Decreasing trend in size for small pelagic fish across European waters :

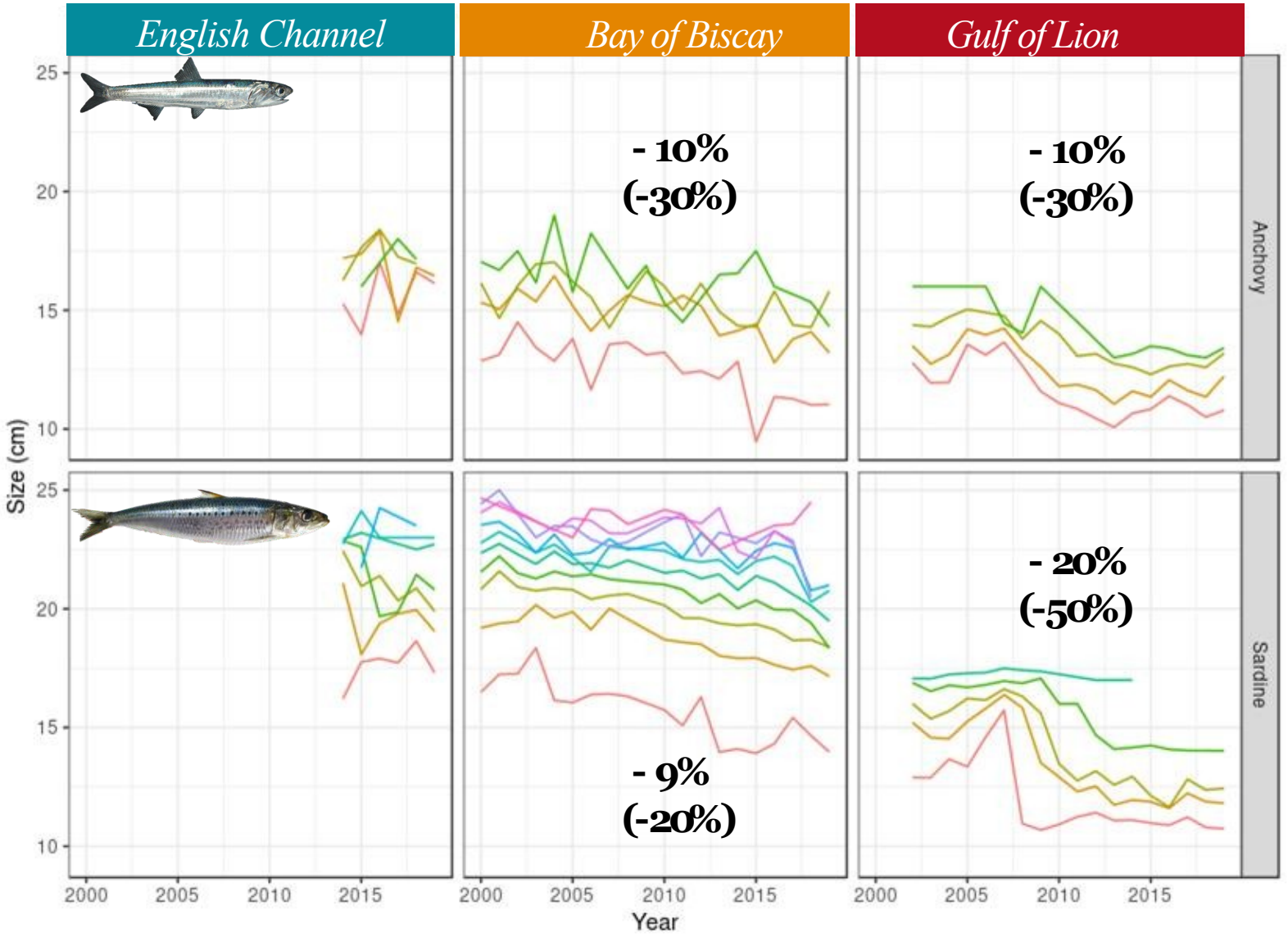
Bioenergetic modeling to explore the underlying processes from individual to population scale

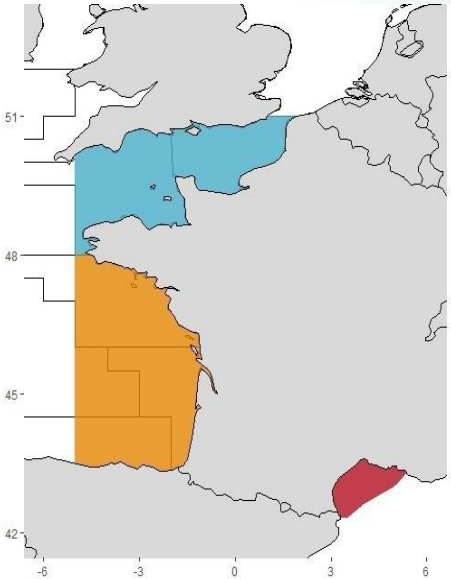
Clara Menu

Laure Pecquerie, Cedric Bacher, Mathieu Doray, Tarek Hattab, Jeroen van der Kooij, Martin Huret

Decreasing trend in size for SPF

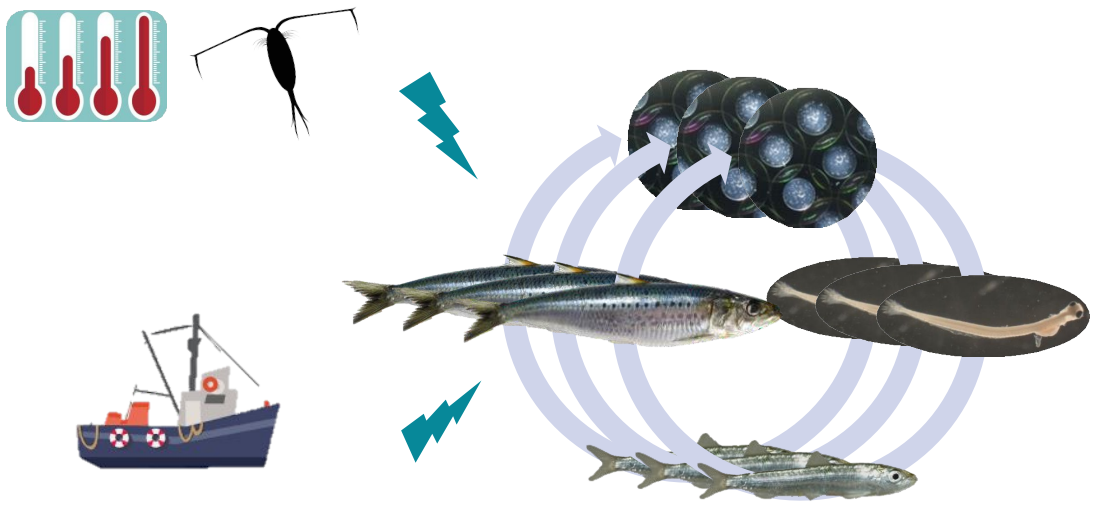
Decrease in length (weight)





Hypotheses to explain the decrease in size

- A change in **planktonic communities** (quantity and/or quality)
- A change in **density-dependence** affecting growth
- A change in **natural or fishing mortality**, selective according to individual size or body condition



(Brosset et al., 2016 ; Saraux et al., 2019 ; Véron et al., 2020 ; Boëns 2022)

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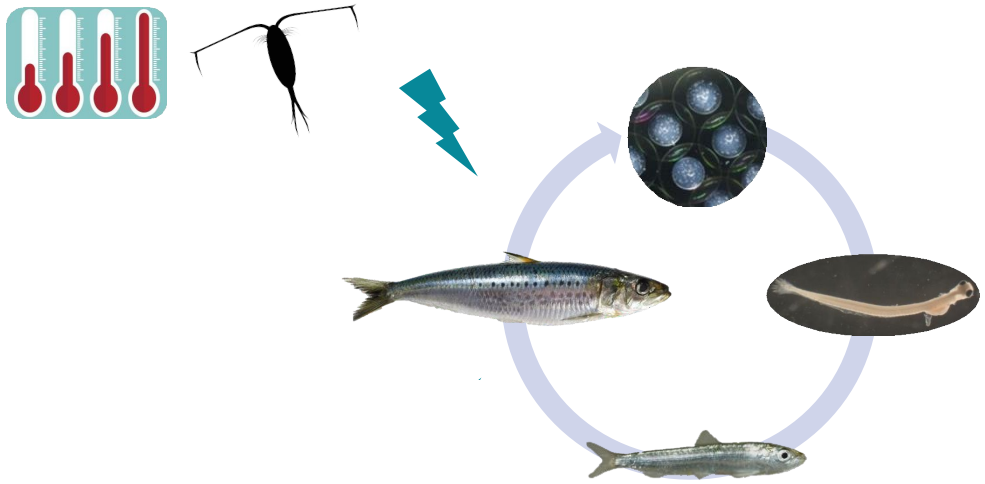
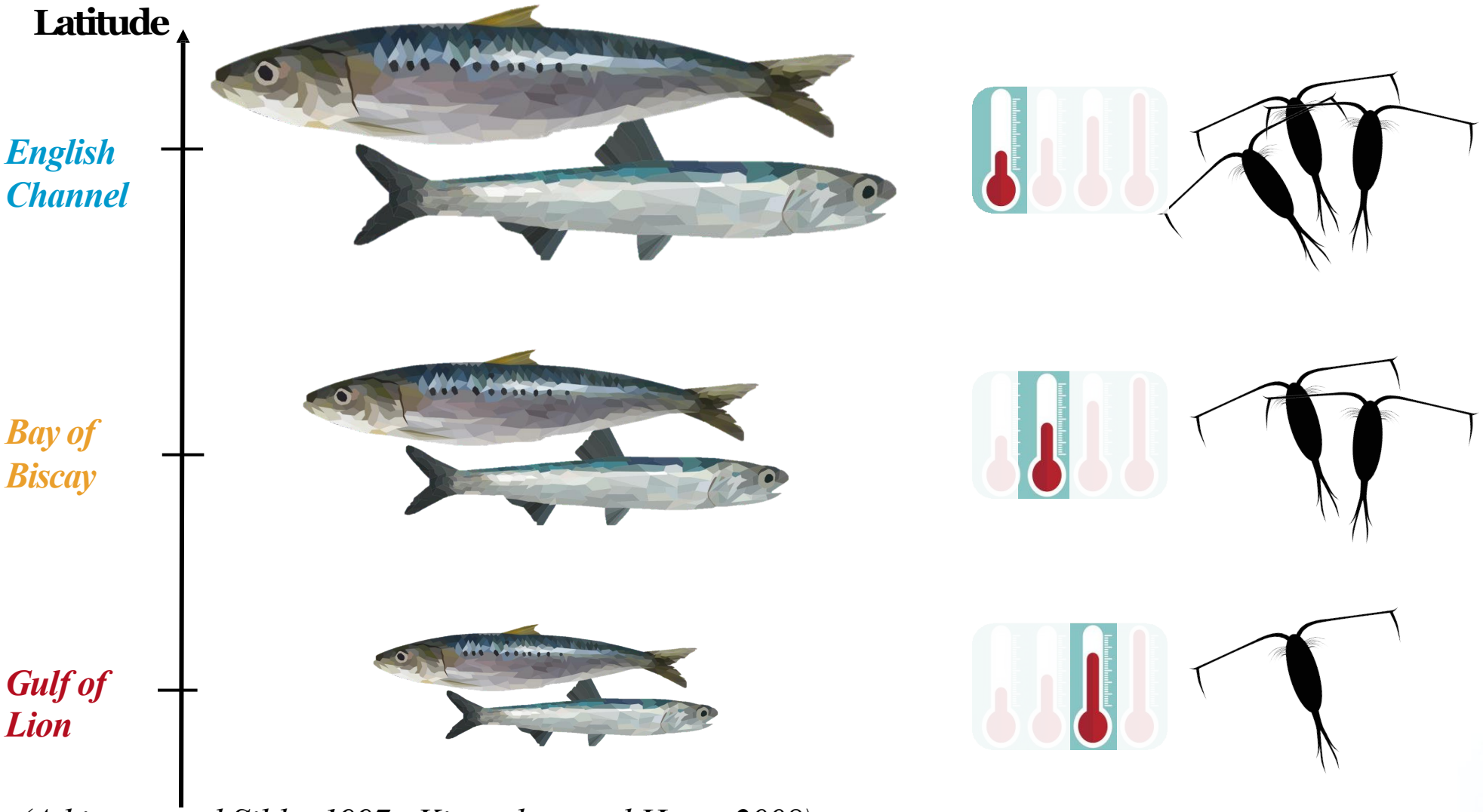
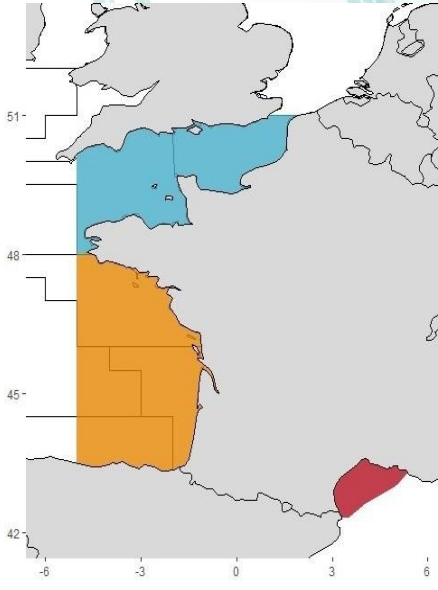


(Menu et al. in revision)

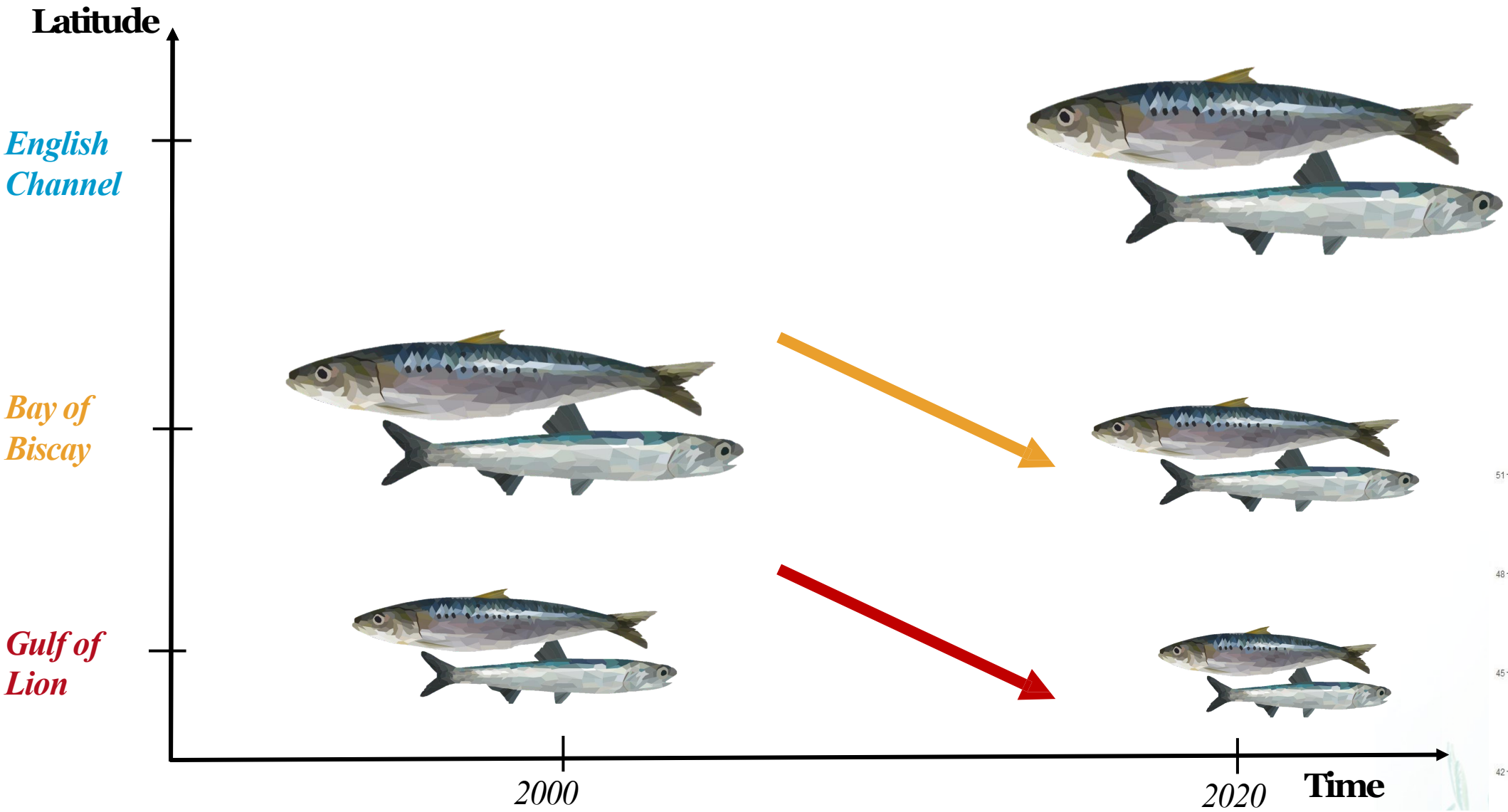
Spatial variability in size and body condition

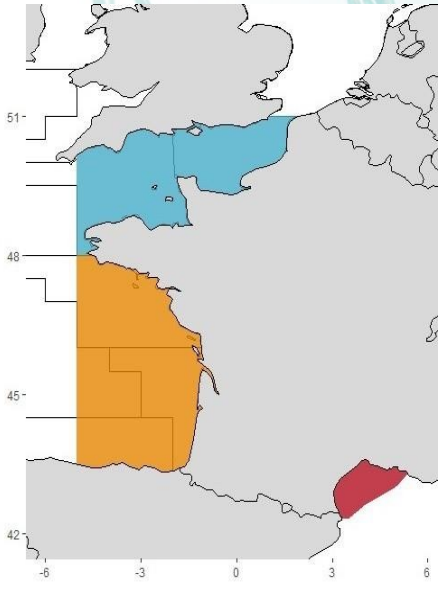




(Atkinson and Sibly, 1997; Kingsolver and Huey, 2008)

Spatial variability in size and body condition





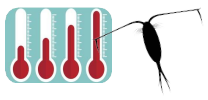
Methods

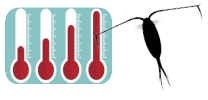
Environment

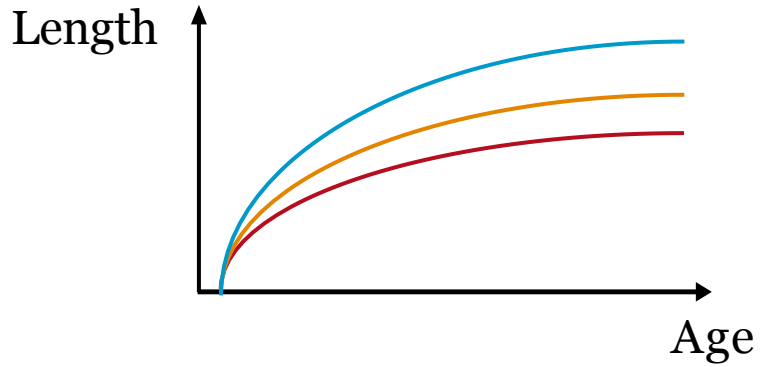
English Channel

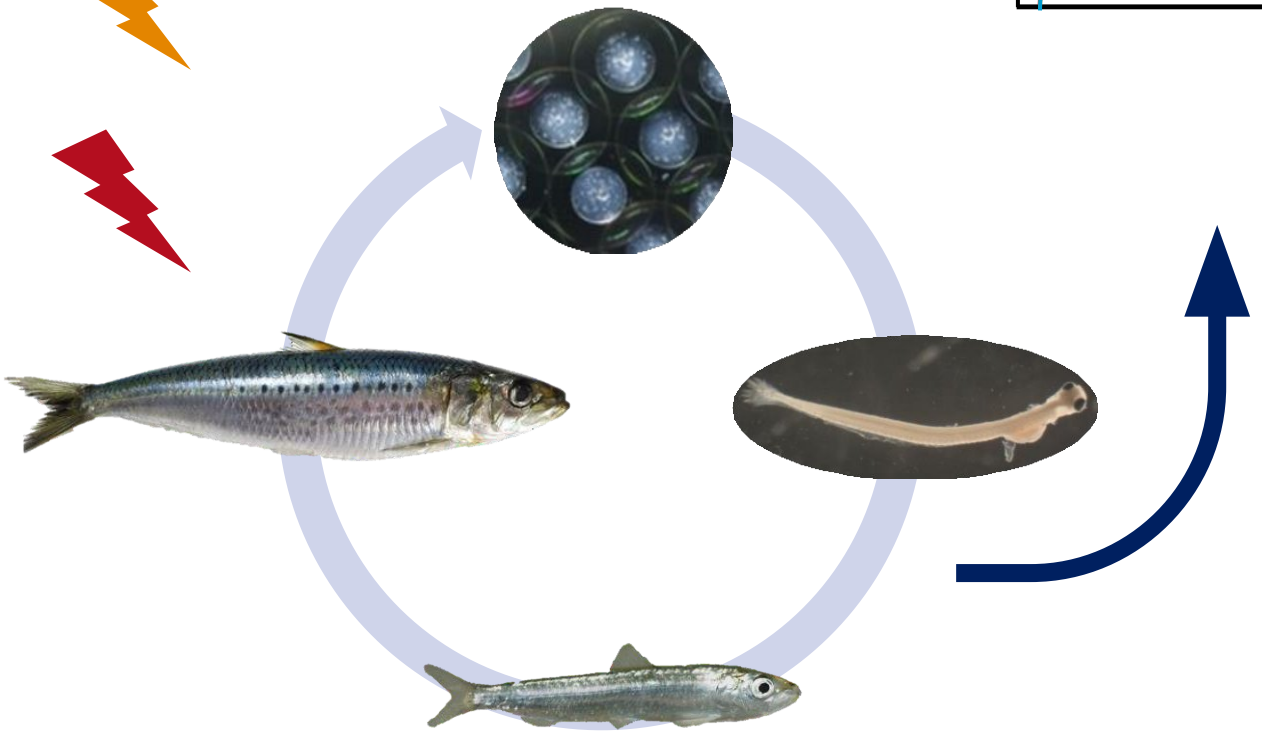
Bay of Biscay

Gulf of Lion





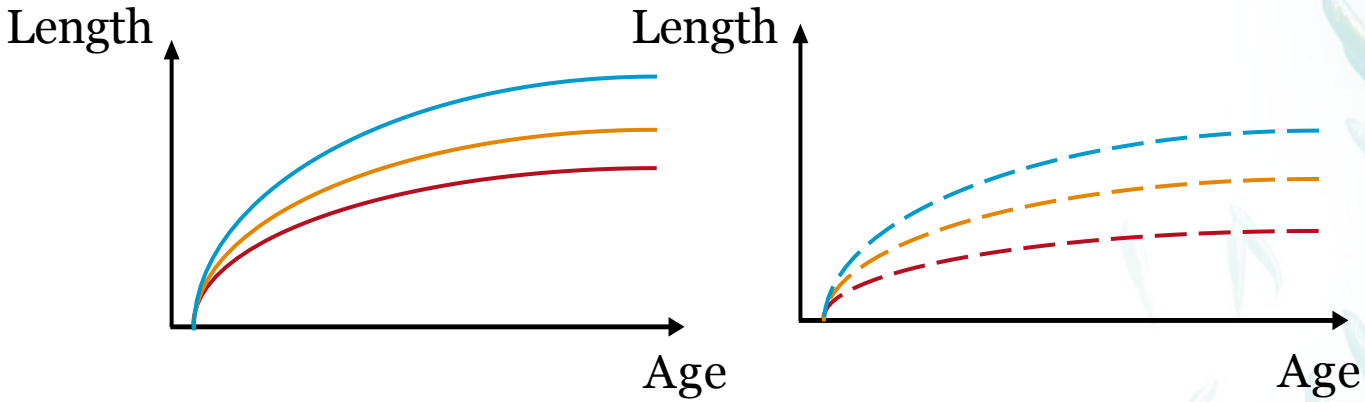


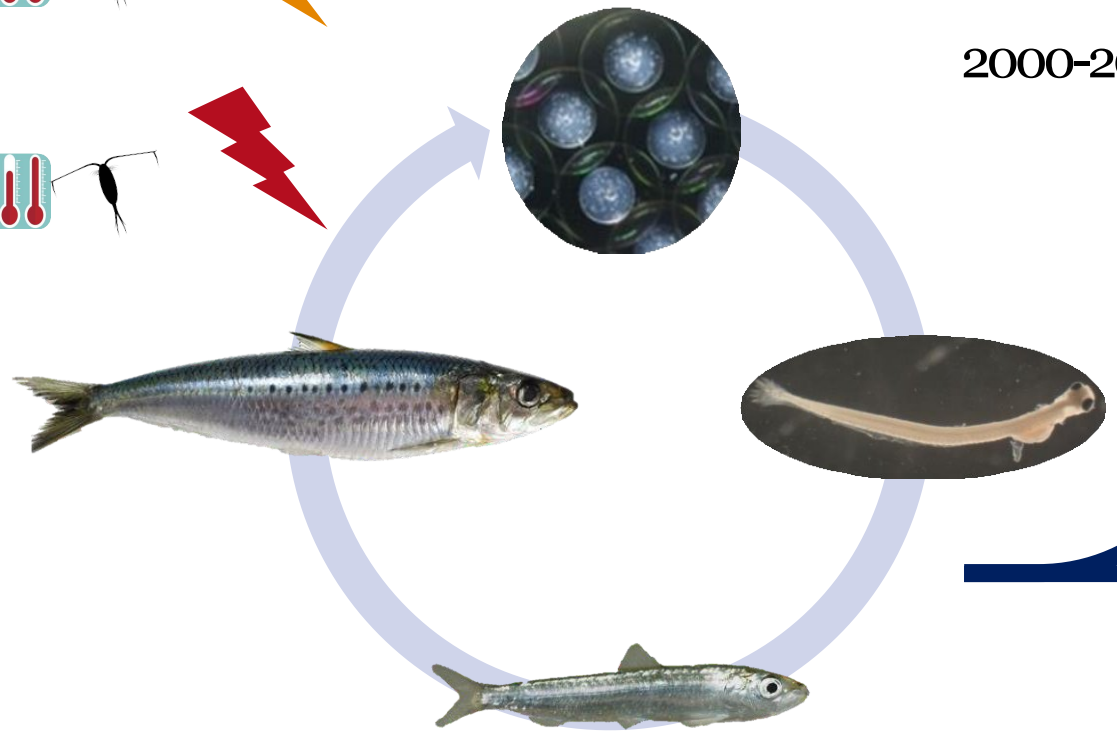


Methods

Environment

	2000-2005	2010-2015
English Channel		
Bay of Biscay		
Gulf of Lion		





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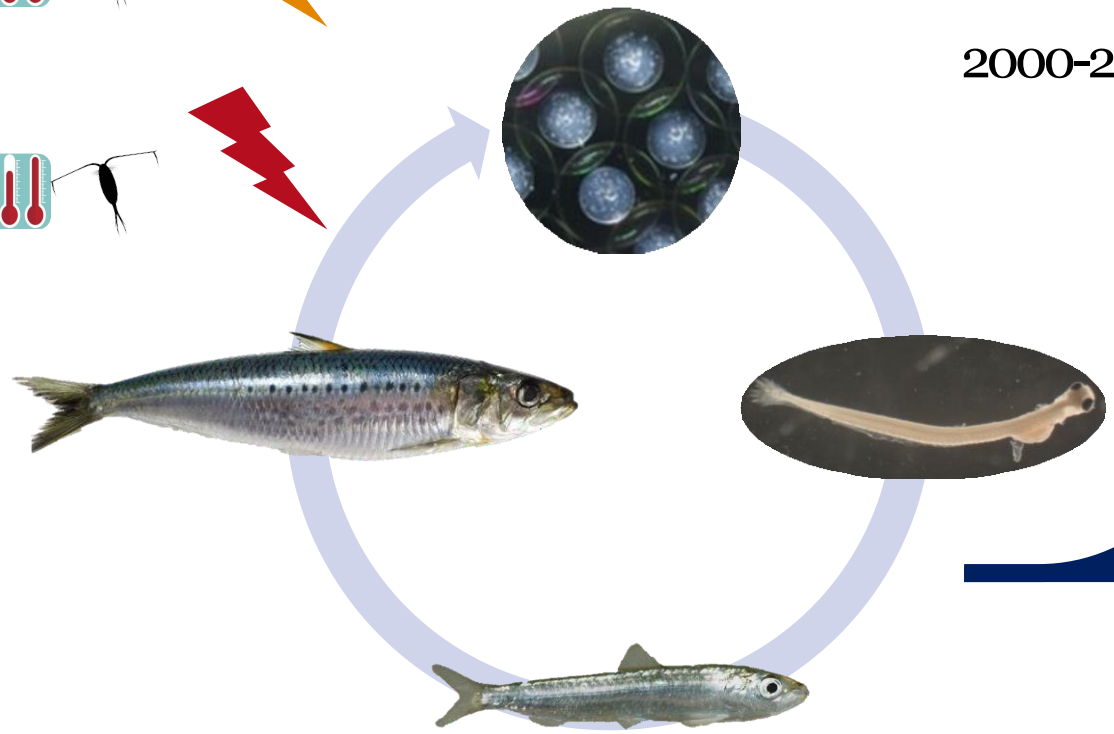
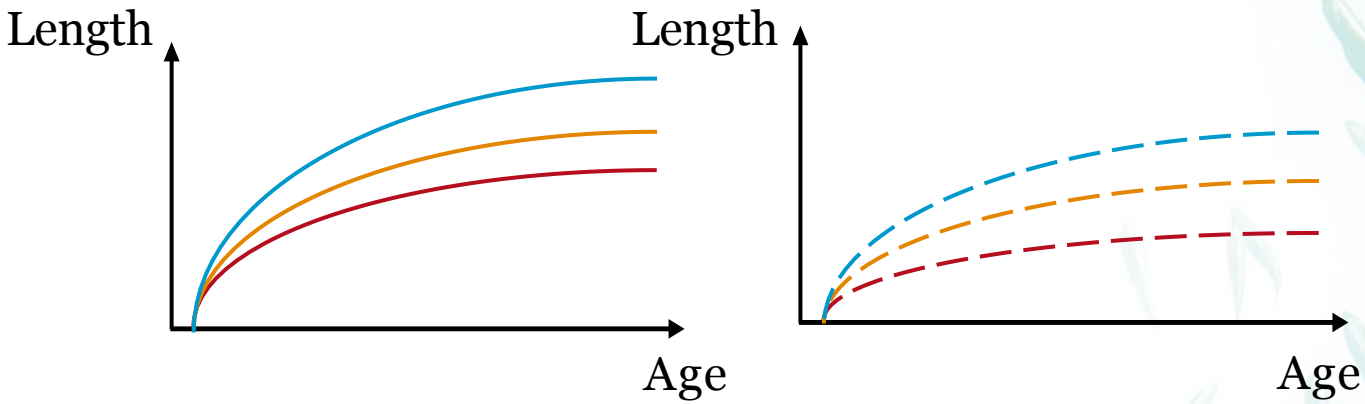
POLCOMS-ERSEM

SEAPODYM





2000-2005 2010-2015

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?

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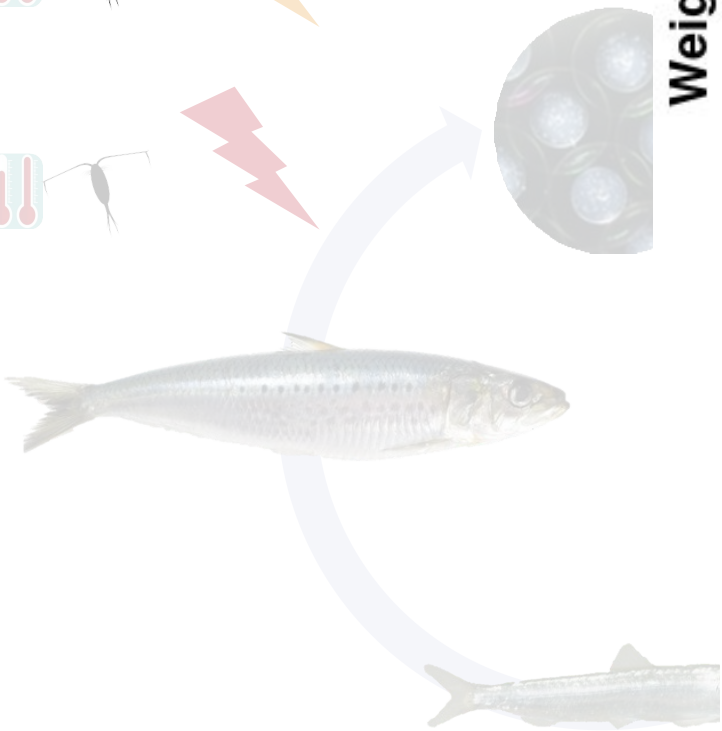
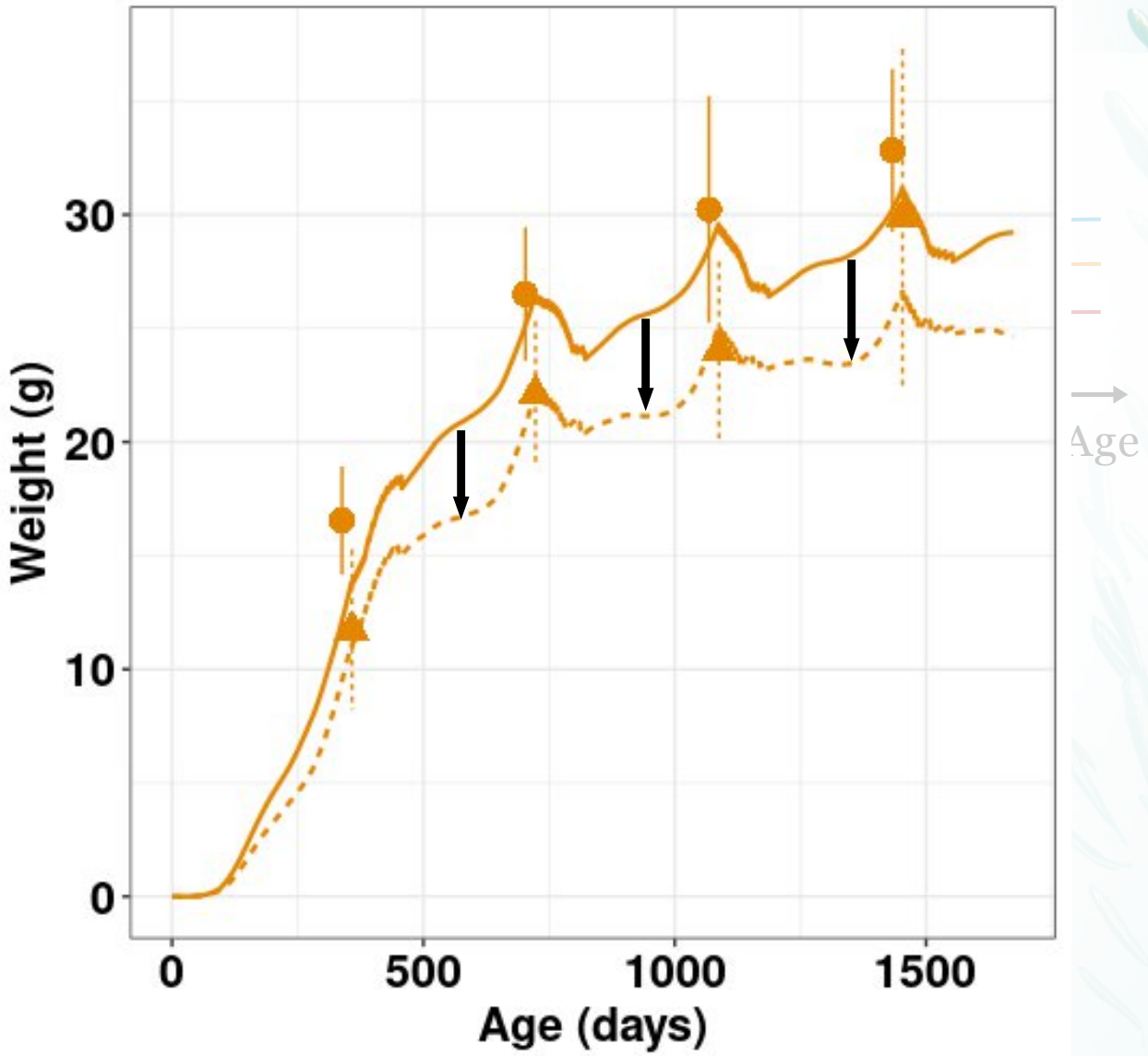
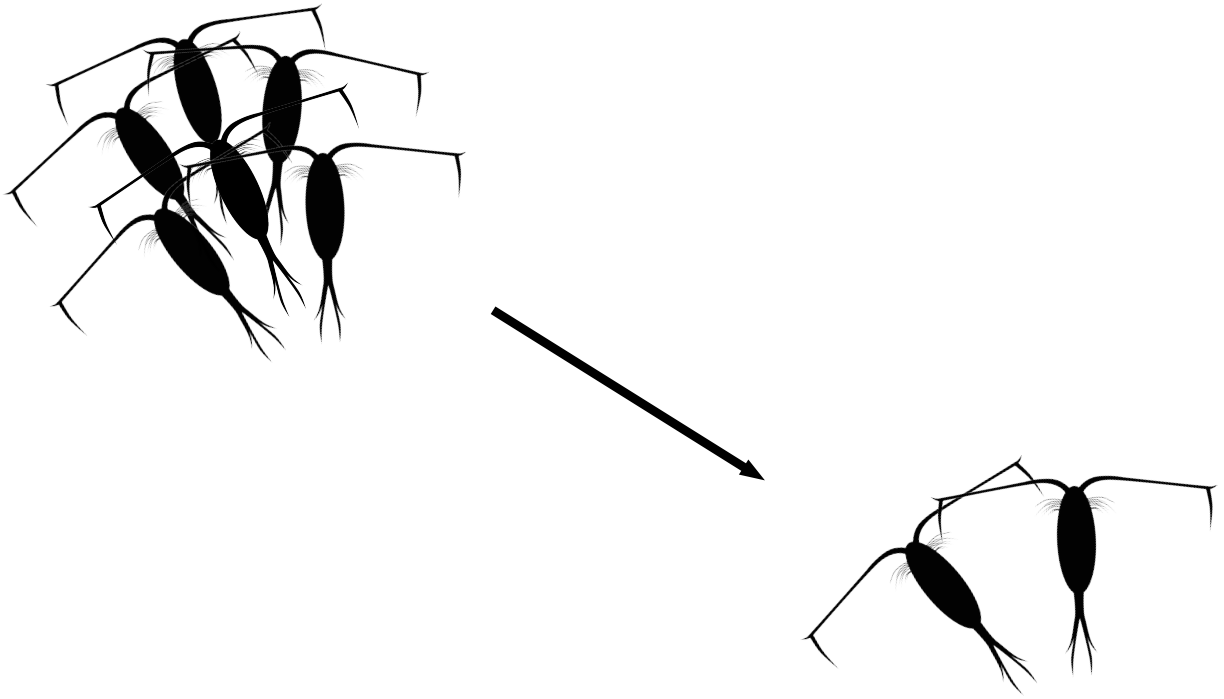




Scenario : a change in zooplankton

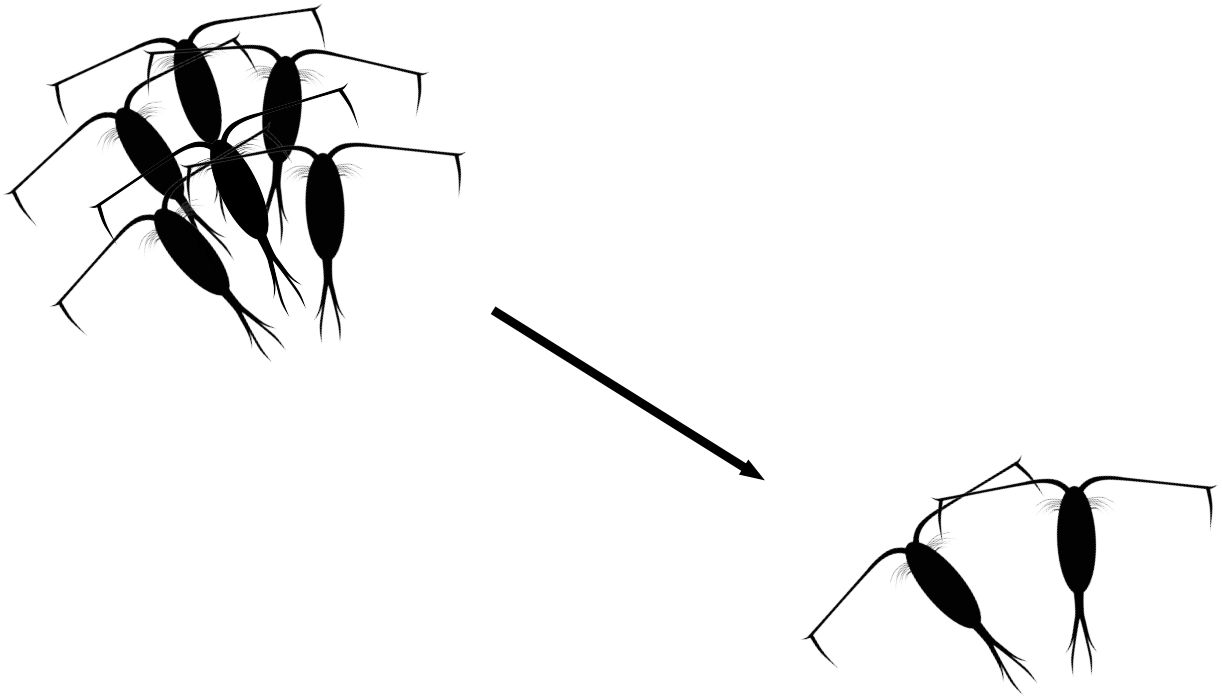
SC1 : decrease in quantity



SC2 : decrease in quality

Scenario : a change in zooplankton

SC1 : decrease in quantity



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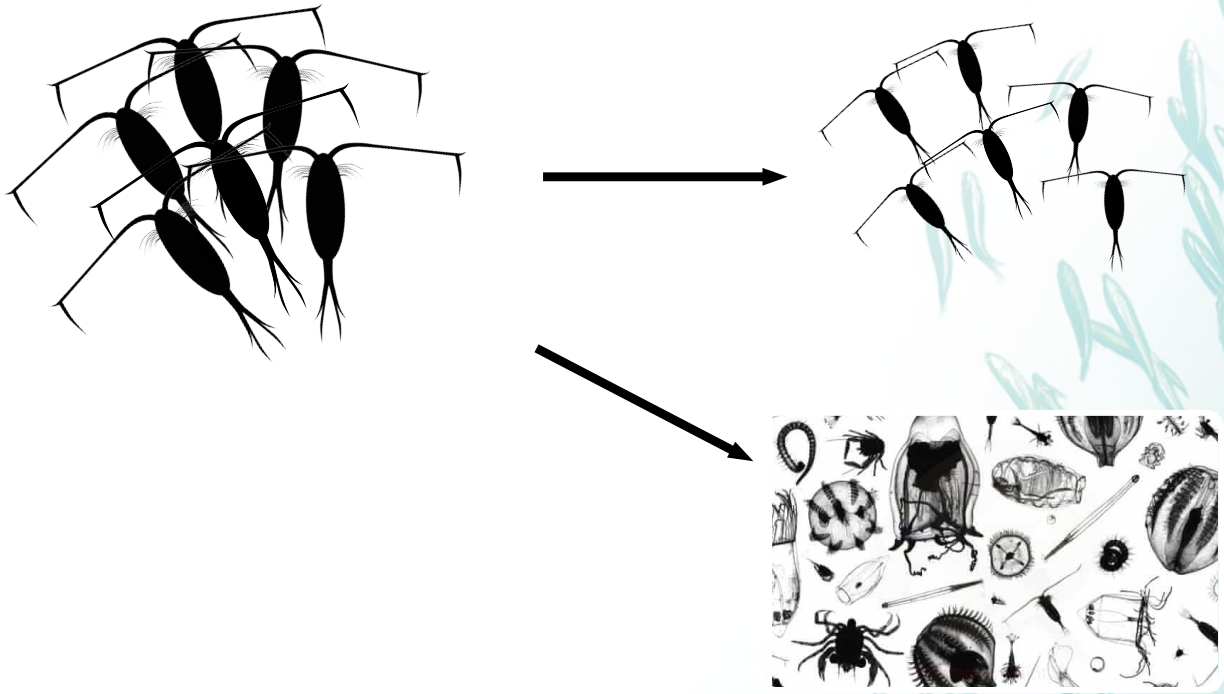
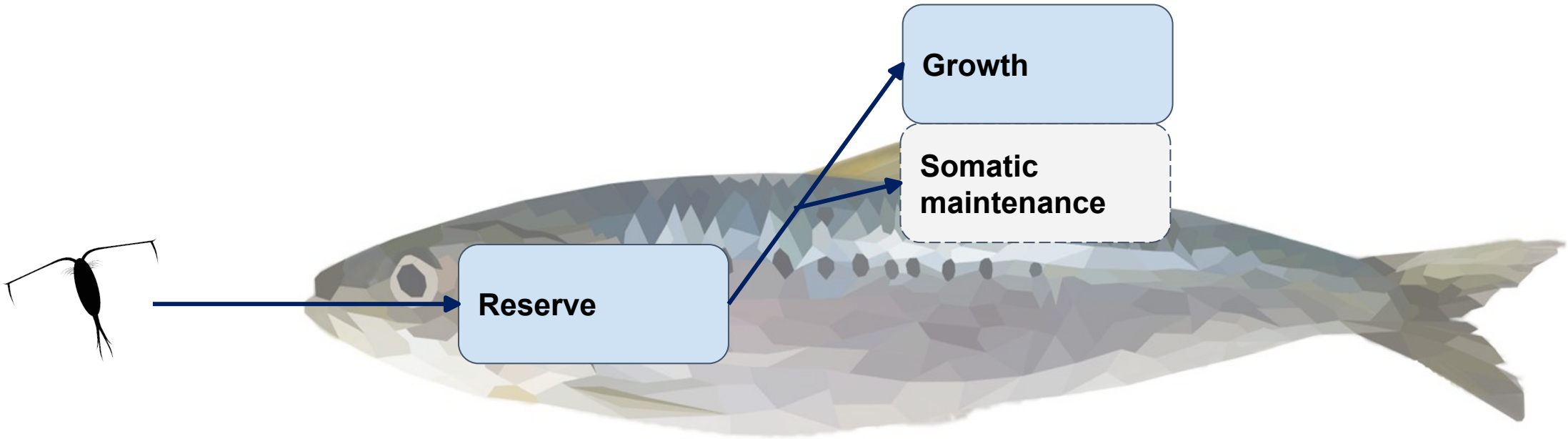


Dynamic Energy Budget theory (DEB)



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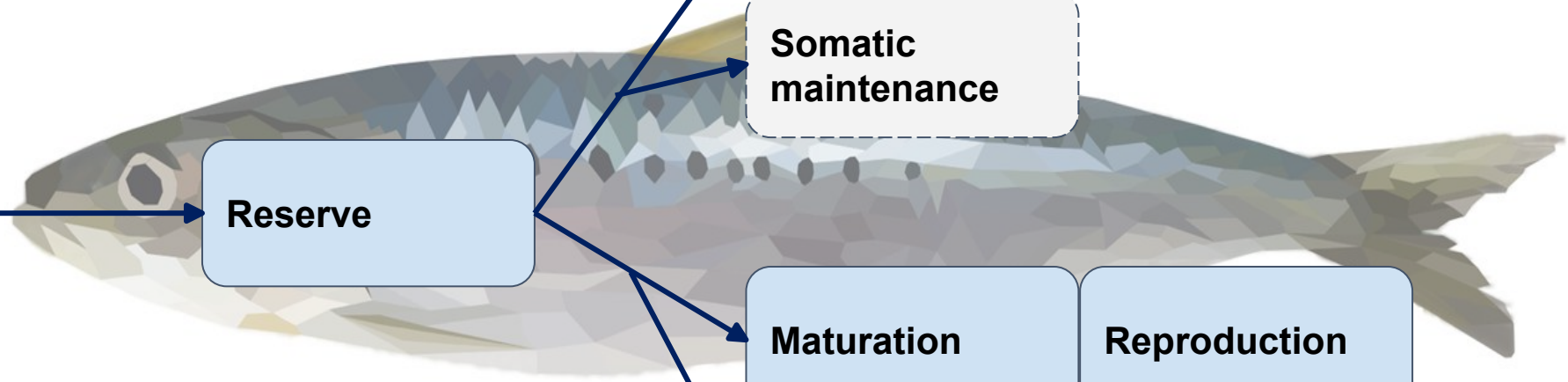

Reserve

Growth

Somatic maintenance

Maturation

Reproduction

Maturity maintenance

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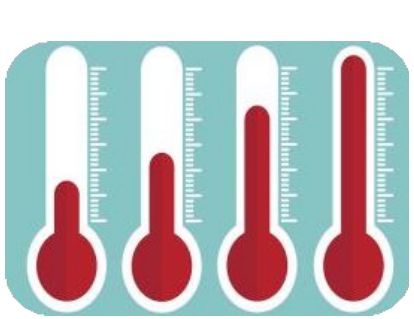
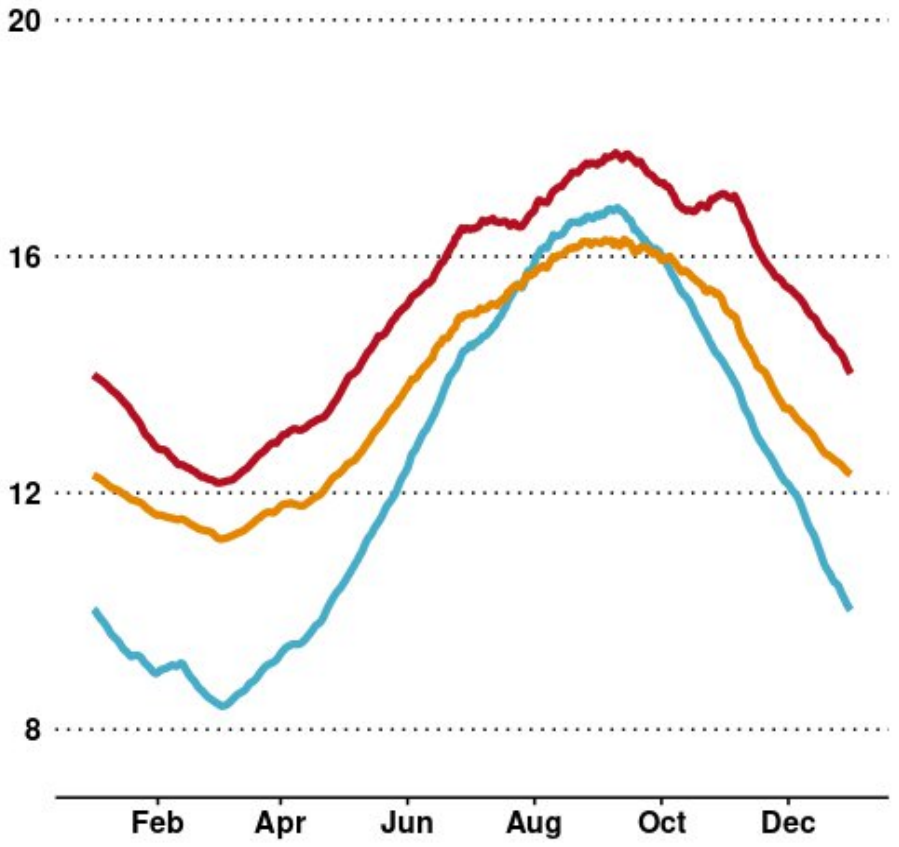
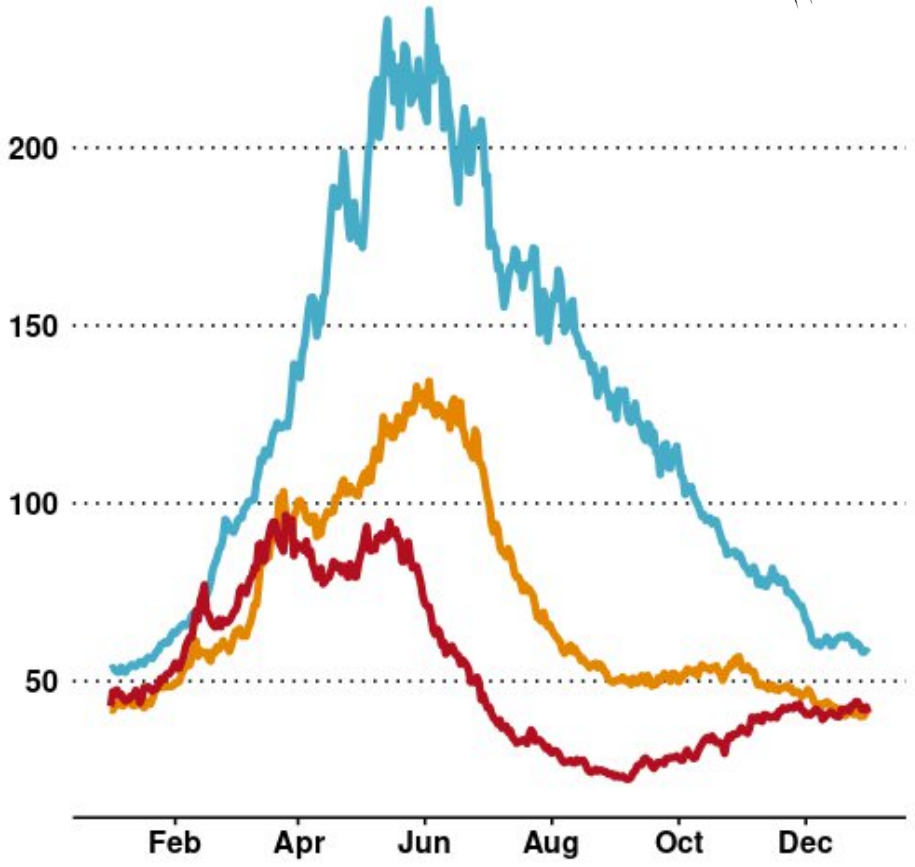


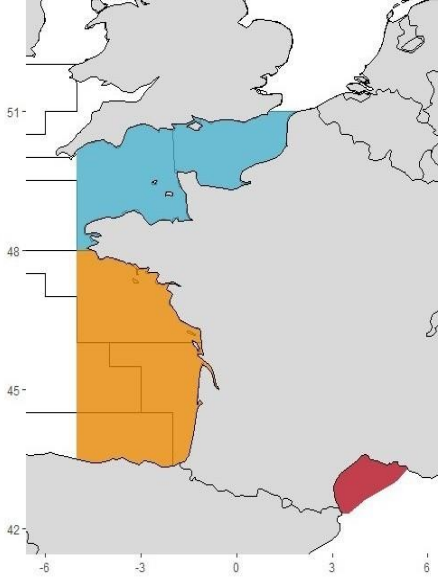
A strong spatial variability

Temperature (°C)



Zooplankton (mgC.m^{-3})





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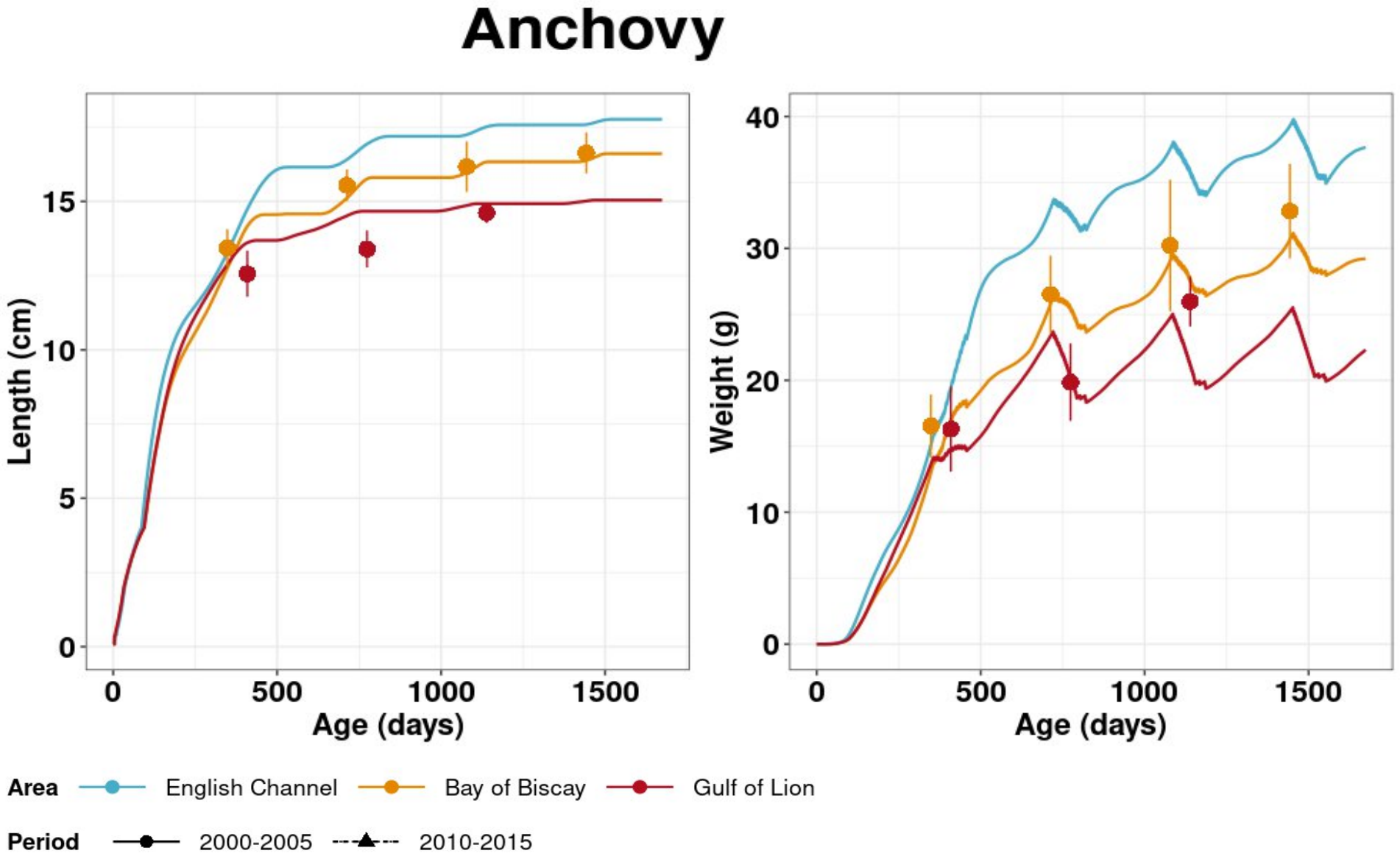
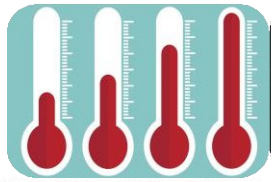


A low temporal variability



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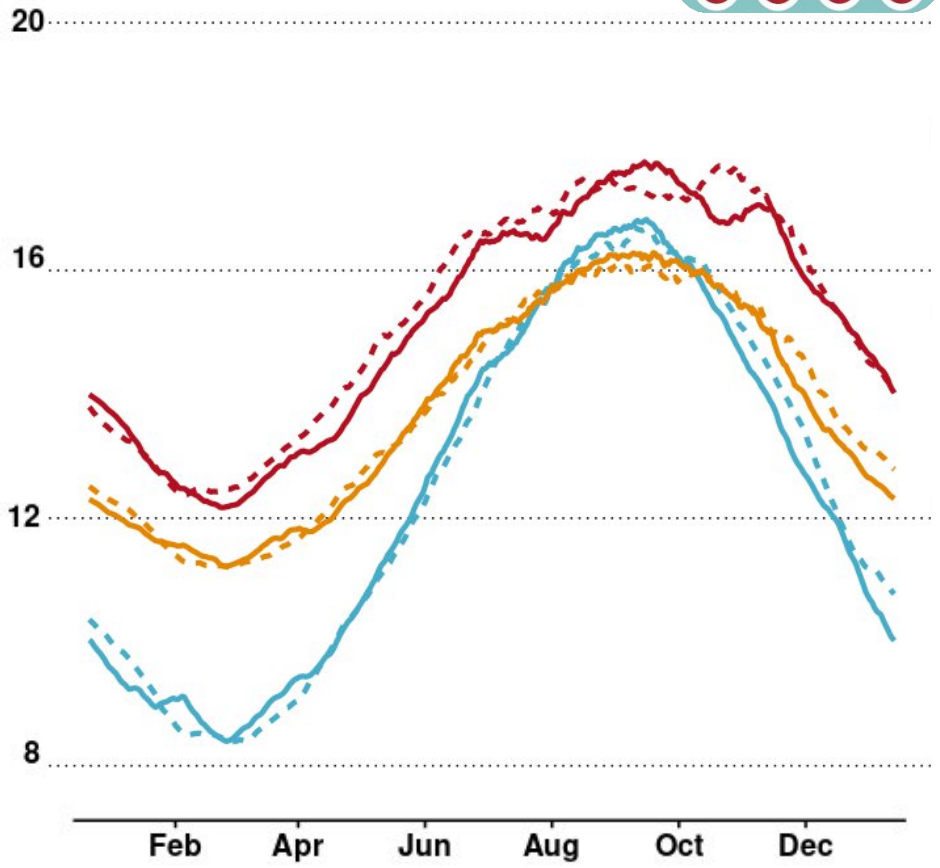

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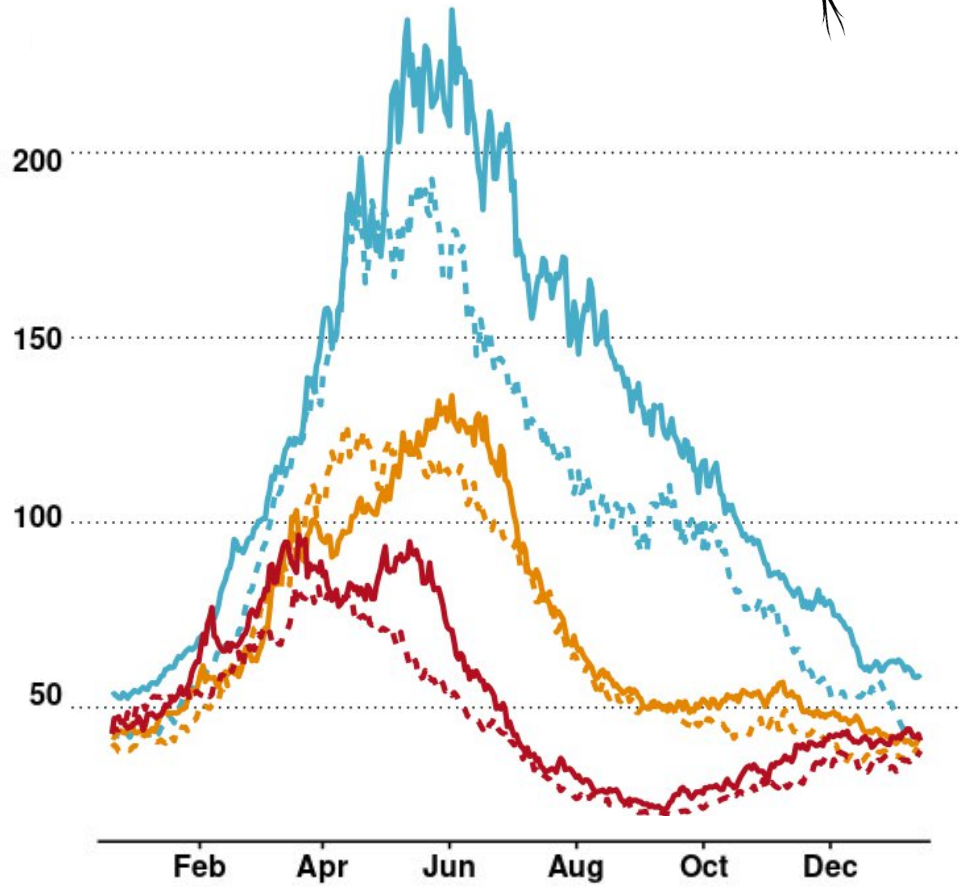

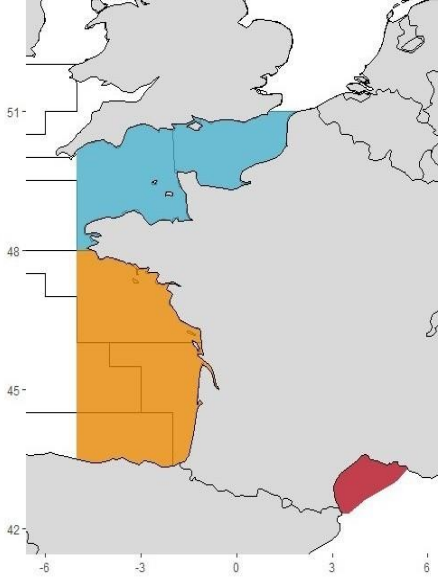

Period — 2000-2005 ····· 2010-2015

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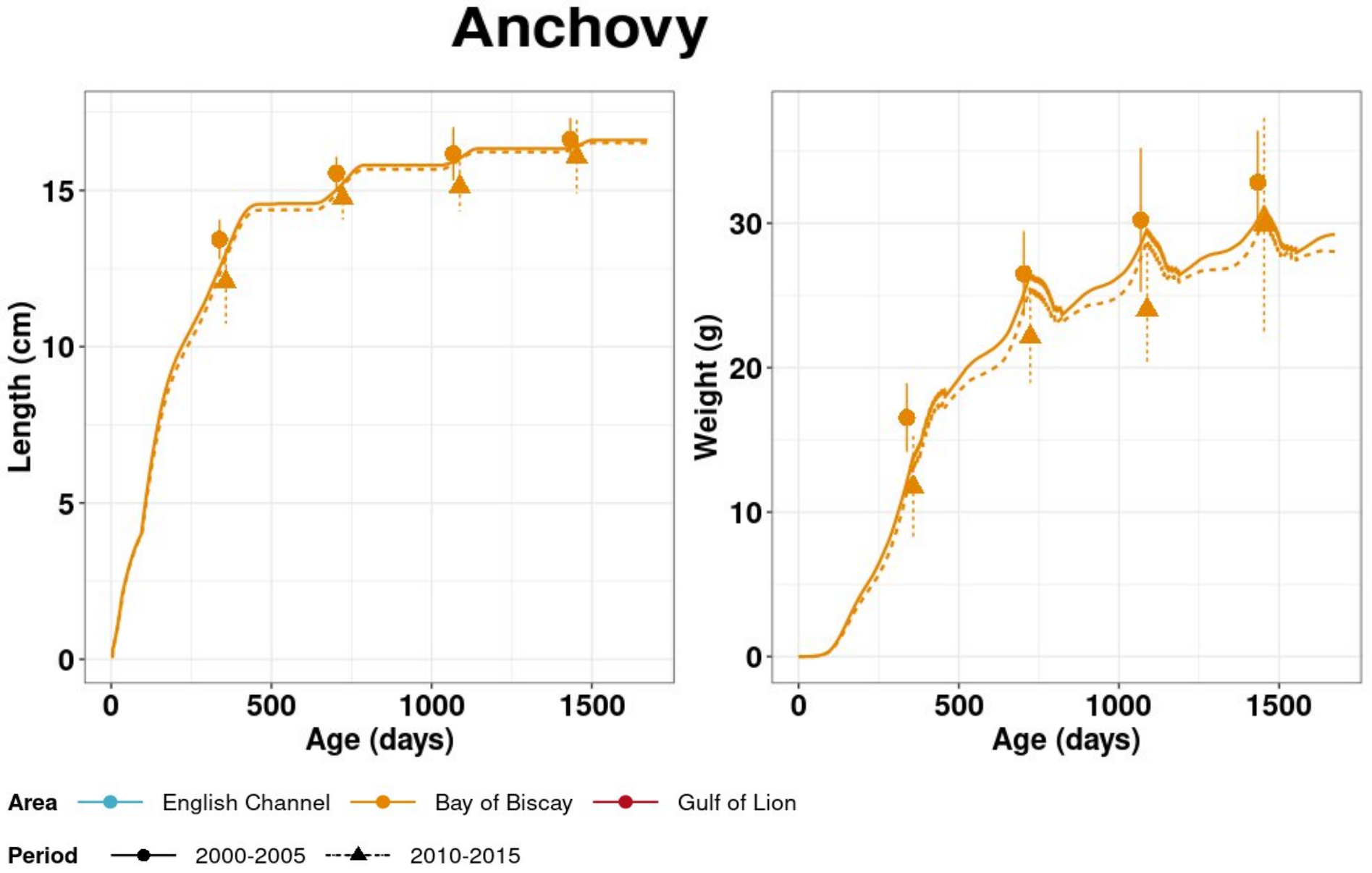

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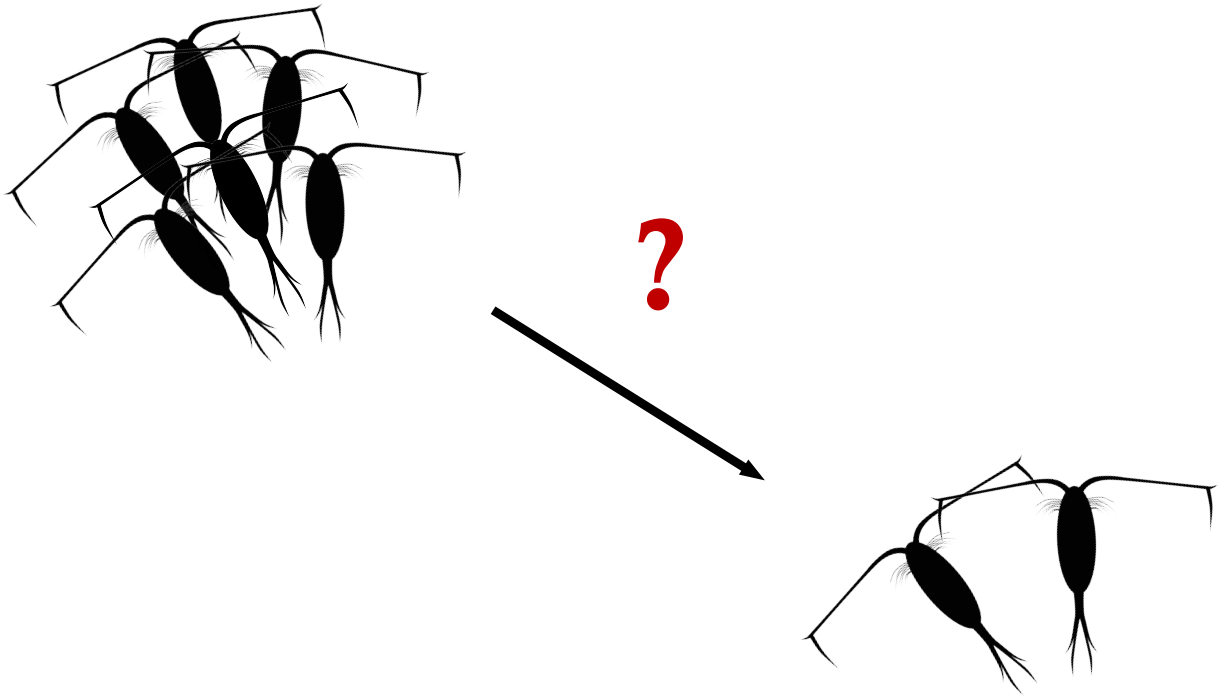
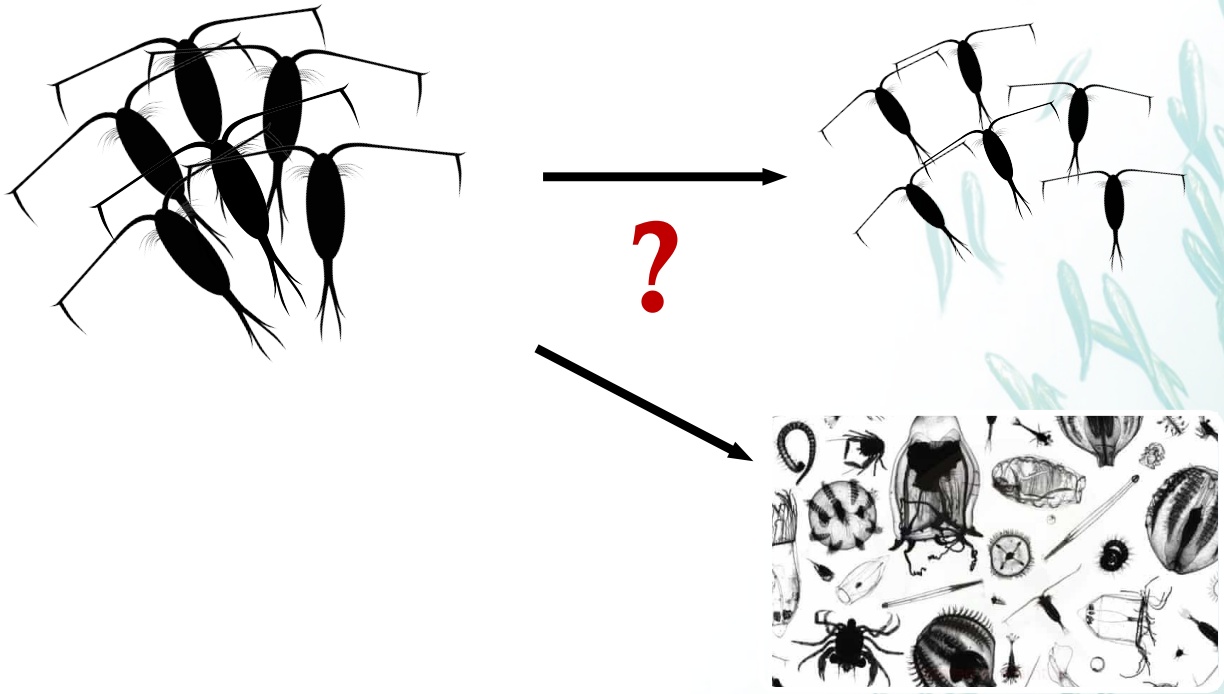


SC2 : decrease in quality



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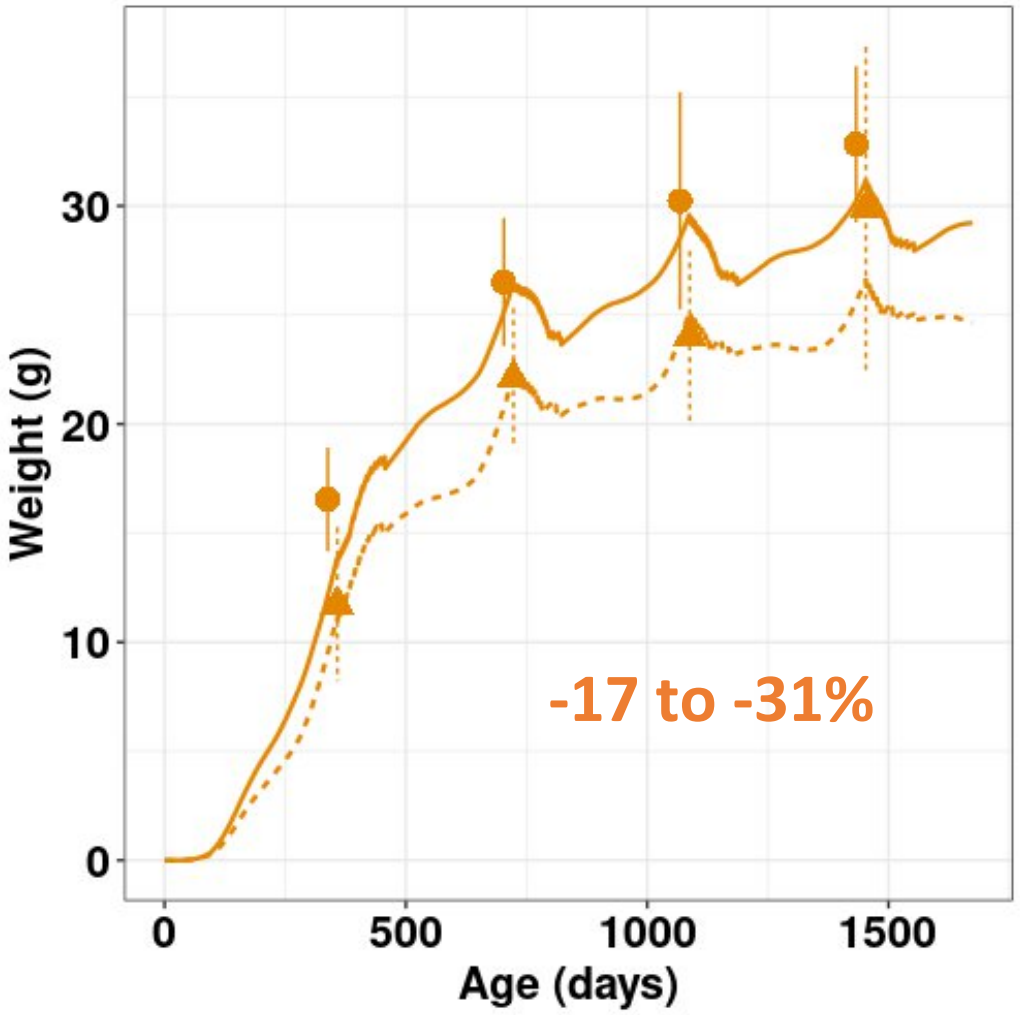

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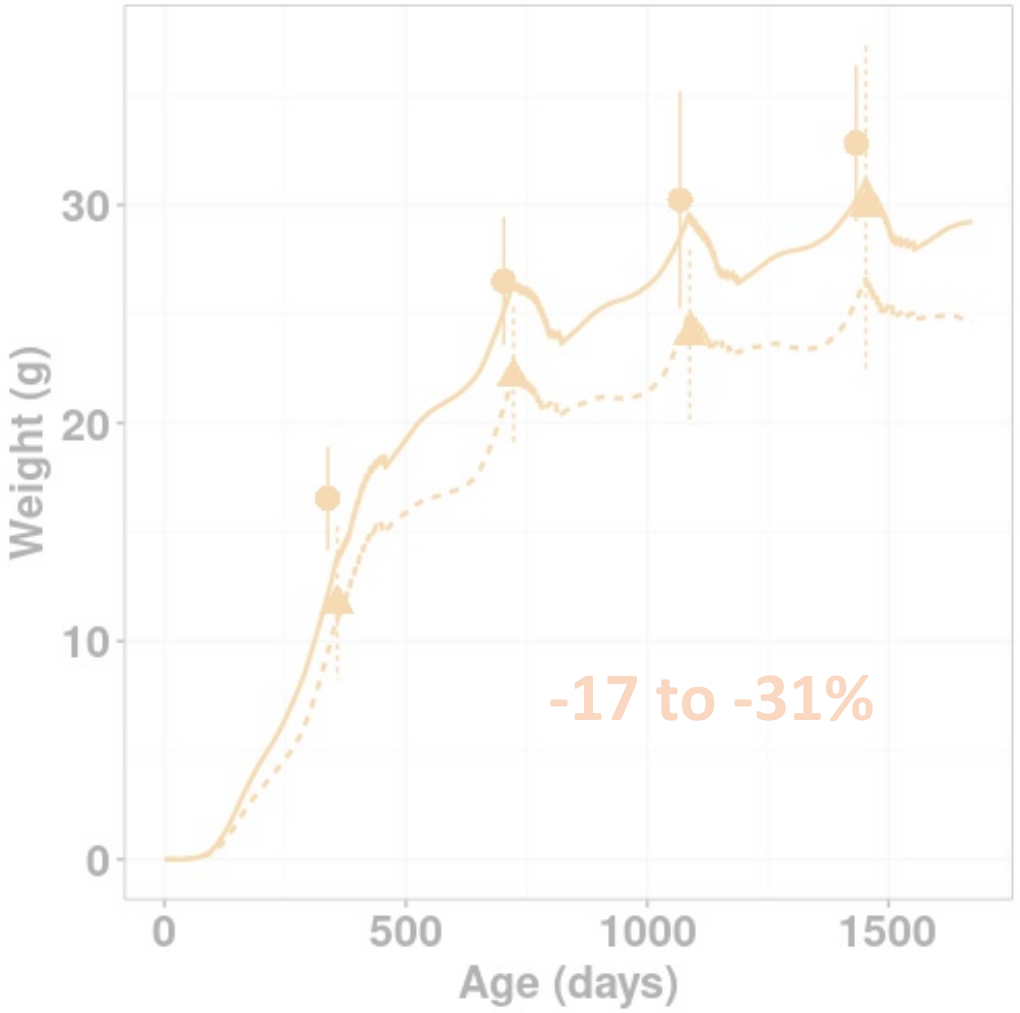

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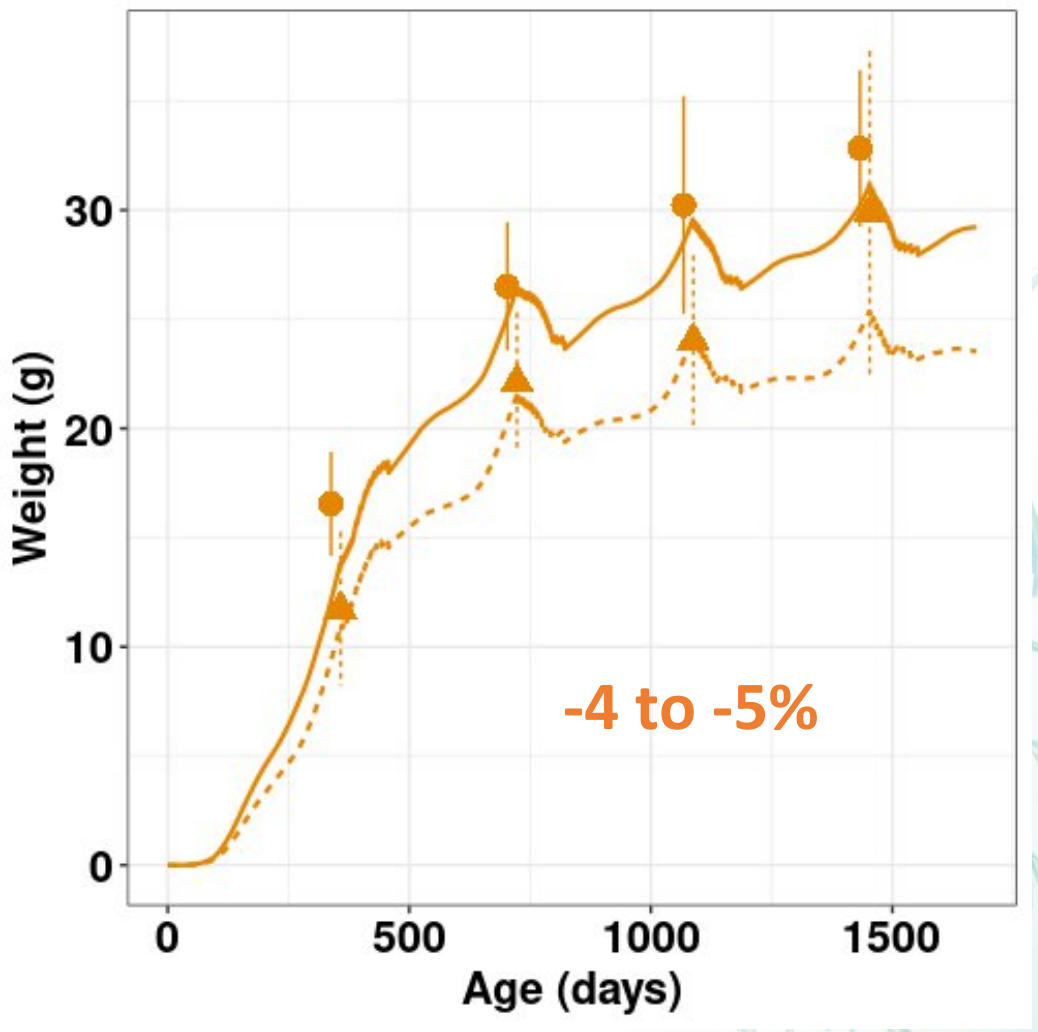
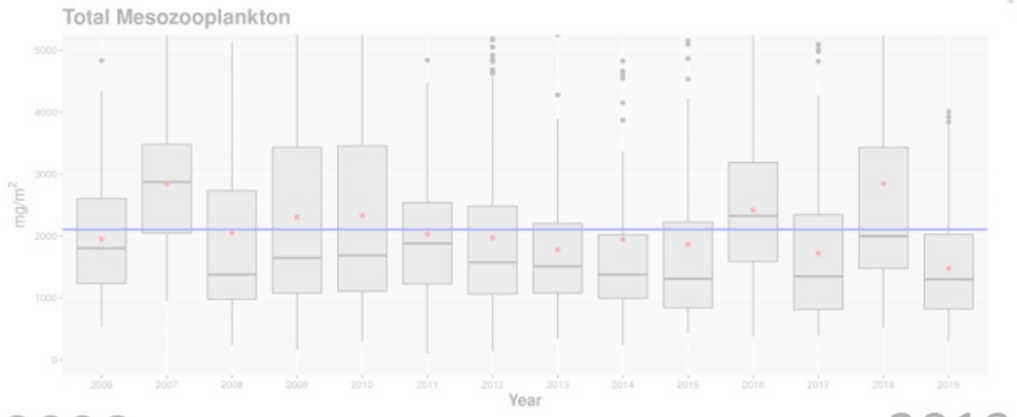


Discussion

A change in **planktonic communities**
(quantity and/or quality)

- Decrease in **quantity**: **-17 to -31%** in the Bay of Biscay in 10 years

Realistic ?



(Schmidt et al., 2020)

Discussion

A change in **planktonic communities**
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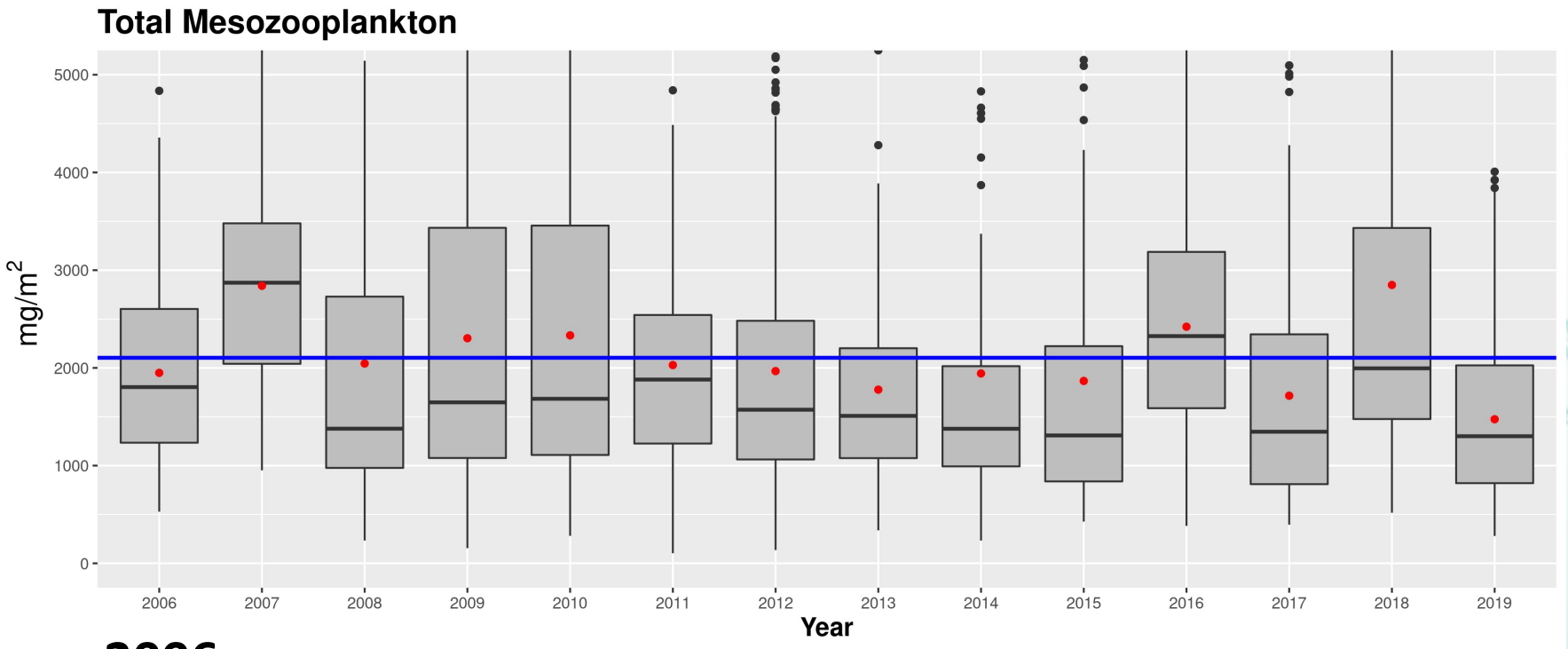
PELGAS
No temporal trend in mesozoo biomass



2006 **2019**

Discussion

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  -15 à -17% in the Gulf of Lion

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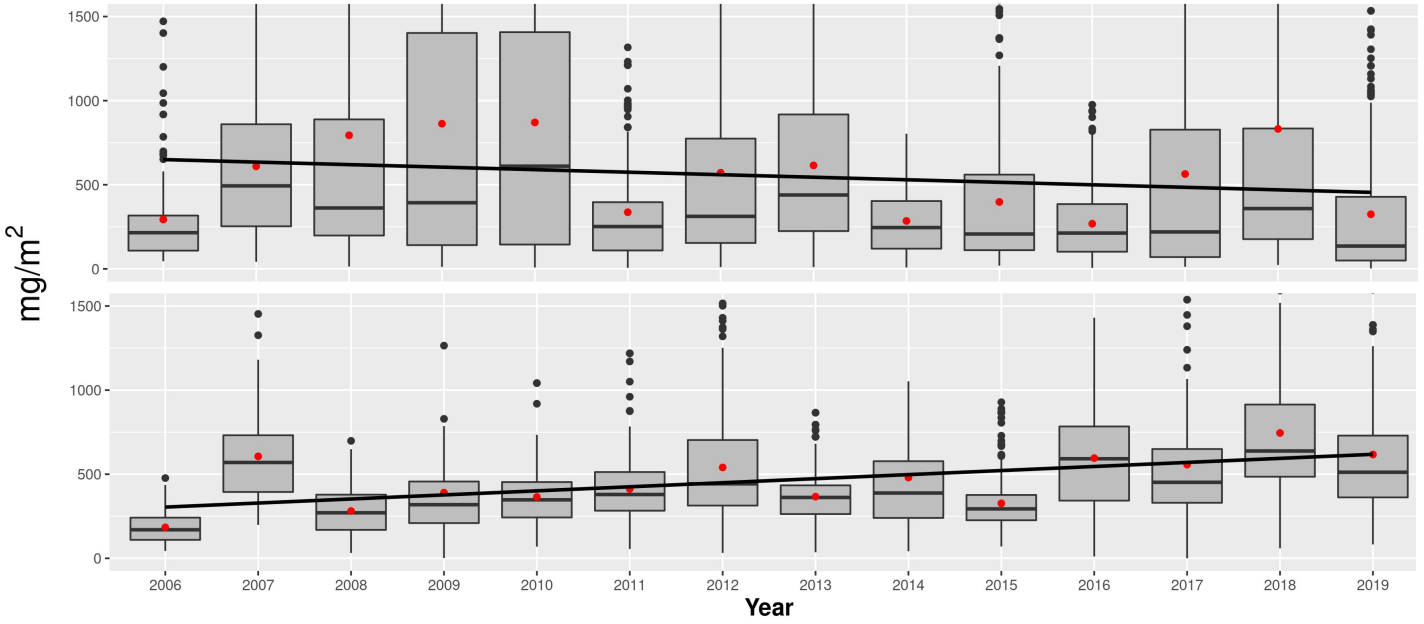

2006 **2019**

PELGAS

- Decrease 1000 > zoo > 2000 µm (biomass)
- Increase 200 > zoo > 500 µm (biomass)

(Nina Grandrémy, PhD candidate; Queiros et al., 2019)

Individual to population scale

- **Planktonic communities** (quantity and/or quality)
  - Impact on population dynamics ? (DEB-IBM)

(Bueno-Pardo et al., 2020)

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(Bueno-Pardo et al., 2020 ; Boëns, 2022)

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(Bueno-Pardo et al., 2020 ; Boëns, 2022)

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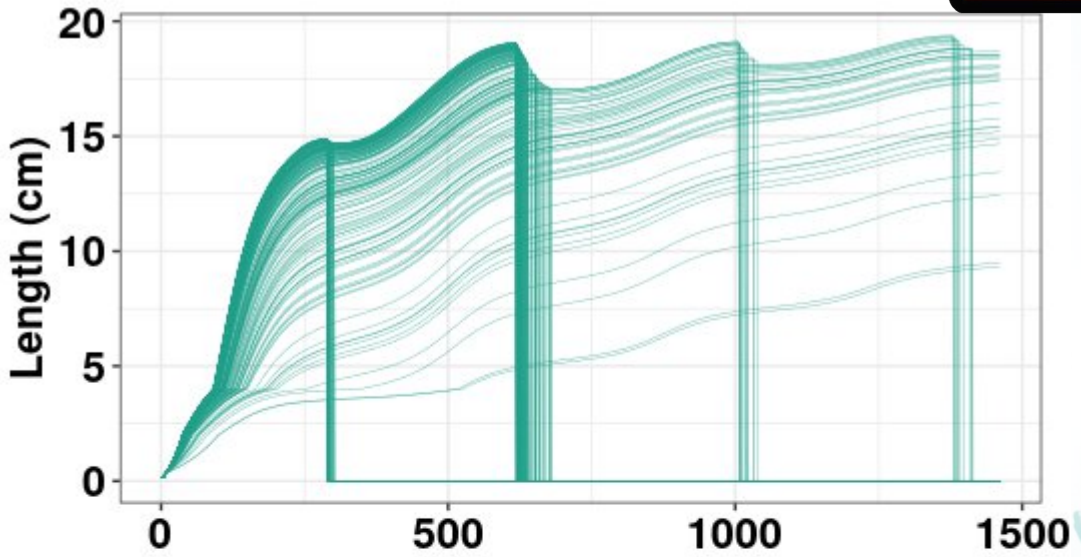
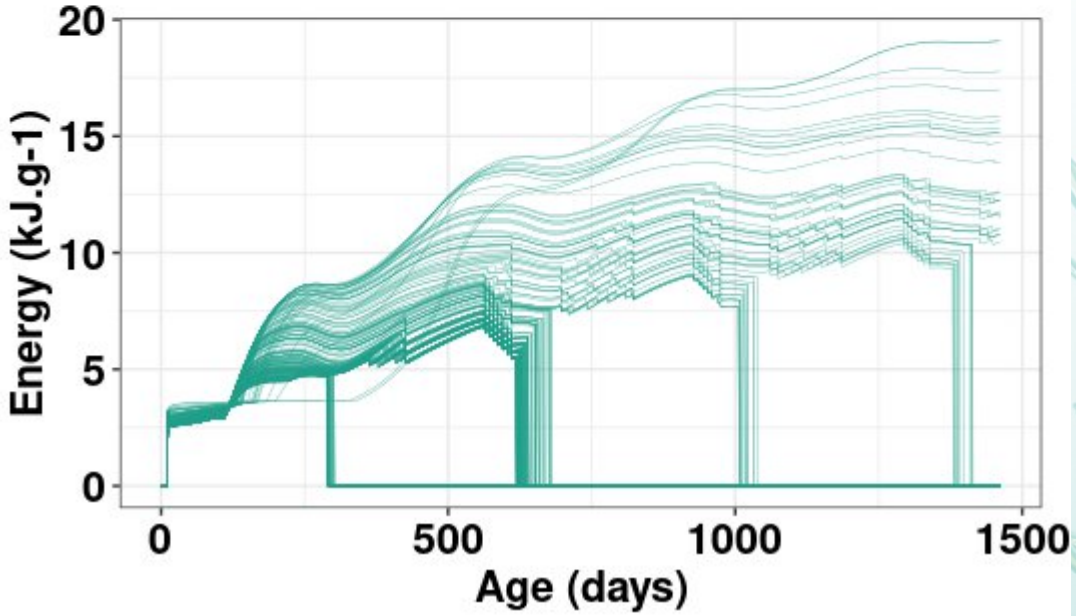
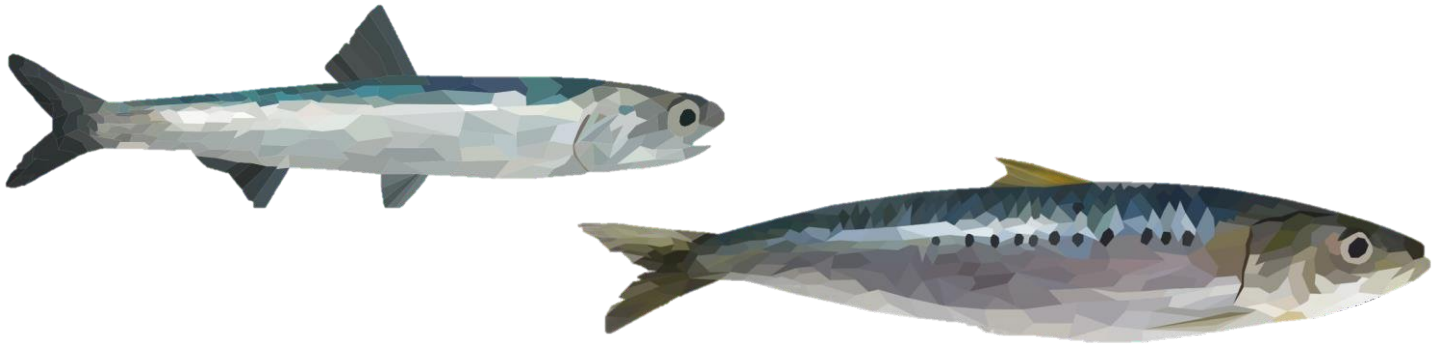




(Bueno-Pardo et al., 2020 ; Boëns, 2022)

Thank you for your attention



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