

➤ Environmental integration of a H₂ production at sea

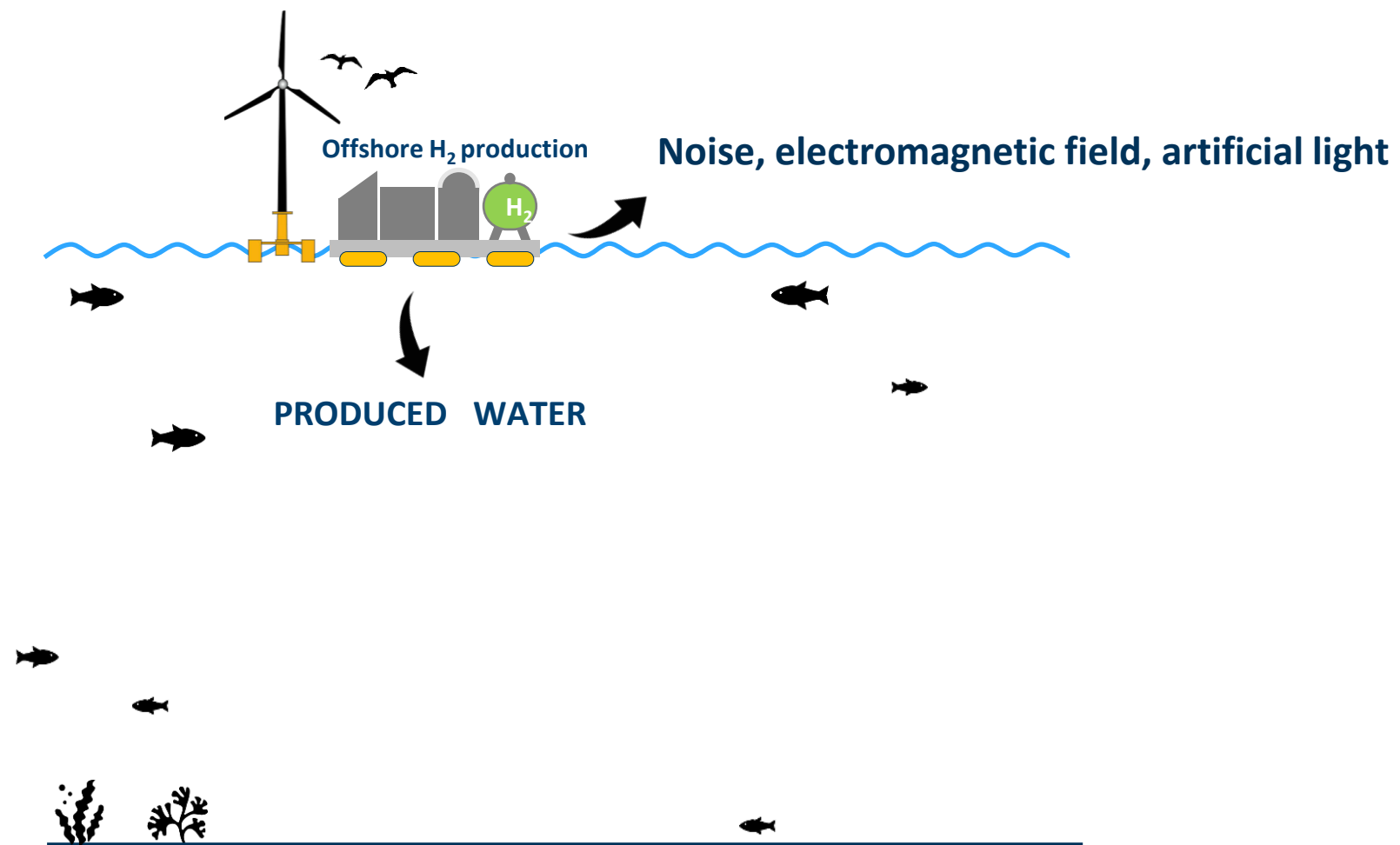
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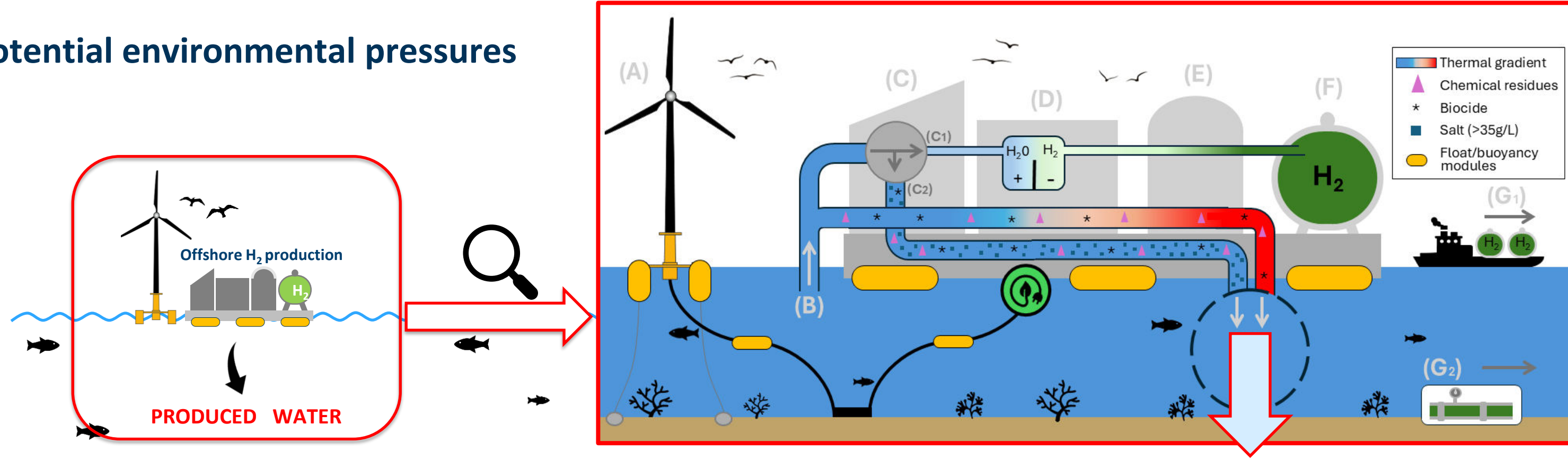
Potential environmental pressures



Adapted from Dussauze *et al.*, 2026

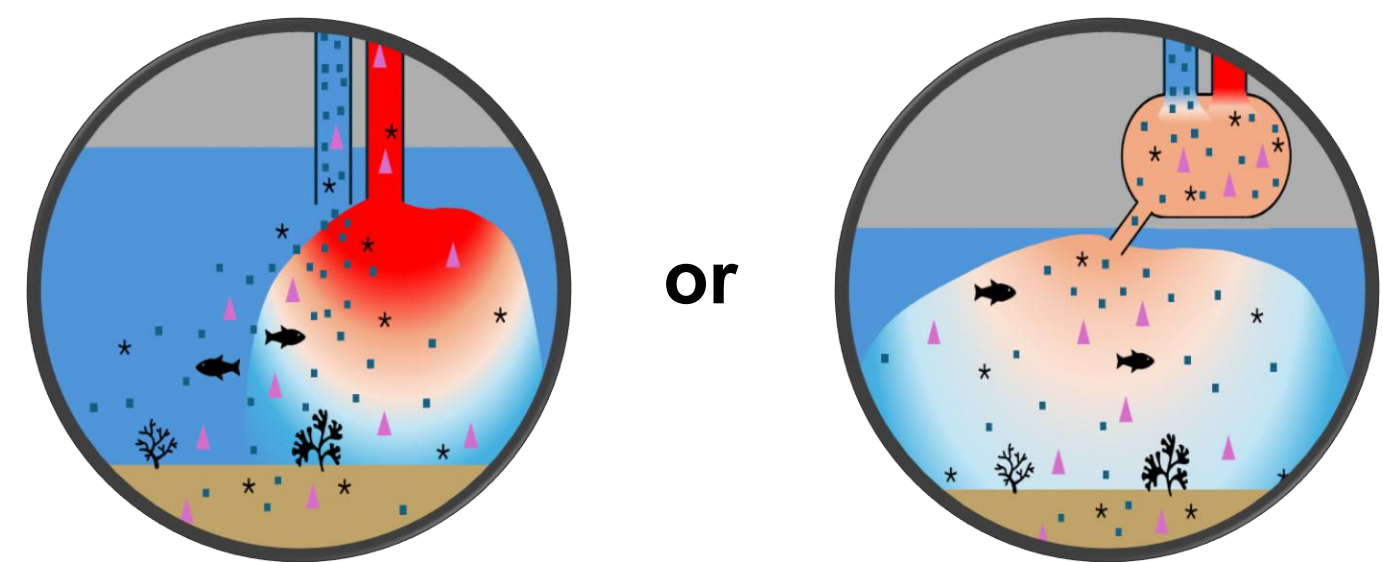
Context : Identify the environmental pressures related to offshore H₂ production

Potential environmental pressures



- (A) Floating offshore wind farm ;
- (B) Seawater intake ;
- (C) Desalinisation station ;
- (D) H₂ production by water electrolysis ;
- (E) H₂ compressor ;
- (F) H₂ storage ;
- (G) H₂ transports ;
- (H) Produced water discharge.

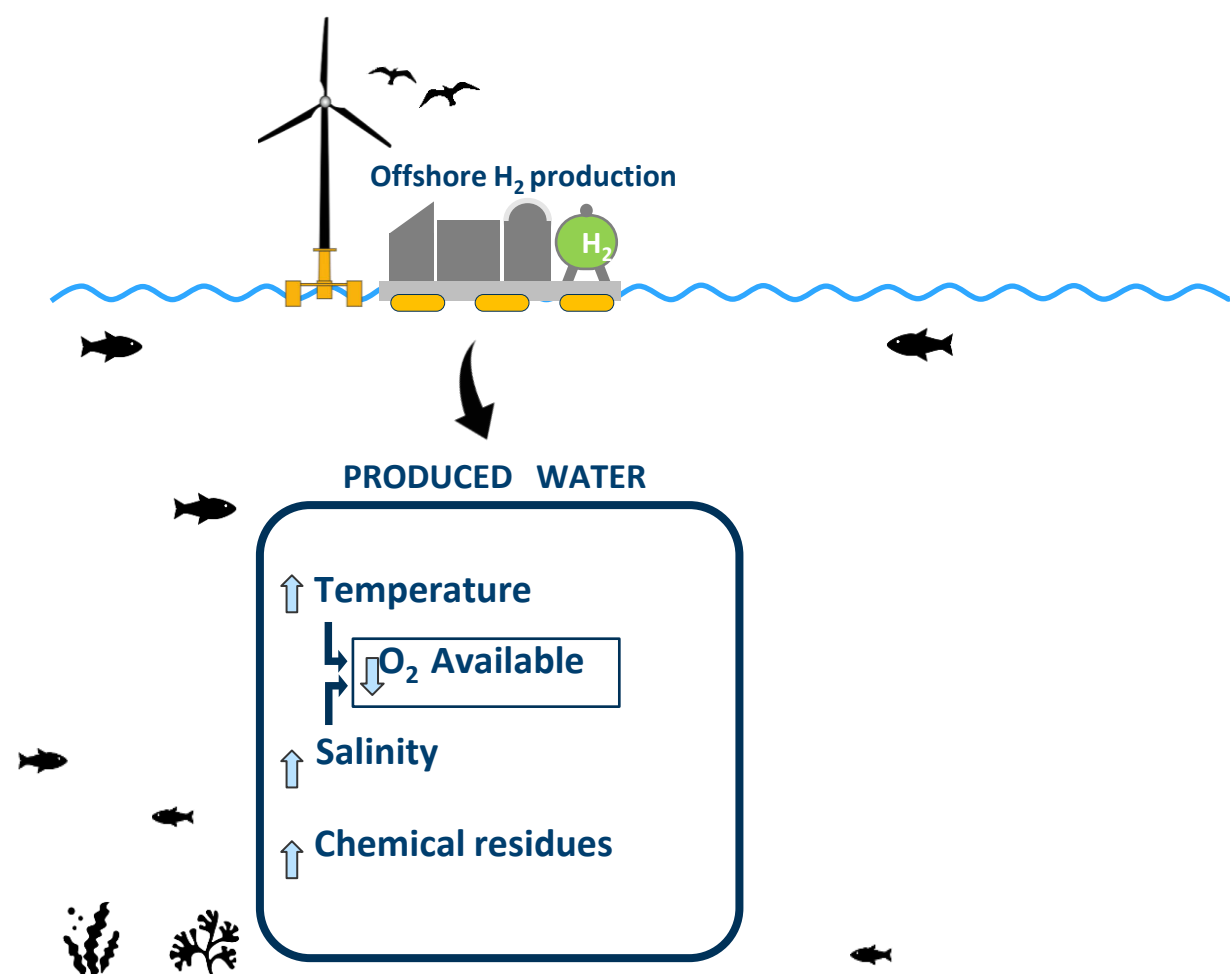
Produced water (PW)
=
Brine + Cooling water



But

Adapted from Dussauze et al., 2026

Potential environmental pressures



Adapted from Dussauze *et al.*, 2026

How the potential biological impacts can be anticipated at different spatial scales ?

How can we improve our understanding of the biological mechanistic effect of PW ?



To date no H₂ production at sea

Need to anticipate an Environmental Impact Assessment of the H₂ production in marine environment

Define some realistic environmental concentration/ intensity of the pressure

1

Modelling approach

Define toxicity thresholds over biological organization and trophic levels

2

Lab approach

1 Define some realistic environmental concentration/ intensity of the pressure

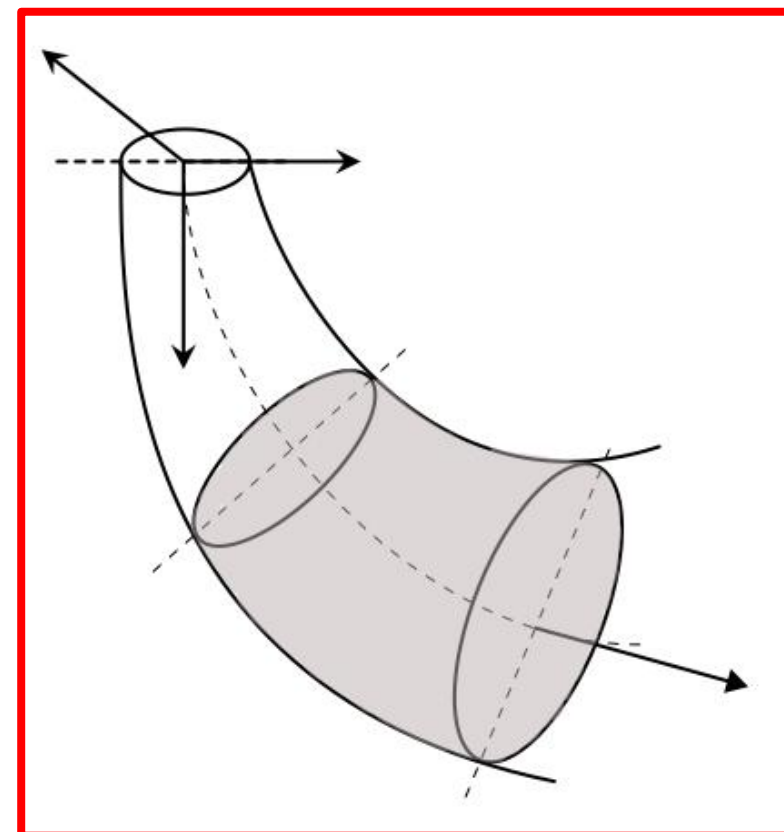
- Estimation of the Predicted Environmental Concentration (PEC) using numerical modeling both on a Near and Far field

Near-Field

PLUMES2.0



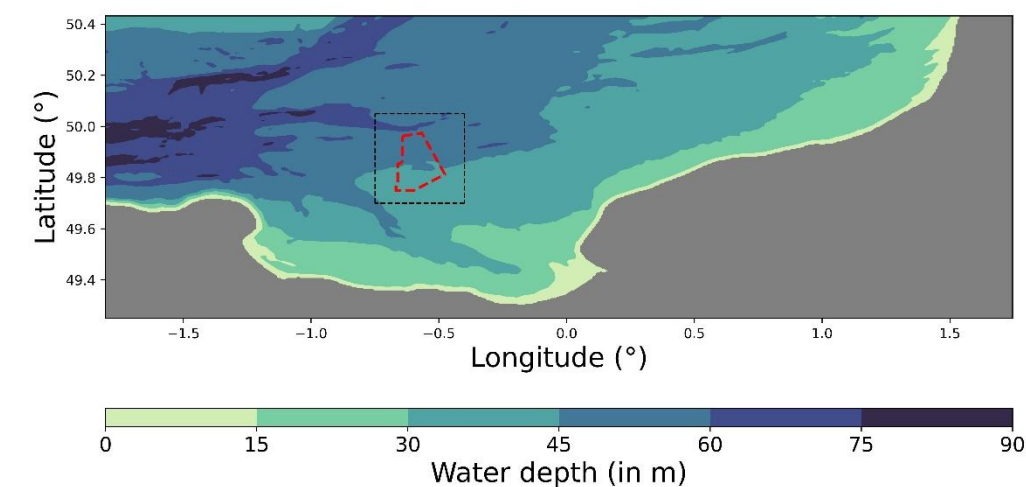
<https://www.ramboll.com/net-zero-explorers/offshore-hydrogen-at-scale>



Lagrangian Control Volume (LCV) representation. Adapted from Plume 2.0 manual

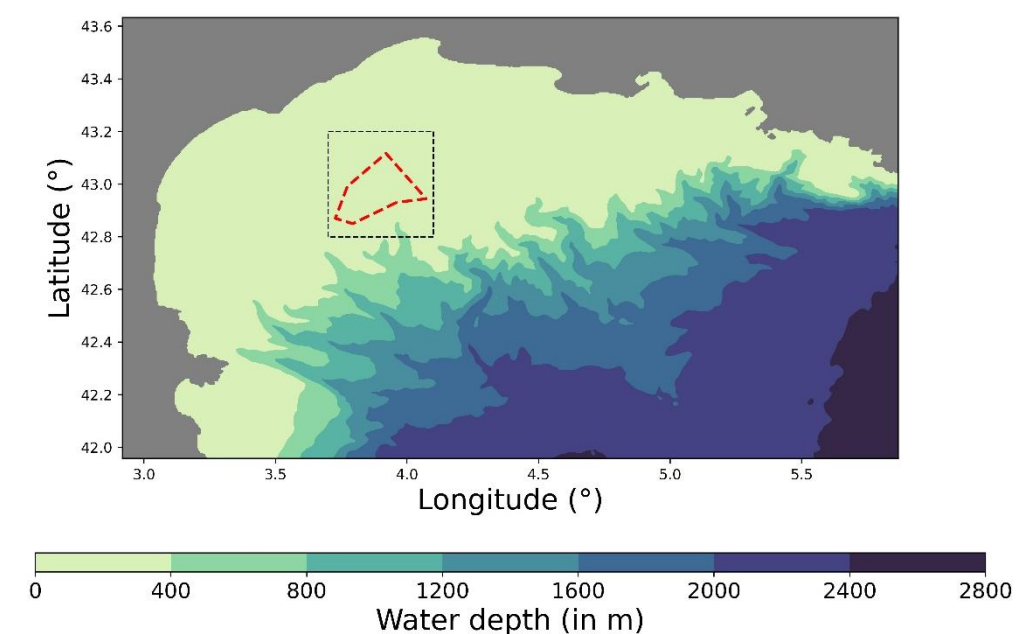
Far-Field

CROCO
Coastal and Regional Ocean COmmunity model

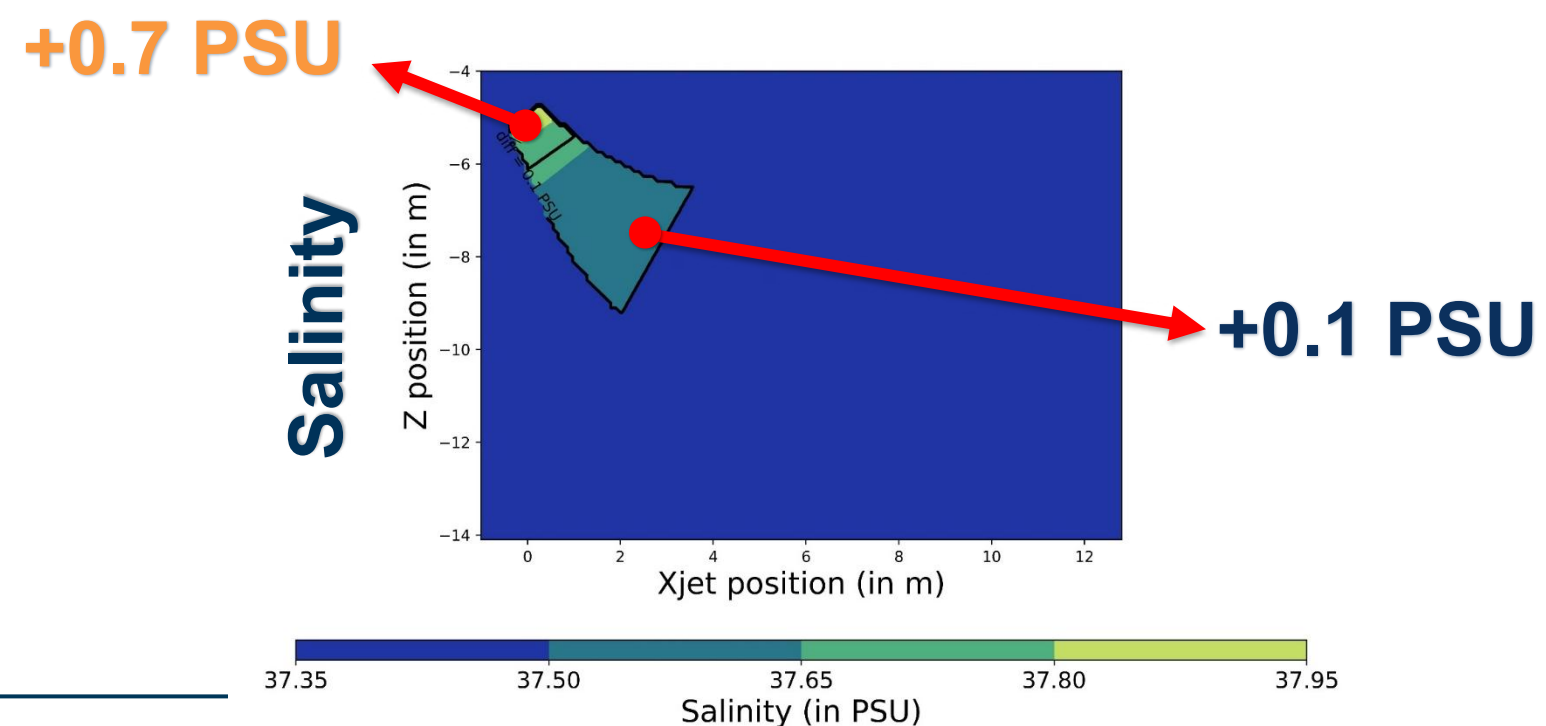
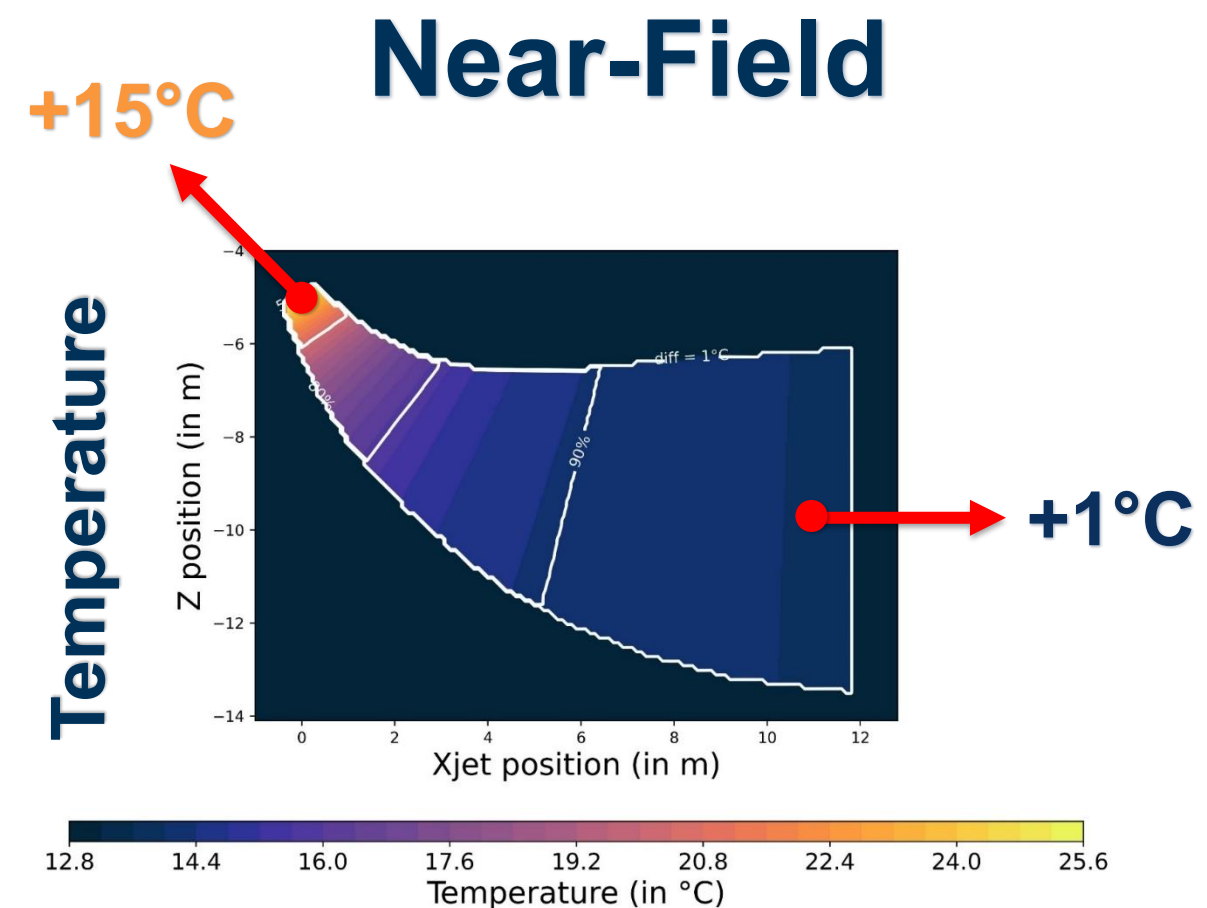


Seine Bay
Extended to the
North (SBEN)

Gulf Of Lion (GOL)



➤ 1 Define some realistic environmental concentration/ intensity of the pressure

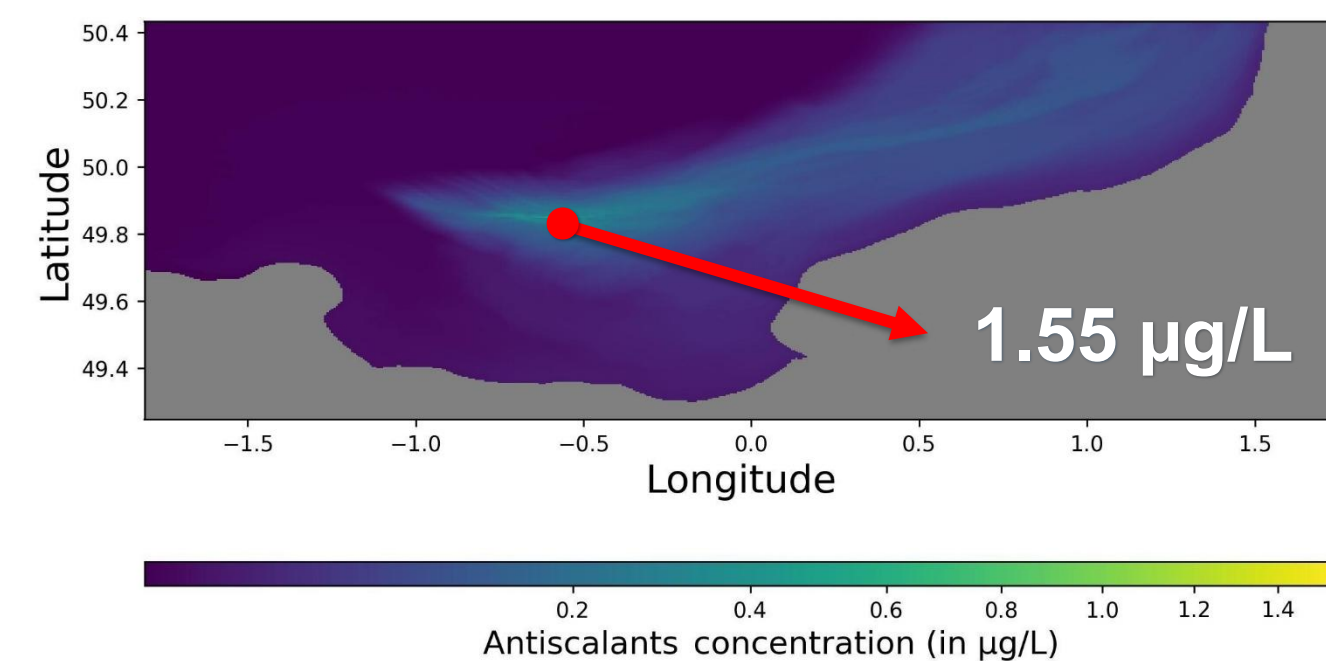
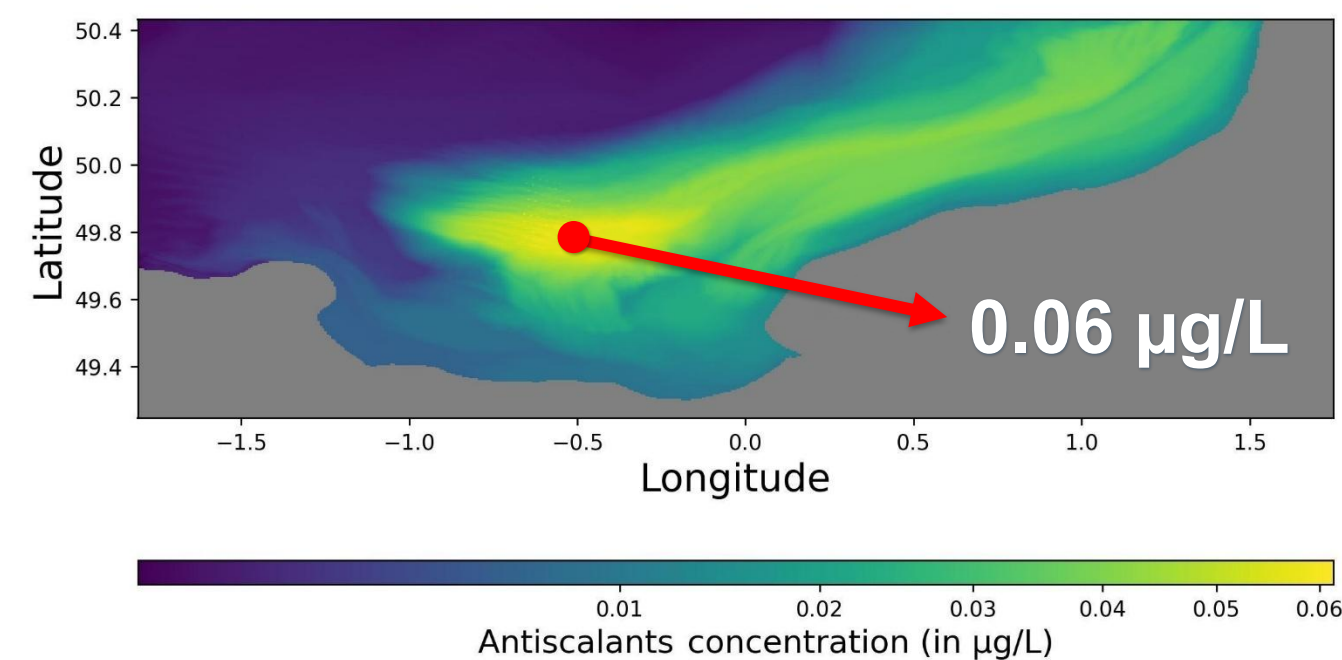


Decentralized

Centralized

- Run over 1 year with release depending on production

Far-Field



Chemical elements
simulated

Antiscalants

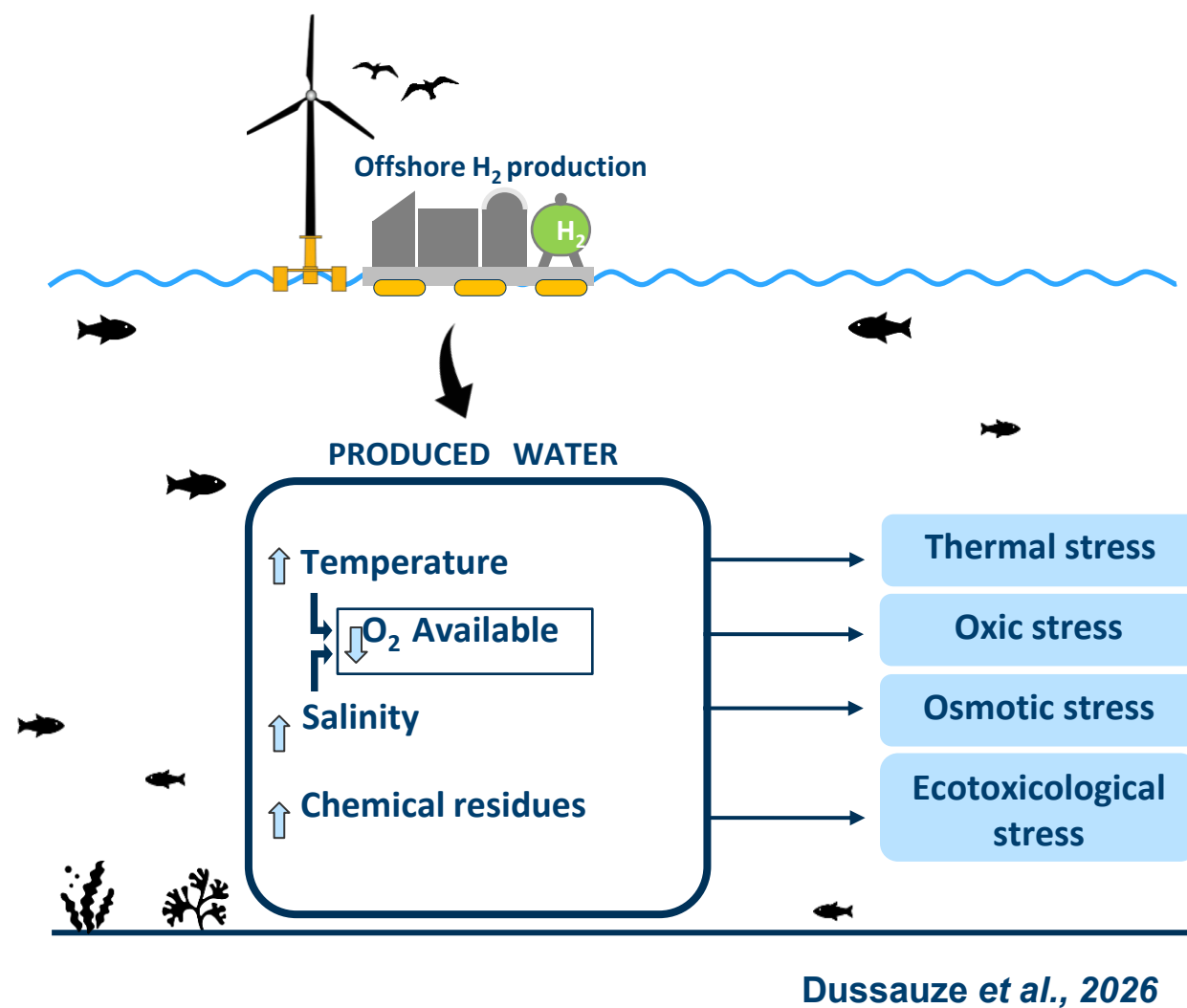
Coagulants

Flocullants

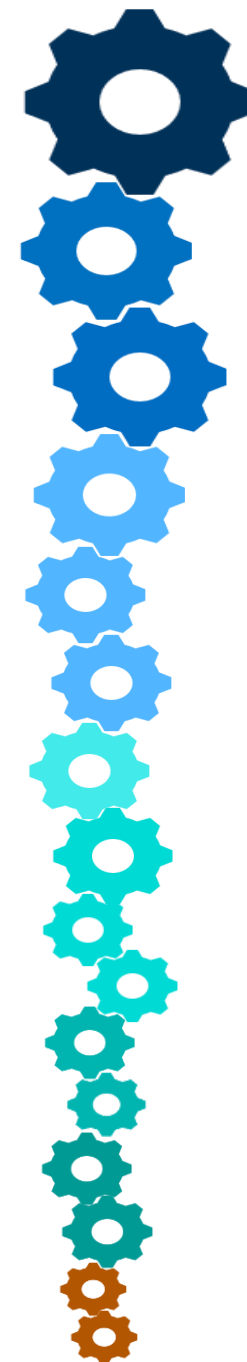
Antifoams

Reducing Agents

2 Define toxicity thresholds over biological organization, trophic levels and time



Life scales



Ecosystem

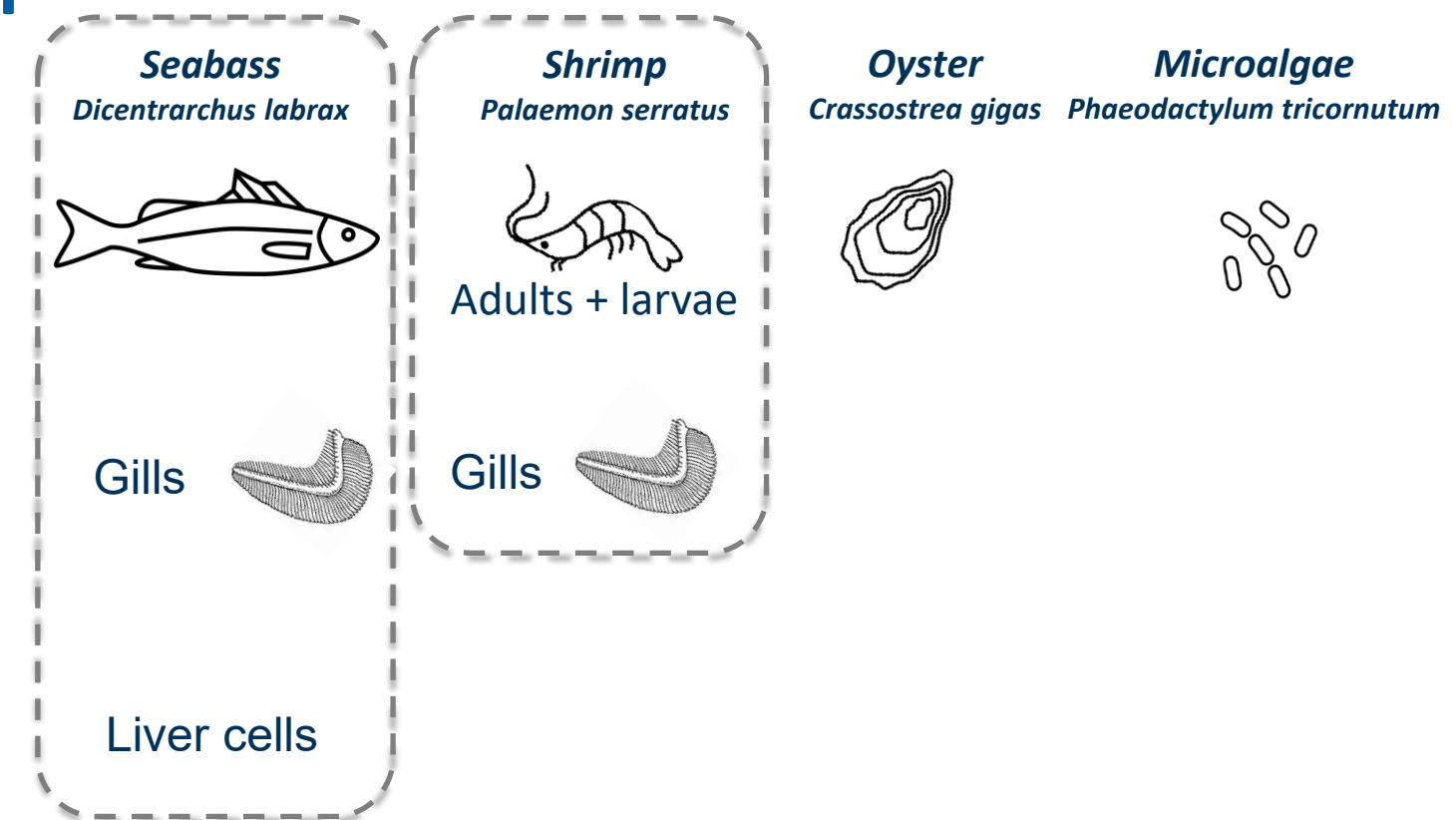
Population

Individual

Tissues

Cells

Molecules



Summary of Acute thresholds for brine

Interspecific responses and different threshold following levels of biological organisation

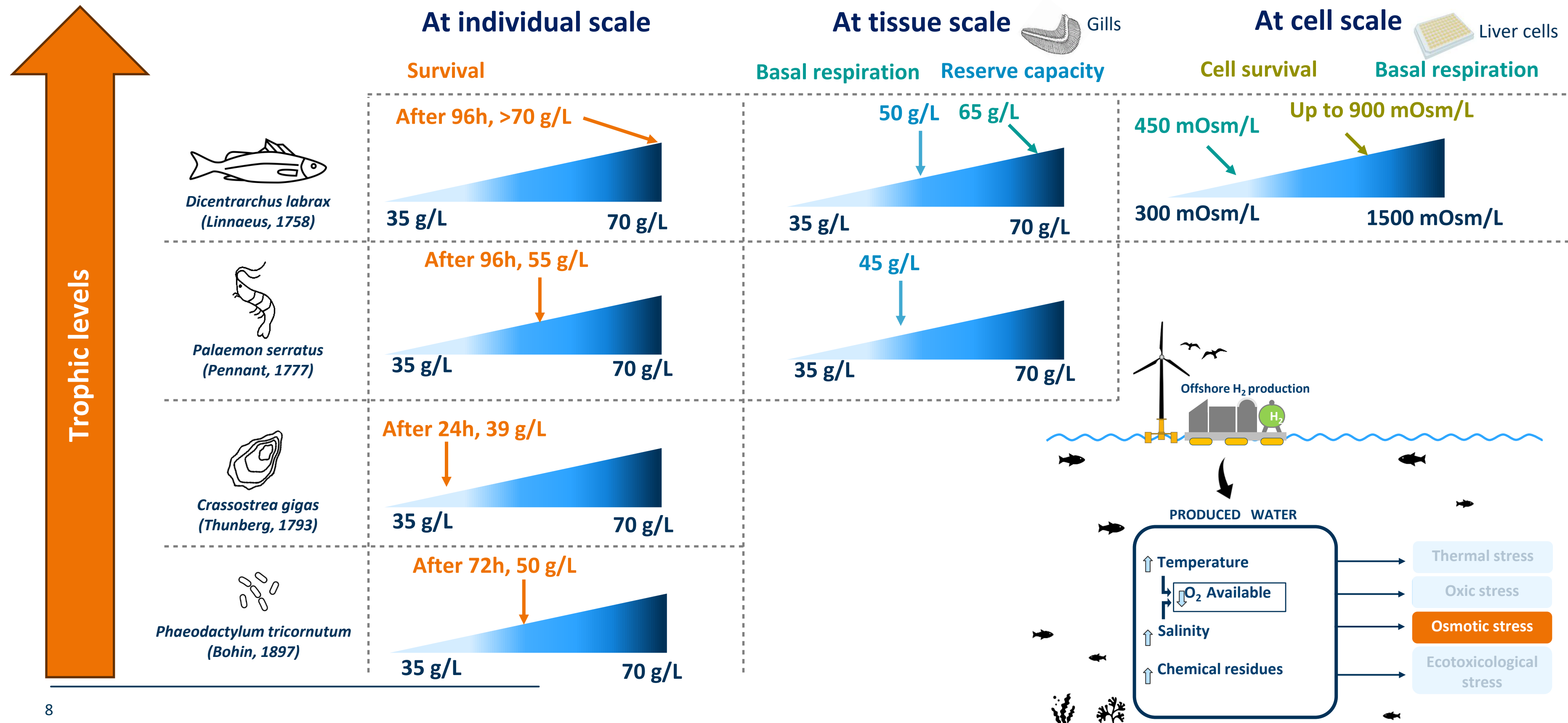


Figure modified from Dussauze et al., 2025 (RSER)

- **First data acquisition :**
 - **Near-field far field conclusion**
 - **Sensitivity differs markedly following species & time**
- **Need :**
 - **chronic assay based on realistic exposure scenario**
 - **investigated other environmental pressure generated by H2 production (light, noise...) alone and combined with PW release**
- **Integrated modelling and ecotoxicology are essential for assessing environmental risks and anticipating potential biological impacts in the offshore receiving environment.**

➤ Thank you for your attention.

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Summary of thresholds for brine

Combined stress induced cumulated impact

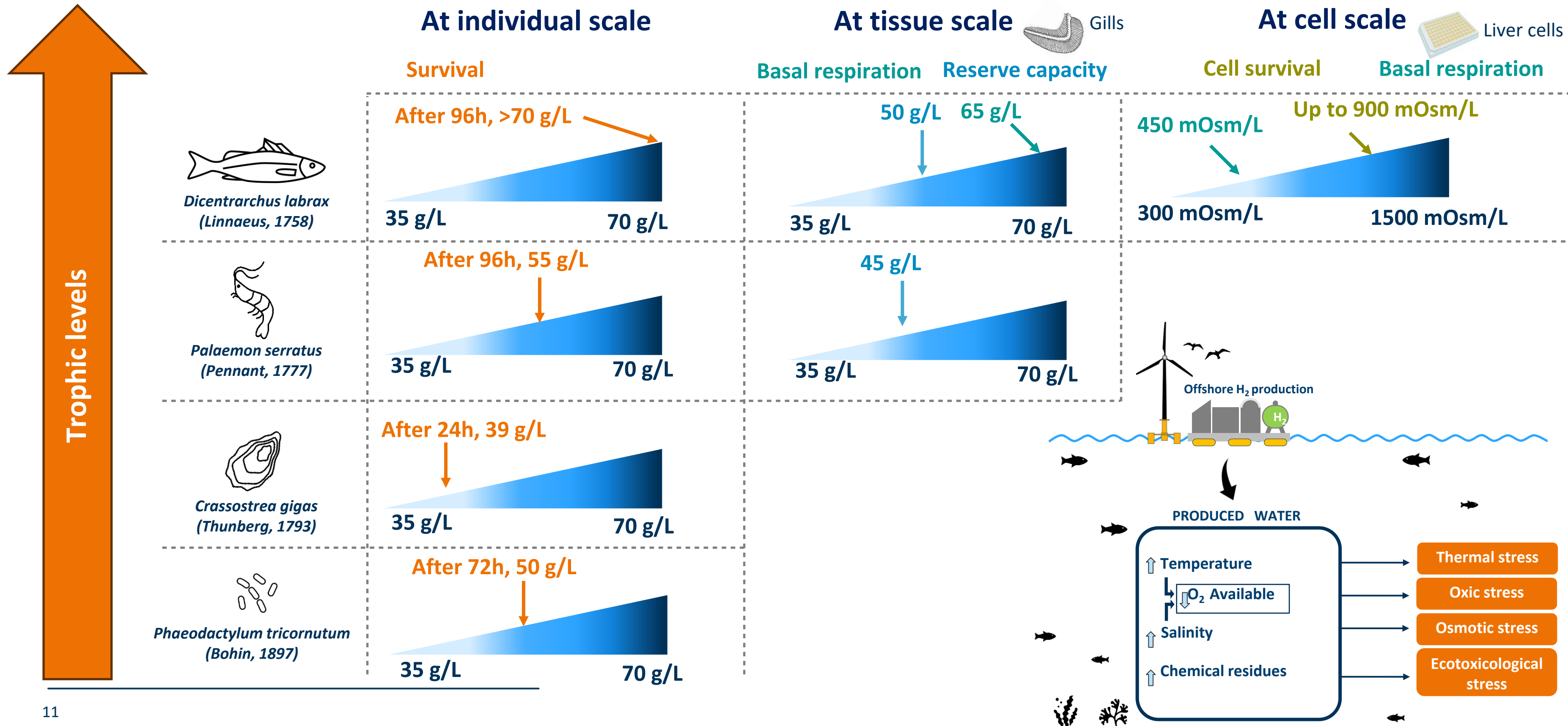


Figure modified from Dussauze et al., 2025 (RSER)