Conservation behaviour, translocation and captive breeding

Ioannis Leris, Ph.D & Yiannis Kapakos

afresh

Bristol Workshop

December 2nd, 2022

Overview

1. Introduction - definitions
2. Behavioural interactions between killifish and mosquitofish (DECAGON)
3. Effects of turbidity on the behaviour of a native minnow
4. Behavioural effects of turbidity: killifish vs mosquitofish (AFRESH)
5. Captive breeding of two threatened native killifish species (DECAGON)
6. Conservation translocation: creating a refugia population (AFRESH)
7. Creating breeding stocks of 2 range-restricted threatened fishes (AFRESH)
8. Future perspectives

1. Introduction - definitions

Behaviour refers to animal responses to stimuli (external or internal) and includes all the ways animals interact with one another and with the environment

Ethology → the scientific study of animal behaviour (in the light of evolution)

Conservation aims to prevent biodiversity loss and mitigate the impact of anthropogenic pressures

Lack of knowledge of key behavioural characteristics of the target species can lead to problems in the implementation of conservation plans

Conservation behaviour: the application of ethology to biodiversity conservation efforts

2. Behavioural interactions between killifish and mosquitofish (DECAGON)

29 Pairs of *Valencia letourneuxi* and *Gambusia holbrooki* → in 3 consecutive phases:

60-min acclimation

1. In an **empty** tank (15 min)

5-min interval

2. In the presence of **artificial cover** (15 min)

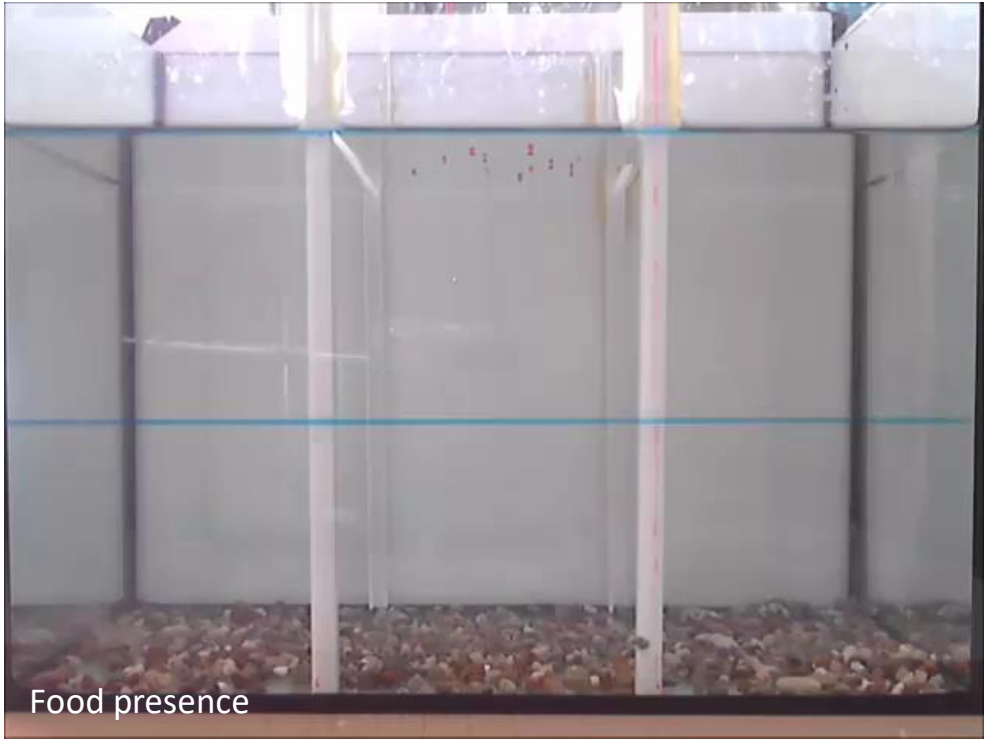
5-min interval

3. In the presence of **food** (15 min)

We measured various behaviours including **aggressive** and **stress-related behaviours**

2nd stage → **cover use**

3rd stage → **feeding attempts**



2. Behavioural interactions between killifish and mosquitofish (DECAGON)

mosquitofish → **bolder**
more **aggressive**
less **prone to stress**

killifish → more **cover** use
no **feeding** attempts

Article submitted to *Animal Behaviour* by Kapakos *et al*. (2022)

3. Effects of turbidity on the behaviour of a native minnow

Turbidity

- Natural (e.g. flash floods)
- **Impacts expected to intensify!**
- Human-induced (e.g. quarries)

V. letourneuxi feeding in a turbid environment.

70 ***Pelasgus stymphalicus***, a native minnow with 'least concern' status

→ model for other more vulnerable congeners (e.g. ***Pelasgus laconicus***) and other small-sized cyprinids

3. Effects of turbidity on the behaviour of a native minnow

Three tests conducted in succession:

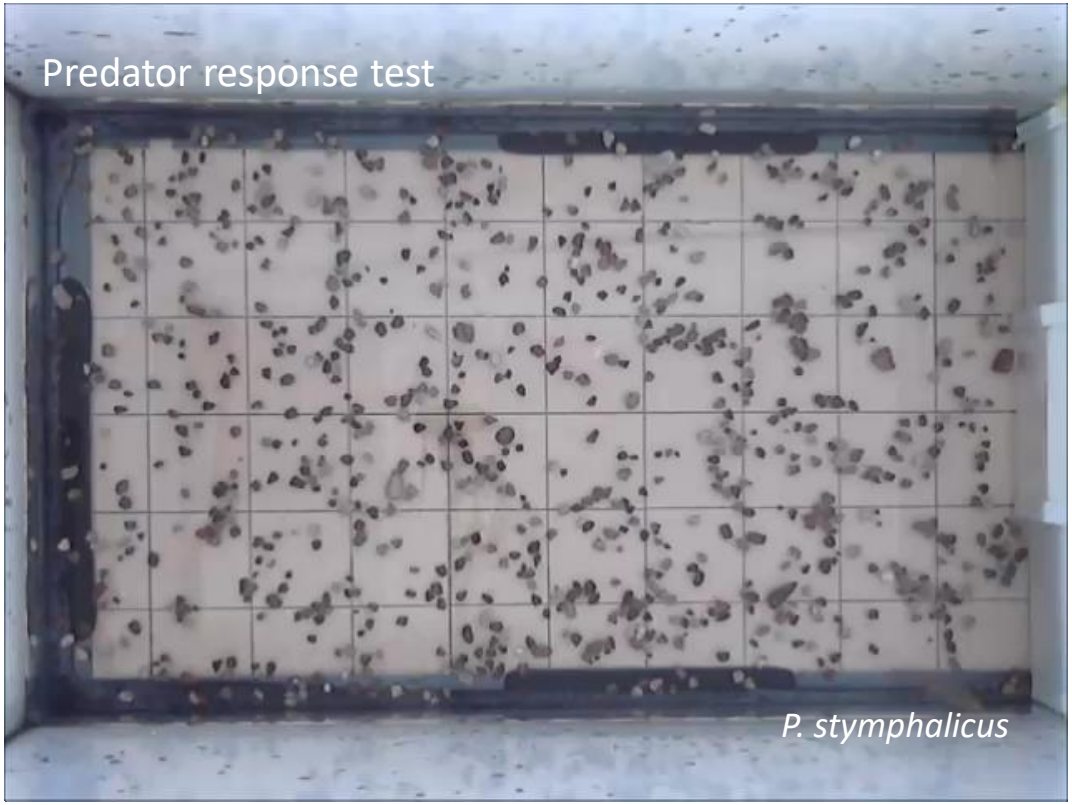
5-min acclimation

1. **Emergence** test (5 min)
2. **Open field** test (5 min)
3. **Predator response** test (3 + 3 min)

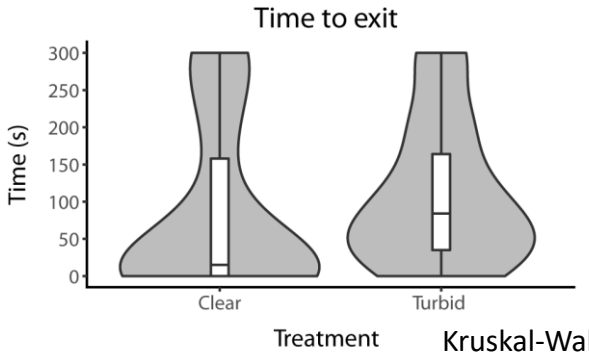
Two turbidity levels
Clear: 0 NTU
Turbid: 30 NTU

Behavioural measures:

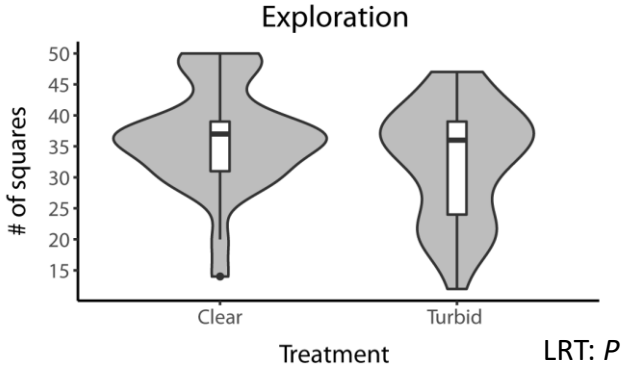
- Time to exit
- Activity & exploration
- Time immobile
- Time in the centre
- Dashing/erratic behaviour



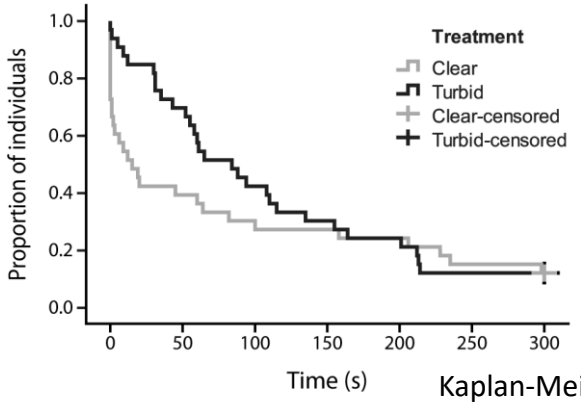
3. Effects of turbidity on the behaviour of a native minnow



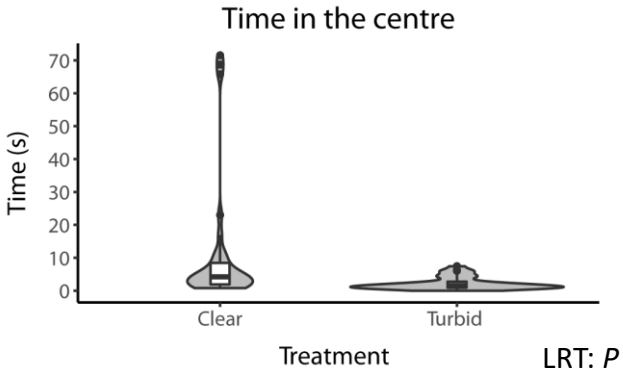
Kruskal-Wallis: $P < 0.05$



LRT: $P < 0.05$

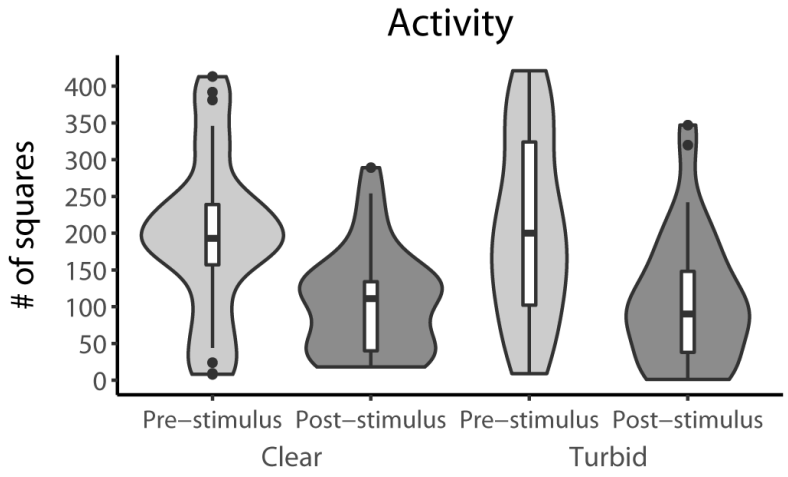


Kaplan-Meier: $P < 0.05$

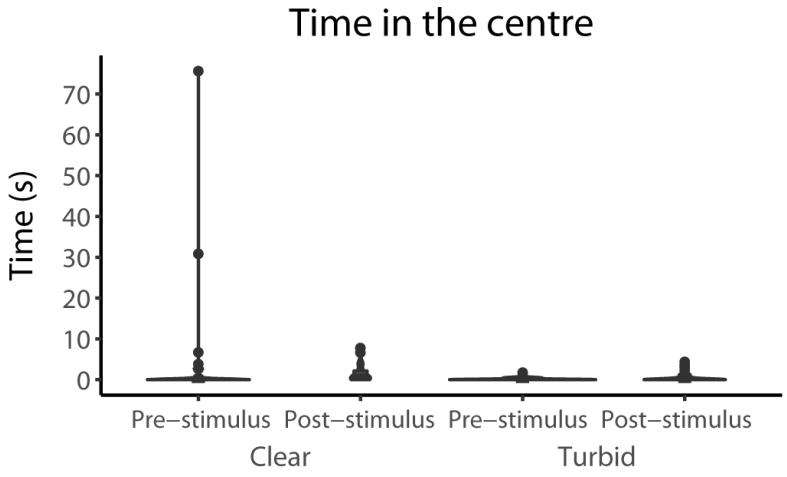


LRT: $P < 0.001$

3. Effects of turbidity on the behaviour of a native minnow



GLM: Activity ~ Turbidity treatment + Stimulus addition



GLM: Time in the centre ~ Turbidity treatment

3. Effects of turbidity on the behaviour of a native minnow

Animal Behaviour 186 (2022) 1–9

Contents lists available at ScienceDirect

Animal Behaviour

journal homepage: www.elsevier.com/locate/anbehav

Turbidity and predation risk: behavioural responses of a freshwater minnow

Ioannis Leris*, Lea Koepchen-Thomä [1], Evangelia Smeti, Eleni Kalogianni

Hellenic Centre for Marine Research, Institute of Marine Biological Resources and Inland Waters, Anavissos, Attica, Greece

4. Behavioural effects of turbidity: killifish vs mosquitofish (AFRESH)

Two tests conducted in succession:

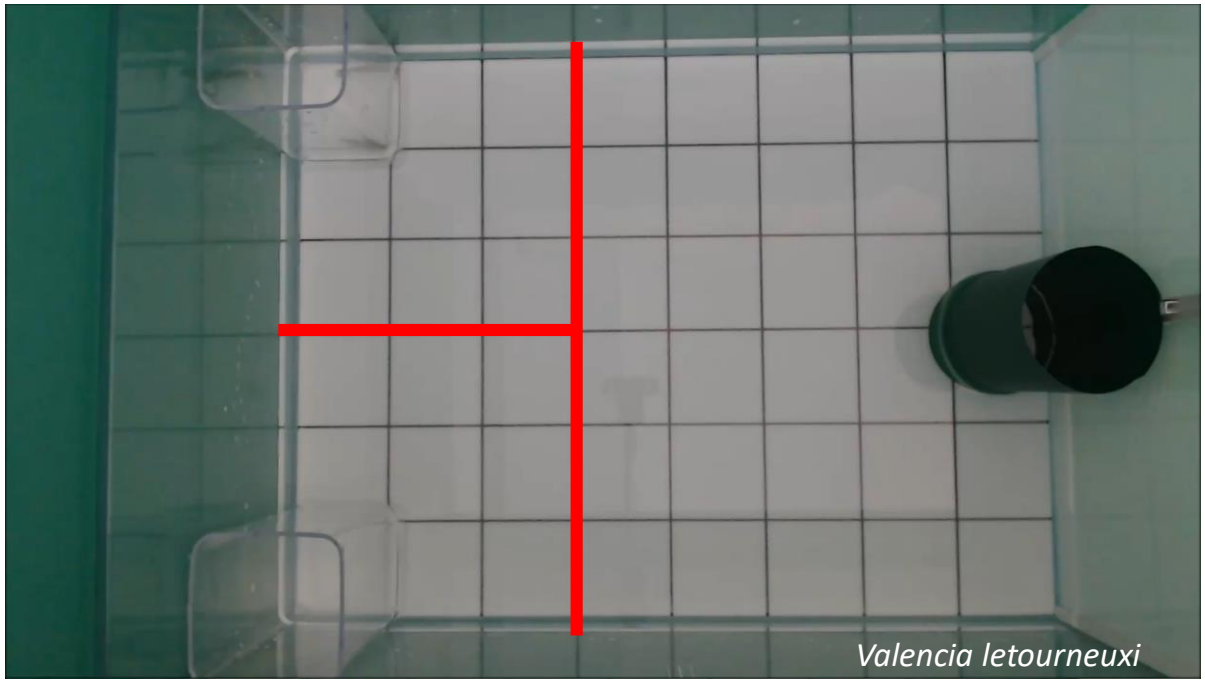
2-min acclimation

1. **Open field** test (5 min)

2-min interval

2. **Sociability** test (5 min)

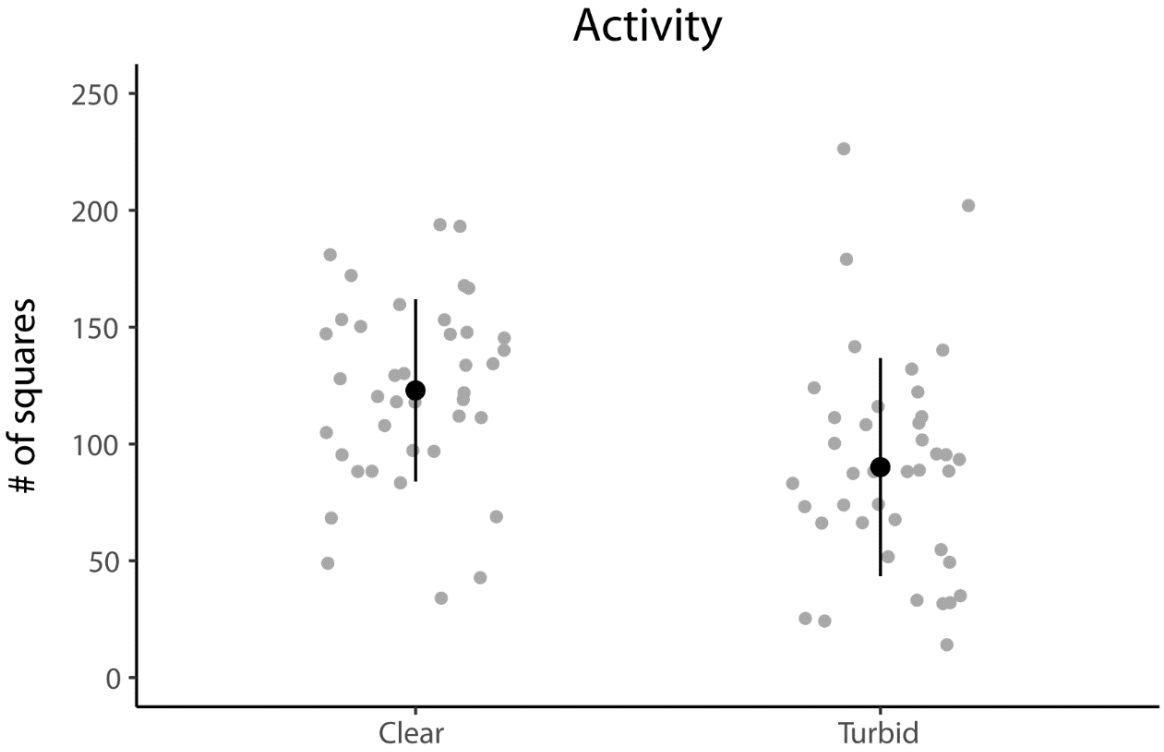
Two turbidity levels
Clear: 0 NTU
Turbid: 30 NTU



Behavioural measures:

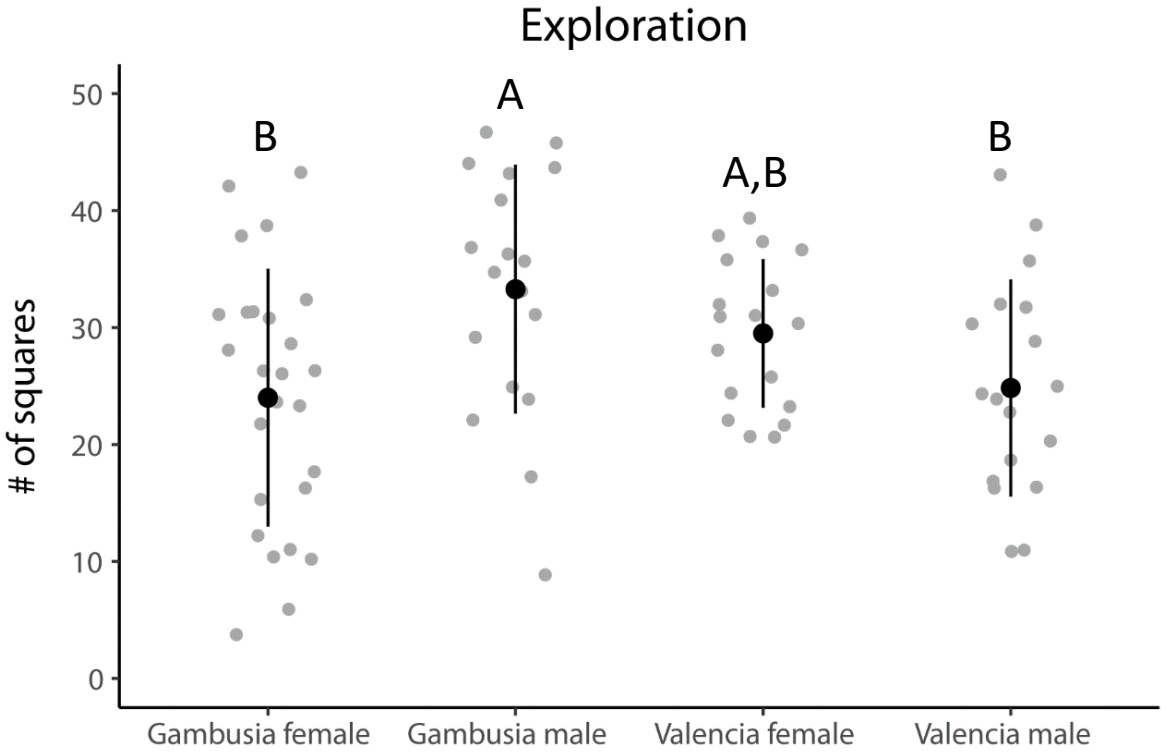
- Activity & exploration
- Time immobile
- Time in the centre
- **Time shoaling**
- Dashing/erratic behaviour

4. Behavioural effects of turbidity: killifish vs mosquitofish (AFRESH)



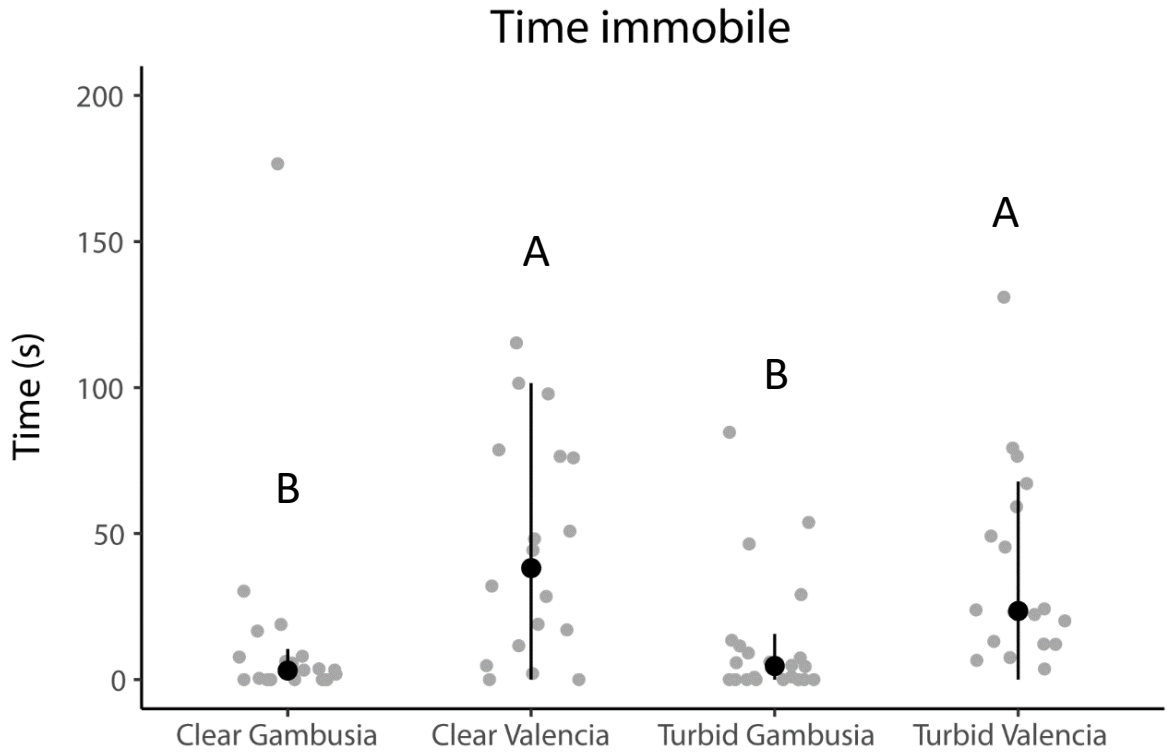
2-way ANOVA: $P < 0.01$

4. Behavioural effects of turbidity: killifish vs mosquitofish (AFRESH)



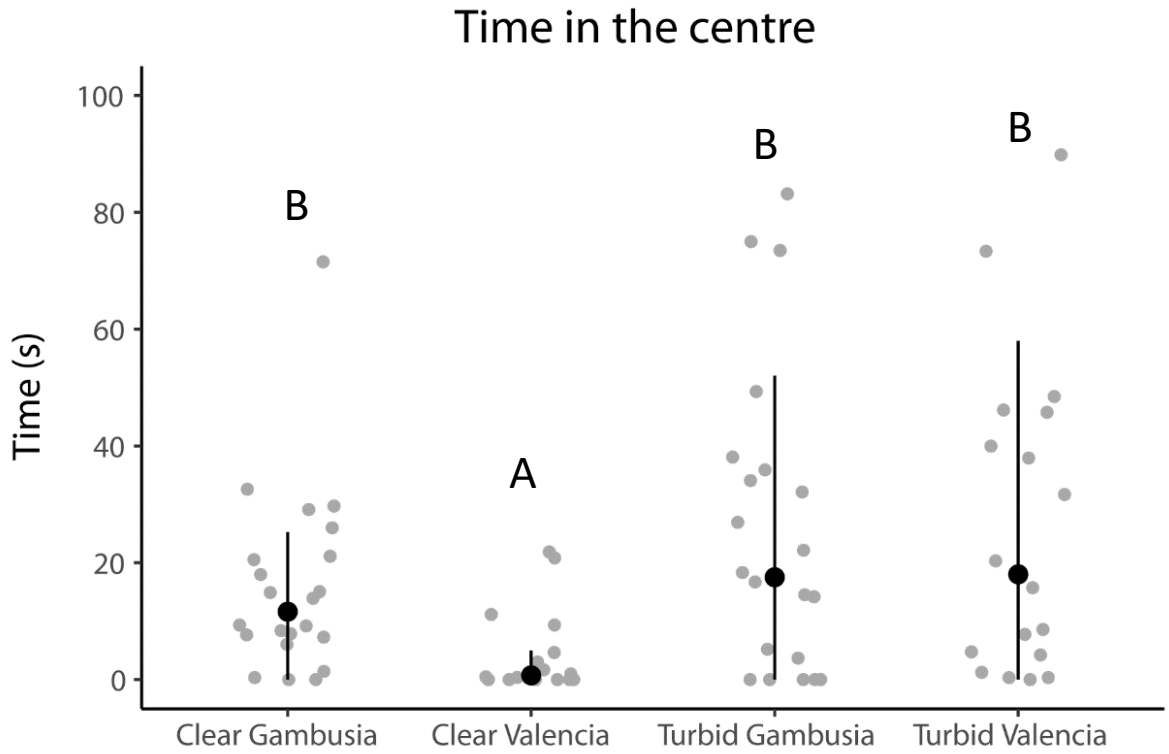
2-way ANOVA: $P < 0.01$

4. Behavioural effects of turbidity: killifish vs mosquitofish (AFRESH)



Kruskal-Wallis: $P < 0.001$

4. Behavioural effects of turbidity: killifish vs mosquitofish (AFRESH)



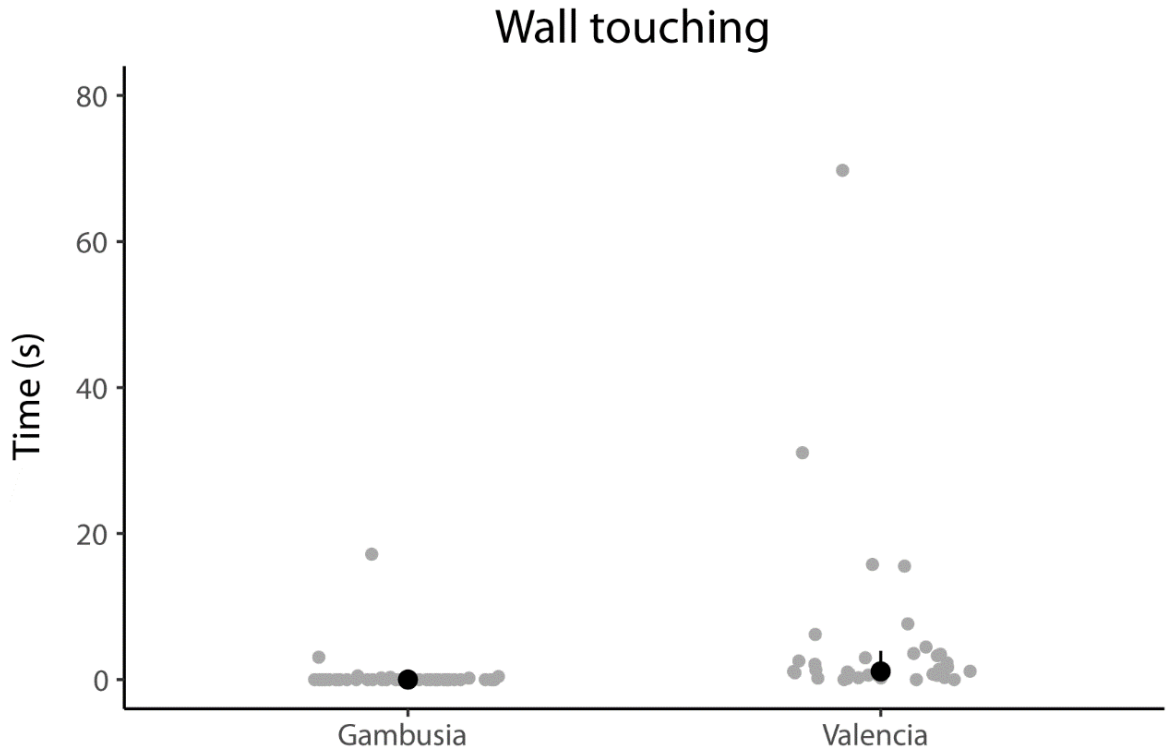
Kruskal-Wallis: $P < 0.01$

4. Behavioural effects of turbidity: killifish vs mosquitofish (AFRESH)

Wall touching

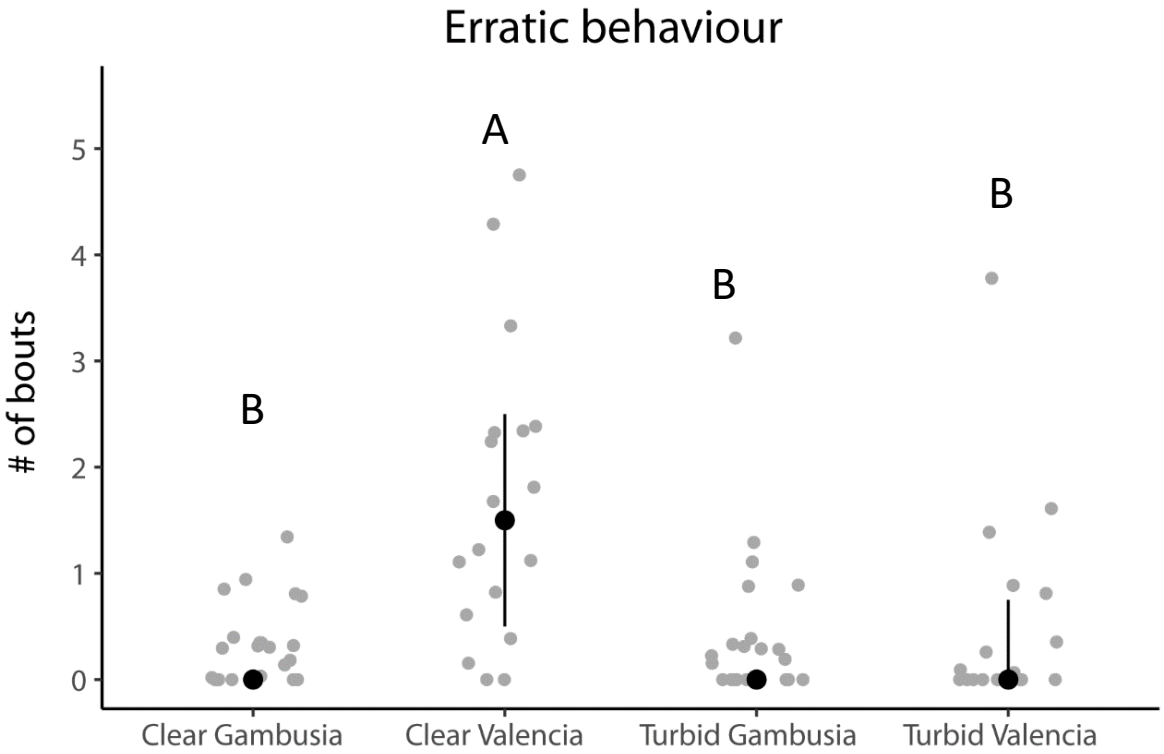
Erratic behaviour

4. Behavioural effects of turbidity: killifish vs mosquitofish (AFRESH)



Kruskal-Wallis: $P < 0.001$

4. Behavioural effects of turbidity: killifish vs mosquitofish (AFRESH)



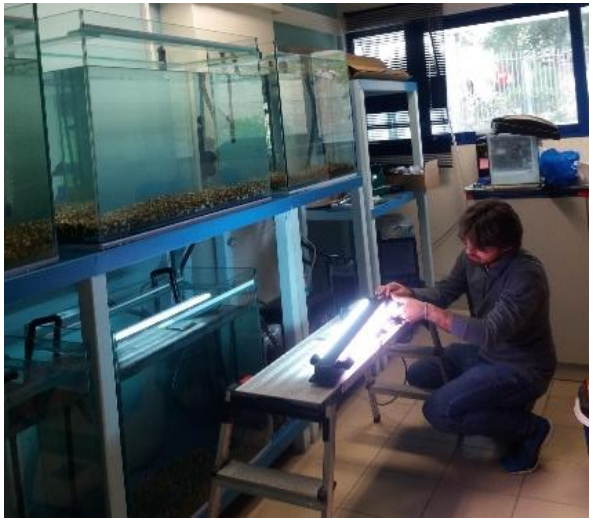
Kruskal-Wallis: $P < 0.001$

5. Captive breeding of two threatened native killifish species (DECAGON)

Development of breeding protocols for ***Valencia robertae*** and ***Valencia letourneuxi***

Study of their reproductive behaviour and larval development

3 aquaria of 350 l (dimensions 100x70x50 cm) and 3 aquaria 280 l (dimensions 80x70x50 cm) were established at **HCMR facilities** in 2018



5. Captive breeding of two threatened native killifish species (DECAGON)

103 ***V. robertae*** (2018) and 45 ***V. letourneuxi*** (2019) were transferred to the aquarium facilities

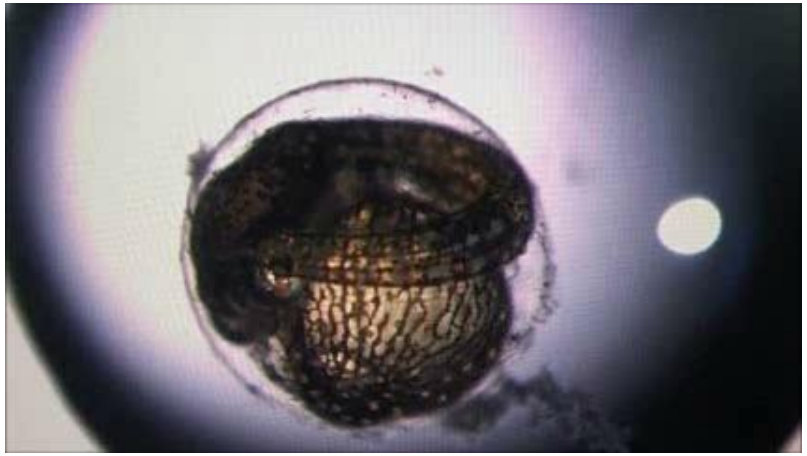
5. Captive breeding of two threatened native killifish species (DECAGON)

Both *V. letourneuxi & V. robertae* **reproduced** in aquaria conditions

5. Captive breeding of two threatened native killifish species (DECAGON)

Eggs hatched and larvae reared to adult stage

F1 generation reproduced in the following year



6. Conservation translocation: creating a refugia population (AFRESH)

The aim was to move adult fish into a safe habitat to act as a **refugia** in the wild for the threatened Corfu killifish *Valencia letourneux*i

6. Conservation translocation: creating a refugia population (AFRESH)

September 2021

48 adult (>1.7 cm) killifish were transferred to the release site with no mortalities

6. Conservation translocation: creating a refugia population (AFRESH)

June 2022

Larvae presence was confirmed (with hand nets) + enhancement with 36 adult fish

September 2022

Population of various sizes was detected (with electrofishing)

7. Creating breeding stocks of 2 range-restricted threatened fishes (AFRESH)

Economidichthys trichonis
Economidis & Miller 1990

Pungitius hellenicus
Stephanidis, 1971

7. Creating breeding stocks of 2 range-restricted threatened fishes (AFRESH)

Economidichthys trichonis

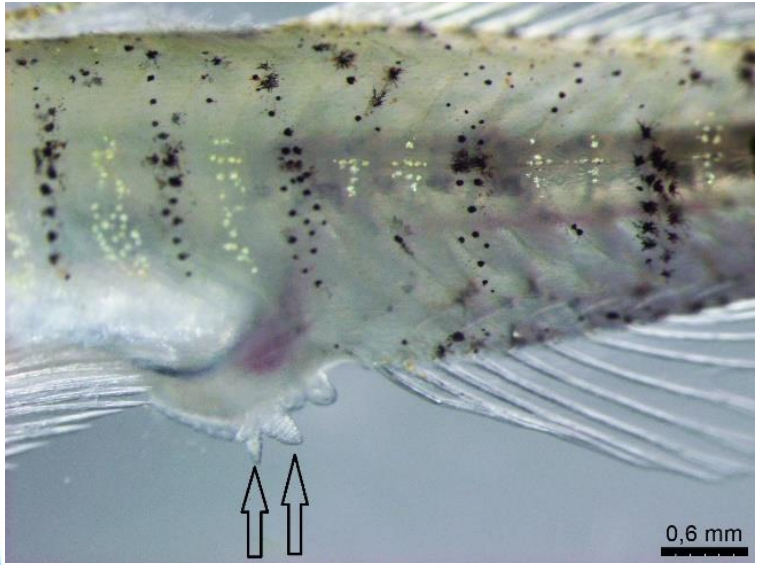
***November 2021* (1st attempt)**

Seine net → 107 fish collected, sorted and transported to HCMR

7. Creating breeding stocks of 2 range-restricted threatened fishes (AFRESH)

Economidichthys trichonis

After 4 hours, 58 live fish arrived in the laboratory (46% mortality)
Mortality continued in the following days → **histopathological examination** of fish
Treated with Emamectin benzoate



7. Creating breeding stocks of 2 range-restricted threatened fishes (AFRESH)

Economidichthys trichonis

After the treatment!

7. Creating breeding stocks of 2 range-restricted threatened fishes (AFRESH)

Economidichthys trichonis

Ιωάννης Καπάκος, Ιωάννης Λέρης, Λεωνίδας Βαρδάκας, Ελένη Καλογιάννη

Ελληνικό Κέντρο Θαλασσίων Ερευνών, Ινστιτούτο Θαλάσσιων Βιολογικών Πόρων & Εσωτερικών Υδάτων, 46,7 χλμ, Λεωφ. Αθηνών Σουνίου, Ανάβυσσος, ΤΚ, 190 13 – ykapakos@hmcr.gr, i.leris@hcmr.gr, louisvard@gmail.com, ekalog@hcnr.gr

ABSTRACT

Yiannis Kapakos, Ioannis Leris, Leonidas Vardakas, Eleni Kalogianni: Collection, transfer and acclimatization of the dwarf goby *Economidichthys trichonis* in a closed circuit system

7. Creating breeding stocks of 2 range-restricted threatened fishes (AFRESH)

Economidichthys trichonis

***November 2022* (2nd attempt)**

We collected 89 gobies (seine net) → 500 ml plastic bottles + pure oxygen + ammonia detoxifier
Transport with 0% mortality + preventive treatment with hemamectin benzoate (same day)
Fish consumed food within 24h

7. Creating breeding stocks of 2 range-restricted threatened fishes (AFRESH)

Pungitius hellenicus

***January 2022* (1st attempt)**

We collected 40 sticklebacks (electrofishing), transported in plastic container

*T*collection: ~8 °C → *T*aquaria: ~20 °C

Fish were not feeding and some males assumed breeding colours

7. Creating breeding stocks of 2 range-restricted threatened fishes (AFRESH)

Pungitius hellenicus

Mortality recorded after three weeks
Infected by *Trichodina* parasites
Treatment with malachite green oxalate & formaldehyde solution
Five individuals eventually survived

7. Creating breeding stocks of 2 range-restricted threatened fishes (AFRESH)

Pungitius hellenicus

***November 2022* (2nd attempt)**

We collected 32 sticklebacks (electrofishing), transported in plastic container

$T_{collection}$: ~12 °C → $T_{aquaria}$: ~16 °C

Preventive treatment in the field: malachite green oxalate & formaldehyde solution bath (30 min)

Extended treatment in the lab (3 days)

Use of live food (*Tubifex*, *Artemia*, white mosquito larvae, *Daphnia*)

8. Future perspectives

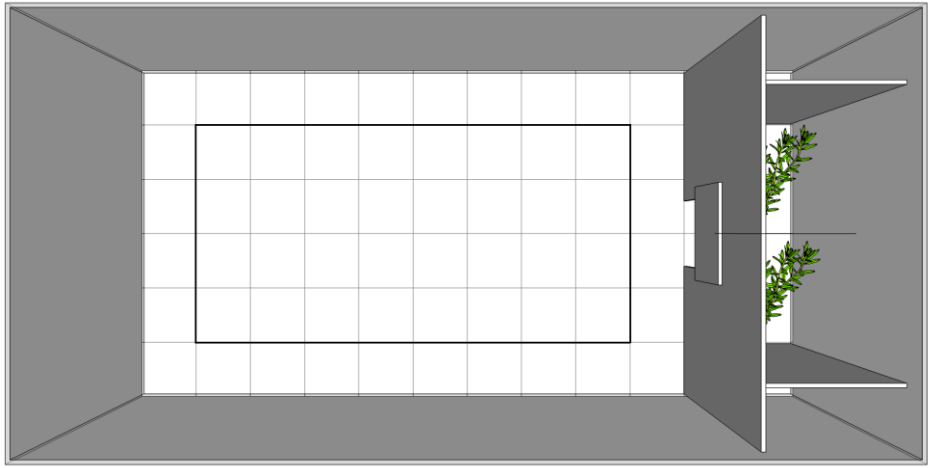
Comparative (killifish – mosquitofish) and new species studies

Behavioural tests

- Emergence test
- Predator response test
- Novel object test

Environmental factors

- Temperature
- Salinity
- Turbidity



8. Future perspectives

In HCMR facilities there is now a modern laboratory for captive breeding and rearing threatened fish species and for the study of their behavior (social, reproductive etc)

Thank you for your attention!