Policy perspective on lake water quality monitoring in Europe

Jenni Attila, Finnish Environment Institute

With contributions from
Therese Harvey, NIVA
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Ongoing actions with policy perspective

European Topic Centre Biodiversity and Ecosystems (ETC BE)

- Terrestrial, freshwater and marine biodiversity and ecosystems.
- Working in partnership with the European Environment Agency (EEA).
- Support to the implementation of the range of **EU directives, strategies and policies** constituting the environmental acquis.

ECOSTAT working group

- ECOSTAT *Working Group (Ecological Status Working Group*) – group of Member States experts on **Water Framework Directive.**
- Creates guidelines and methodologies for assessing the *ecological* status of surface waters in the European Union.
- Established under the European Commission.

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European Topic Centre Biodiversity and Ecosystems (ETC BE)

- Consortium of 24 European organizations
- Expertise in the topic area of terrestrial, freshwater and marine biodiversity and ecosystems, working in partnership with the European Environment Agency (EEA)
- ETC BE supports EEA through activities:
    - Support to the implementation of the range of **EU directives, strategies and policies** constituting the environmental acquis.
    - Contributing to integrated systemic assessments of terrestrial, freshwater and marine ecosystems **focusing on effects under climate change and to mitigate climate change**, on cumulative drivers and pressures on these ecosystems, as well as socio-economic implications of solutions.
    - Designing and providing support for **monitoring requirements** and approaches for tracking progress towards the implementation of the 8th EAP and **European Green Deal**, including EEA's input to mid-term reviews of underlying policies, particularly the **Biodiversity Strategy for 2030**, **Farm to Fork** Strategy, the **Zero Pollution Action Plan**, and the various sector policies.

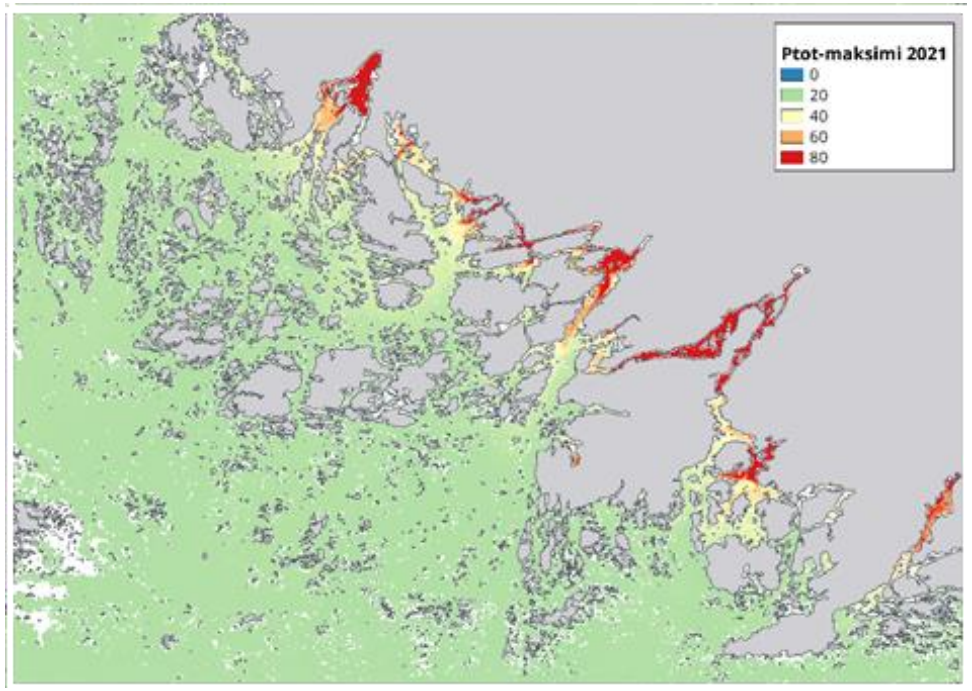
European Environment Agency
European Topic Centre
Biodiversity and ecosystems

ETC-BE studies focusing on EO

Task 1.2.1.6 Scoping study exploring the impacts of agriculture and climate change on aquatic variables

Mapping of land-use drivers, nutrients and organic pollution variables and biological response variables

Led by Katri Rankinen 2023



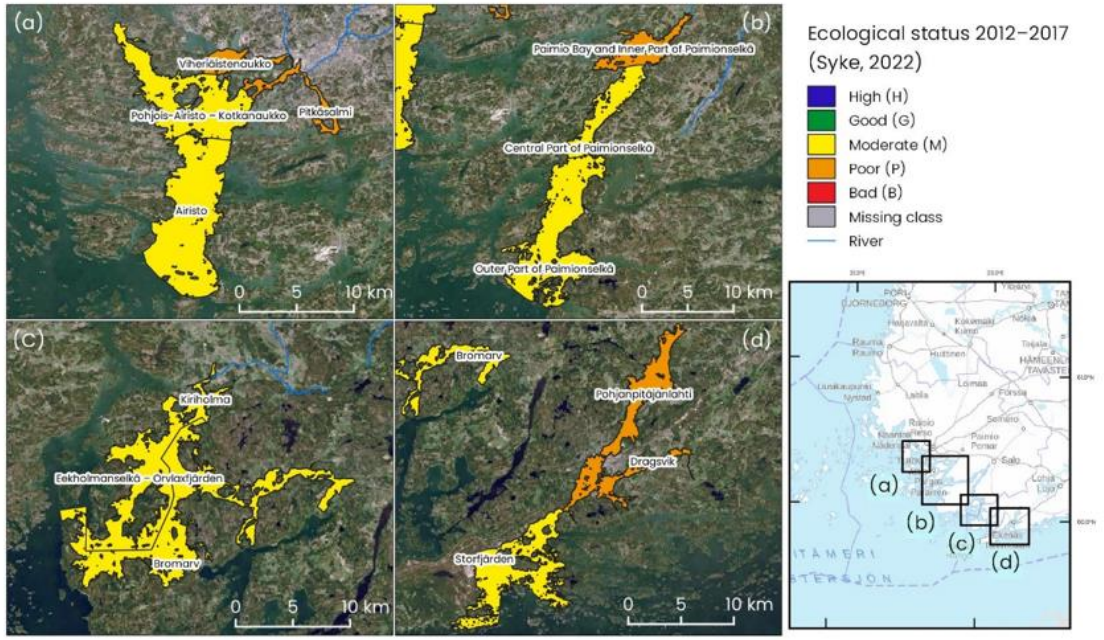


Figure 15. The ecological status during the latest assessment period (2012–2017) on the coastal water bodies of Archipelago Sea (southwestern Finland) assessed for this case study.

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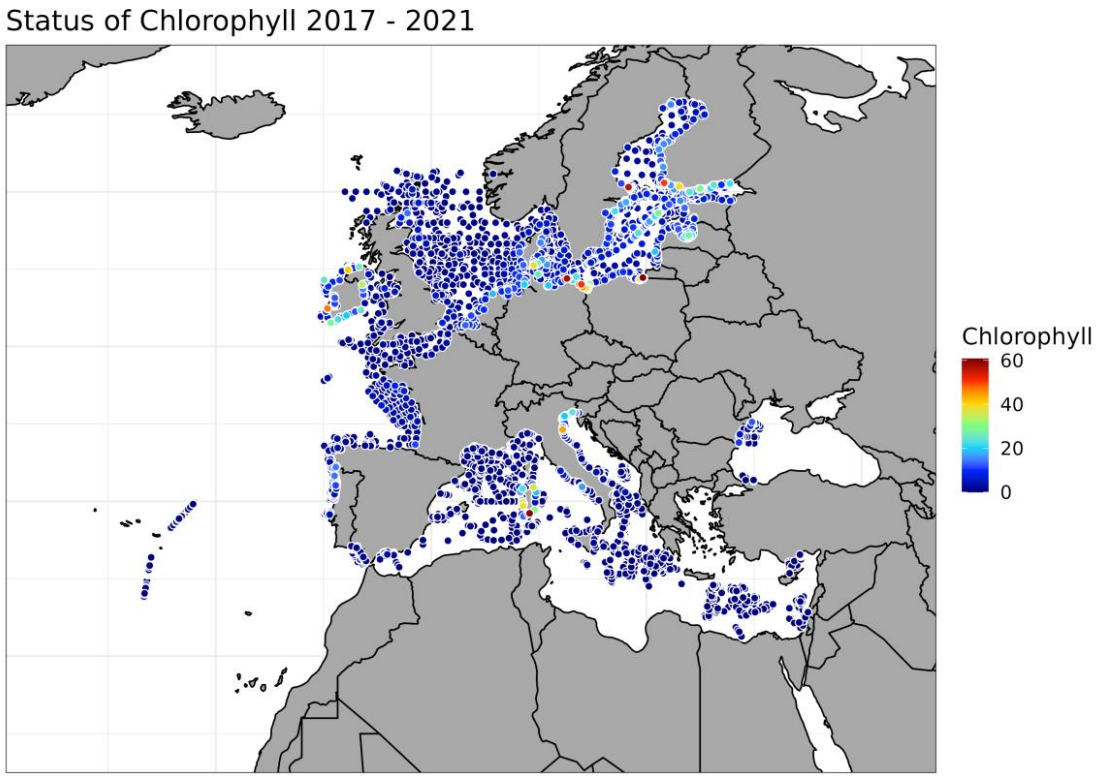
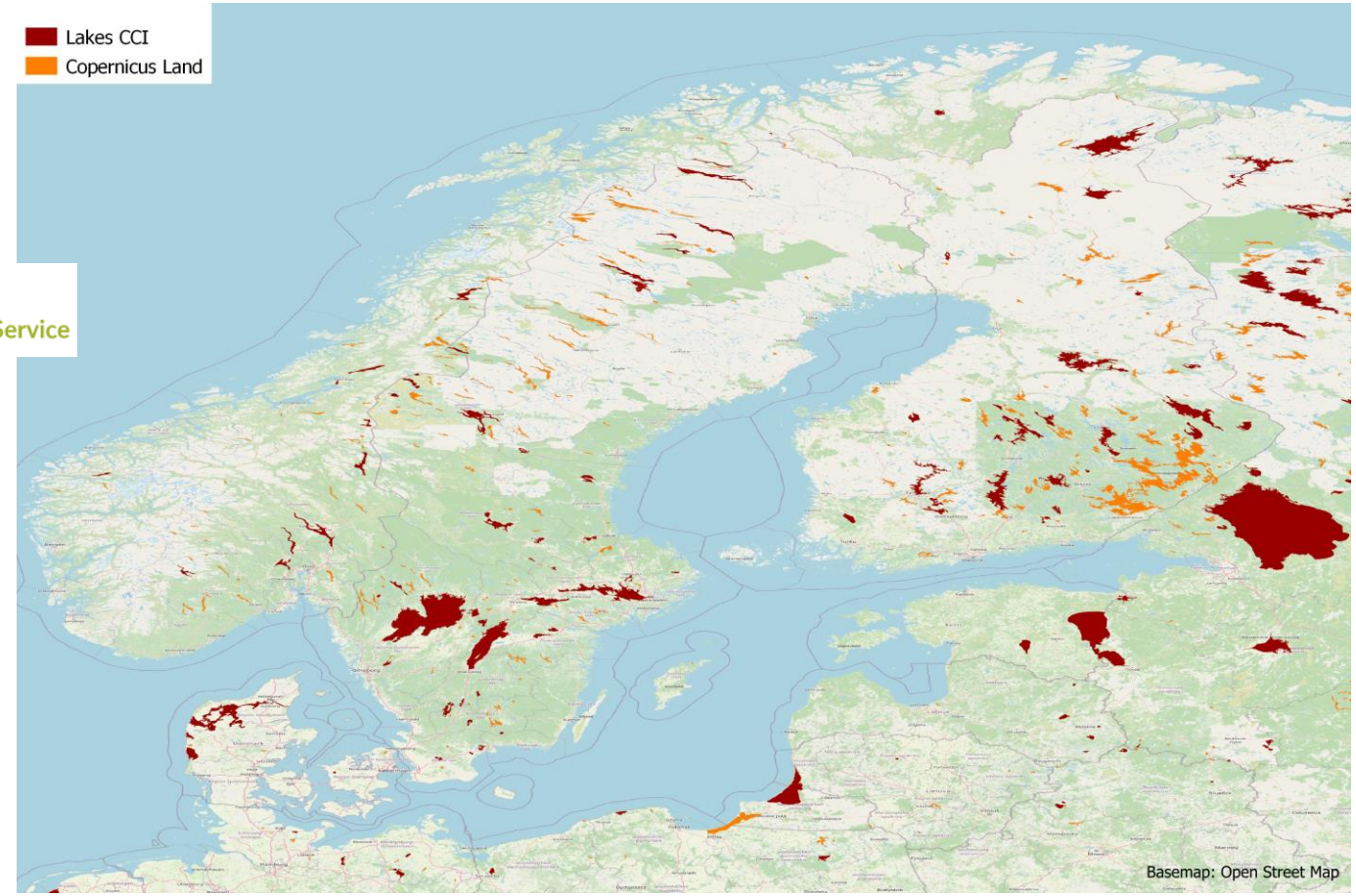
ETC-BE studies focusing on EO

Task 1.2.1.5 Eutrophication, Jesper Andersen, 2023, Therese Harvey 2024
Satellite observation-based chl-a-map covering European seas



Global services providing EO materials for lakes water quality: Copernicus Land service and Lakes CCI

- Chl-a, turbidity materials for European lakes
- Copernicus Land service
- Copernicus Lakes (esa.int) CCI (Climate Change Initiative)



MS	WFD water bodies	Copernius Land	Lakes -CCI
Finland	4640	196	65
Sweden	6925	249	113
Estonia	89	5	3

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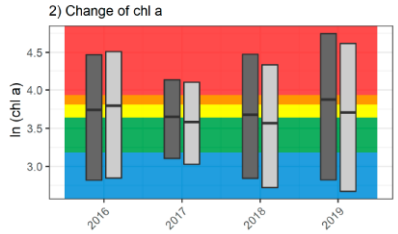
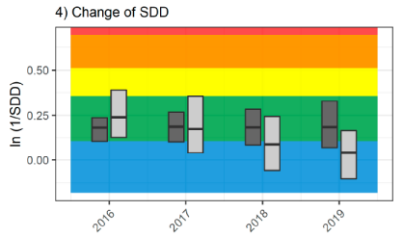
GIS materials on Land service and Lakes CCI: Stefan Simis, PML

EO for WFD - examples from EU countries

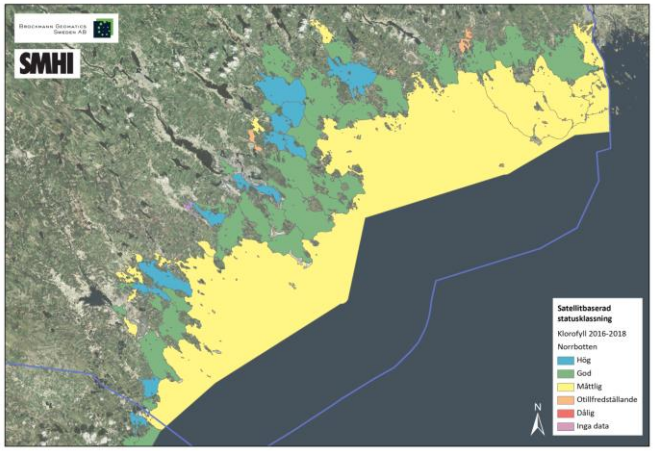
Norway: Therese Harvey, NIVA

Estonia: Krista Alikas, Tartu University

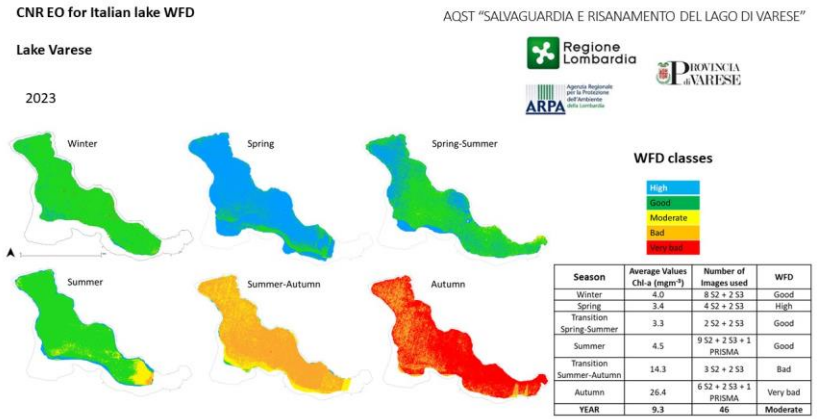




Sweden: Petra Philipson, Brockman Geomatics



Italy, CNR Mariano Breciani, Claudia Giardino,



Summary

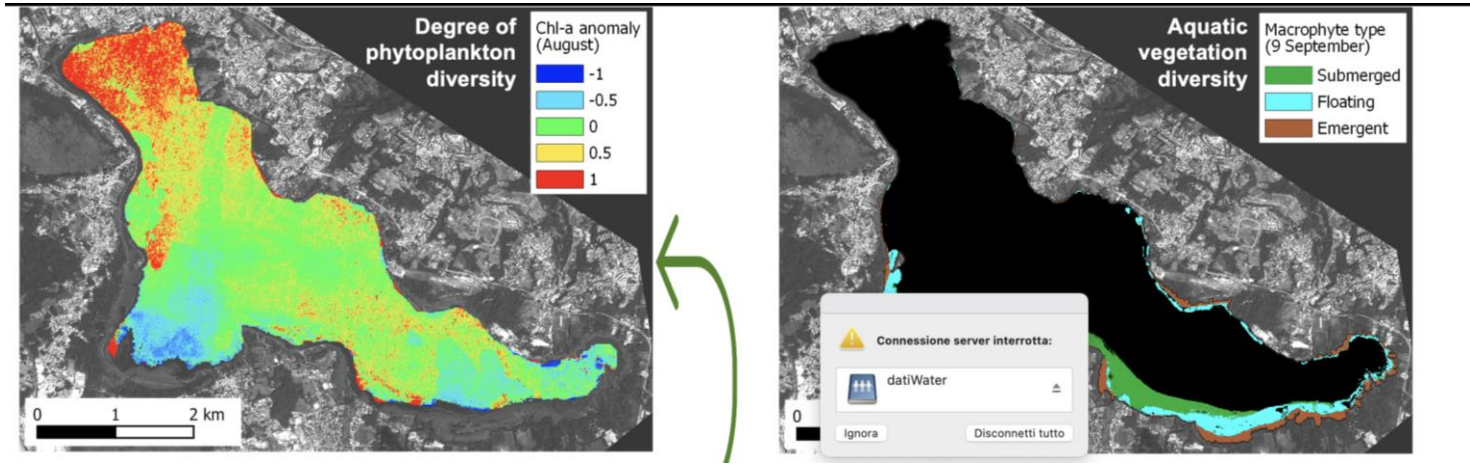
Most MS focus on deriving reliable estimates on

- **Chlorophyll-a** as most relevant indicator of eutrophication

Complementing parameters:

- **Algae blooms** (cyanobacteria blooms)
- **Secchi depth** or other indicator of water transparency
- Mapping of **macrophytes** (submerged and emerged)
- **Total phosphorus**

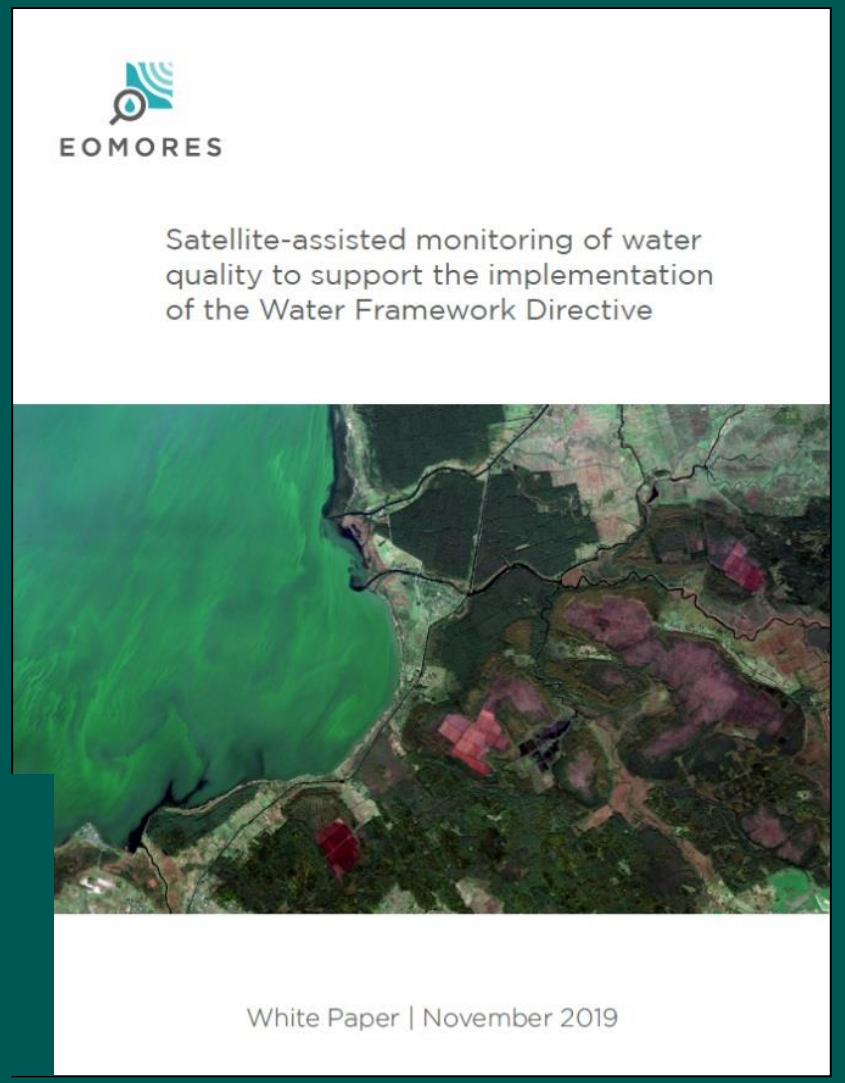
Figure by CNR: Mariano Breciani, Claudia Giardino



White paper

Recommends: actions should be taken to utilise the EO derived metrics in the WFD

doi: 10.5281/zenodo.3463051



ECOSTAT Working group: supporting actions for considering EO for WFD

- **This year**: to define current scene and gaps in boundary setting for WFD assessment and monitoring harmonization, that could be addressed by the use of EO.
- Update for the dedicated EU member states experts: perspective on the use of EO in WFD
  - Workshop to discuss findings from questionnaire (October) and consult with MS
  - Report with current scene, end user needs and requirements, gaps and drawbacks, good practice examples, and recommendations to be presented to ECOSTAT WG.
- Proposed task in the **ECOSTAT work progamme** for the period **2025-27**
  - *'Supporting the member states to use remote sensing data for WFD monitoring and assessment'*

WATER QUALITY IN FINLAND

What it is about

Sentinel-2 and Sentinel-3 data are being used to monitor water bodies in Finland. These measurements allow the environmental institute of Finland and regional environmental agencies, known as ELY Centres, to monitor the quality of water in lakes throughout their region to a degree that is not possible using traditional in-situ water sampling and testing.

Using satellite data is especially helpful in a country like Finland where the large amount of water bodies would imply enormous associated costs for authorities should they have to use traditional monitoring methods across the whole country. Sentinel data therefore helps authorities to improve water quality at a lower cost, which in turn improves the quality of life for citizens, aids in the protection of biodiversity and helps to ensure environmental sustainability.

What we found

- Sentinel data helps regional authorities and the Finnish environmental institute to monitor the lakes more effectively, more frequently and more comprehensively.
- Thanks to the use of Sentinel data offered through a publicly available platform, economic and leisure activities are better informed and lake ecosystems are better protected. The associated benefits are important and will grow significantly in the next five to ten years.
- This exemplary use of Sentinel satellite data in Finland not only generates positive impact in the country but also illuminates the associated value for regulatory aspects of water monitoring across Europe.

Copernicus Sentinels Benefits Study: A Show Case

Funded by the EU and ESA

Lake water quality in Finland An experience from Finland (SeBS benchmark case)

Jenni Attila
Hanna Alasalmi, Vesa Keto, Sakari Väkevä, Jesse Anttila, Sampsa Koponen, Eeva Bruun, Eero Alkio

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https://earsc.org/sebs/water-quality-in-finland/

Summary

Economic	Environmental	Societal	Regulatory	Innovation & Entrepreneurship	Scientific & Technological
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★

Table 5-3 Benefits Assessment by Category

- Cost savings from avoided satellite data acquisition (tier 1)
- Cost savings from avoided in-situ monitoring (tier 2)
- Cultural ecosystem services from good quality water (tier 4)

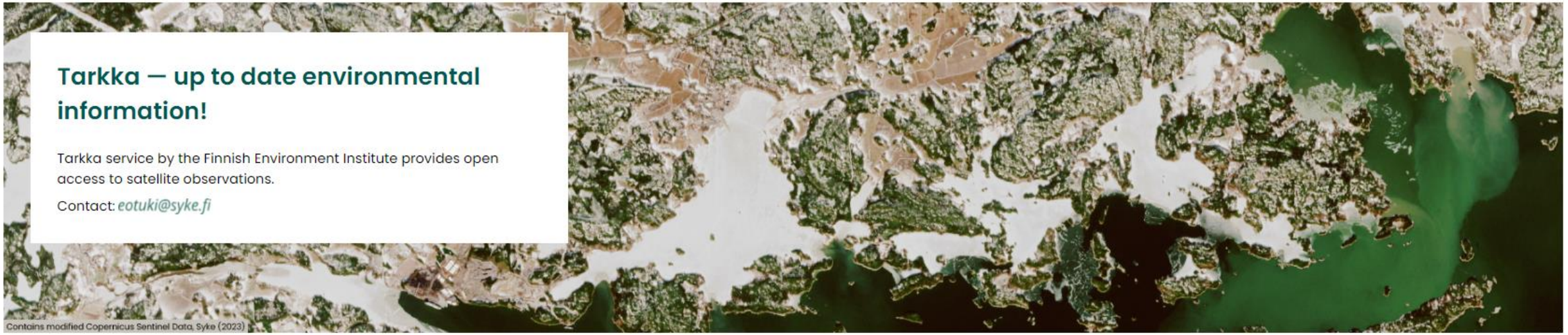
- Reduce pollution (less fertilizer run-off)
- Maintenance of natural habitats and ecosystems (tier 4)
- Supporting tool in the detection of environmental threats (tiers 3 and 4)

- Improved access to amenities linked to water bodies – swimming, fishing, canoeing, etc. (tier 4)
- Better quality of life (tier 4)

- Better monitoring and enforcement sustainability commitments (tier 2)
- Better monitor impact of policies (tier 3)
- Improve policies (tier 3)

- Creation of innovative services (tier 1)
- Championing of innovative services and changing of operational practices (tier 2)

- Wide-scale nature of the measurements possible with Sentinel data is enabling research projects into ecosystems services as well as impact of water quality.



Tarkka — up to date environmental information!

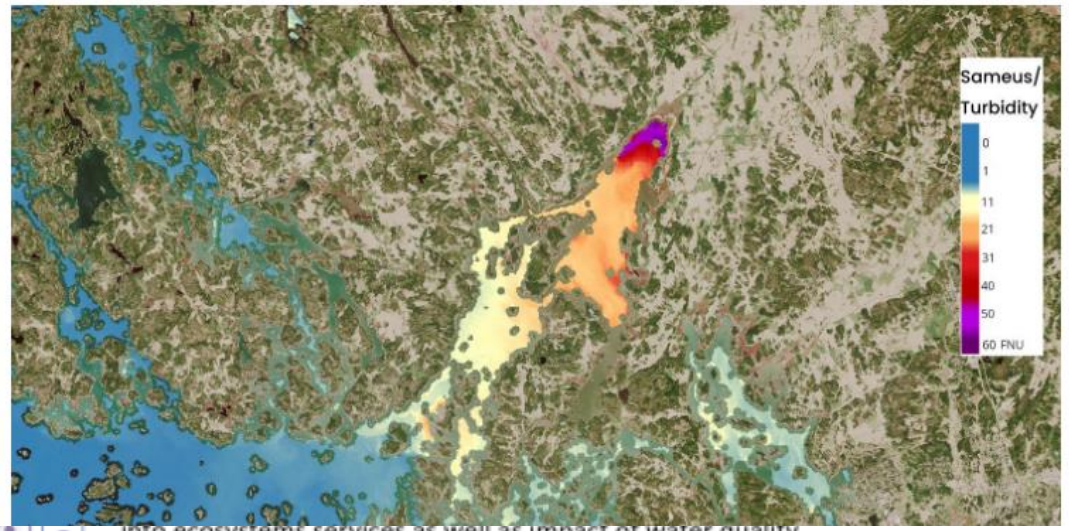
Tarkka service by the Finnish Environment Institute provides open access to satellite observations.

Contact: *eotuki@syke.fi*

Highlights

26.5.2024	Pollen off the coast of Hiiumaa.
22.5.2024	Satellite observation of turbidity in Mynälahti
19.5.2024	The bottom of the sea can be seen in Jurmo
19.5.2024	The sandy beaches of Hanko in spring
11.5.2024	Liminganlahti in Spring time
11.5.2024	Turbid lakes in the western Uusimaa
4.5.2024	Turbid water in the freshwater reservoir of Uusikaupunki
1.5.2024	Turbid meltwaters in the Eastern Gulf of Finland
1.5.2024	Ice melting off the coast of Oulu and Hailuoto
1.5.2024	Crimson-glowing Mynälahti
1.5.2024	Melting ice on lake Kemijärvi
12.4.2024	The waters flowing from the catchment areas carry sediment and push ice floes off the coast of Kristiinankaupunki.
8.4.2024	Turbid river estuaries at the Gulf of Finland
4.4.2024	Almost cloudless snowy Finland

Satellite observation of turbidity in Mynälahti. 22 May 2024.



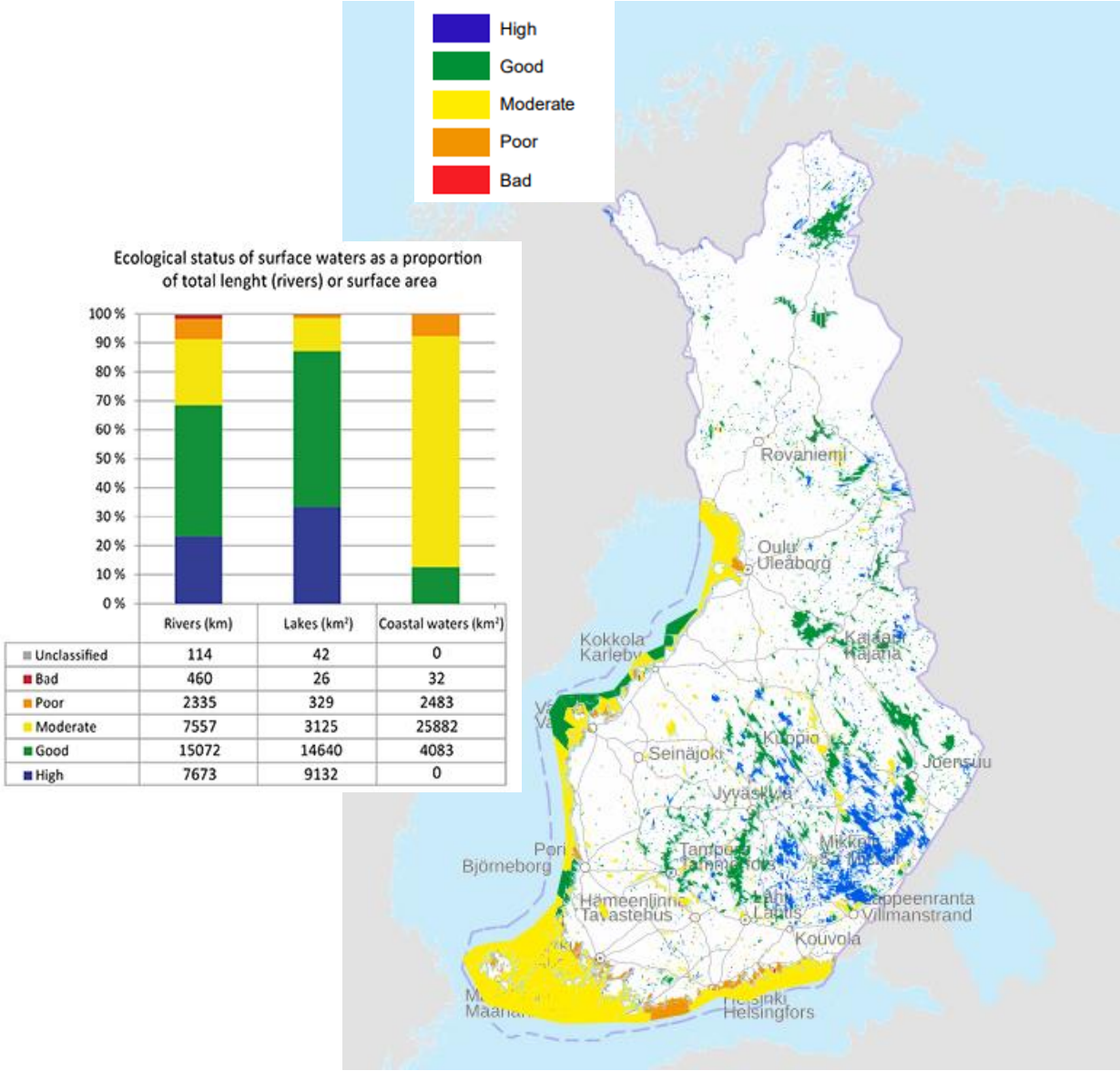
into ecosystems services as well as impact of water quality.

WFD in Finland

Environmental administration is responsible for WFD reporting

- **Ministry of Environment**: implementation
- **Regional centers**: status assessment
- **Syke**: coordination, databases, interfaces, EO

- Fragmented coastline, thousands of islands
  - 278 coastal, 4639 lake & 960 river water bodies
  - Cost-efficient and automated methods for water quality monitoring are of importance.
  - Expert judgement rule.



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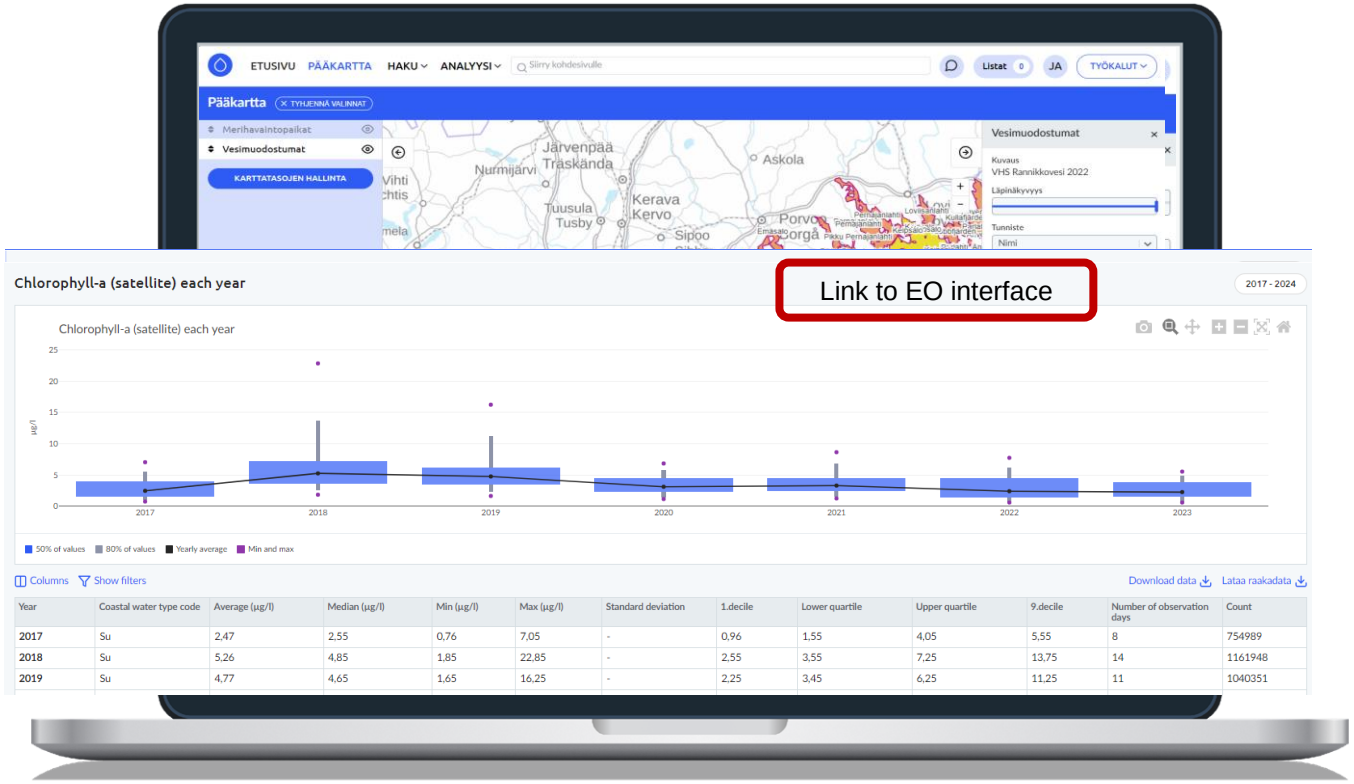
Linking EO to water management

Pisara (Drop) – information system for water management

- Supports the planning process of water and marine management, e.g
  - status assessments
  - monitoring
  - planning the measures
  - impact assessment
- Visualization and sharing information
  - experts as users

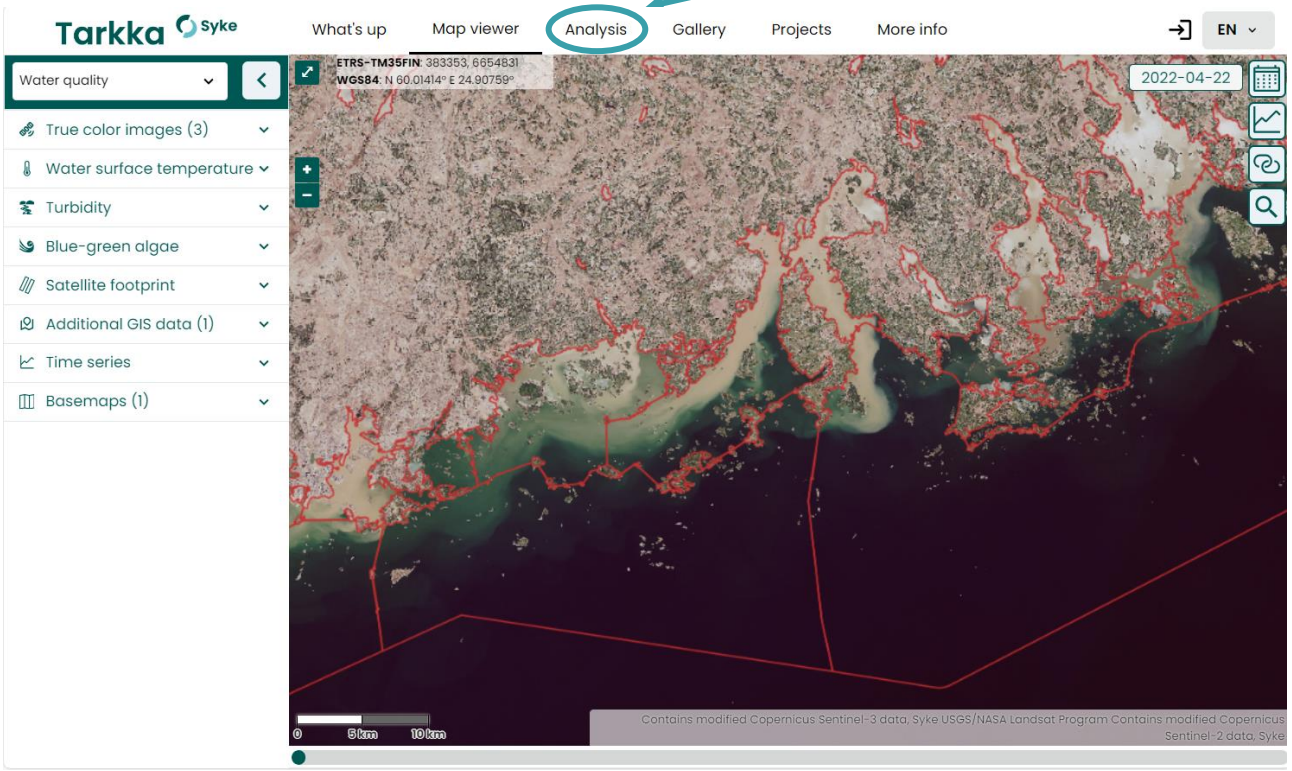


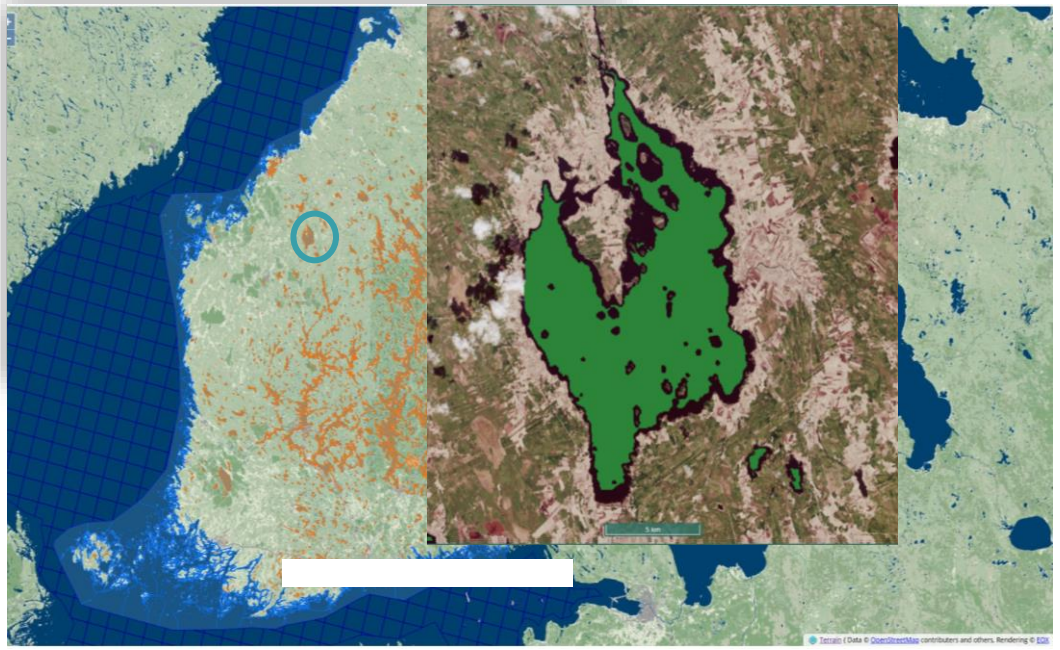
Year	Coastal water type code	Average (µg/l)	Median (µg/l)	Min (µg/l)	Max (µg/l)	Standard deviation	1.decile	Lower quartile	Upper quartile	9.decile	Number of observation days	Count
2017	Su	2,47	2,55	0,76	7,05	-	0,96	1,55	4,05	5,55	8	754989
2018	Su	5,26	4,85	1,85	22,85	-	2,55	3,55	7,25	13,75	14	1161948
2019	Su	4,77	4,65	1,65	16,25	-	2,25	3,45	6,25	11,25	11	1040351

Open interface and EO database Status

Tarkka Tarkka.syke.fi

- Open service: Water quality products over Finnish lakes and the Baltic Sea (FI/EN)
- Used by authorities, media and citizens





STATUS Database

- Numerical and aggregated EO water quality data & database for water bodies

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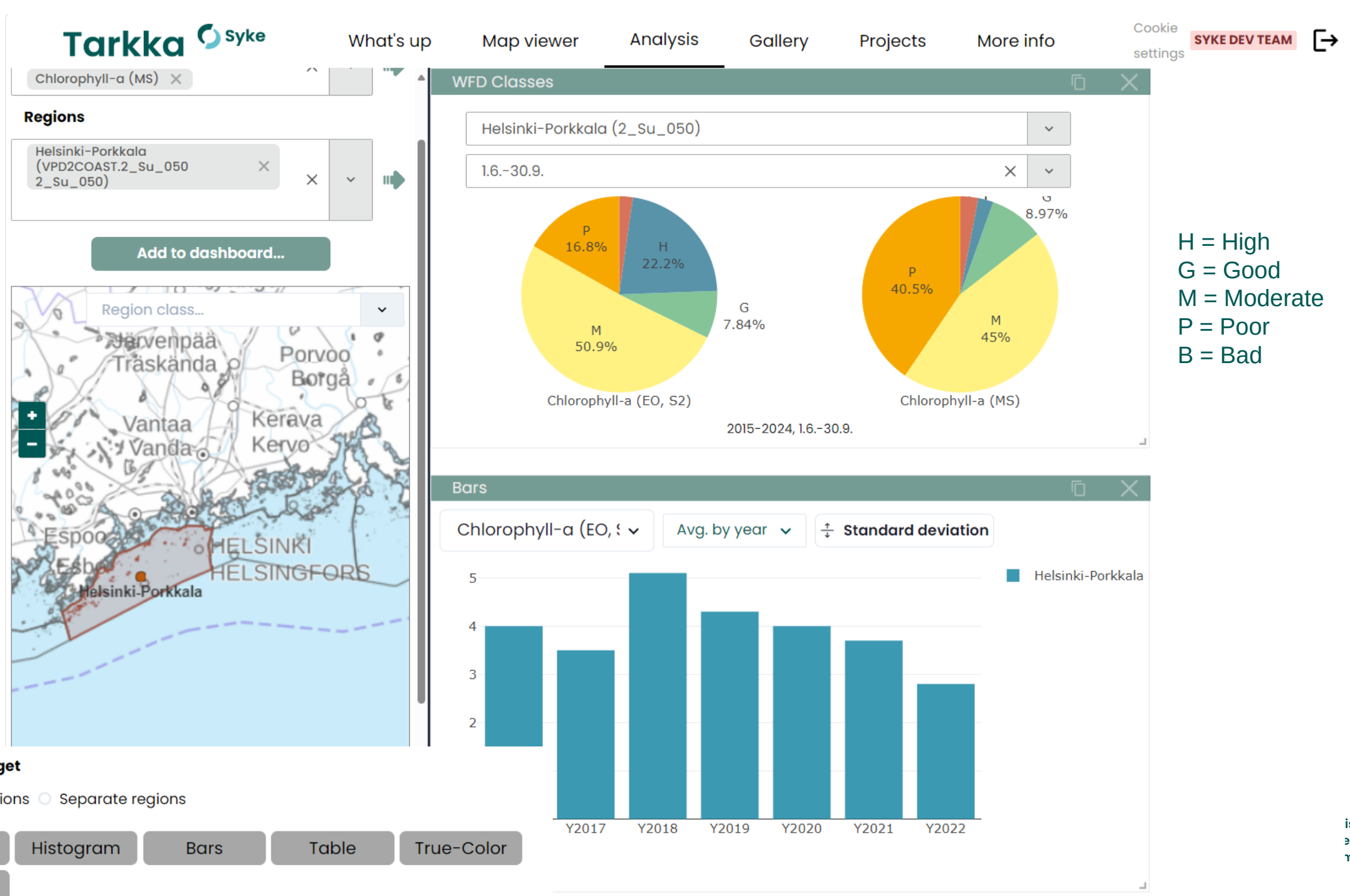

H = High
G = Good
M = Moderate
P = Poor
B = Bad

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Many thanks!

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https://earsc.org/sebs/water-quality-in-finland

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