

# BIOMONDO



## Towards Earth Observation supported monitoring of freshwater biodiversity

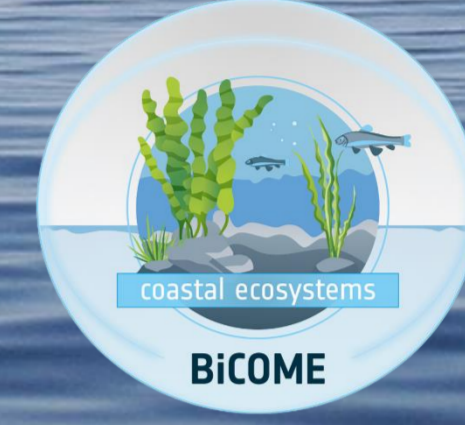
The European Space Agency (ESA) activity called Biodiversity+ Precursors is a contribution to the joint EC-ESA Earth System Science Initiative launched in February 2020 to jointly advance Earth System Science and its response to the global challenges that society is facing at the onset of this century. BIOMONDO is the ESA Biodiversity+ Precursor project focused on freshwaters and biodiversity in lakes and rivers.



Project partners



ESA Biodiversity+ Precursors



## BIOMONDO Pilots

The purpose of the biodiversity pilot studies is to explore if Earth Observation products in combination with models and in situ data can support freshwater biodiversity monitoring and management.

► **Pilot 1 – Eutrophication** Exploring the impact of eutrophication and other habitat changes on the water quality.

▼ **Pilot 2 – Heat tolerance** Exploring the impact of changes in water temperature and heat waves on freshwater fish diversity.



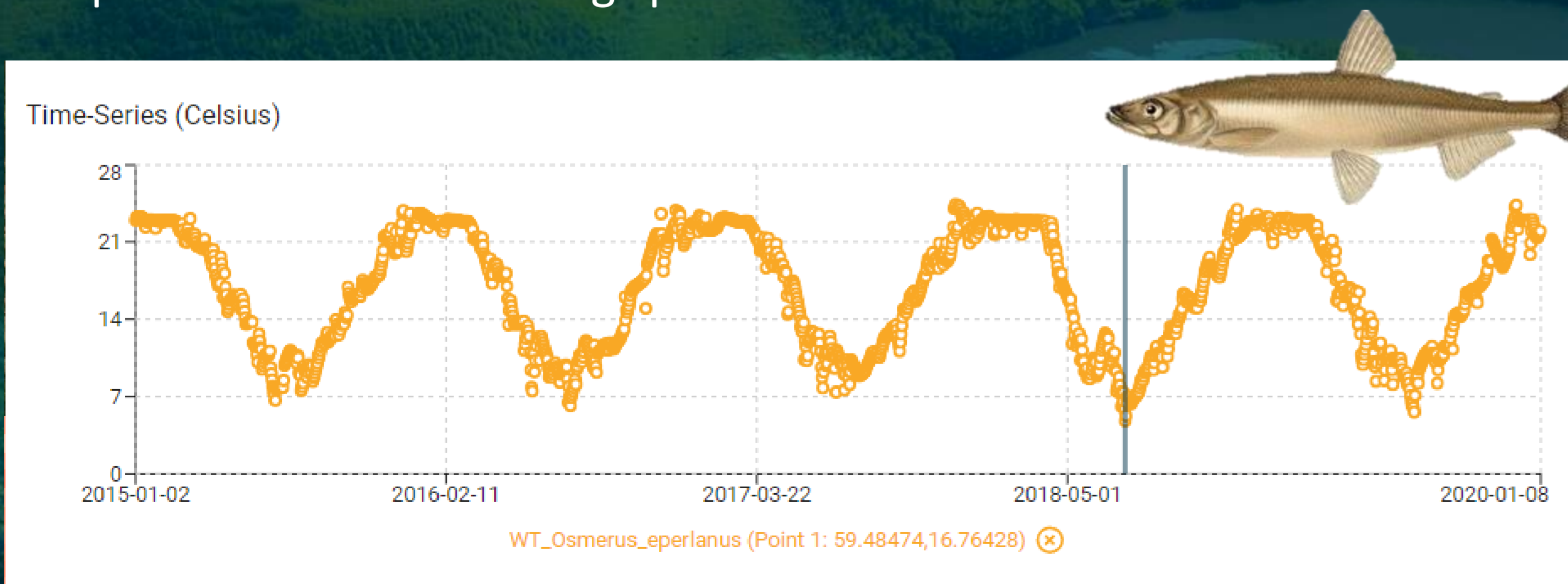
Fish kills in Lake Hjälmaren, Sweden, 2018

The integrated use of EO based LSWT and modelled Heat Tolerance values to estimate daily fish Warming Tolerance, were assessed with respect to the usefulness for management and decision support in relation to:

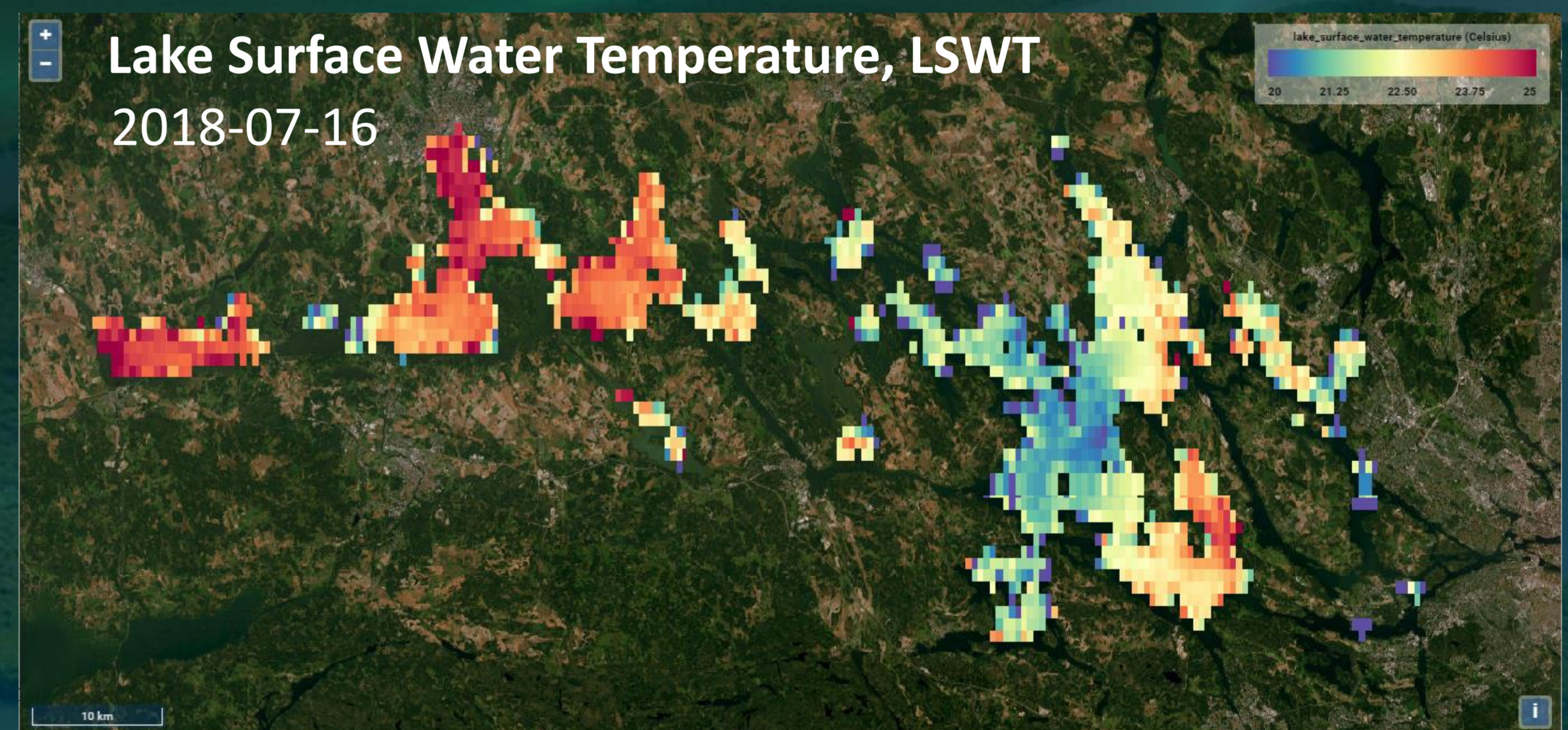
- Surveillance monitoring including how temporal variation in temperature and other parameters affect different species addressed in the **WFD**.
- Assessing the spatial distribution of the most sensitive habitats requiring long-term protection as tasked by the **Habitats Directive**.
- Prioritisation of lakes and freshwater ecosystems in need of restoration to help reach targets of the **EU 2030 Biodiversity Strategy**.
- Reducing information gaps related to vulnerability and resilience to fluctuations in temperature of different fish species for Resource Managers working to preserve biodiversity and minimise impacts of climate change as addressed in **KM-GBF** and **Agenda for Sustainable Development**.

► **Pilot 3 – Connectivity** Monitoring river connectivity effect by dams, and their changes and impact on biodiversity.

The EU Nature Directives and the WFD call for protection and monitoring of habitats, biodiversity and water quality of European water bodies. Understanding and minimizing the effects of climate change are key to the goals and targets of global biodiversity, sustainability and climate adaptation strategies. In the Pilot 2 showcase we demonstrate the utility of using calculated daily Warming Tolerance for different fish species to further the understanding of how fish abundance and distribution varies over time with fluctuations in temperature and heatwaves. In Lake Mälaren, Sweden, we could show that cold water species, such as European Smelt and Vendace, were closer to their thermal limit in recent years compared to other occurring species.



The graph shows the calculated time series of daily warming tolerance between 2015-2020 for *Osmerus eperlanus* (European smelt) in Lake Mälaren, Sweden. Low values indicate that the current conditions are close to the species thermal limits. The summer of 2018 was unusually warm during a longer time period and fish kills were observed.



Warming Tolerance = LSWT – Heat Tolerance per species

