WHAT REALLY SCARES ZEBRA MUSSELS?

A few words about the impact of biotic factors on valve movement reactions of the zebra mussel *Dreissena polymorpha*

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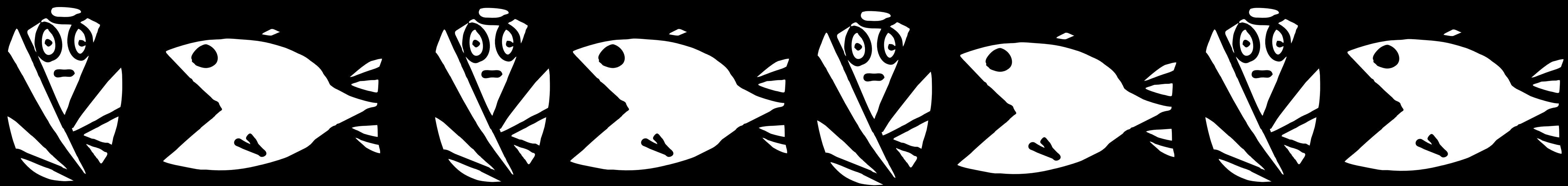
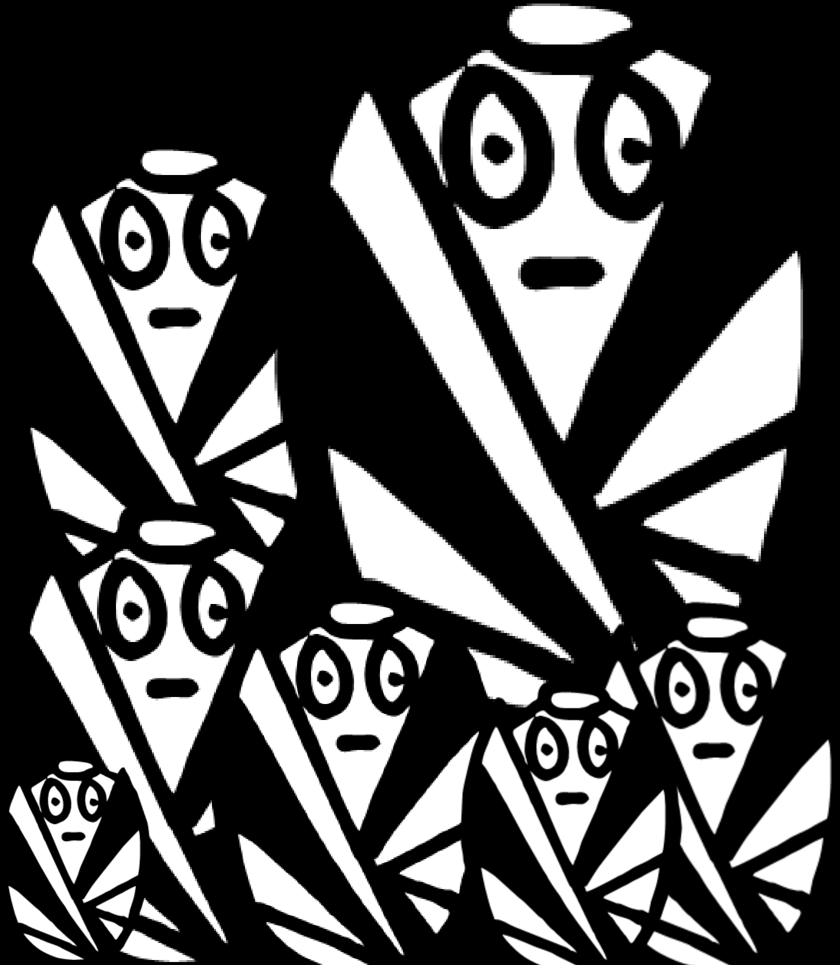


ZEBRA MUSSEL *DREISSENA POLYMORPHA*

- Invasive species from the Ponto-Caspian region
- Used in early warning systems based on mussel valve gaping



Ecotoxicology **6**, 153–165 (1997)

Valve movement response of the mussel *Dreissena polymorpha* – the influence of pH and turbidity on the acute toxicity of pentachlorophenol under laboratory and field conditions

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The Influence of Suspended Particles on the Acute Toxicity of 2-Chloro-4-Nitro-Aniline, Cadmium, and Pentachlorophenol on the Valve Movement Response of the Zebra Mussel (*Dreissena polymorpha*)

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TECHNICAL NOTE

SHELL VALVE MOVEMENT RESPONSE OF DARK FALSE MUSSEL, *MYTILOPSIS LEUCOPHAETA*, TO CHLORINATION

SANJEEVI RAJAGOPAL[1]*, GERARD VAN DER VELDE[1] and HENK A. JENNER[2]

Valve movement responses of *Velesunio angasi* (Bivalvia: Hyriidae) to manganese and uranium: An exception to the free ion activity model

Scott J. Markich [a,b,*], Paul L. Brown [a], Ross A. Jeffree [a], Richard P. Lim [b]

TOXICOLOGY

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Aquatic Toxicology 66 (2004) 333–343

www.elsevier.com/locate/aquatox

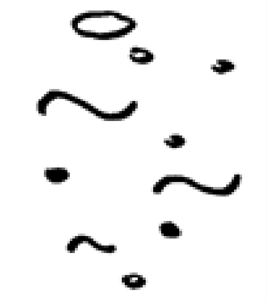
Copper detection in the Asiatic clam *Corbicula fluminea*: optimum valve closure response

Damien Tran [a,b,*], Elodie Fournier [a,b], Gilles Durrieu [b], Jean-Charles Massabuau [b]

THE AIM OF OUR STUDY

- To check valve responses of zebra mussels to biotic factors
- 6 variants with chemical cues:

1 control

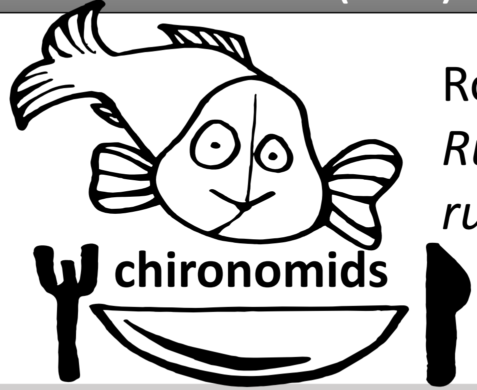


areated
clean
water

2 with alarm substance

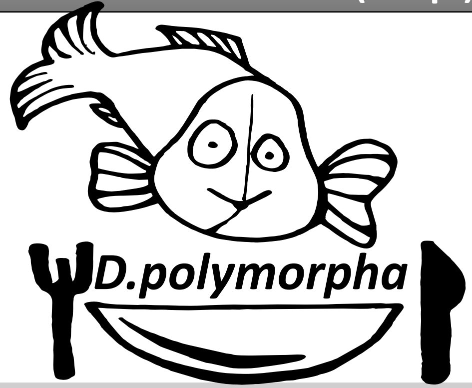
from
crushed
mussels

3 with fish scent (fCh)

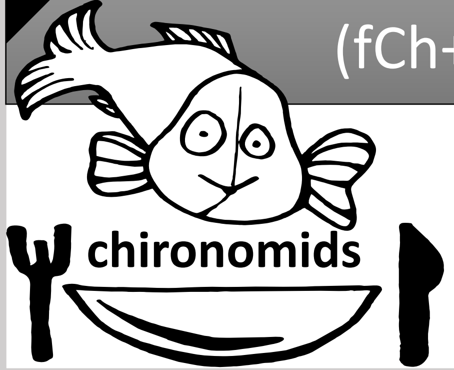


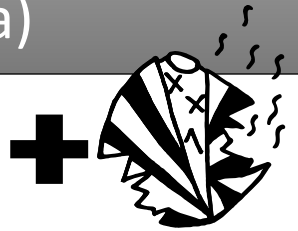
Roach
Rutilus rutilus

4 with fish scent (fDp)

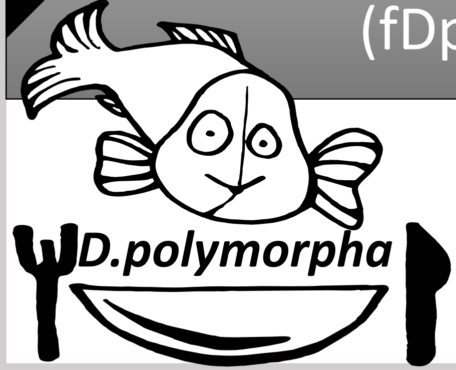


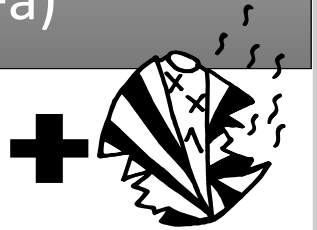
5 with fish scent and alarm (fCh+a)





6 with fish scent and alarm (fDp+a)





THE AIM OF OUR STUDY

- To check valve responses of zebra mussels to biotic factors
- 2 variants with the physical presence of:

7 with the presence of Dikerogammarus villosus

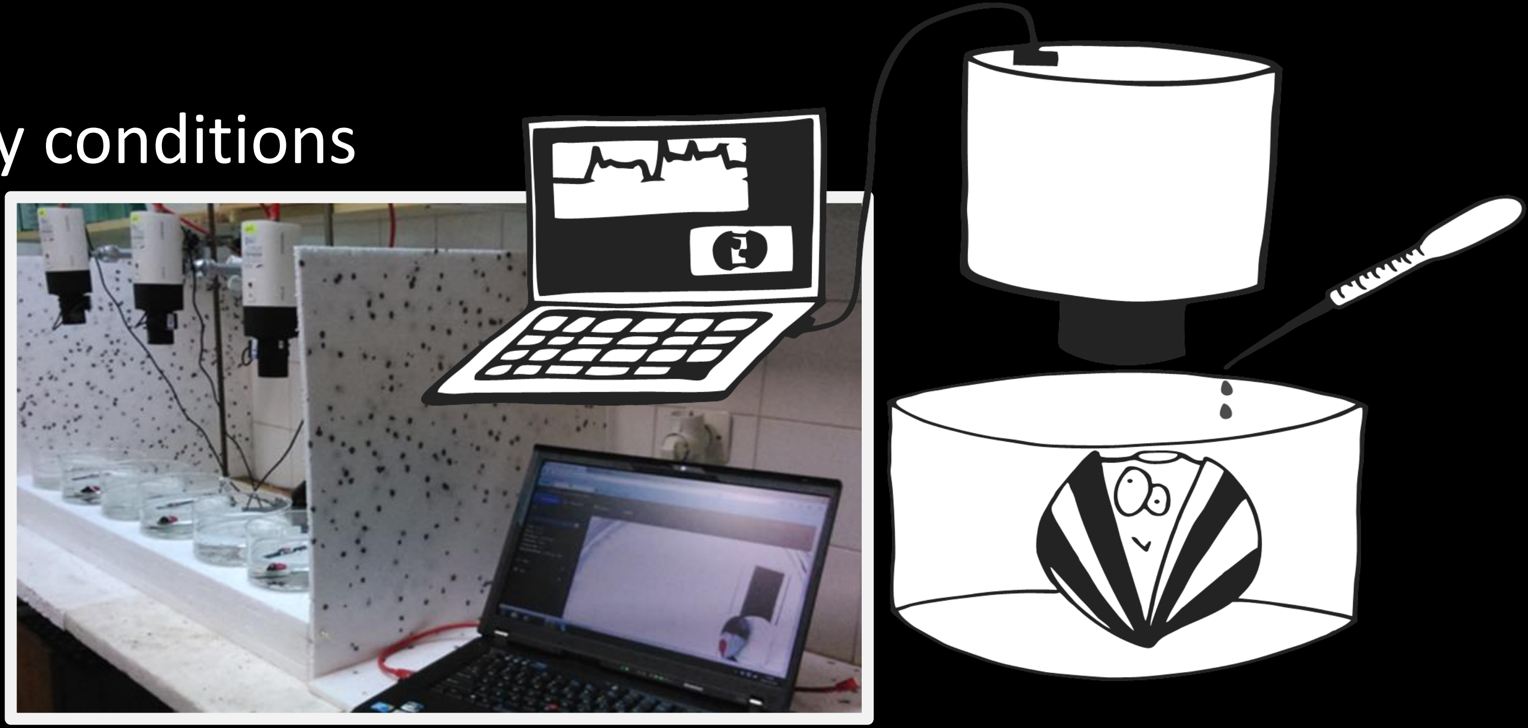
3 individuals per tank

8 control for variant 7

areated clean water

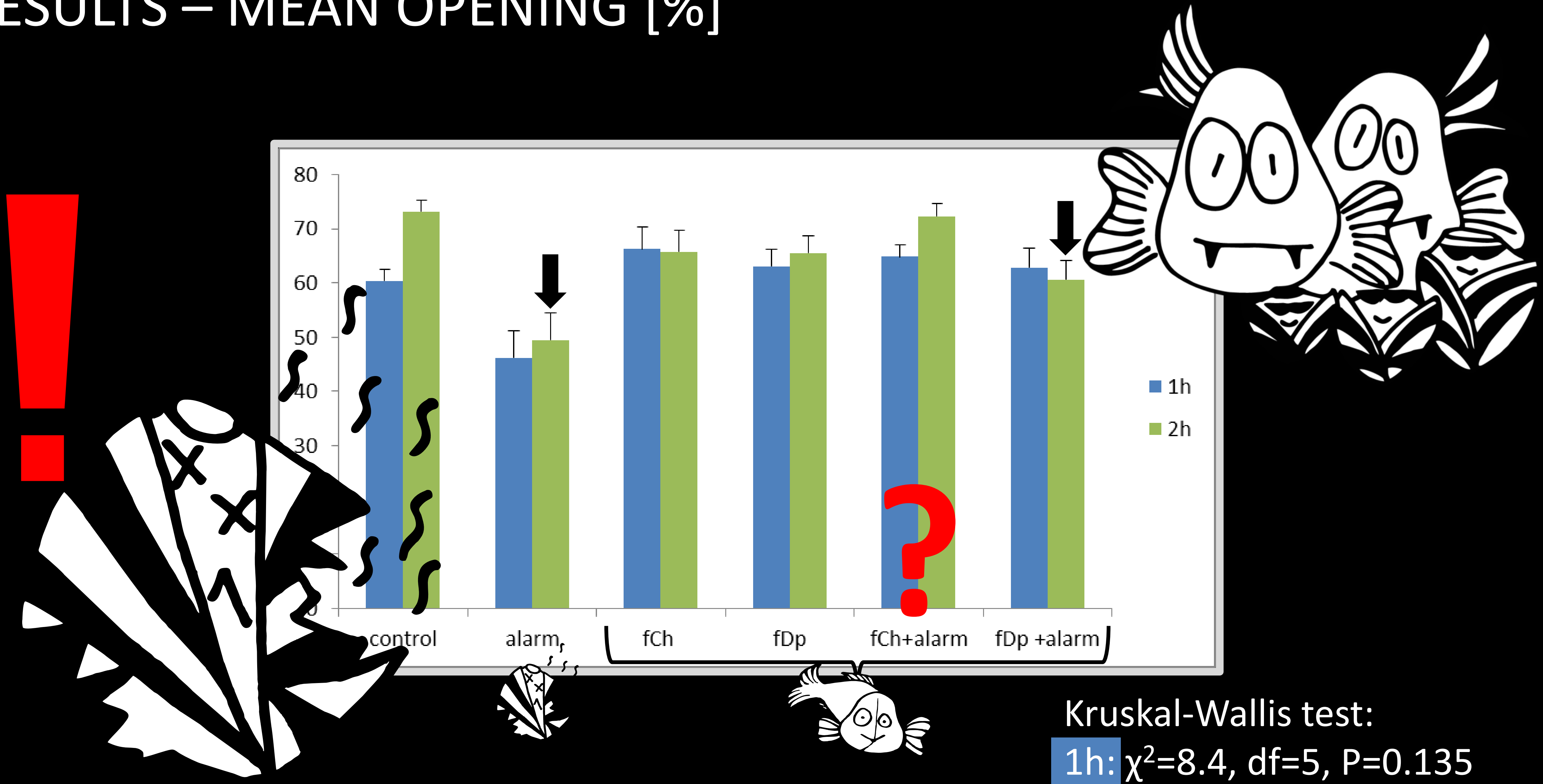
METHODS

- ❖ Experiments under laboratory conditions
- ❖ Recorded by video cameras



- ❖ Tested individuals:
  - one per treatment
  - specially marked
- ❖ Duration: 2 hours
- ❖ Noldus Ethovision XT
  – the software for analysing recorded video files
- ❖ Checked parameters:
- ❖ - mean opening (%)
  - total duration of particular valve gaping levels
  - number of valve opening events

RESULTS – MEAN OPENING [%]



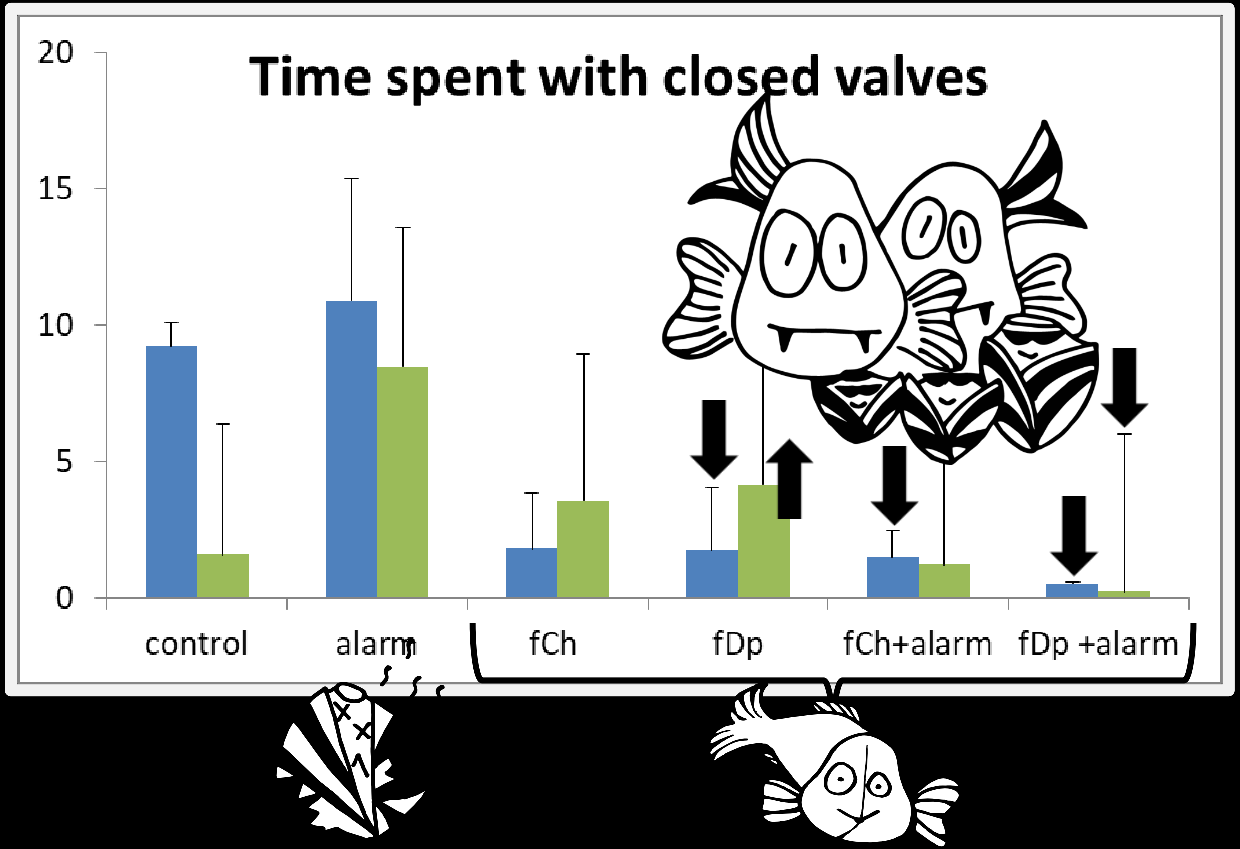
Alarm substance = lower mean opening

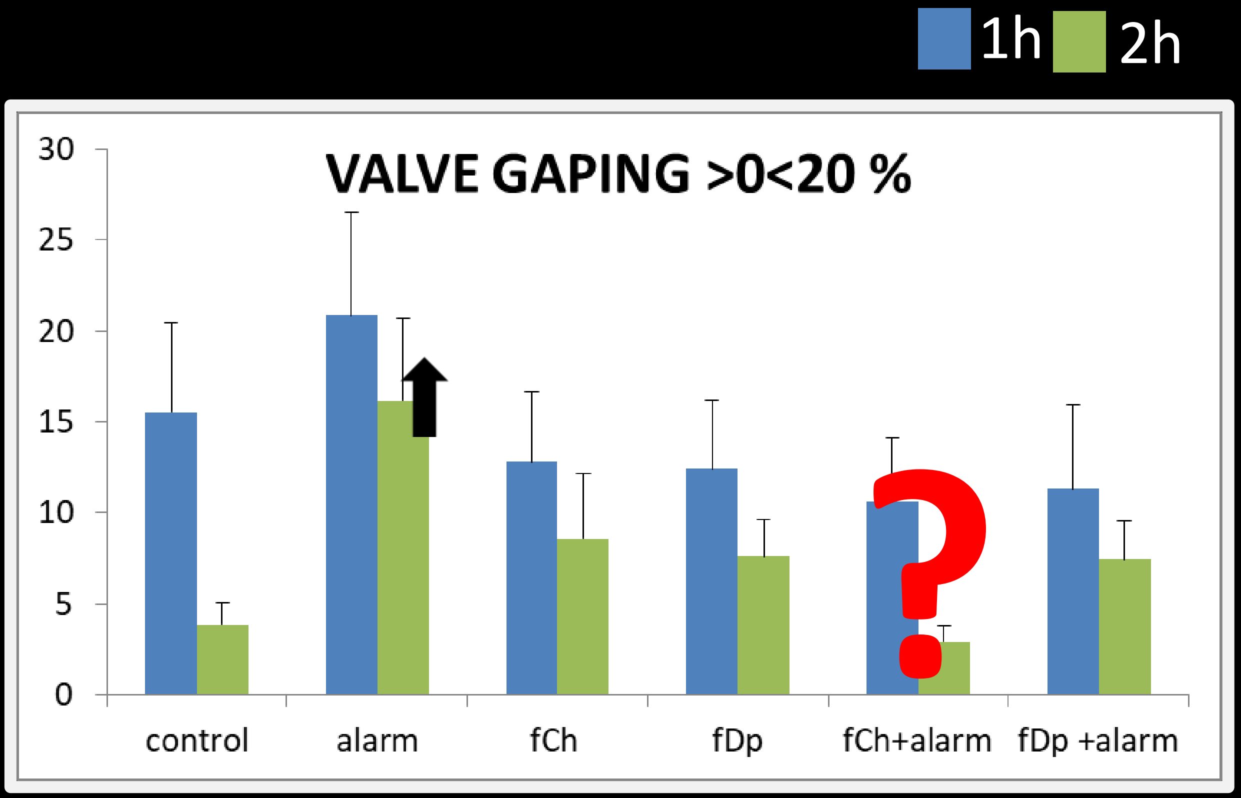
Kruskal-Wallis test:

1h: χ^2=8.4, df=5, P=0.135

2h: χ^2=21.9, df=5, P=0.001

RESULTS – DURATION OF PARTICULAR GAPING LEVELS (% OF TOTAL TIME)





Kruskal-Wallis test:

1h: χ^2=37.7, df=5, P<0.001

2h: χ^2=22.0, df=5, P<0.001

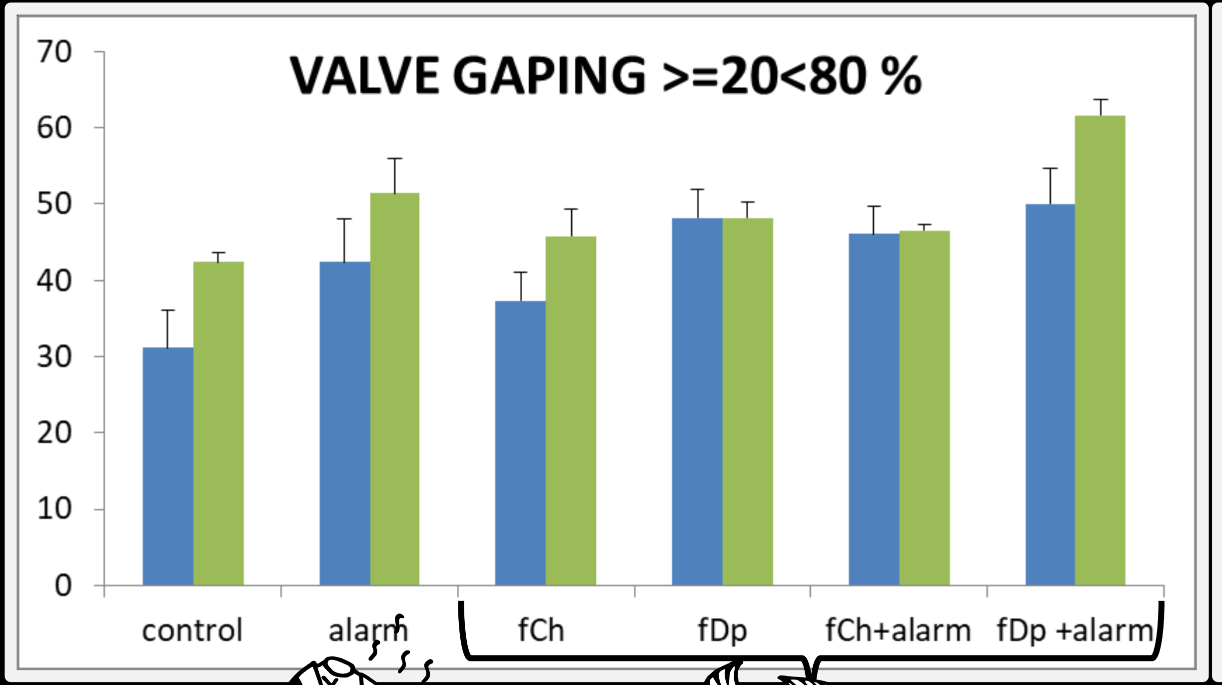
Kruskal-Wallis test:

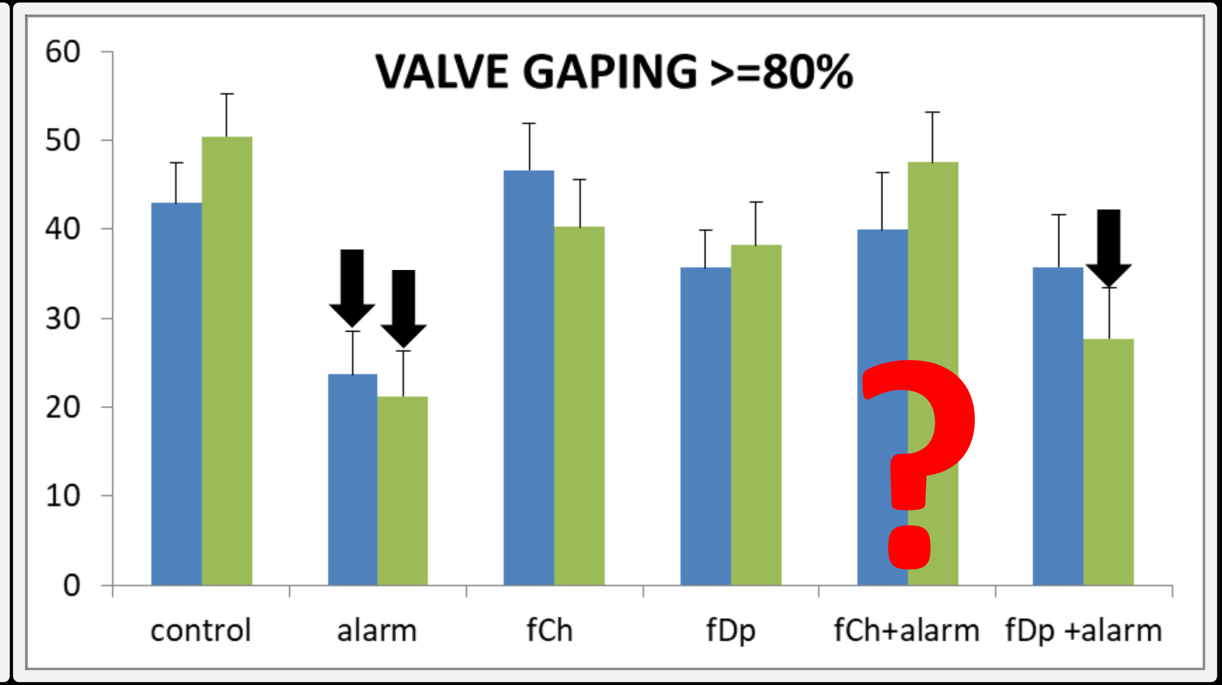
1h: χ^2=10.1, df=5, P=0.071

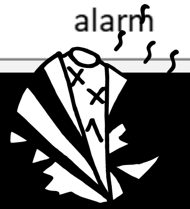
2h: χ^2=21.9, df=5, P=0.006

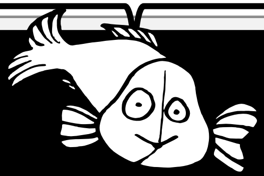
RESULTS – DURATION OF PARTICULAR GAPING LEVELS (% OF TOTAL TIME)

1h 2h









Kruskal-Wallis test:

1h: χ^2=8.6, df=5, P=0.127

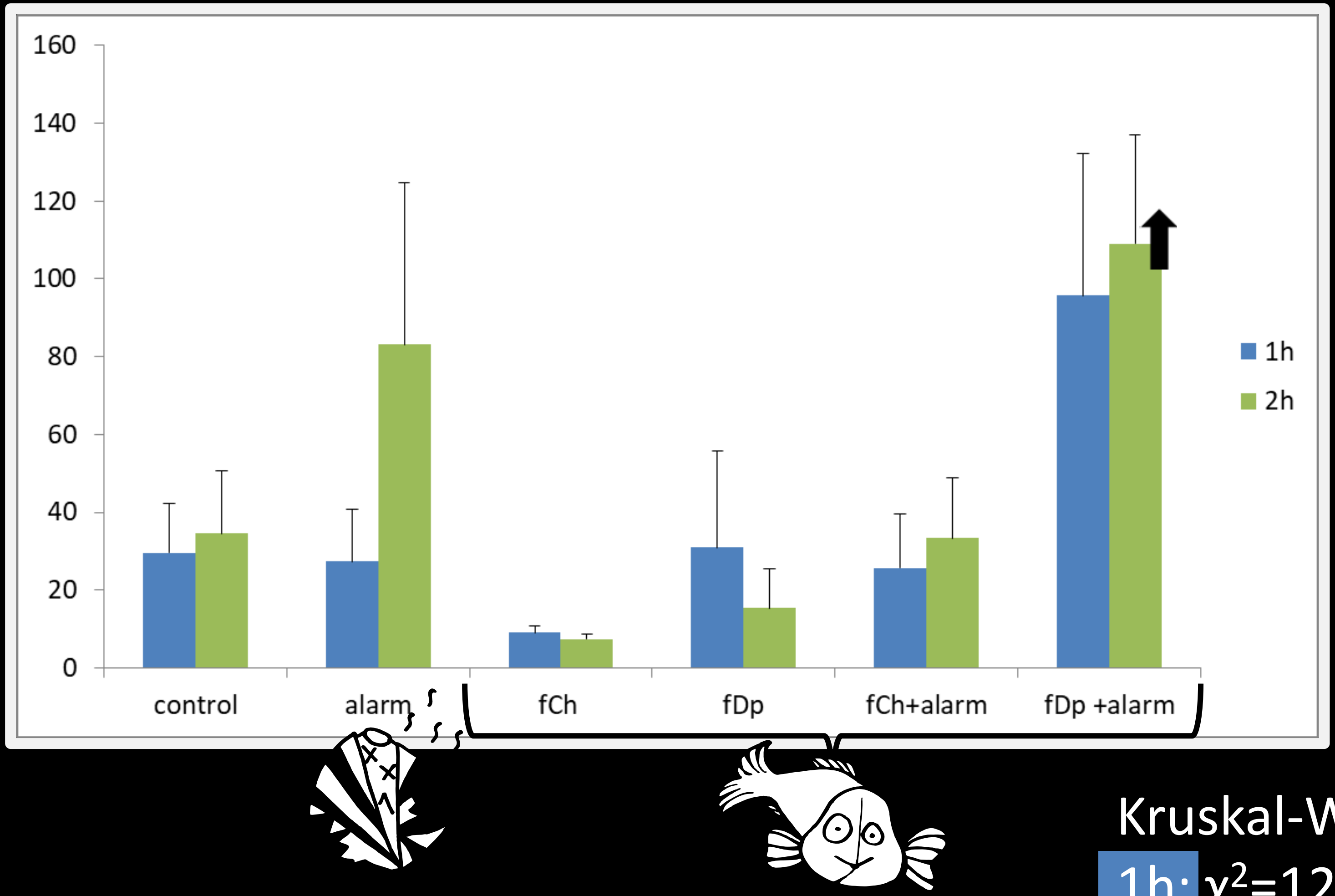
2h: χ^2=9.4, df=5, P=0.095

Kruskal-Wallis test:

1h: χ^2=11.3, df=5, P=0.045

2h: χ^2=19.4, df=5, P=0.002

RESULTS – NUMBER OF THE VALVE OPENING EVENTS <20% OF THE MAXIMUM OF VALVE GAPING



Kruskal-Wallis test:

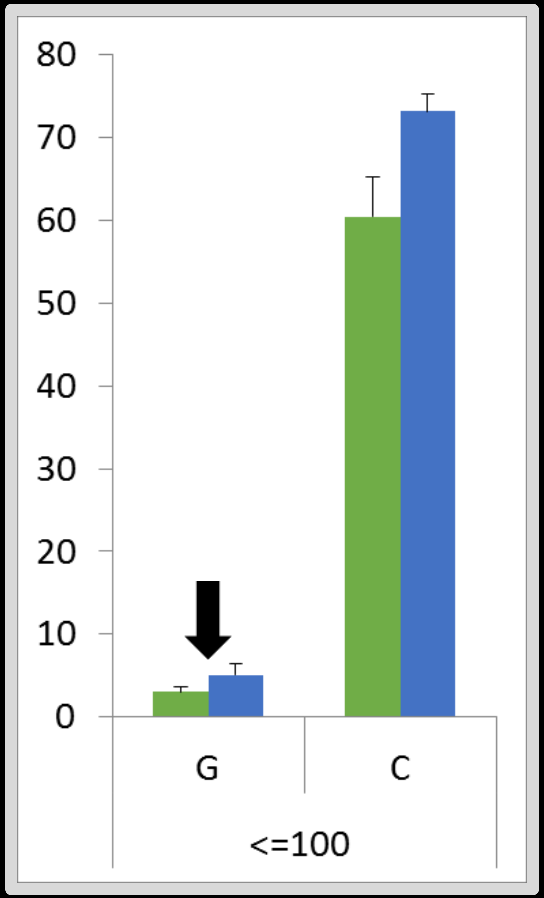
1h: χ^2=12.1, df=5, P=0.034

2h: χ^2=18.4, df=5, P=0.002

Alarm substance = more narrow valve openings

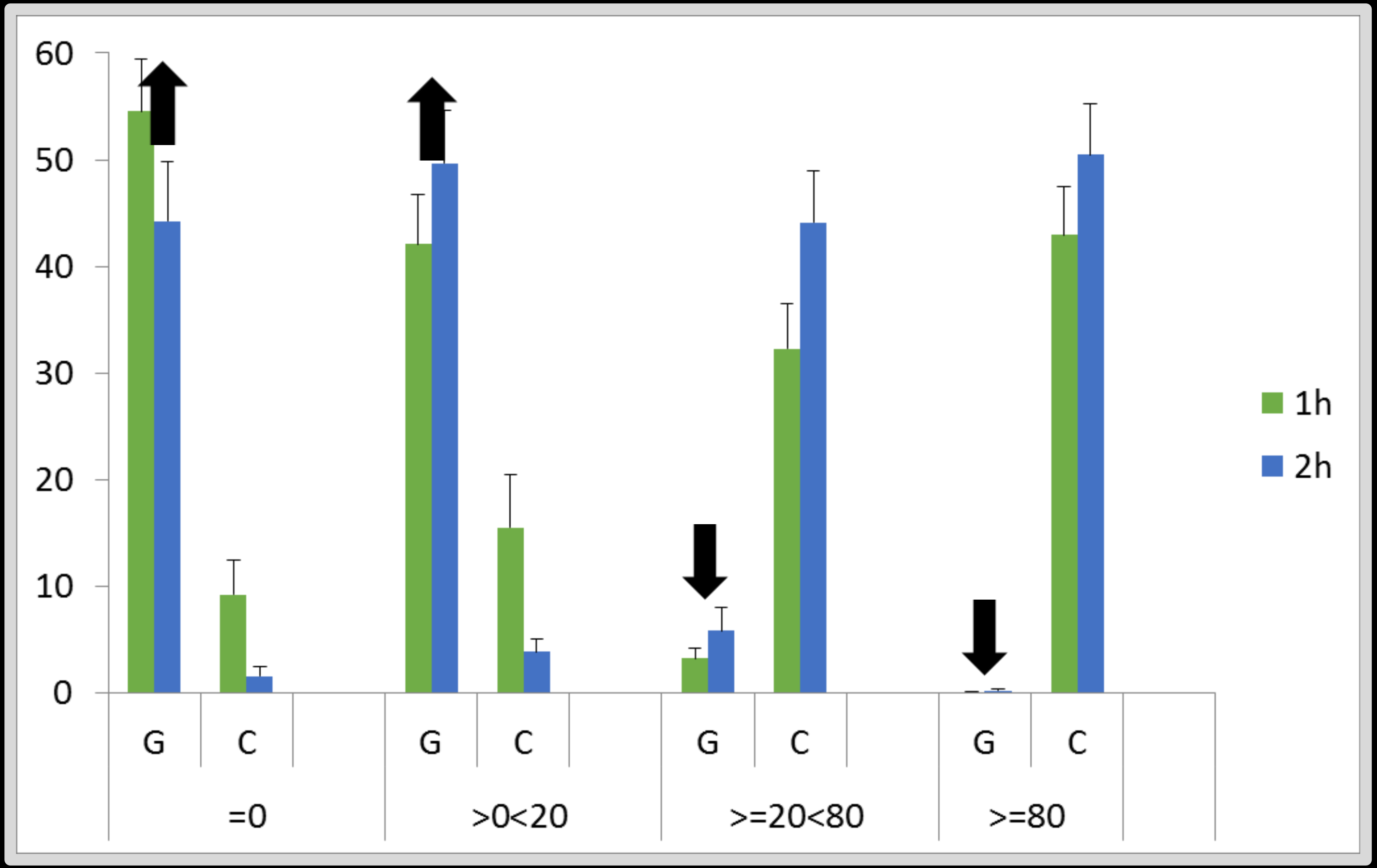
RESULTS – IMPACT OF D. VILLOSUS

MEAN OPENING [%]



DURATION OF PARTICULAR GAPING LEVELS

(% OF TOTAL TIME)



D. villosus = smaller mean opening, longer time spent in small gaping, shorter time spent in large gaping

G – presence of D. *villosus*

C - control

CONCLUSIONS

- Zebra mussels exhibited a clear response to the conspecific alarm substance:
  - -narrower mean opening during the entire experiment
  - -shorter time spent with valves gaping >=80% of the maximum opening and longer time spent with valves gaping >0<20%.

- Tested mussels did not clearly respond to the scent of the roach. We suppose that roach kairomones may:
  - stimulate specific responses to the alarm substance (e.g. number of opening events)
  - „mask” alarm substance what can be beneficial for the predator.

- The physical presence of *Dikerogammarus villosus* is a strong stress factor for the zebra mussel (mussels spent more than 50% of time with closed valves).

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