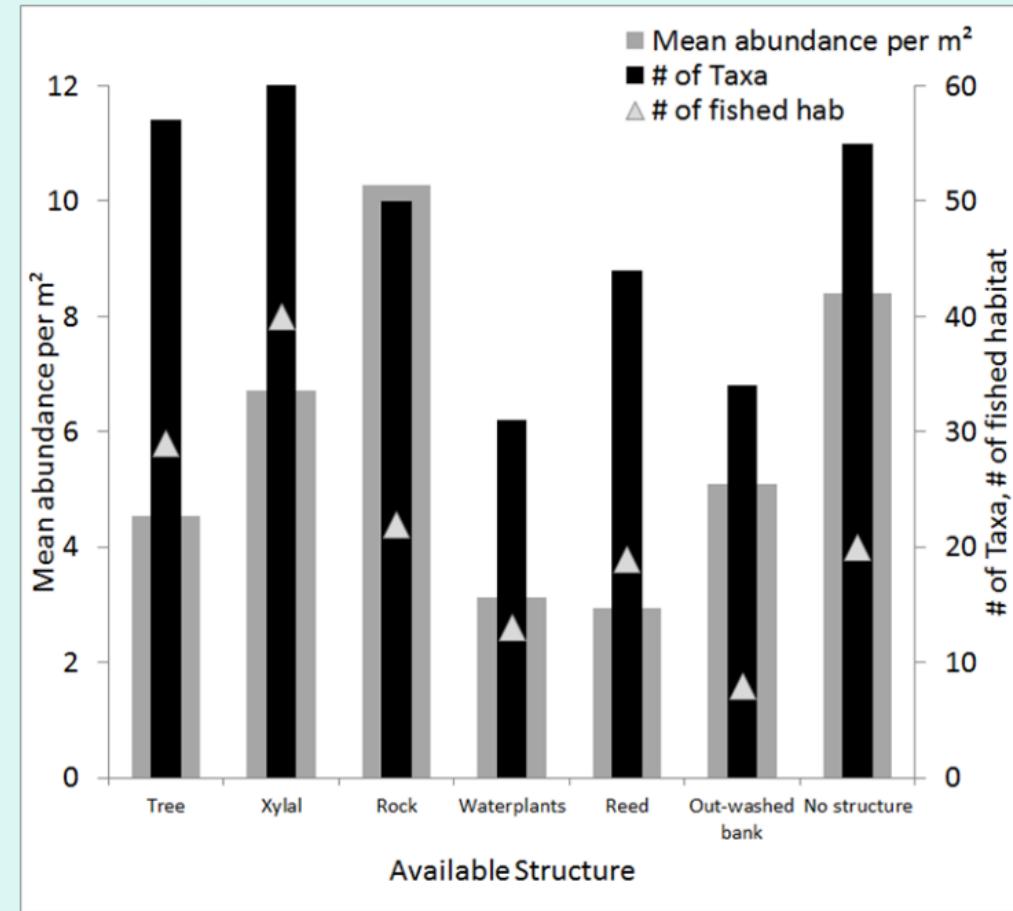
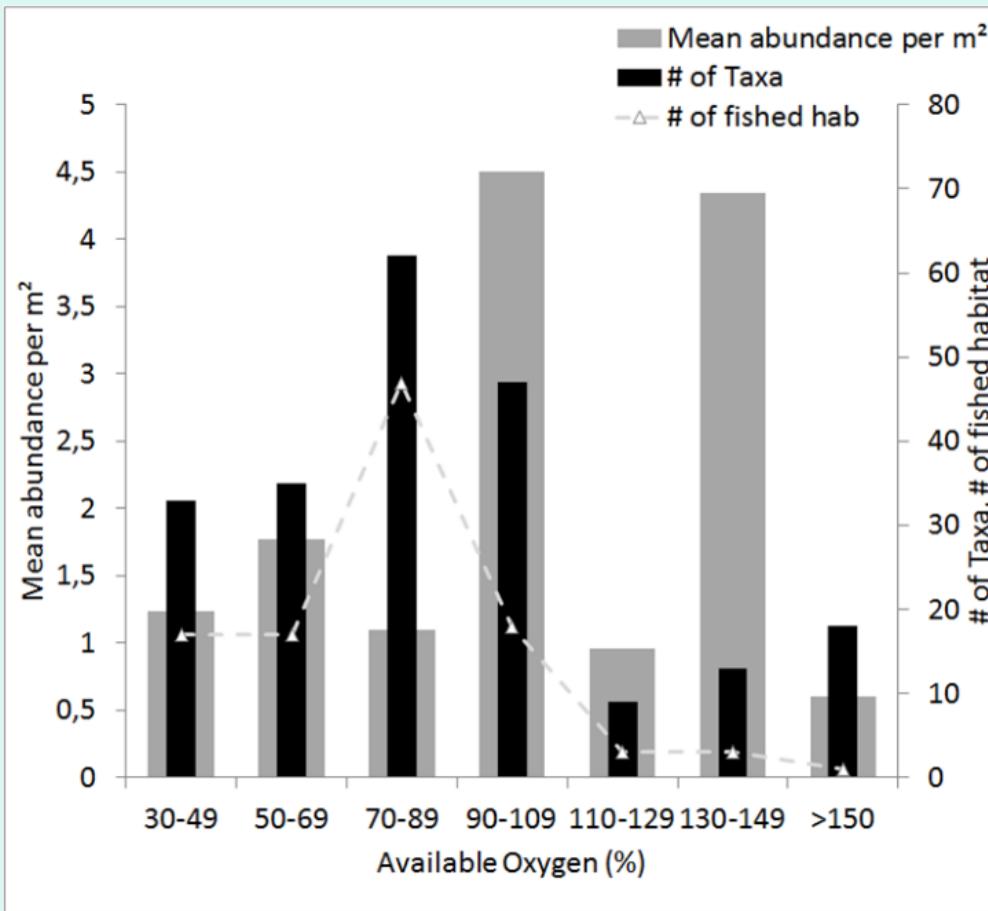


Habitat use at community level

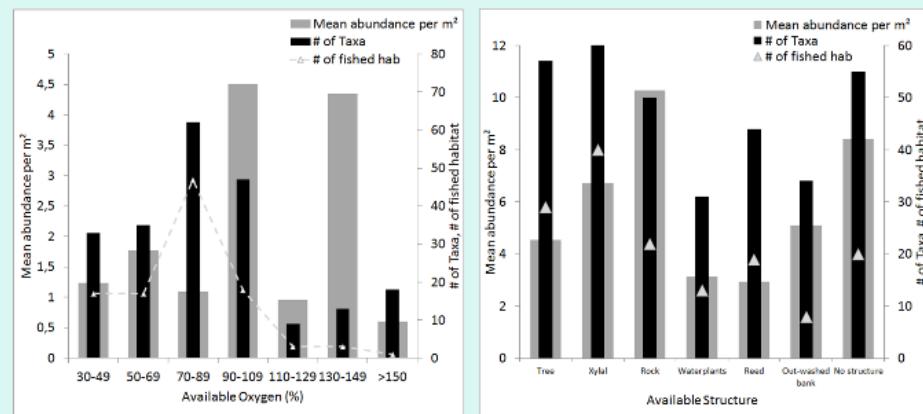
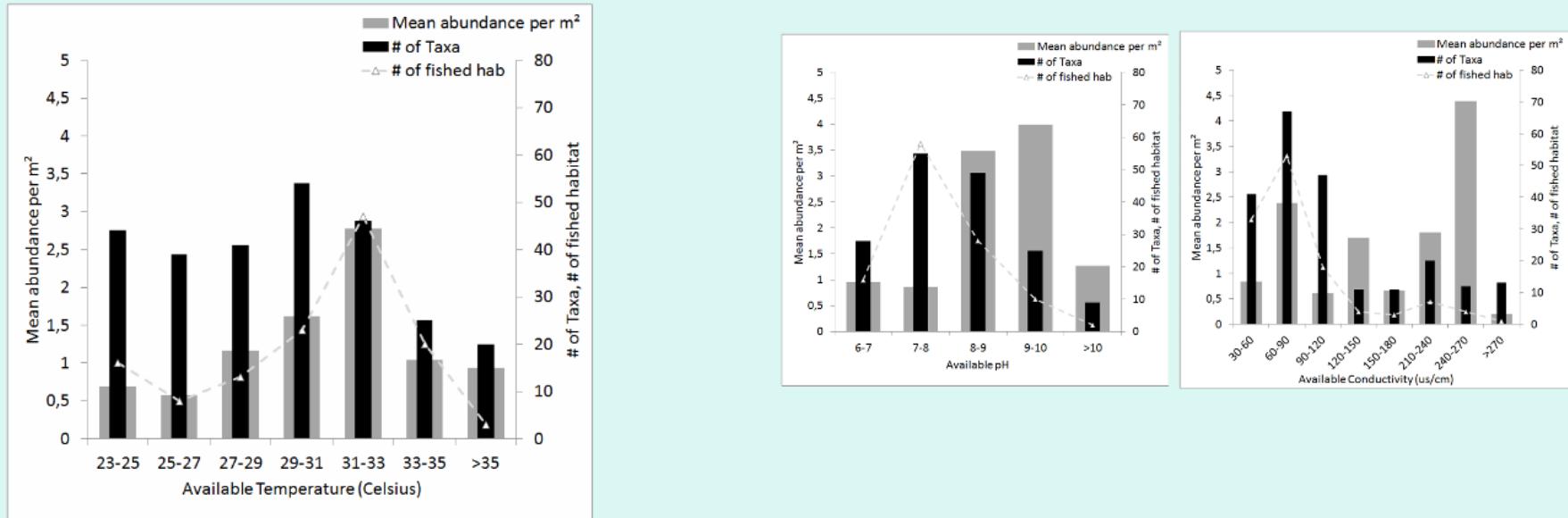






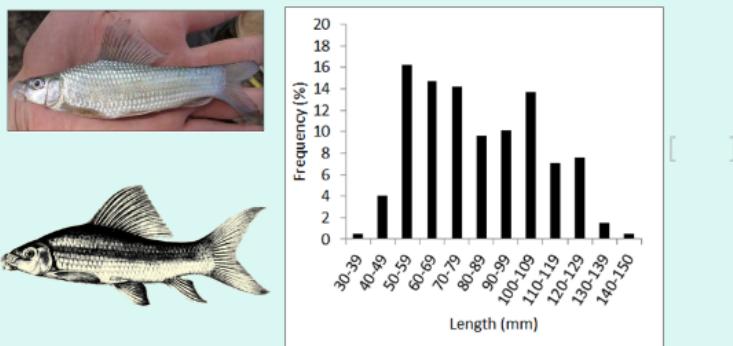


Habitat use at community level

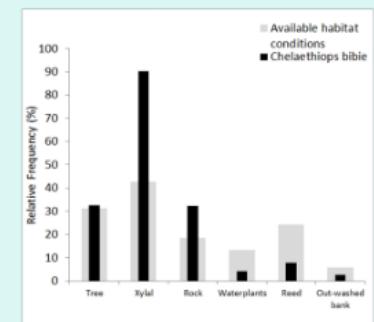
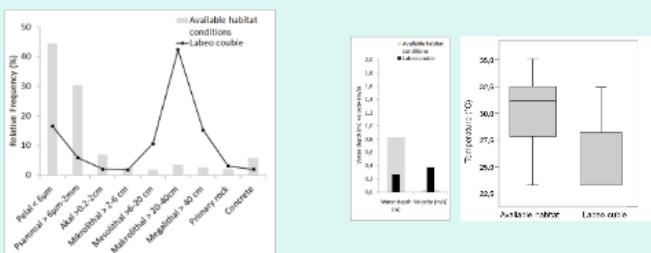
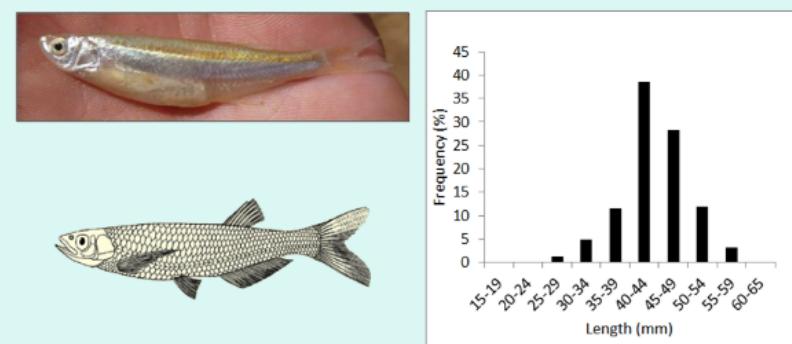


Habitat use and population structure for selected species

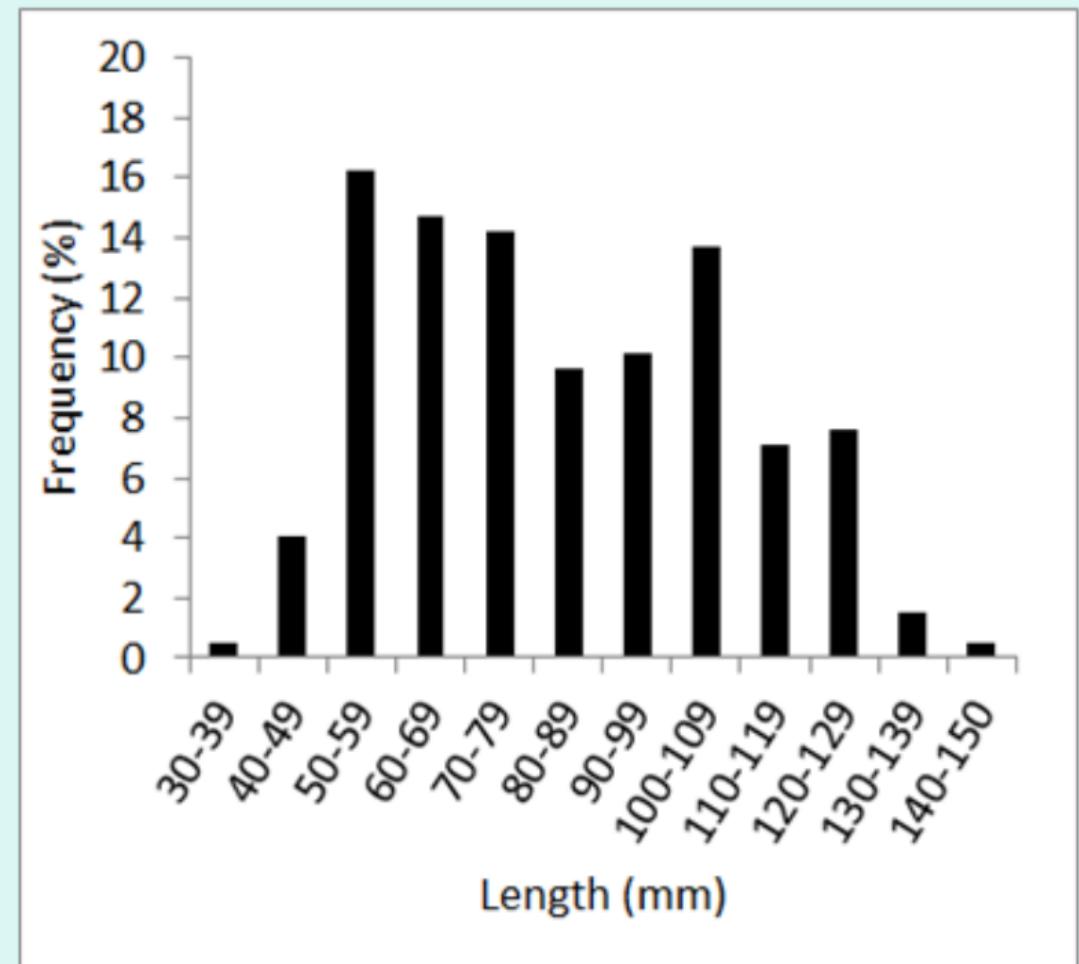
Labeo Cubie

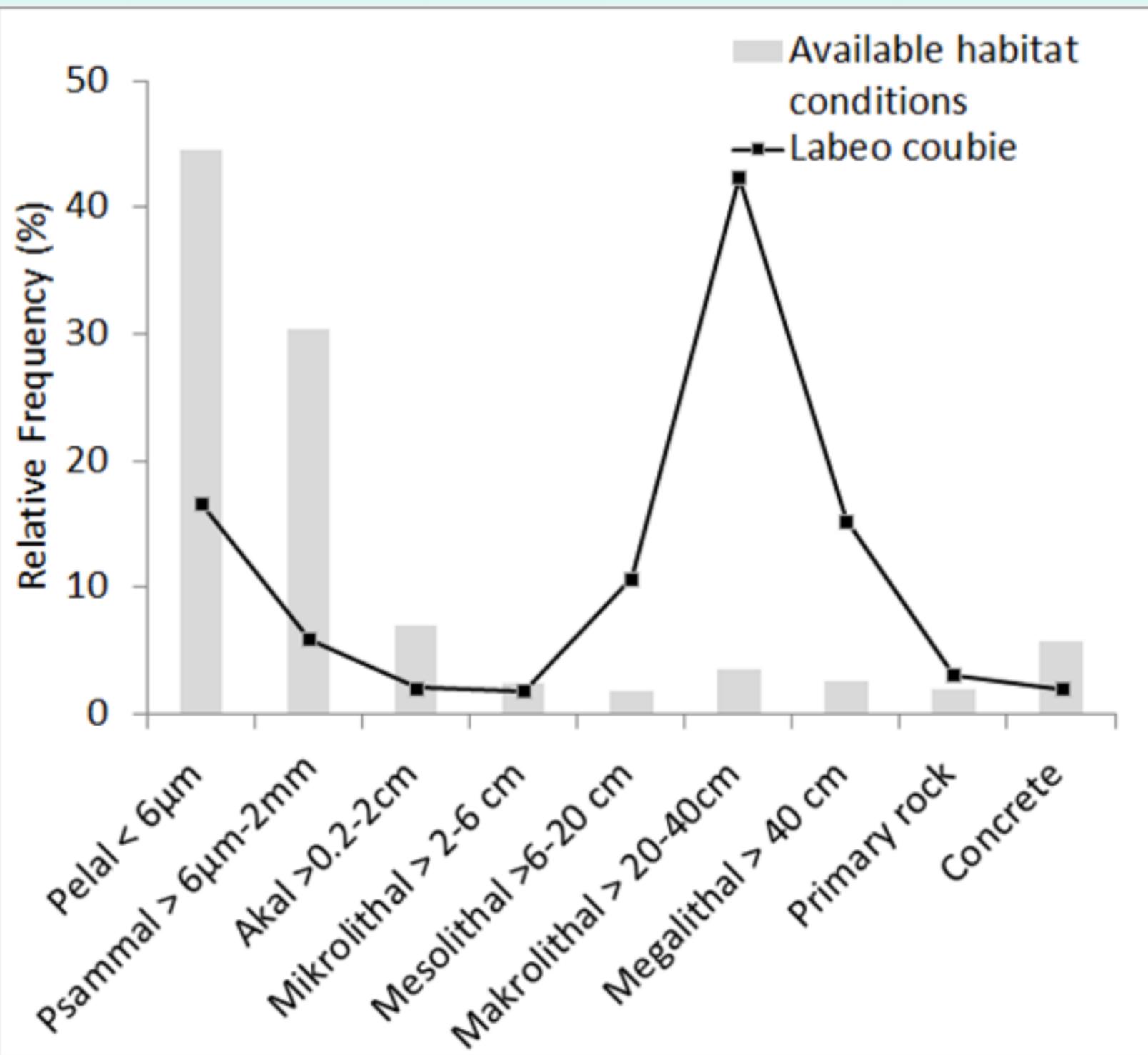


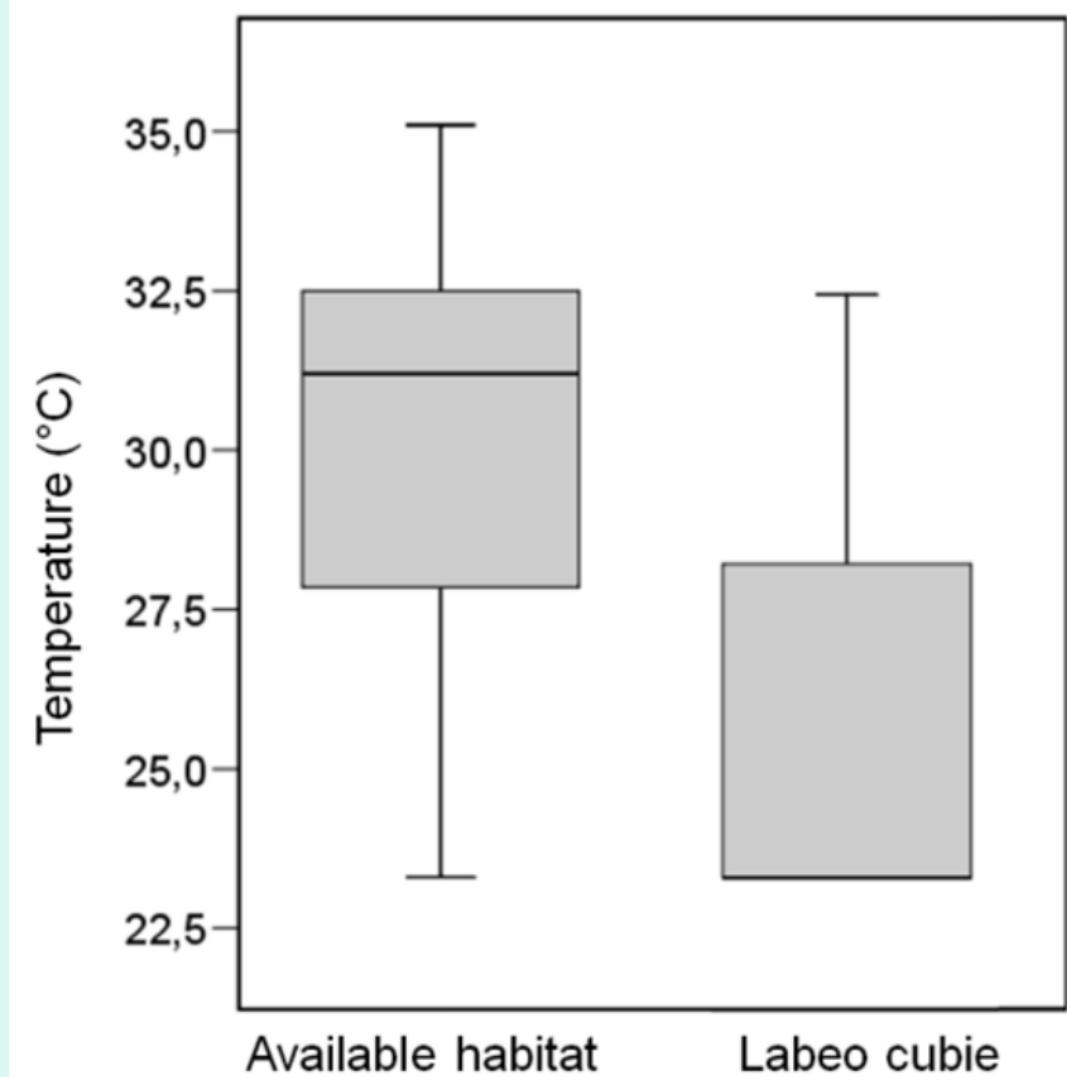
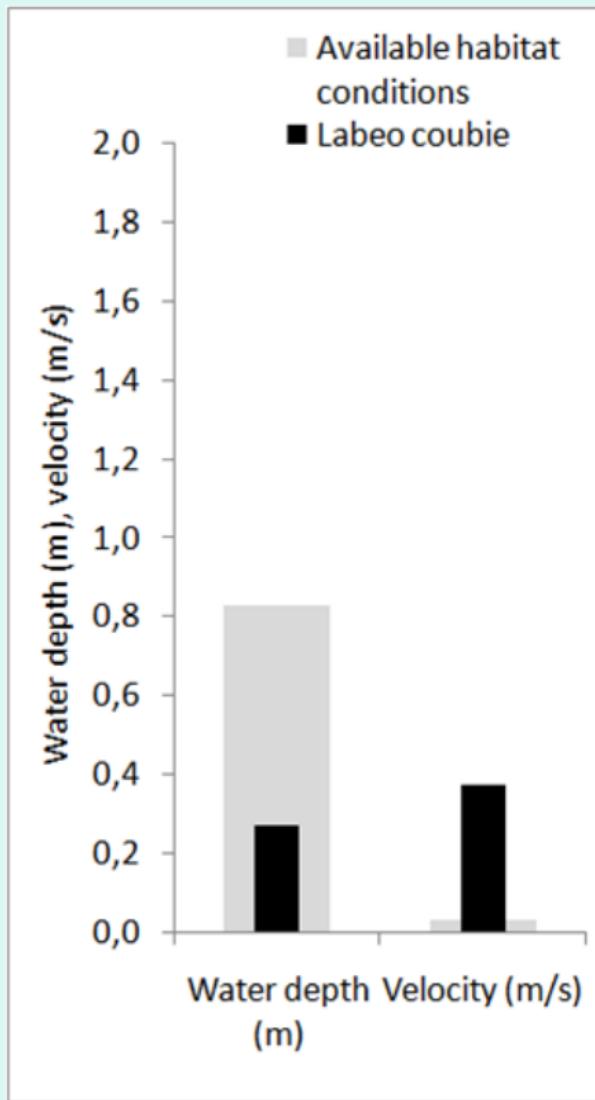
Chelaethiops bibie



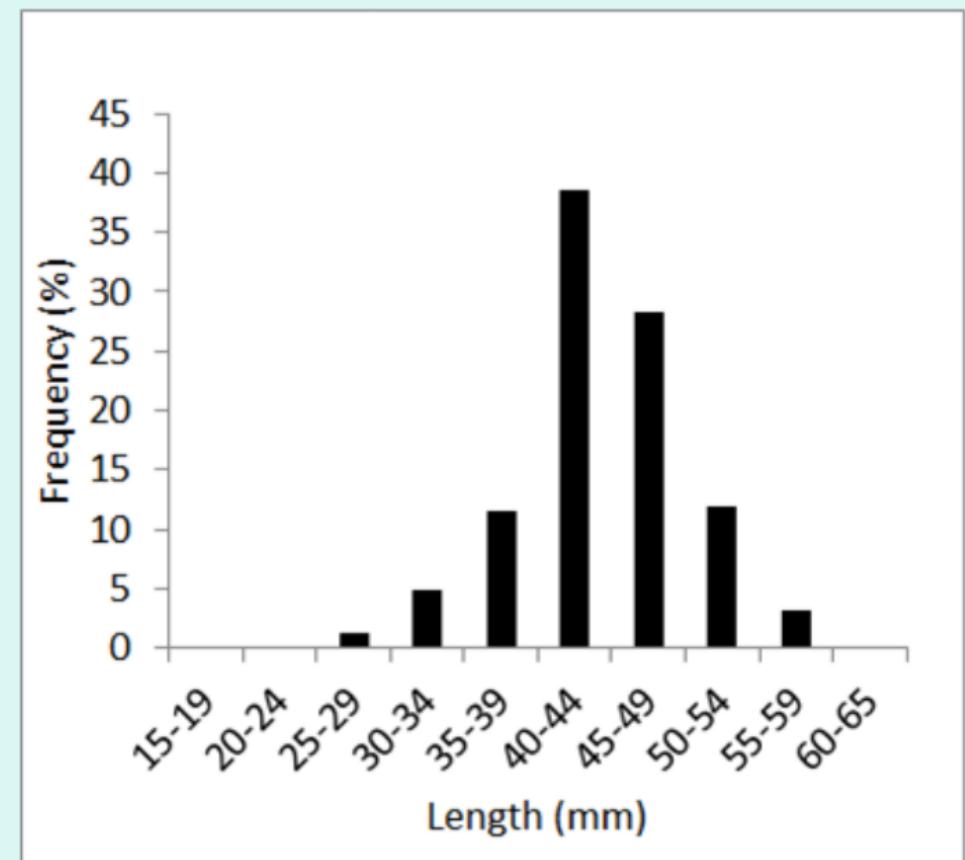
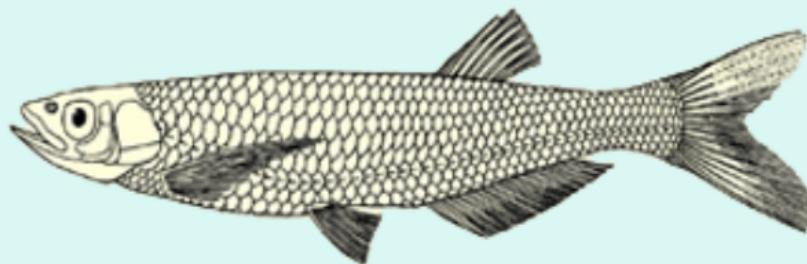
Labeo Cubie

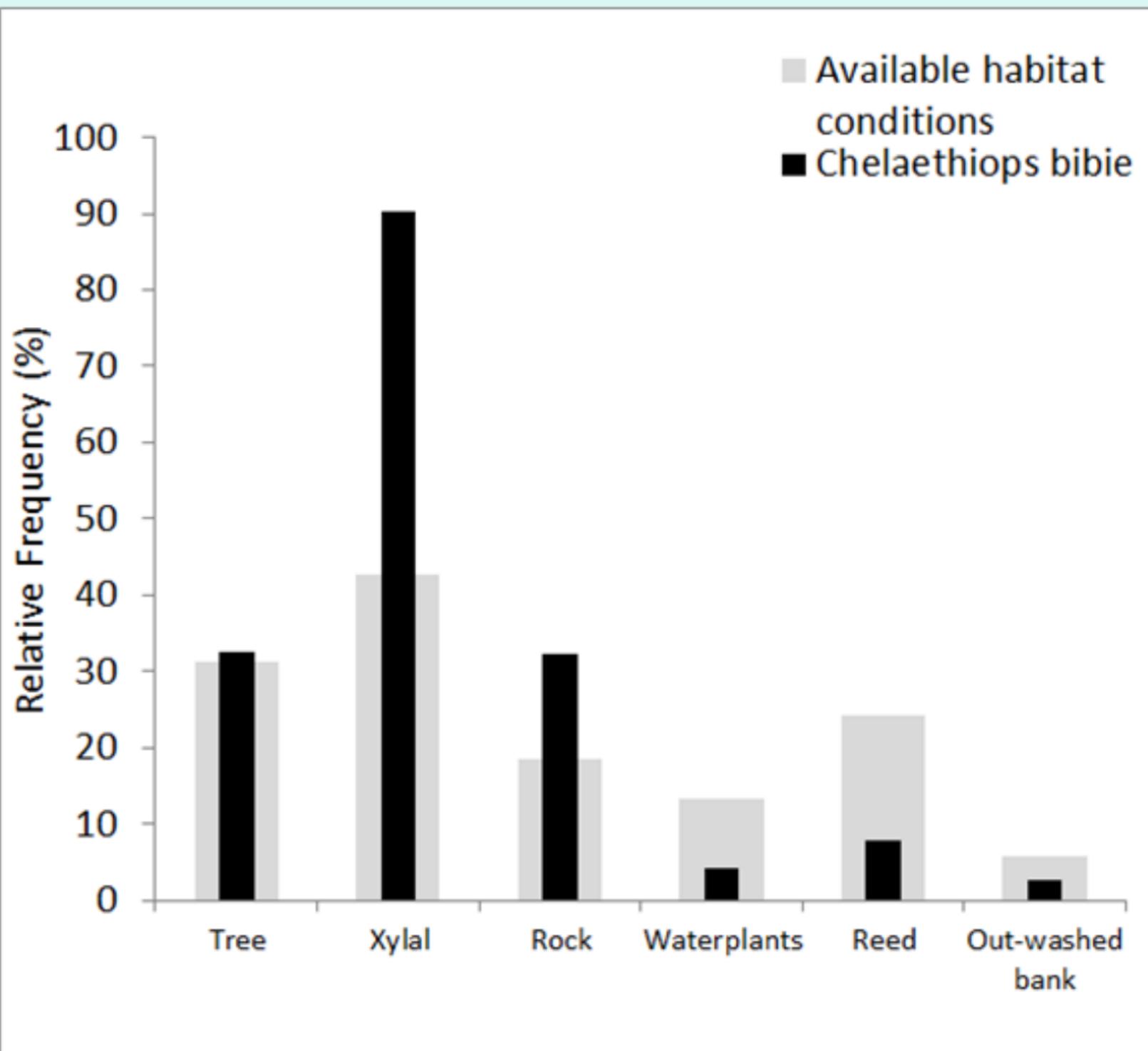




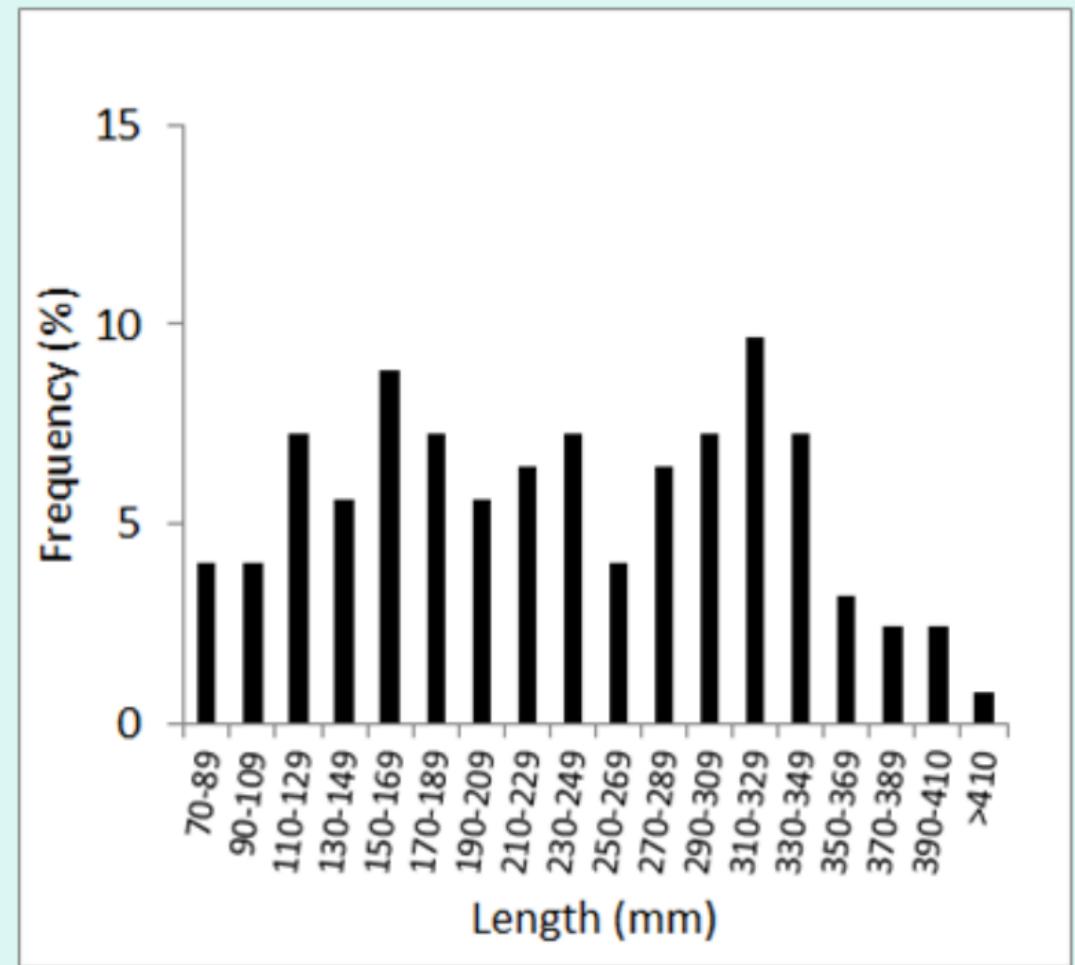
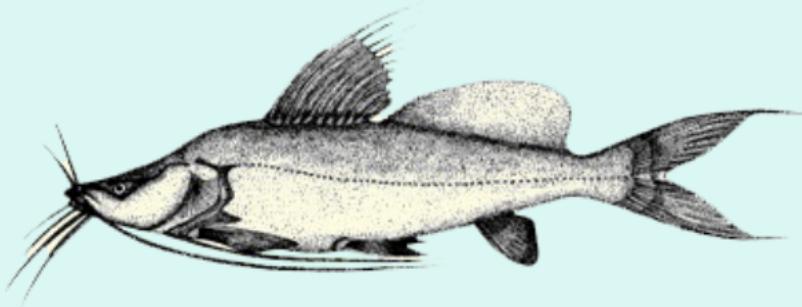


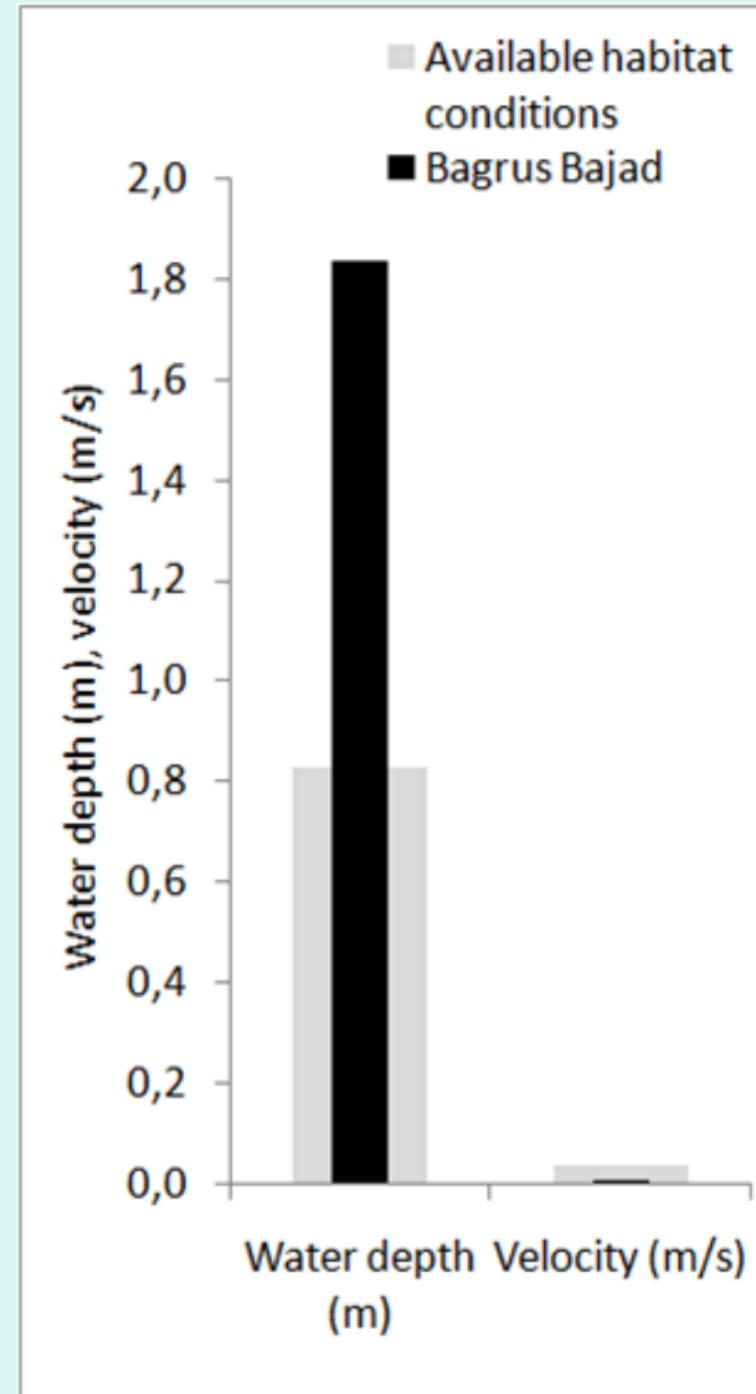
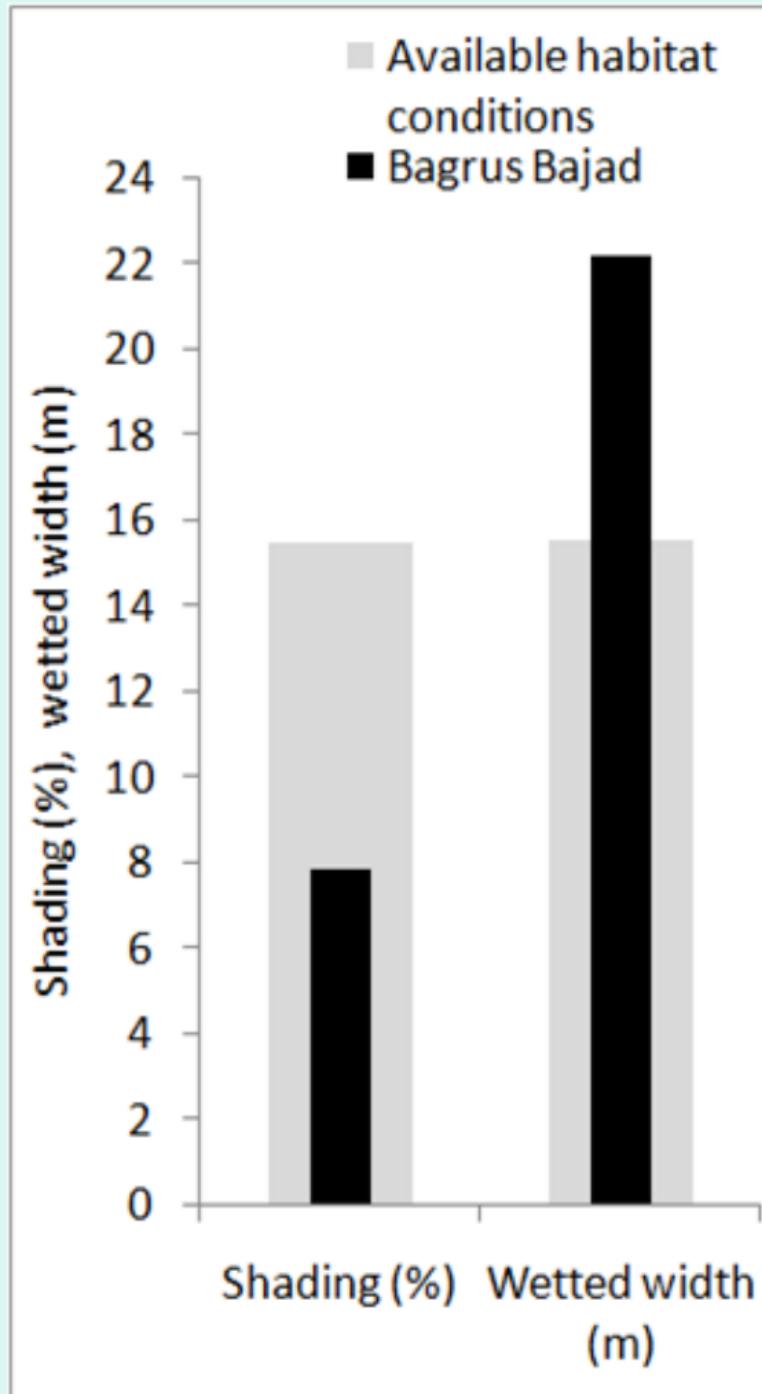
Chelaethiops bibie



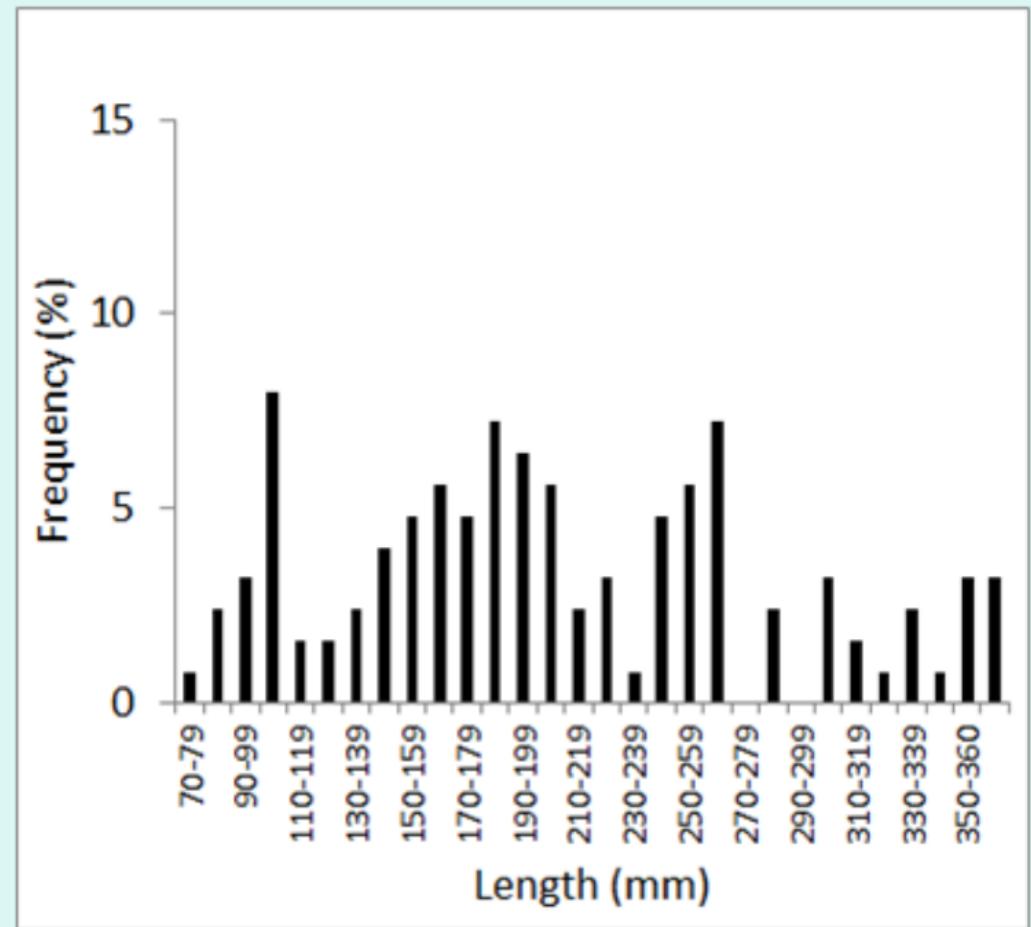
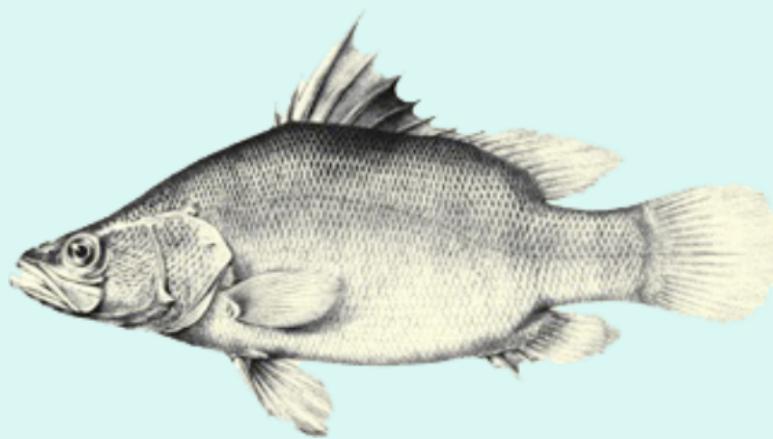


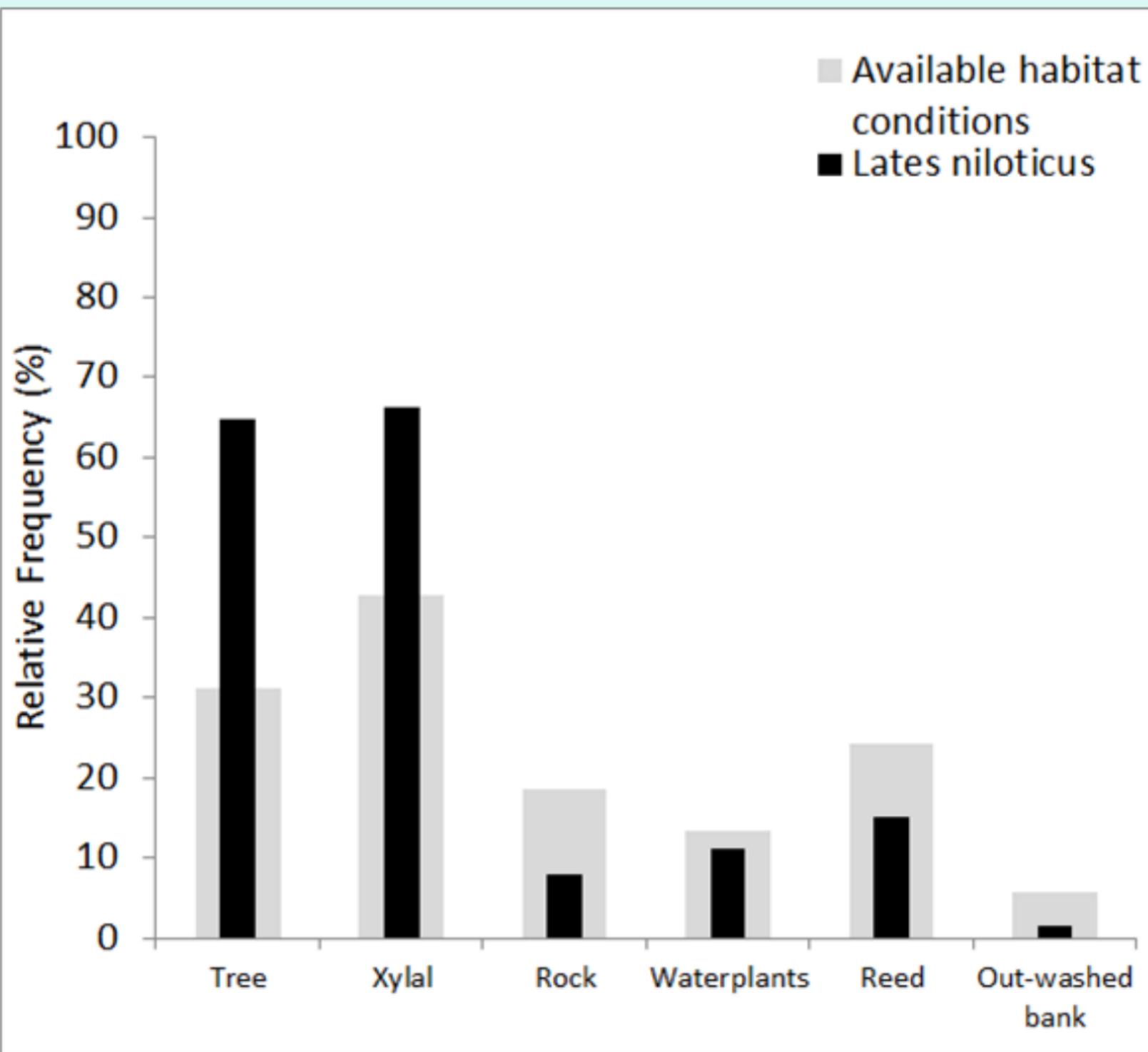
Bagrus bajad





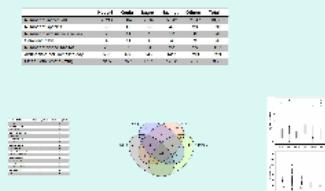
Lates niloticus





Results

Fish asssemblages

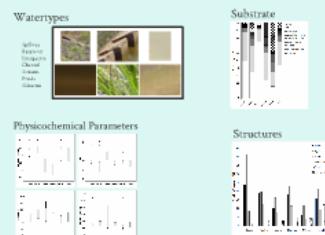


Methods

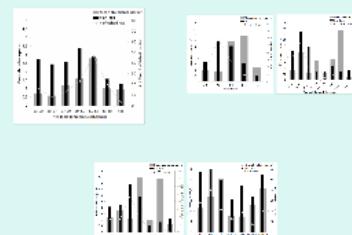


Habitat

Available Habitat conditions



Habitat use at community level



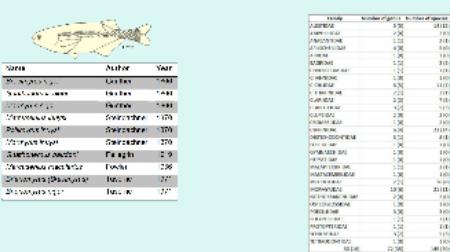
Habitat use and population structure for selected species



Discussion

Fish assambages

| Species | Length | Total | Length | Total | Length | Total | Length | Total |
|-----------------------------|--------|-------|--------|-------|--------|-------|--------|-------|
| Barbodes gonionotatus | 25 | 3 | 36 | 67 | 26 | 11 | | |
| Barbus barbus | 17 | 1 | 17 | 1 | 17 | 1 | 17 | 1 |
| Catlocarpio carpio | 15 | 1 | 15 | 1 | 15 | 1 | 15 | 1 |
| Hypophthalmichthys molitrix | 25 | 2 | 26 | 2 | 25 | 2 | 25 | 2 |
| Mystus mysticetus | 30 | 10 | 30 | 10 | 30 | 10 | 30 | 10 |
| Puntius conchophilus | 25 | 10 | 25 | 10 | 25 | 10 | 25 | 10 |
| Tilapia sp. | 25 | 10 | 25 | 10 | 25 | 10 | 25 | 10 |
| Total | 100 | 40 | 100 | 40 | 100 | 40 | 100 | 40 |



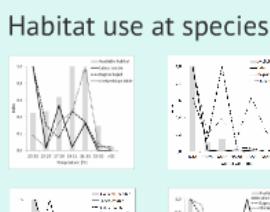
Habitat use at community level

Habitat use at species level

Methods

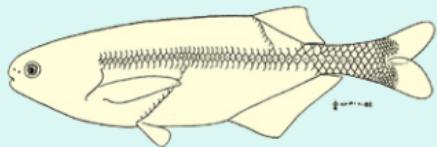
Limitations

| | |
|-----------------------|---------------------------|
| Electric fishing | Cast net fishing |
| Max. water depth 1 m | Min. water depth 0.2 m |
| Conductivity | Velocity |
| Turbidity | Structures (rocks, etc..) |
| Equipment/spare parts | Min. watered width 4 m |
| 3 People | Examiner |
| Size selective | Size selection |
| Species selective | |



Fish asssemblages

| | Kougri | Koubri | Bagre | Nazinga | Others | Total |
|-----------------------------|--------|--------|-------|---------|--------|--------|
| Number of individuals | 2,738 | 5,040 | 2,567 | 5,643 | 2,347 | 18,335 |
| Number of species | 33 | 45 | 33 | 47 | 33 | 70 |
| Number of exclusive species | 2 | 11 | 1 | 12 | 0 | 26 |
| Sampling days | 4 | 11 | 4 | 4 | 3 | 26 |
| Number of fished habitat | 23 | 53 | 34 | 22 | 25 | 157 |
| Abundance per sampling day | 685 | 458 | 642 | 1411 | 799 | 799 |
| Mean Total length (mm) | 73.5 | 76.1 | 61.1 | 123.8 | 78.8 | 86.9 |

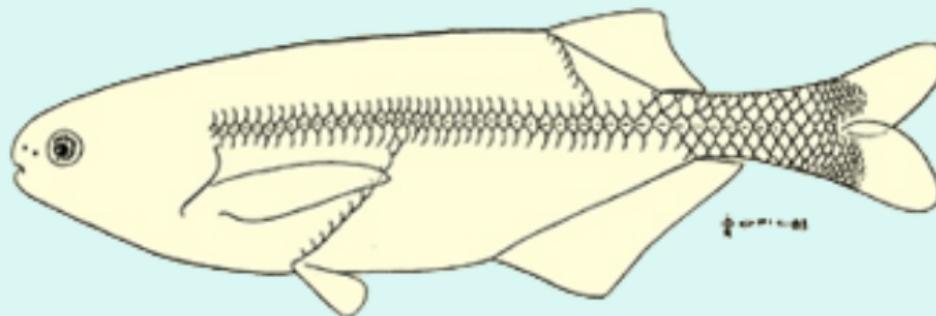


| Name | Author | Year |
|---------------------------------|--------------|------|
| <i>Brevimyrus niger</i> | Günther | 1866 |
| <i>Gnathonemus niger</i> | Günther | 1866 |
| <i>Mormyrus niger</i> | Günther | 1866 |
| <i>Marcusenius lhuysi</i> | Steindachner | 1870 |
| <i>Pollimyrus lhuysi</i> | Steindachner | 1870 |
| <i>Mormyrus lhuysi</i> | Steindachner | 1870 |
| <i>Gnathonemus baudoni</i> | Pellegrin | 1919 |
| <i>Marcusenius macularius</i> | Fowler | 1936 |
| <i>Brienomyrus (Brevimyrus)</i> | Taverne | 1971 |
| <i>Brienomyrus niger</i> | Taverne | 1971 |

| Family | Number of genus | Number of species |
|------------------|-----------------|-------------------|
| ALESTIDAE | 5 (5) | 14 (12) |
| AMPHILIIDAE | 2 (0) | 2 (0) |
| ANABANTIDAE | 1 (1) | 2 (1) |
| APLOCHEILIDAE | 4 (0) | 5 (0) |
| ARIIDAE | 1 (0) | 1 (0) |
| BAGRIDAЕ | 1 (1) | 3 (2) |
| CENTROPOMIDAE | 1 (1) | 1 (1) |
| CHANNIDAE | 1 (0) | 1 (0) |
| CICHLIDAE | 6 (5) | 11 (7) |
| CITHARINIDAE | 2 (1) | 3 (1) |
| CLARIIDAE | 2 (2) | 7 (3) |
| CLAROTEIDAE | 3 (2) | 5 (3) |
| CLUPEIDAE | 2 (0) | 2 (0) |
| CROMERIIDAE | 1 (0) | 2 (0) |
| CYPRINIDAE | 6 (4) | 23 (14) |
| DISTICHODONTIDAE | 5 (1) | 8 (1) |
| ELEOTRIDAE | 1 (0) | 1 (0) |
| GYMNARCHIDAE | 1 (0) | 1 (0) |
| HEPSETIDAE | 1 (0) | 1 (0) |
| MALAPTERURIDAE | 1 (1) | 2 (1) |
| MASTACembelidae | 1 (0) | 1 (0) |
| MOCHOKIDAE | 2 (1) | 16 (8) |
| MORMYRIDAE | 10 (6) | 21 (11) |
| NOTHOBRANCHIIDAE | 2 (0) | 2 (0) |
| OSTEOGLOSSIDAE | 1 (0) | 1 (0) |
| POECILIIDAE | 3 (0) | 3 (0) |
| POLYPTERIDAE | 1 (1) | 3 (1) |
| PROTOPTERIDAE | 1 (1) | 1 (1) |
| SCHILBEIDAE | 3 (2) | 5 (3) |
| TETRAODONTIDAE | 1 (0) | 1 (0) |
| | 30 (16) | 72 (35) |
| | | 149 (70) |

Fish asssemblages

| | Kougri | Koubri | Bagre | Nazinga | Others | Total |
|-----------------------------|--------|--------|-------|---------|--------|--------|
| Number of individuals | 2,738 | 5,040 | 2,567 | 5,643 | 2,347 | 18,335 |
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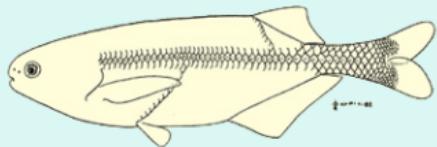


| Name | Author | Year |
|---------------------------------|--------------|------|
| <i>Brevimyrus niger</i> | Günther | 1866 |
| <i>Gnathonemus niger</i> | Günther | 1866 |
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| <i>Marcusenius lhuysi</i> | Steindachner | 1870 |
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| <u>Family</u> | <u>Number of genus</u> | <u>Number of species</u> |
|------------------|------------------------|--------------------------|
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| GYMNARCHIDAE | 1 (0) | 1 (0) |
| HEPSETIDAE | 1 (0) | 1 (0) |
| MALAPTERURIDAE | 1 (1) | 2 (1) |
| MASTACEMBELIDAE | 1 (0) | 1 (0) |
| MOCHOKIDAE | 2 (1) | 16 (8) |
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| OSTEOGLOSSIDAE | 1 (0) | 1 (0) |
| POECILIIDAE | 3 (0) | 3 (0) |
| POLYPTERIDAE | 1 (1) | 3 (1) |
| PROTOPTERIDAE | 1 (1) | 1 (1) |
| SCHILBEIDAE | 3 (2) | 5 (3) |
| TETRAODONTIDAE | 1 (0) | 1 (0) |
| | 30 (16) | 72 (35) |
| | | 149 (70) |

Fish asssemblages

| | Kougri | Koubri | Bagre | Nazinga | Others | Total |
|-----------------------------|--------|--------|-------|---------|--------|--------|
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| Mean Total length (mm) | 73.5 | 76.1 | 61.1 | 123.8 | 78.8 | 86.9 |



| Name | Author | Year |
|---------------------------------|--------------|------|
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| <i>Gnathonemus niger</i> | Günther | 1866 |
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| <i>Brienomyrus niger</i> | Taverne | 1971 |

| Family | Number of genus | Number of species |
|------------------|-----------------|-------------------|
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| AMPHILIIDAE | 2 (0) | 2 (0) |
| ANABANTIDAE | 1 (1) | 2 (1) |
| APLOCHEILIDAE | 4 (0) | 5 (0) |
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| CLUPEIDAE | 2 (0) | 2 (0) |
| CROMERIIDAE | 1 (0) | 2 (0) |
| CYPRINIDAE | 6 (4) | 23 (14) |
| DISTICHODONTIDAE | 5 (1) | 8 (1) |
| ELEOTRIDAE | 1 (0) | 1 (0) |
| GYMNARCHIDAE | 1 (0) | 1 (0) |
| HEPSETIDAE | 1 (0) | 1 (0) |
| MALAPTERURIDAE | 1 (1) | 2 (1) |
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| POECILIIDAE | 3 (0) | 3 (0) |
| POLYPTERIDAE | 1 (1) | 3 (1) |
| PROTOPTERIDAE | 1 (1) | 1 (1) |
| SCHILBEIDAE | 3 (2) | 5 (3) |
| TETRAODONTIDAE | 1 (0) | 1 (0) |
| | 30 (16) | 72 (35) |
| | | 149 (70) |

Methods

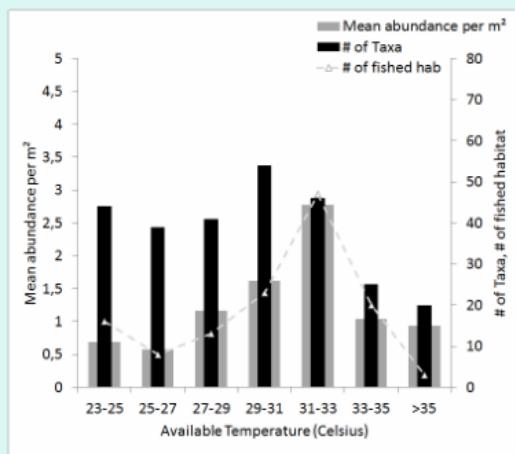
Limitations

| Electric fishing | Cast net fishing |
|-------------------------|--------------------------------------|
| Max. water depth 1 m | Min water depth 0.2 m |
| Conductivity | Velocity |
| Turbidity | Structures (rocks, <u>xylal...</u>) |
| Equipment/spare parts | Min wetted width 4 m |
| 3 People | Experience |
| Size selective | Size selective |
| Species selective | |



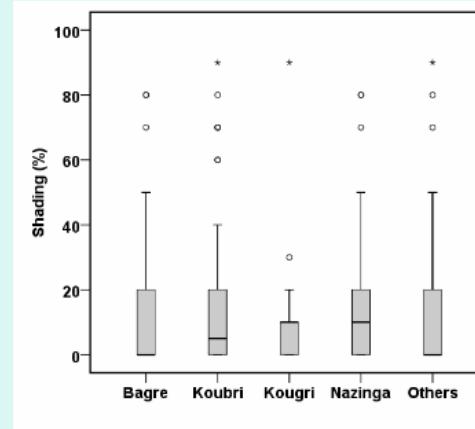
Habitat

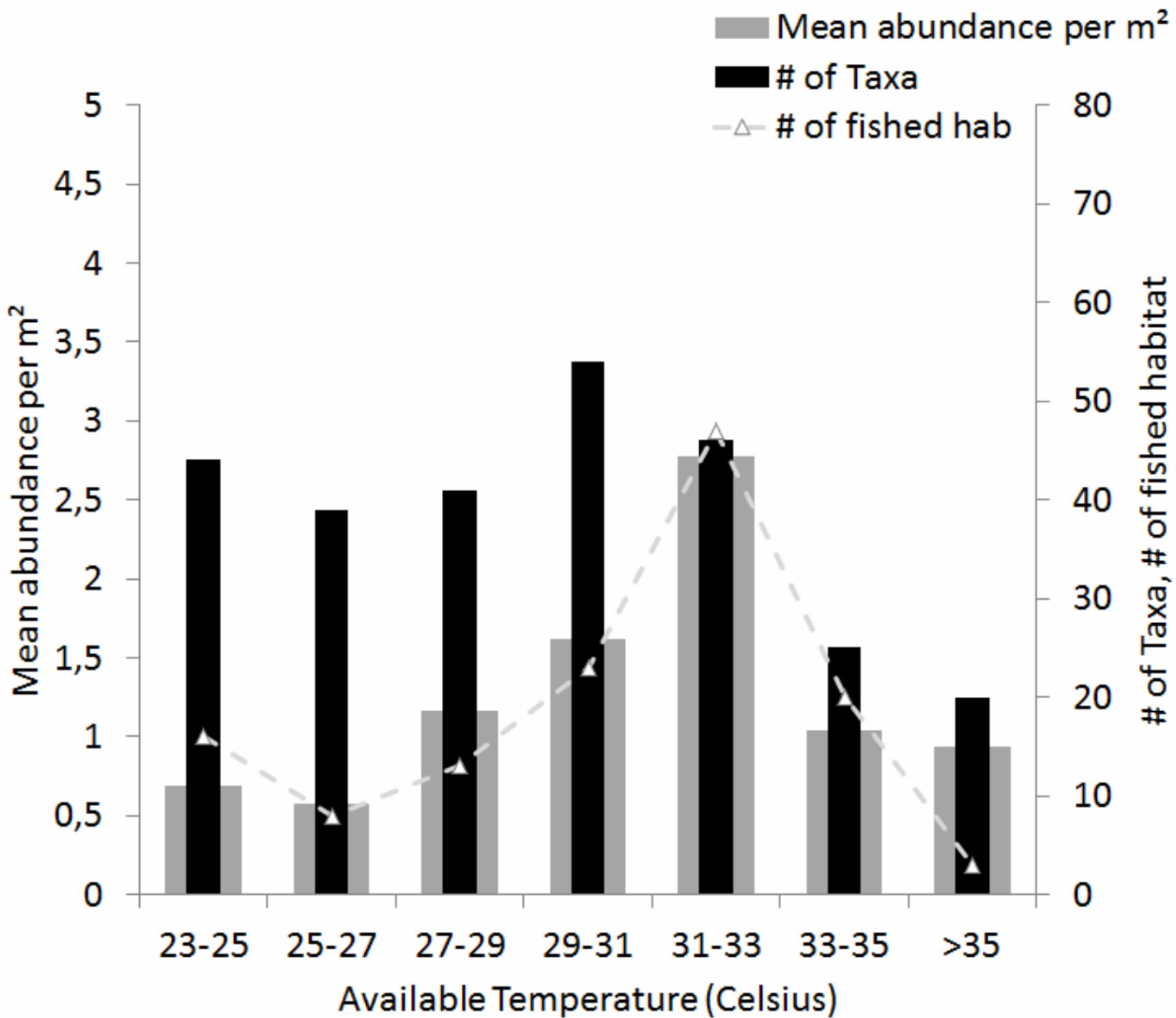
Habitat use at community level



| | Temperature (°C) | | | pH value | | |
|---------|------------------|------|------|----------|------|------|
| | Min | Max | Mean | Min | Max | Mean |
| Kougri | 28.0 | 35.1 | 31.7 | 7.2 | 9.8 | 7.9 |
| Koubri | 29.2 | 35.1 | 31.8 | 6.4 | 10.1 | 7.6 |
| Bagre | 24.0 | 31.0 | 26.9 | 6.8 | 9.0 | 8.3 |
| Nazinga | 23.3 | 30.2 | 25.5 | 7.6 | 8.6 | 7.8 |
| Others | 28.2 | 35.0 | 32.5 | 7.2 | 9.6 | 7.8 |
| Total | 23.3 | 35.1 | 30.1 | 6.4 | 10.1 | 7.8 |

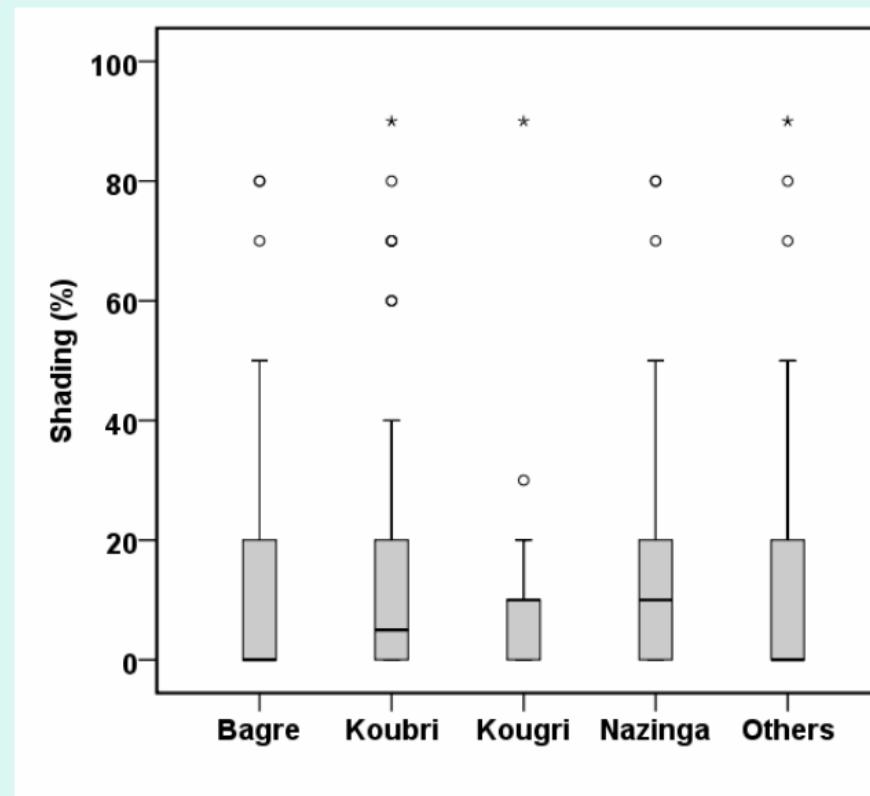
-> Effect of reservoir + Shading



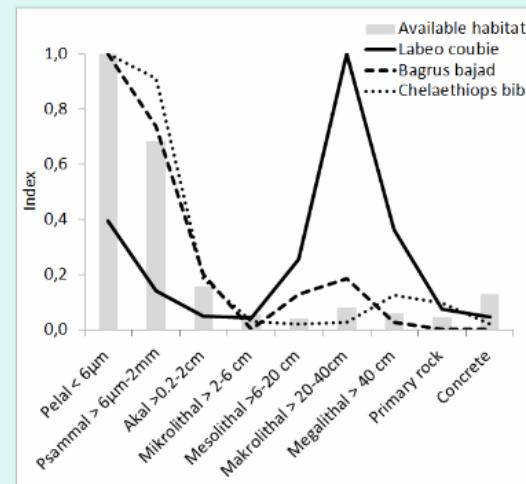
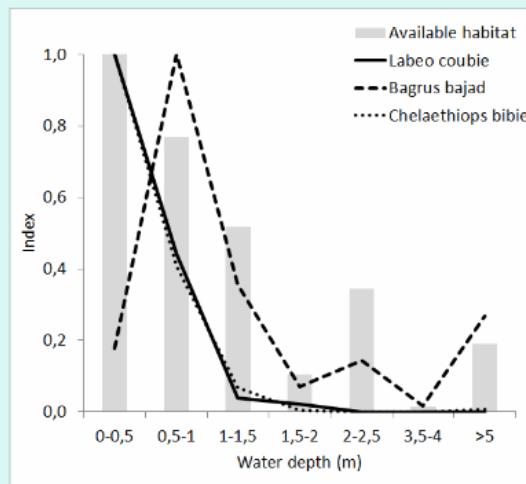
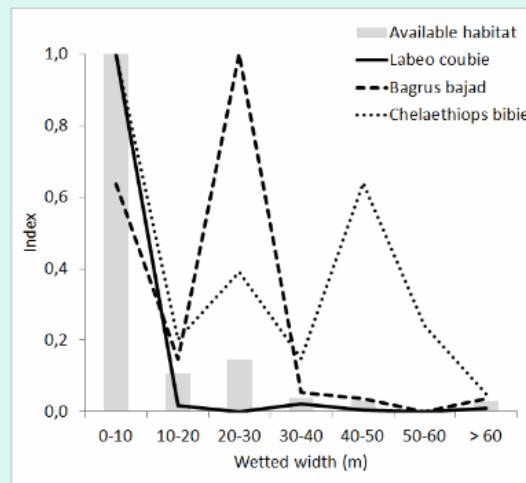
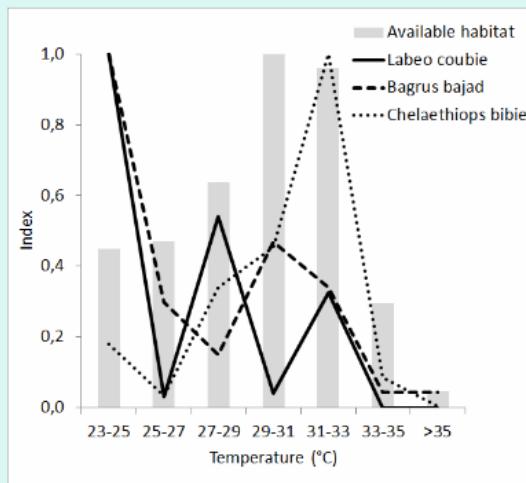


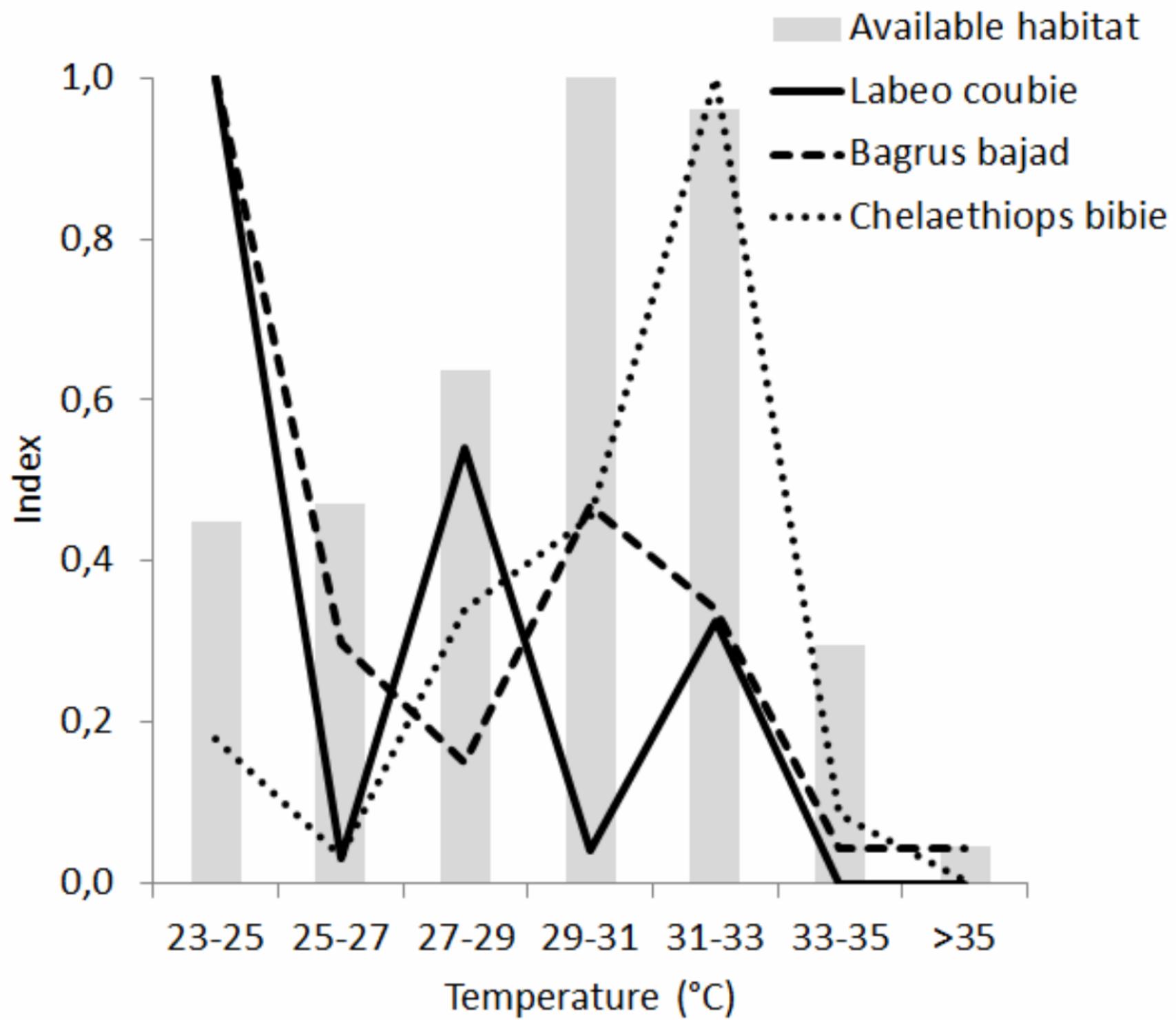
| | Temperature (°C) | | | pH value | | |
|---------|------------------|------|------|----------|------|------|
| | Min | Max | Mean | Min | Max | Mean |
| Kougri | 28.0 | 35.1 | 31.7 | 7.2 | 9.8 | 7.9 |
| Koubri | 29.2 | 35.1 | 31.8 | 6.4 | 10.1 | 7.6 |
| Bagre | 24.0 | 31.0 | 26.9 | 6.8 | 9.0 | 8.3 |
| Nazinga | 23.3 | 30.2 | 25.5 | 7.6 | 8.6 | 7.8 |
| Others | 28.2 | 35.0 | 32.5 | 7.2 | 9.6 | 7.8 |
| Total | 23.3 | 35.1 | 30.1 | 6.4 | 10.1 | 7.8 |

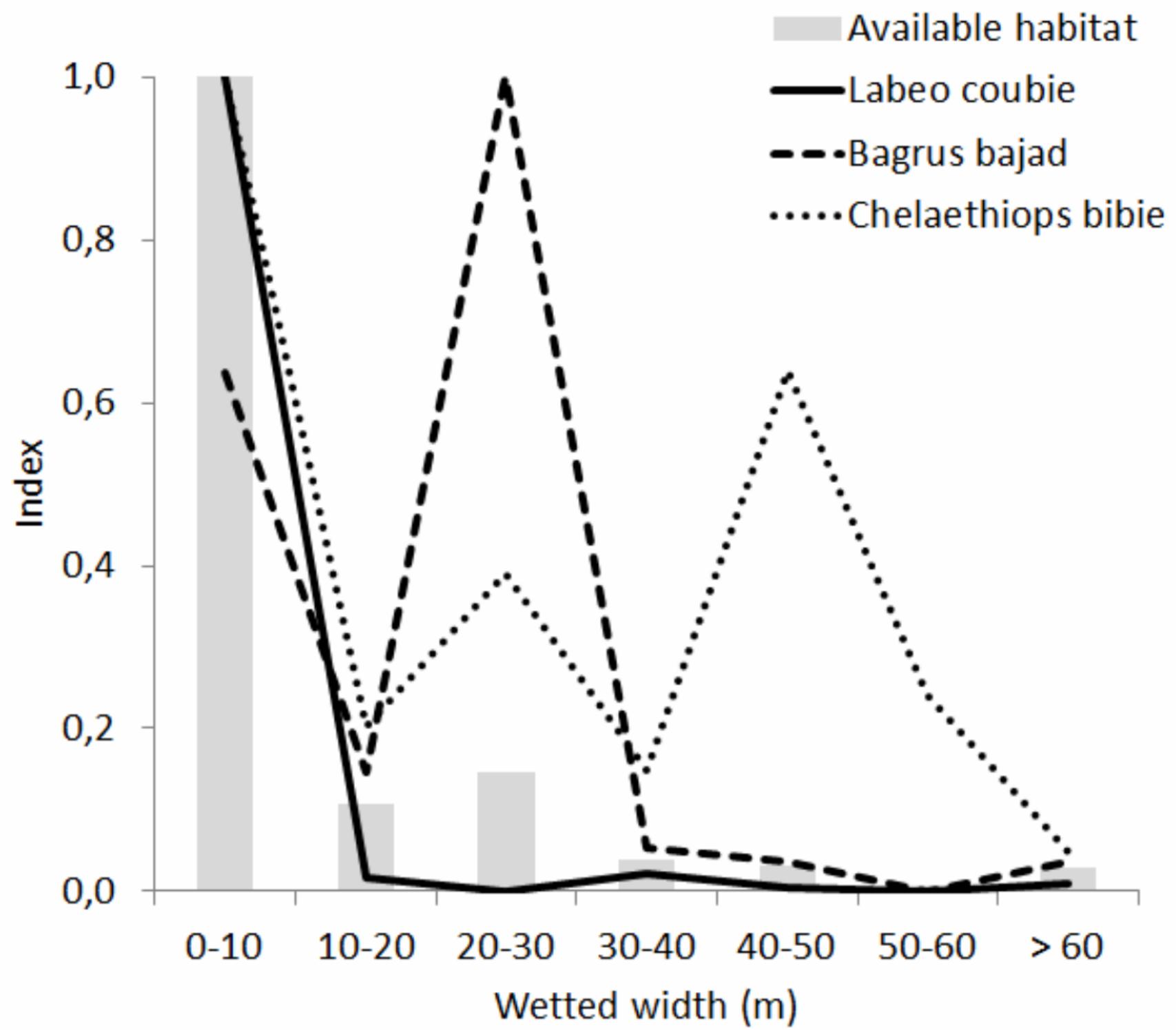
-> Effect of reservoir + Shading

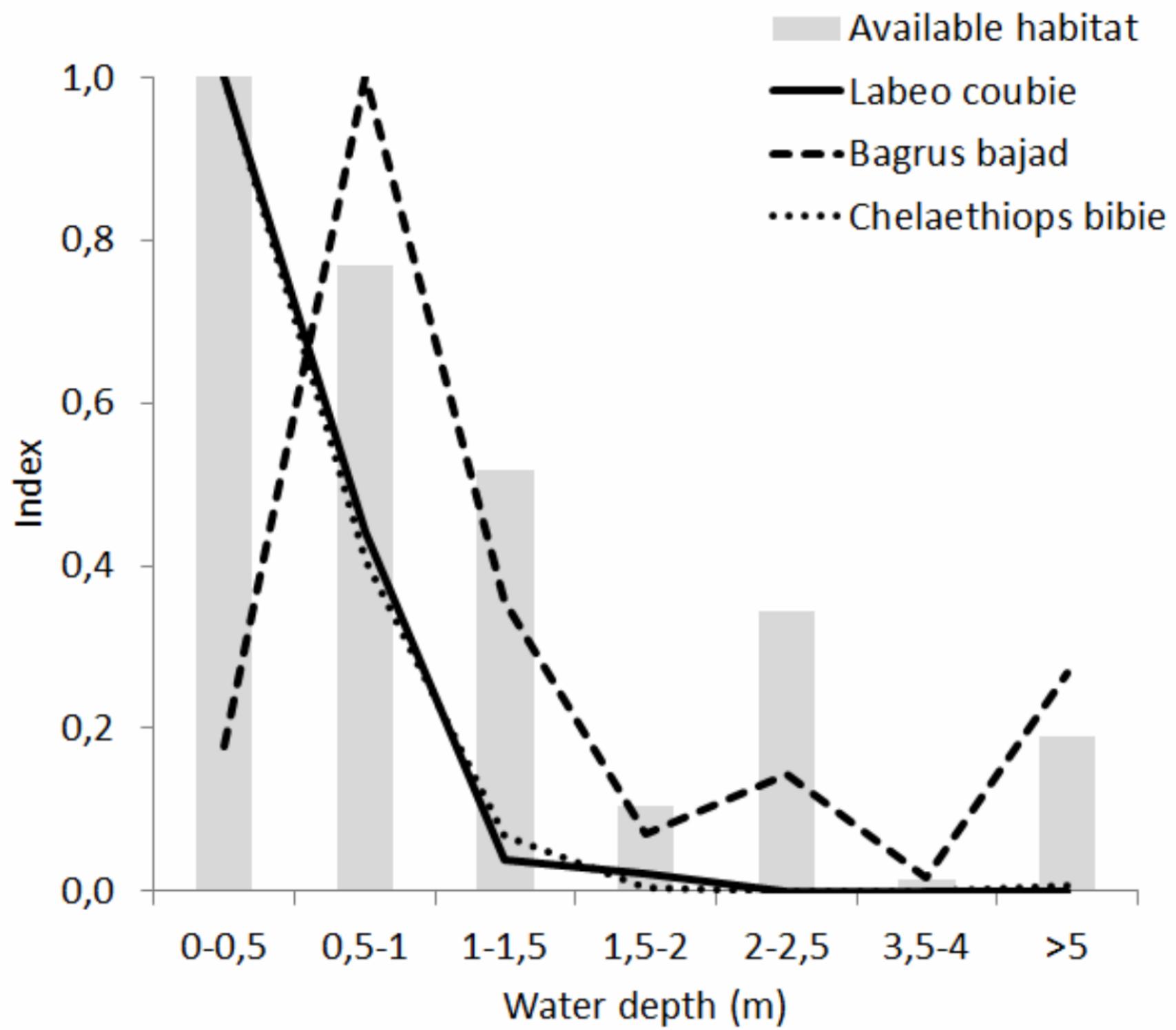


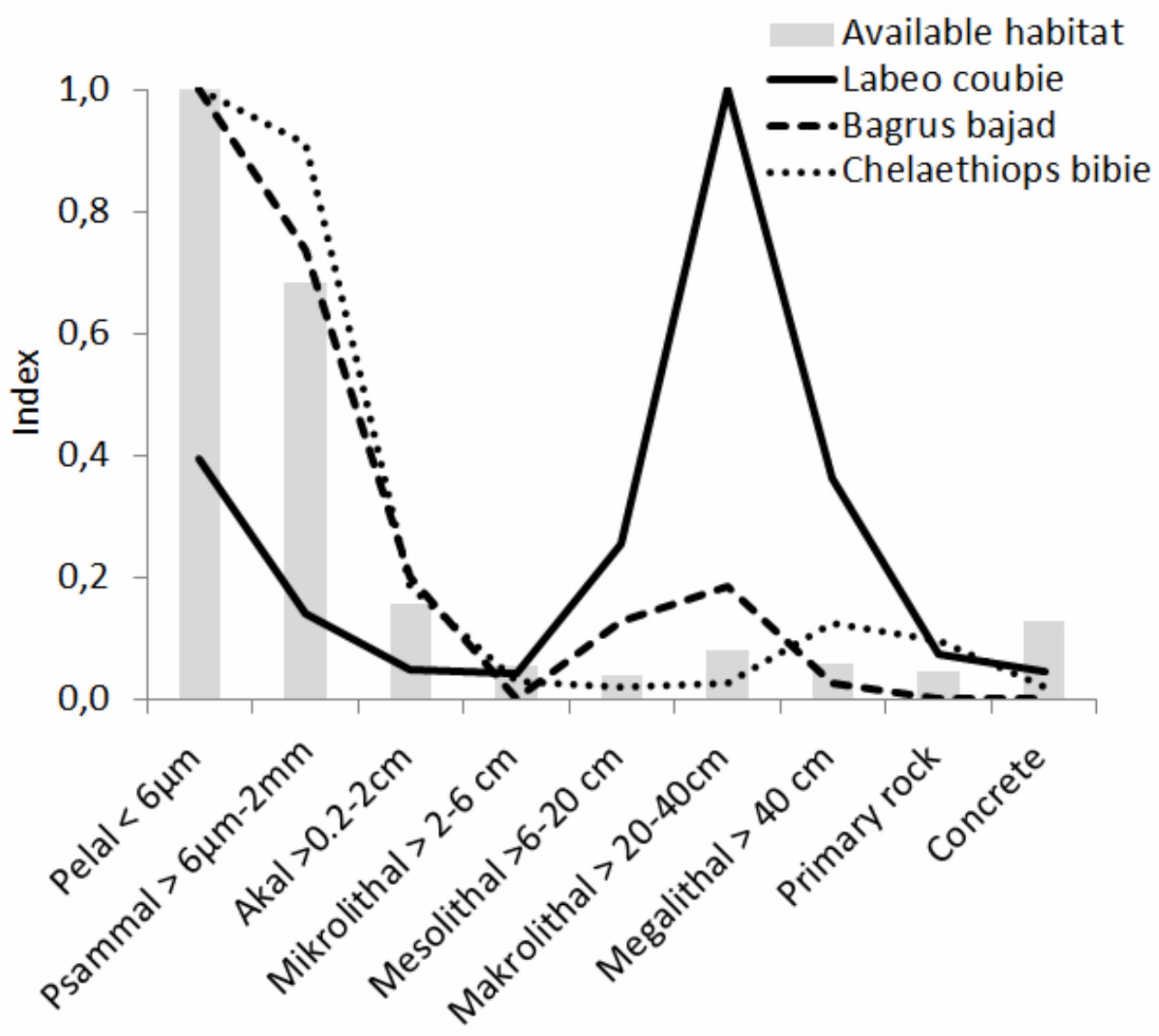
Habitat use at species level







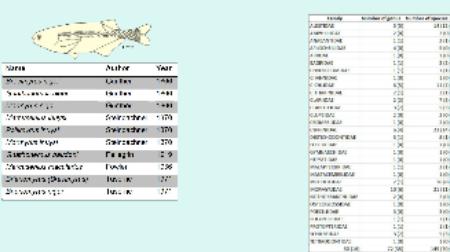




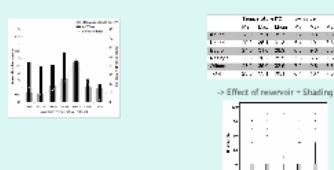
Discussion

Fish assambages

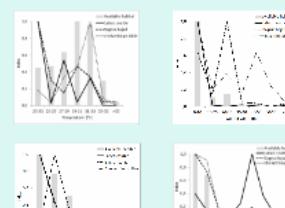
| Species | Length | Total | Length | Total | Length | Total | Length | Total |
|-----------------------------|--------|-------|--------|-------|--------|-------|--------|-------|
| Barbodes gonionotatus | 25 | 3 | 36 | 67 | 26 | 11 | | |
| Barbus barbus | 17 | 1 | 17 | 1 | 17 | 1 | 17 | 1 |
| Catlocarpio carpio | 15 | 1 | 15 | 1 | 15 | 1 | 15 | 1 |
| Hypophthalmichthys molitrix | 25 | 2 | 26 | 2 | 25 | 2 | 25 | 2 |
| Mystus mysticetus | 30 | 10 | 30 | 10 | 30 | 10 | 30 | 10 |
| Puntius conchophilus | 24 | 10 | 24 | 10 | 24 | 10 | 24 | 10 |



Habitat use at community level



Habitat use at species level



Methods

Limitations

| | |
|-----------------------|---------------------------|
| Electric fishing | Cast net fishing |
| Max. water depth 1 m | Min. water depth 0.2 m |
| Conductivity | Velocity |
| Turbidity | Structures (rocks, etc..) |
| Equipment/spare parts | Min. watered width 4 m |
| 3 People | Examiner |
| Size selective | Size selection |
| Species selective | |



Conclusions

- Combination of fishing methods cause of limitiations and exclusive species
- Rarefaction Curve, 13 habitat/site are enough to catch 95% of the species
- Temperature effects abundace and species richness (Reservoir, shading)
- Spatial differences
- Different Habitat Use of species

Thank you for your attention!

