From plankton to Sardine
-
Spatial patterns in the trophic transfer of essential nutrients

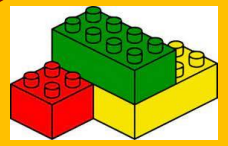
Revealed by taxonomic and fatty acid analysis

Carolin J. Neven[1], Alain Lefebvre[2], David Devreker[2], Guillaume Wacquet[2], Philippe Soudant[4], Paul Marchal[1], Fabrice Pernet[4] and Carolina Giraldo[1]

[1] Ifremer, HMMN, Laboratoire Ressources Halieutiques, F-62200 Boulogne-sur-Mer, France
[2] Ifremer, LITTORAL, F-62200 Boulogne-sur-Mer, France
[3] Univ Brest, CNRS, IRD, Ifremer, UMR 6539, LEMAR, Plouzané, France
[4] Univ Brest, Ifremer, CNRS, IRD, LEMAR, Plouzané, France

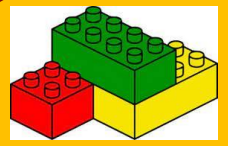
Essential fatty acids

Essential fatty acids



LIPIDS

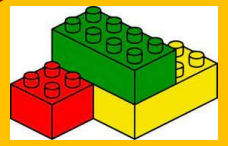
Essential fatty acids



LIPIDS

TRIGLYCERIDE

Essential fatty acids



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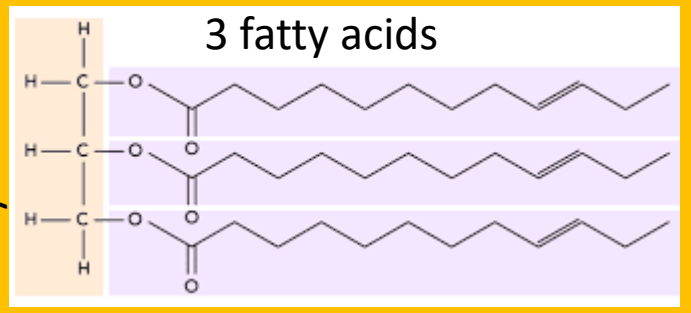

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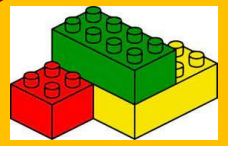

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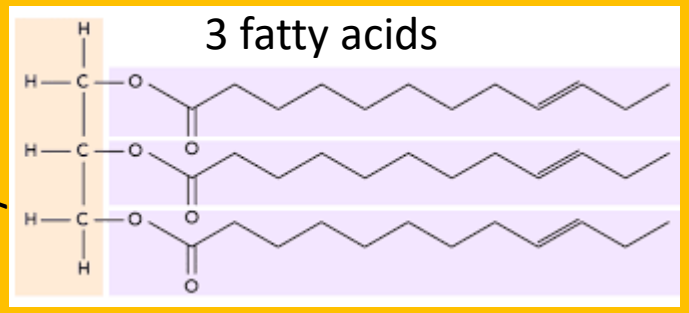
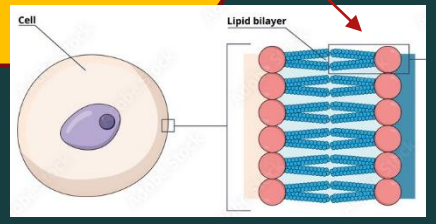


PHOSPHOLIPID



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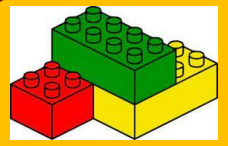
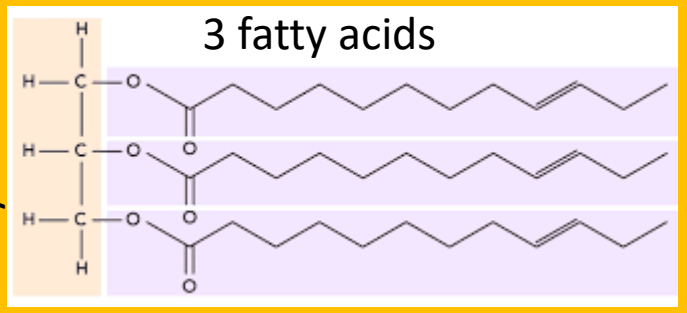


LIPIDS

TRIGLYCERIDE

3 fatty acids

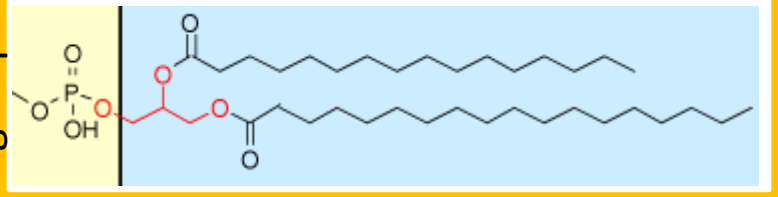
Glyceride

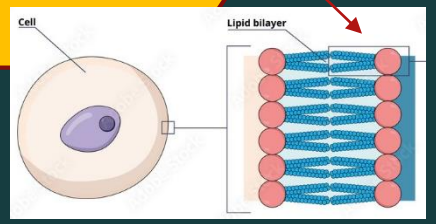


PHOSPHOLIPID

2 fatty acids

Phosphate group





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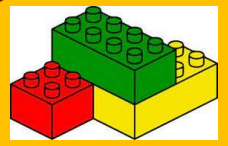

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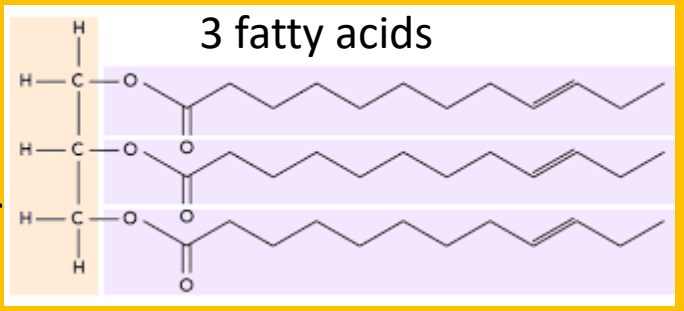

Essential FA

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2 fatty acids

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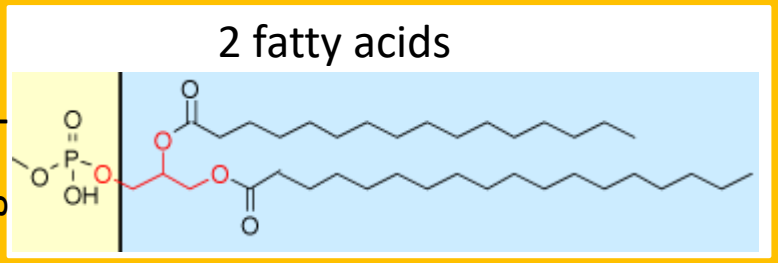

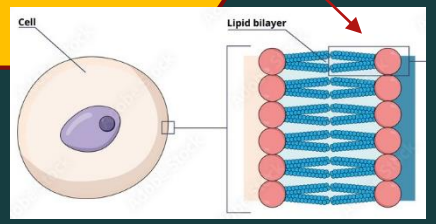

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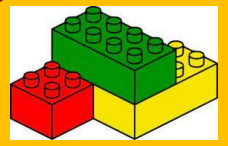

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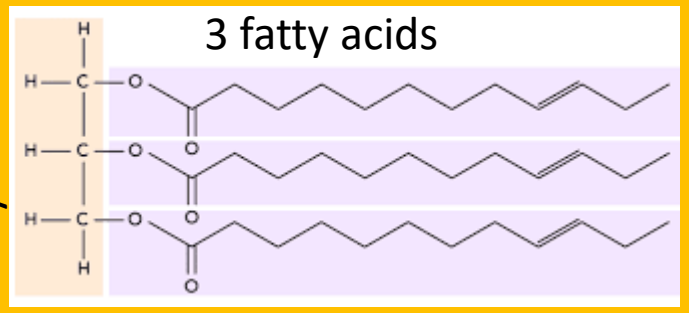

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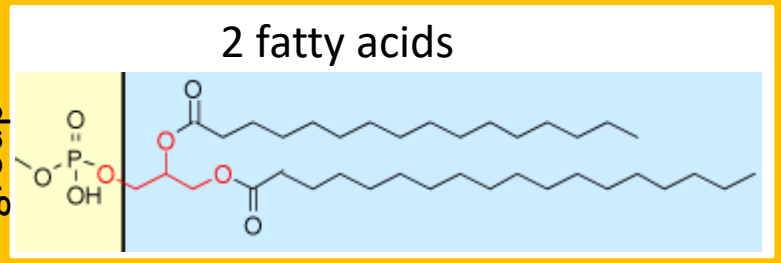
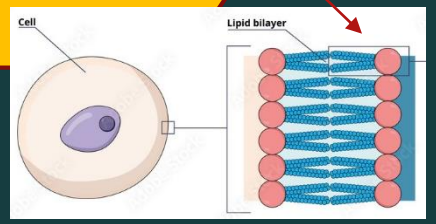
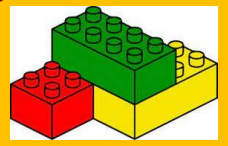




Essential FA

- Membrane functionality
- Hormones
- reproduction
- Brain development and functioning

Essential fatty acids



LIPIDS

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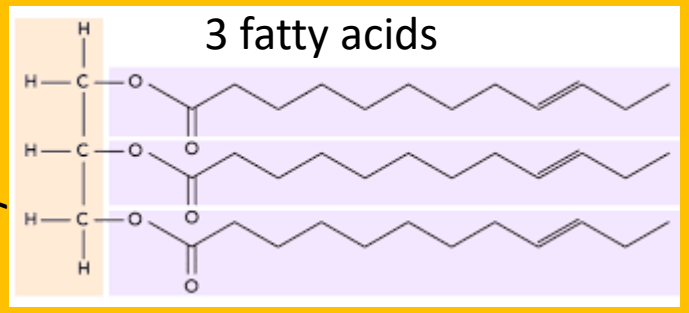

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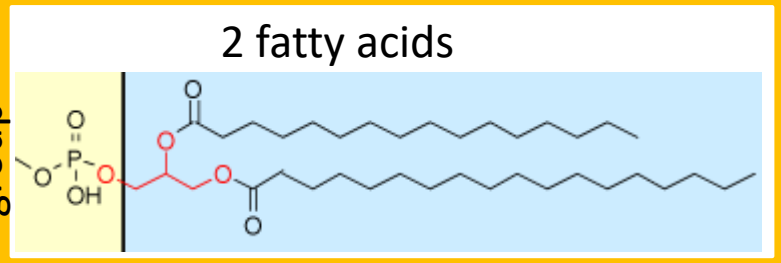

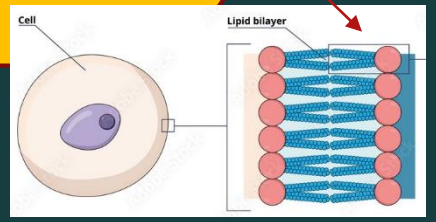

Essential FA

- Membrane functionality
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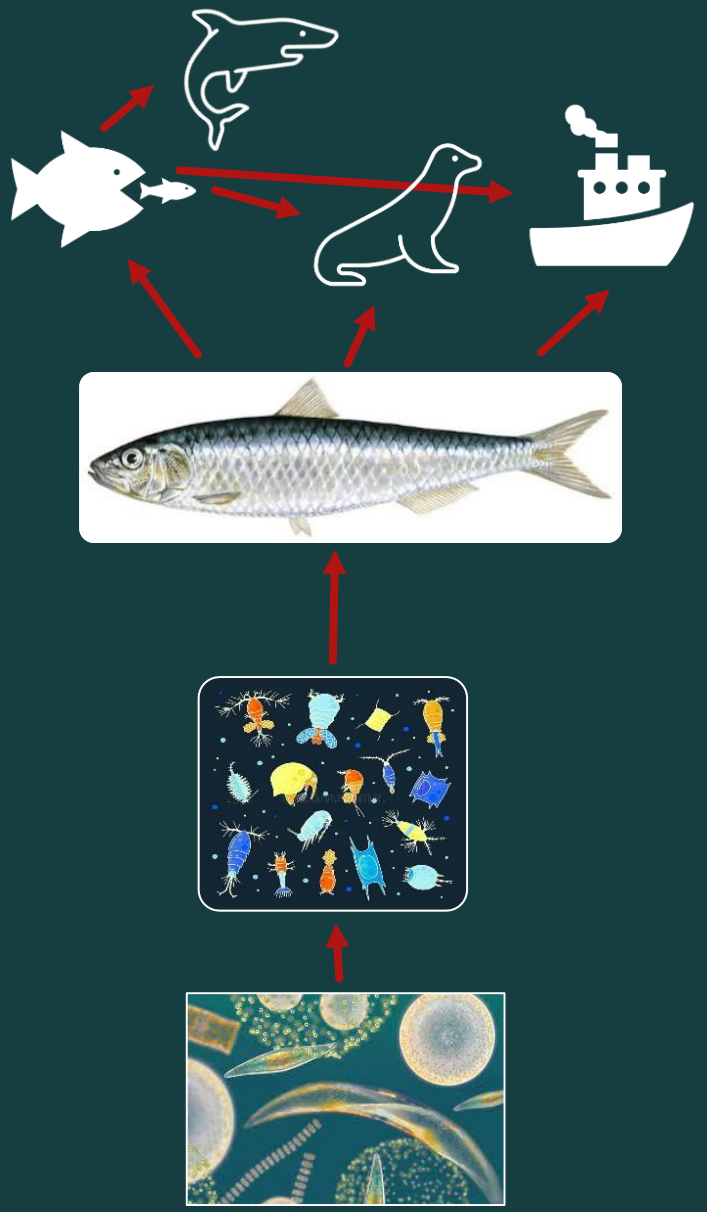
Essential FA in the marine food web



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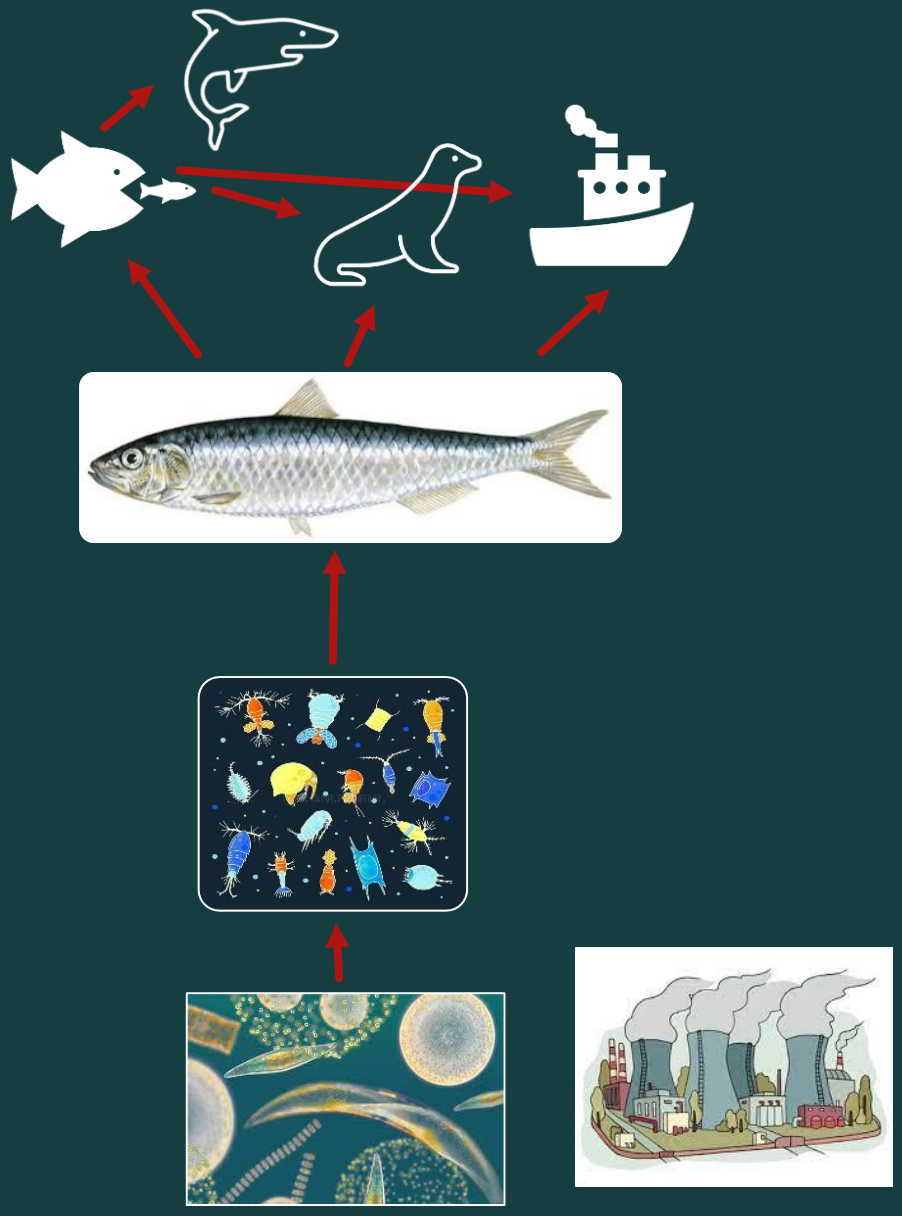

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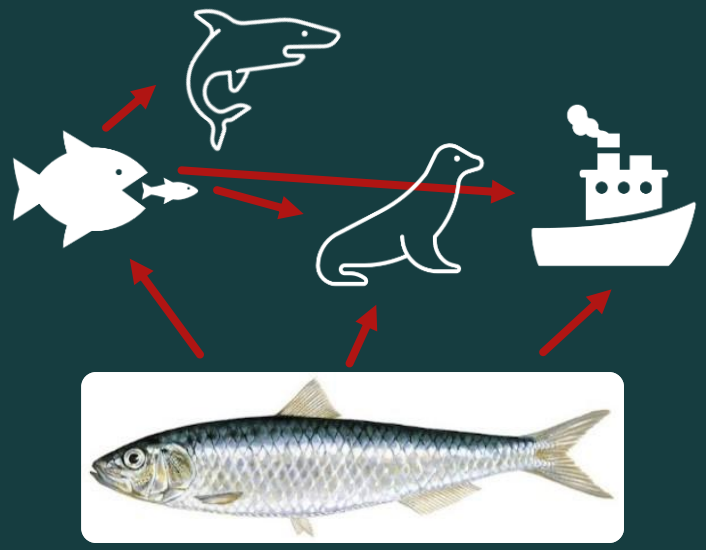
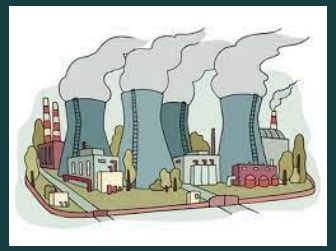


taxonomy



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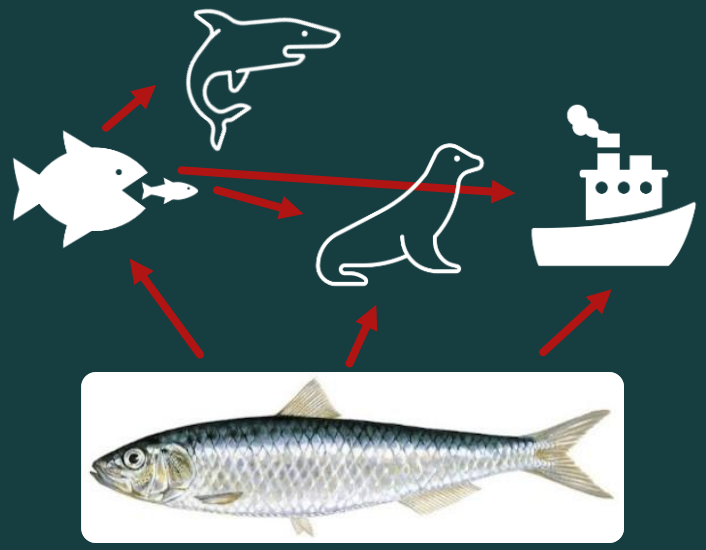

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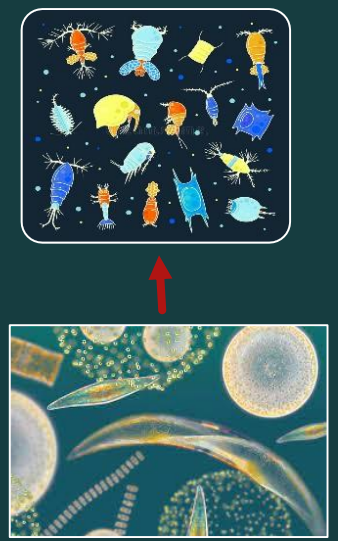

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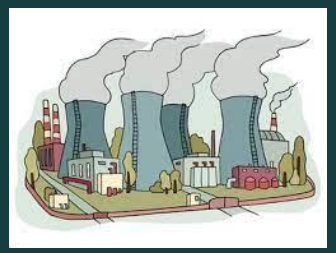

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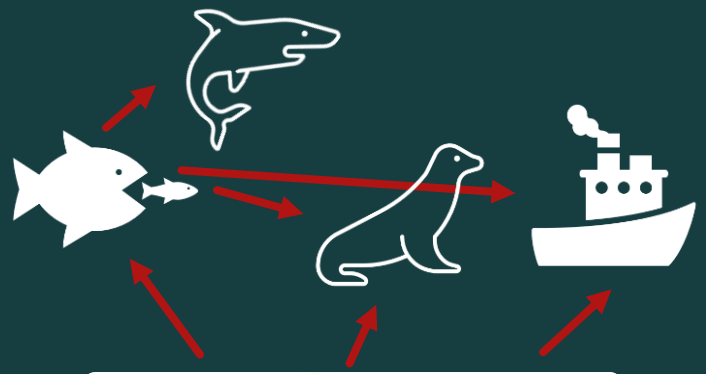
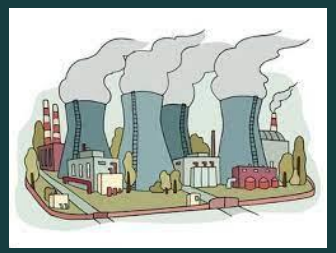


PHYSIOLOGY
condition
spawning

taxonomy

taxonomy



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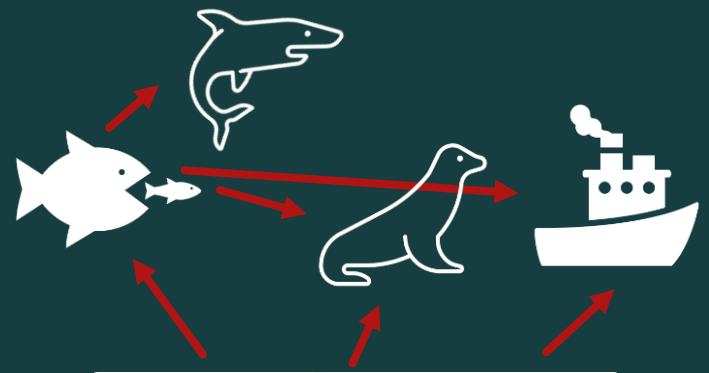

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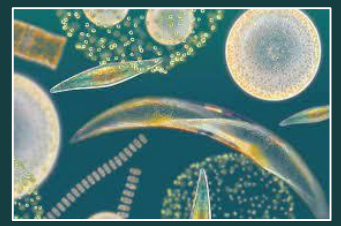

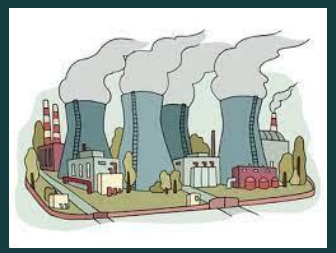

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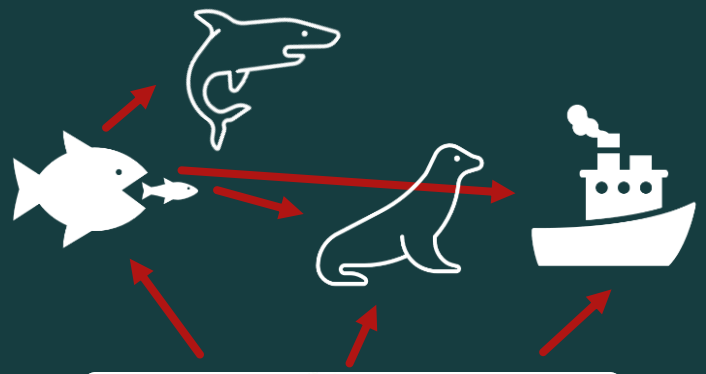
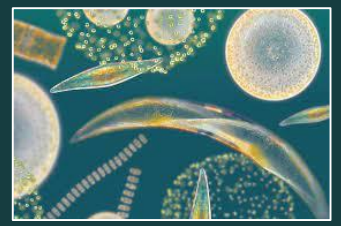


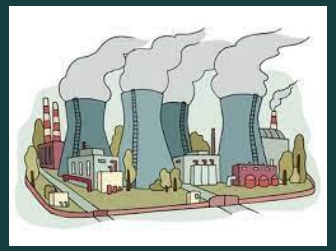
PHYSIOLOGY
condition
spawning

1) Spatial variability in FA profile

taxonomy

taxonomy





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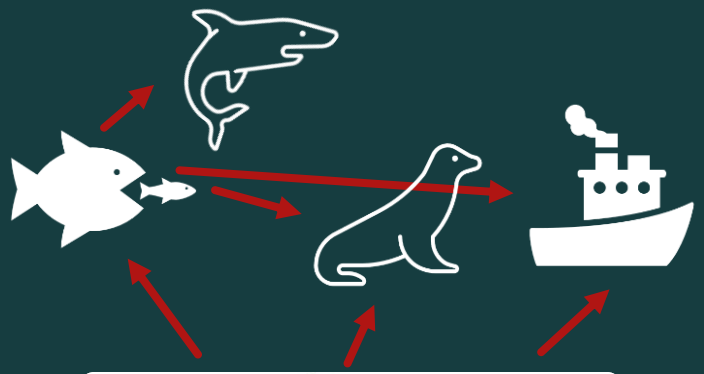

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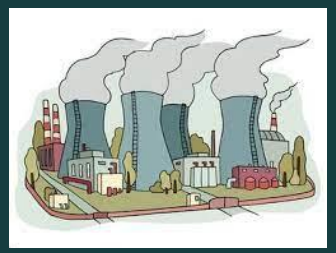
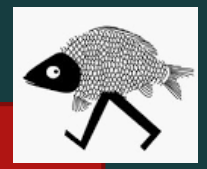


1)

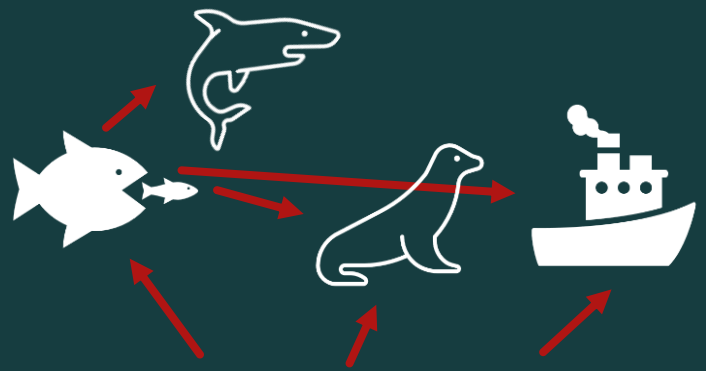
Spatial variability in FA profile



2)

Are small pelagic fish spatial smoothers due to mobility ?!

Essential FA in the marine food web



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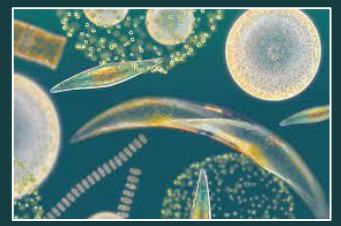

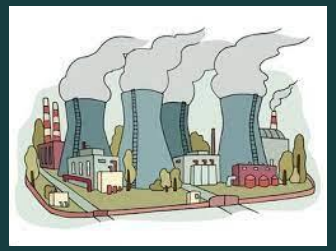

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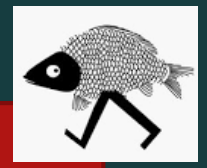
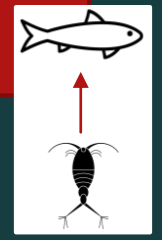


2) Are small pelagic fish spatial smoothers due to mobility ?!

3) How big is the influence of fish physiology on trophic transfer?



SAMPLING & Sample and statistical analysis

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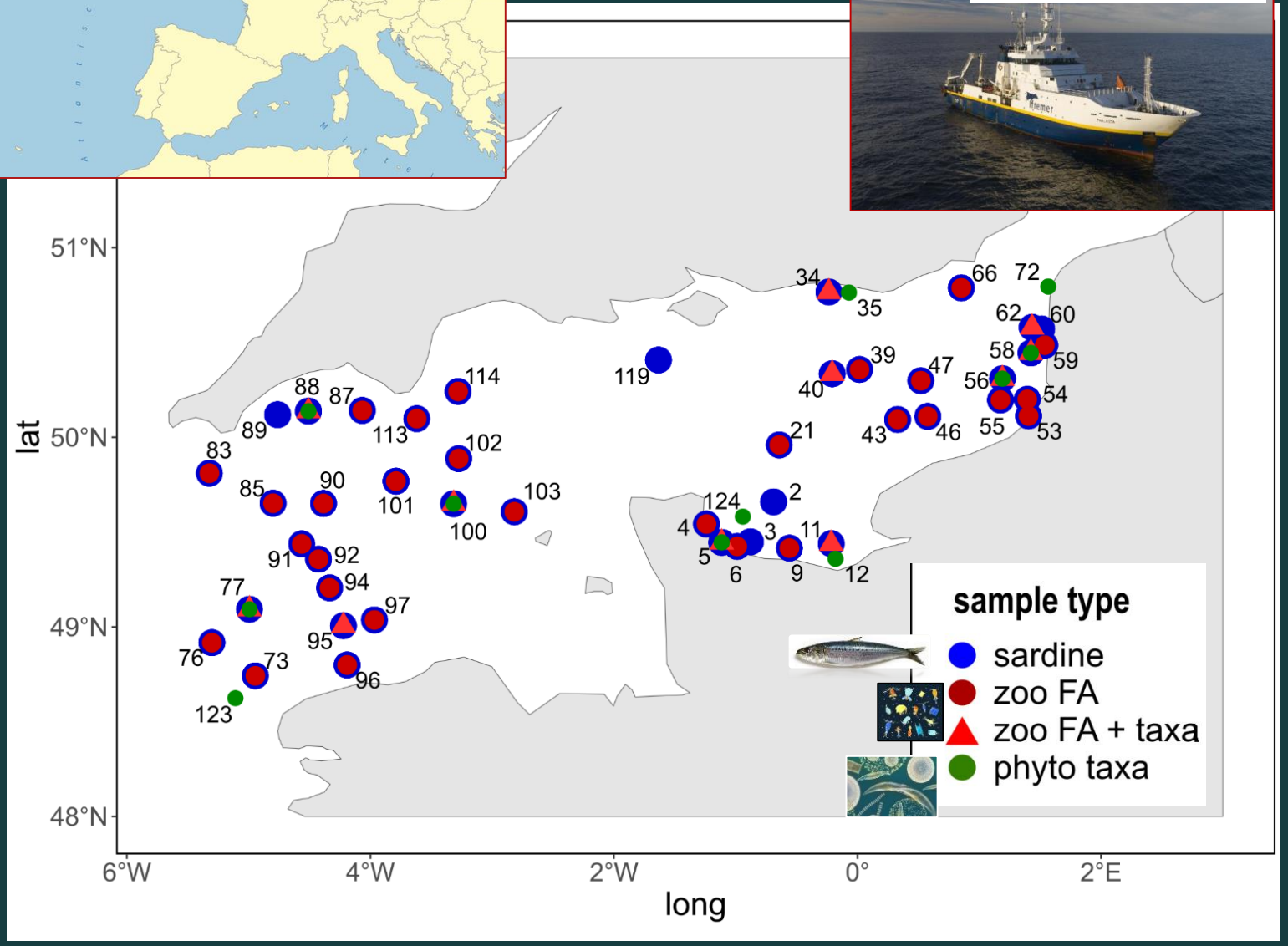

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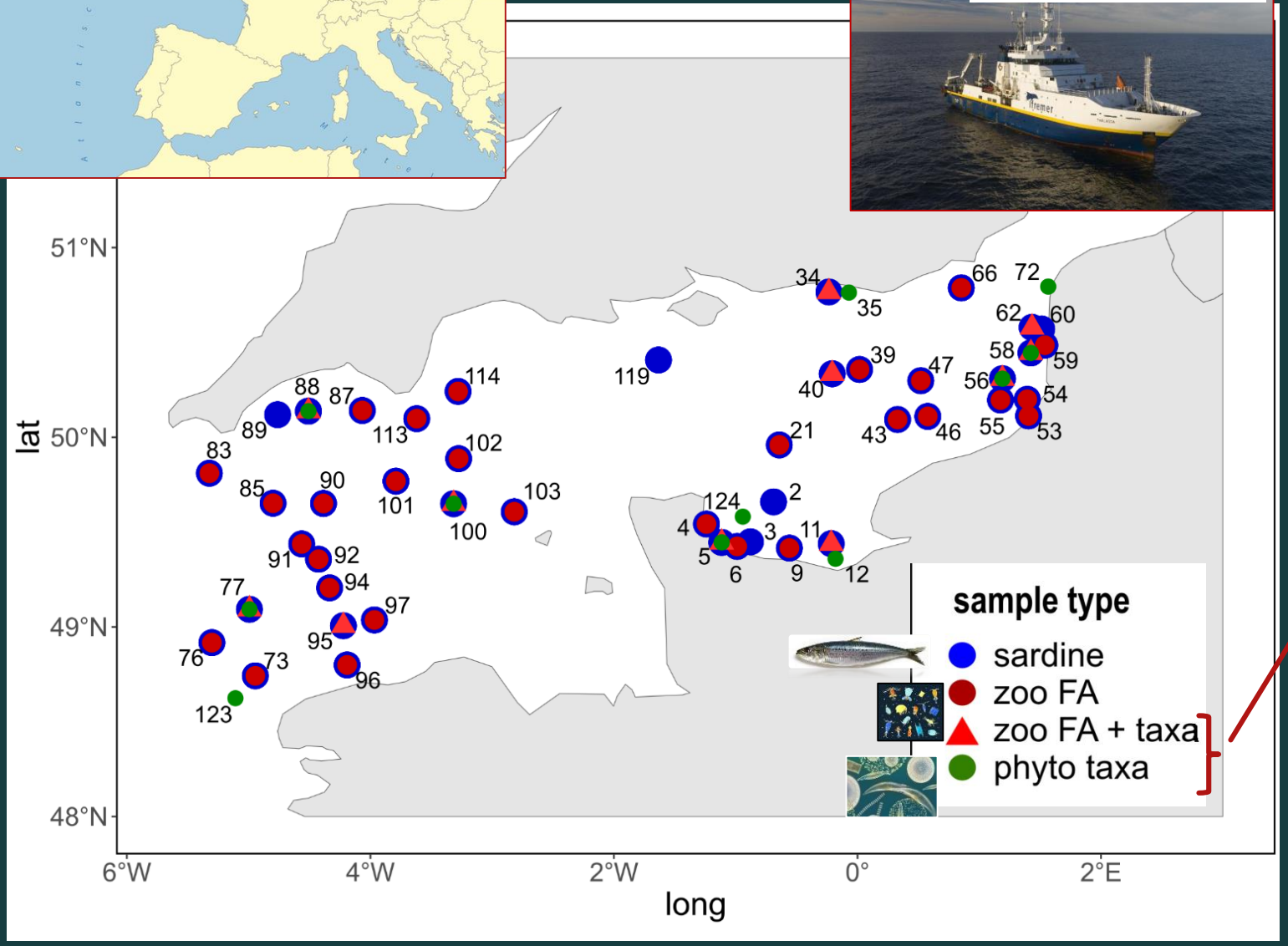
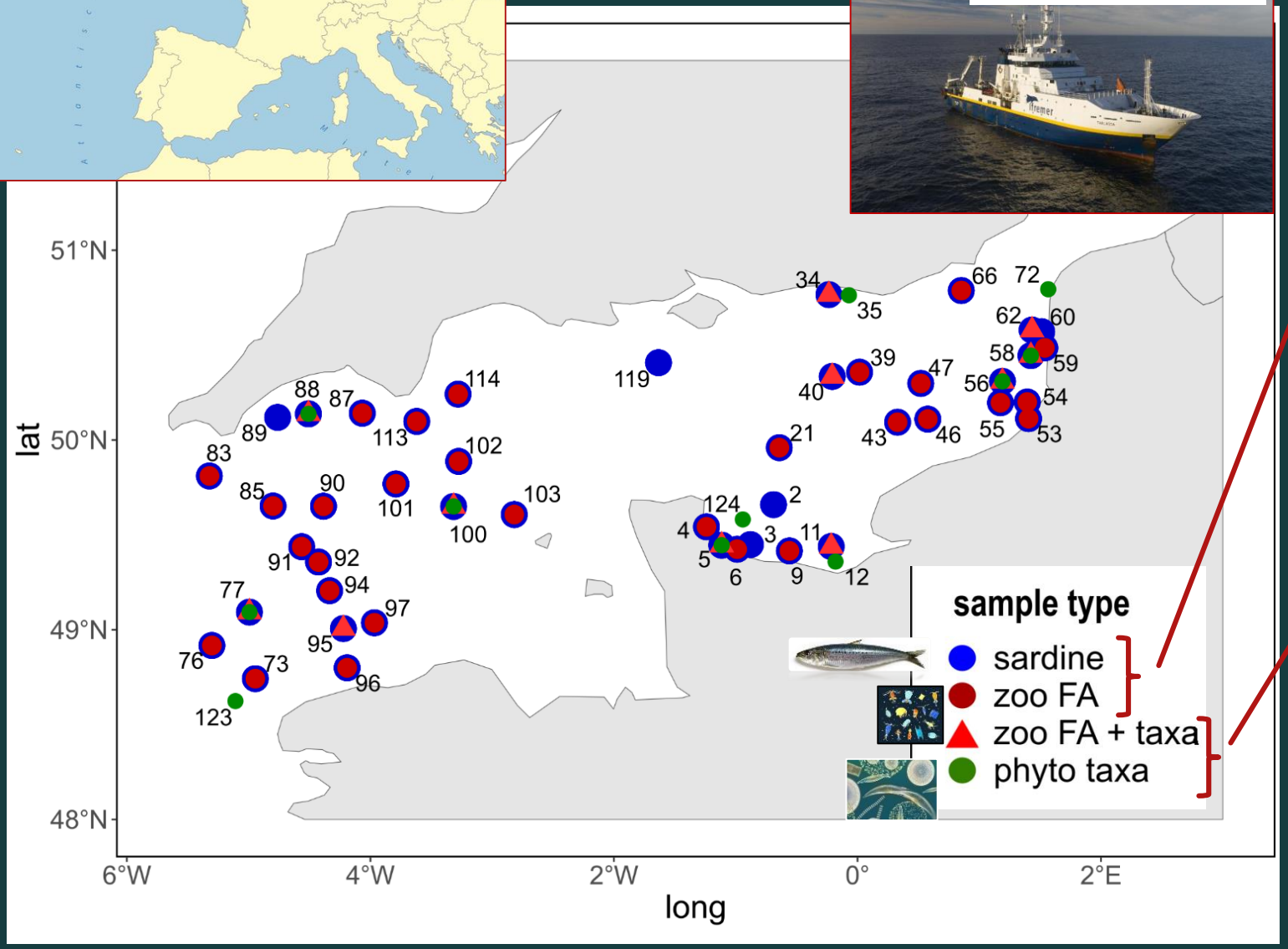


Taxonomy

Phytoplankton
(Flowcam)

Zooplankton
(Zooscan)

SAMPLING & Sample and statistical analysis



Fatty acid analysis

(Gas-chromatography)

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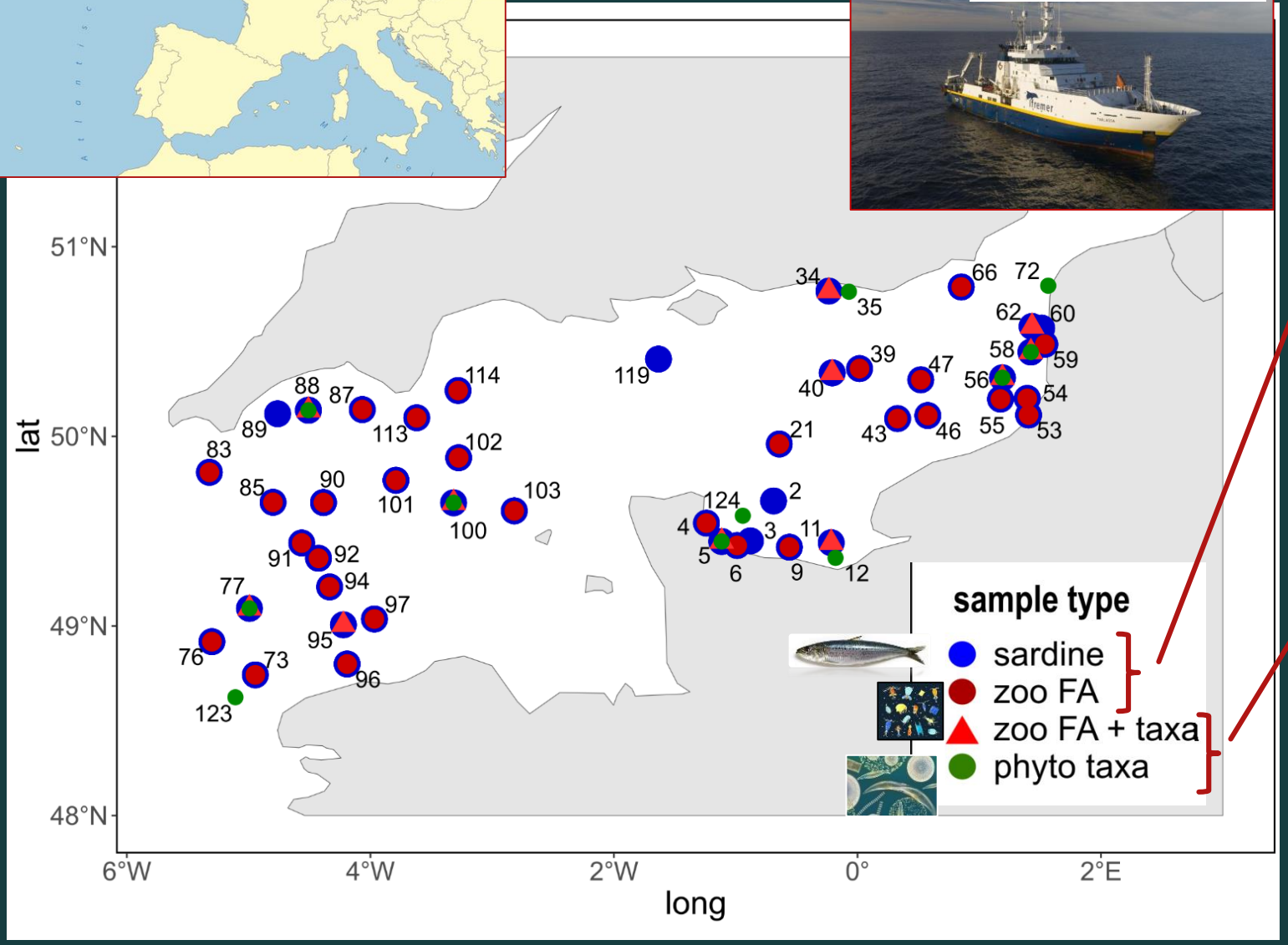


Fatty acid analysis

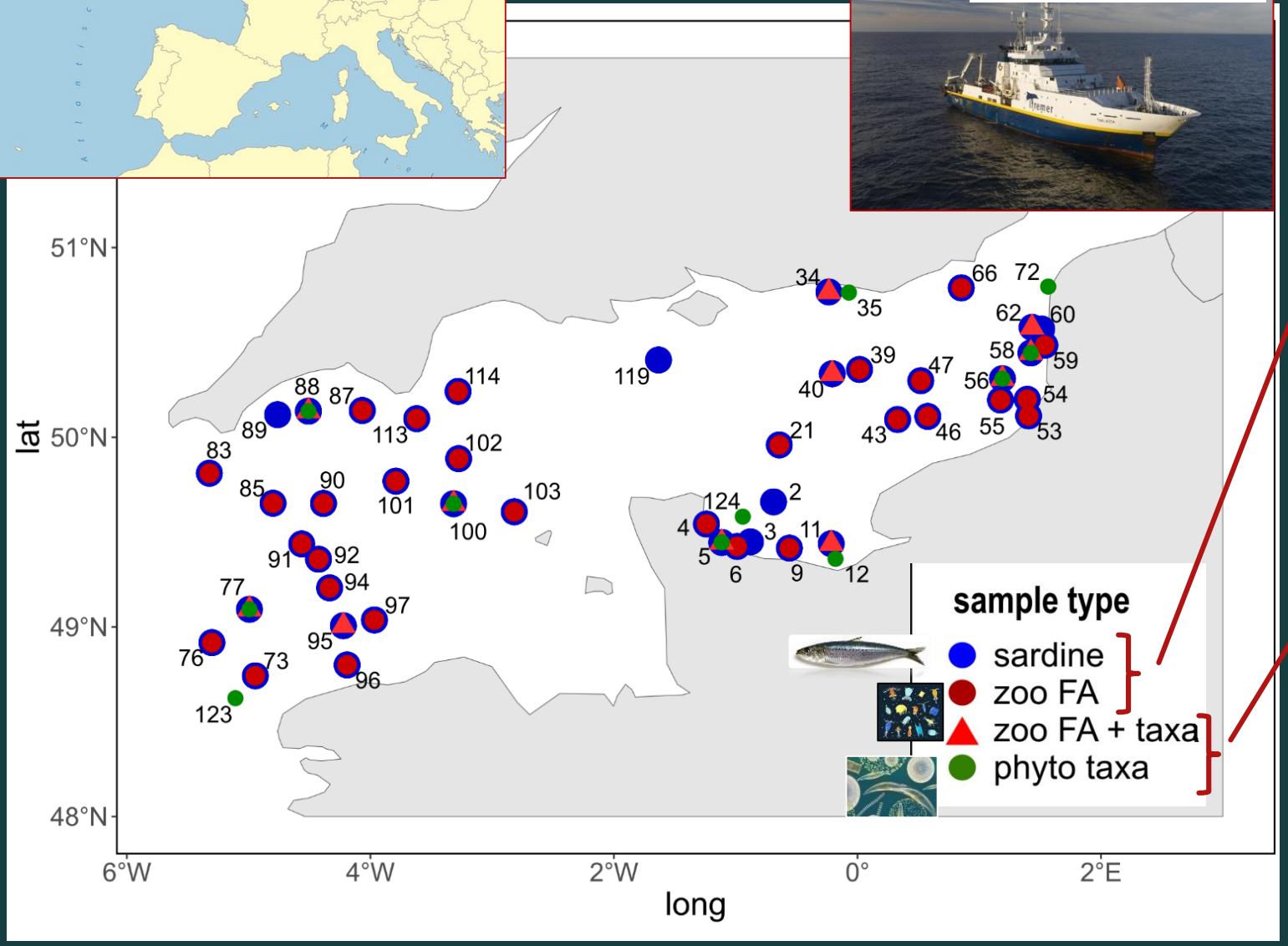
(Gas-chromatography)

Taxonomy

Phytoplankton (Flowcam) → PCA spatial pattern

Zooplankton (Zooscan) → PCA spatial pattern

SAMPLING & Sample and statistical analysis



Fatty acid analysis

(Gas-chromatography) → PCA spatial pattern

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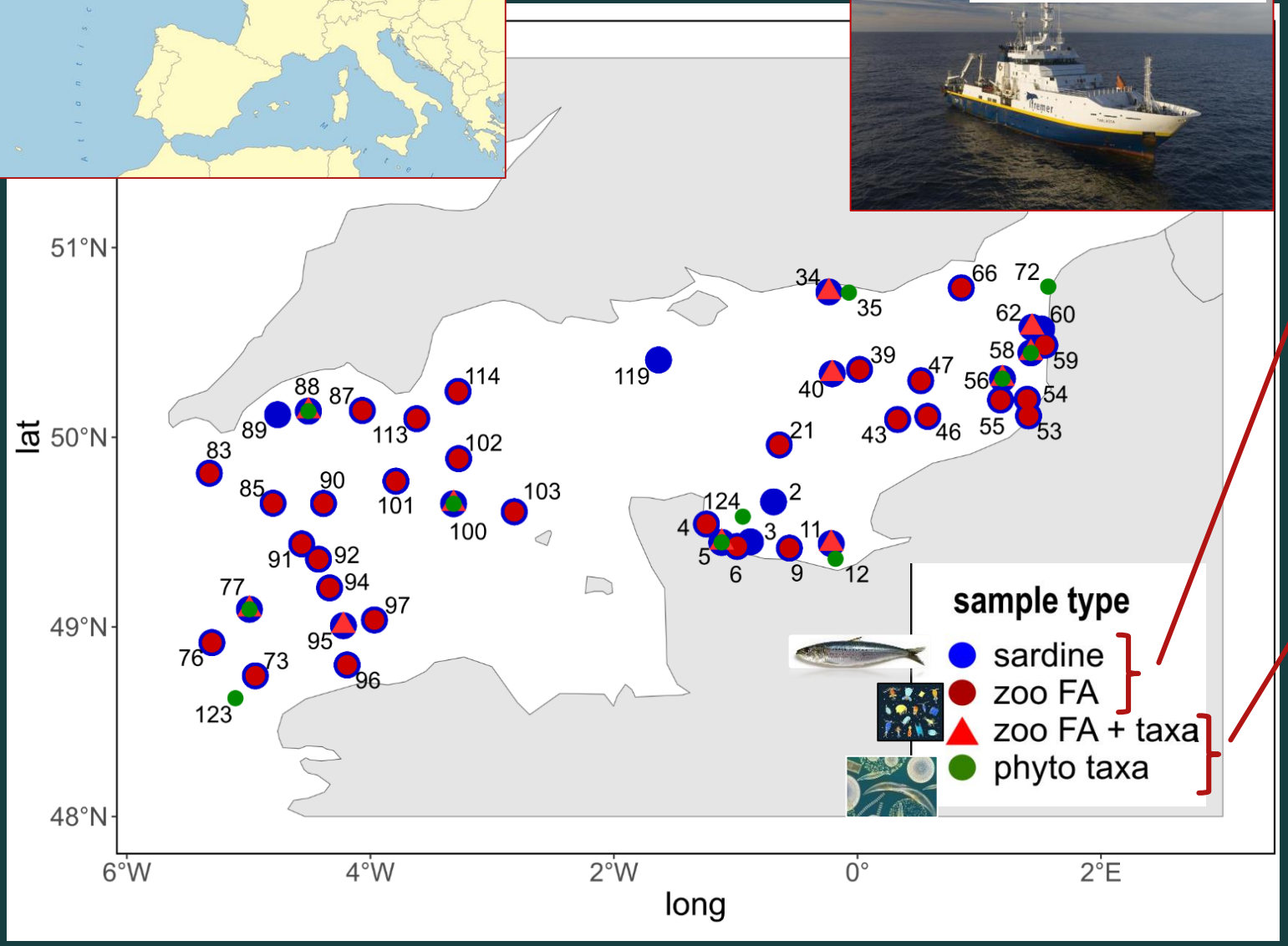
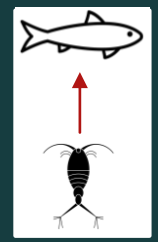


Fatty acid analysis

(Gas-chromatography)

→ PCA spatial pattern



→ GLMM/GAM → Factors influencing FA of sardine

Taxonomy

Phytoplankton (Flowcam) → PCA spatial pattern

Zooplankton (Zooscan) → PCA spatial pattern

Spatial differences: FA profile

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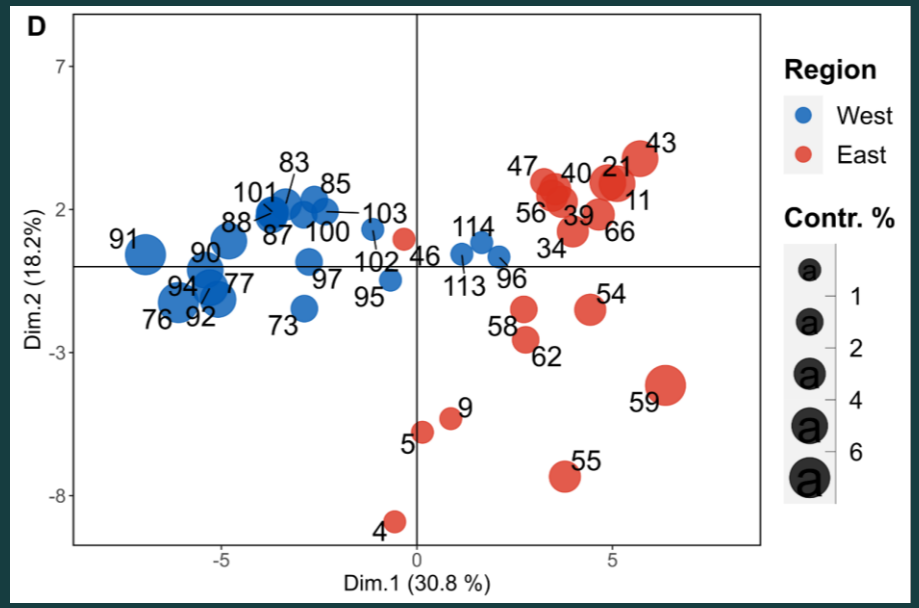

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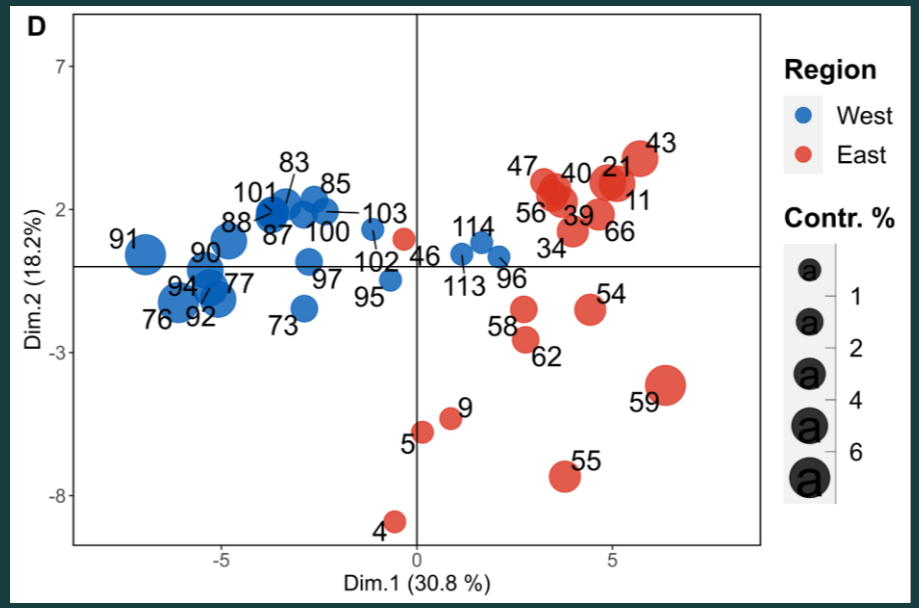
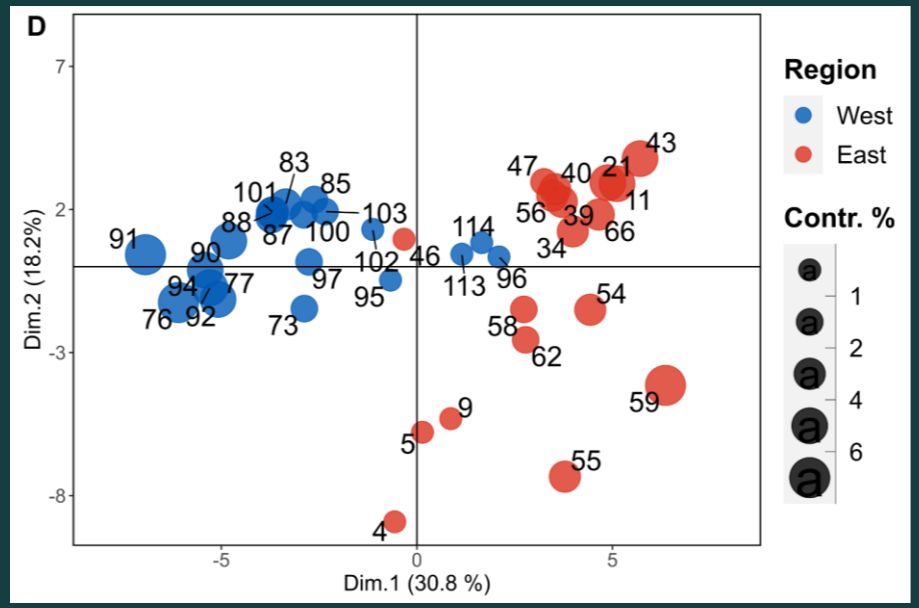


Spatial differences: FA profile



dino-flagellates + *Calanus spp.*

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EPA/DHA

22:1(n-11)

wax esters (µg/mg)

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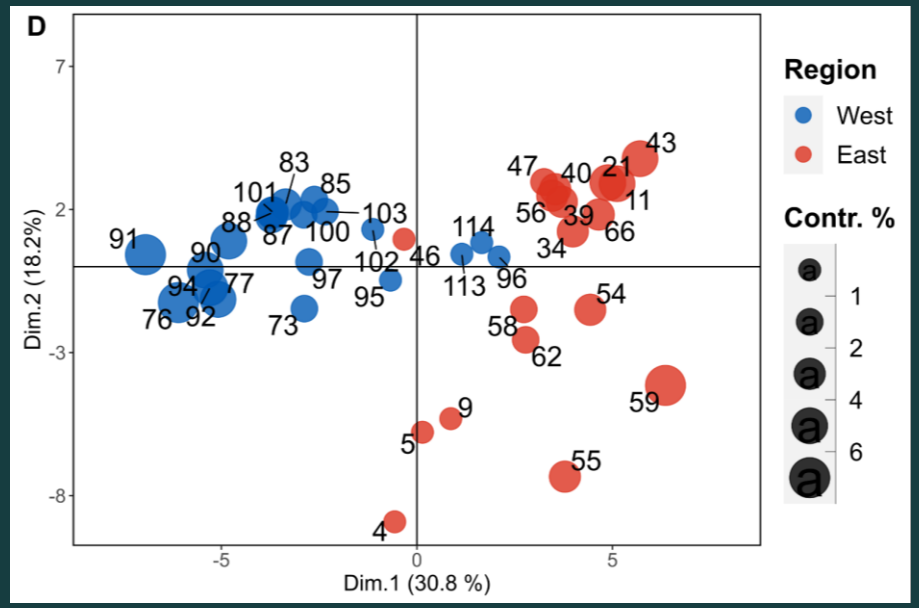

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16:4(n-1)

EPA/DHA

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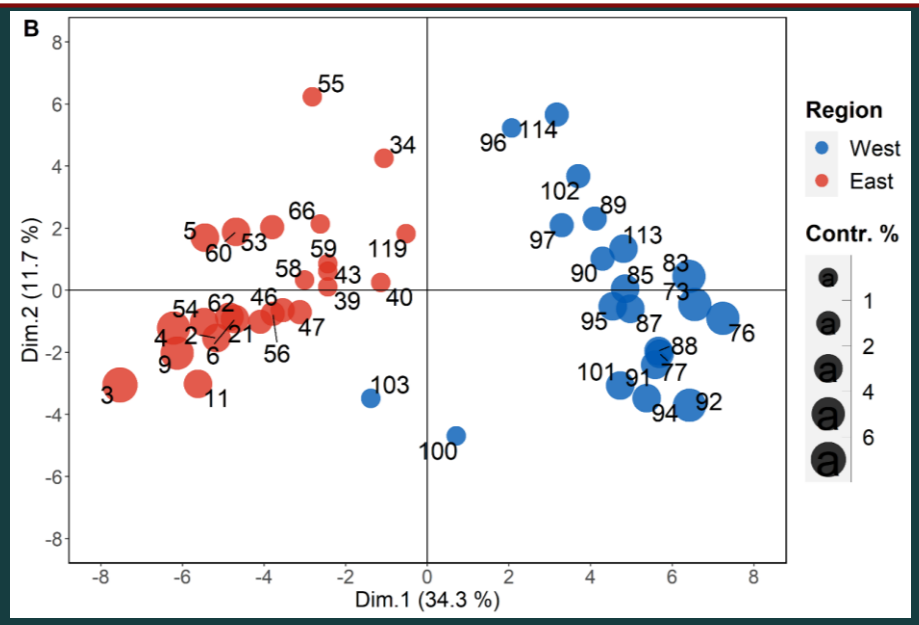
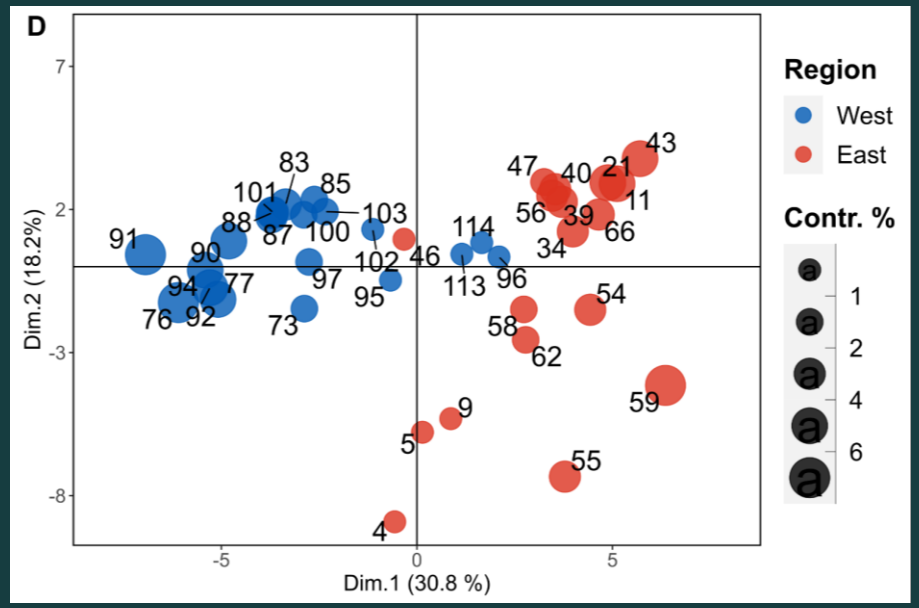
Results & Discussion





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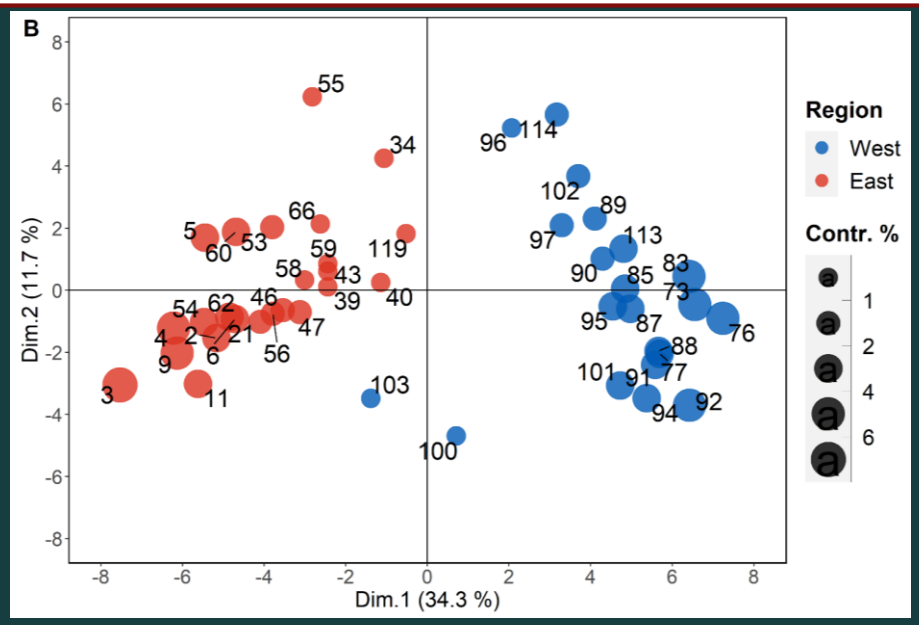

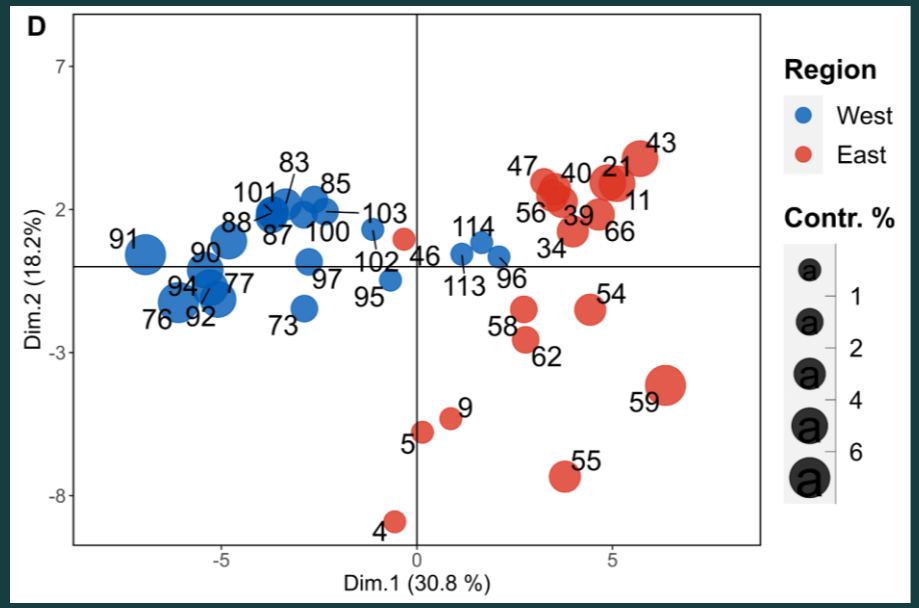

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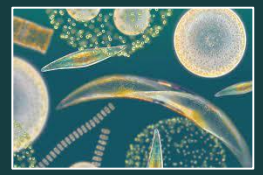

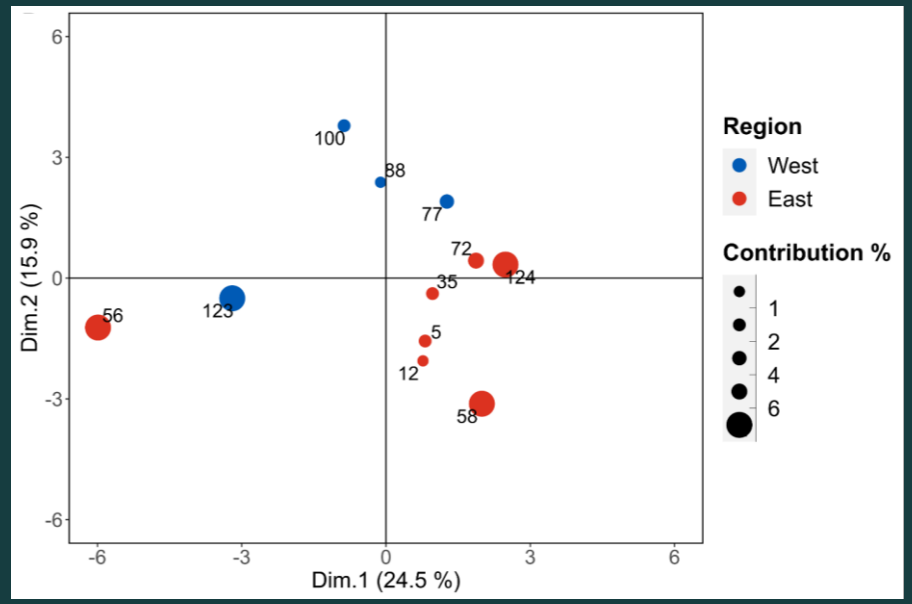

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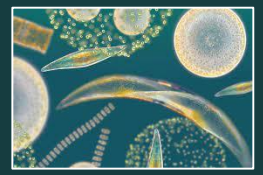

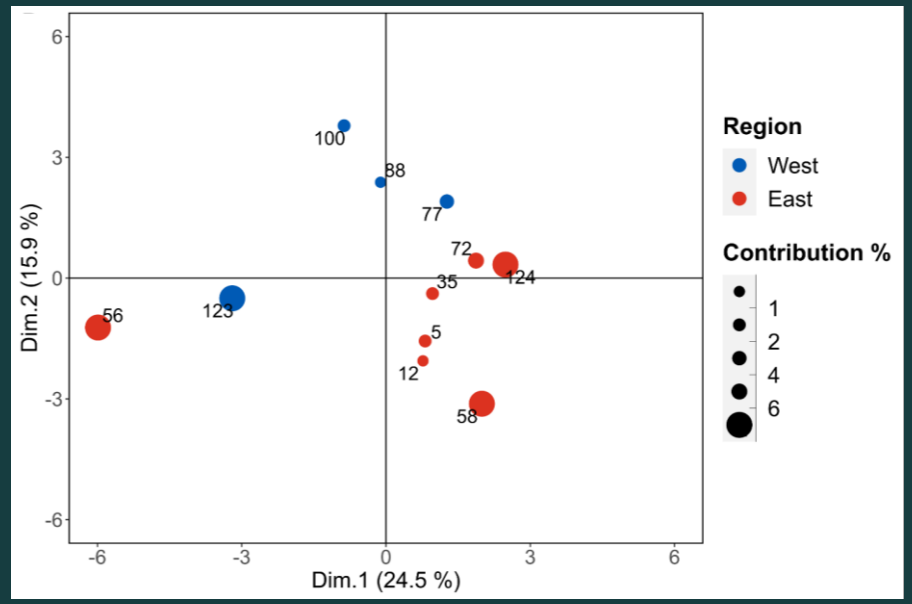

dino-falgellates

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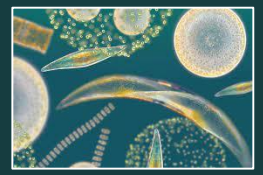

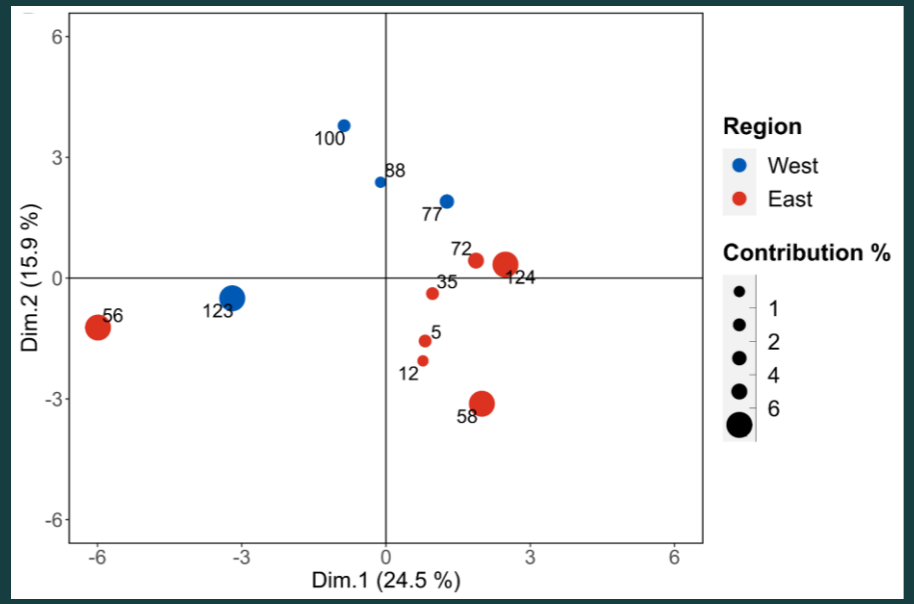

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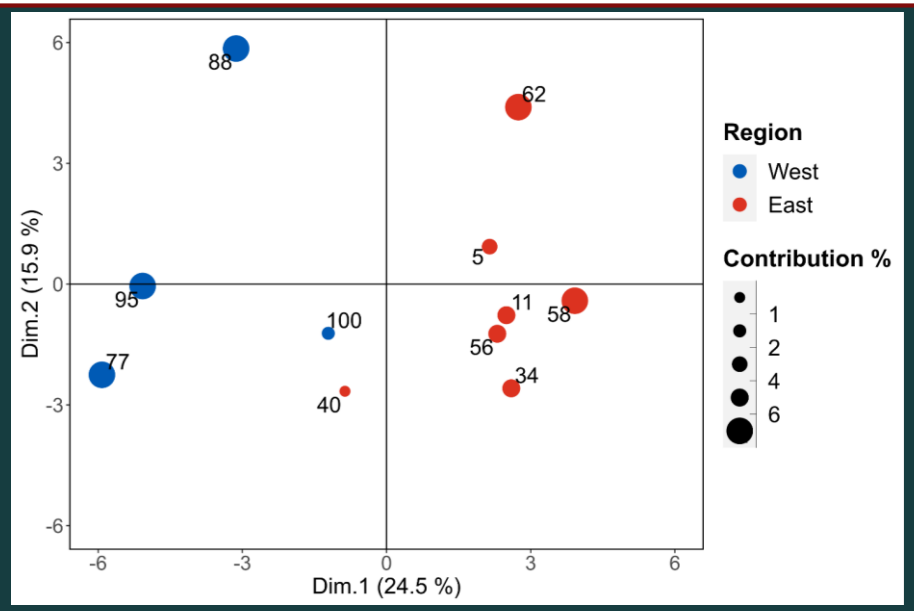

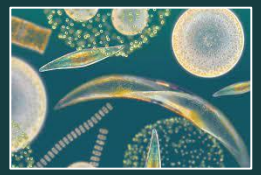

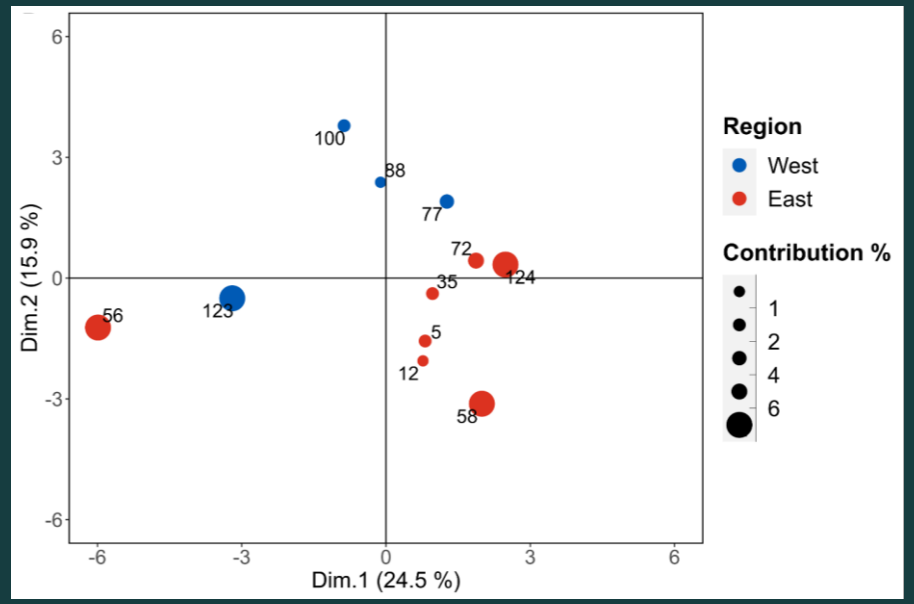

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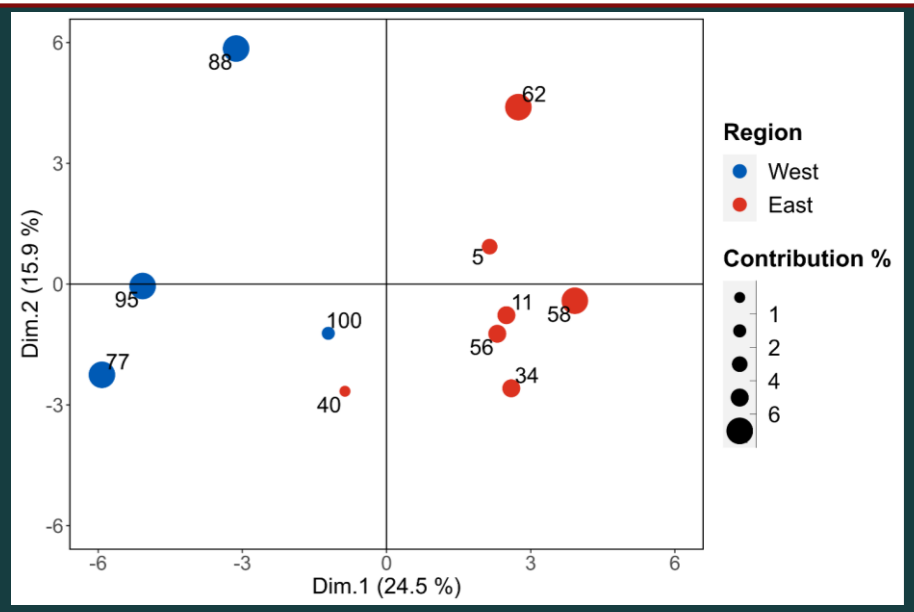
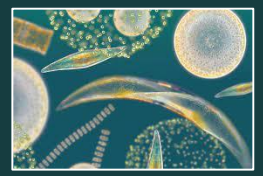
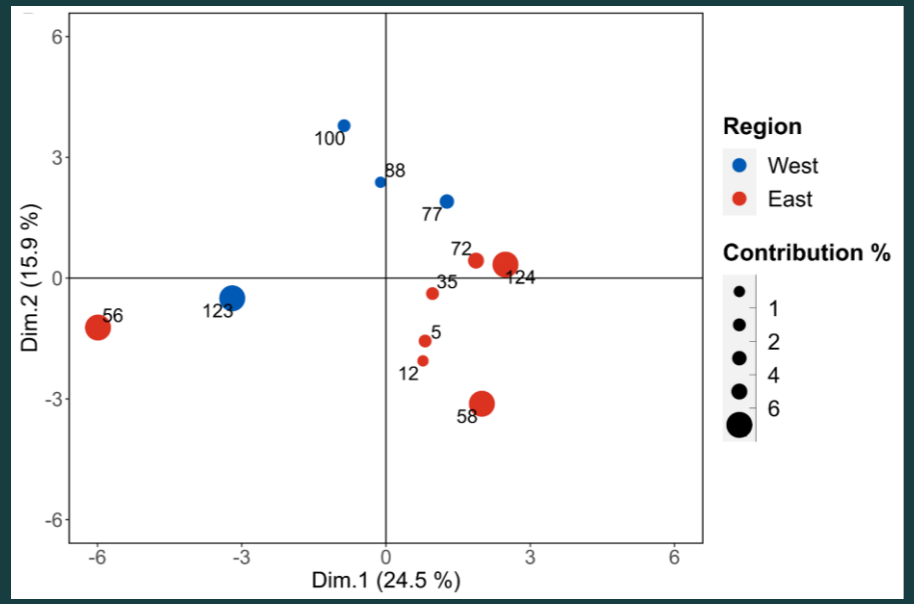


Candacia spp., *Calanus spp.* Euphausiacea





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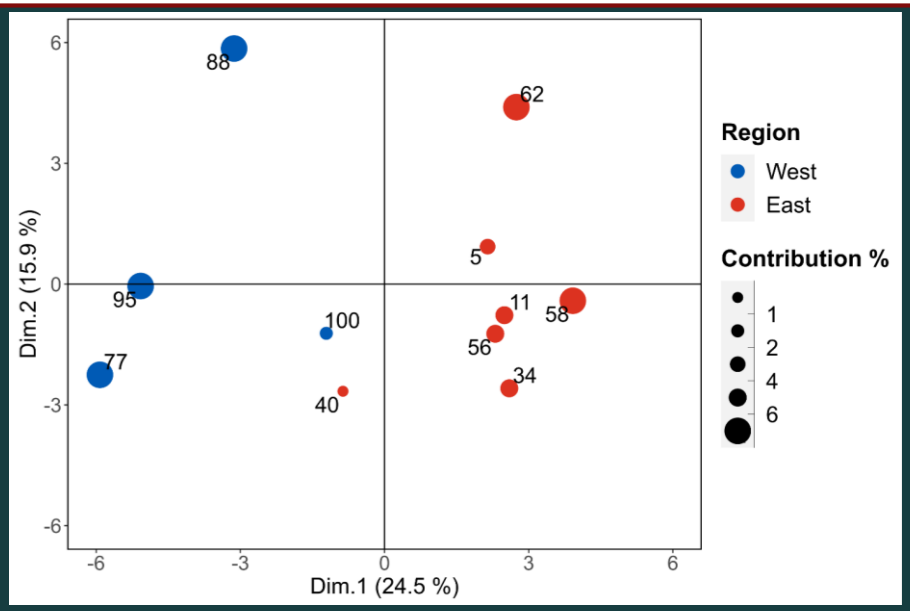
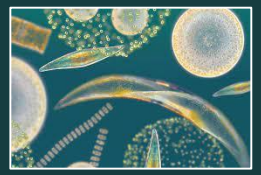
Spatial differences: Taxonomic composition

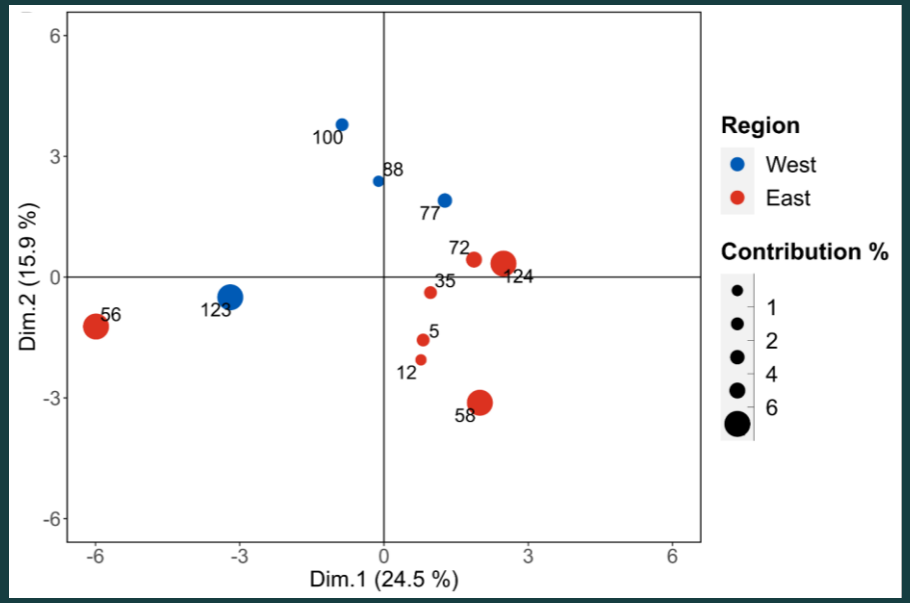
Results & Discussion



Candacia spp., *Calanus spp.* Euphausiacea

Temora longicornis *Acartia spp.*





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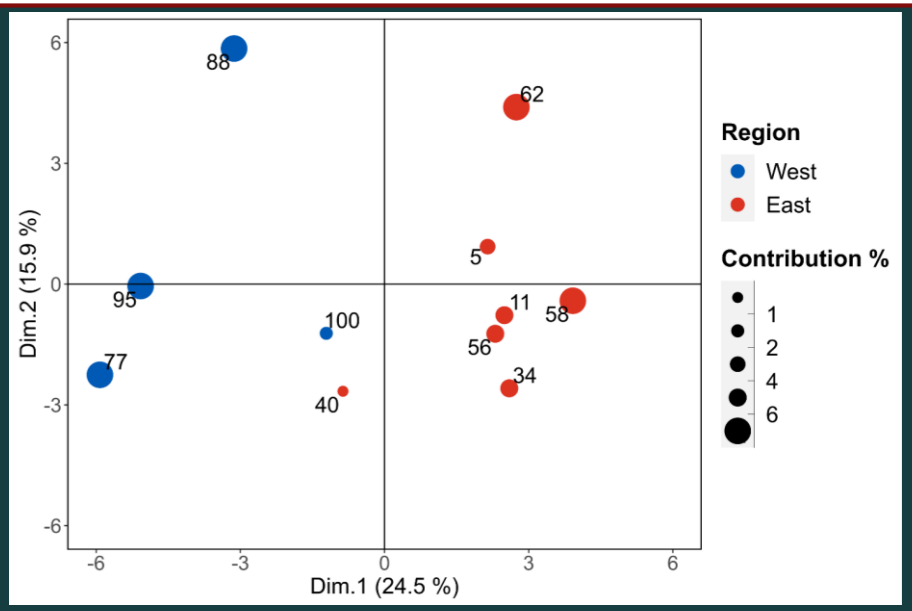

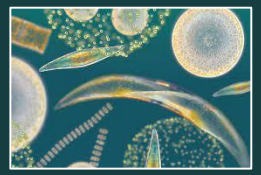

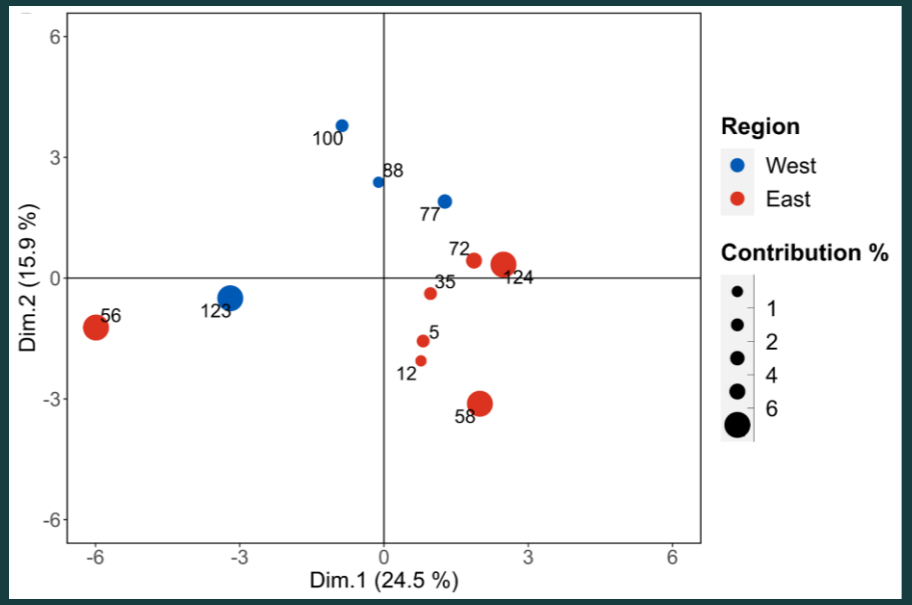

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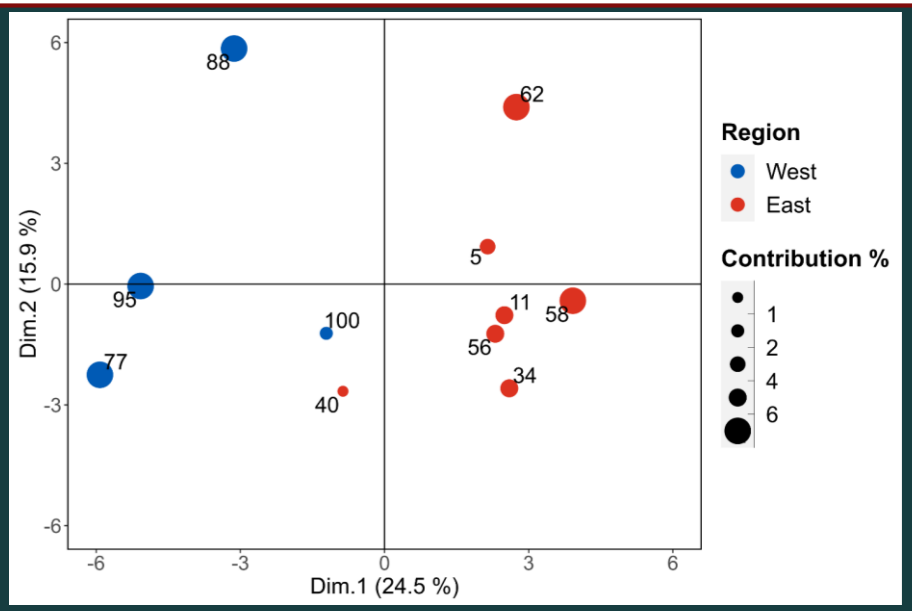

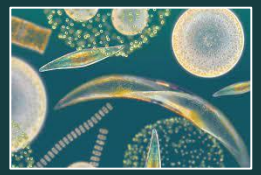

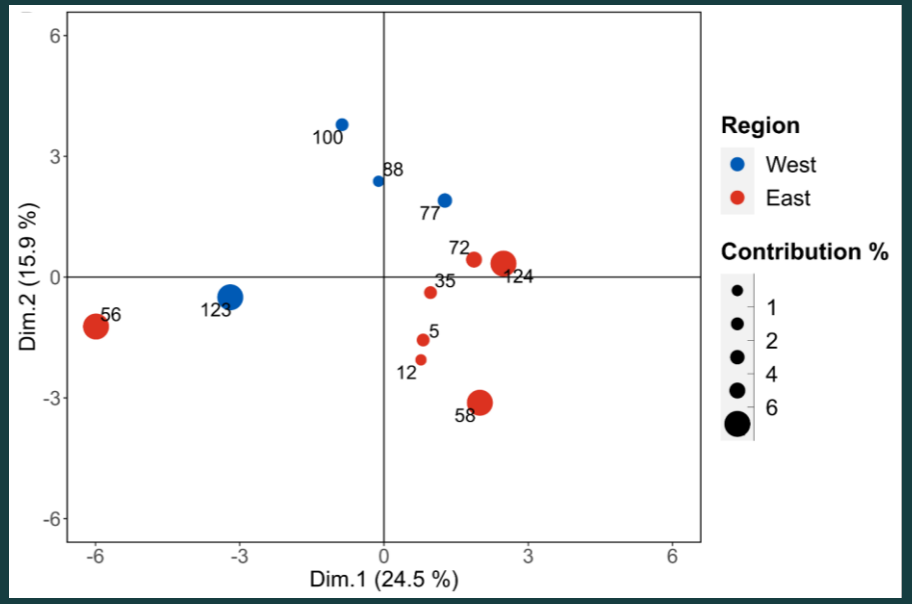

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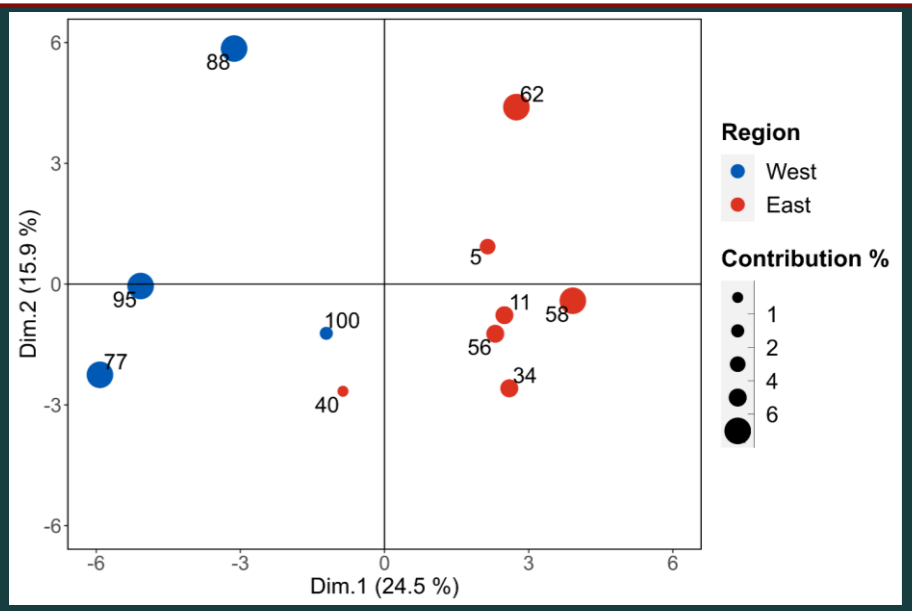

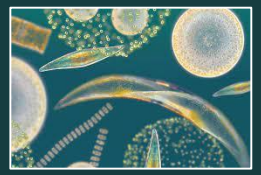

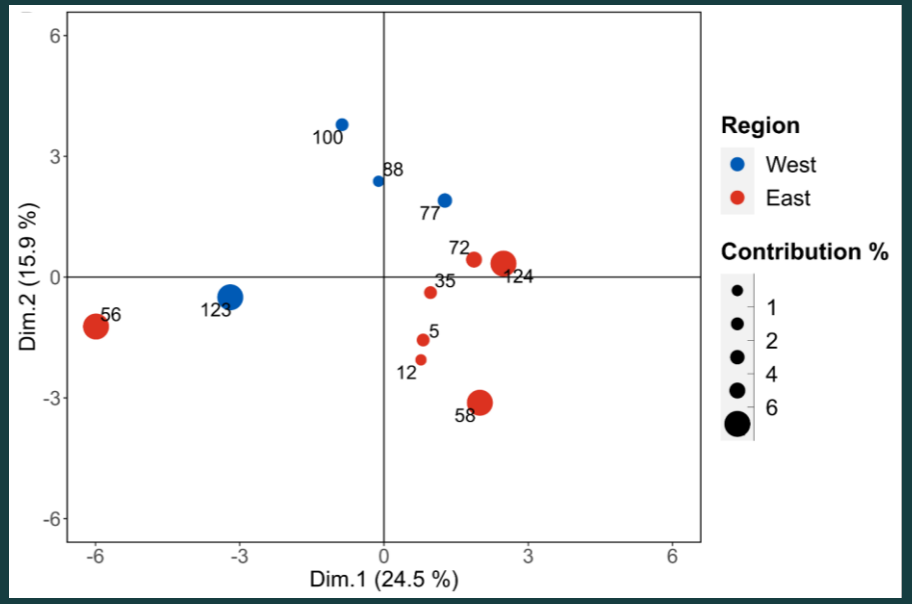

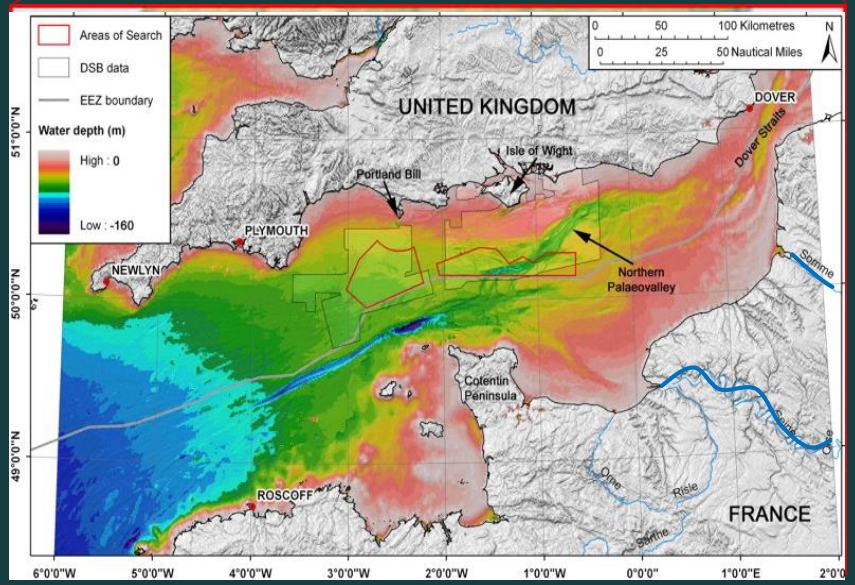

WEC ≠ EEC - trophic bottom-up effect

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1) Spatial variability in FA profile

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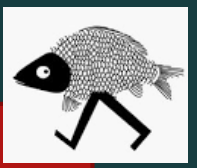

2) Are small pelagic fish spatial smoother due to mobility ?!

WEC ≠ EEC - trophic bottom-up effect

BOTTOM-UP EFFECT

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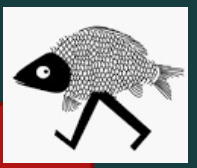

2) Are small pelagic fish spatial smoother due to mobility ?!

3) How big is the influence of biometry in trophic transfer?

?

Influence of fish physiology on trophic transfer

GLMM or GAM
with
beta distribution

Influence of fish physiology on trophic transfer

GLMM or GAM with beta distribution

Sardine FA %

=

Influence of fish physiology on trophic transfer

GLMM or GAM with beta distribution

Sardine FA % = Zooplankton FA % +

Influence of fish physiology on trophic transfer

GLMM or GAM with beta distribution

proxys physiology

Sardine FA %

=

Zooplankton FA %

+

Influence of fish physiology on trophic transfer

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TAG/Sterol

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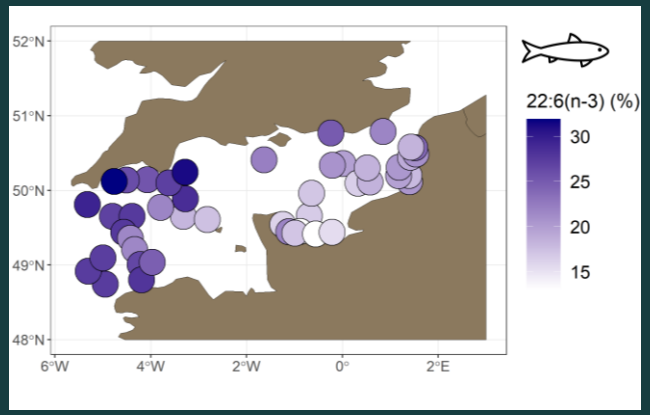
Trophic transfer:

GLMM

sardineDHA = zooDHA + TAG/ST + LeCren + spawning + region

DHA
22:6(n-3)



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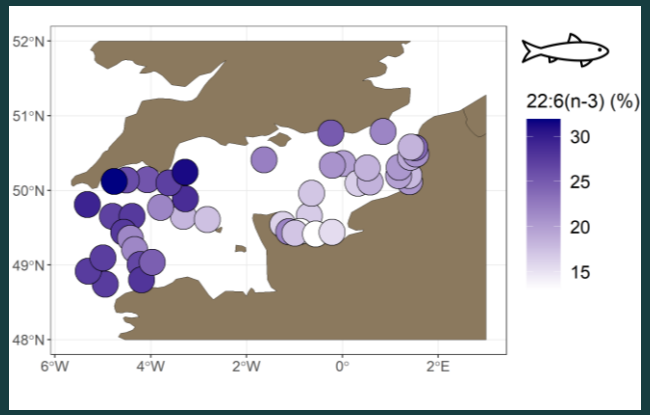

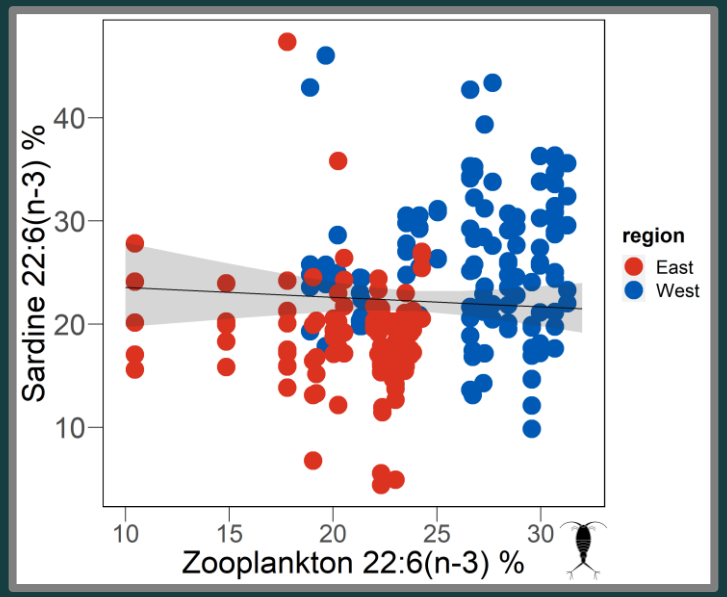

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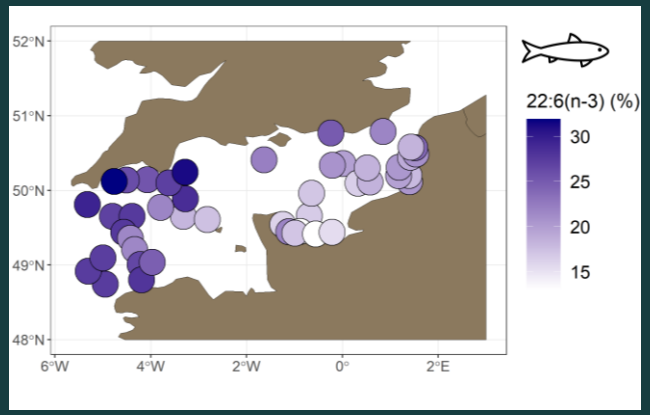

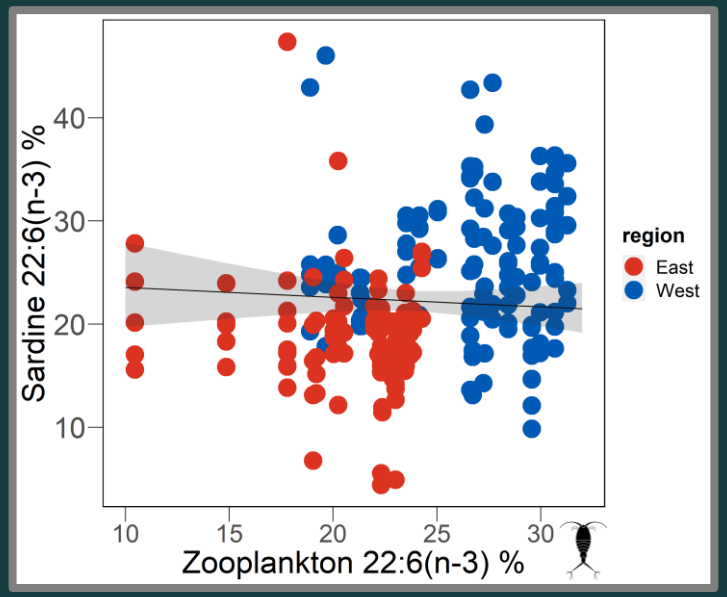

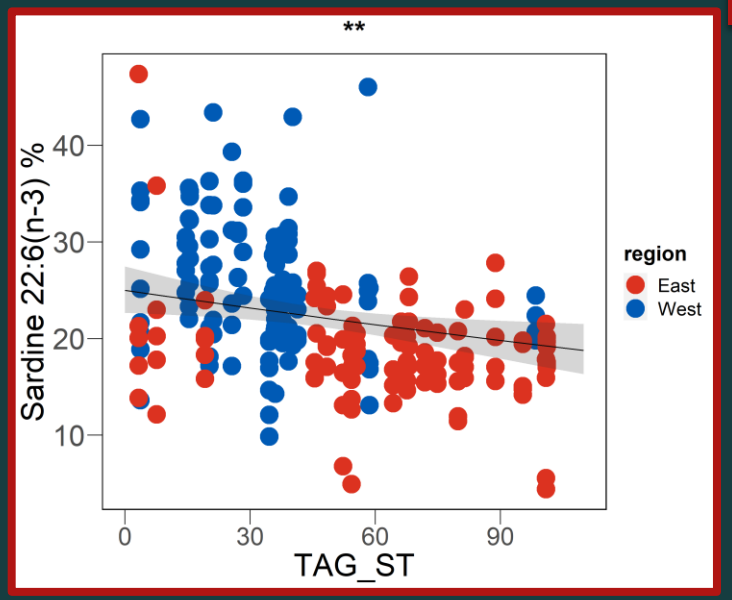

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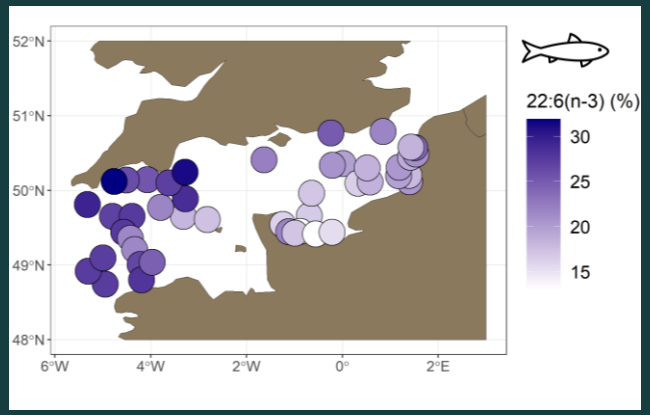

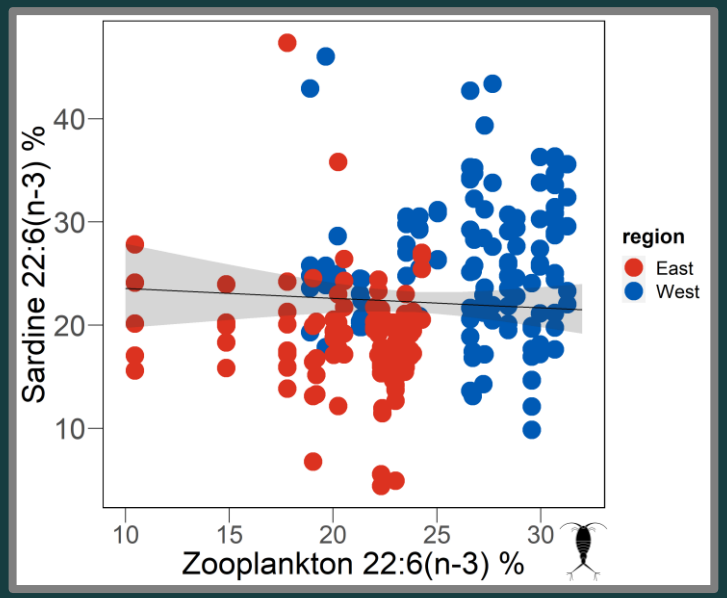

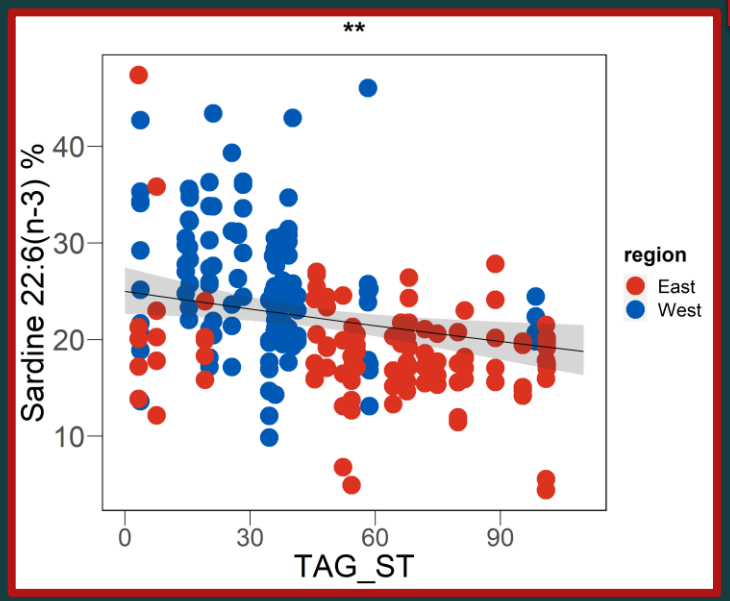

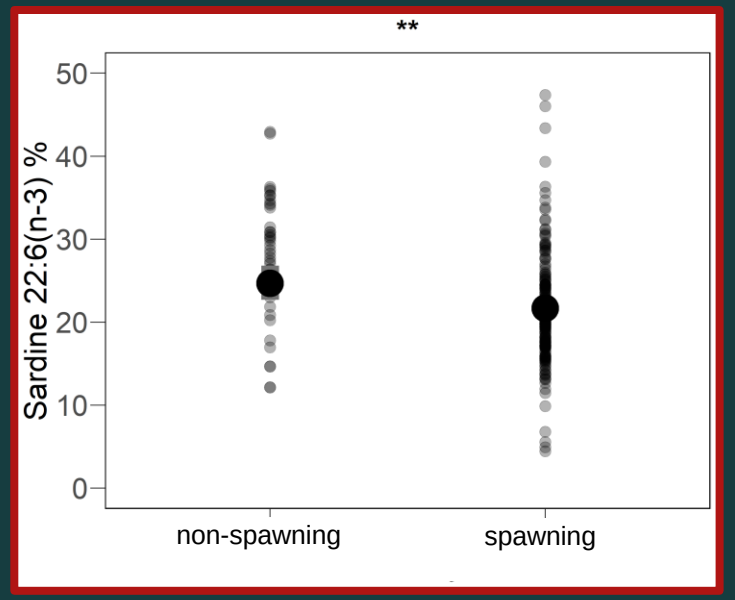

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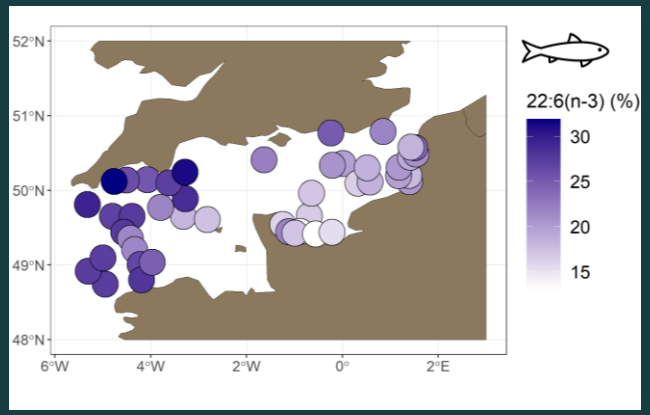

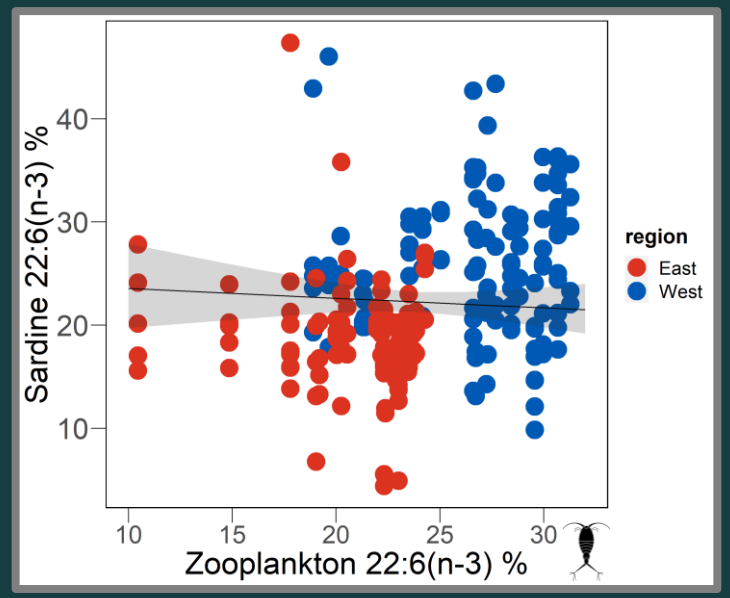

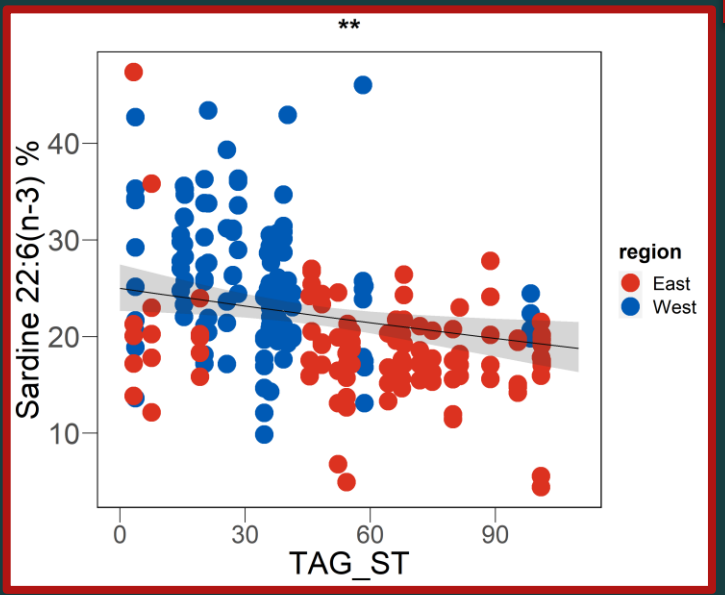

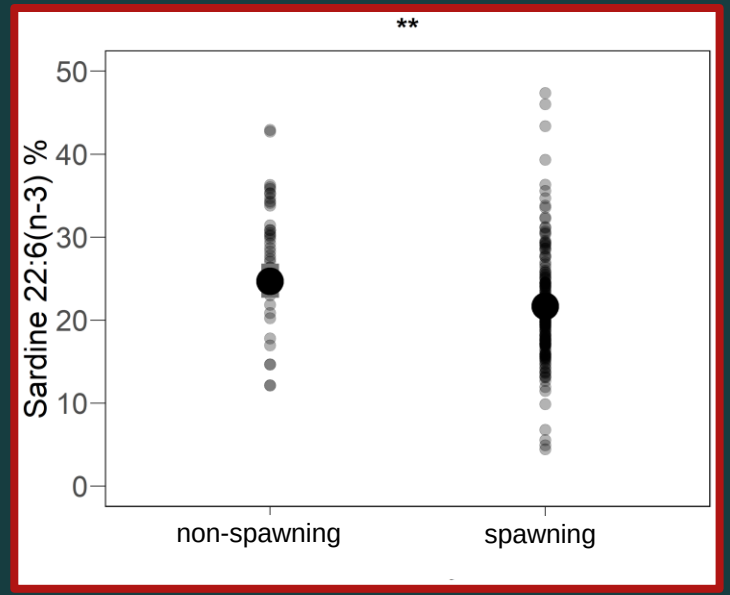

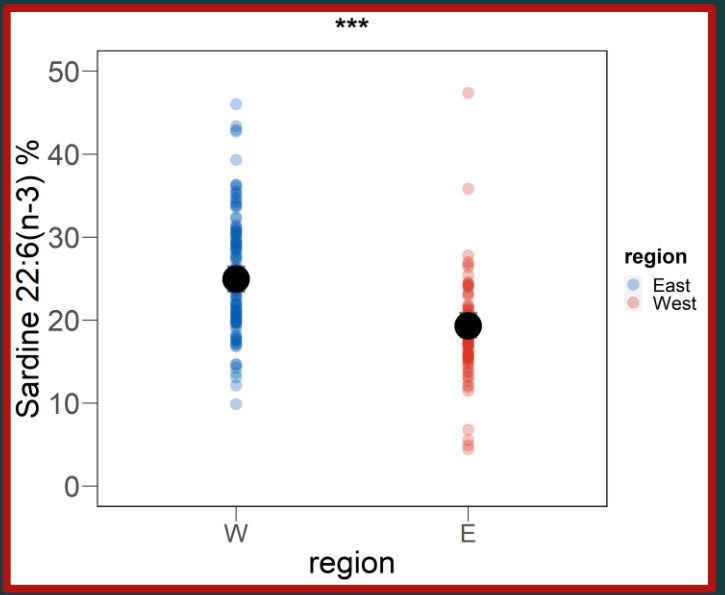

Trophic transfer:

GAM

sardineEPA = zooEPA + TAG/ST + LeCren + spawning + region

Results & Discussion

EPA
20:5(n-3)

Trophic transfer:

GAM

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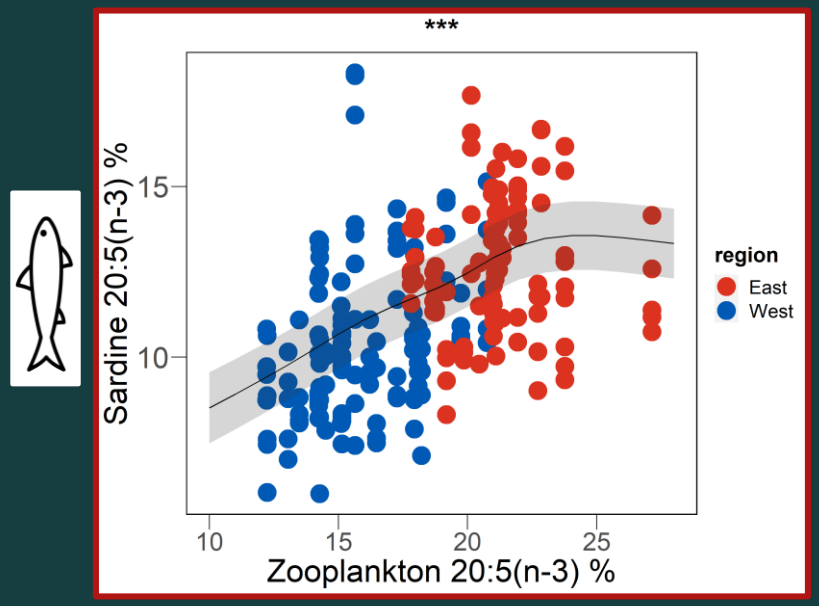
EPA 20:5(n-3)



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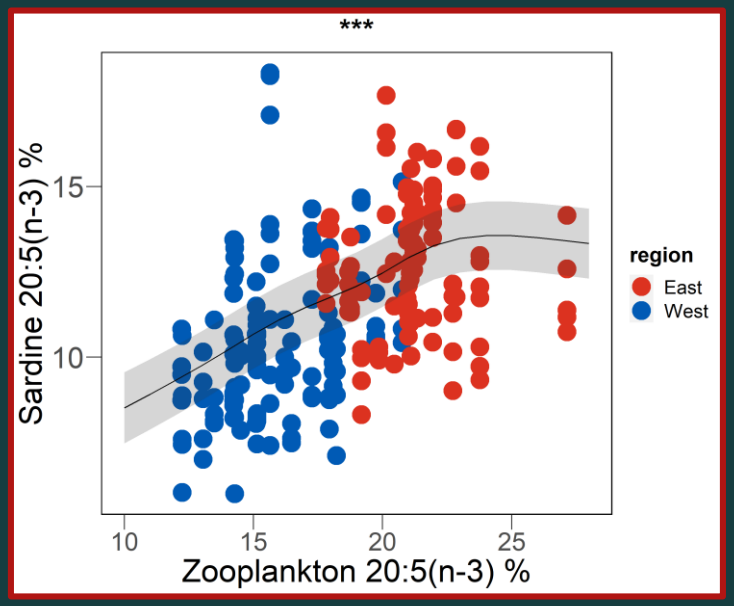
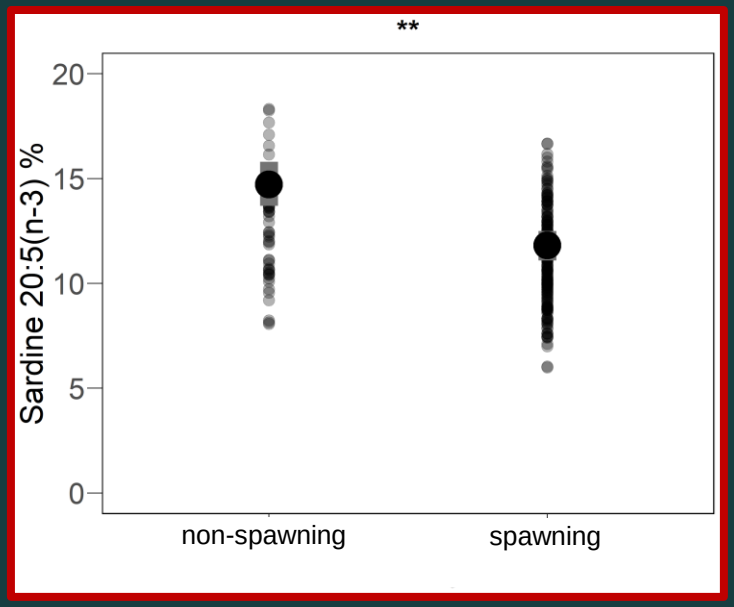
EPA 20:5(n-3)





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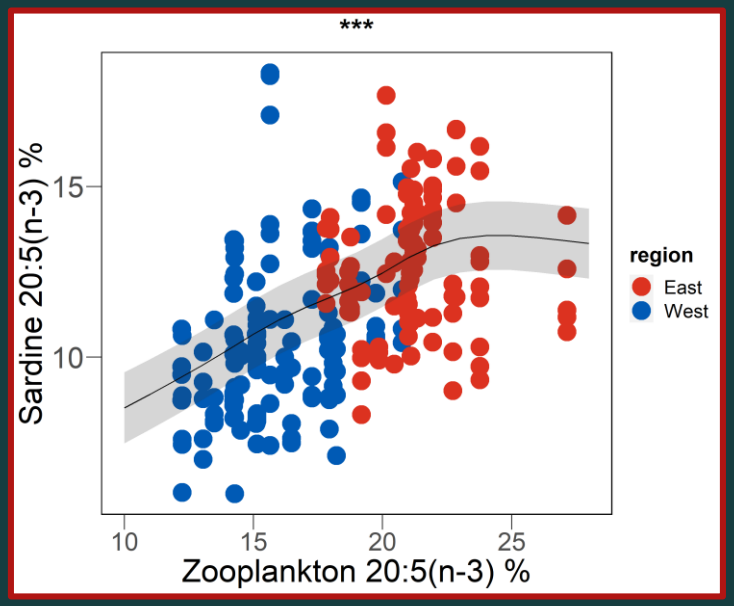
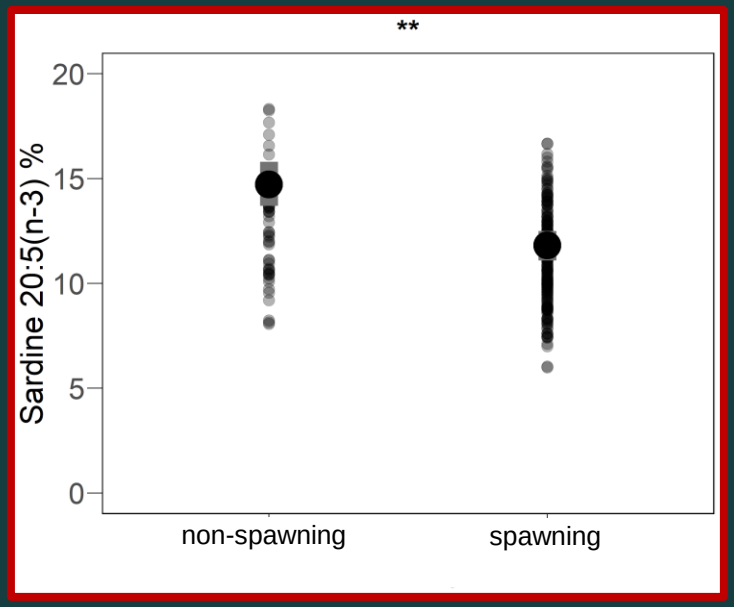
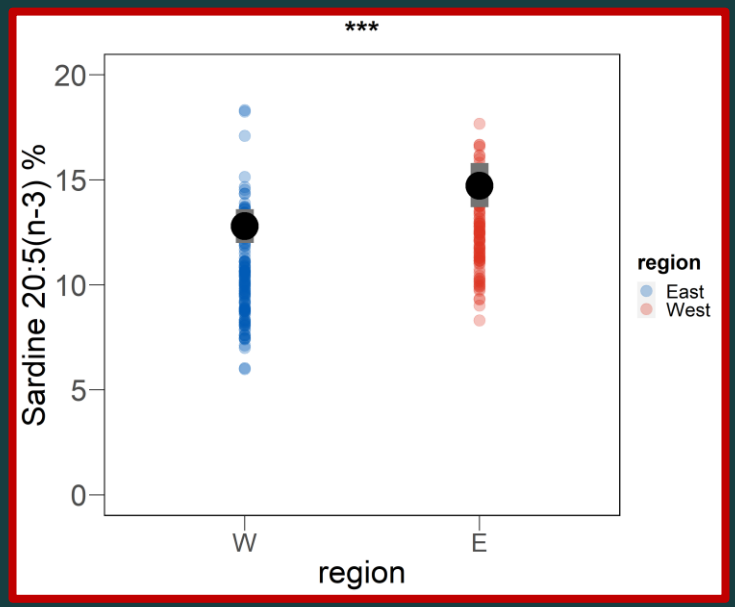
Results & Discussion

EPA 20:5(n-3)



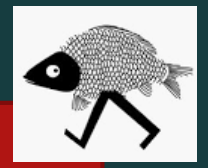




Conclusion

1) Spatial variability in FA profile

2) Are small pelagic fish spatial smoother due to mobility ?!



BOTTOM-UP EFFECT

Conclusion

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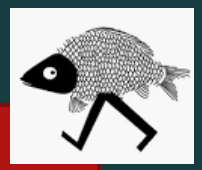

3) physiology

BOTTOM-UP EFFECT

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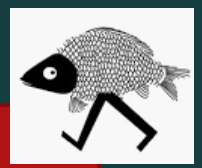

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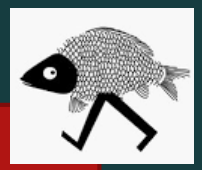
BOTTOM-UP EFFECT

Conclusion

1) Spatial variability in FA profile



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BOTTOM-UP EFFECT

3) physiology

PERSPECTIVES

FA phytoplankton

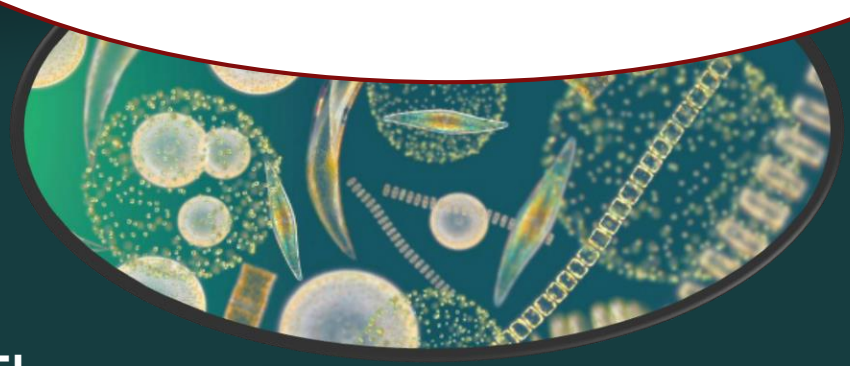
stable isotope multi-tissue

several years

all seasons

Thank you for your attention!

Questions?



I am searching a post-doc position for beginning of 2025!

Carolin.Neven@ifremer.fr

Thank you!
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