# EXPERIMENTAL EVIDENCE ON SHRIMPS' POPULATION DYNAMICS DRIVEN BY CONTAMINATION AND PREDATION: SUSCEPTIBILITY OF POPULATIONS TO SPATIAL ISOLATION AND LOCAL EXTINCTION

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# Introduction



Landscape ecology







Landscape composition

Connectivity rupture





#### Habitat fragmentation

# Hypothesis

Contamination in aquatic environments may isolate populations, changing the spatial dynamics and connectivity populations distributed among in landscapes with high predation risk and foraging demand. populations.

- $\checkmark$  To study the role of contamination against
  - predation risk and food availability.



# Objectives

- $\checkmark$  To assess the suitability of a new assay
  - system to simulate complex
  - environmental scenarios.
- ✓ To evaluate the effect that contamination
  - may exert to lead to the isolation among



Methodology

## Palaemon varians (Leach, 1814)

#### Distribution

West Baltic

British isles (Smaldon, 1993)

West Mediterranean (González-Ortegón and Cuesta, 2006)

#### **Ecotoxicology background**

Triclosan (Araújo, et al., 2019)

Musk fragances (Ehiguese, et al., 2019)

Copper (Araújo et al., 2020)



# HeMHAS: Heterogeneous Multi - Habitat Assay System



Length: 24 cm, Width: 24 cm Height: 8 cm, Volume: 700 mL

#### POLYOXYMETHYLENE

Acetal - Good sliding properties and low chemical reactivity (Mergler et al., 2014) https://drive.google.com/file/d/19YRPCTfGSf\_abaE5IDsWCUiWi4IutCjx/view?usp=sharing





Length: 22.2

Length: 5 cm Width: 5 cm Height: 8 cm



Diameter: 2.45 cm



Height: 6.5 cm Diameter: 3.5 cm Diameter hole: 2.1 cm

# Stressors





#### **CONTAMINATION**

0.5 µg/L

Environmentally

relevant

25	µg/L
Aversive	

(triggers

avoidance)

#### **PREDATION RISK**

5% dilution of filtered liquid of Recirculating Aquaculture

System

per compartment

# Stimulus





#### Artemia salina **FISH FOOD FLAKES**

20 organisms

0.5 g per compartment

# Habitat selection experiments

- Number of organisms: 80 per replicate
- Laboratory conditions:
  - Darkness
  - Temperature: ~22 °C
- Observation times: Each 30 min
- Exposure period: 4 hours

## COPPER

To check the organism's spatial distribution exposed to a contaminant. REPLICATES: 3

## **COPPER + KAIROMONES**

To check whether the role than contamination plays over anti/predator behavior of organisms. **REPLICATES: 4** 

**REPLICATES: 4** 

### COPPER + KAIROMONES + FOOD

- To check whether an attractive stimulus may
- increase the organism's response to explore new
- areas crossing through stressed areas.

#### SPATIAL ARRANGEMENT









- Isolated High Conc.
- High Cu Conc.
- Low Cu Conc.
- Isolated Low Conc.
- Undisturbed High Conc.
- Transit High Conc.
- Transit Low Conc.
- Undisturbed Low Conc.

# Copper

Filtered seawater
Copper at 25 µg/L
Copper at 0.5 µg/L

#### SPATIAL ARRANGEMENT

# Copper + kairomones (5%)



- Low Cu Conc.
- Predation Risk Difficult

High Conc. Kairomones

Low Conc. Kairomones

Predation Low Conc.

 $\bigcirc$ 

Predation Risk Easy



- Filtered seawater
- Copper at 25 µg/L
- O Copper at 0.5 µg/L
- Kairomones (diluted at 5%)

#### SPATIAL ARRANGEMENT





# Copper + kairomones + food



Filtered seawater O Copper (0.5  $\mu$ g/L) + kairomones (5%) Kairomones (5%)  $\bigcirc$  Food (artemia and Tetramin<sub>®</sub> flakes)



Results and Discussion

# Copper (regions)

Shrimps detected and avoided contaminated regions







# Copper (areas)

Avoidance response was stronger in the most contaminated area





# Copper + kairomones (regions)

Shrimps detected predator signal and moved towards contaminated regions







# Copper + kairomones (areas)

Within contaminated regions, the preference for uncontaminated areas was higher





# Copper + kairomones + food

Contamination created a chemical barrier reducing slightly colonization percentage by organisms towards feeding areas











# Conclusions

- Ecotoxicology should integrate the contamination risk ٠ assessment into a more ecological perspective, by including it as a factor as important as predation risk and food availability.
- Systems like HeMHAS allow a wider view of • contamination at the landscape scale and provide to the ecotoxicology a new methodological and conceptual tool to reach a higher level of ecological relevance.



## **CONTAMINATION**

interferes spatial distribution of organisms

exacerbates predation effects, jeopardizing pop. persistence

# Acknowledgments











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# Thanks for

your attention!