Heritability of coping styles in farmed European sea bass

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HERITABILITY OF COPING STYLES IN FARMED EUROPEAN SEABASS

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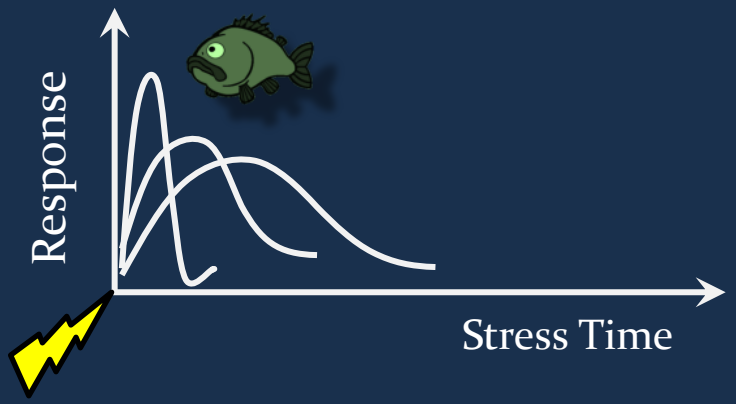
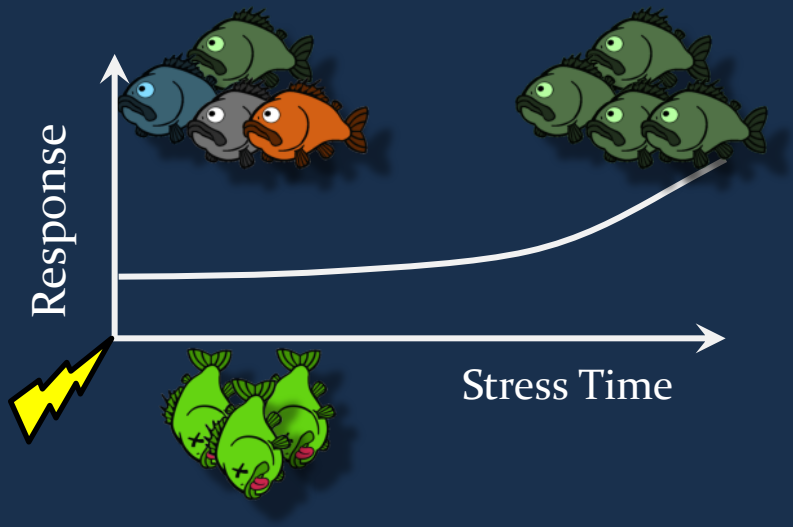
Allal F., Ferrari S., Horri K., Vidal M.-O., Ruelle F., Vandeputte M., Chatain B., Bégout M.-L.

"Coping" with changes



Individual response

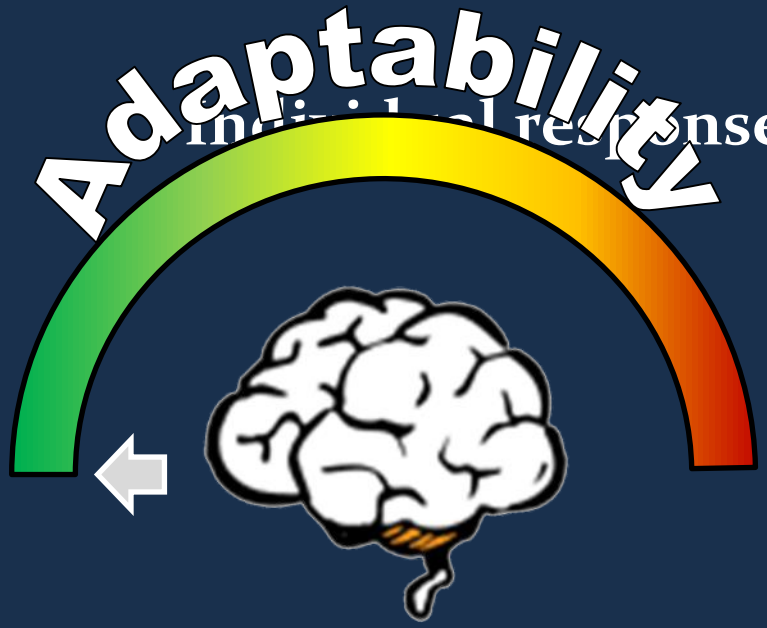
Behavioral
Physiological
Acclimatization



Populational response

Mortality
Fecundity shift
→Modification of allele frequencies
Changes occur at a genetic level

"Coping" with changes



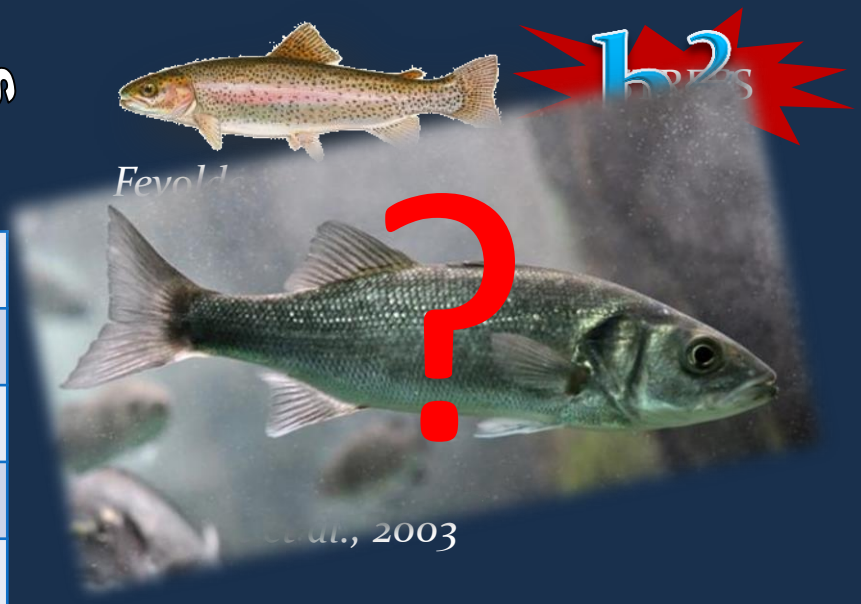
The Behavioral and Physiological adaptability defines " Coping Style"

Increase pathologies
Decreased performance

Veissier et al., 2007

"Coping" with changes

The Coping Style distinguishes animals into two groups



Is there a genetic component to these personality traits ?

Wright et al., 2005

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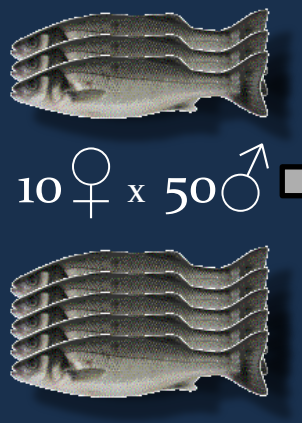
Material & Methods

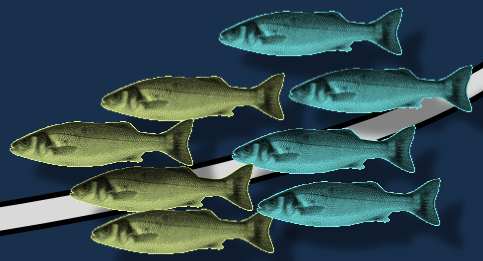


10 ♀ x 50 ♂

N = 1938

VITASSIGN

Challenge:
Creating behavioral tests compatible with a genetic study



N = 1308

Risk taking 3	Risk taking 2	Risk taking 1	Hypoxia avoidance
304 dph	286 dph	276 dph	255 dph

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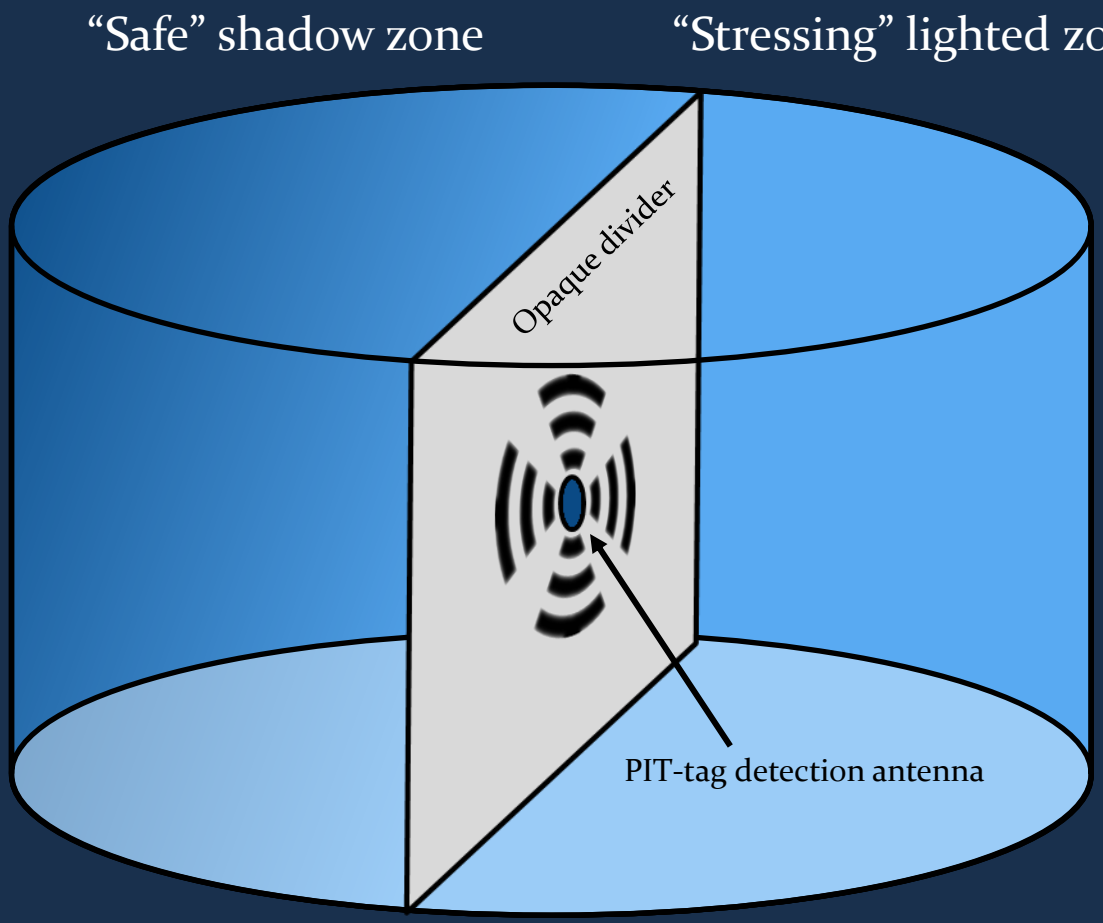
Material & Methods



V = 5 m^3
H = 1.5m
Ø = 2.5m

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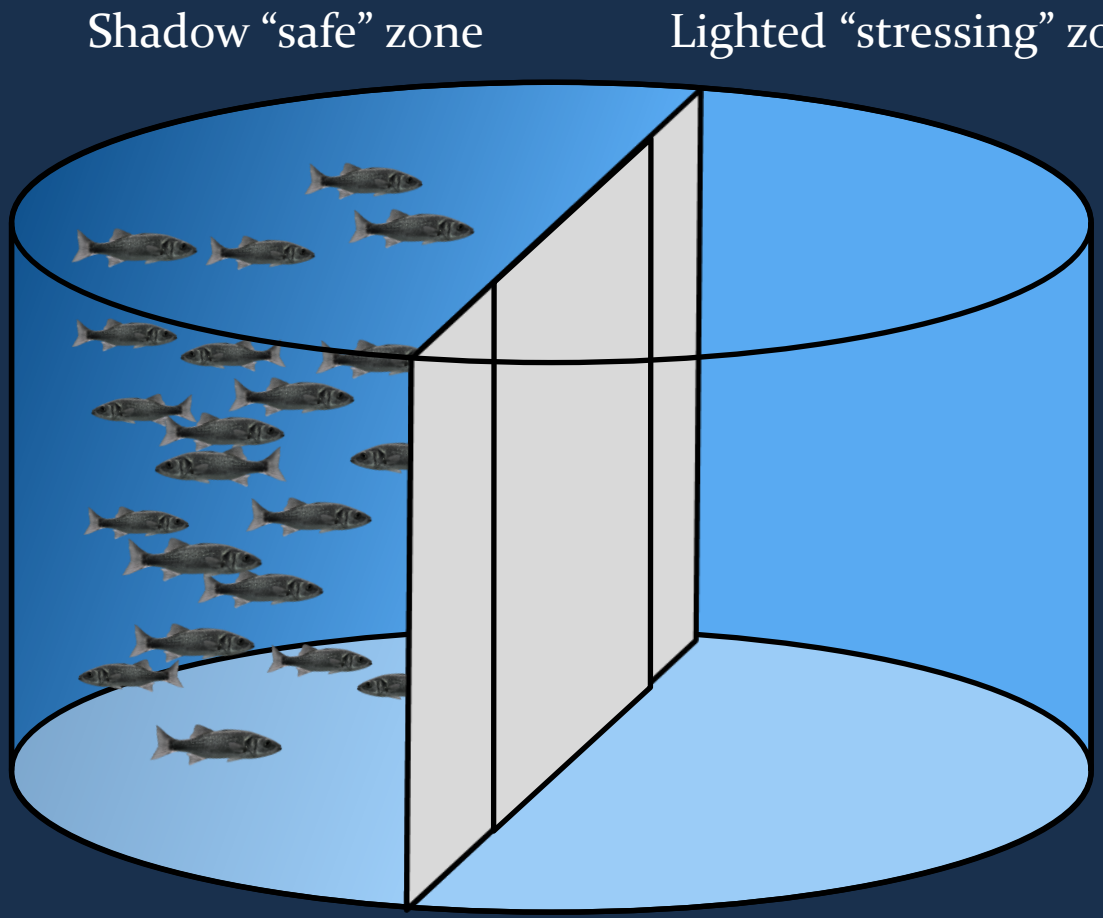
Material & Methods

Risk taking test

PIT-tag	1st passage
#3830604	00:14:37
#3854641	00:38:45
#3795461	01:21:16
#3863145	01:37:24
#3897844	02:54:46



After 30 minutes of acclimatization

24 hours

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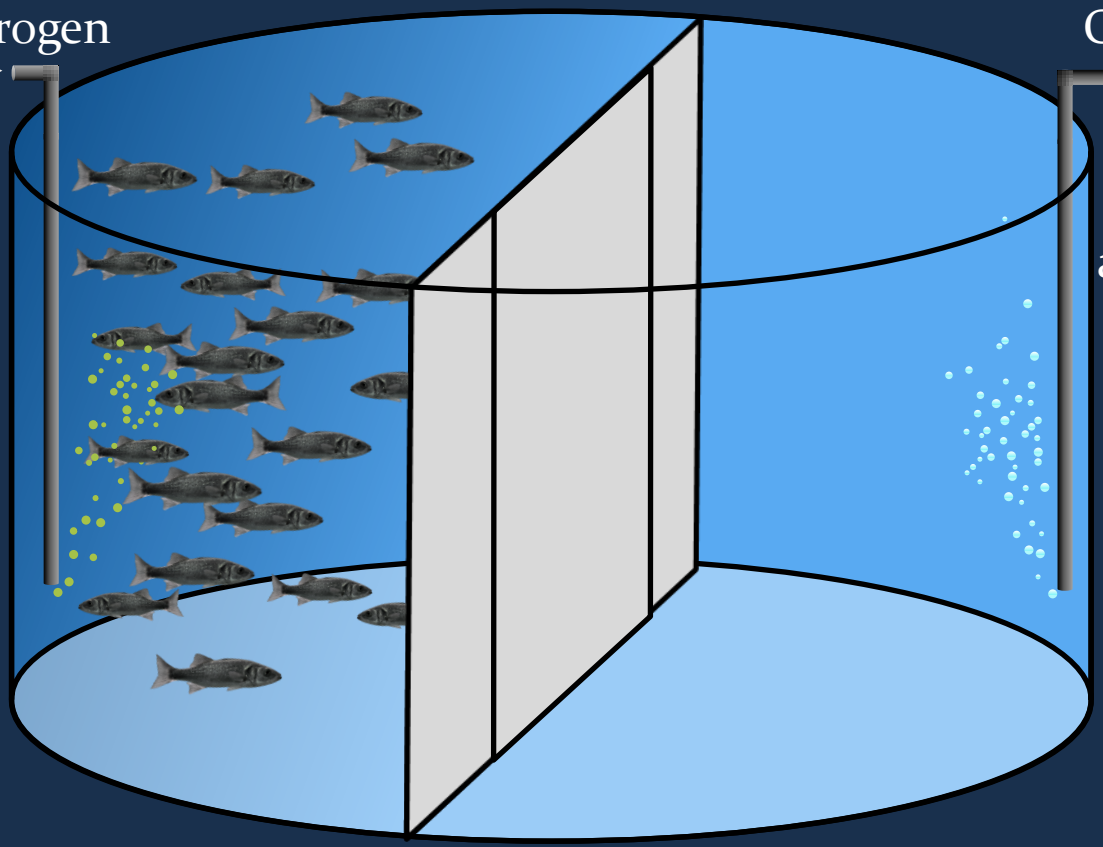
Material & Methods

Hypoxia avoidance test



PIT-tag	Passage	O_2 sat.
#3852041	00:04:22	95%
#3830645	00:04:48	93%
#3496561	00:06:16	84%
#3863145	00:11:17	83%

After 30 minutes of acclimatization

2 hours

~10% O_2 sat.

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Results & Discussion

Group testing validation

	Hypoxia avoidance		Risk taking 1		Risk taking 2		Risk taking 3	
Sex	♂	♀	♂	♀	♂	♀	♂	♀
Proactive %	19	15	16	14	17	16	20	18
Reactive %	81	85	84	86	83	84	80	82

$r_P = 0.69$ but $r_A = 0.99(\pm 0.05) - 1(\pm 0.01)$

Risk taking vs Hypoxia avoidance: $r_P = 0.10$; $r_A = 0.43(\pm 0.21)$

~20 % of fish are proactive
No sex effect!
Over time consistency of risk-taking behavior! $r_A \approx 1$
Hypoxia ≠ Risk taking

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Results & Discussion

Heritability of behavior

Trait addressed	h^2 (SE)
Hypoxia avoidance	0.23 (0.10)
Boldness (mean of the 3 risk taking tests)	0.42 (0.12)

→ **Low but usable hypoxia avoidance heritability**
→ **High boldness heritability**
→ **Boldness h^2 = weight h^2**
→ **we can expect similar selection response!**

Results & Discussion

Genetic correlations between coping styles and phenotypic traits

	Weight (SE)	**TGC** (SE)	**Gonads** (SE)
Hypoxia avoidance	**-0.56** (0.18)	**-0.45** (0.15) ; **-0.55** (0.11)	0.32 (0.24)
Boldness (mean of the 3 risk taking tests)	-0.24 (0.15)	-0.12 (0.27); -0.23 (0.11)	**-0.73** (0.16)

There is a genetic link between personality and growth traits in sea bass

→ Hypoxia intolerant fish are significantly smaller
→ Bolder fish invest less energy in gonadal production

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Conclusions

- Low hypoxia avoidance heritability (h^2 = 0.23 ±0.10)
- High boldness heritability (h^2 = 0.42 ±0.12)
- Hypoxia avoidance and Risk taking tests do not address the same personality trait in sea bass
- Link between growth and personality

  → proactive < reactive

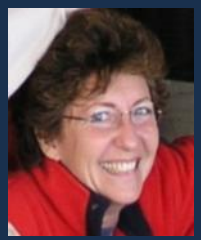
Looking for a boldness related QTL in sea bass!

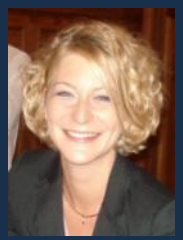
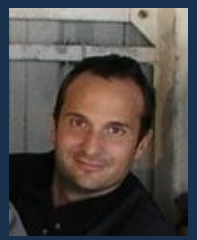
COPE well

SEVENTH FRAMEWORK PROGRAMME

Laboratoire Adaptation & Adaptabilité des Animaux et des Systèmes


Thanks for your attention!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INRA SCIENCE & IMPACT

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marbec marine biodiversity exploitation & conservation