PhD project “Feeding behaviour and growth of sole bred in captivity”

Is burying and anti-predator behaviour related to body weight and growth in sole?

Julia Mas Munoz[1,2,3]
Hans Komen[2]
Oliver Schneider[3]
Johan Schrama[1]

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[1]Aquaculture and Fisheries Group
[2]Animal Breeding and Genetics Group
[3]Wageningen IMARES

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Outline

- General aim of the PhD project
- Introduction
- Research questions
- Materials & Methods
- Results
- Discussion & Conclusions
- Further research

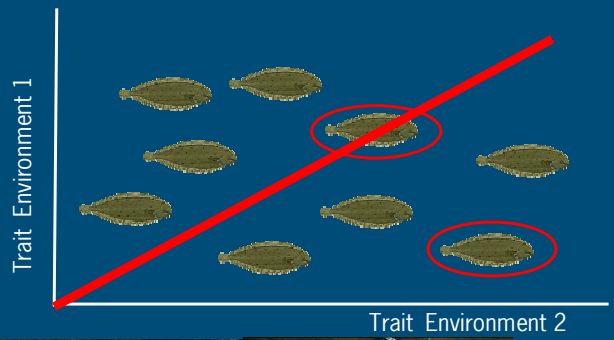
General Aim of Research Project

PhD project: "Feeding behaviour and growth of sole bred in captivity"

1 Behaviour ↔ FI & Growth

2 Environmental conditions

3 GXE



INTRODUCTION (i): Development sole culture

- Bottleneck Sole culture
- ➡ slow and variable GROWTH

INTRODUCTION (ii): Feeding behaviour sole

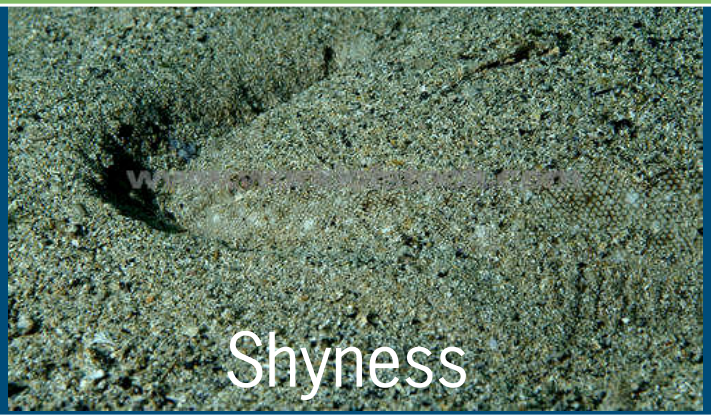
- Solitary flatfish, nocturnal and bottom feeder
- Buried in sand→ Anti-predator behaviour of minimum detection strategy
- Feeding behaviour→ Trade off between Fear & Hunger

Non-feeding behaviour

- Anti-predator
- Hiding motivation
- Activity levels

Feeding behaviour

- Feeding motivation
- Feeding frequency
- Meal size

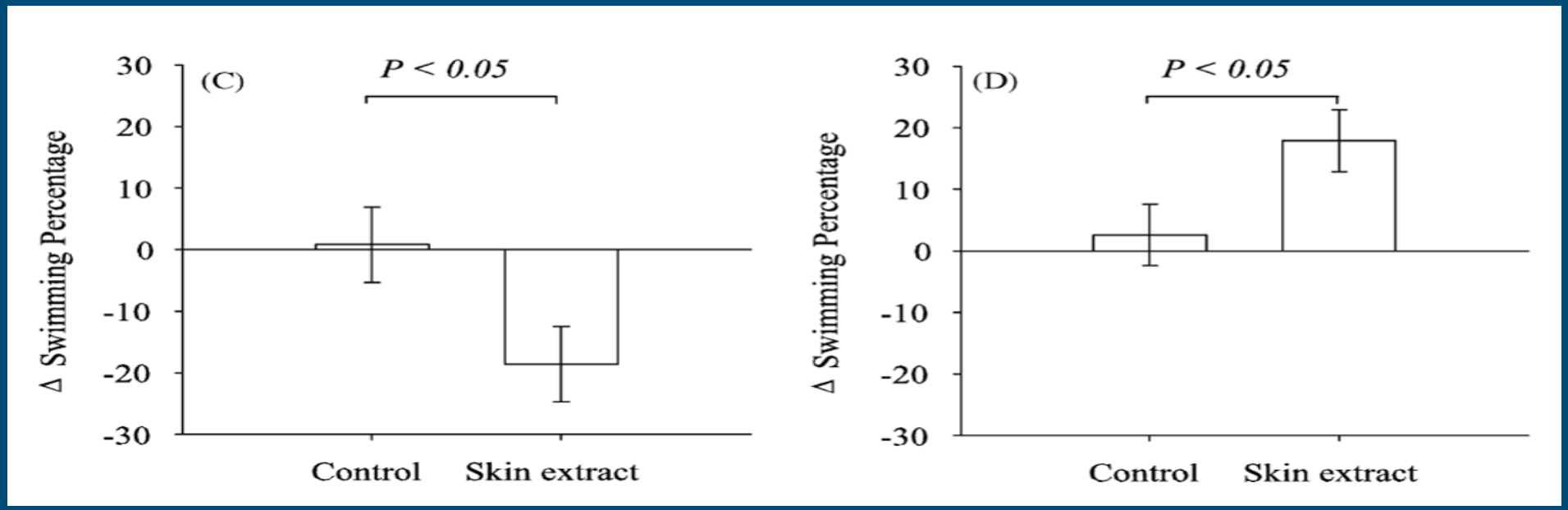


Fear

INTRODUCTION (iii) Anti-predator behavior & FI/Growth

African catfish: skin alarm cues

(van de Niewegiessen et al., 2008)

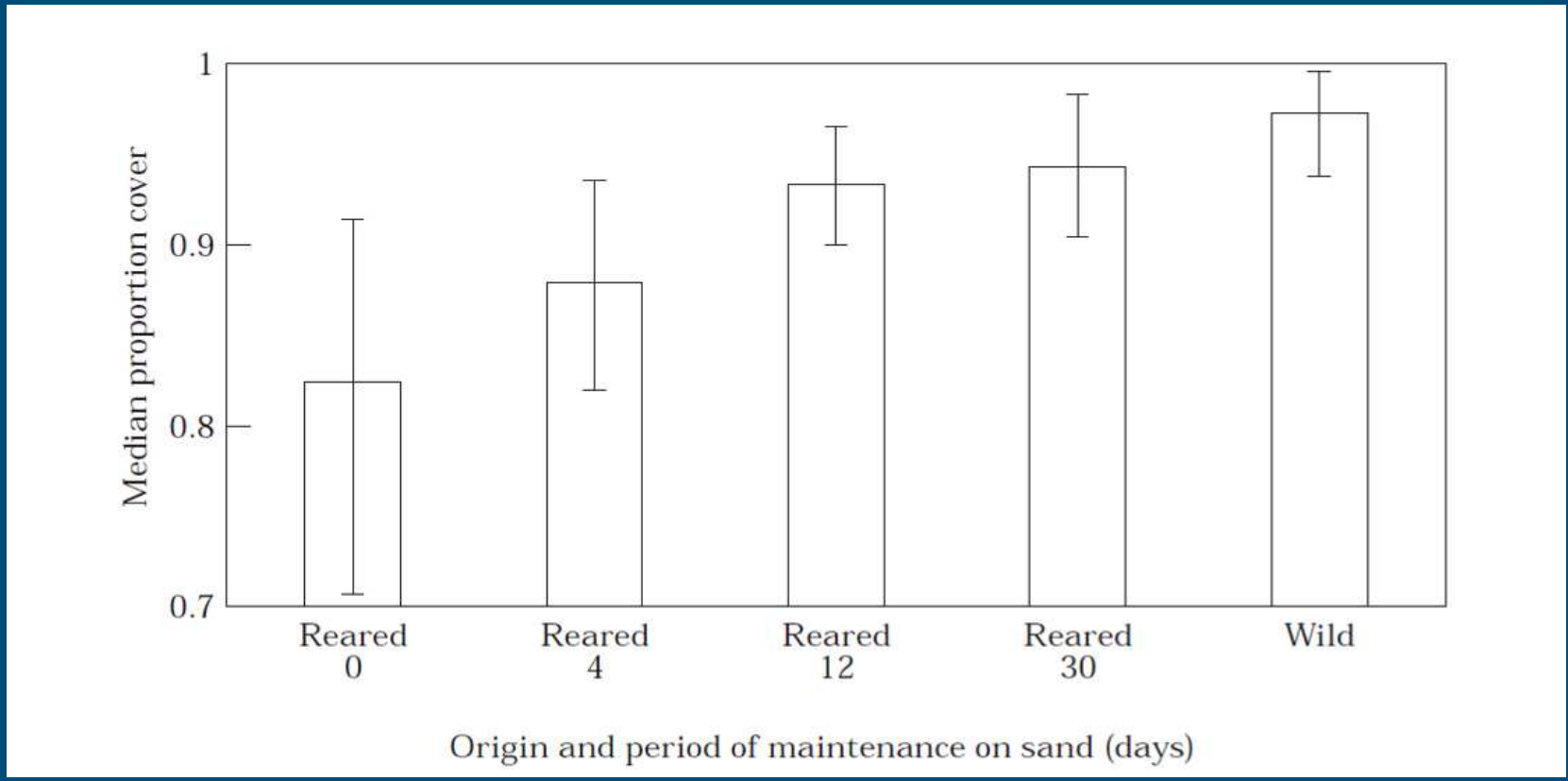


High feed efficiency (RFI<0)

Low feed efficiency (RFI>0)

INTRODUCTION (iv) Hiding behaviour in sole

Proportion of coverage in sand (Ellis et al., 1997)



RESEARCH QUESTIONS

HYPOTHESIS:

ΔGrowth ↔ ΔFeed Intake ↔ ΔAnti-predator & hiding behaviour

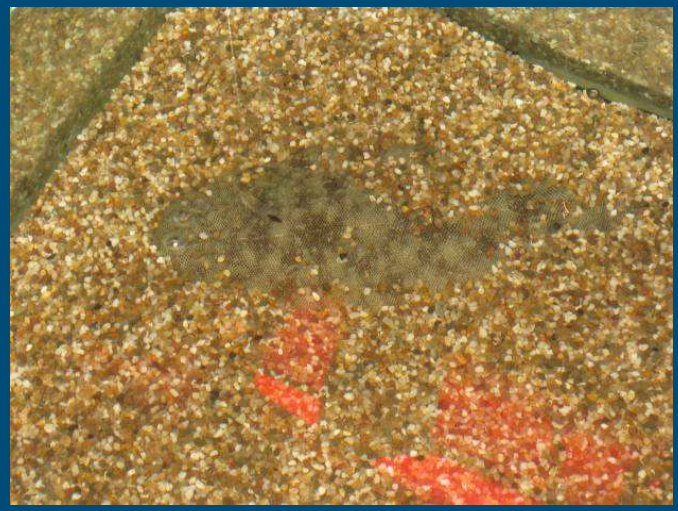
- Are differences between individuals in growth related to burying and anti-predator behavioural characteristics?
- Are the measured behavioural characteristics consistent over time?

MATERIALS & METHODS (i)

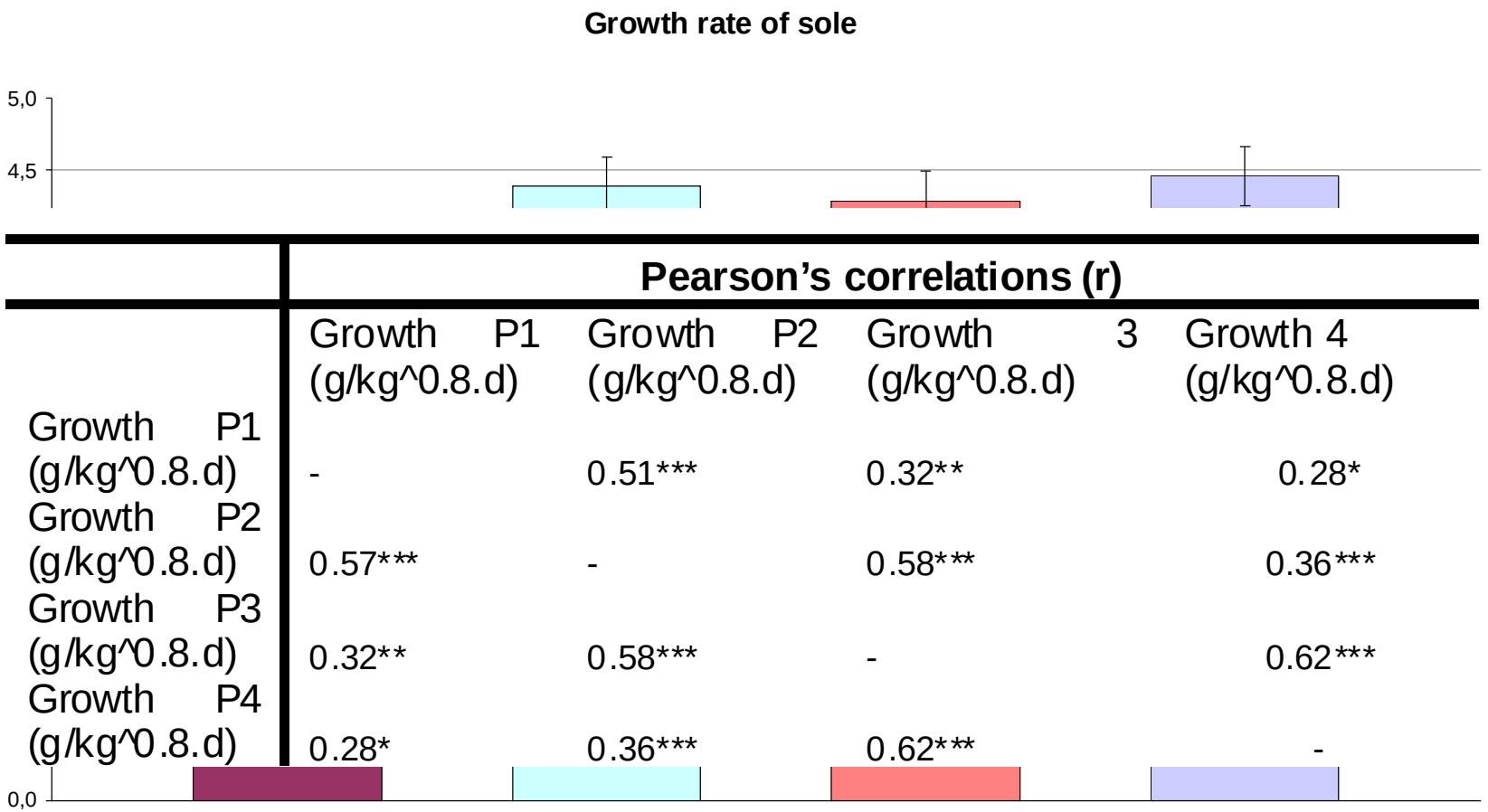
- ANIMALS
  - 96 individually tagged sole
- HOUSING
  - 2*400L tanks (48 fish/tank)
  - 12D:12L
  - Belt feeder 8h/day
- DURATION
  - 4 consecutive 16-d growth periods
- BEHAVIOURAL TETS
  - Between periods
  - Each test repeated twice
    1. Anti-predator behaviour Test
    2. Hiding motivation Test

MATERIALS & METHODS (ii)

- Anti-predator test
  - 120L bare bottom aquaria
  - After 25 min adaptation
  - 8 cm ball moved towards head fish
  - Reaction to the ball was recorded
- Hiding motivation test
  - 120L aquaria provided with 3cm sand
  - 25 min duration
  - Burying latency was recorded



RESULTS (i): Consistent growth variation

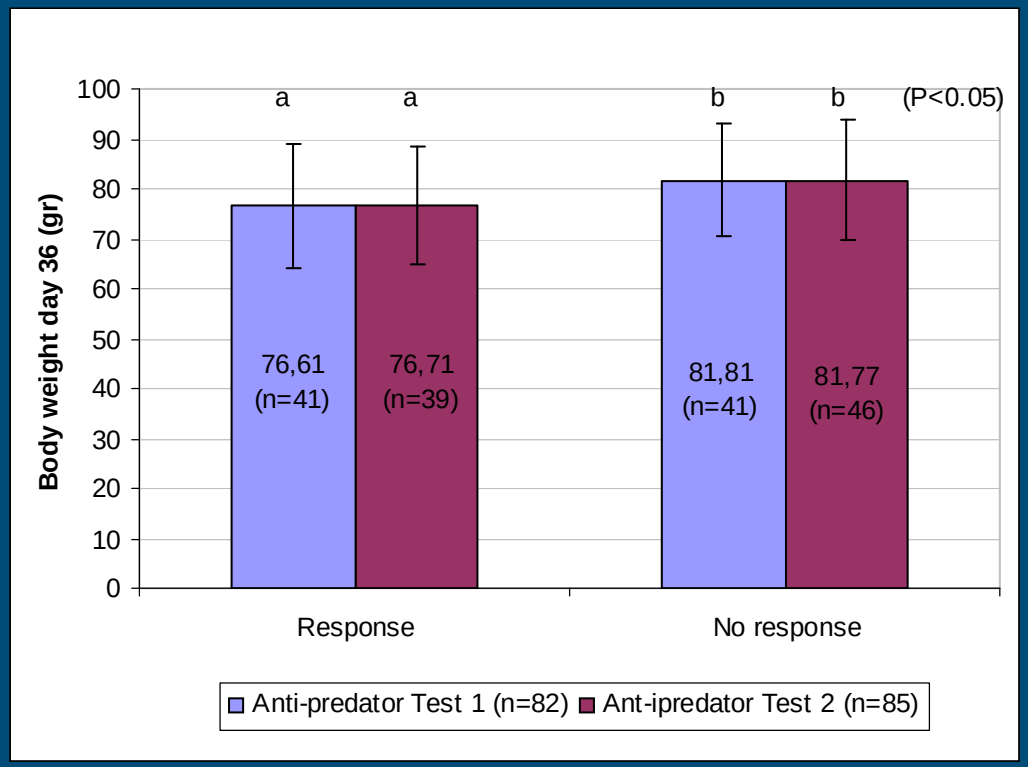


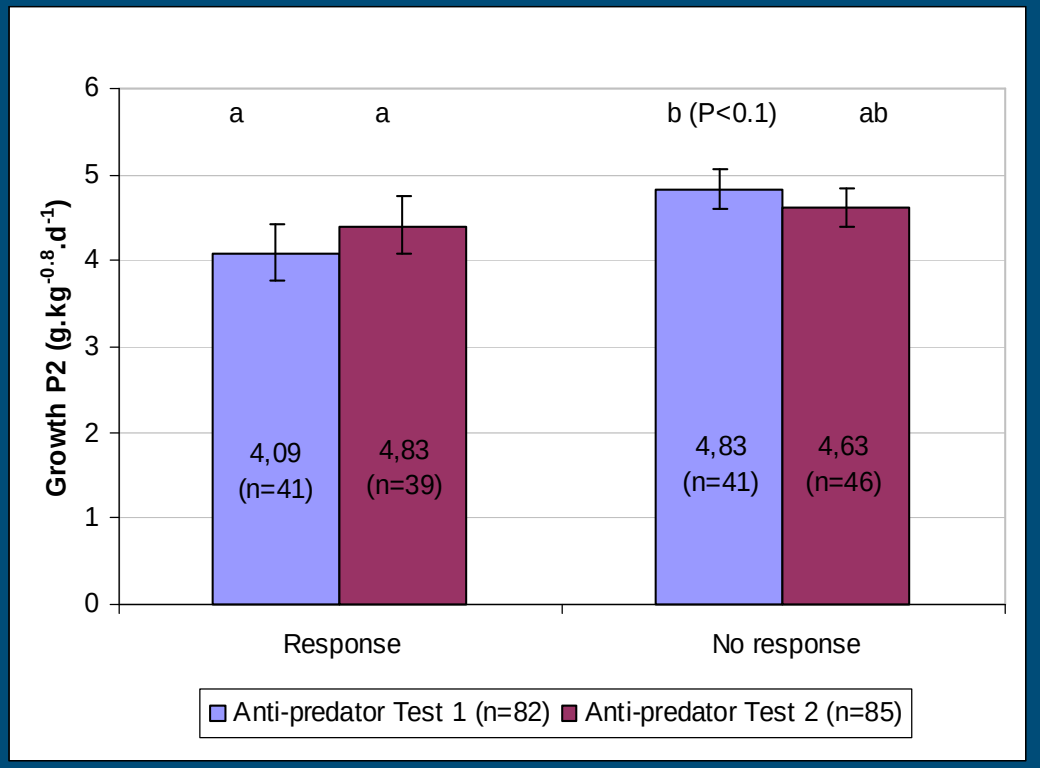
Pearson's correlations (r)

	Growth P1 (g/kg^0.8.d)	Growth P2 (g/kg^0.8.d)	Growth 3 (g/kg^0.8.d)	Growth 4 (g/kg^0.8.d)
Growth P1 (g/kg^0.8.d)	-	0.51***	0.32**	0.28*
Growth P2 (g/kg^0.8.d)	0.57***	-	0.58***	0.36***
Growth P3 (g/kg^0.8.d)	0.32**	0.58***	-	0.62***
Growth P4 (g/kg^0.8.d)	0.28*	0.36***	0.62***	-

RESULTS (ii): Anti-predator behaviour test

- Two opposite responses
  - Active response: Flight reaction
  - Passive response: Immobility
- Consistency of the test: Kappa value=0.53±0.18





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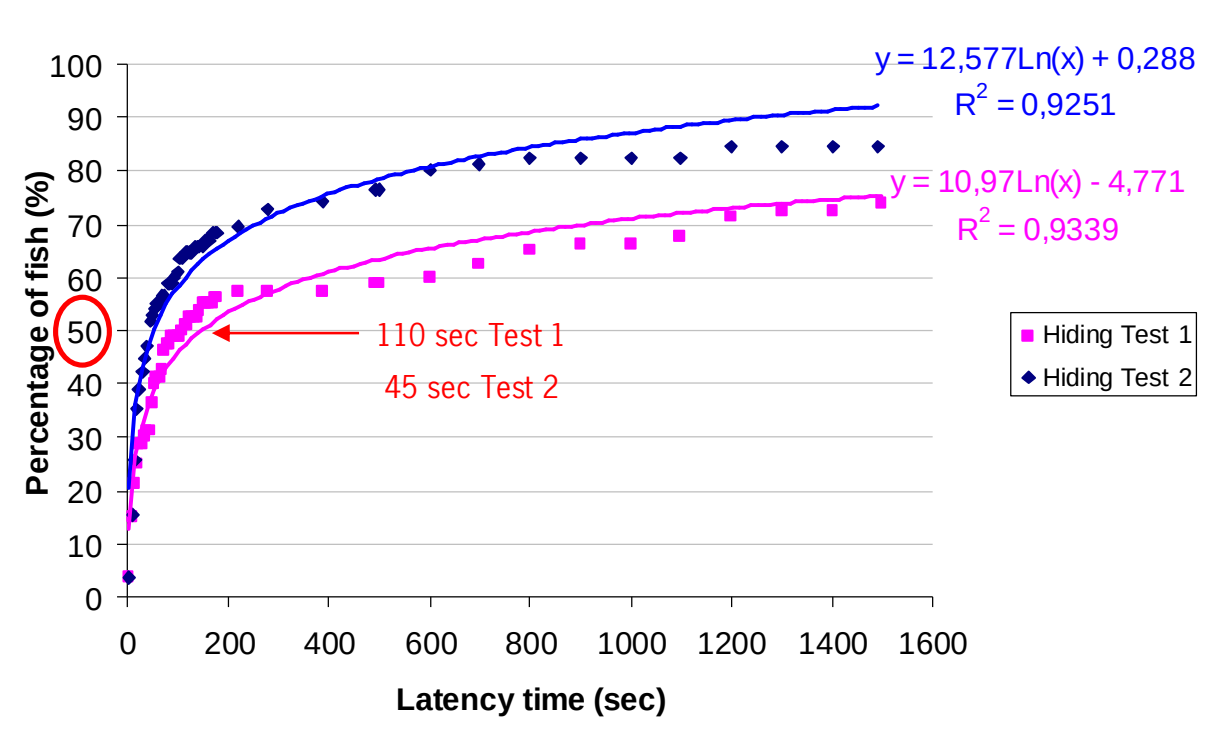
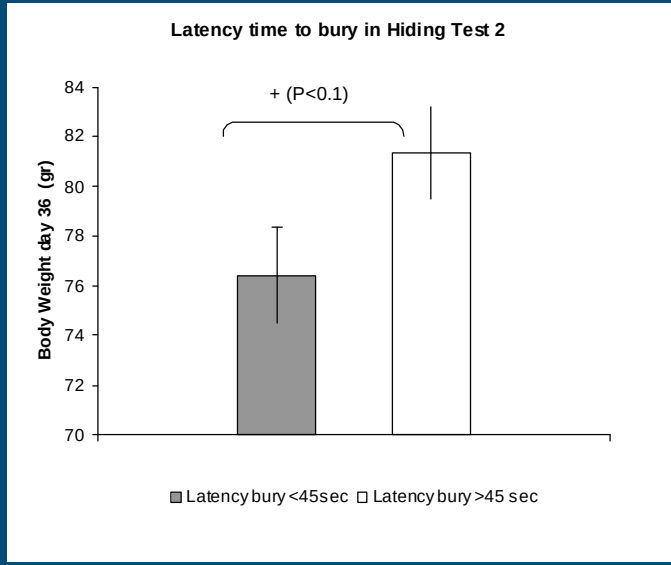
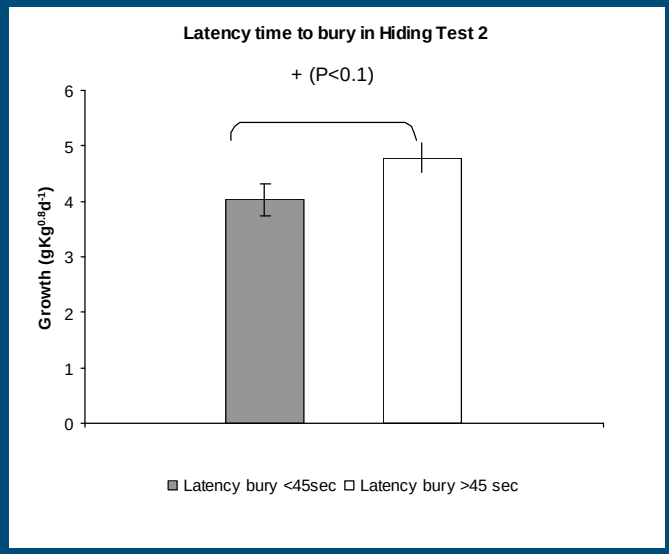
Results (iii): Hiding motivation test

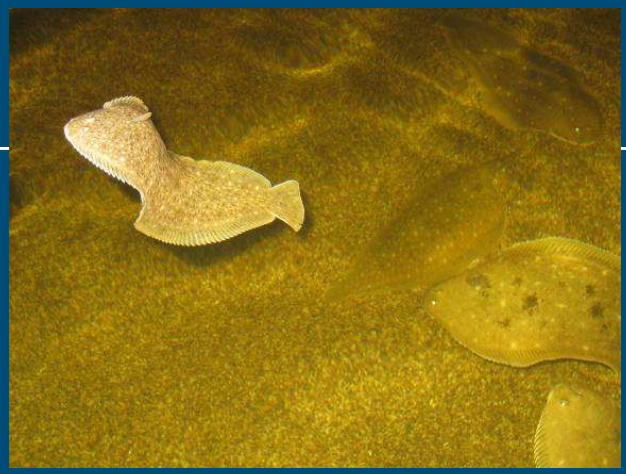
- Consistency of the test r=0.26*
- Sole buried quicker during the 2nd test







DISCUSSION & CONCLUSIONS (i)



- ↑ CV Growth (43-54%)
- Consistent differences in growth
- Relative consistency of behavioural traits over time: innate traits?
  - Repeatability may be low due to novelty or habituation
- Anti-predator test
  - Flight response to the artificial predator (ball) similar to response to natural predator (de Groot, 1969)
  - Different opposing strategies → Flight vs Immobility
    - Seen also in other fish species (Vilhumen and Hirvonen, 2003)
  - Sole which showed strong anti-preator responses (flight) had lower BW and tended to show lower growth

DISCUSSION & CONCLUSIONS (ii)

- Hiding motivation
  - In nature sole buried in sand→ strategy to avoid predation
  - Sole presented to sand 1st time in life→ still strong motivation to bury
    - Low burying latencies
    - Burying attempts also when bare bottom
  - Lower latency to bury in 2nd test→ habituation/learning effect ?
  - Sole with stronger hiding motivation during 2nd test tend to have a higher body weight and growth

Differences in anti-predator behaviour & hiding motivation seem to be related to growth

→ trade-off between risk-taking behaviour and growth

FURTHER RESEARCH…

- Feeding behaviour/motivation and activity of group housed sole and its relation to growth
- Effect of environmental factors (stocking density, substrate, light and feed type) on behaviour and growth of sole
- Genotype x environment interaction regarding behaviour and growth of sole

CONTACT DETAILS:

Address: Marijkeweg 40, P.O 338 6700AH Wageningen, The Netherlands

Email: Julia.mas@wur.nl

Internet: http://www.zod.wur.nl

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