

# Short-term response of fish communities to freshwater marshes hydrological restoration and partial reconnection to coastal marine waters

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Are particularly vulnerable to **human pressures** and **global change** (Lu et al. 2018; Mahoney et al. 2021)

Cover an estimated **3%** world's surface area and account for **half** of the global monetary value of **ecosystem services** (Davidson et al. 2019) *e.g.* carbon sequestration and climate change mitigation (Mitsch et al. 2013; Wu et al. 2020)



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Provide many ecological services to ichthyofauna: **refuge** and **food resources** (Copp 1997; Zeug and Winemiller 2008), offer **spawning** habitat (Levin et al. 2001) and act as **nurseries** (Brockmeyer et al. 1996)





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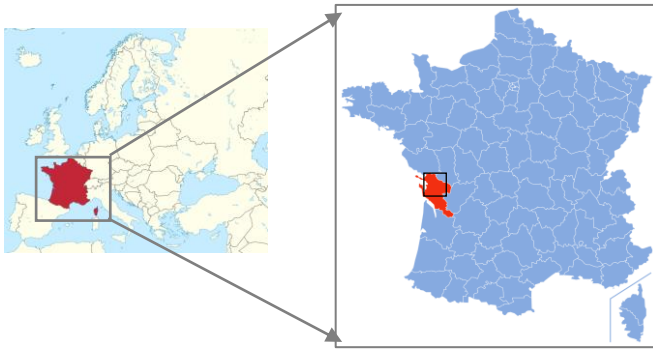
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**Restoration** initiatives are increasing as awareness grows of the **ecological impact** of degraded or lost habitats (Simenstad et al. 2006; Mahoney et al. 2021)

This study aimed to assess the **short-term response** of **fish communities** to the **restoration work** of an **urban freshwater marsh** and its **partial reconnection** to the coastal **marine waters**

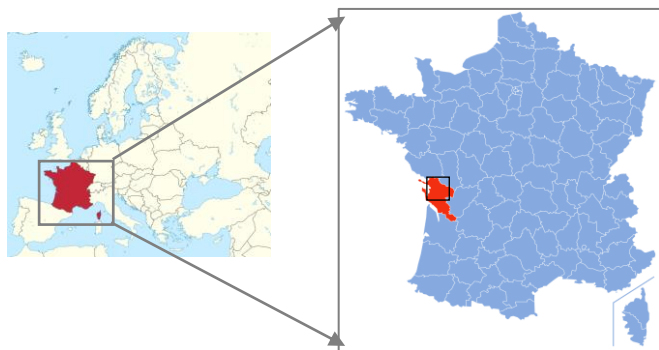




Tasdon marsh (125 ha) - Atlantic coast of France in La Rochelle city

- Network of **ponds** connected to a main **freshwater stream**



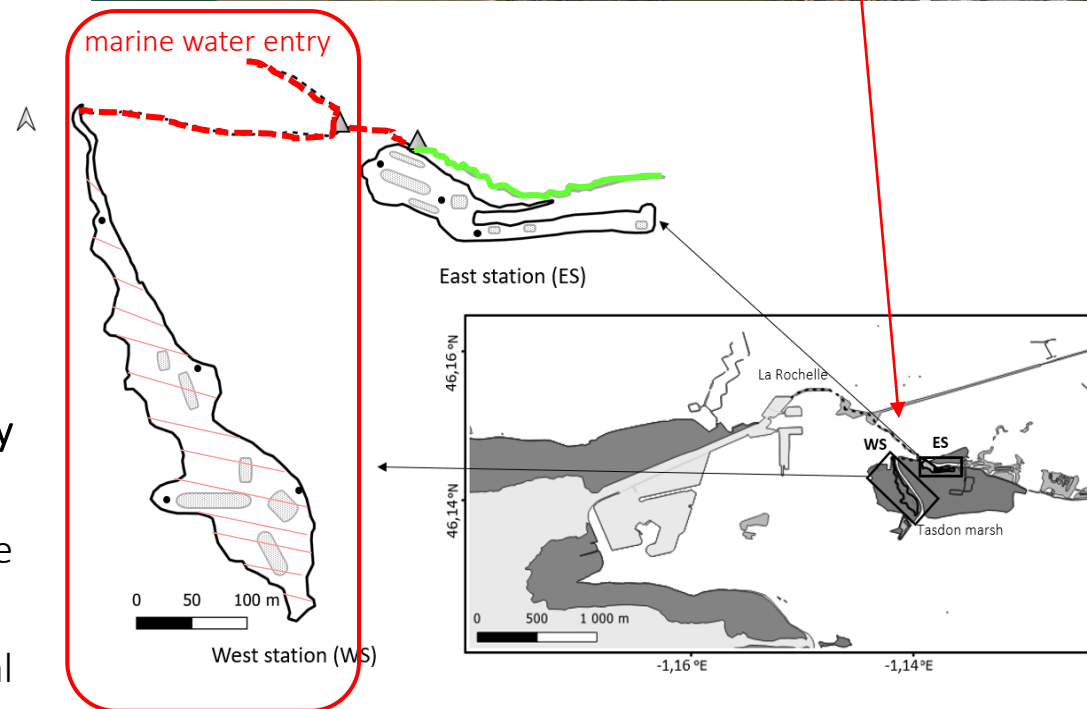


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
- Network of **ponds** connected to a main **freshwater stream**

Used to be **coastal tidal saltmarsh** in Middle Age for salt production

- 1962 Coastal urban **freshwater marsh** after a dam construction
- 2010 Management oriented to **regulation of rainwater** and **biodiversity conservancy**
- 2019 Restoration program starts with the restructuration of landscape and hydrology
- 2021 A part of the marsh was **partially reconnected** to marine coastal water





- Abiotic parameters : water **depth** (m), **Water temperature** ( $^{\circ}\text{C}$ ), **dissolved oxygen** ( $\text{DO}_2$ ) concentration ( $\text{mg. L}^{-1}$ ) and **salinity** ( $\text{‰}$ )
- Double fyke nets (4mm mesh size ) set for 24h  Fish species **identified** (species or sub-species level), **counted**, **measured** (mm) and **weighted** (g)




Double fyke nets deployed (Credit: IRSTEA)







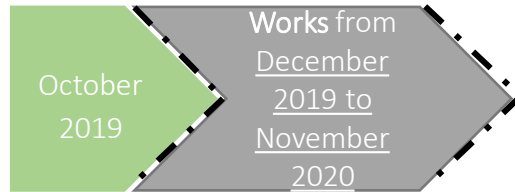
October  
2019

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


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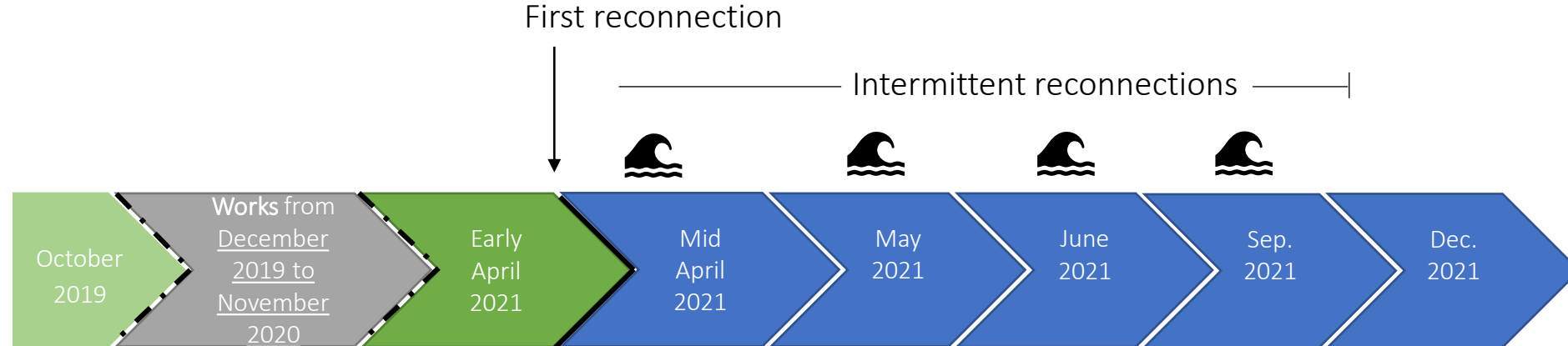


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- Monitoring of abiotic parameters : water **depth** (m), **Water temperature** ( $^{\circ}\text{C}$ ), **dissolved oxygen** ( $\text{DO}_2$ ) concentration ( $\text{mg. L}^{-1}$ ) and **salinity** ( $\text{‰}$ )
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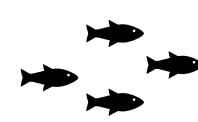


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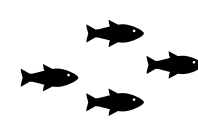
## Data processing and analysis

- **Capture and Biomass Per Unit Effort**  
(CPUE number of individuals. net<sup>-1</sup>. 24h<sup>-1</sup> and BPUE g. net<sup>-1</sup>. 24h<sup>-1</sup>)
- **Species richness**
- **Shannon-Weaver diversity**



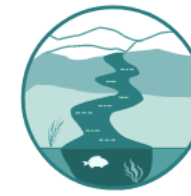
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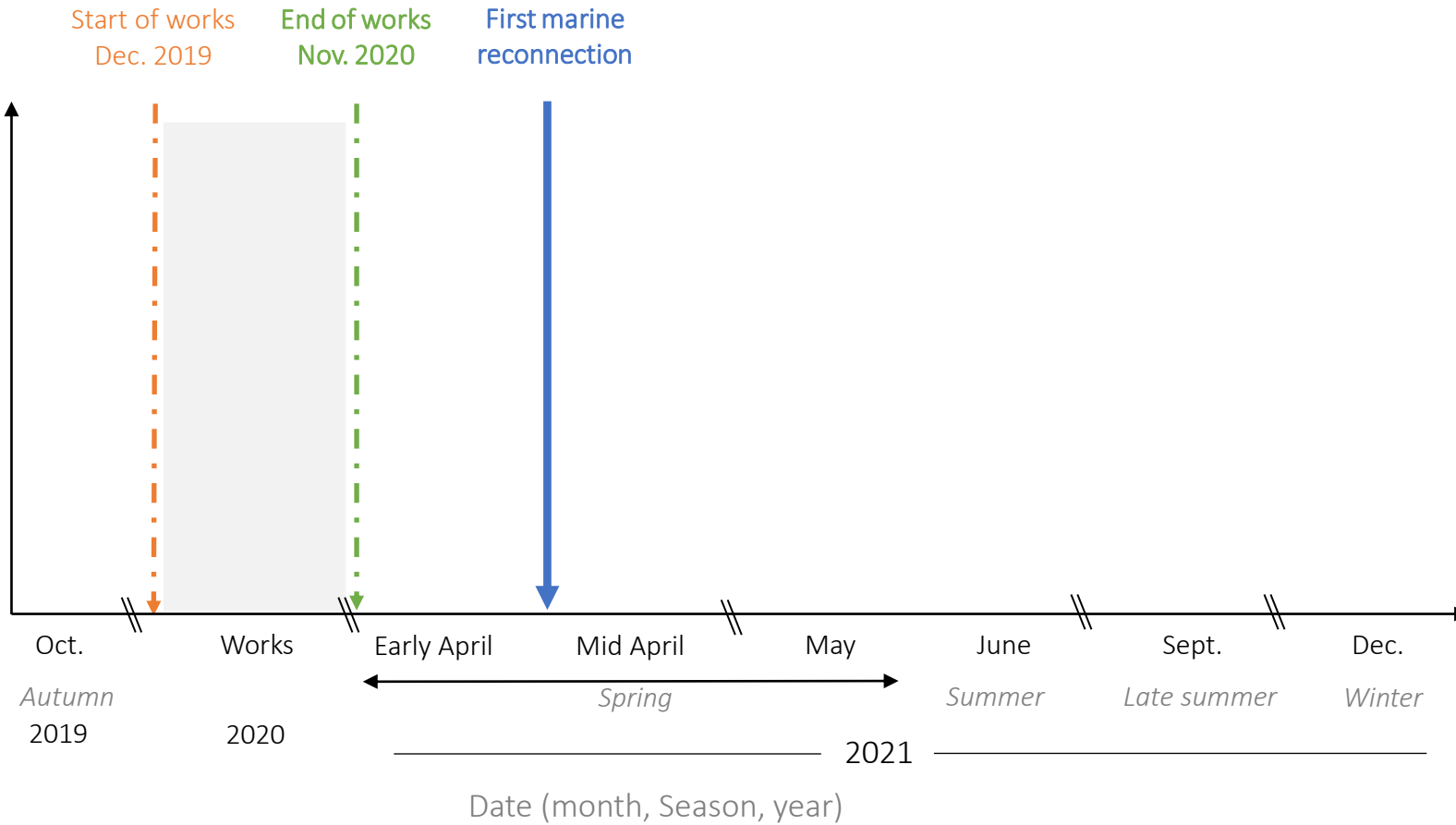


## Classification by functional traits

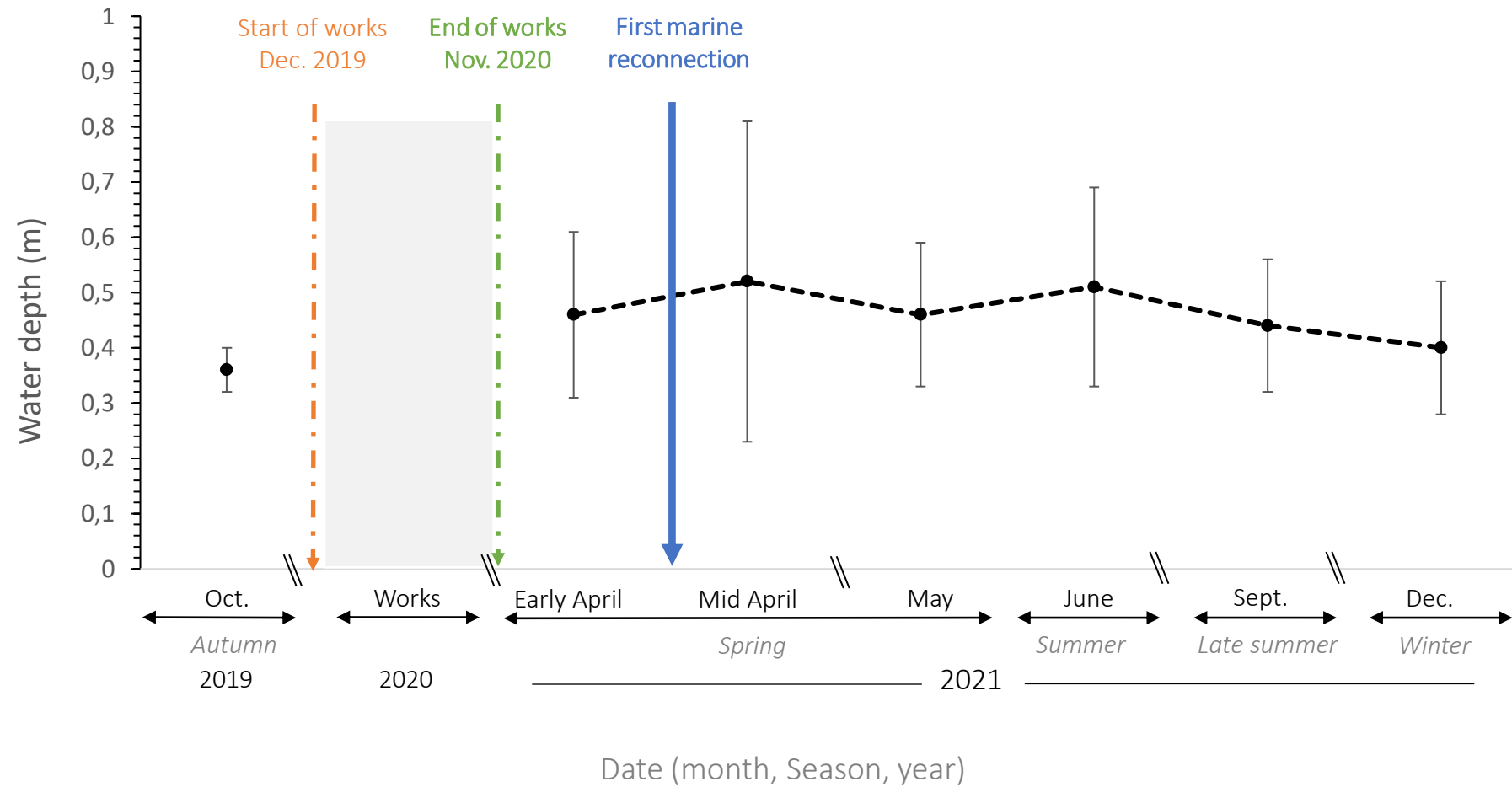
- **Life-cycle ecology** : Diadromous, Freshwater, Estuarine & Marine
- **Ontogenic stage** : Adult, Juvenile
- **Biogeographical status** : Allochthonous, Autochthonous



## Study timeline

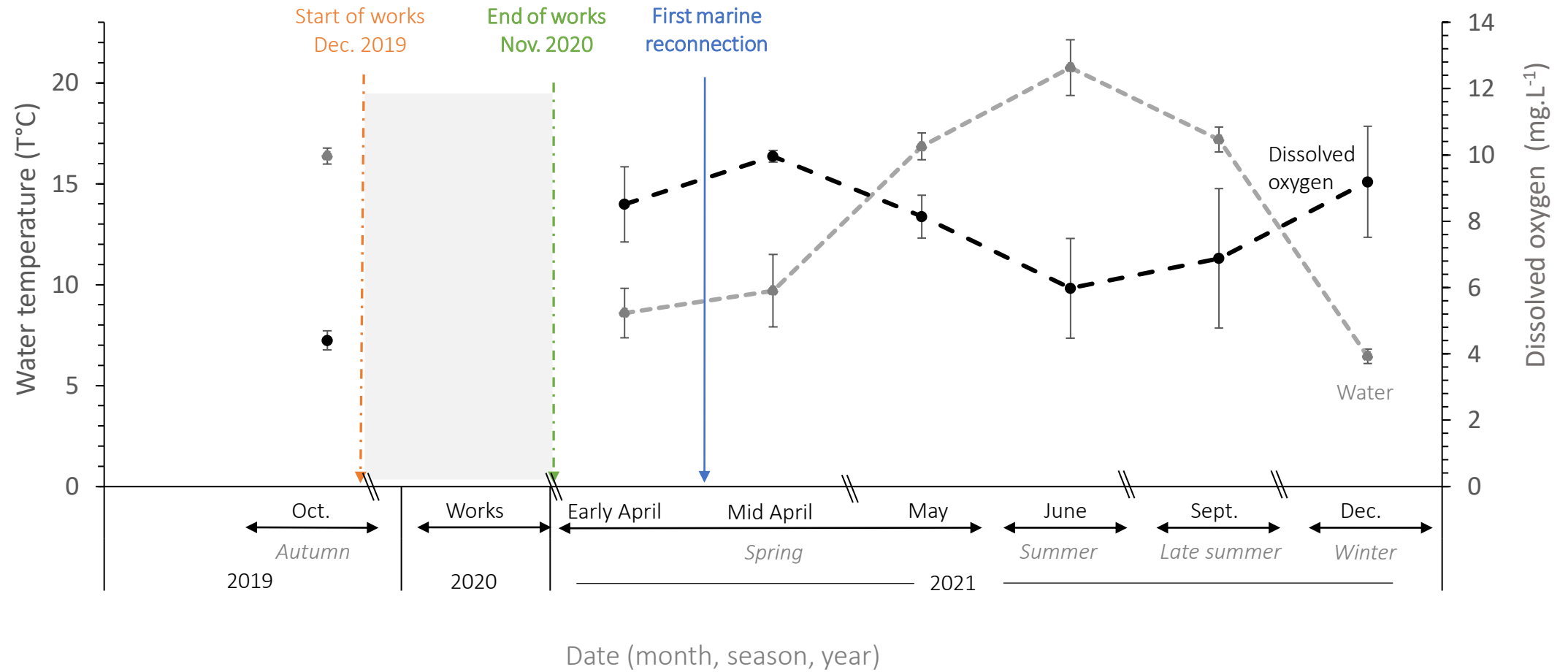


Average **depth increased** from  $0.36 \pm 0.04$  m in autumn 2019 to  $0.46 \pm 0.15$  m in spring 2021 and **remained stable**

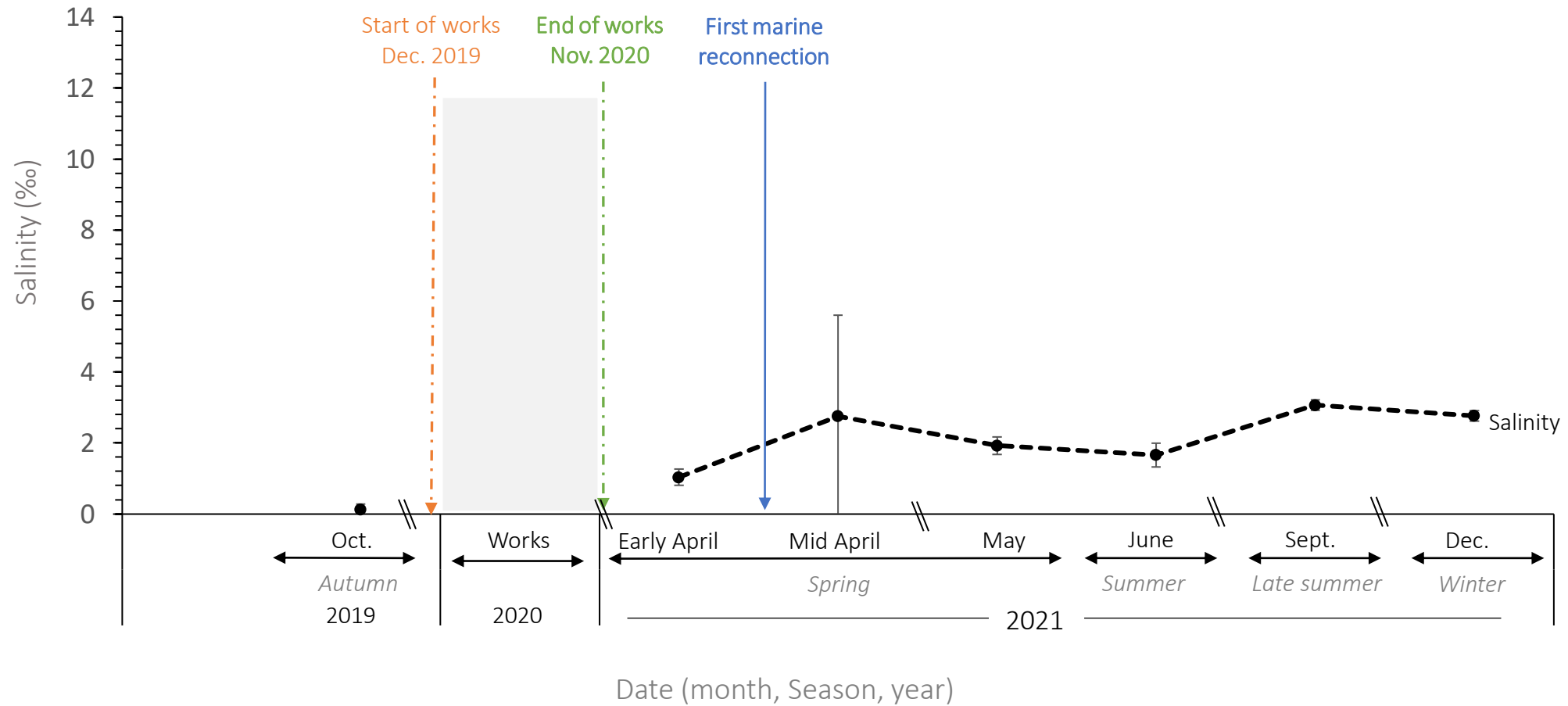


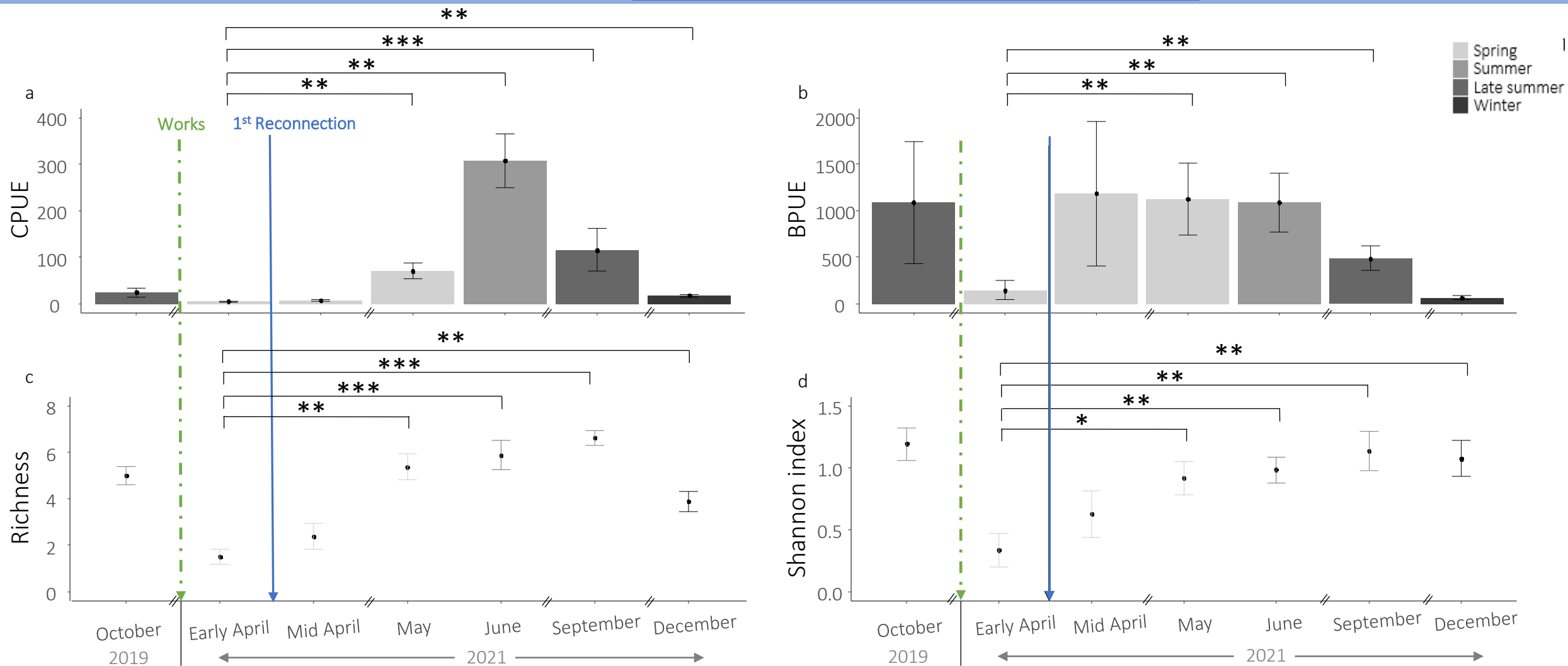


Abiotic parameters fluctuated according to a classical temperate **seasonality**



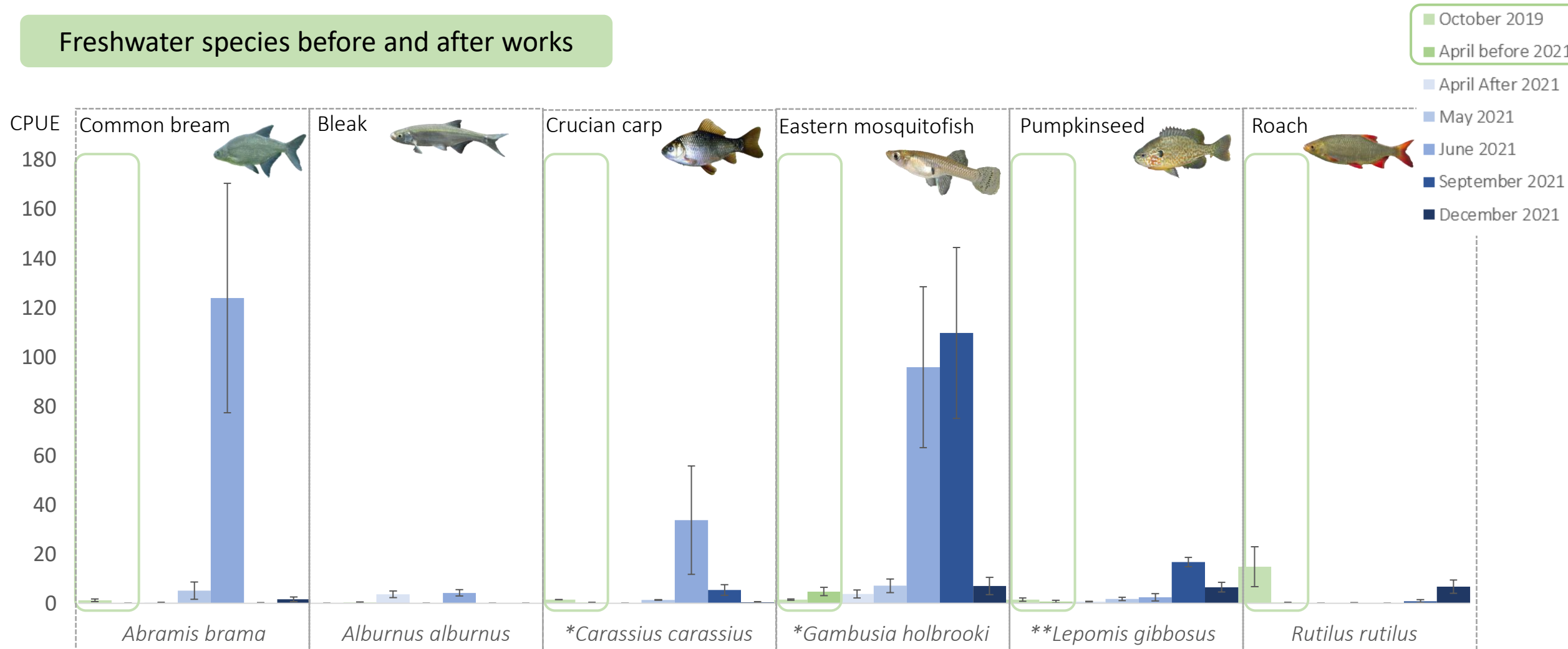
After reconnection, **salinity increased slightly** (from  $0.15 \pm 0.09\text{‰}$  to  $2.73 \pm 2.60 \text{‰}$ ) and **remained stable** until winter ( $2.75 \pm 0.05 \text{‰}$ )





Mean  $\pm$  sd of eight nets using U-test (CPUE and BPUE) and a t-test for (Richness and Shannon index)  
 Significance values:  $p \leq 0.001$  (\*\*\*) ;  $0.001 < p \leq 0.01$  (\*\*);  $0.01 < p \leq 0.05$  (\*)

## Freshwater species before and after works

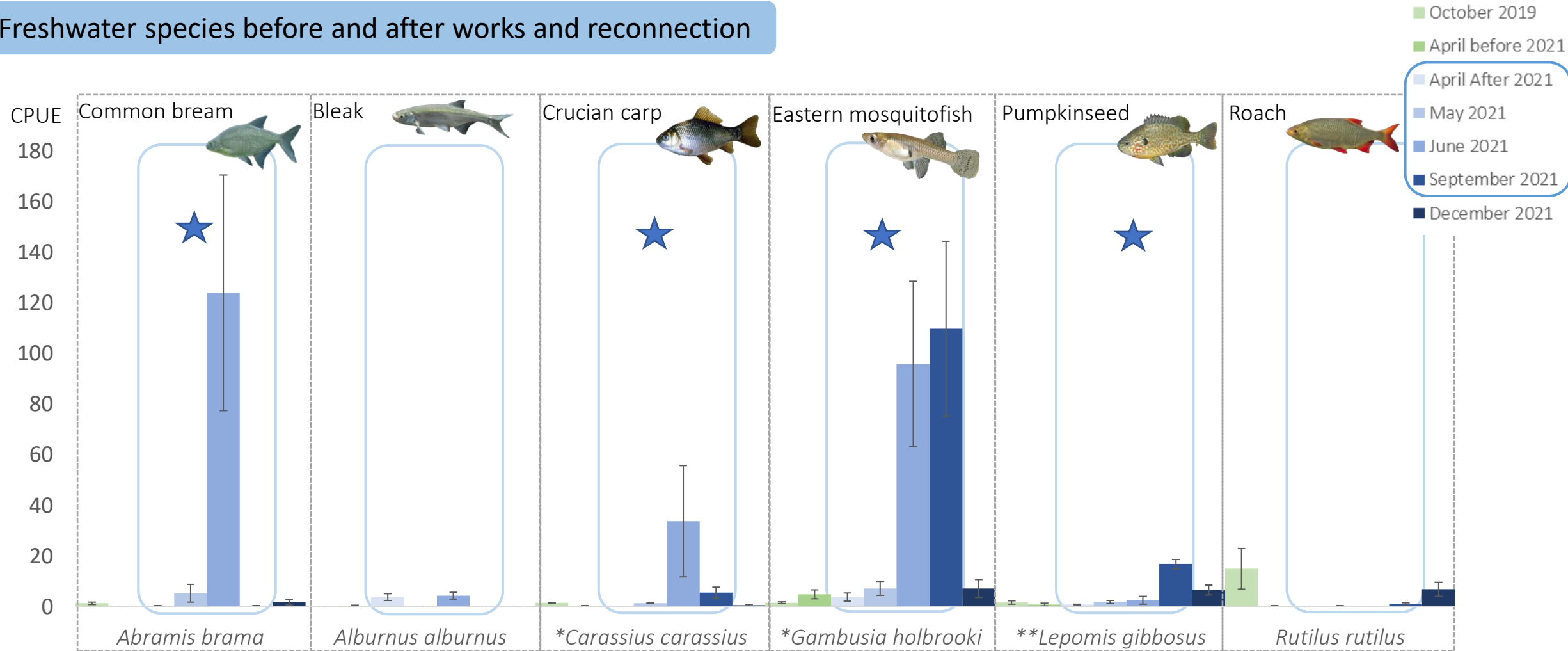


\*allochthonous species in French metropole

\*\*invasive species (INPN)

**Freshwater** community **changed** after works and reconnection, with **opportunistic allochthonous** species dominating

## Freshwater species before and after works and reconnection

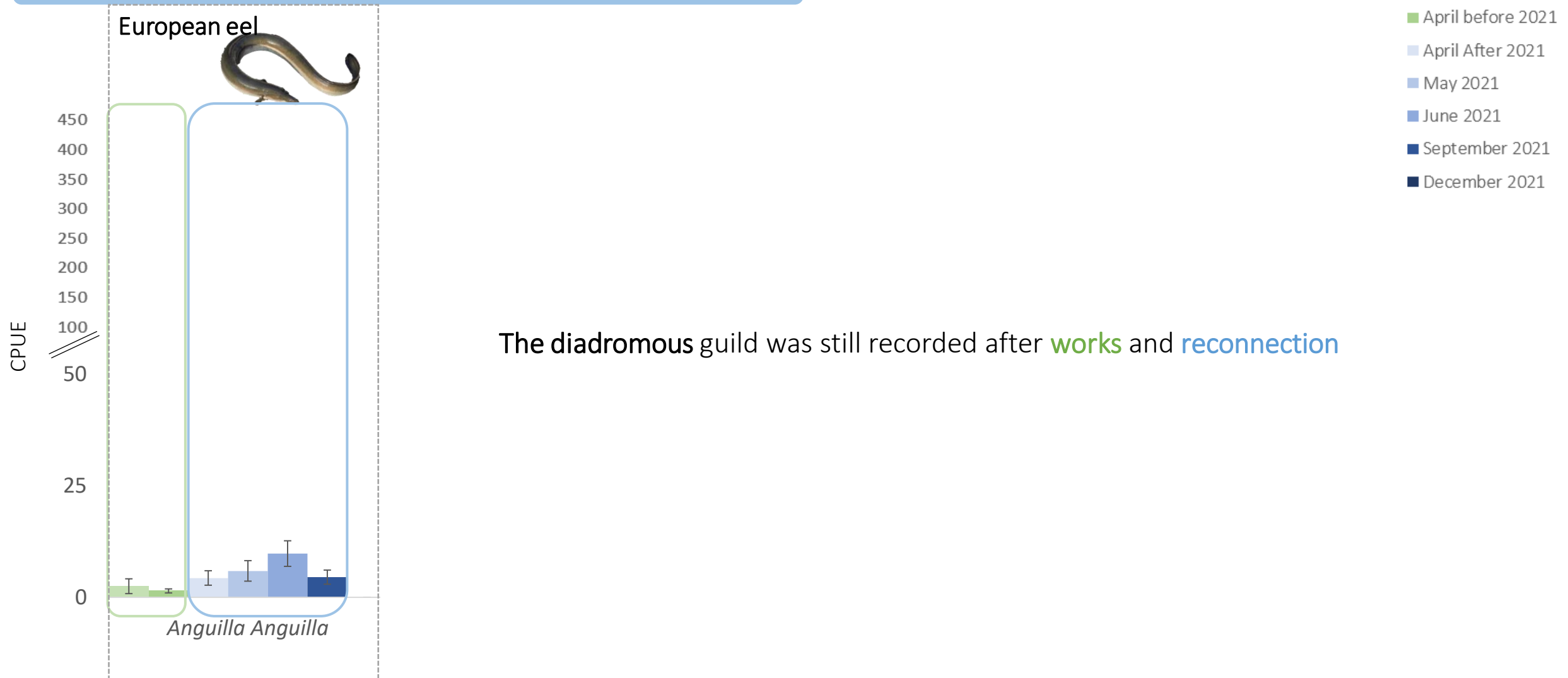


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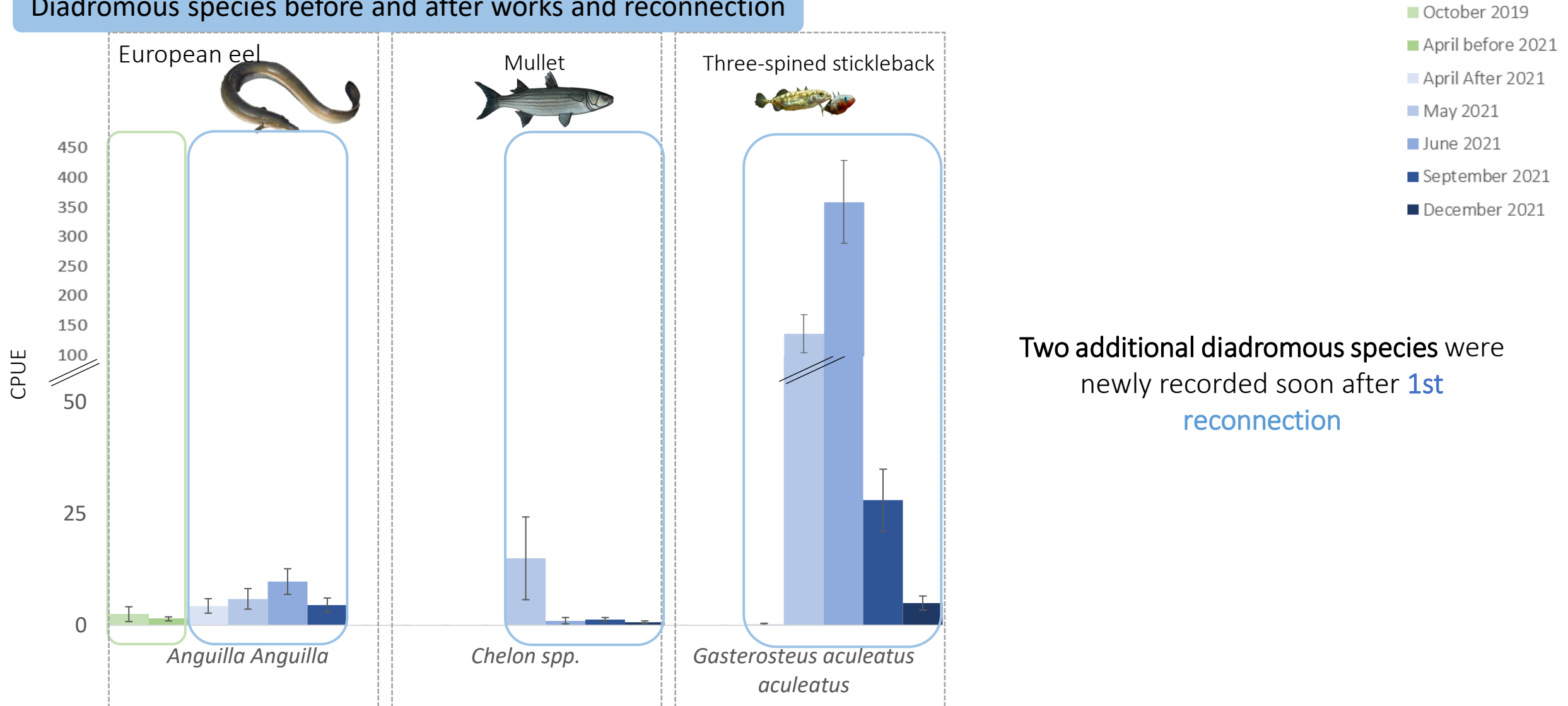
★ Freshwater species completing their **life cycle** in the station after works and reconnection (Beck et al. 2001)

## Diadromous species before and after works and reconnection



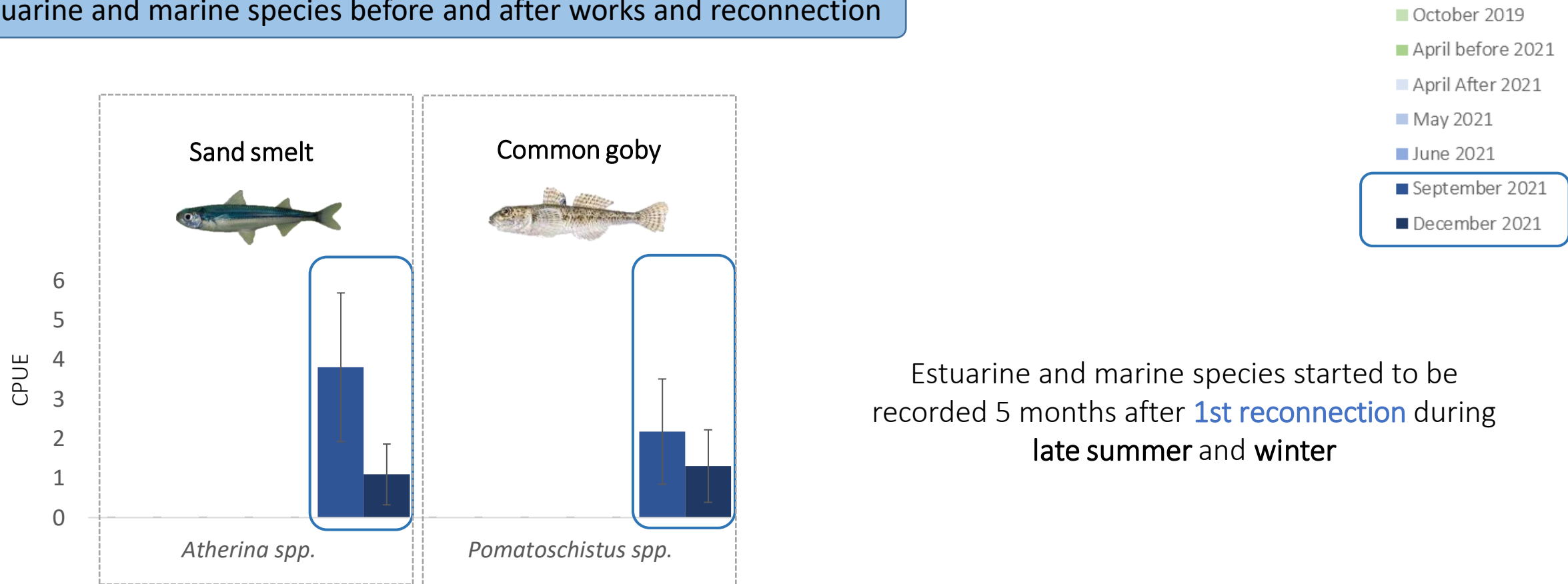
The diadromous guild was still recorded after **works** and **reconnection**

Diadromous species before and after works and reconnection



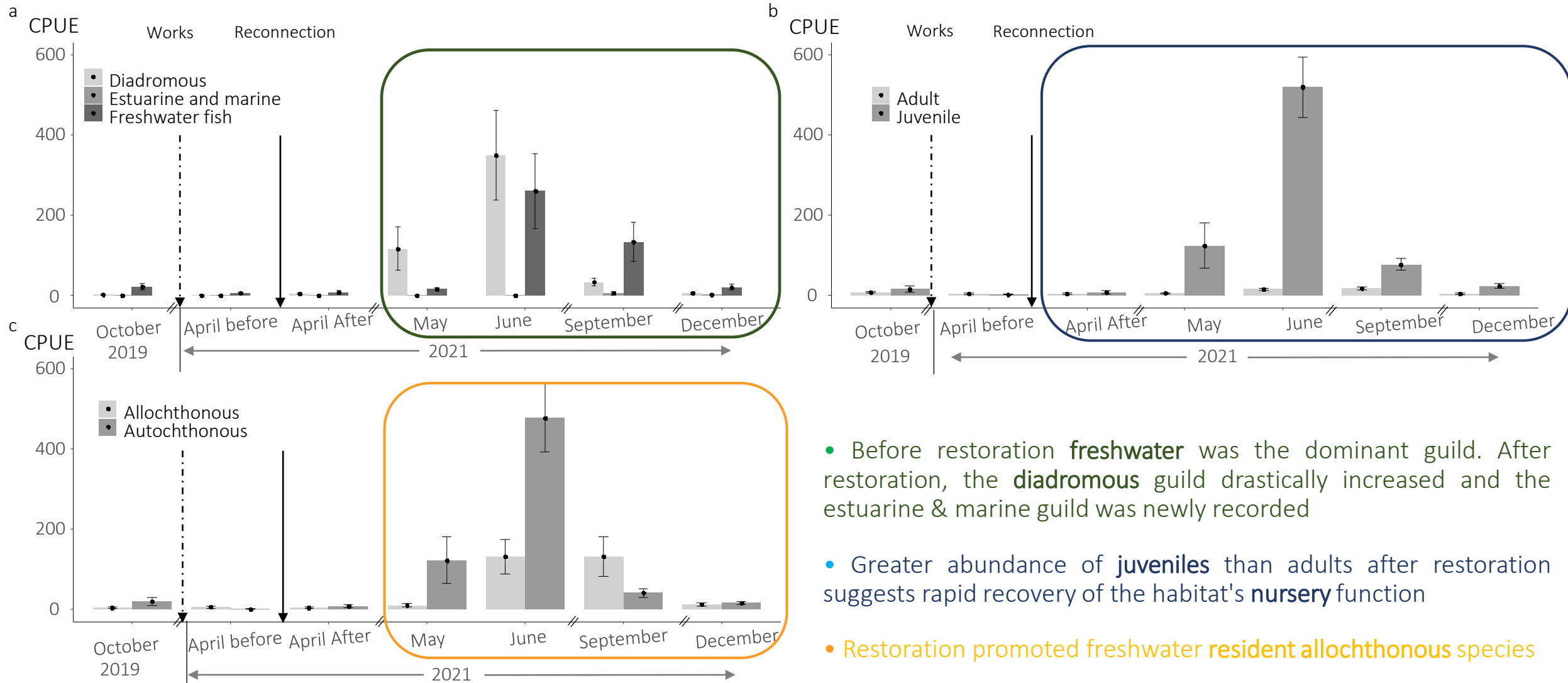
Two additional diadromous species were newly recorded soon after **1st reconnection**

## Estuarine and marine species before and after works and reconnection



Estuarine and marine species started to be recorded 5 months after **1st reconnection** during **late summer** and **winter**





- Before restoration **freshwater** was the dominant guild. After restoration, the **diadromous** guild drastically increased and the estuarine & marine guild was newly recorded
- Greater abundance of **juveniles** than adults after restoration suggests rapid recovery of the habitat's **nursery** function
- Restoration promoted **freshwater resident allochthonous** species

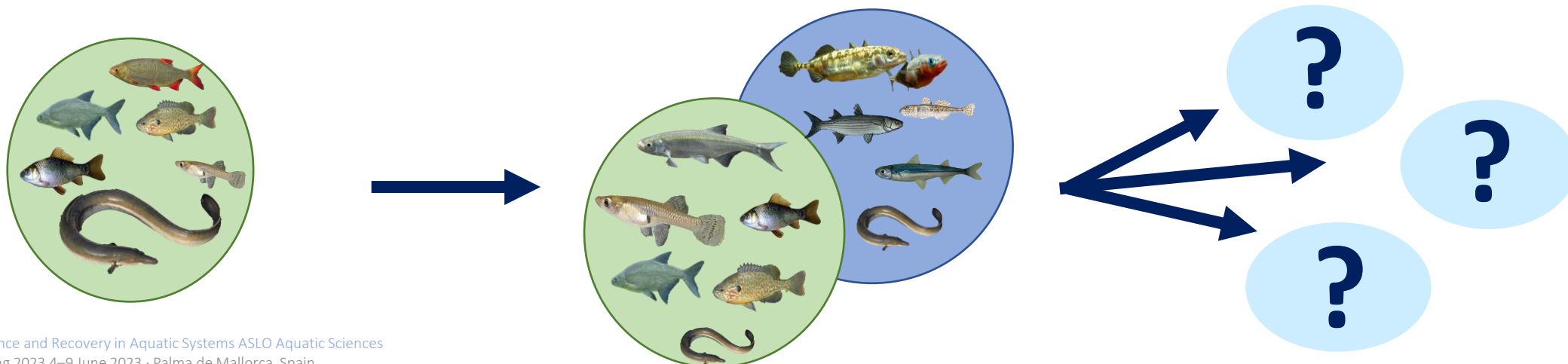
This study highlights the **short-term** responses of fish assemblages to the habitat restructuring and marine reconnection :

- Restoration induced habitat modifications that changed the composition and the stability of fish assemblages
- While **taxonomic diversity** was maintained, the **functional diversity** approach allowed changes in fish community trajectories to be assessed
- Restoration promoted **resident allochthonous freshwater** species. It also supported access to **new diadromous and saltwater autochthonous species**, but with questionable benefits regarding the **intermittent connectivity** to marine waters

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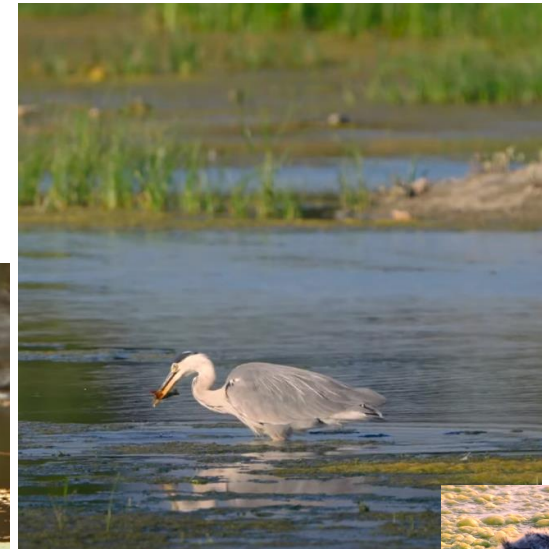
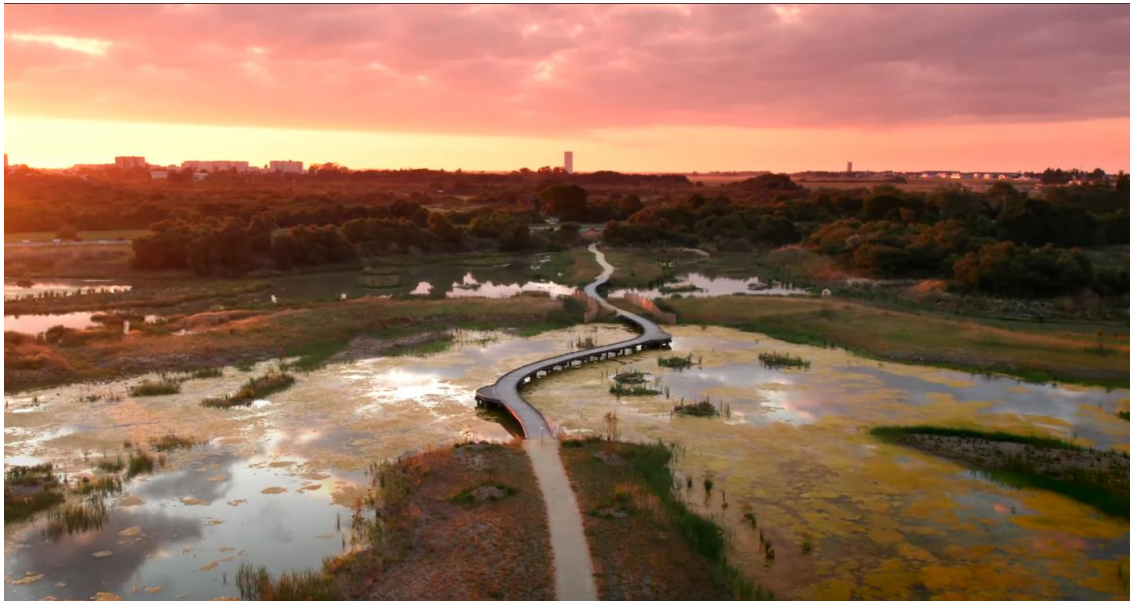
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- **Longer term** studies are recommended to assess the **new ecological trajectory** of the marsh
- This restoration program aimed to promote **shorebirds** habitat functionalities. It was not designed for **fish**, for which the benefits were not initially anticipated and are disputable
- This study provides insight into the **management** objectives for the **ecological functions** of the **habitats** under consideration for restoration



# Thanks for your attention

Kohler et al. Short-term response of fish communities to freshwater marshes hydrological restoration and partial reconnection to marine coastal waters. *in prep Wetlands Ecology and Management*



La Rochelle : renaturation du Marais de Tasdon (<https://youtu.be/z7PpHFZ4Yfo>)

[https://www.pewtrusts.org/-/media/post-launch-images/2022/04/kxtr9njpgmaster/16x9\\_m.jpg?mw=1290&hash=B3E0F09A653BC40CFFF8A9C5878E5368](https://www.pewtrusts.org/-/media/post-launch-images/2022/04/kxtr9njpgmaster/16x9_m.jpg?mw=1290&hash=B3E0F09A653BC40CFFF8A9C5878E5368)



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