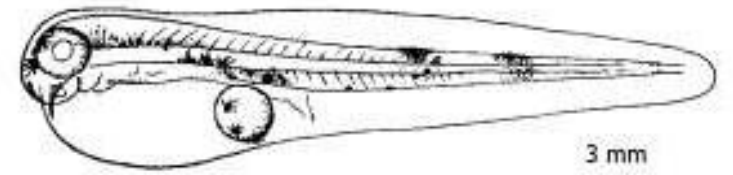
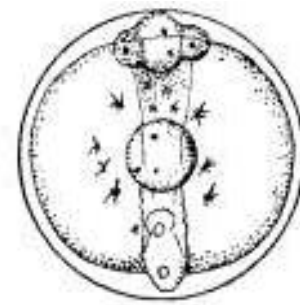


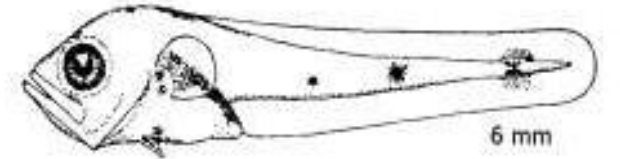
Maternal effects on egg and larval size and their temporal variability on European hake in the Galician shelf

García-Fernández, C., Aldanondo, N.
Saborido-Rey, F. & Domínguez-Petit, R.

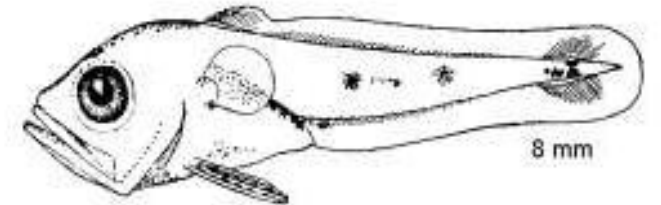
cgarci@iim.csic.es



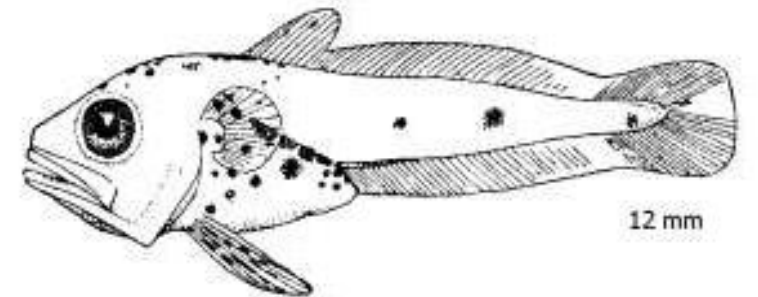
3 mm



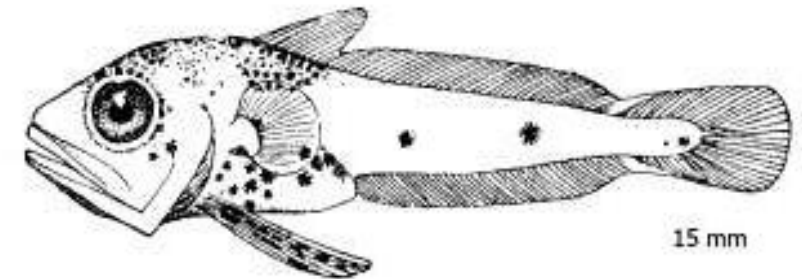
6 mm



8 mm

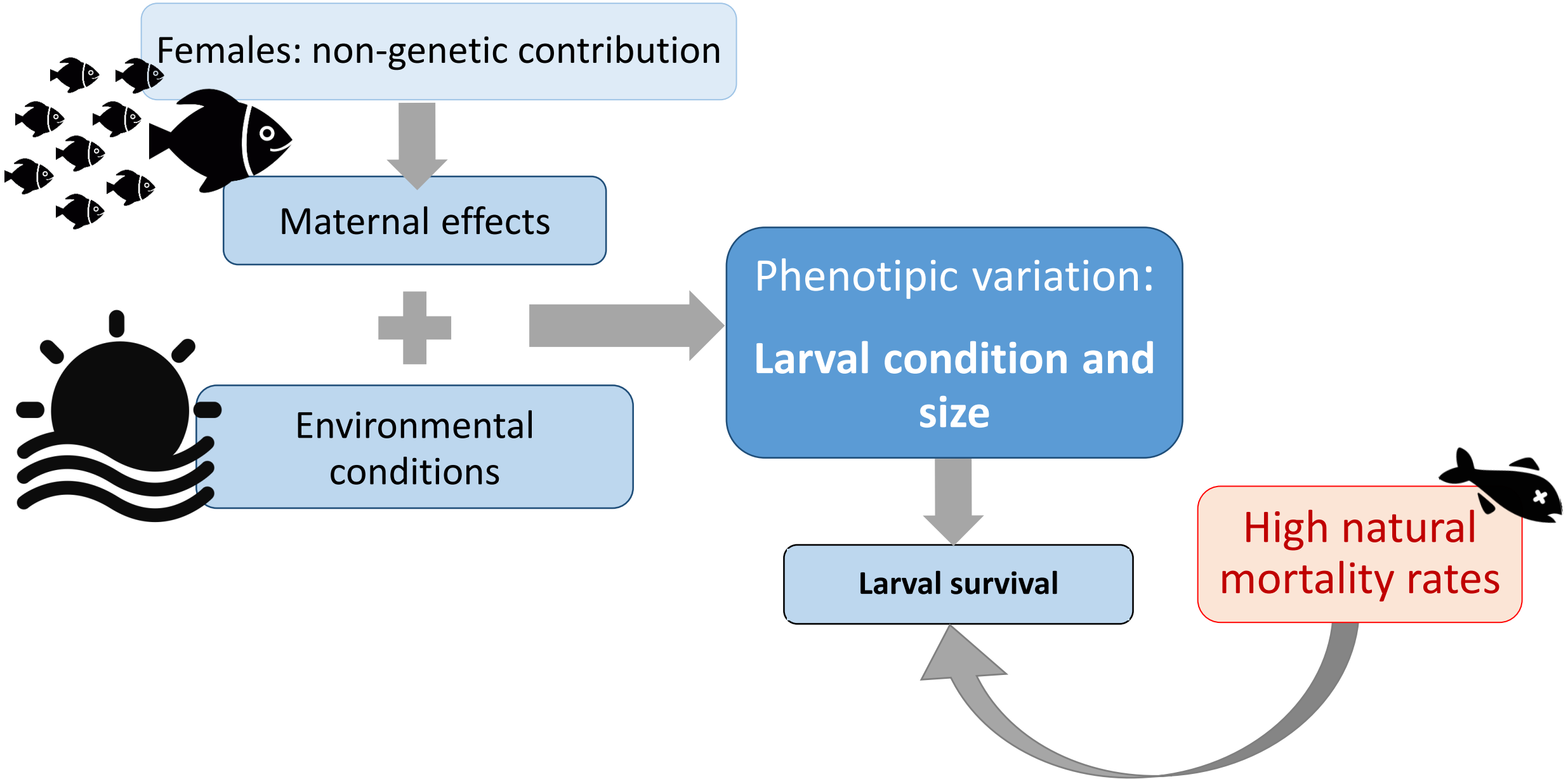


12 mm

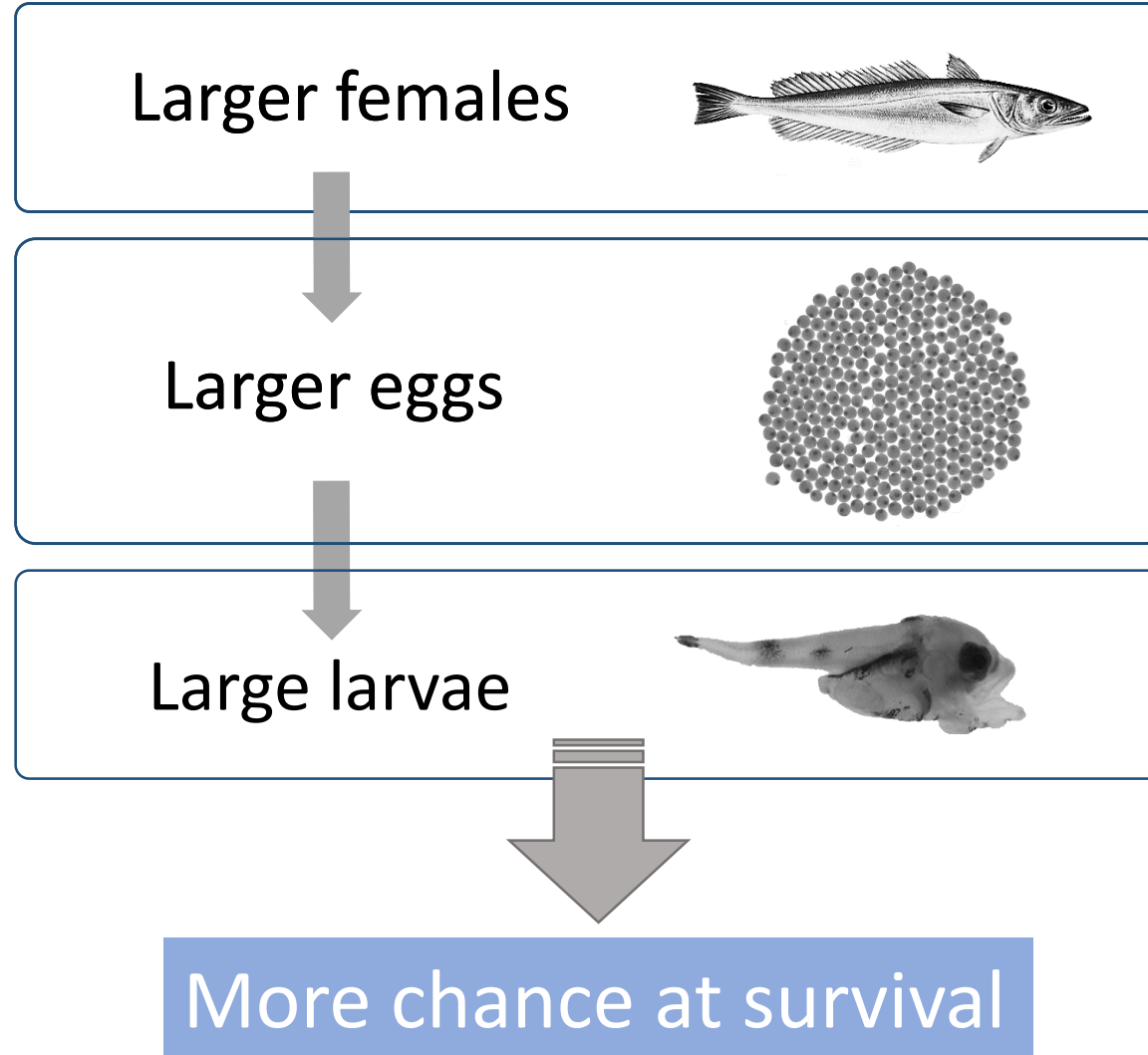


15 mm

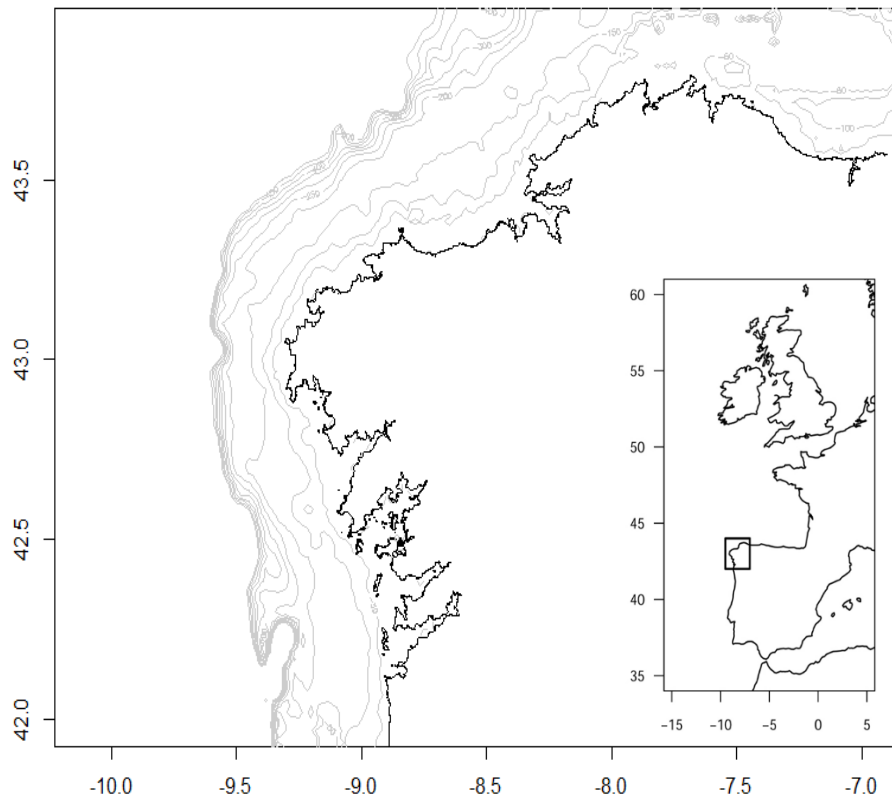




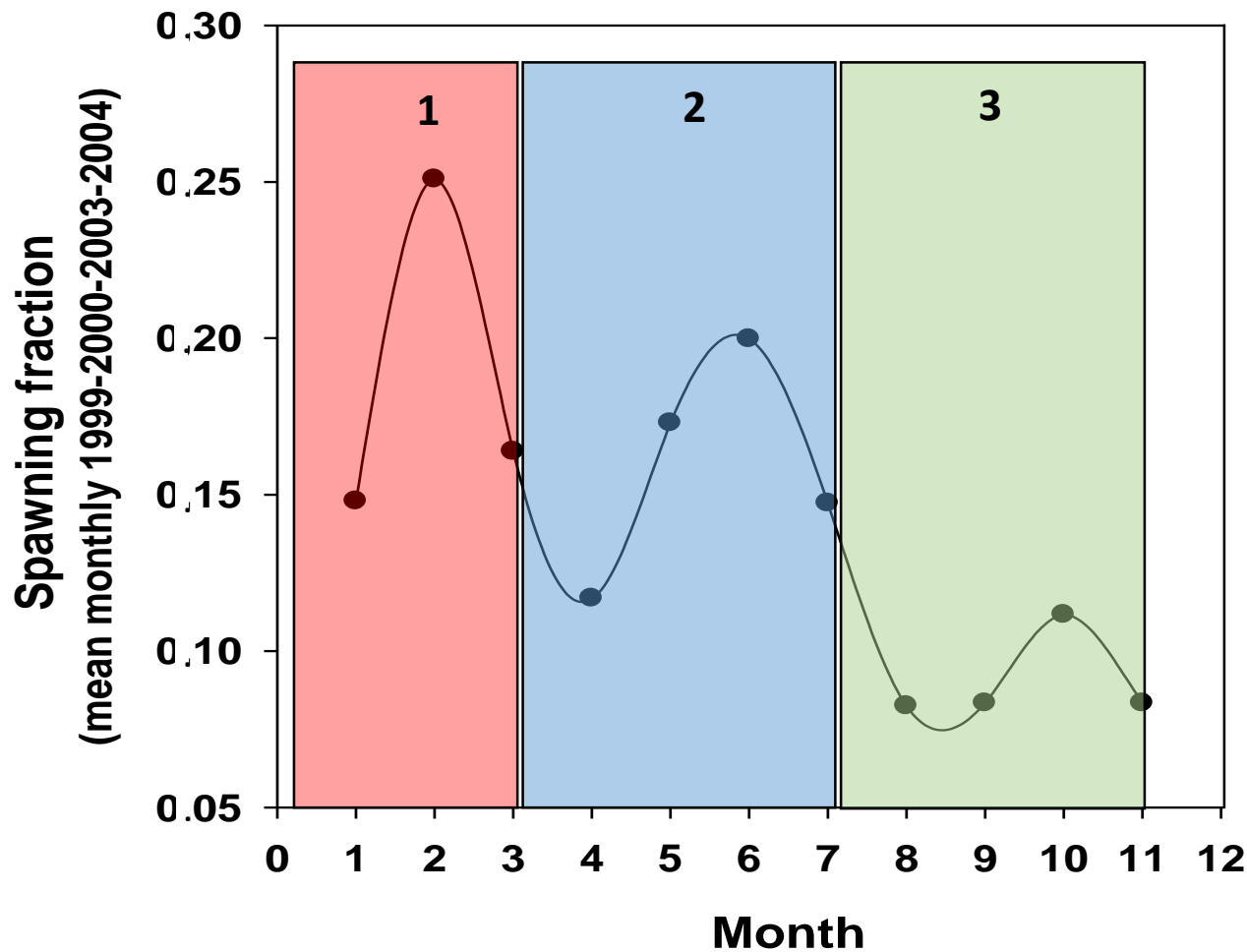
Current unifying theory



Southern Stock Galician Shelf



European hake (*Merluccius Merluccius*)



Dominguez-Petit, 2015

Actively spawning females (n=143)

- Size: total length (cm) & gutted weight (g)
- Condition: HSI & Fulton's condition factor (K)

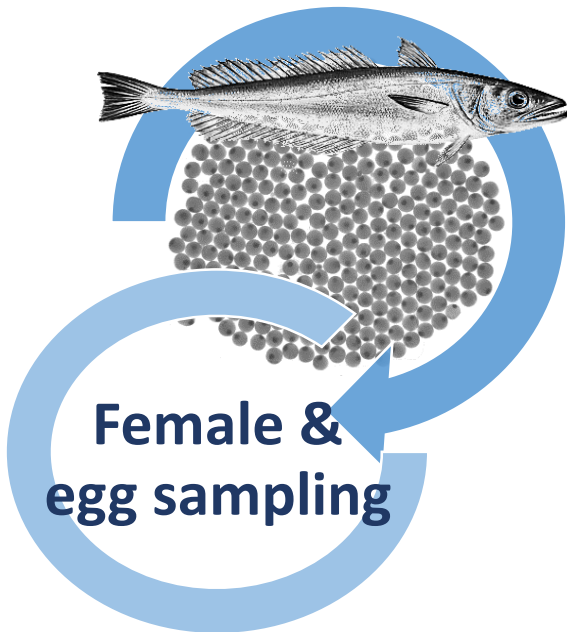
$$\text{HSI} = \frac{\text{liver weight}}{\text{gutted weight}} \times 100$$

$$K = \frac{\text{gutted weight}}{\text{length}^3}$$



Hydrated eggs (n=21689)

- Quantity: n^o of eggs per batch
- Quality:
 - Dry weight
 - Egg diameter
 - Lipid droplet diameter





Larval
sampling



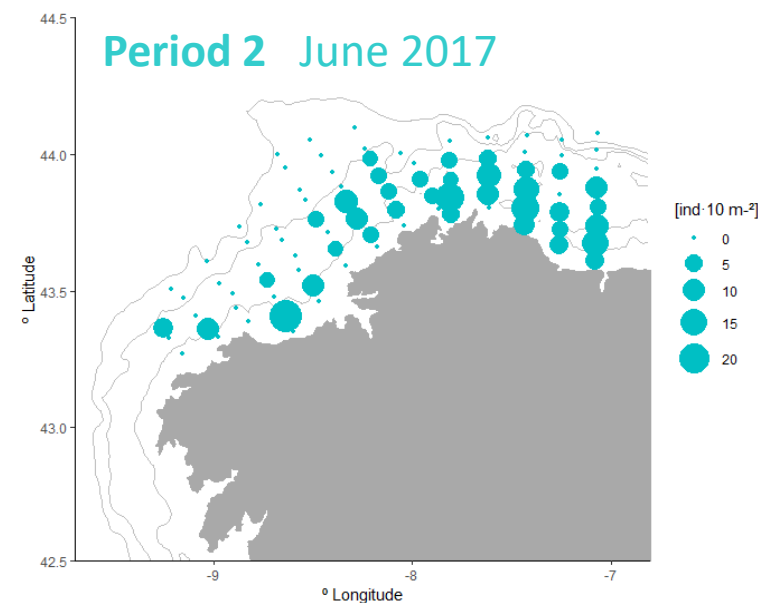
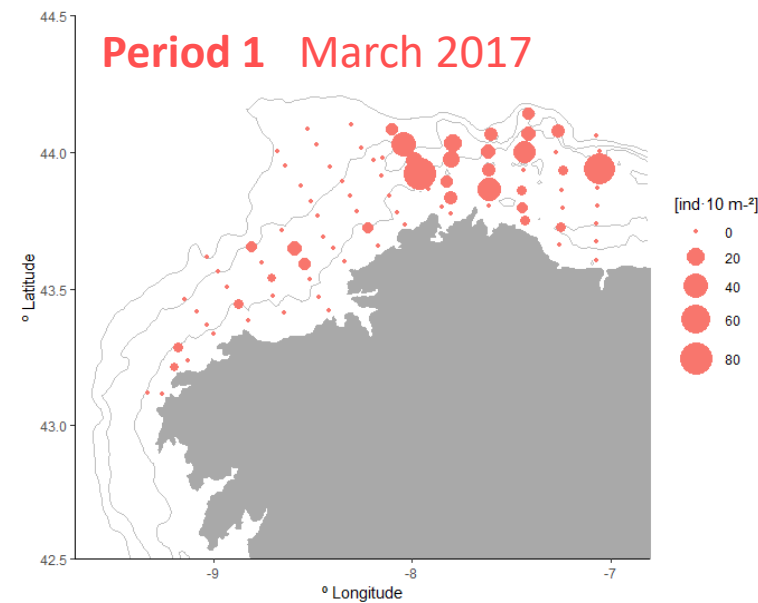
- Bongo net in 144 stations
- Identification & classification
- Larval photography
- Larval conservation



- Larval measurement analysis
- Allometric relationships
- Otolith extraction and analysis



- Statistical analysis



Larval measurement analysis

Larvae in stage 2 (n=285)

Standard length

Preorbital length

Eye diameter

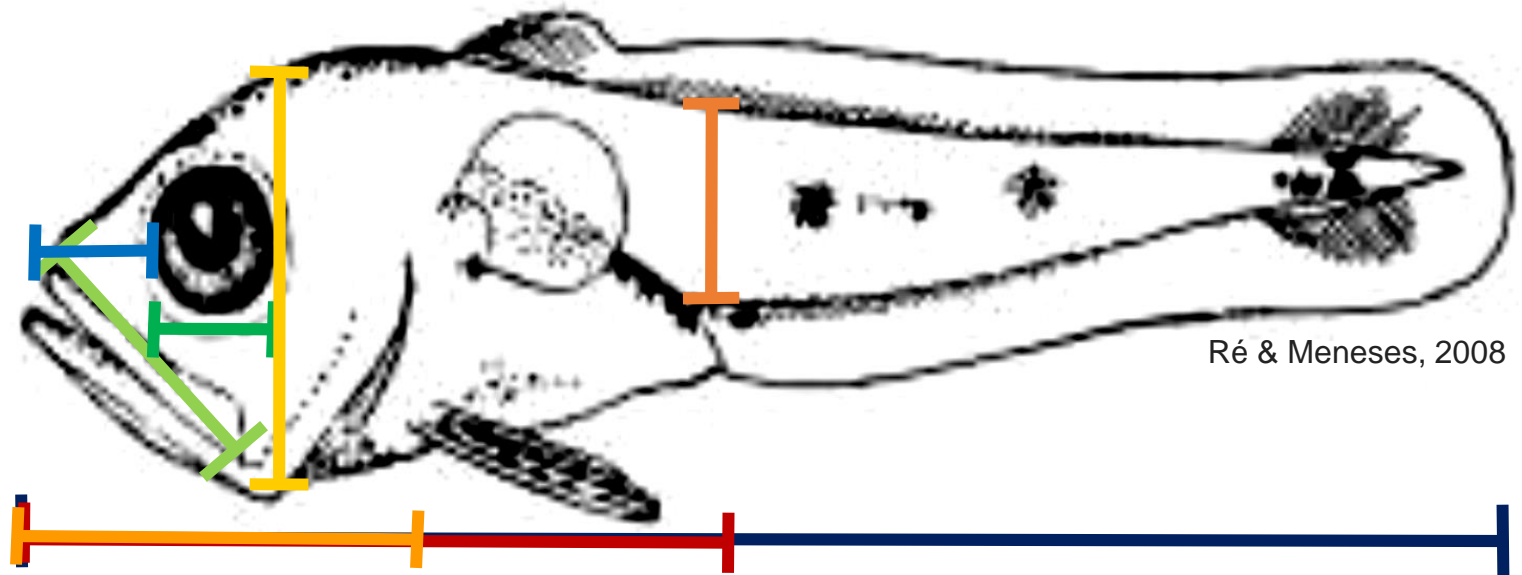
Mouth length

Anus length

Body height at anus

Head length

Head height

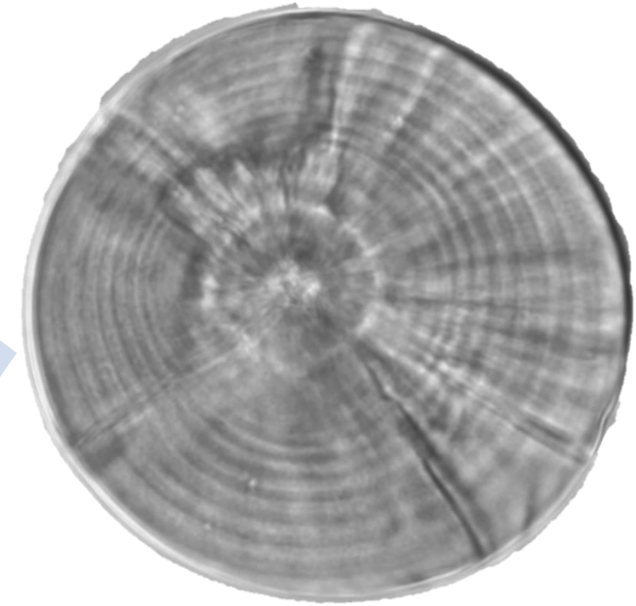
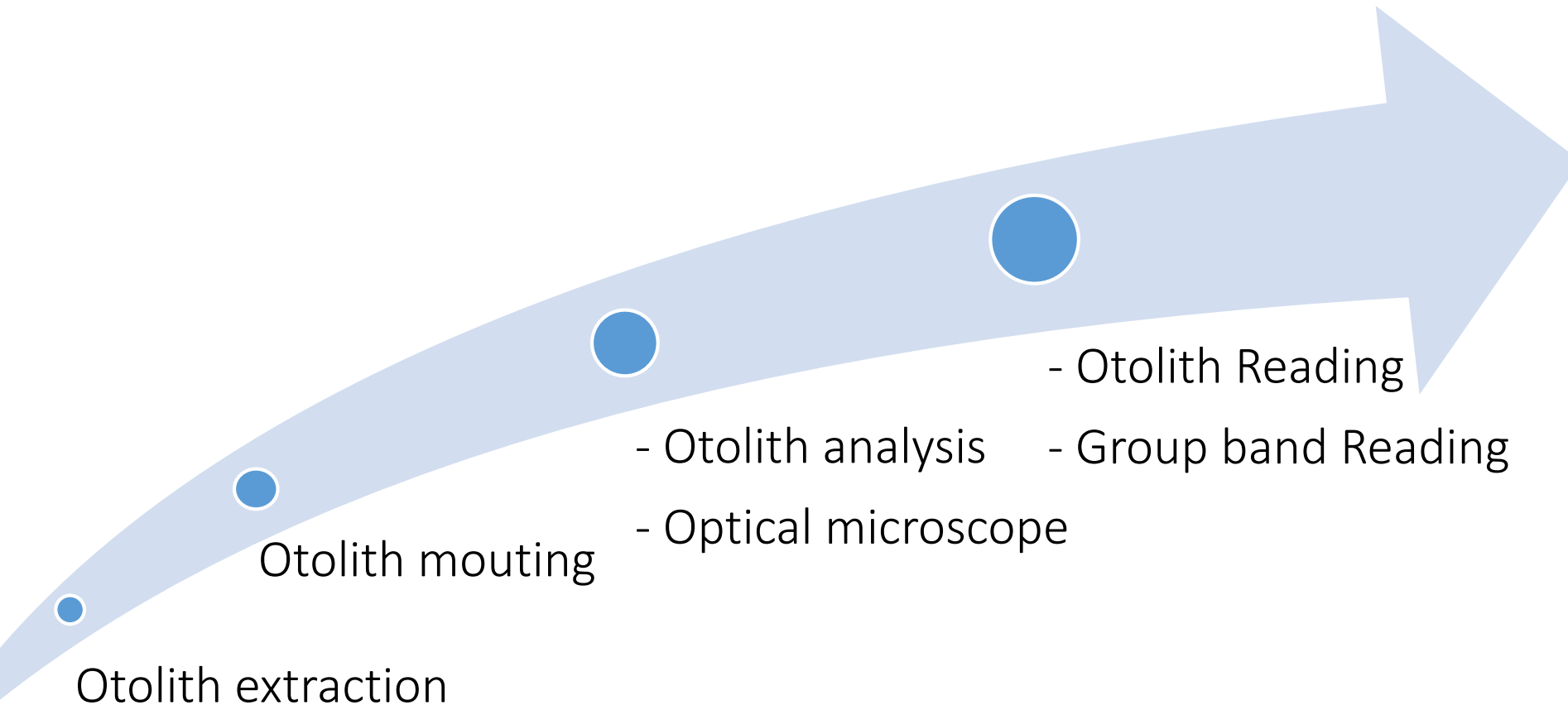


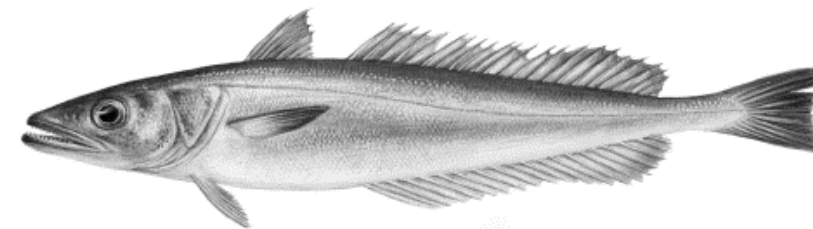
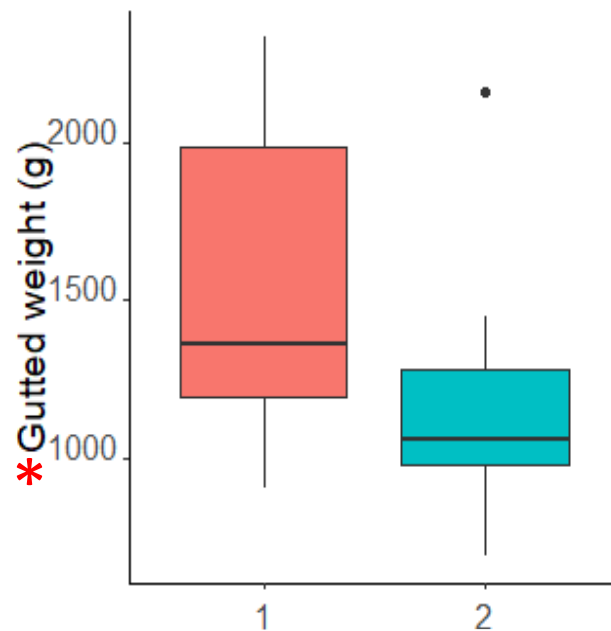
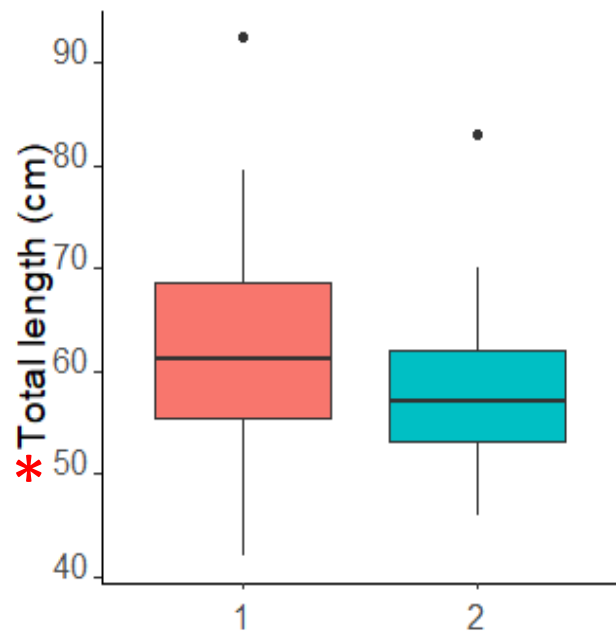
Ré & Meneses, 2008

Otolith analysis

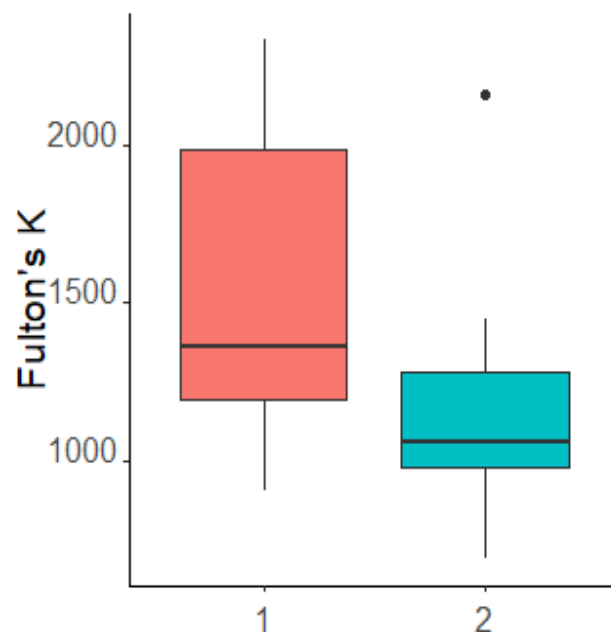
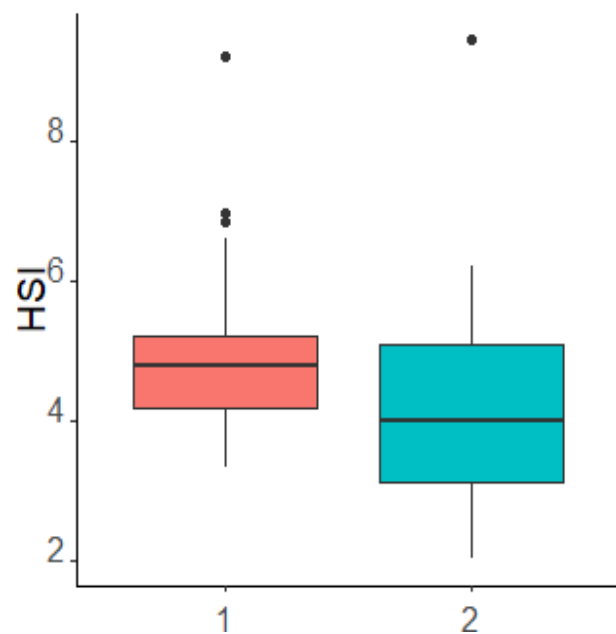
Larvae: stages 1 & 2 (n=117)

Saggita otolith





Spawning female traits



Total length
Gutted weight



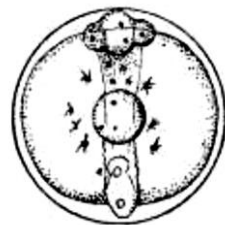
Significant
differences between
P1 and P2

Condition
indexes

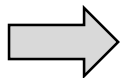


Similar P1 and P2

Hydrated egg traits

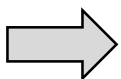


Number of eggs
Dry weight
Egg diameter

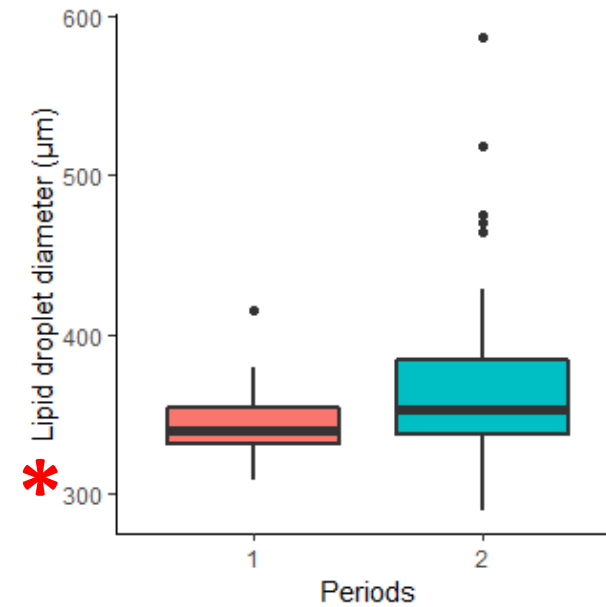
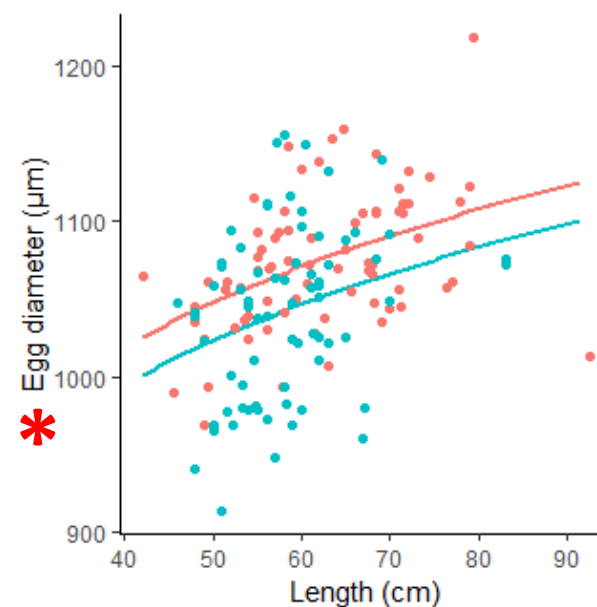
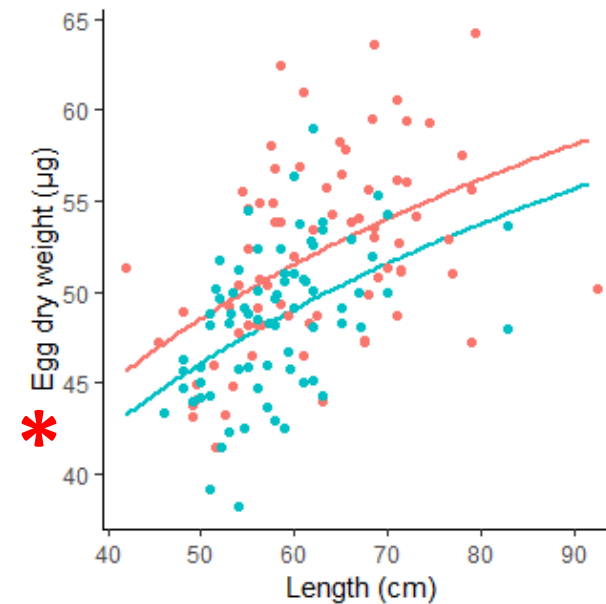
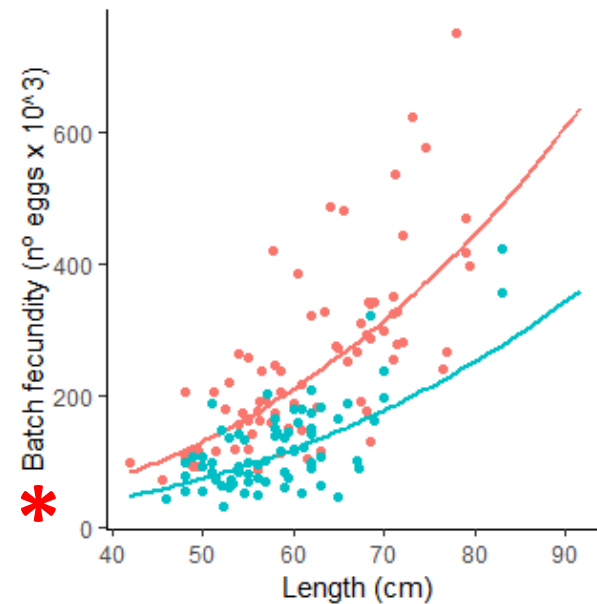


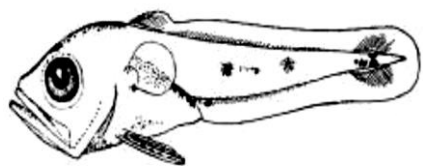
Significant relation with female size
Significant differences between **P1**
and **P2**

Droplet diameter



Significant differences between **P1**
and **P2**

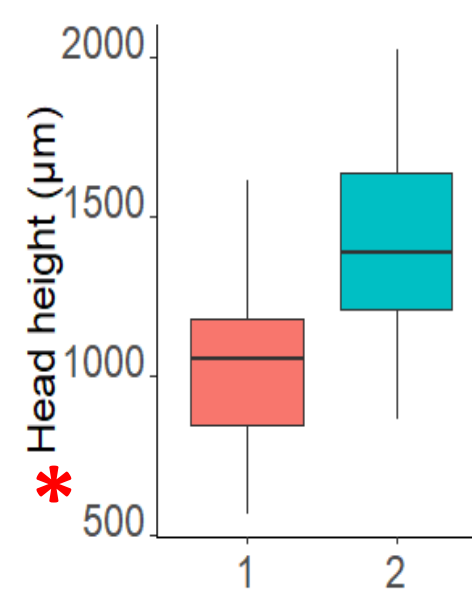
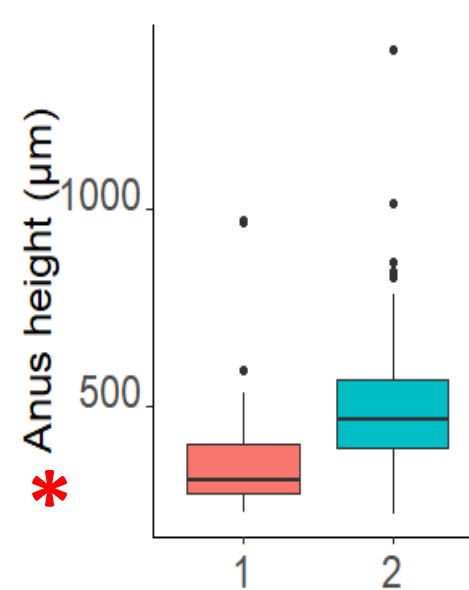
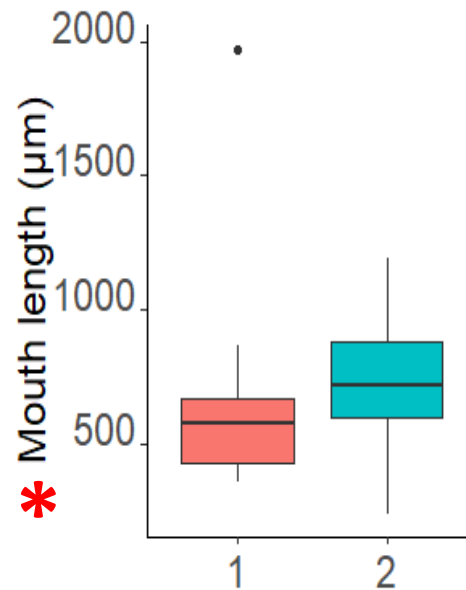
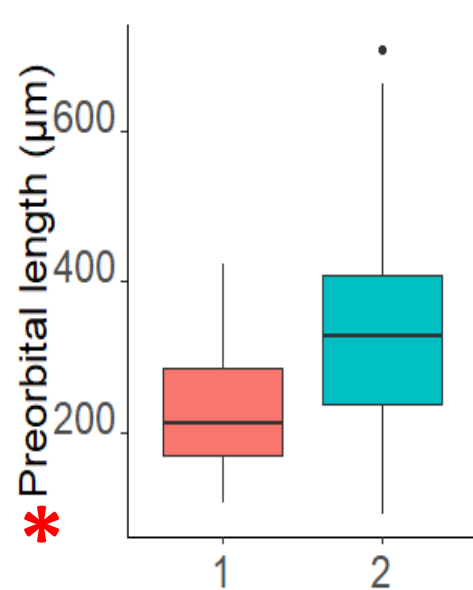
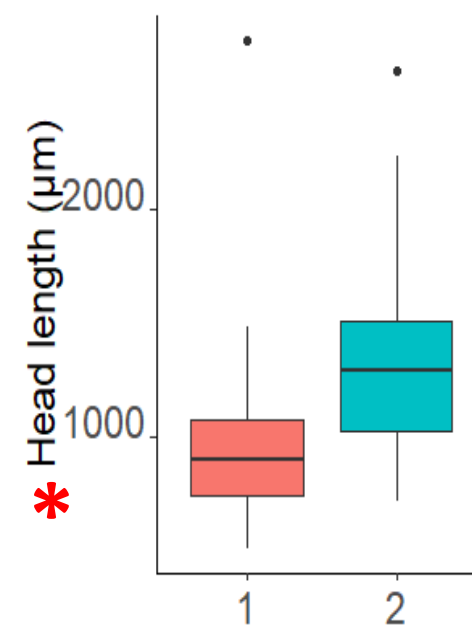
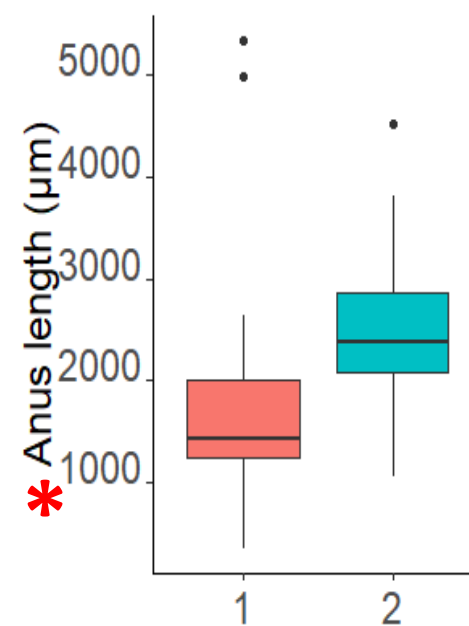
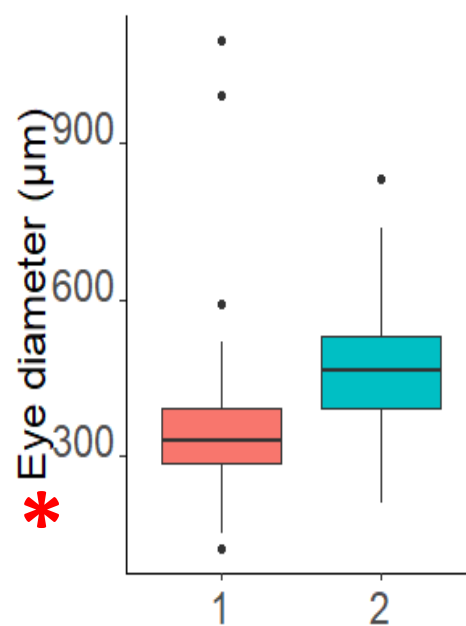
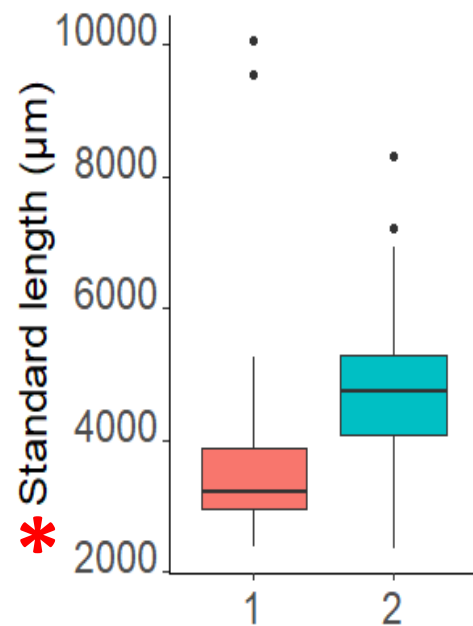


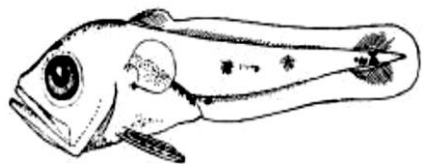


Larval morphometry



Differences among periods





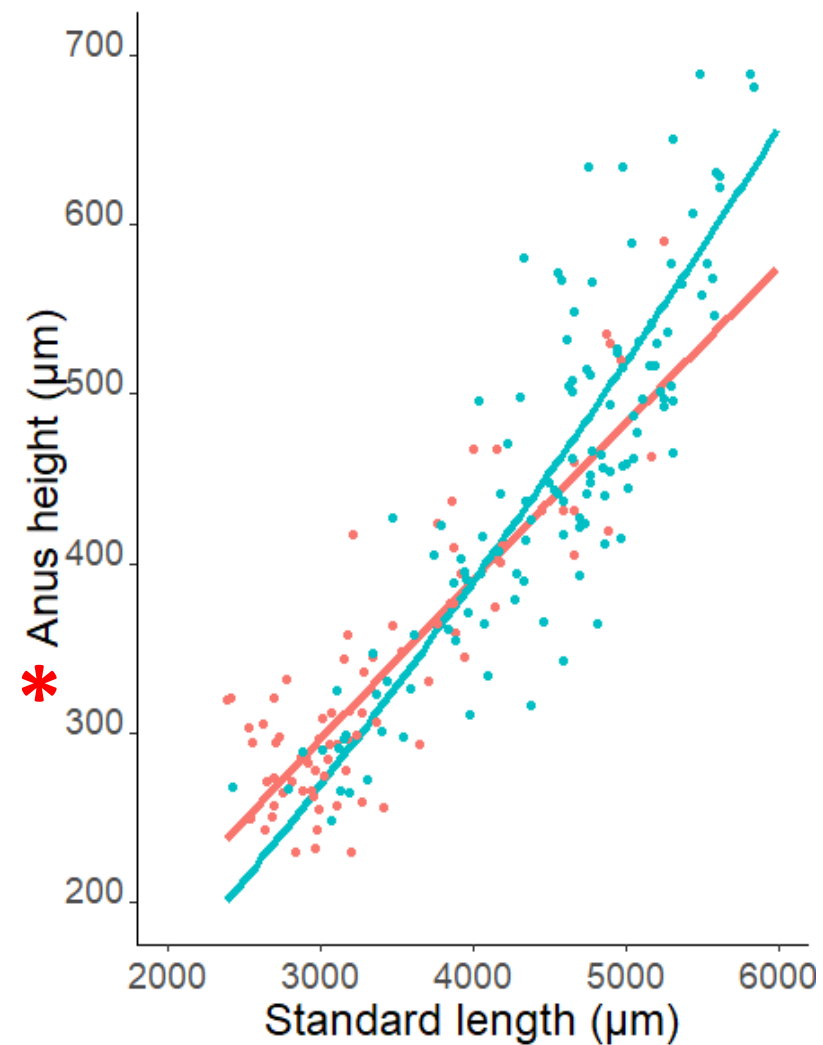
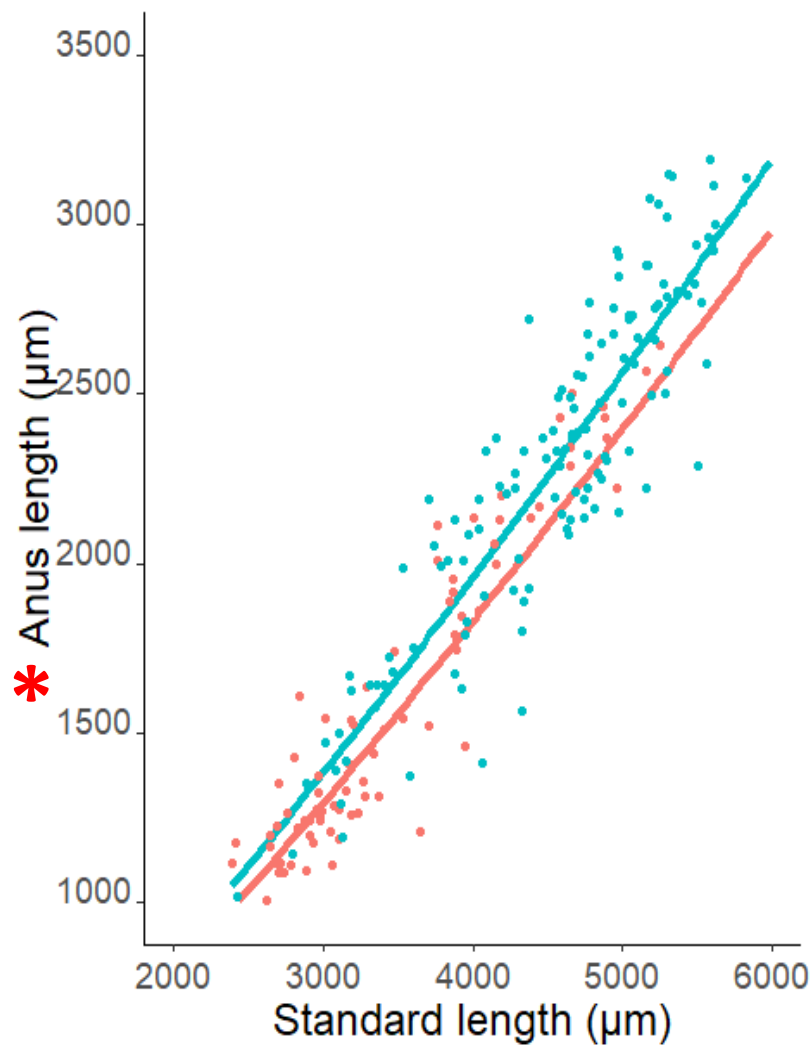
Larval
morphometry



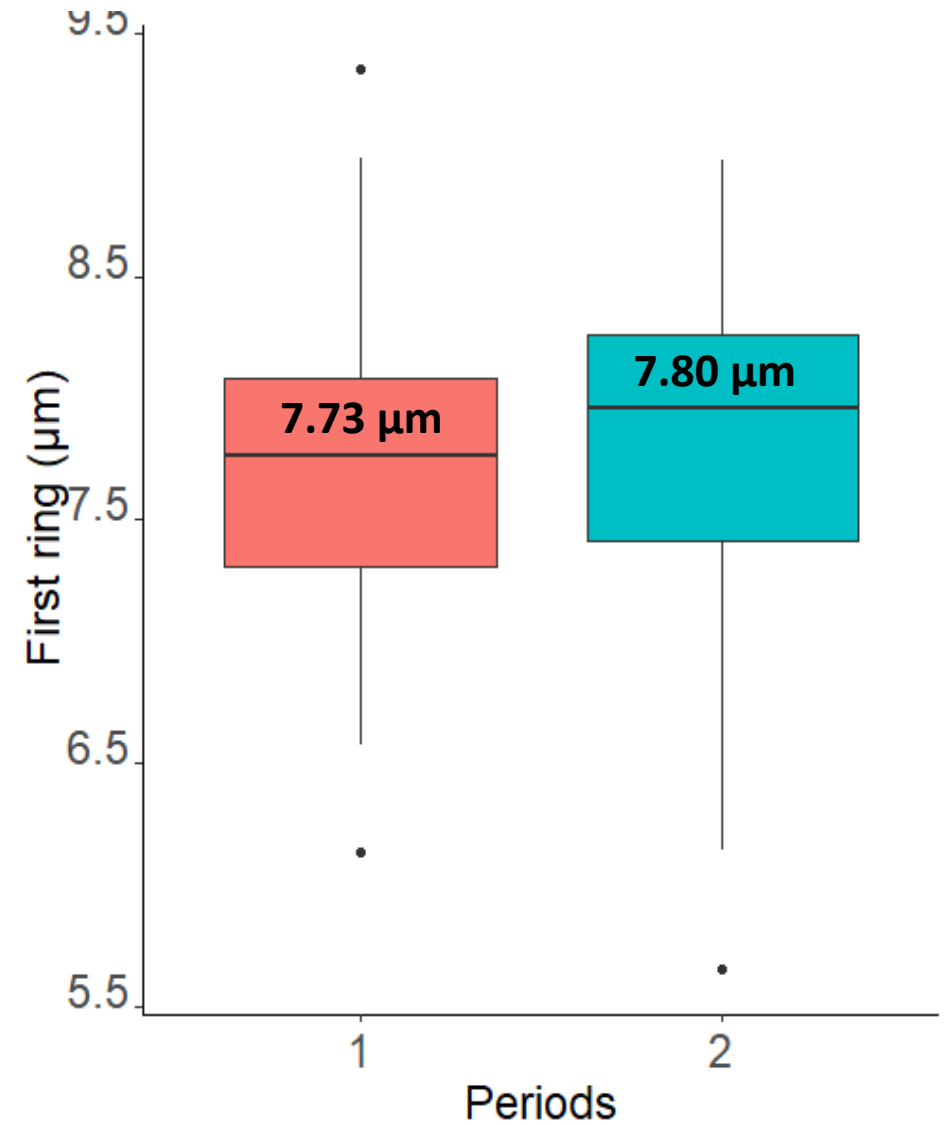
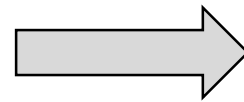
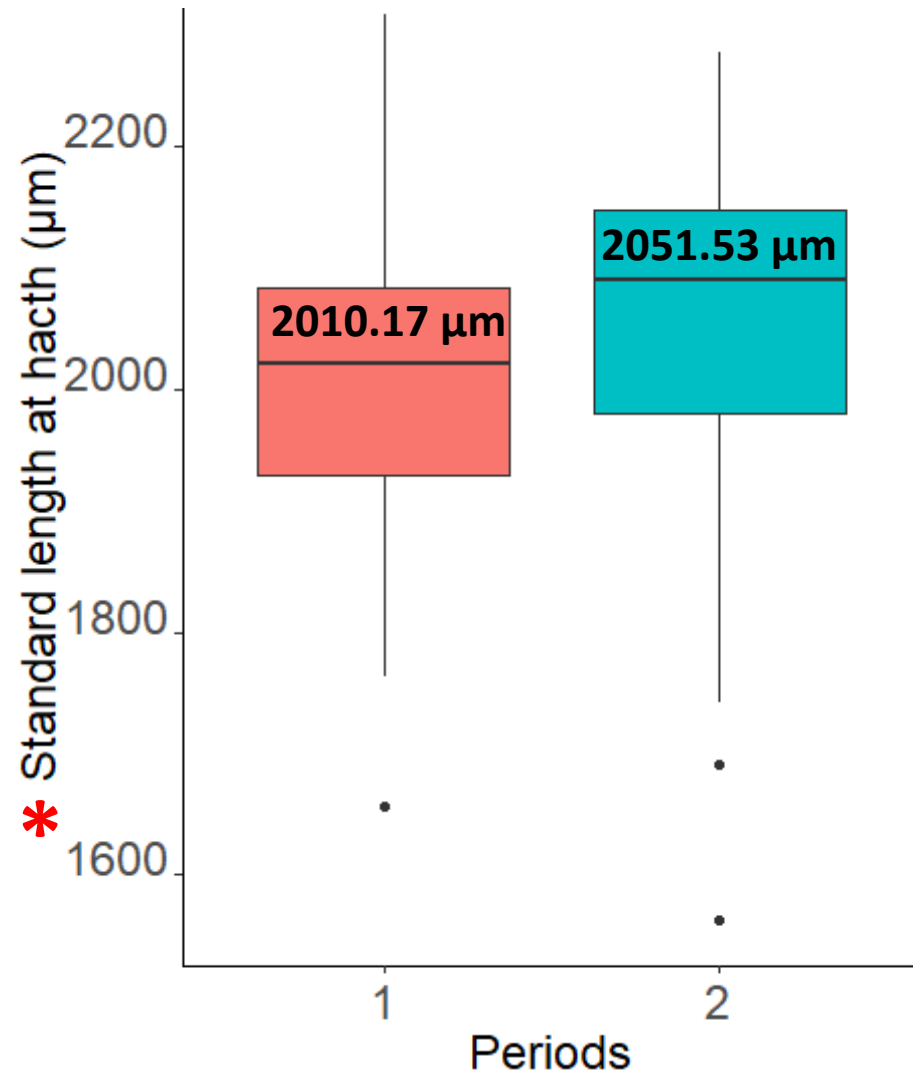
Relative
measures

P1: larvae hatch shorter but wider

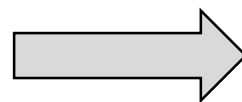
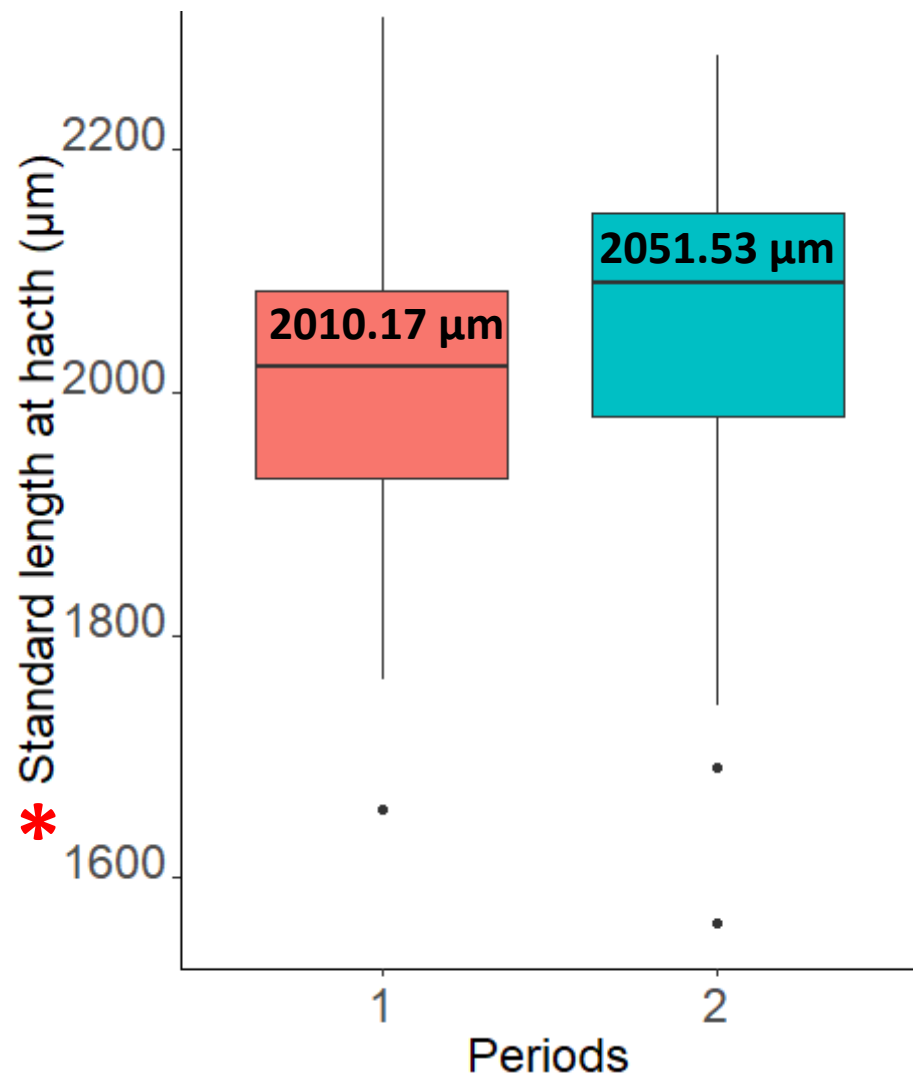
P2: larvae hatch larger but thinner



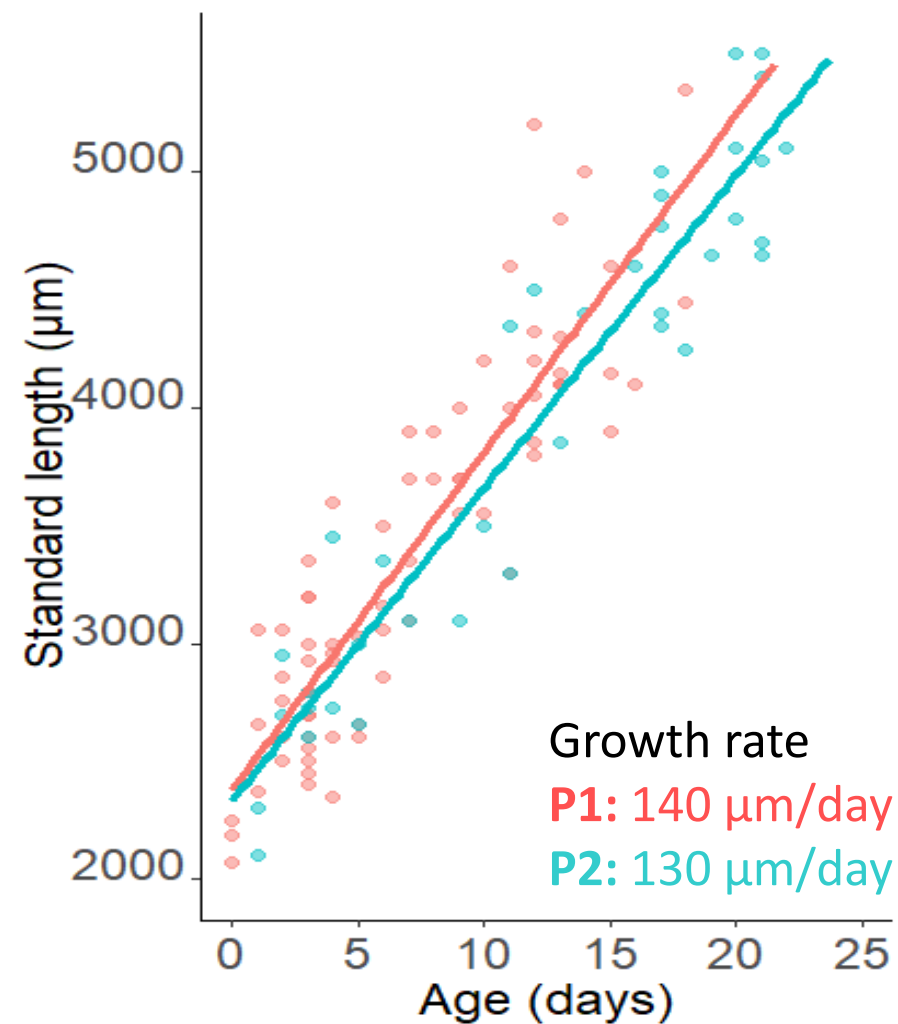
Otolith analysis



Otolith analysis



$$SL = 2380.3 + 143.1 \text{ age}; r^2=0.80; p<0.001$$
$$SL = 2373.2 + 126.2 \text{ age}; r^2=0.89; p<0.001$$





Spawning females

- Bigger in P1
- Similar condition



Eggs

- Oil droplet diameter: higher in P2



Larvae

- Bigger in P2
- P1: larvae hatch shorter but wider
- P2: larvae hatch larger but thinner

Temporal variability



different spawning peaks
different conditions

Current unifying theory

BUT

Bigger eggs don't imply bigger larvae

Oil droplet diameter

Egg size determines larval size

Large larvae



Advantage
Survival



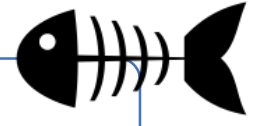
Prey encounter rates & capture events



Avoidance of predation



Resistance to starvation



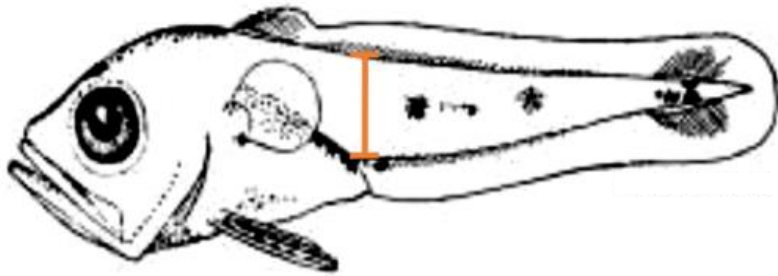
"The bigger the better"

Relative measures

Condition



Larvae hatch larger but thinner in P2



BUT



As length increases:
larvae is wider

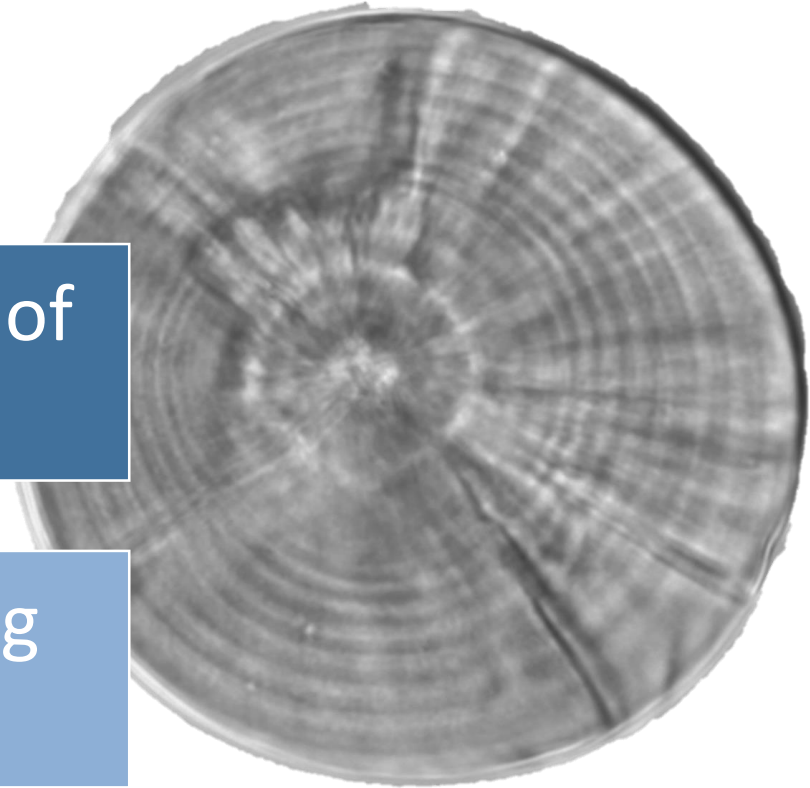
Biochemical composition of eggs

Larvae growth

Similar than other growth studies of hake spp

Non significant differences among periods

Size at hatch: influenced by maternal effects



**Further analysis:
environmental conditions**

- 1. Maternal effects in European hake affect offspring but not as strong as in other species**
- 2. These effects are stronger in eggs**
- 3. Larger females produce bigger eggs but not necessary bigger larvae**
- 4. Size of European hake larvae may be related with egg condition**
- 5. There are differences between periods. Eggs from period 1 are more, heavier and bigger. But larvae hatched shorter and wider while larvae from period 2 were larger and thinner**
- 6. These variations can also be an adaptation to environmental conditions of each period. This analysis should be integrated with environmental conditions to understand the complex process of larval recruitment**

Thank you for your attention!



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