The effects of population personality composition on ecosystem functioning

38th annual meeting of SQEBC
November 9th 2013

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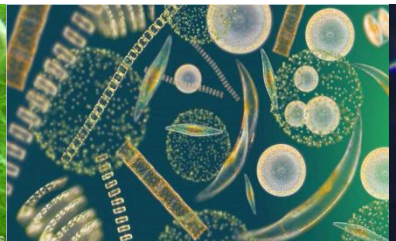
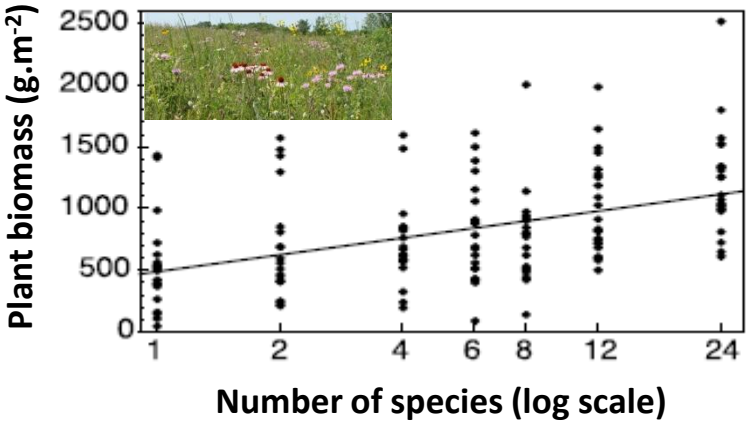


INTRODUCTION: *biological diversity and ecosystem functioning*

→ **INTERSPECIFIC** variations can affect ecosystem functioning



- Diversity
- Abundance

Loreau *et al.* 2001, Science

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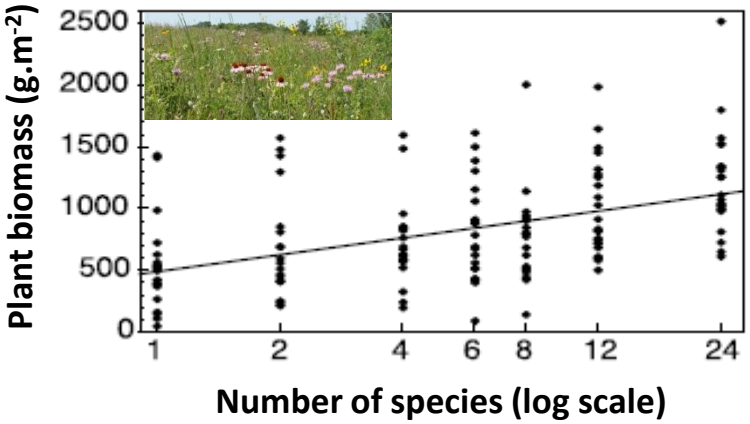
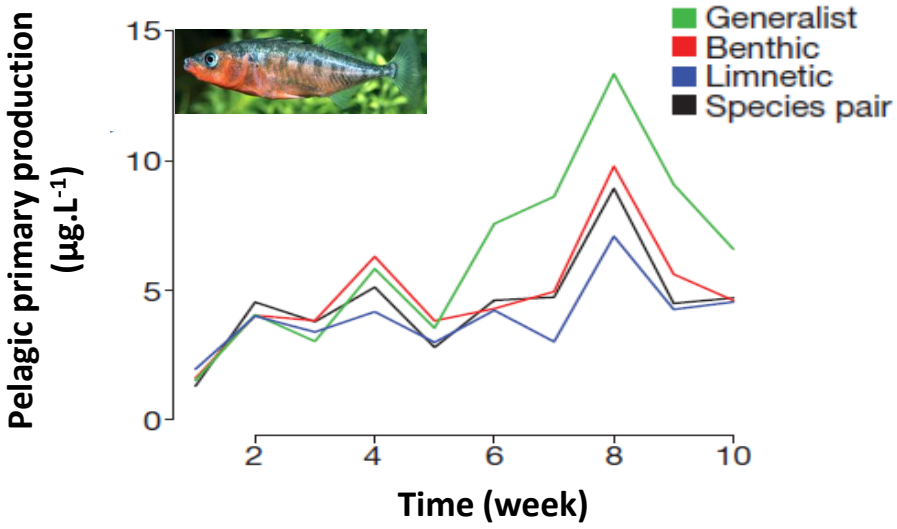


- Diversity
- Abundance

→ **INTRASPECIFIC** variations can also affect ecosystem functioning



- Trophic specialization
- Morphological differences

Loreau *et al.* 2001, Science
Harmon *et al.* 2009, Nature

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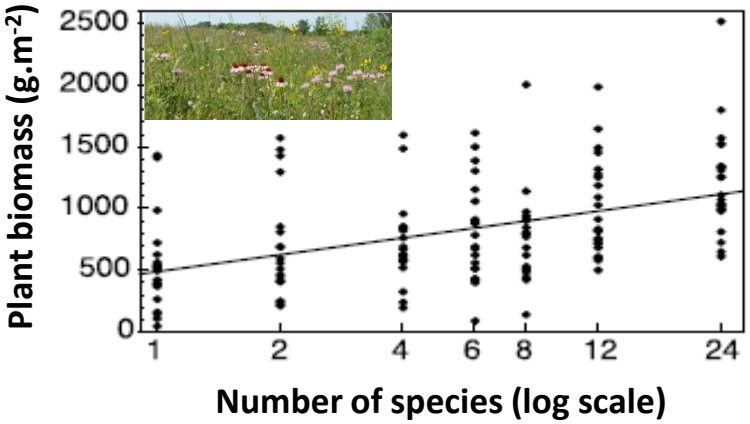

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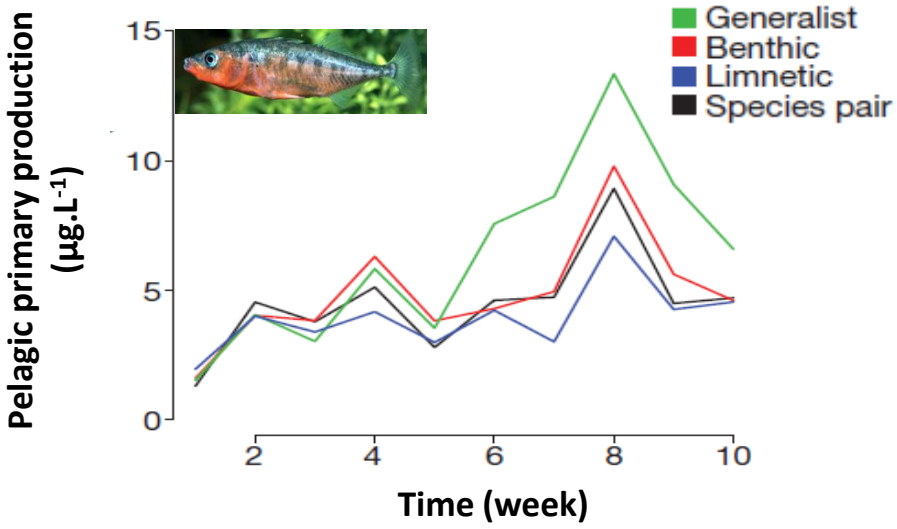

- Trophic specialization
- Morphological differences

- Behavioural variations ?

Loreau *et al.* 2001, Science
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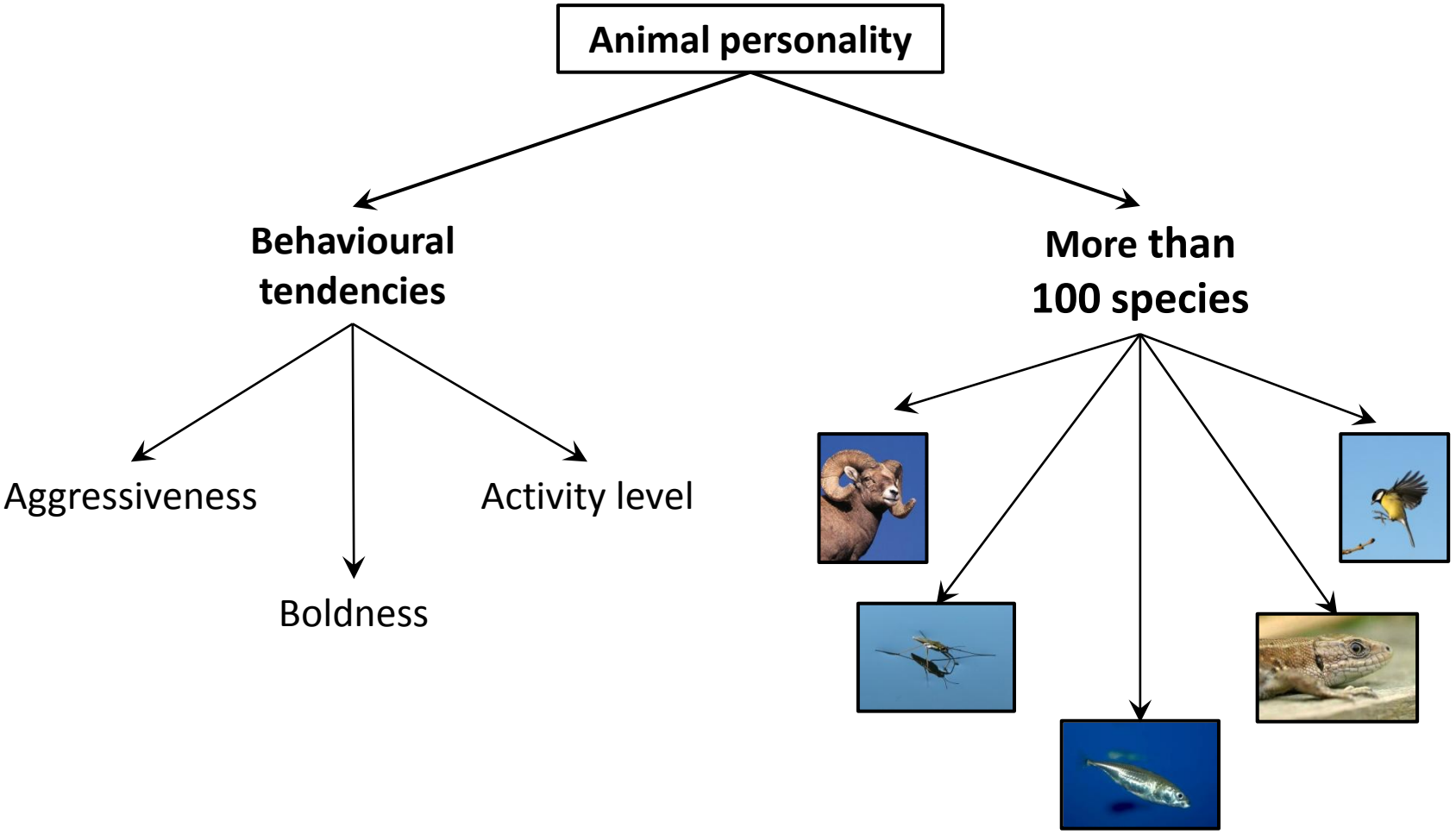
INTRODUCTION: *animal personality concept: a behavioural variation source*

Animal personality

INTRODUCTION: *animal personality concept: a behavioural variation source*



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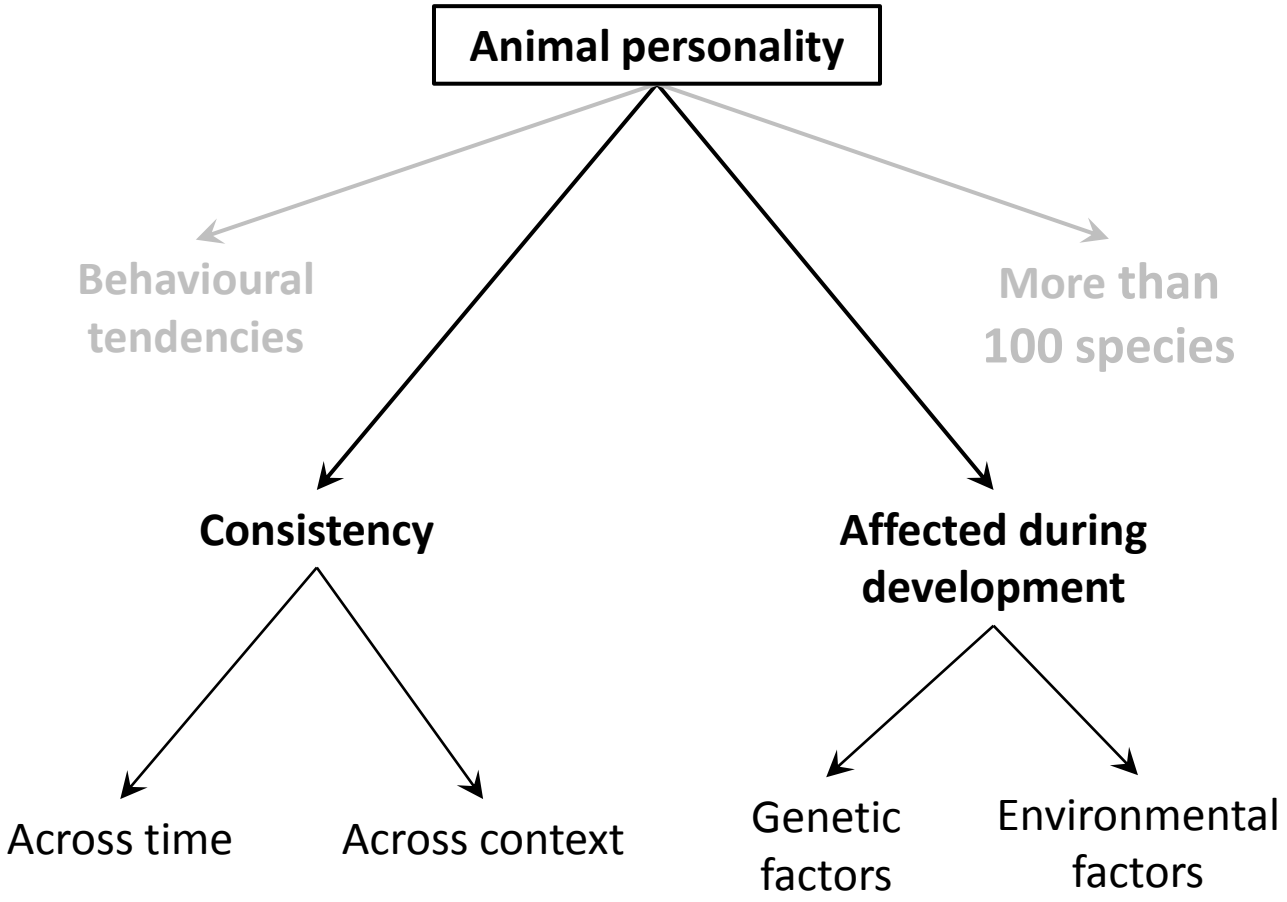

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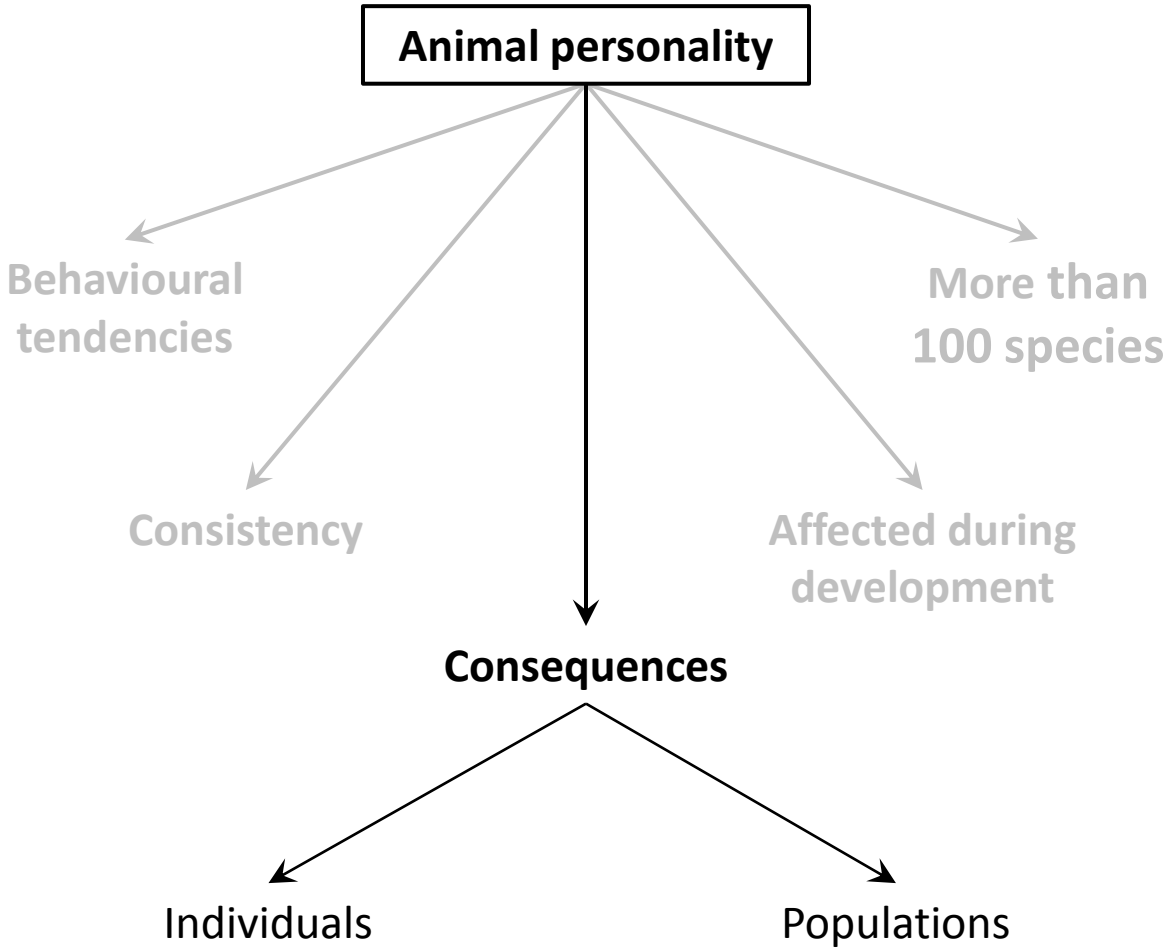

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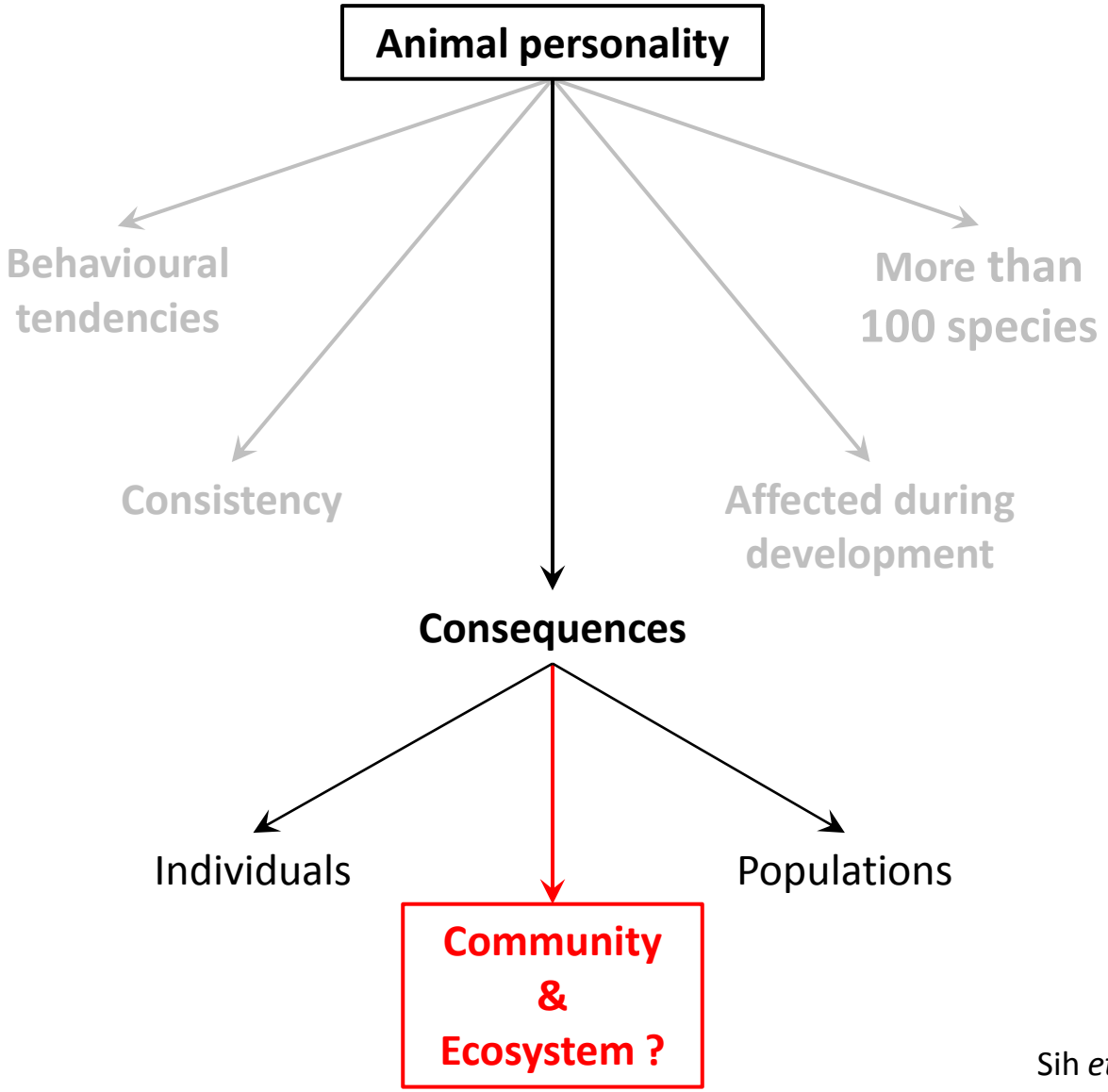

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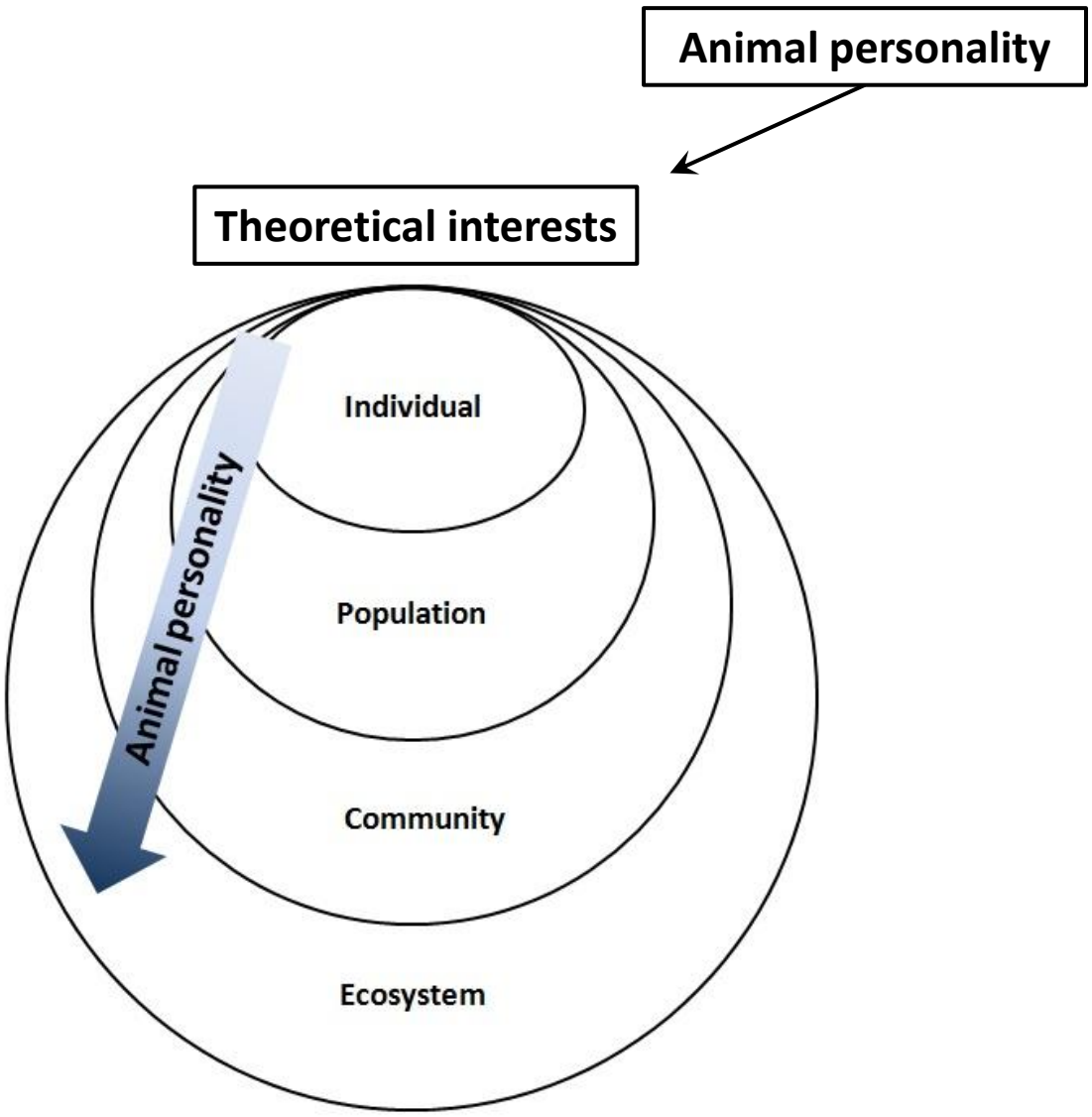
INTRODUCTION: *animal personality concept: studies interests*



Inspired from Cucherousset & Olden 2011, Fisheries

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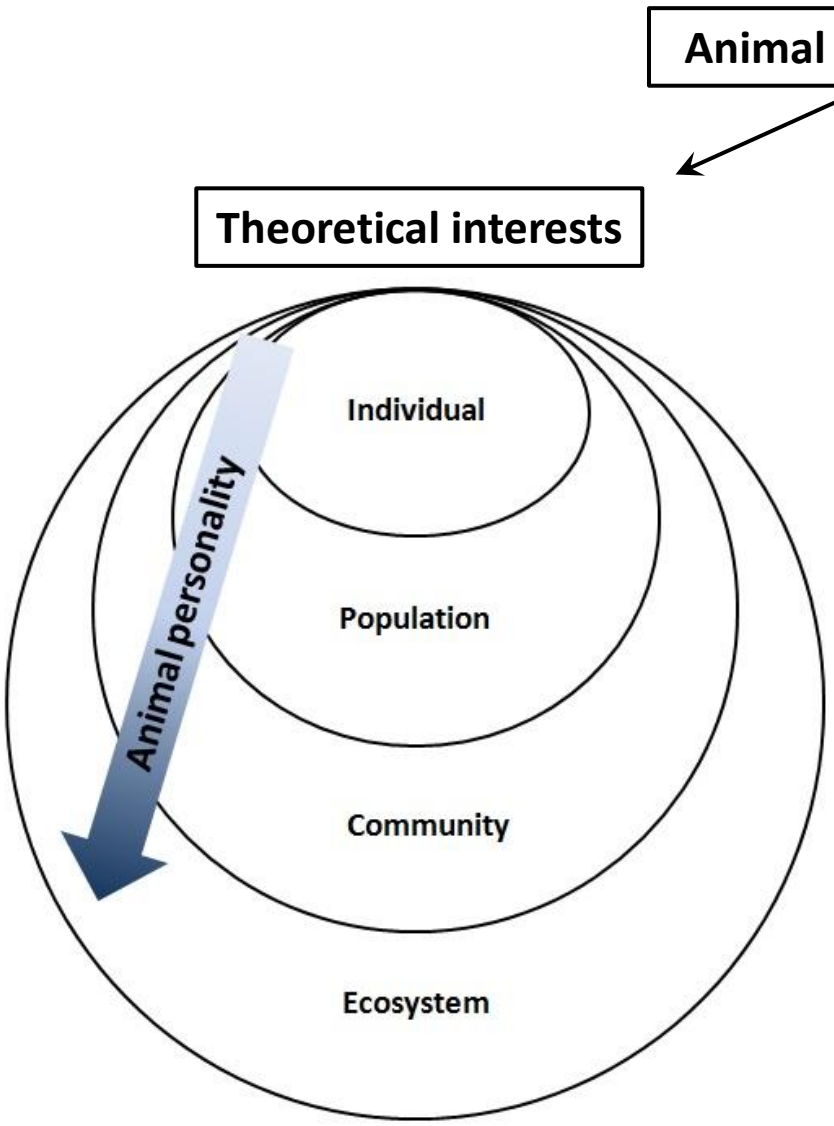

Human impacts
(pollution, resource using, habitat fragmentation, …)

Conservation plans
(Species reintroduction, genetic diversity, …)

Inspired from Cucherousset & Olden 2011, Fisheries

INTRODUCTION: *objective & hypotheses*

To determine whether differences in animal personality could affect ecosystem functioning

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To determine whether differences in animal personality could affect ecosystem functioning

Whether changes in personality composition of predator population, affects:

Hypothesis 1

Individual **growth rate** and population **trophic niches**

INTRODUCTION: *objective & hypotheses*

To determine whether differences in animal personality could affect ecosystem functioning

Whether changes in personality composition of predator population, affects:

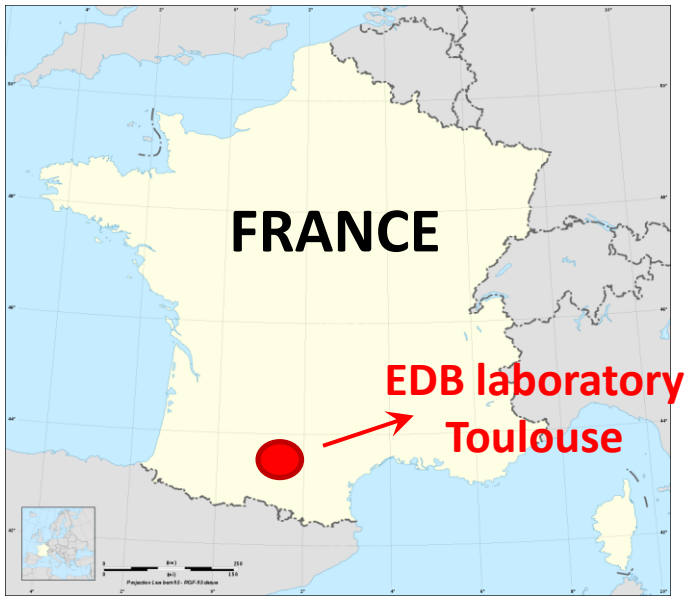
Hypothesis 1

Individual **growth rate** and population **trophic niches**

Hypothesis 2

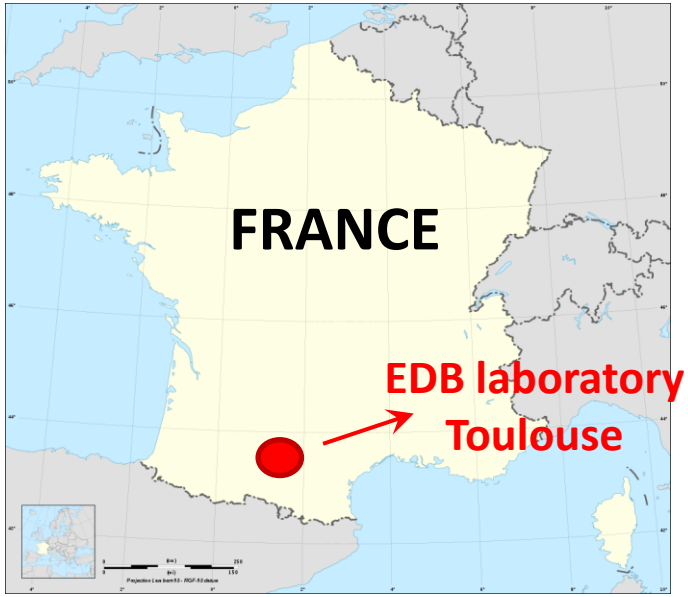
Prey community and **ecosystem functioning**

MATERIAL & METHODS: *behavioural test and individual selection*



Largemouth bass (*Micropterus salmoides*) → **Individually PIT tagged**

MATERIAL & METHODS: *behavioural test and individual selection*



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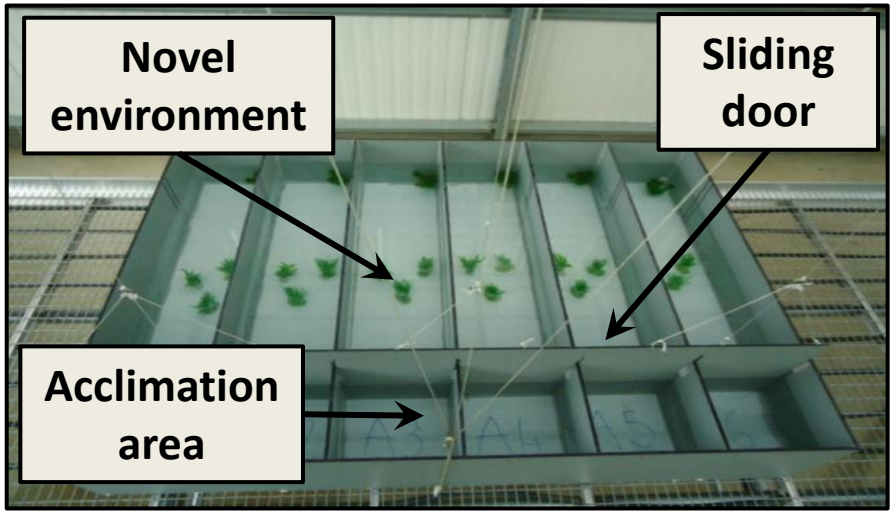
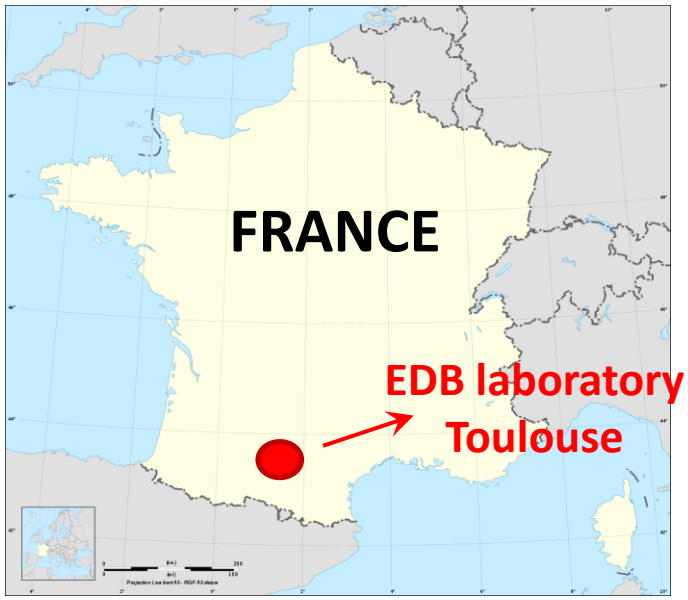


Personality test:

Emergence time → boldness

Brown *et al.* 2005, Anim. Behav.

MATERIAL & METHODS: *behavioural test and individual selection*



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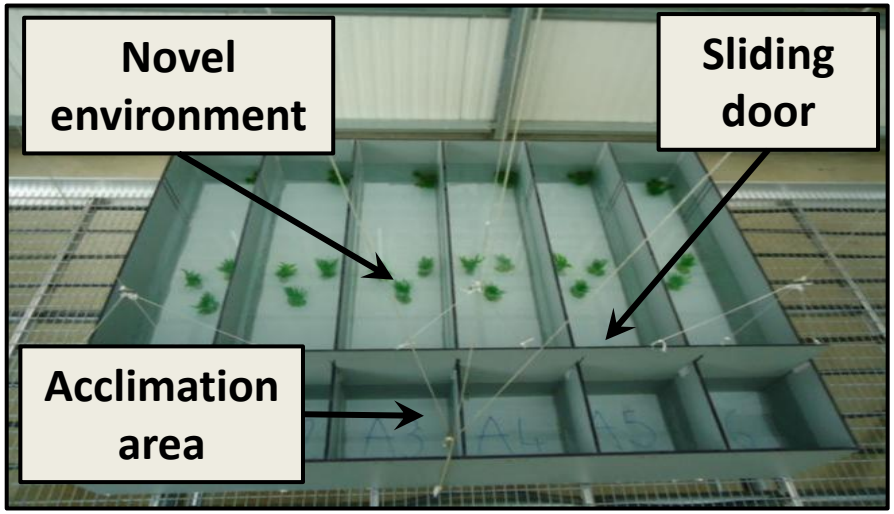


Personality test:

Emergence time → boldness

Selection of 72 most temporally consistent individuals among 178

Bold
24 individuals

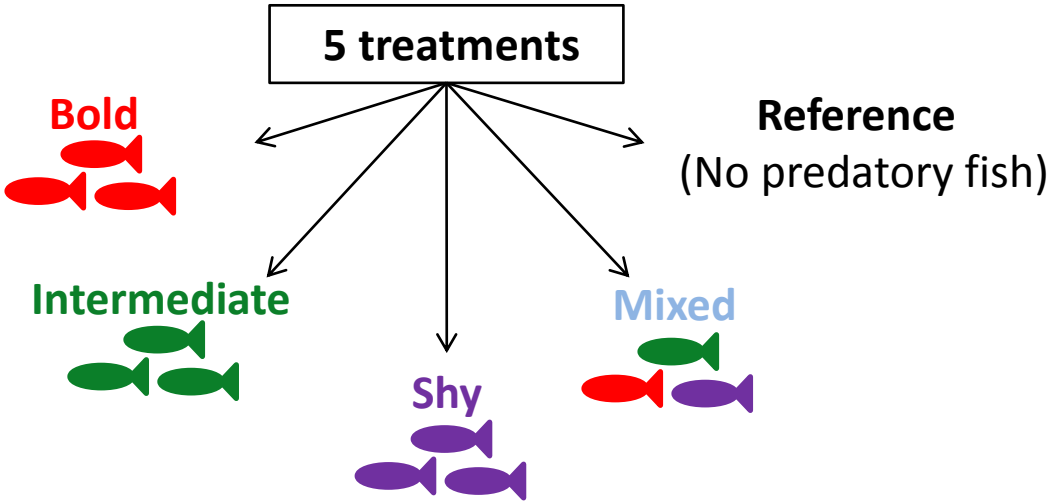
Intermediate
24 individuals

Shy
24 individuals

ICC = 0.51
P < 0.001

Brown *et al.* 2005, Anim. Behav.

MATERIAL & METHODS: *behavioural test and individual selection*



24 populations composed of 3 individuals

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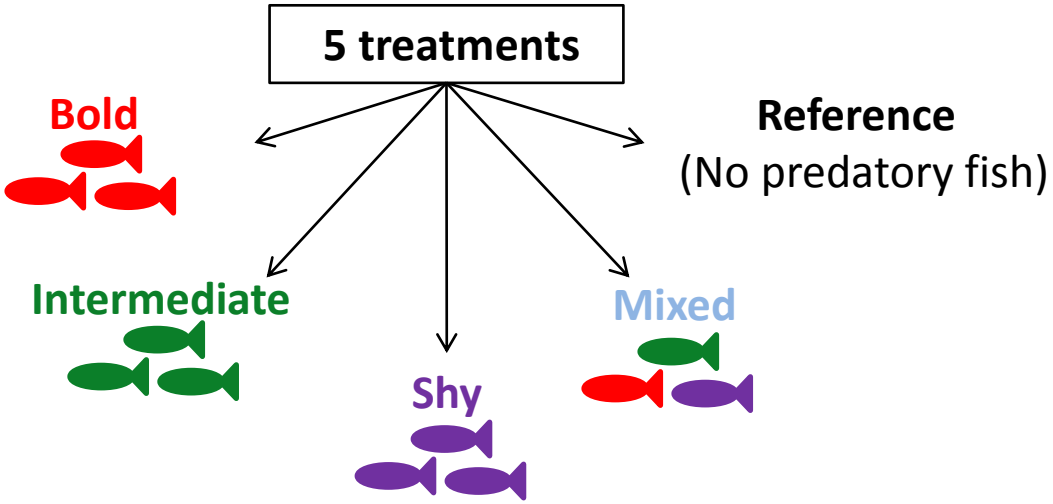


24 populations composed of 3 individuals

Moulis experimental station
(Summer 2012: during 6.5 weeks)

Experimental design:

- 5 treatments X **6 replicates** = 30 mesocosms

- Inoculation of **primary producers** and **primary consumers**
(3 weeks before the experiment)

↓

Lake ecosystem

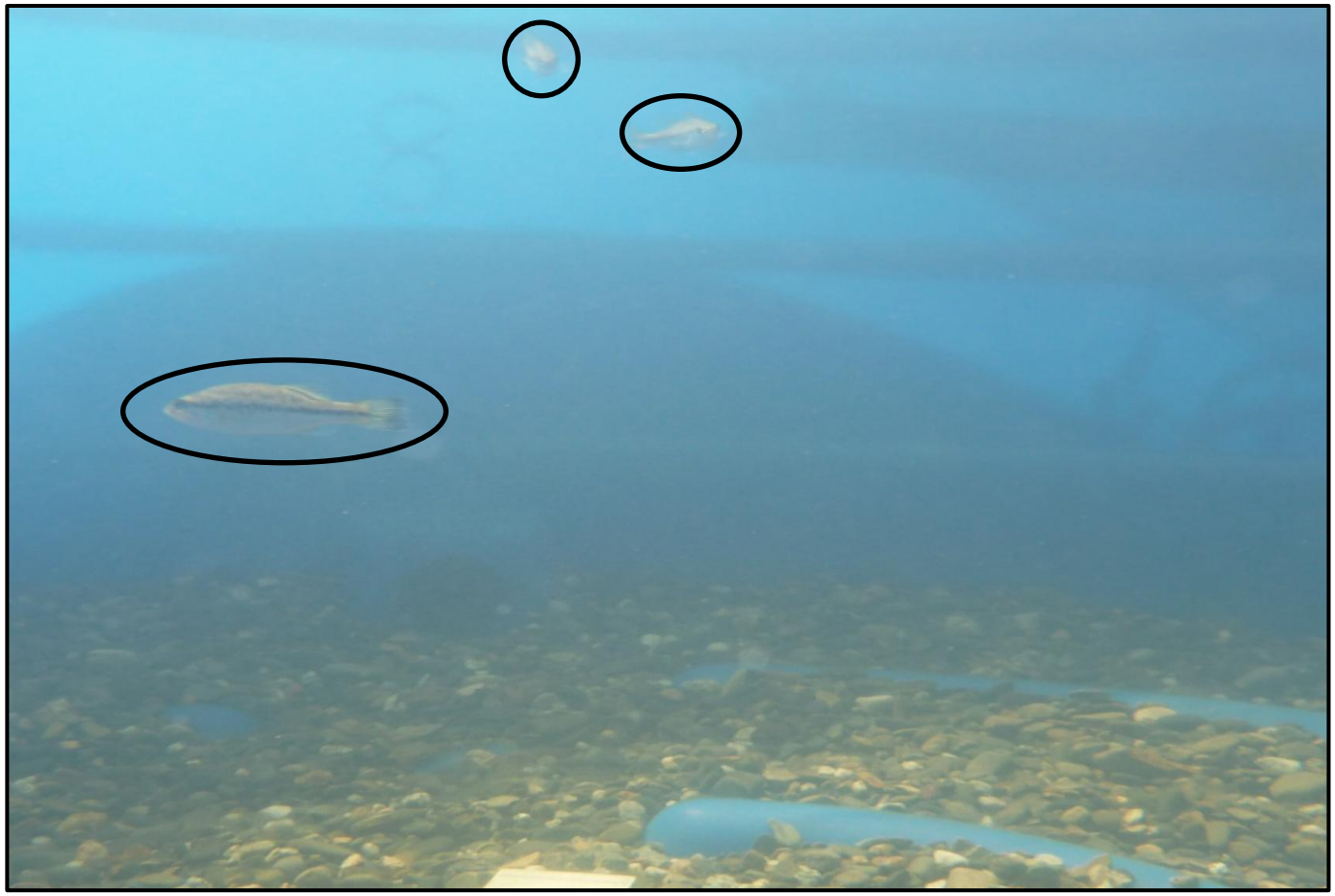
MATERIAL & METHODS: *data acquisition*

Internal view of a mesocosm

MATERIAL & METHODS: *data acquisition*

- **Individuals growth rate**

Predator population
(fish)



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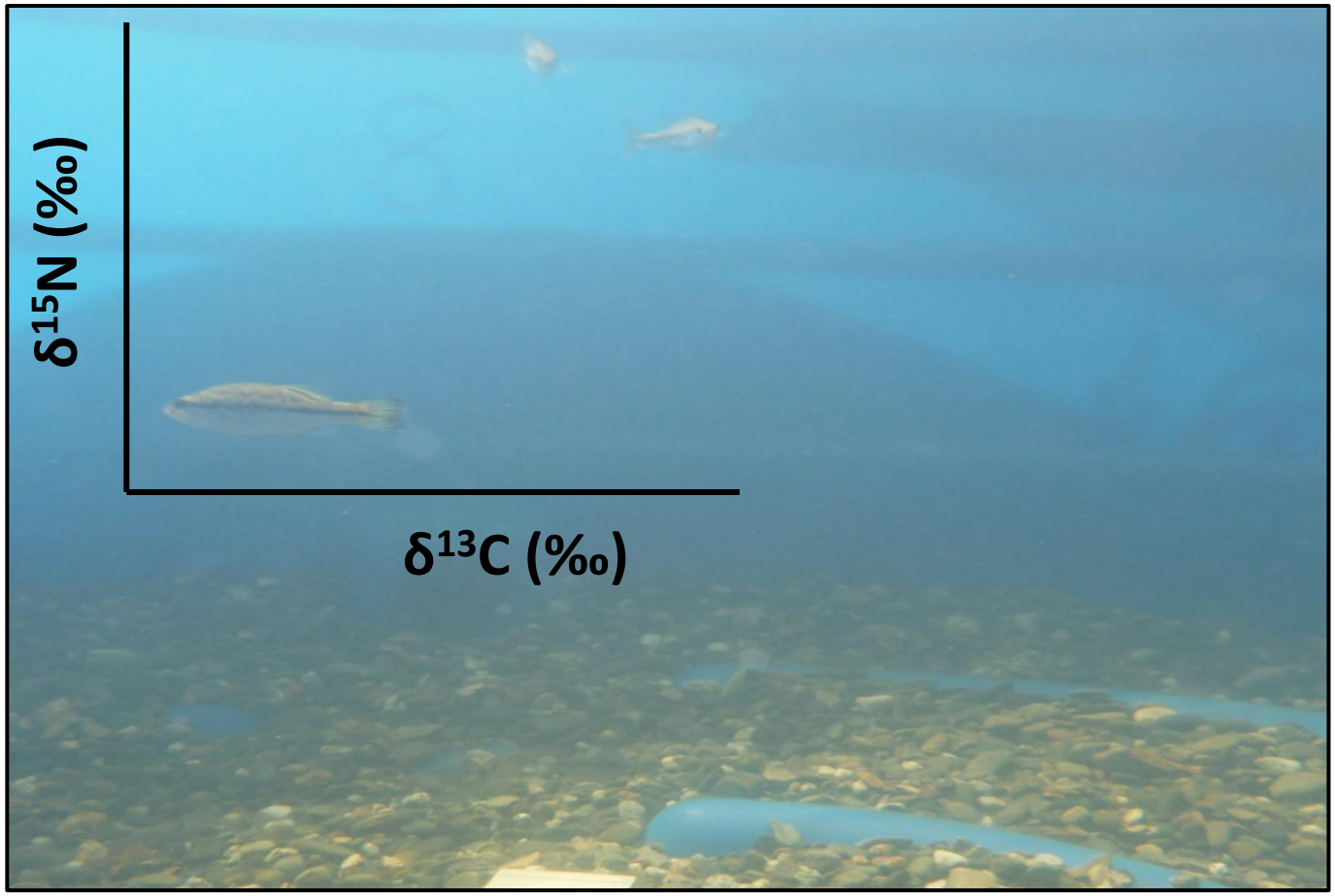

MATERIAL & METHODS: *data acquisition*

- **Individuals growth rate**
- **Trophic niche position**
- **Trophic niche size**

Predator population
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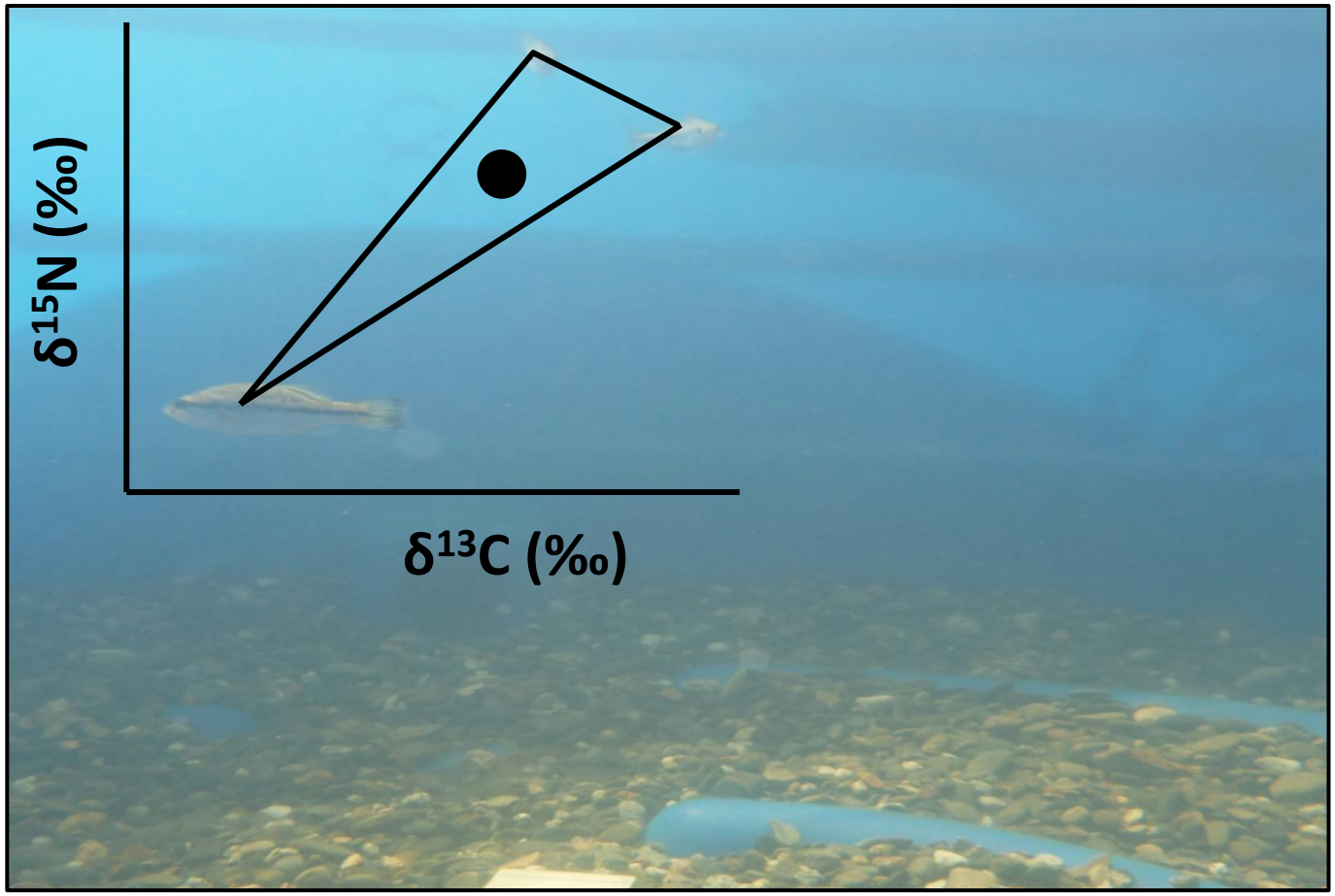
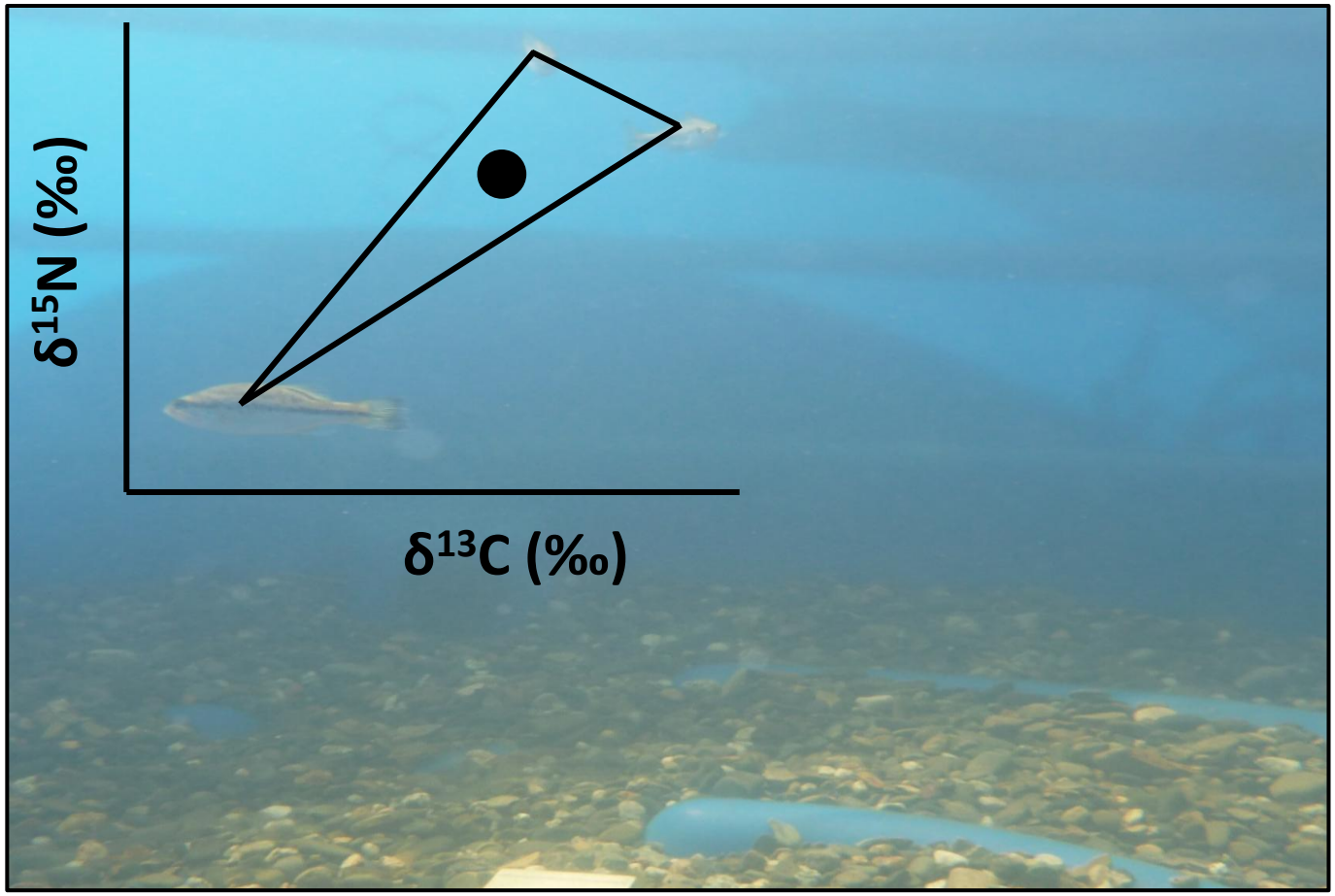


MATERIAL & METHODS: *data acquisition*

- Individuals growth rate
- **Trophic niche position**
- **Trophic niche size**

Stable isotope analysis
- Explanations -



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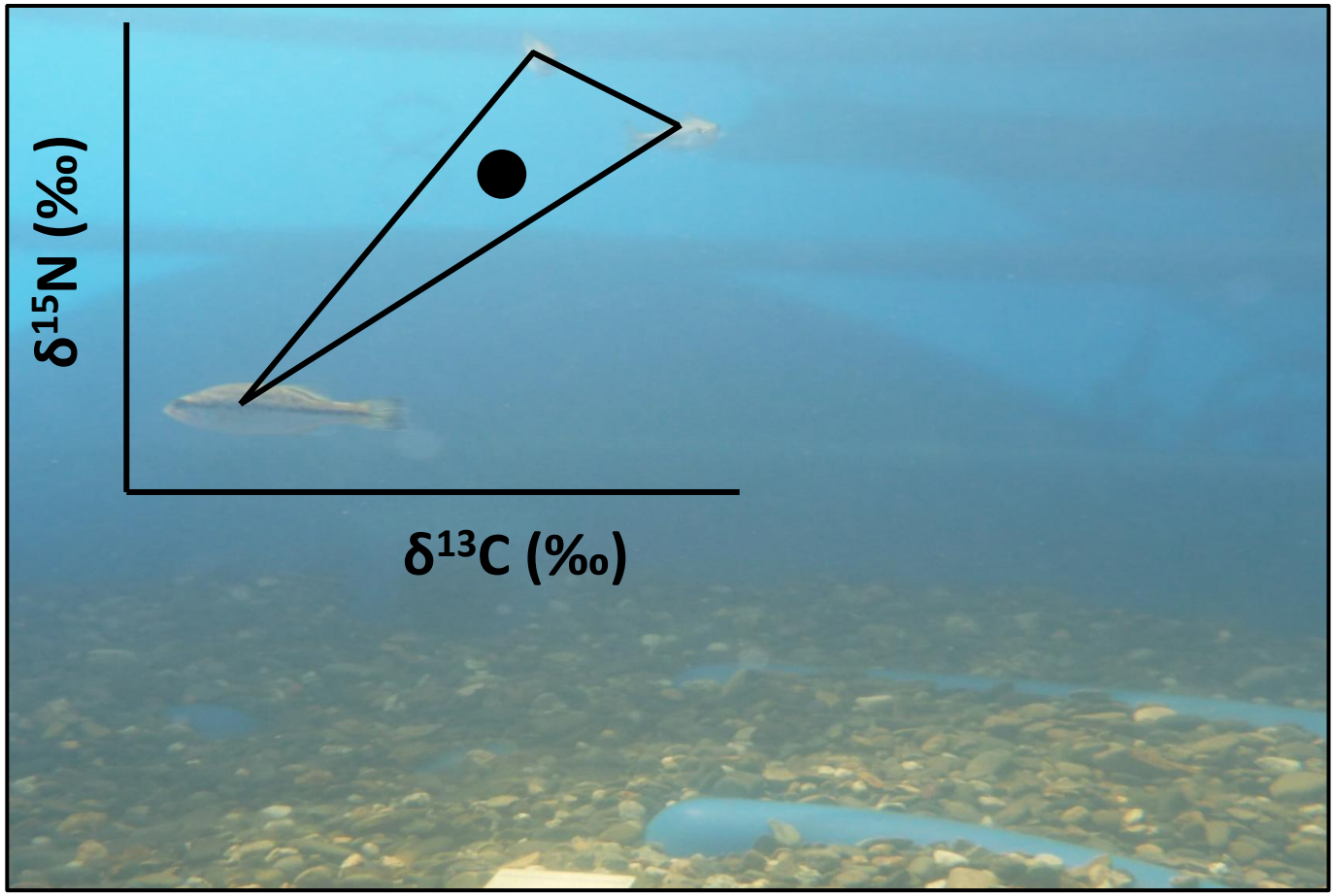
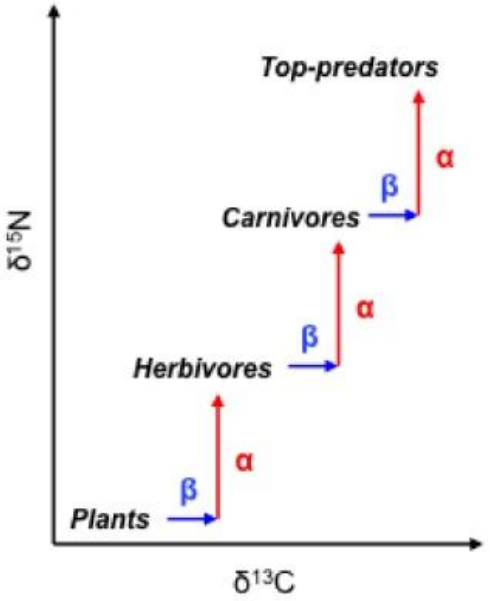
→ Characterization of the origin of the organic matter absorbed by predators





Layman *et al.* 2007, Ecology

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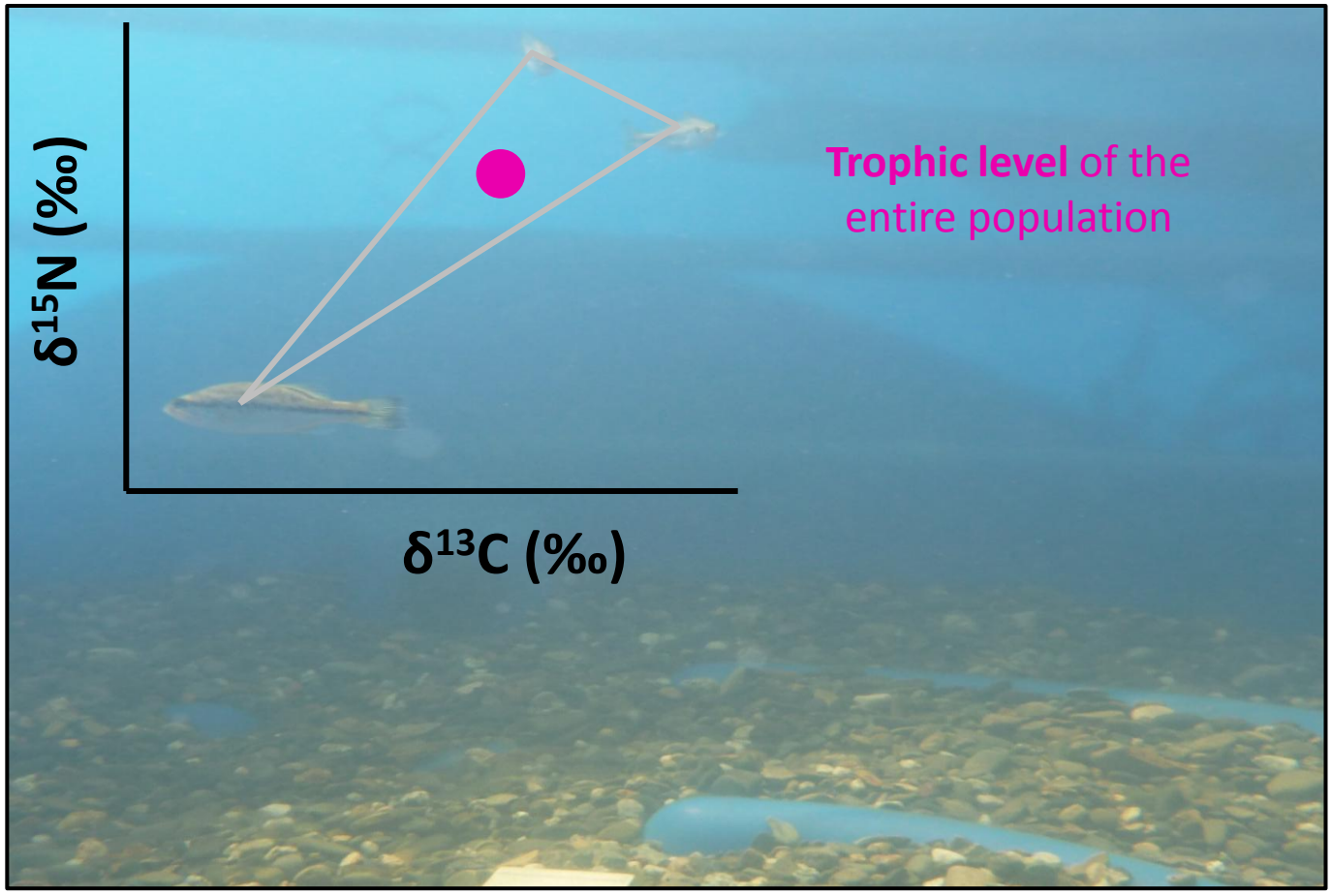

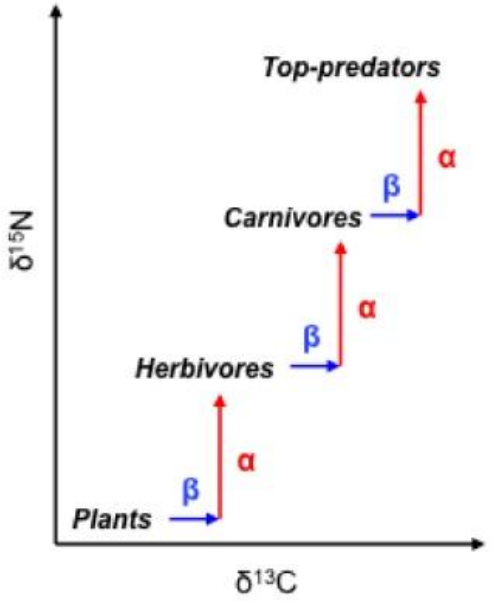

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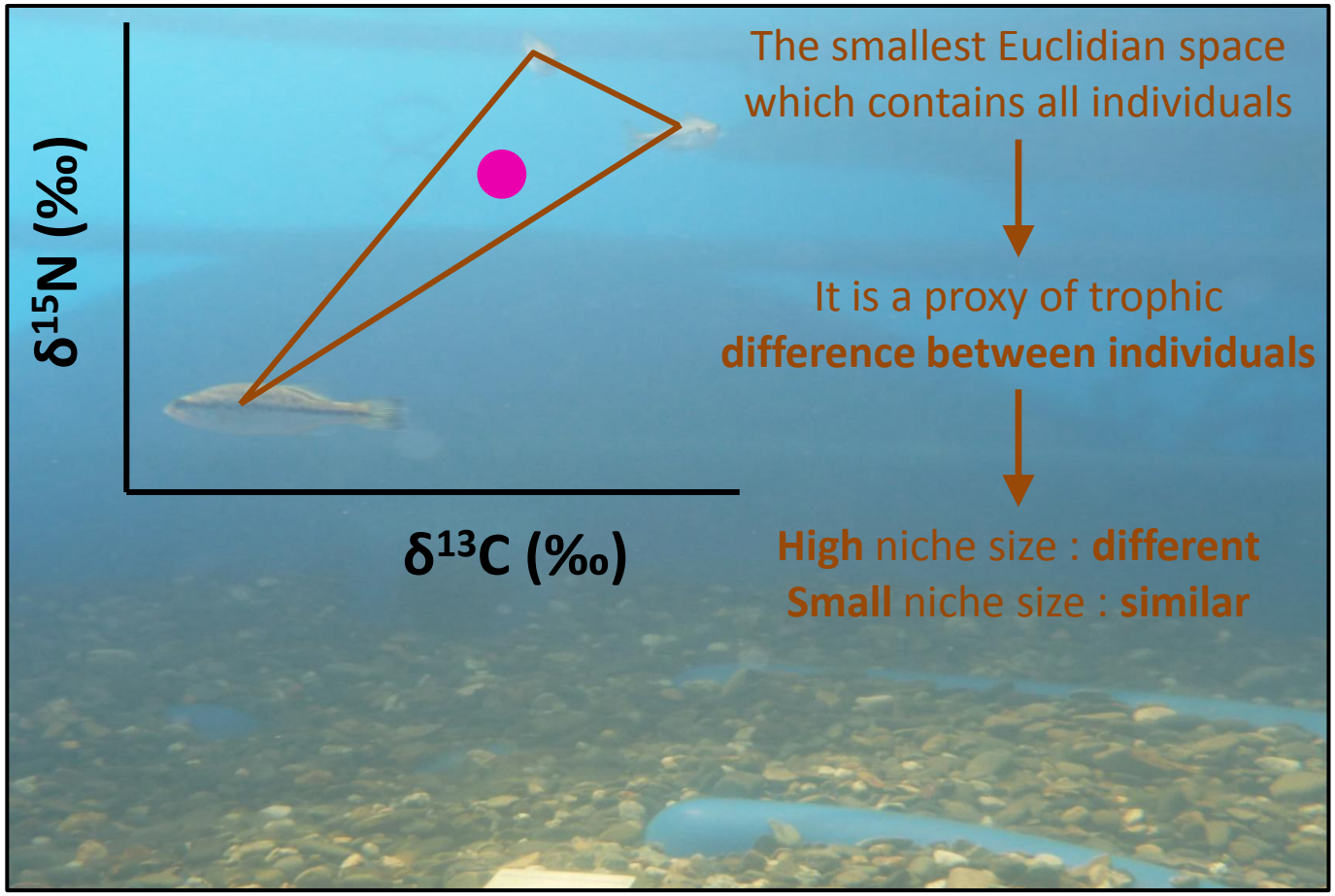

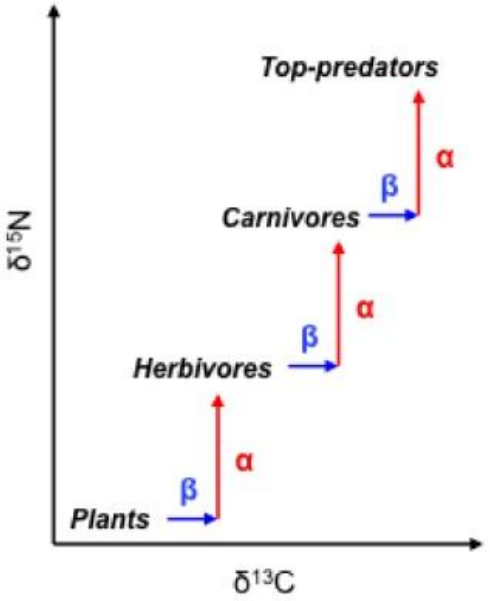

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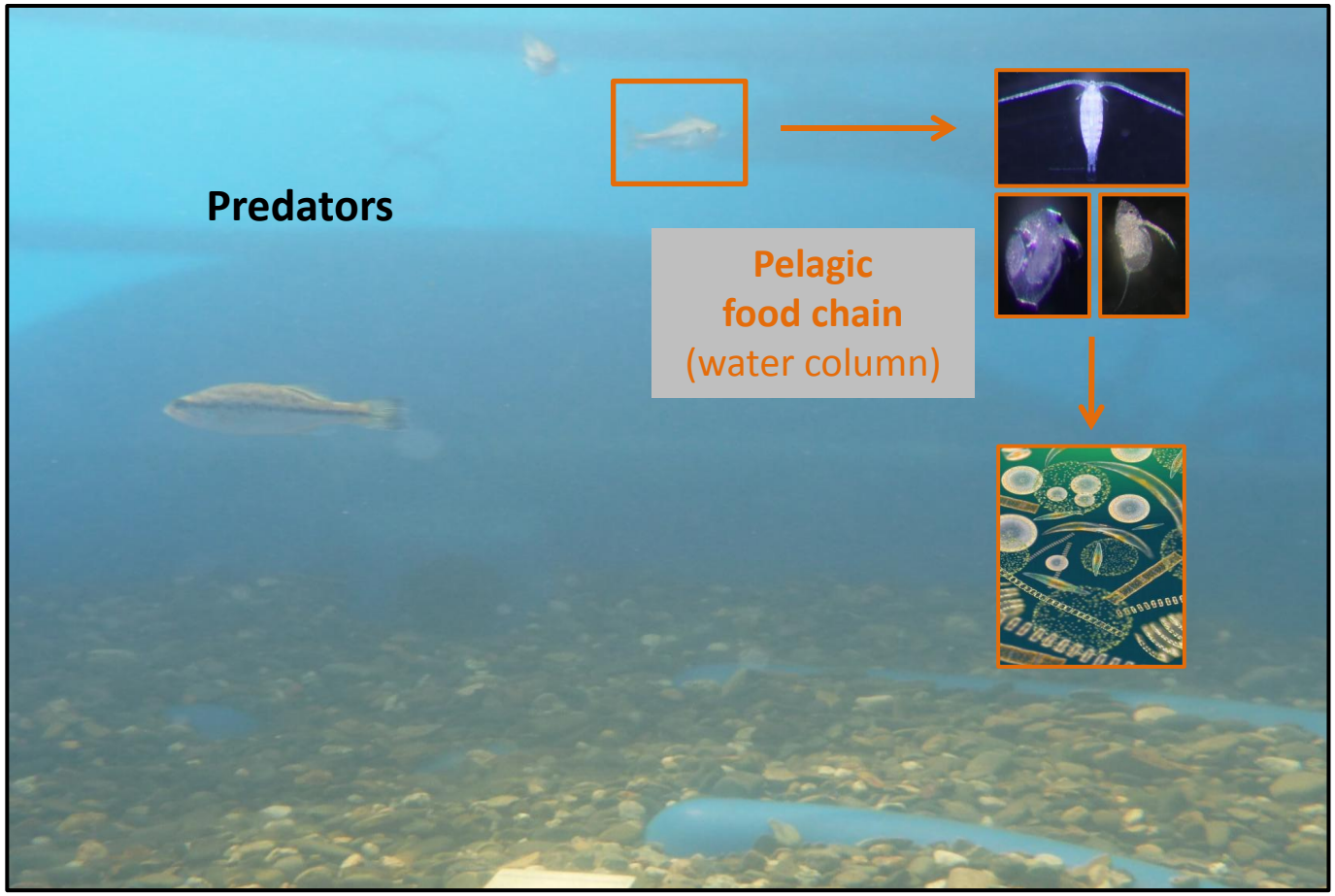
Predator population
(fish)



Prey community
(zooplankton community structure)

Ecosystem functioning
(phytoplankton production)

MATERIAL & METHODS: *data acquisition*

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Predator population
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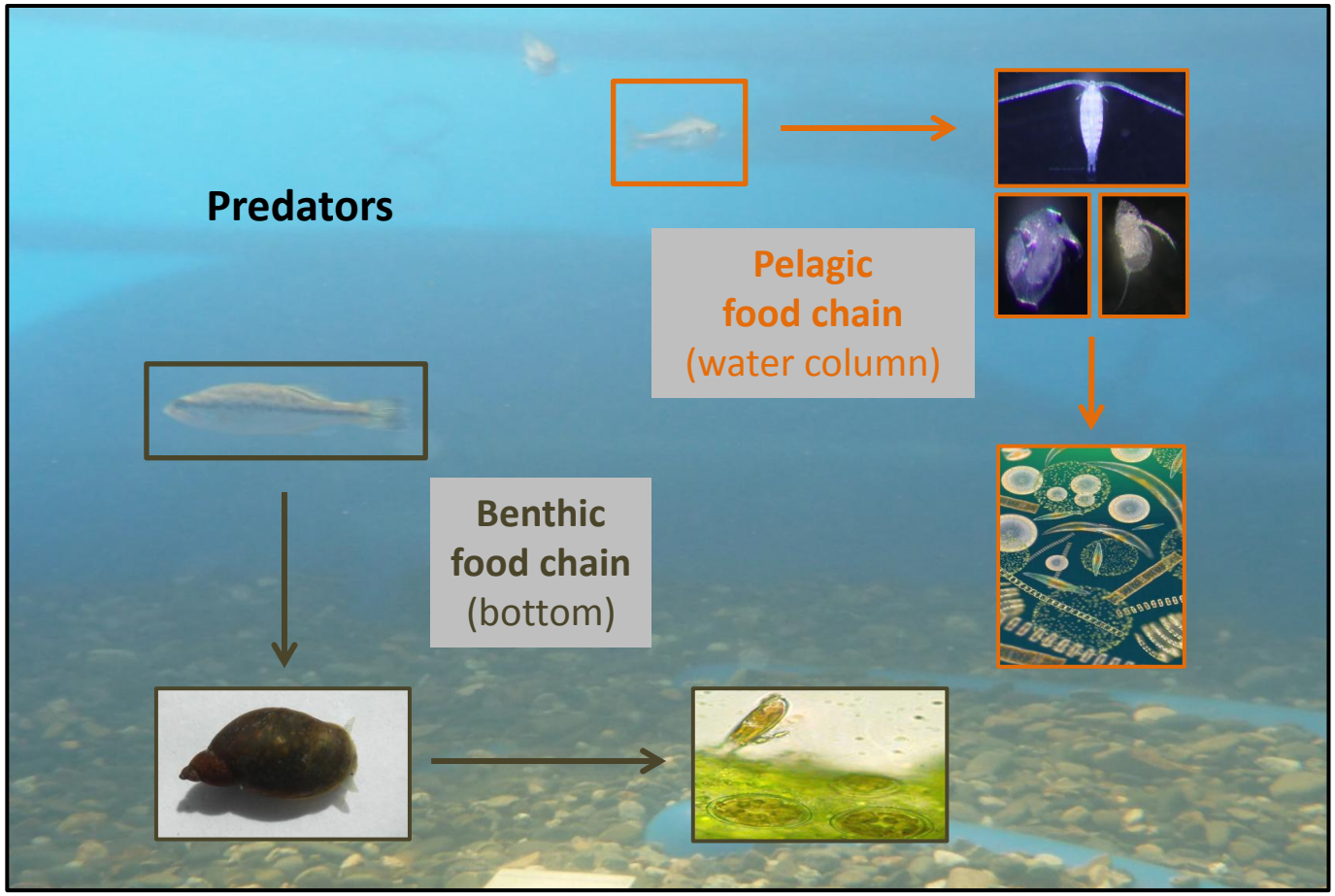


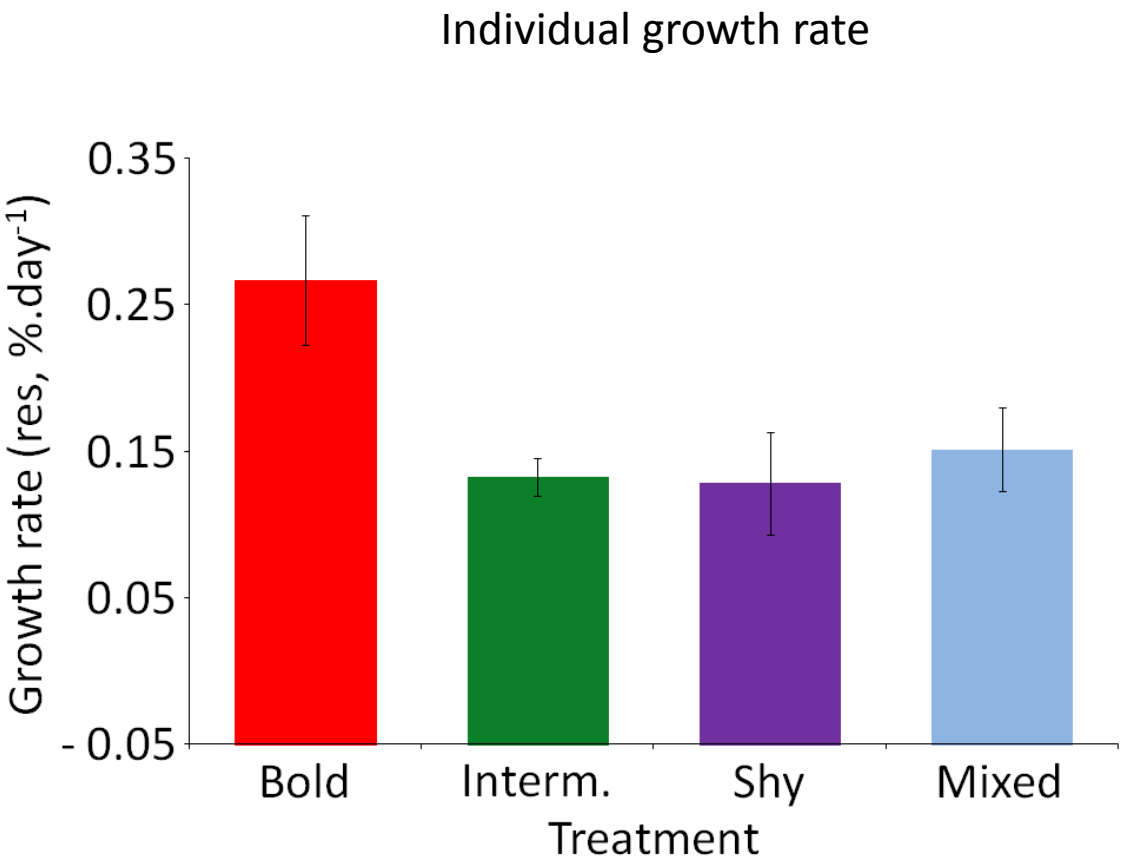
Prey community
(zooplankton community structure)

Ecosystem functioning
(phytoplankton production)

Prey community
(juvenile pond snail density)

Ecosystem functioning
(periphyton production)

RESULTS: H1 - *personality effects on growth rate*



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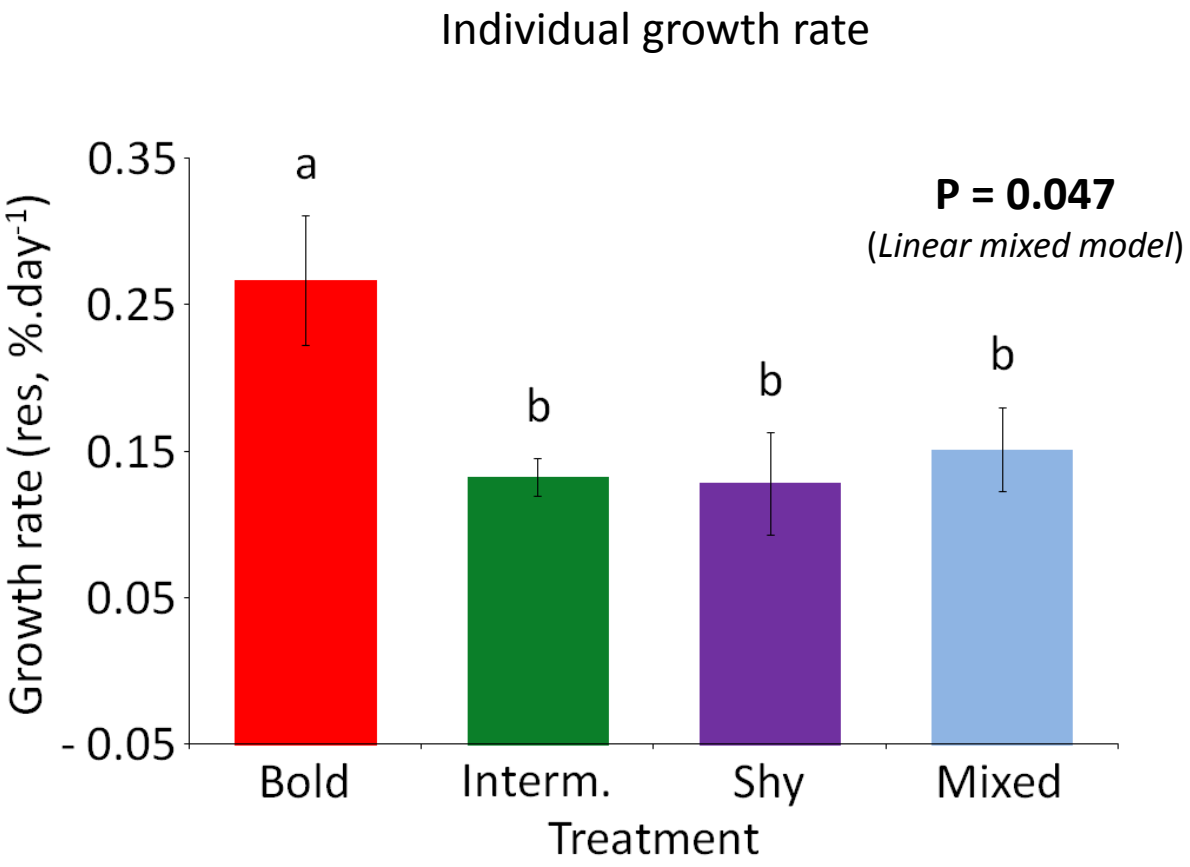
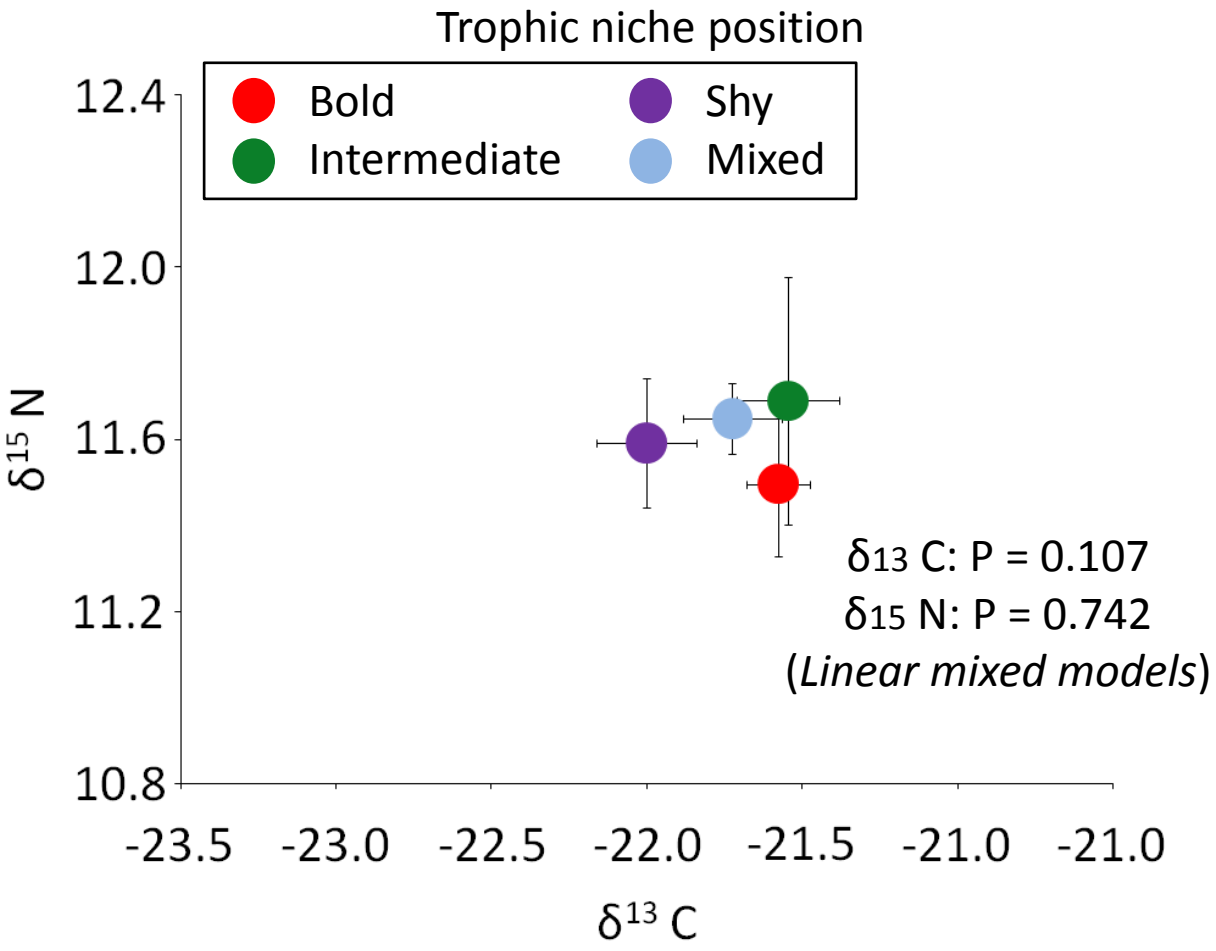


P = 0.047
(*Linear mixed model*)

Significant effect on Population growth rate

RESULTS: H1 - *personality effects on trophic niche*



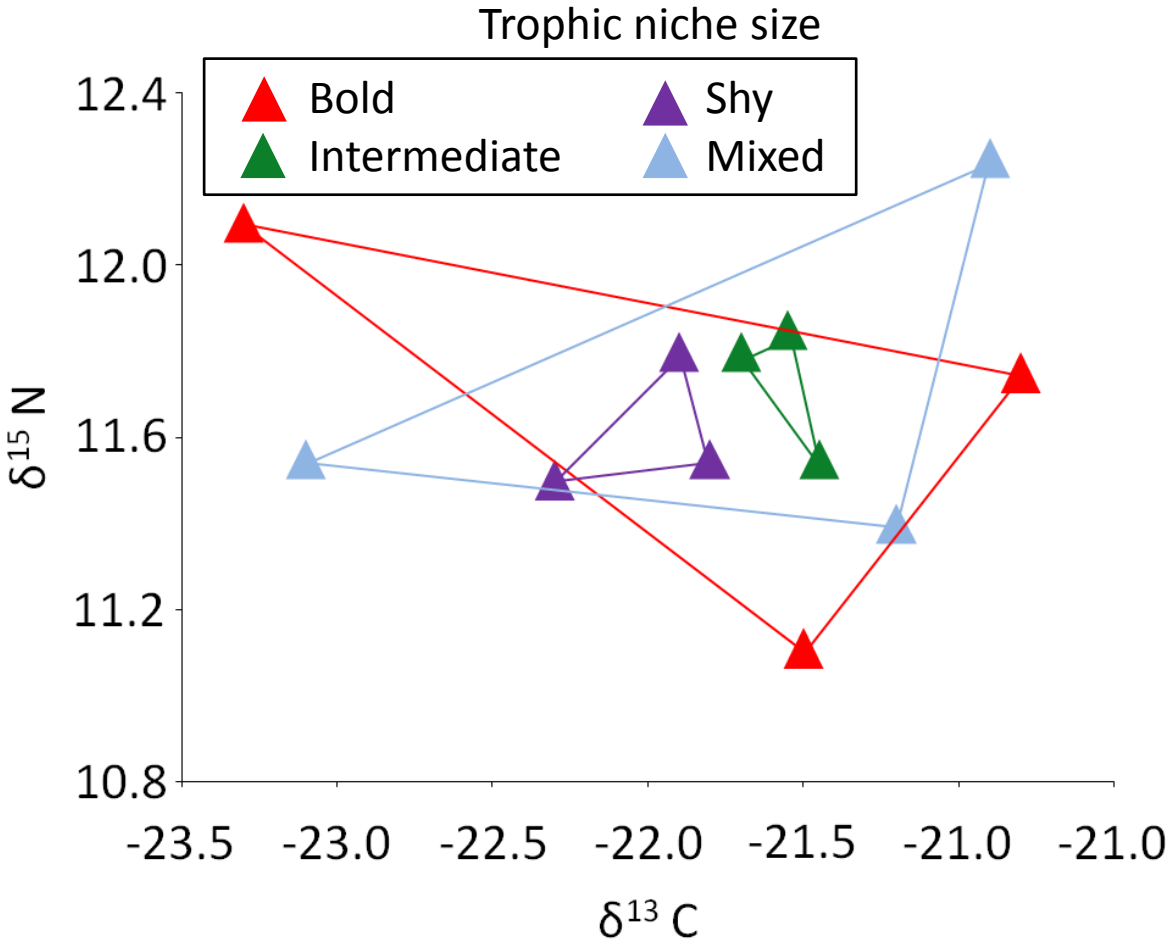
δ13 C: P = 0.107

δ15 N: P = 0.742

(*Linear mixed models*)

→ **No difference of trophic niche position among treatments**

RESULTS: H1 - *personality effects on trophic niche*



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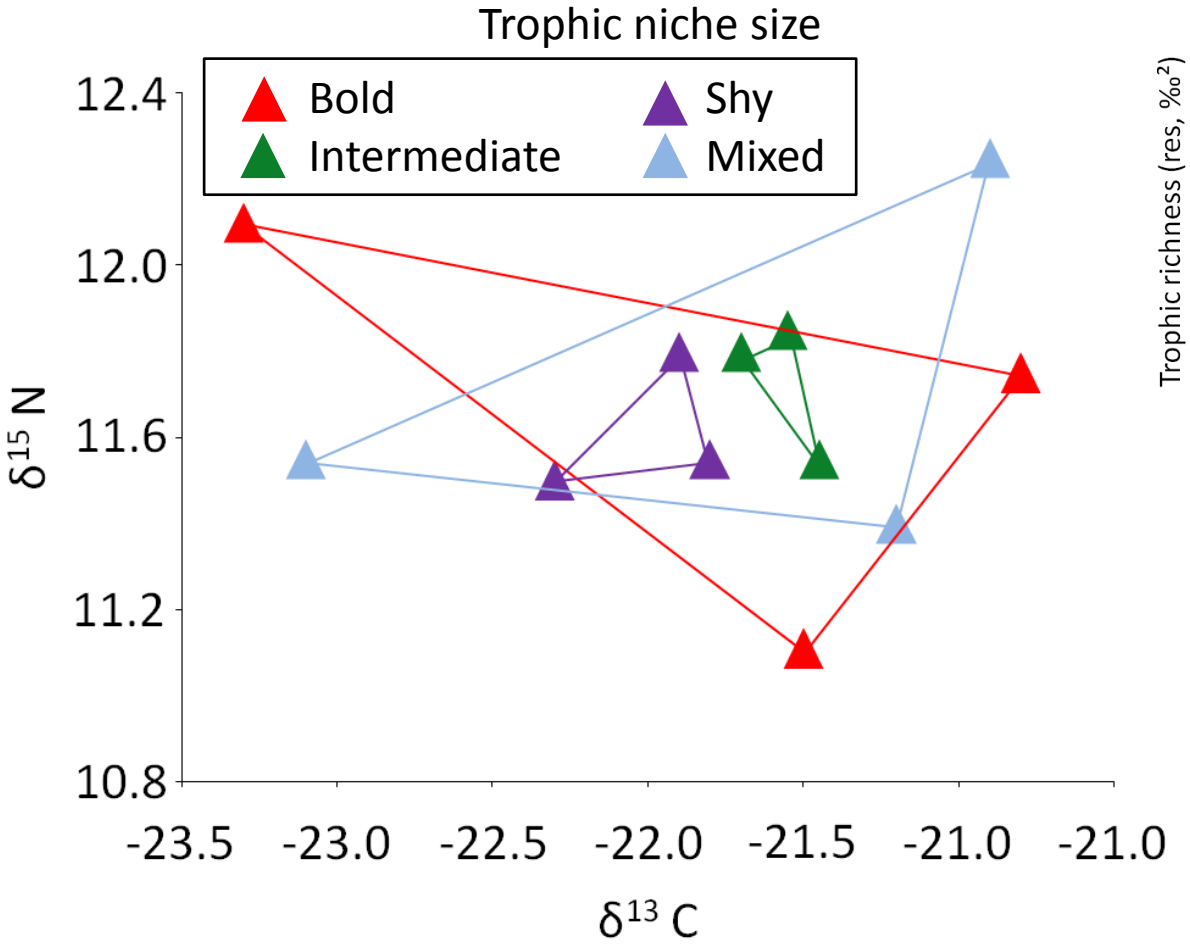
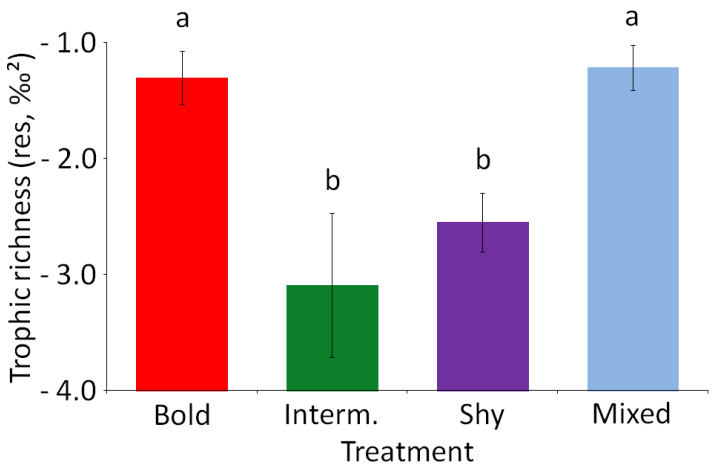




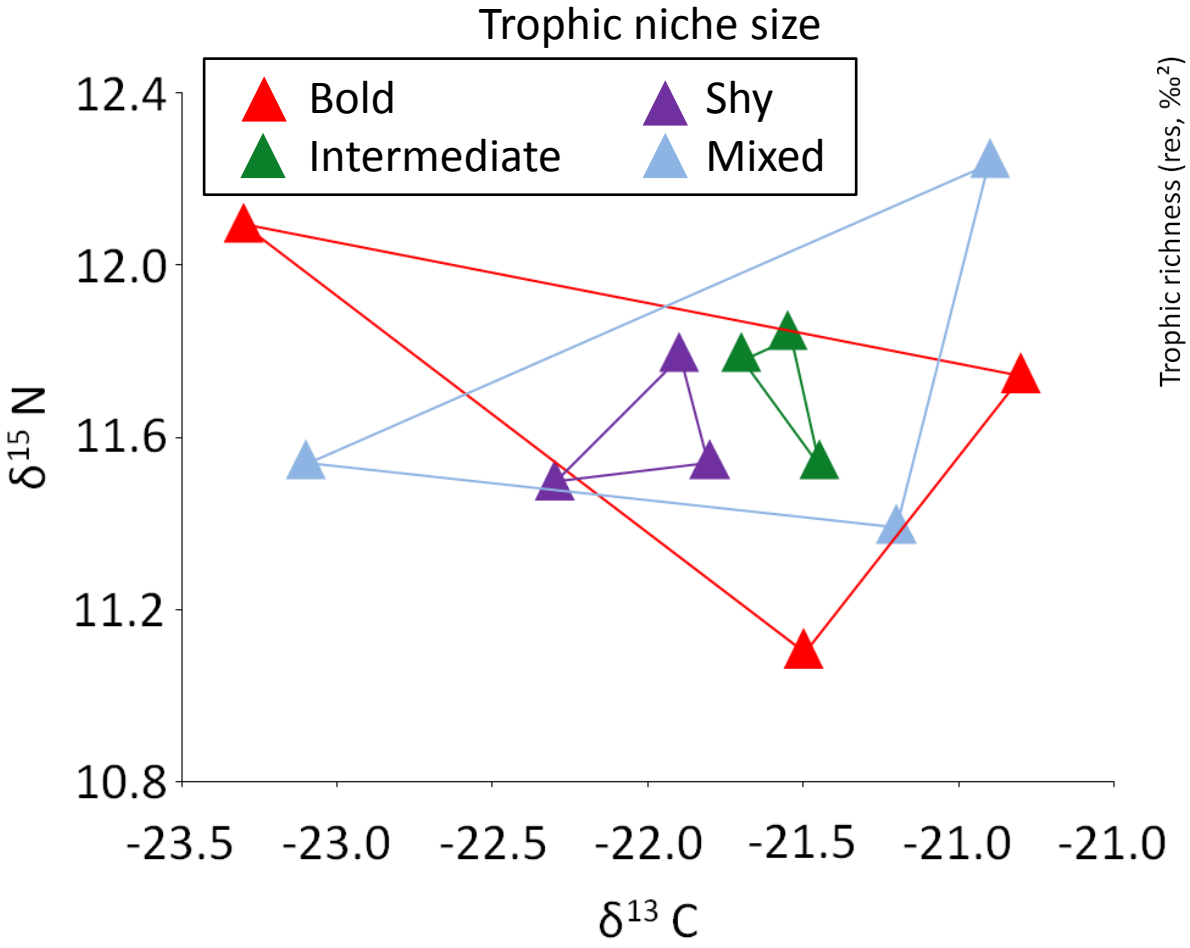
P < 0.001

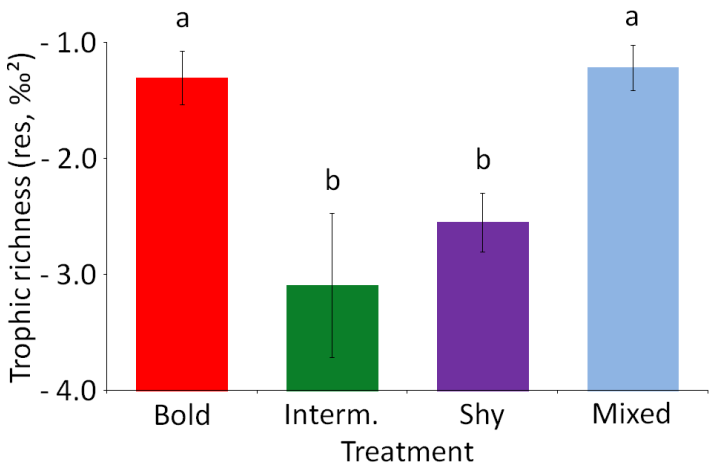
(*Linear mixed model*)

→ **No difference of trophic niche position among treatments**

→ **Differences of trophic niche size among treatments**

RESULTS: H1 - *personality effects on trophic niche*





P < 0.001

(*Linear mixed model*)

→ **No difference of trophic niche position among treatments**

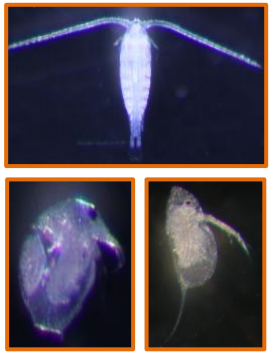
→ **Differences of trophic niche size among treatments**

Bold / **Mixed** } **Specialists** **Vs.** **Generalists** { **Intermediate** / **Shy**

RESULTS: H2 - *personality effects on community and ecosystem functioning*

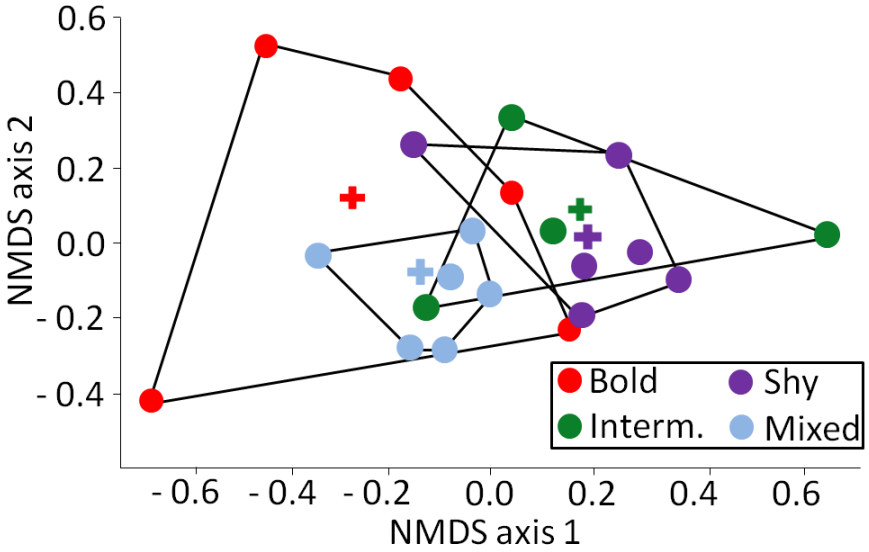
PELAGIC
(water column)

Community



Ecosystem

Zooplankton community structure



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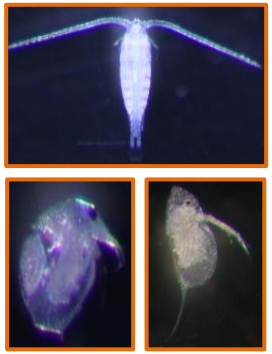

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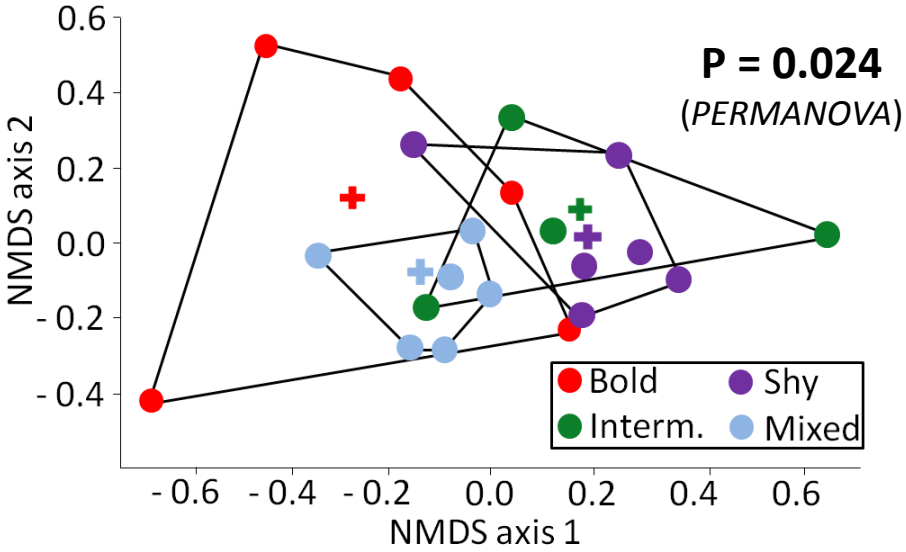
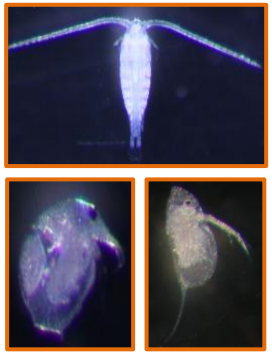


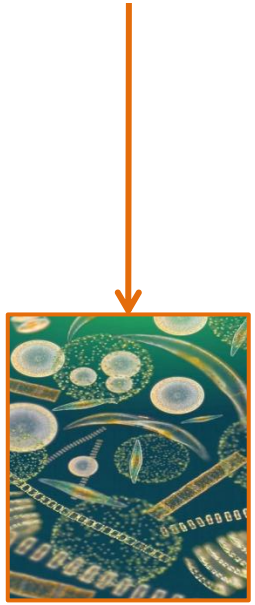
Significant effect on zooplankton diversity

RESULTS: H2 - *personality effects on community and ecosystem functioning*

PELAGIC
(water column)

Community





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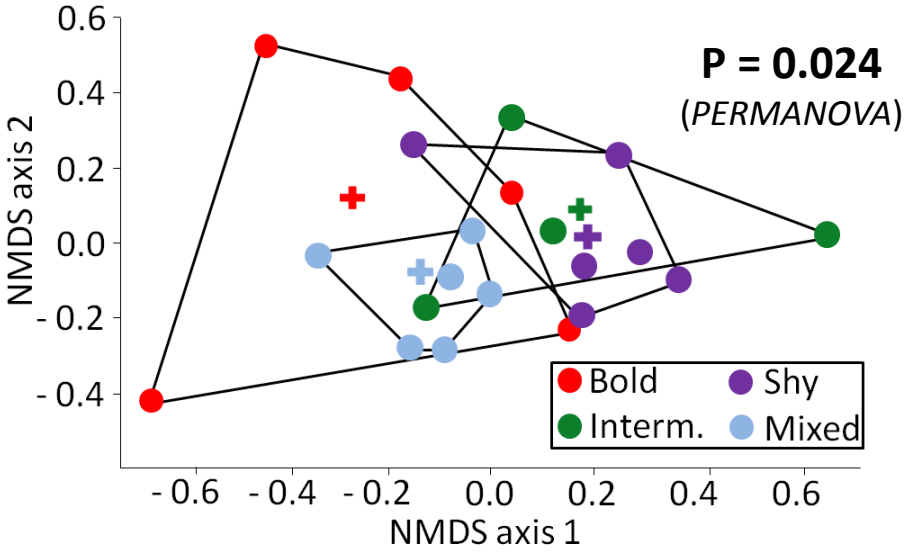
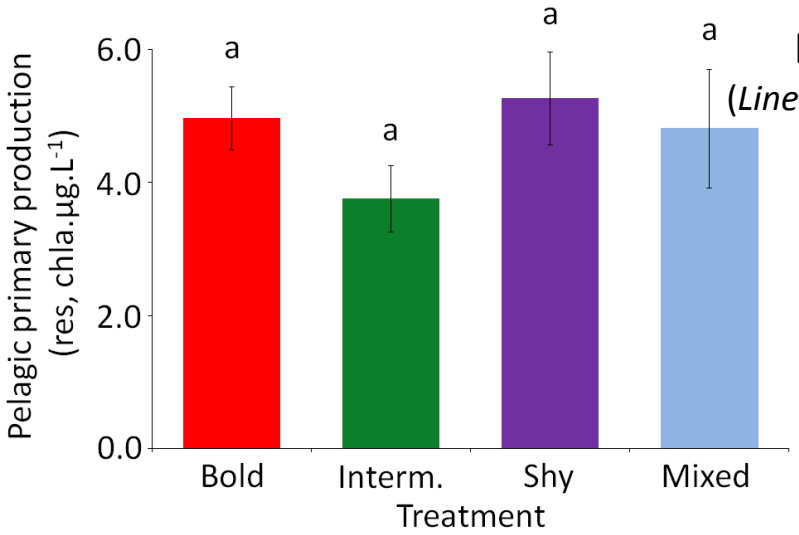


P = 0.024
(*PERMANOVA*)

Significant effect on zooplankton diversity

Pelagic primary production



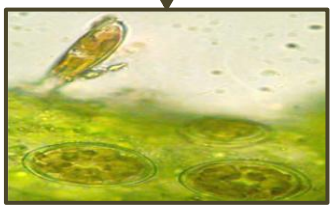
P = 0.678
(*Linear mixed model*)

No effect on pelagic primary production

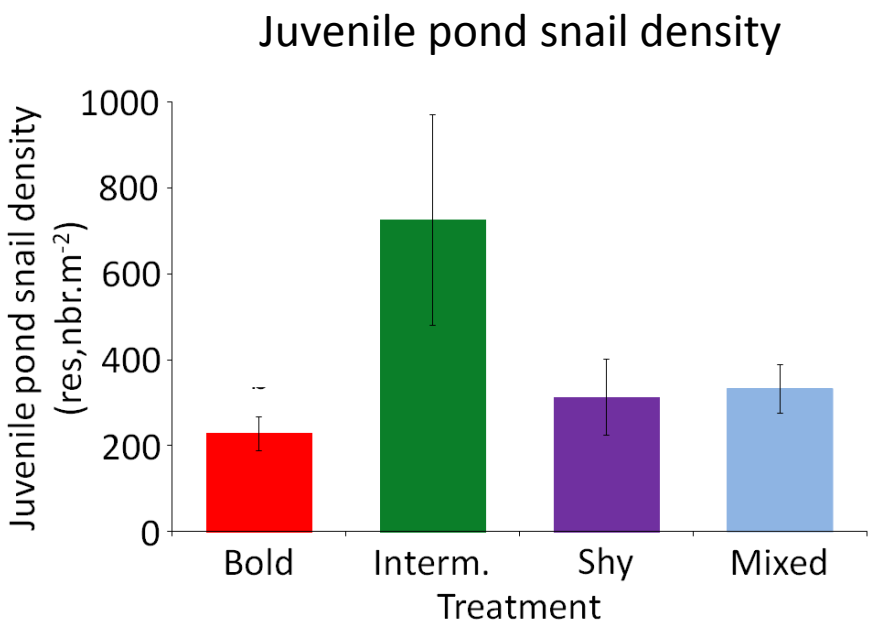
RESULTS: H2 - *personality effects on community and ecosystem functioning*

BENTHIC
(bottom)

Community



Ecosystem



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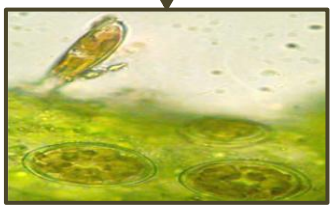
BENTHIC
(bottom)

Community



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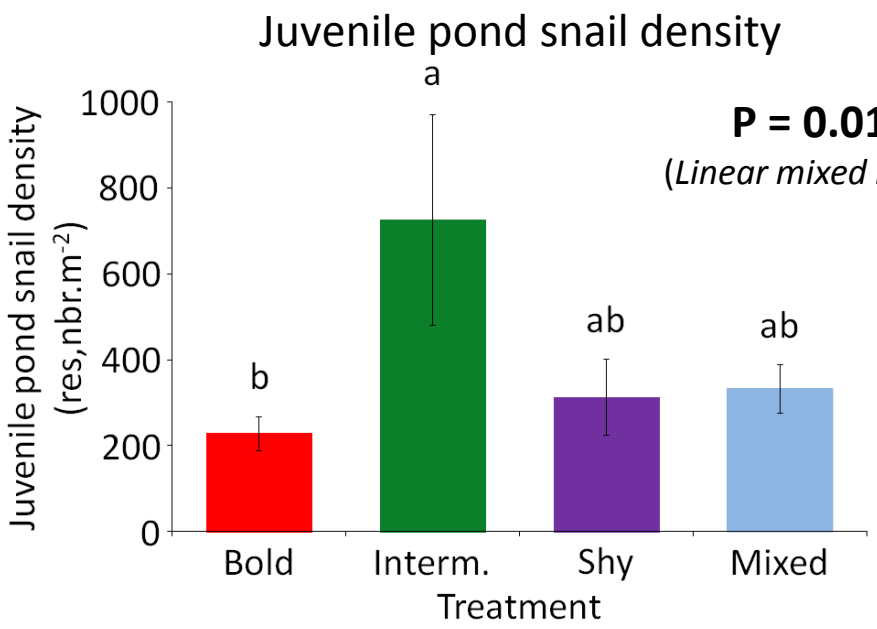


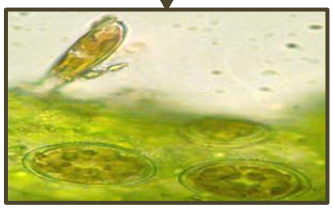
P = 0.019
(*Linear mixed model*)

Significant effect on juvenile pond snail density

RESULTS: H2 - *personality effects on community and ecosystem functioning*

BENTHIC
(bottom)

Community



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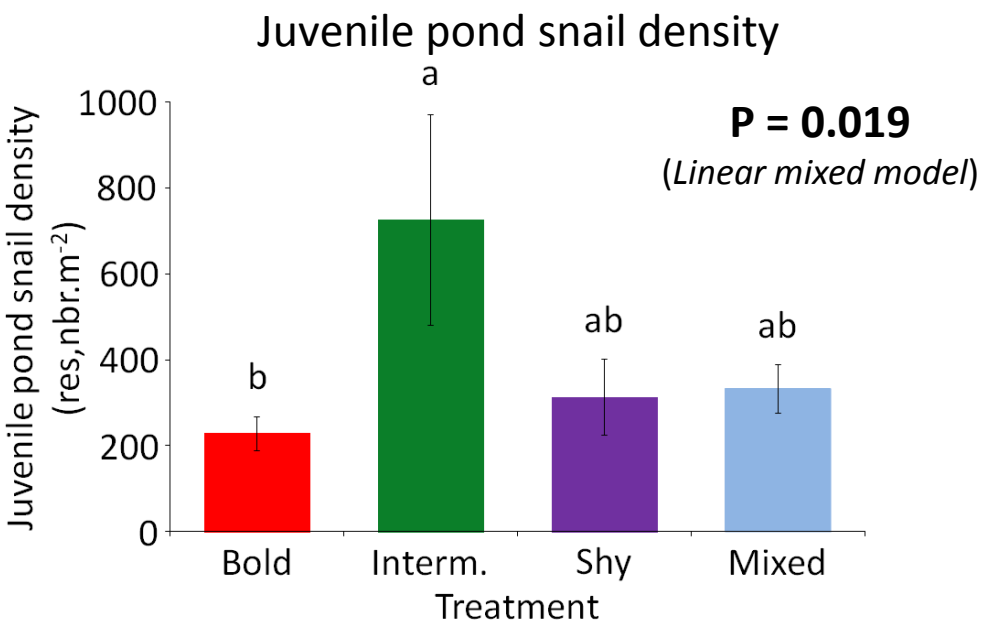

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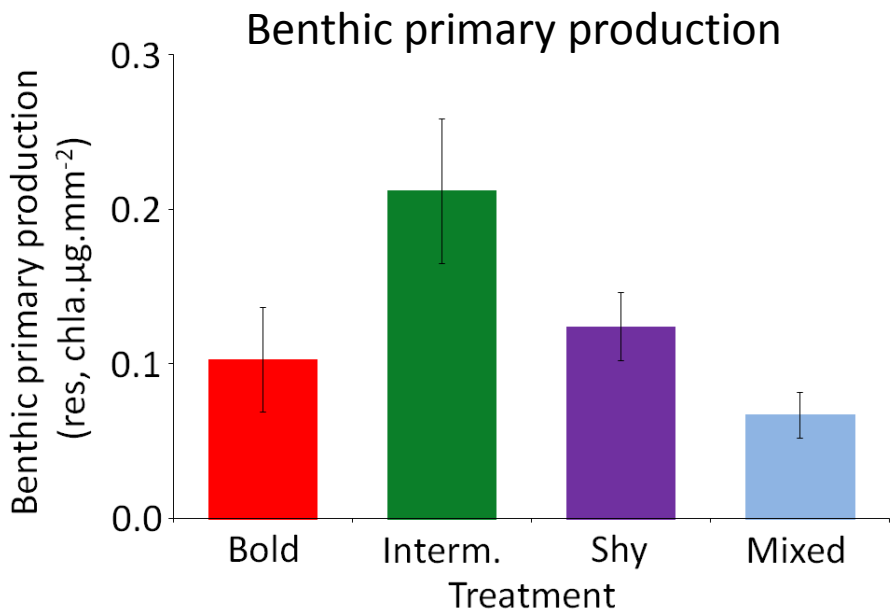

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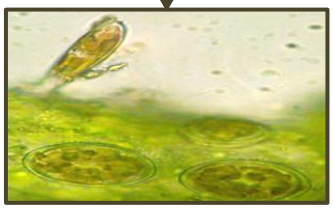
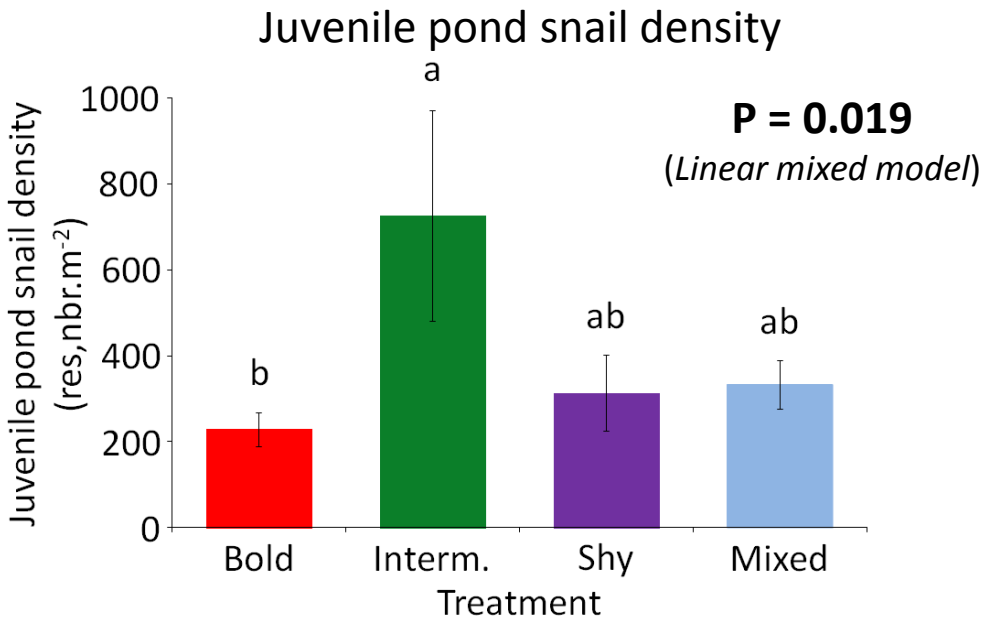
BENTHIC
(bottom)

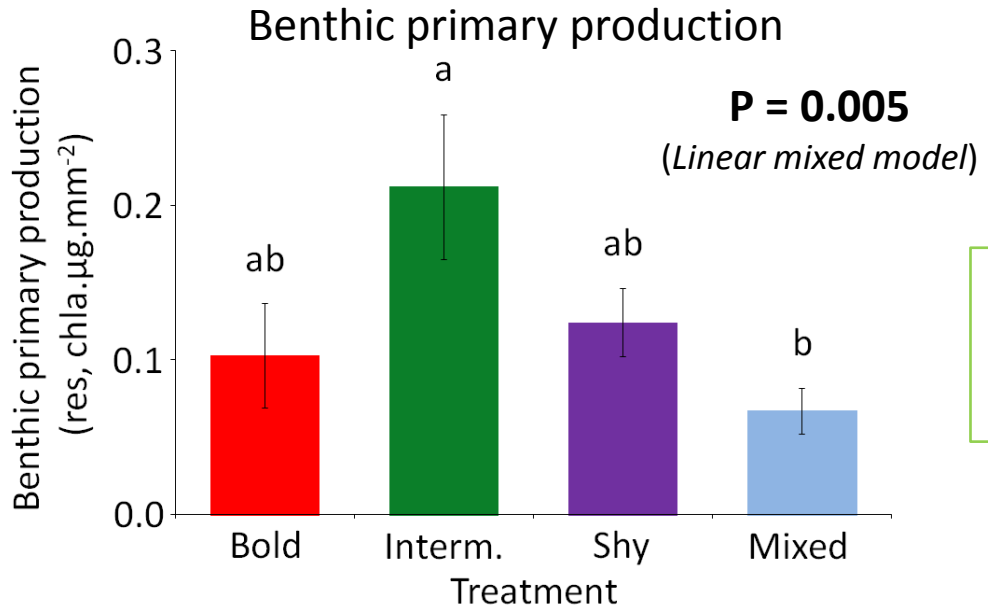
Community



Ecosystem



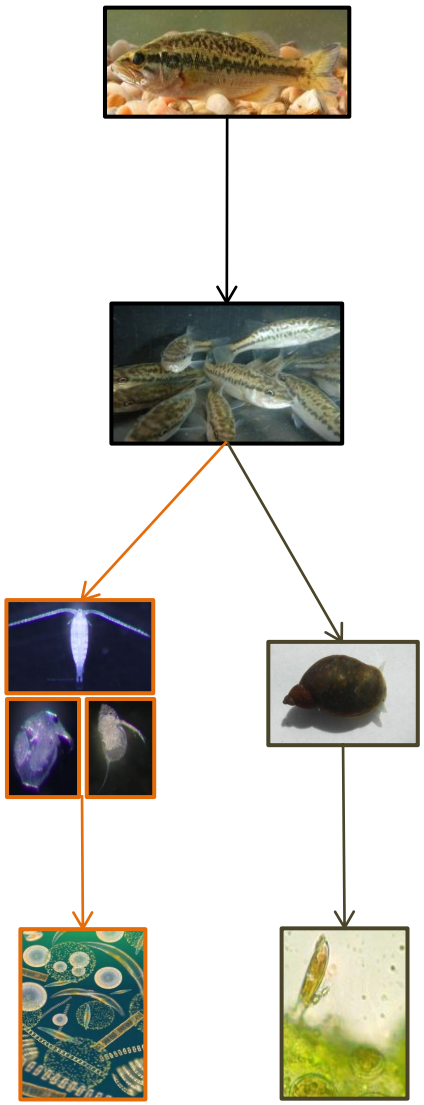
Significant effect on juvenile pond snail density



Significant effect on benthic primary production

DISCUSSION

To determine whether differences in animal personality could affect ecosystem functioning



Individual personality — **Boldness**

↓

Population characteristics — **H1**

↓

Prey community

↓

Ecosystem functioning

H2

DISCUSSION

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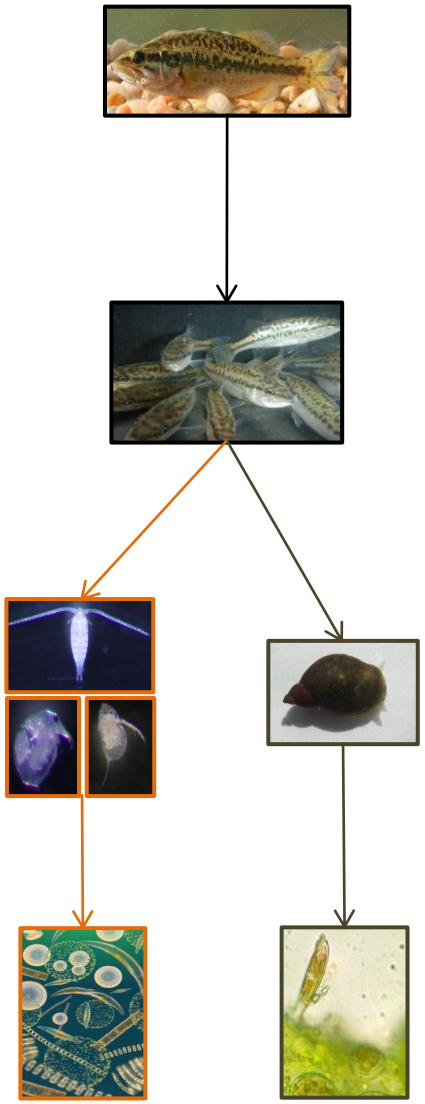

Individual personality — **Boldness**

↓

Population characteristics — **H1** — **Growth rate, Trophic niche**

↓

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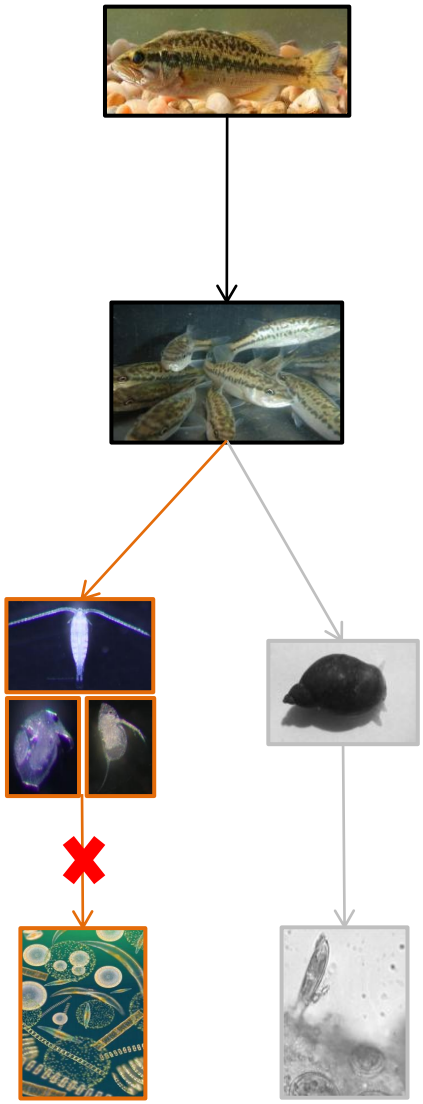
↓

Ecosystem functioning

H2

DISCUSSION

To determine whether differences in animal personality could affect ecosystem functioning



Individual personality — **Boldness**

Population characteristics — **H1** — **Growth rate, Trophic niche**

Prey community — **Zooplankton Community Structure**

H2

Ecosystem functioning — **Pelagic Primary Production**

DISCUSSION

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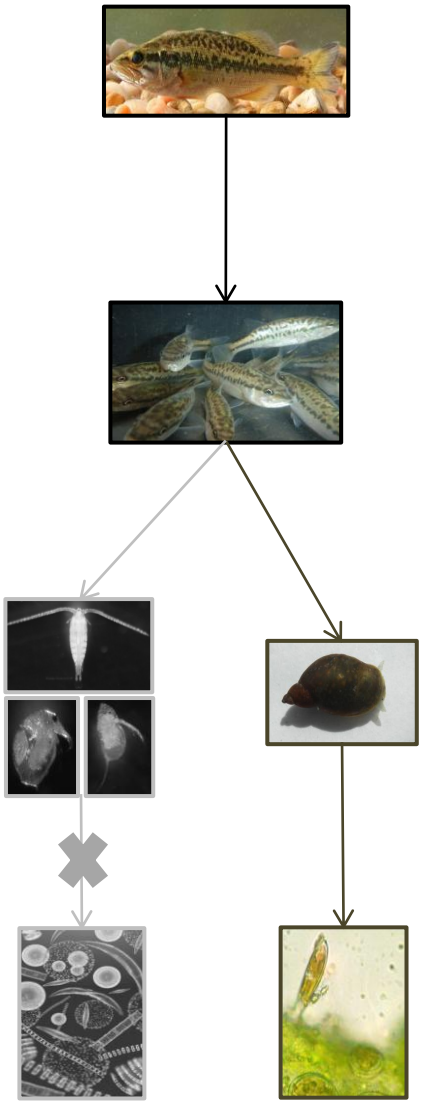

Individual personality — **Boldness**

Population characteristics — **H1** — **Growth rate, Trophic niche**

Prey community — **Juvenile snail pond density**

H2

Ecosystem functioning — **Benthic Primary Production**

DISCUSSION

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However, understanding the mechanisms leading to the observed changes in ecosystem functioning requires **further investigations**

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However, understanding the mechanisms leading to the observed changes in ecosystem functioning requires **further investigations**

Perspectives

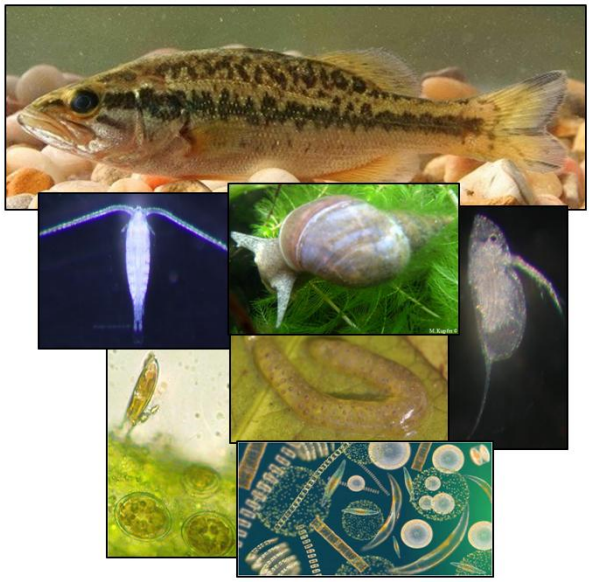
Human activity *can biased personality in populations and could have an effect on environment*

Personality could induce an ***eco-evolutionary feedback*** *?*

Brodin *et al.* 2013, Science
Wolf & Weissing 2012, TREE

Thank for your attention

And thank to:



Elsa Desêtres
Martial Armand
Elouana Gharnit
Gaël Grenouillet
Alban Sagouis
Frédéric Azémar
Charlotte Evangélista
Zhao Tian

FUNDING:

Fondation Fyssen

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