River-Coast-Sea Management

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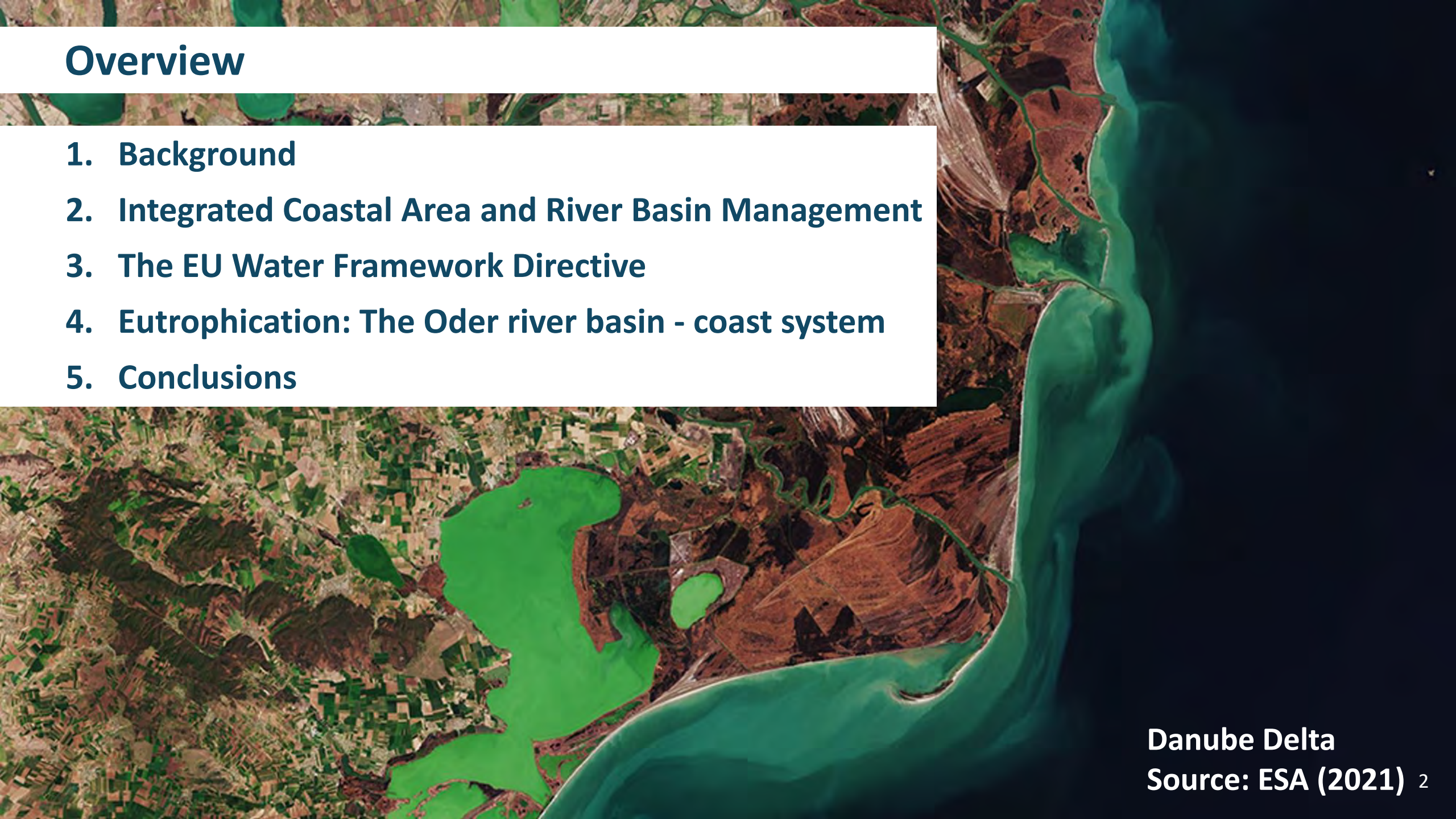
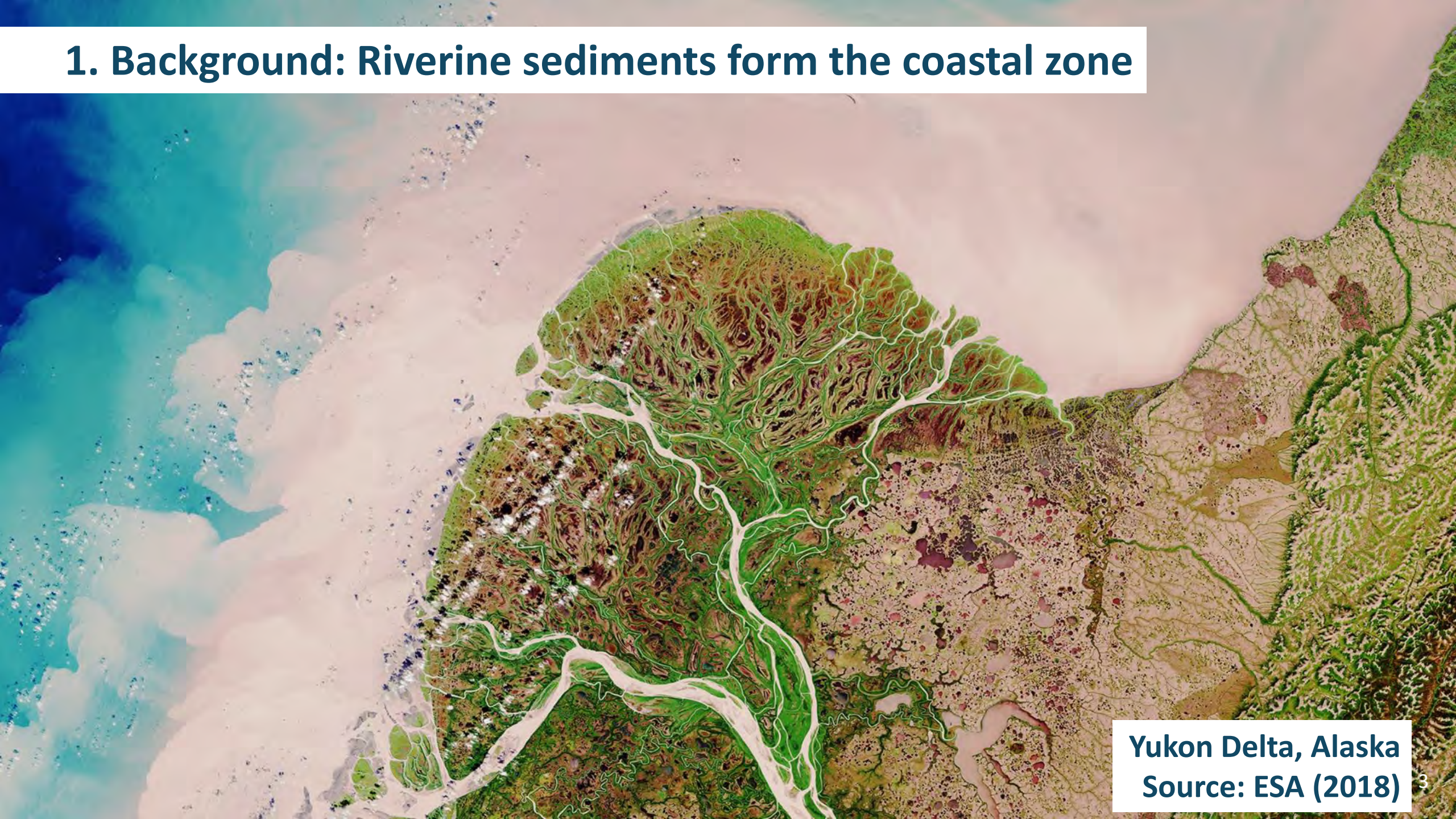
Overview

1. Background
2. Integrated Coastal Area and River Basin Management
3. The EU Water Framework Directive
4. Eutrophication: The Oder river basin - coast system
5. Conclusions



Danube Delta
Source: ESA (2021)

1. Background: Riverine sediments form the coastal zone



Yukon Delta, Alaska
Source: ESA (2018)

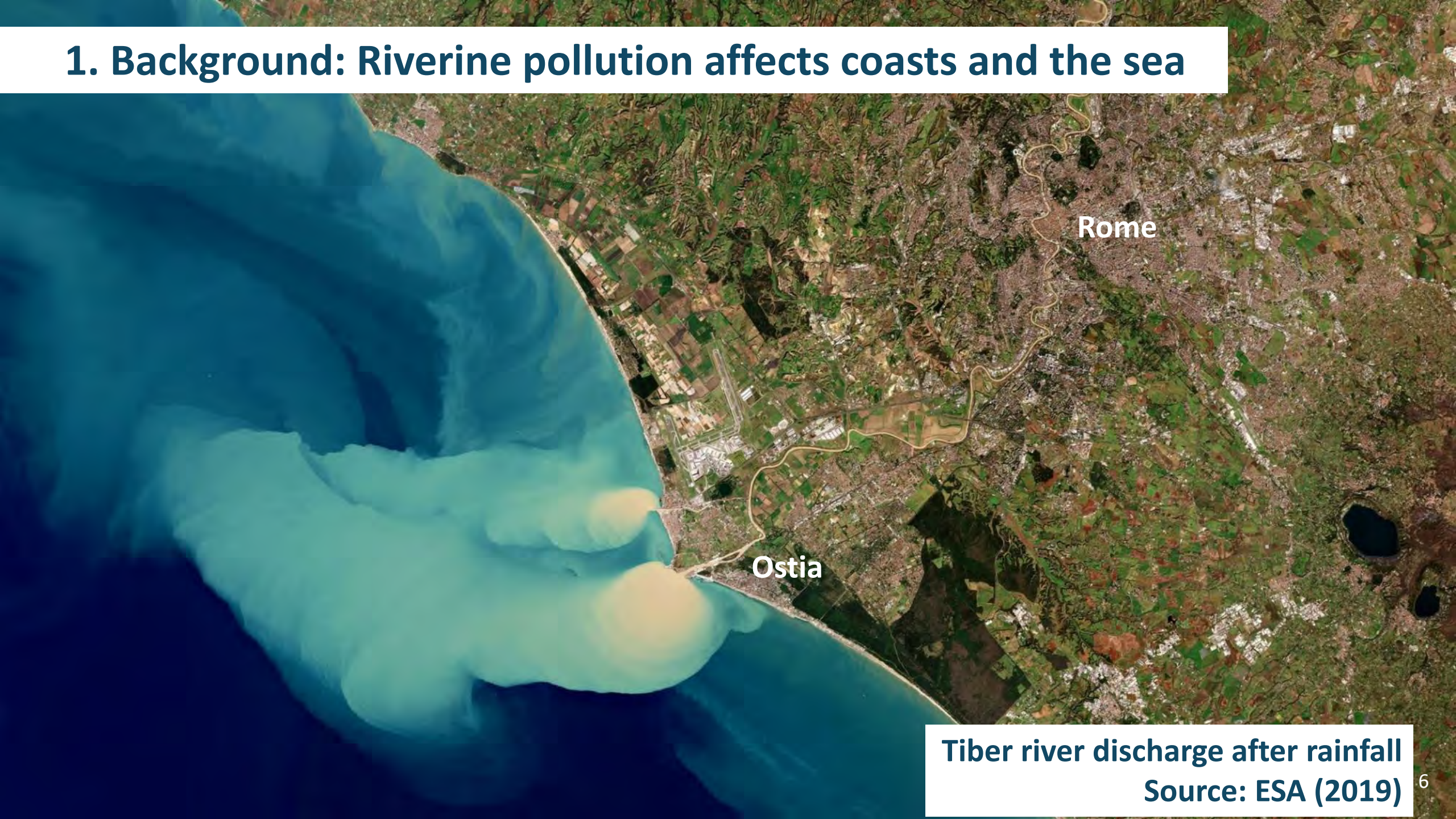
1. Background: Rivers keep the coastal zone dynamic

Amazonas Delta in Brazil
Source: ESA (2018)

1. Background: River mouths are hot-spots of human activities

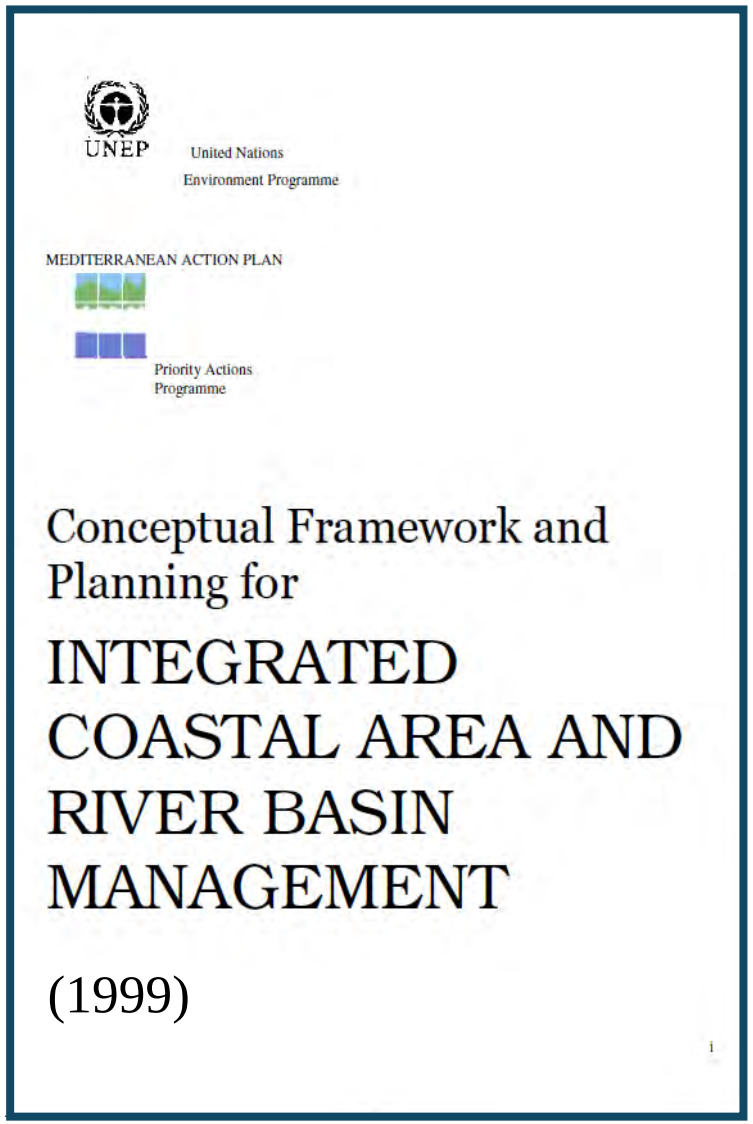
Rhine, Maas & Schelde mouths
Source: ESA (2020)

1. Background: Riverine pollution affects coasts and the sea



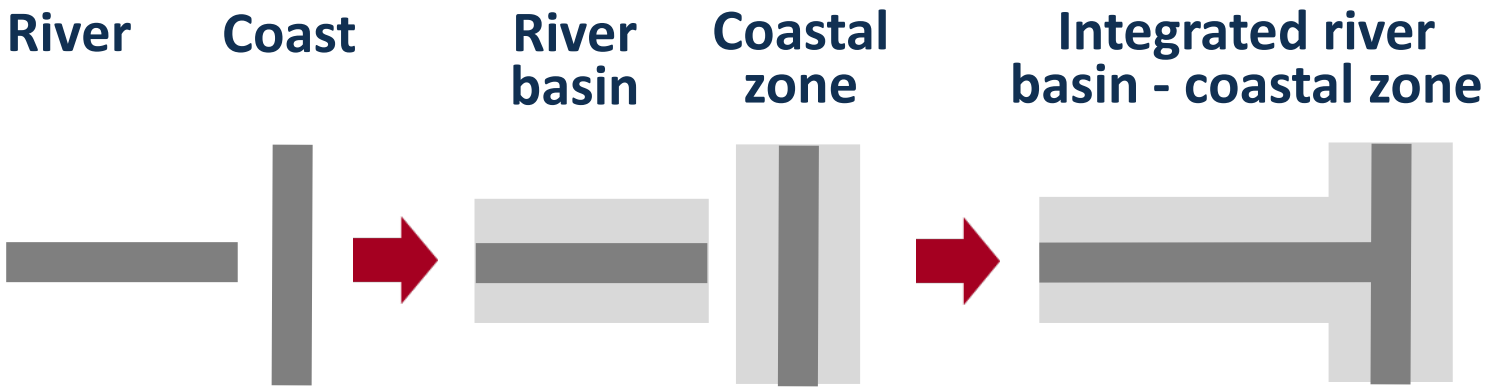
Tiber river discharge after rainfall
Source: ESA (2019)

2. ICARM: Integrated Coastal Area and River Basin Management



- **ICARM goals fall within the scope of sustainable development** where economic efficiency and social equity goals are linked to environmental conservation goals.
- **ICARM is the promotion of sustainable development** including the maintenance of all essential ecological processes, life-support systems and biological diversity, while providing local communities with a basic healthy quality of life and reducing their vulnerability to hazards.
- **ICARM will focus on efficient use of space and resources**, effective reduction of waste emissions, and preservation of valuable ecosystems.
- **ICARM will apply modern management techniques** to ensure multi-sectoral and multi-level integration and will foster participation of all stakeholders involved in the decision-making process.

2. ICARM: The management approach



2. ICARM – 20 worldwide case studies

Lessons learnt for an effective implementation:

- More attention to socio-economically equitable development (e.g. coast-river basin imbalance)
- Strengthening the enabling environment (e.g. lack of political will and legislation)
- Improvement of the institutions (e.g. inadequate co-ordination, co-operation, capacity and issue analysis)
- Involvement of the stakeholders

2. ICARM – 20 worldwide case studies

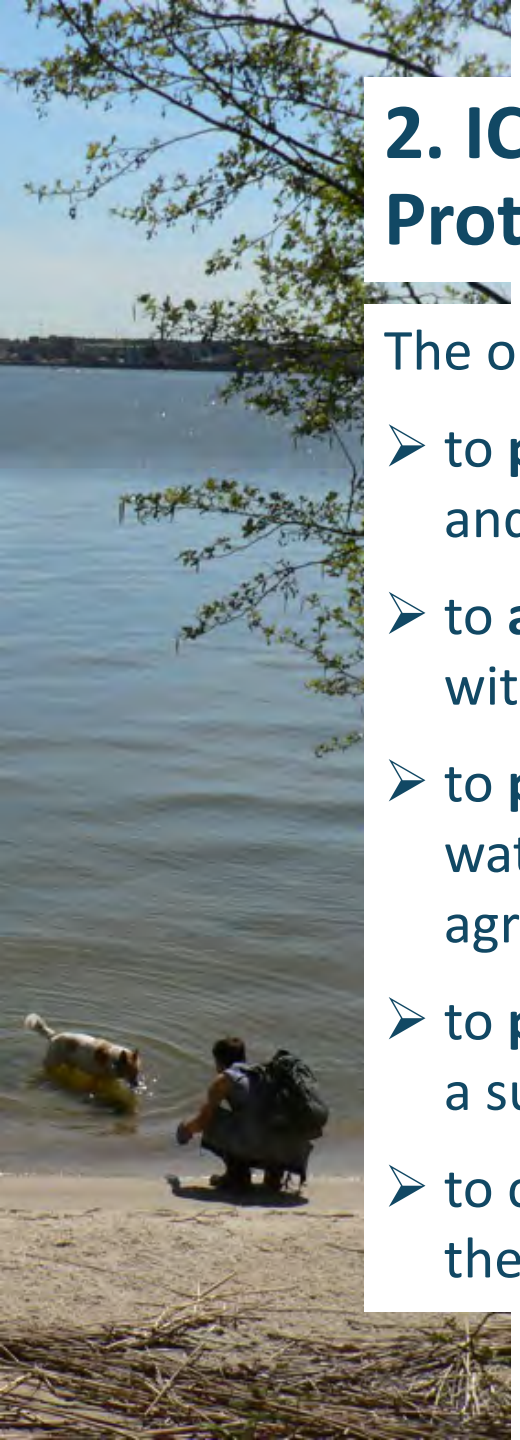
Some **factors for a successful implementation** are

- Strong institutional leadership
- Strategic partnerships and full stakeholder involvement
- Integration with regional planning
- Binding agreements
- Effective communication and sharing relevant information

2. ICARM – The Oder river basin coastal area

The **most urgent issues** in the basin are:

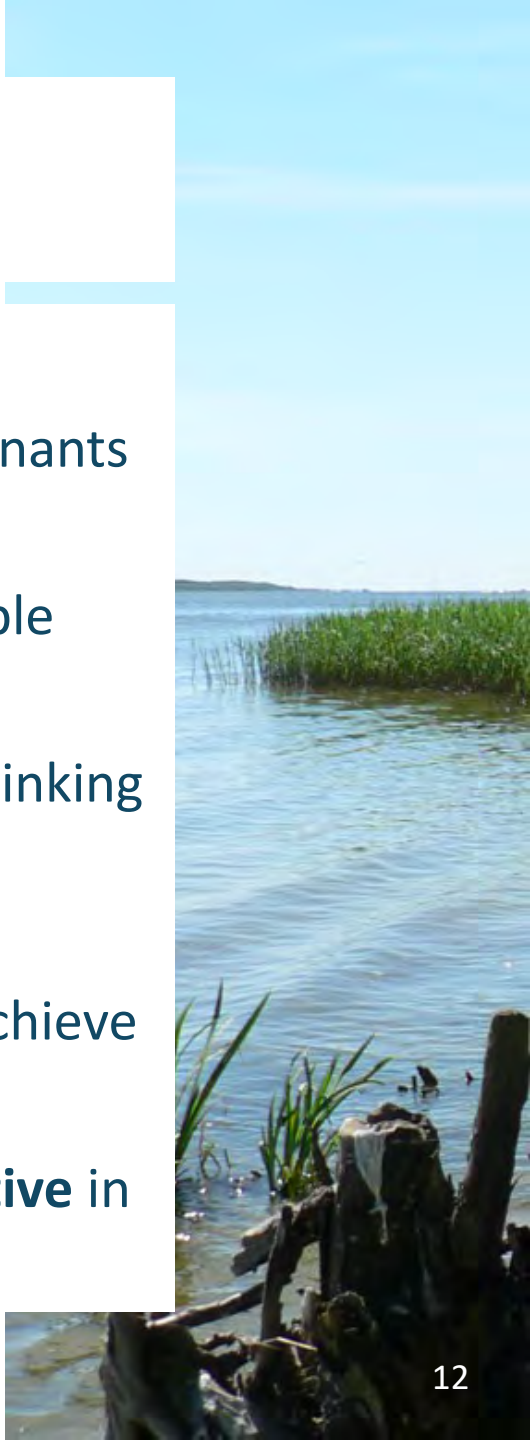
- **Flooding from storm surges and river floods**. Storms can result in flooding, increased coastal erosion and damage to harbours and coastal infrastructure.
- **Dredging and engineering measures** to maintain the navigation channels.
- **Obstruction to fish migration** (e.g. eel, salmon and trout) by the large number of engineering structures in place. The introduction of many alien species by ships is also an issue.
- **Eutrophication and poor water quality** caused by nitrogen and phosphorus loads from intensive agriculture, industries and cities. Eutrophication in the coastal lagoon still remains a central issue that hampers the development of tourism and nature protection.



2. ICARM – The International Commission on the Protection of the Oder against Pollution (ICPO)

The objectives of the ICPO are:

- to **prevent the pollution** of the Oder and the Baltic Sea by contaminants and to achieve a reduction in the pollution thereof;
- to **achieve the most natural aquatic and littoral ecosystems** possible with the corresponding species diversity;
- to **permit utilization of the Oder**, in particular the production of drinking water from bank filtrate and the use of its water and sediments in agriculture;
- to **provide for precautions against the risk of flood damage** and achieve a sustained reduction thereof; and
- to coordinate the **implementation of the Water Framework Directive** in the Oder river basin.



http://www.mkoo.pl/

3. The EU Water Framework Directive (WFD)

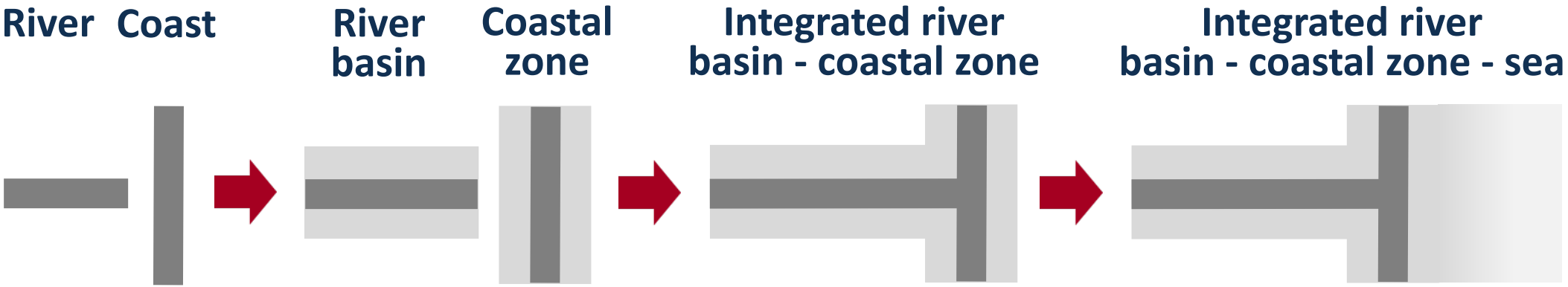
The Directive aims for 'good status' for all ground and surface waters (rivers, lakes, transitional waters, and coastal waters) in the EU.

The ecological and chemical status criteria are:

- **Biological quality** (fish, benthic invertebrates, aquatic flora)
- **Hydromorphological quality** such as river bank structure, river continuity or substrate of the river bed
- **Physical-chemical quality** such as temperature, oxygenation and nutrient conditions
- **Chemical quality** that refers to environmental quality standards for river basin specific pollutants.

The WFD has a focus on eutrophication

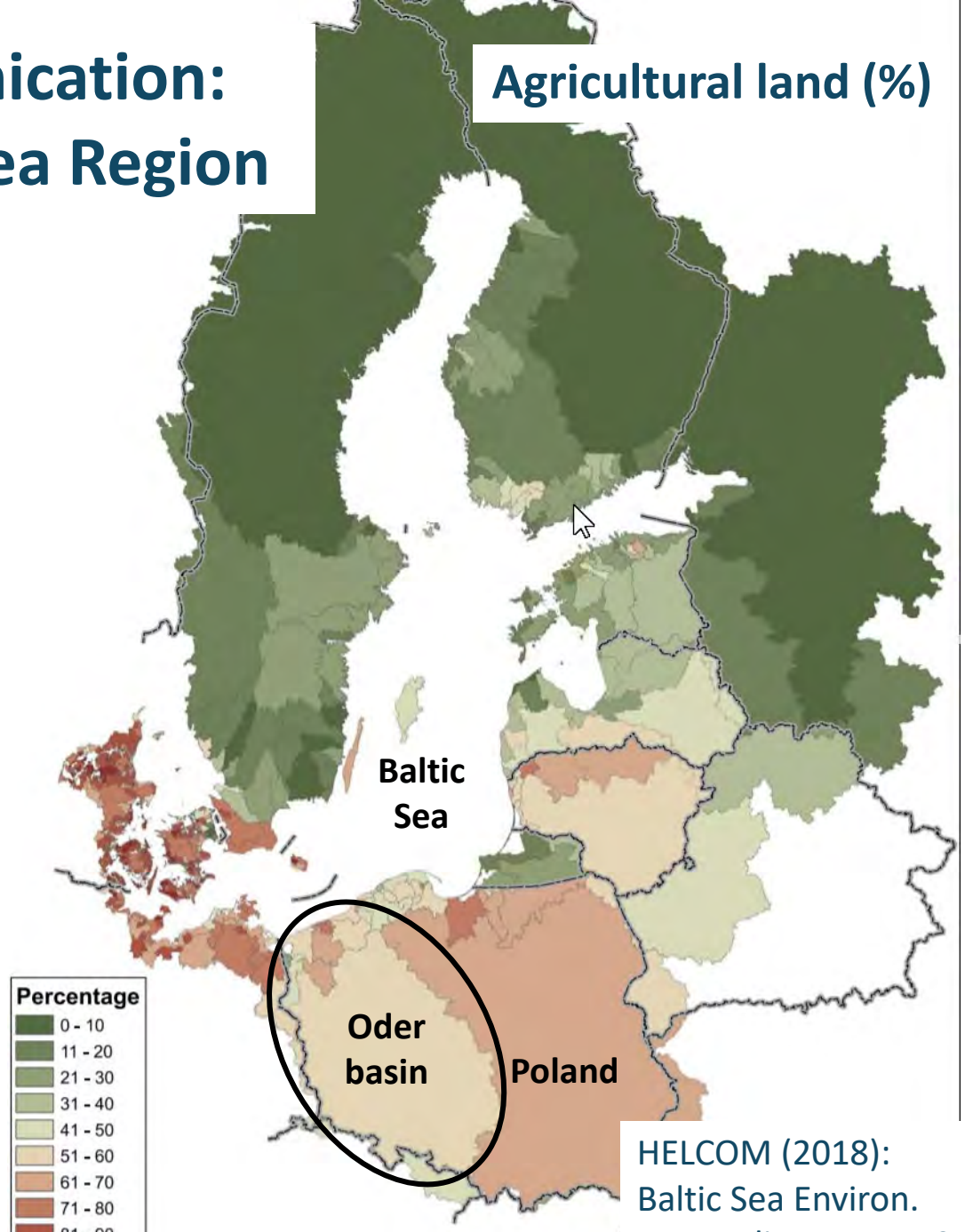
3. The Water Framework Directive



- The WFD follows an integrated river basin – coastal zone approach (1 nautical mile offshore a base line)
- The WFD is part of the EU Marine Strategy Framework Directive. This can be regarded as an extension towards the sea.

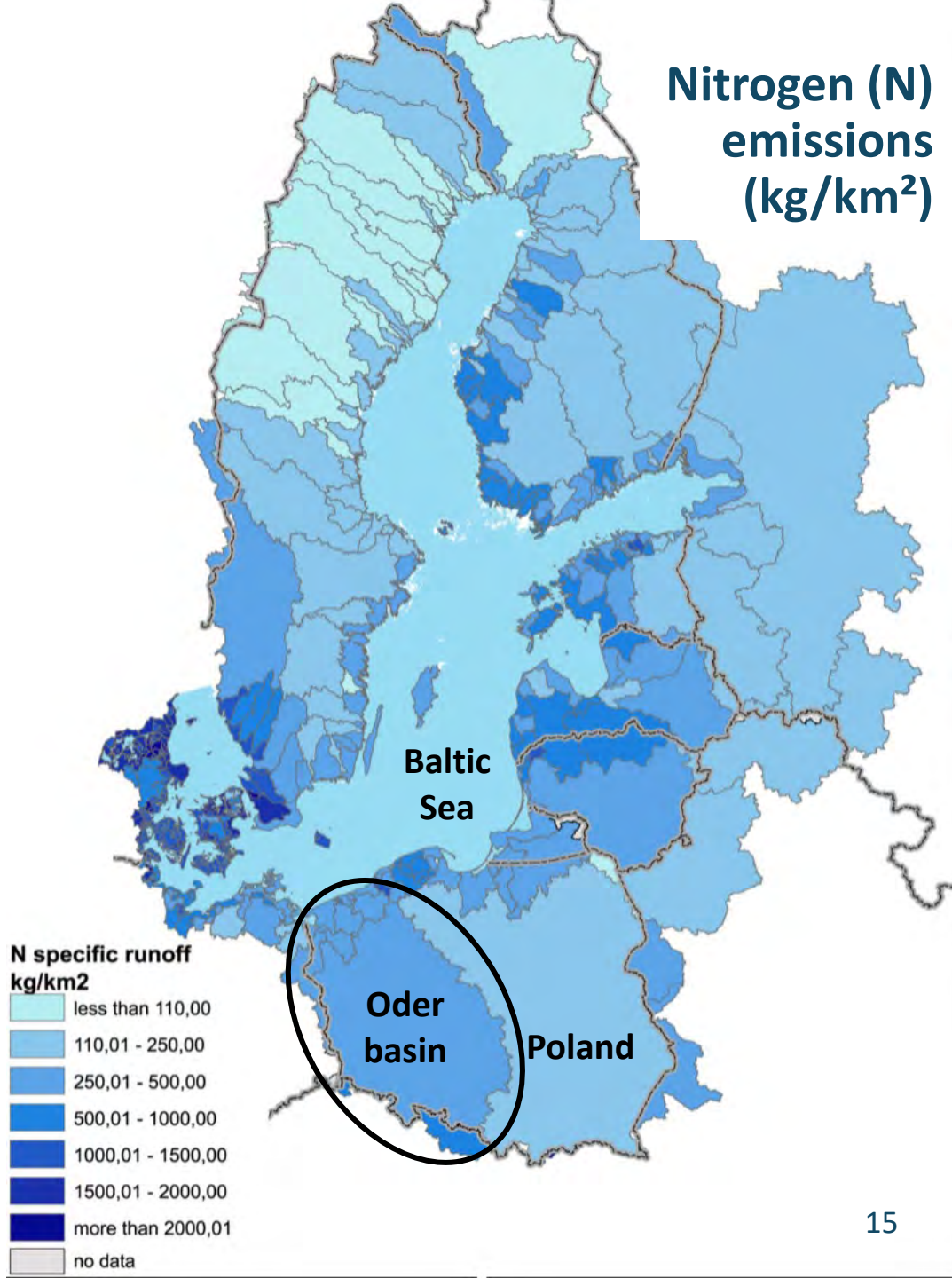
4. Eutrophication: Baltic Sea Region

Agricultural land (%)

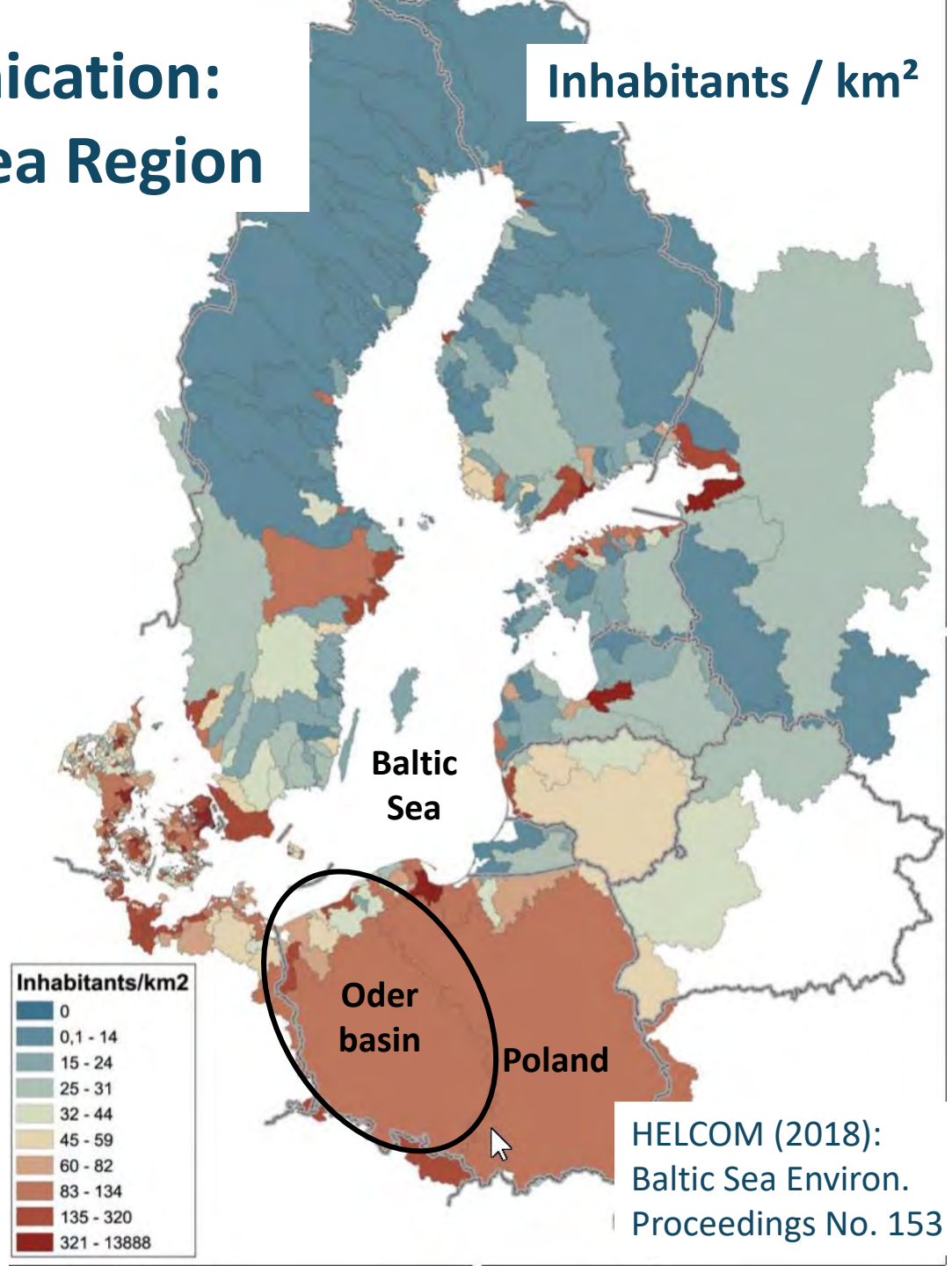


HELCOM (2018): Baltic Sea Environ. Proceedings No. 153

Nitrogen (N) emissions (kg/km²)



4. Eutrophication: Baltic Sea Region



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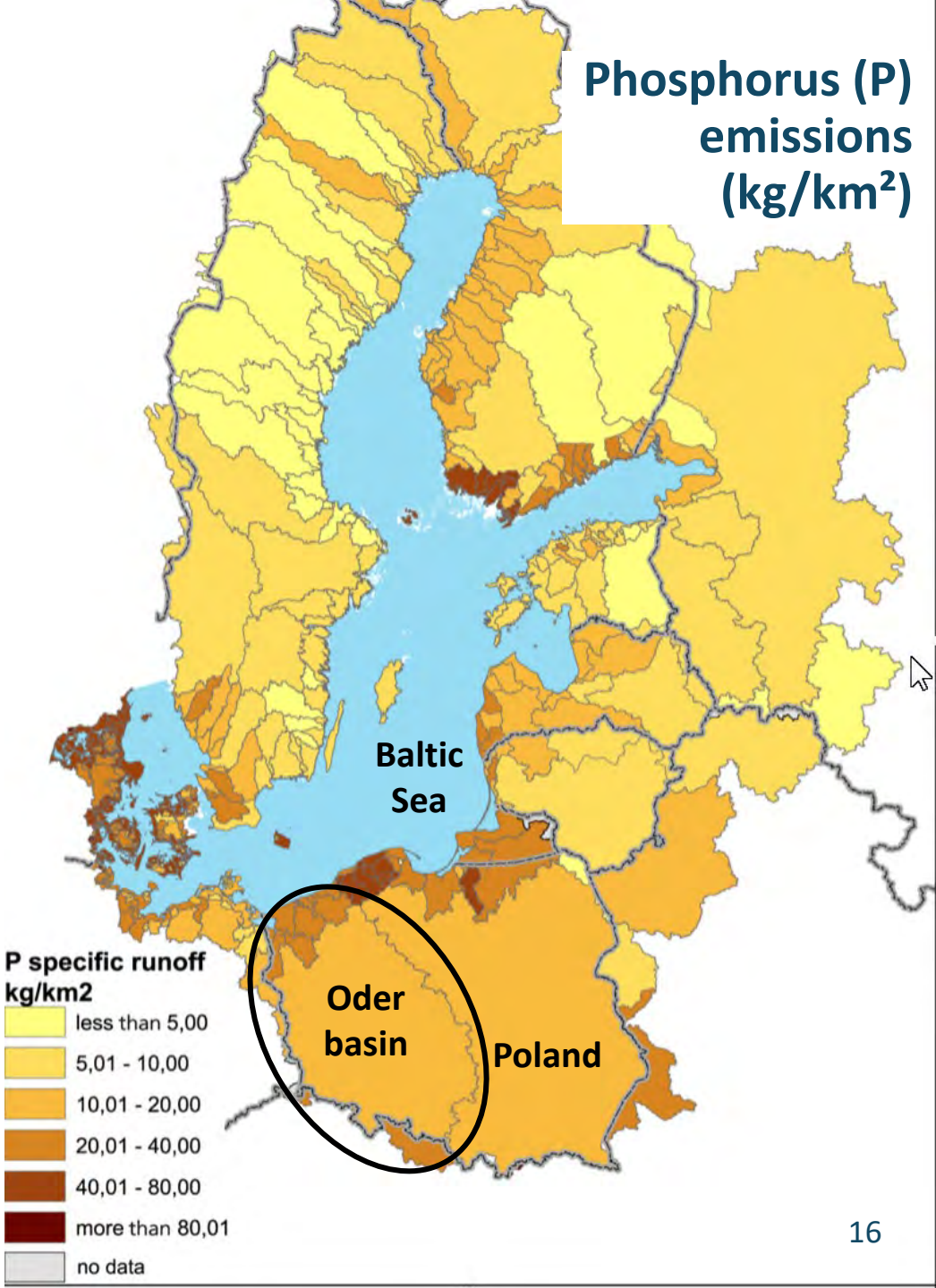

4. Eutrophication: The 7 major Baltic rivers (1995-2017)

River	Area (km^{-2})	TN (tonnes)	TP (tonnes)	Flow ($m^3 s^{-1}$)	Area spec. inputs (kg N km^{-1})	Area spec. inputs (kg P km^{-1})	Area spec. runoff (l s^{-1} km^{-2})
Neva	271,800	50,911	1,998	2,860	187	7.4	10.5
Vistula	194,420	145,867	9,233	1,727	750	47	8.9
Odra	118,840	103,865	4,469	895	874	38	7.5
Daugava	86,530	38,965	1,545	791	450	18	9.1
Göta älv	50,230	14,387	410	698	286	8.2	13.9
Nemunas	97,920	44,057	1,774	624	450	18	6.4
Kemijoki	51,130	6,470	338	549	127	3.6	10.7
Sum	**870,870**	**404,522**	**19,768**	**8,144**			
Weighted average					**465**	**23**	**9.4**
Percentage of total waterborne input to BAS (%)	50.4	53.3	54.7	46.0			
Percentage of BAS average (%)					106	101	84.7

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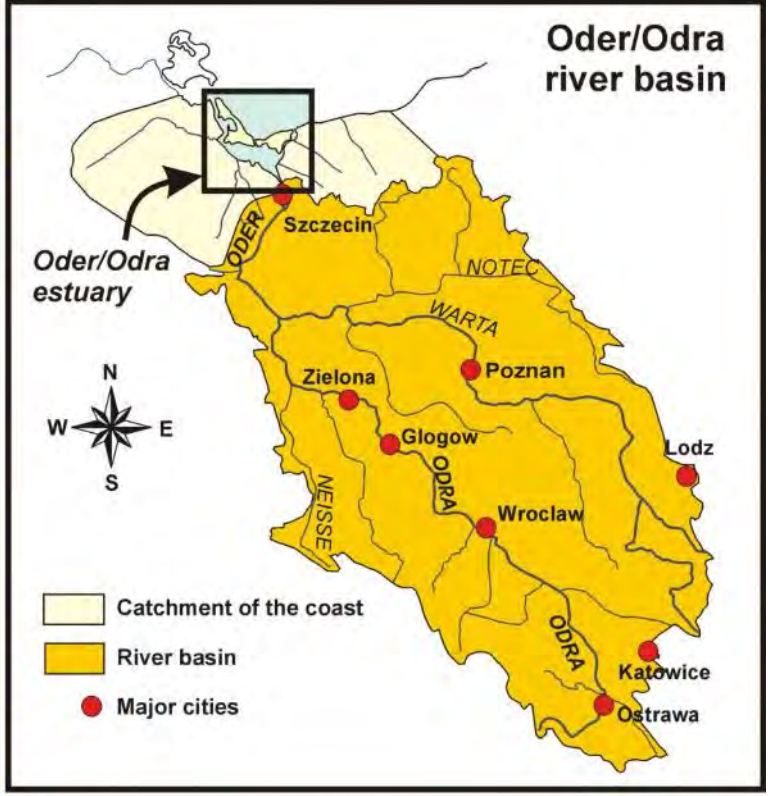
4. Eutrophication:
The Oder river basin – coastal area

A small coastal lagoon/estuary area is dominated by a large river basin.



Oder/Odra river basin

Length (km):	854
Catchment (km²):	118,000
Discharge (m³/s):	530 (average)
Population (Mio):	15.4

Oder/Odra estuary

Catchment (km²):	8000
Lagoon area (km²):	687
Lagoon depth (m):	3.7 (average)

Coastal climate:

Temperature (°C):	8.7 (average)
Precipiation (mm):	550

Schernewski et al. (2012)

4. The Oder/Szczecin Lagoon - an EU Natura 2000 site

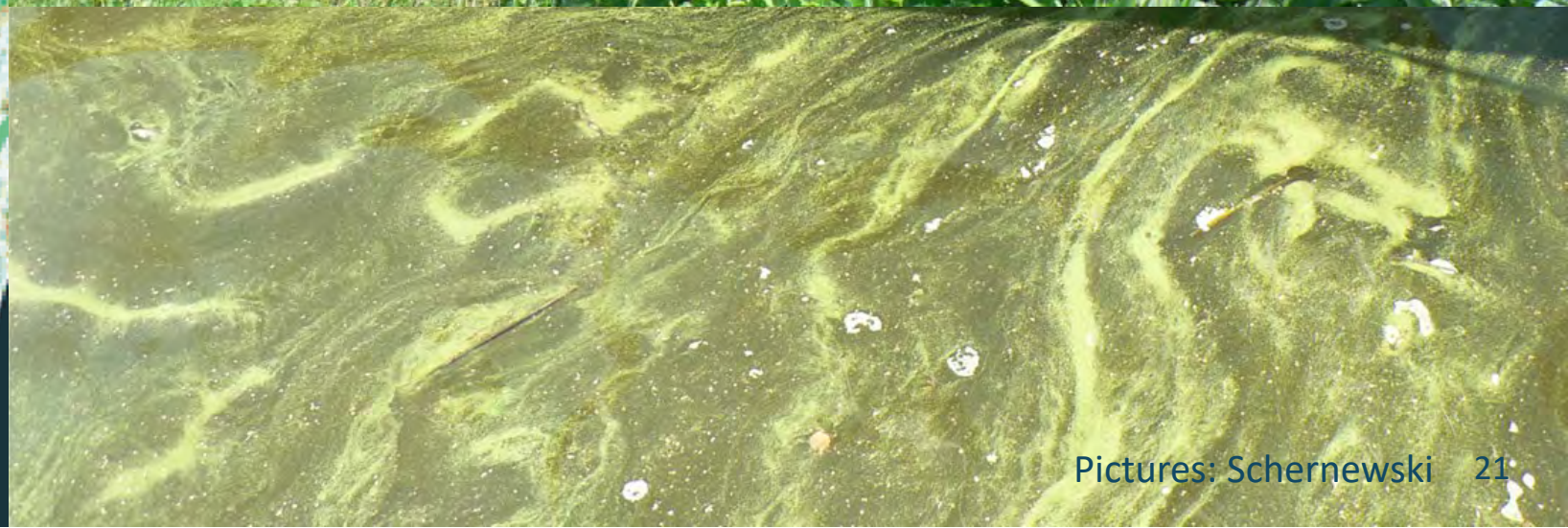
Schernewski (2008)

4. The Oder/Szczecin Lagoon - a tourism region

Schernewski (2008)

4. The Oder/Szczecin Lagoon - algae blooms

Satellite image: Siegel et al. 2000



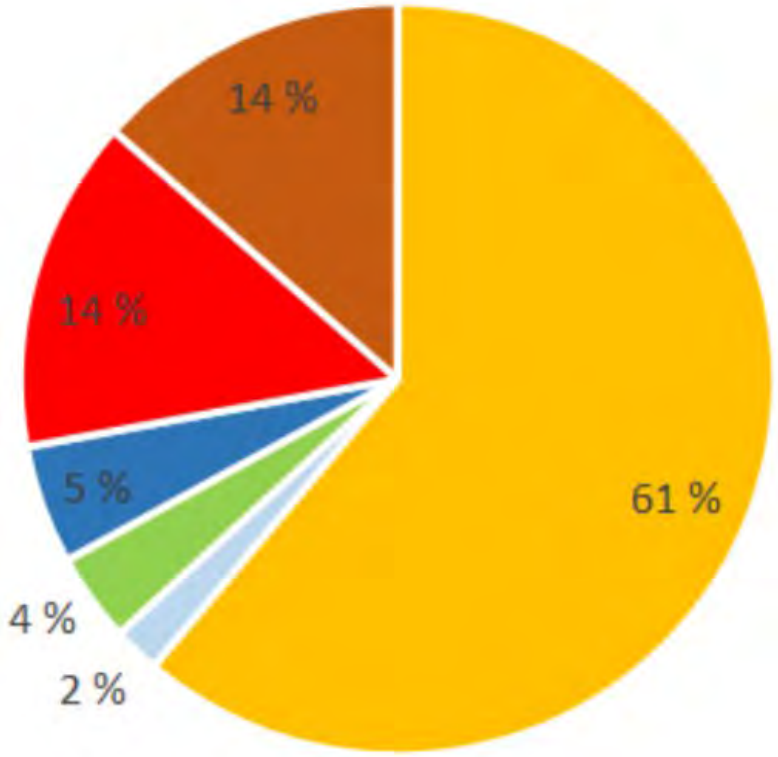
Pictures: Schernewski

4. The Oder/Szczecin Lagoon - hypoxia

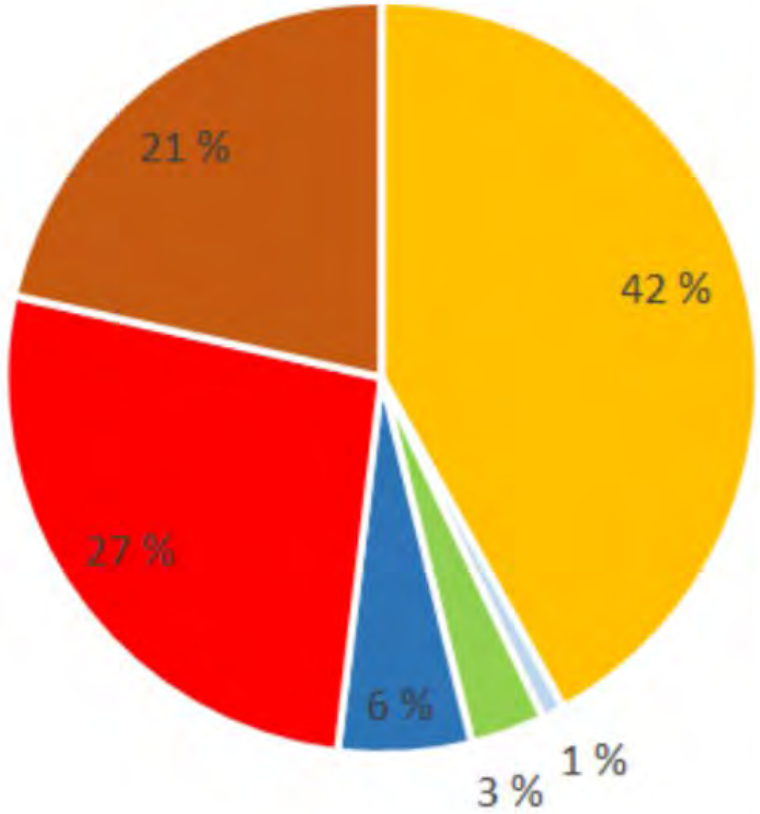
Pictures: Schernewski

4. Eutrophication - Oder River nutrient loads in 2017

Nitrogen: 50,700 t/a



Phosphorus: 2300 t/a



- Agriculture
- Atmospheric
- Natural background
- Diffuse
- Point sources
- Transboundary

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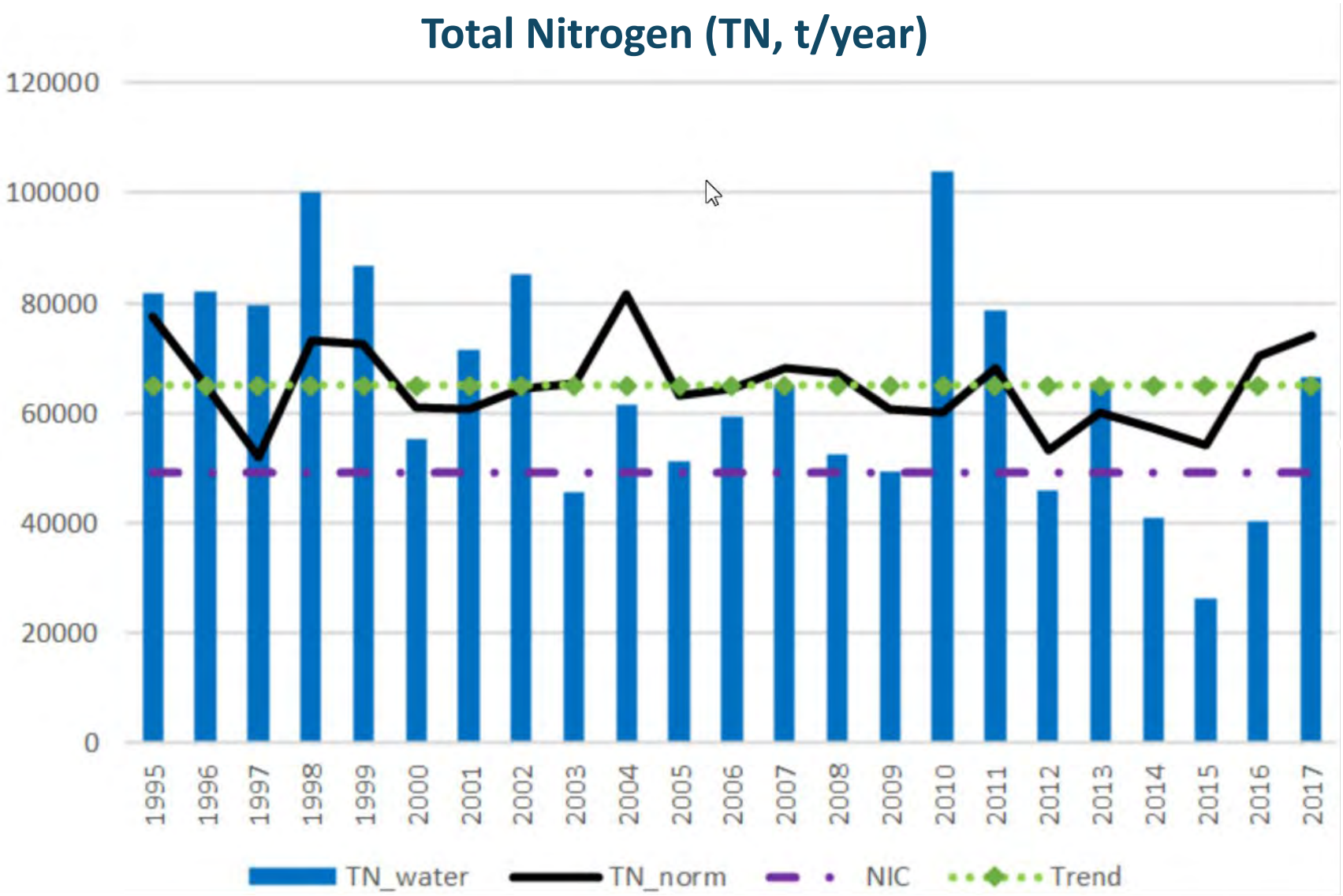
4. Eutrophication - Oder River nutrient loads 1995 – 2017



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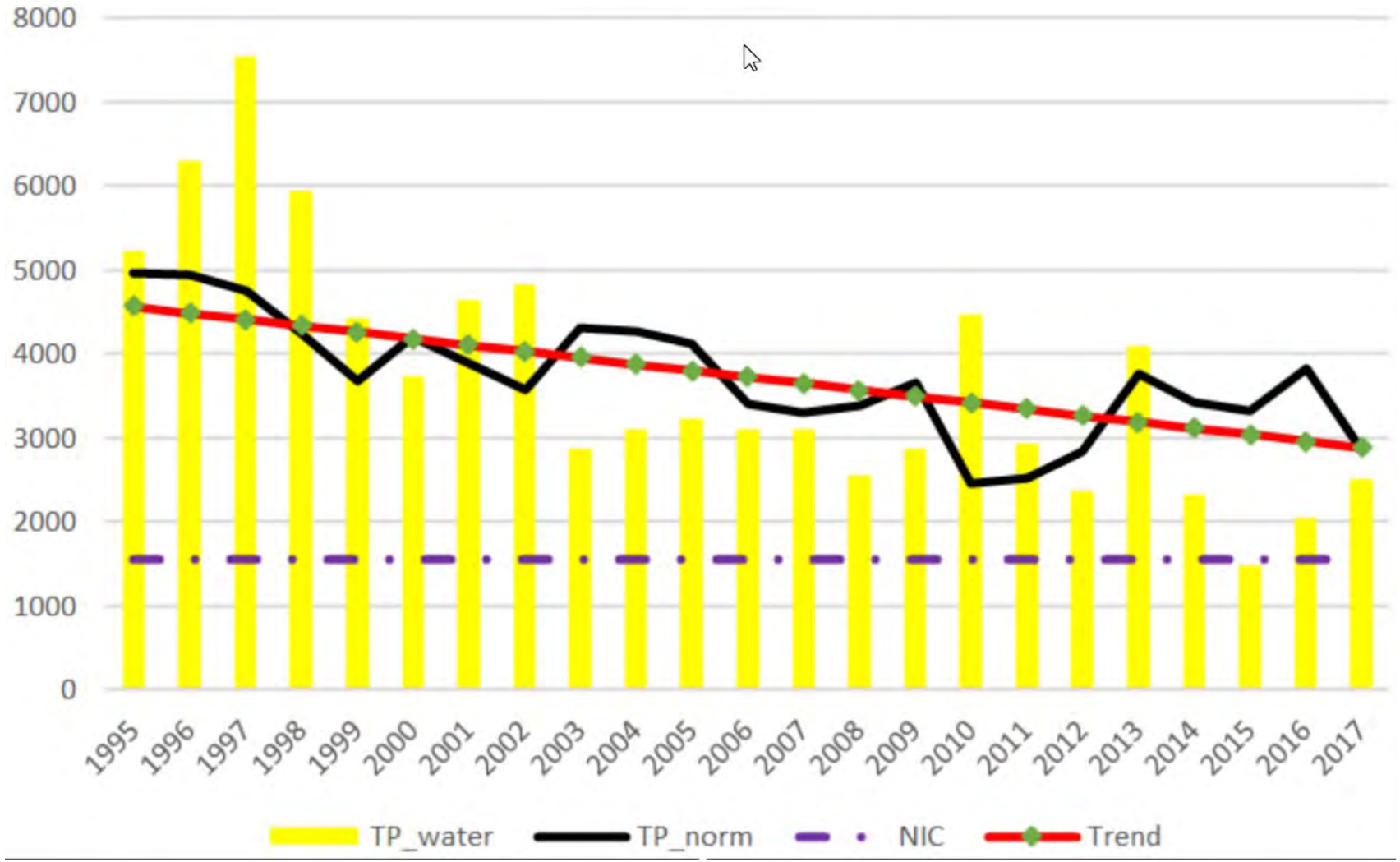
4. Eutrophication - Oder River nutrient loads 1995 – 2017

Total Phosphorus (TP, t/year)



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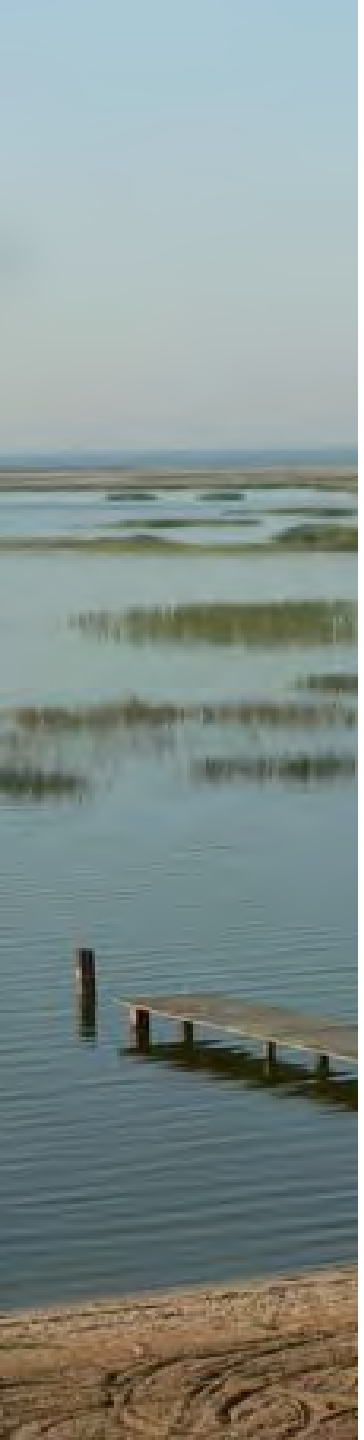
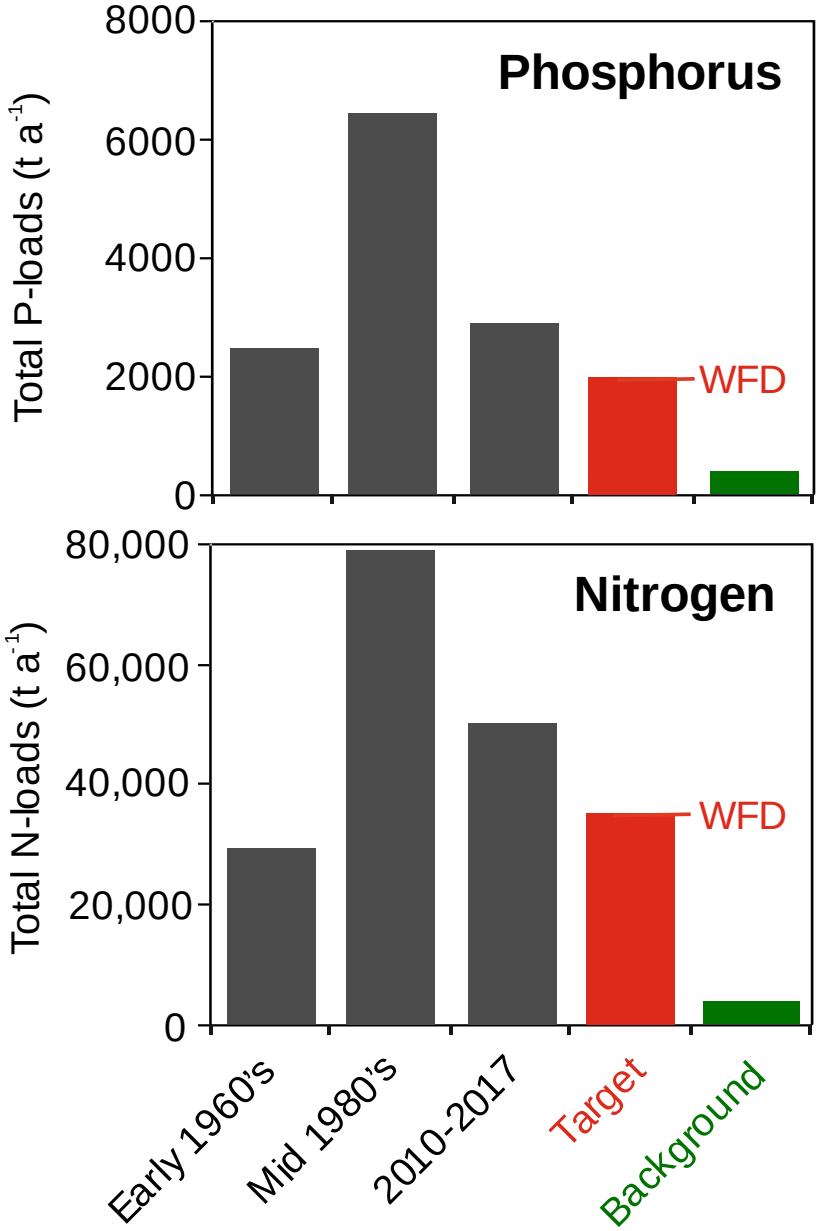
4. Eutrophication: Summary

- Nutrients loads increased until 1988 and showed a sharp decline in early 1990‘s. Reasons were mainly warm and dry years.
- During the last 20 years, the nitrogen loads were stable.
- The phosphorus loads show an ongoing decline, mainly because of improved sewage treatment.
- However, the concentrations of N and P in the Oder River are still relatively high. They are above the thresholds for a good ecological status in the river and the resulting loads are above the requirements for a good status of the Baltic Sea.

Can the nutrients loads be reduced that they meet the requirements of the Water Framework Directive and the Baltic Sea Action Plan?



4. Eutrophication – perspectives for the Oder/Odra River

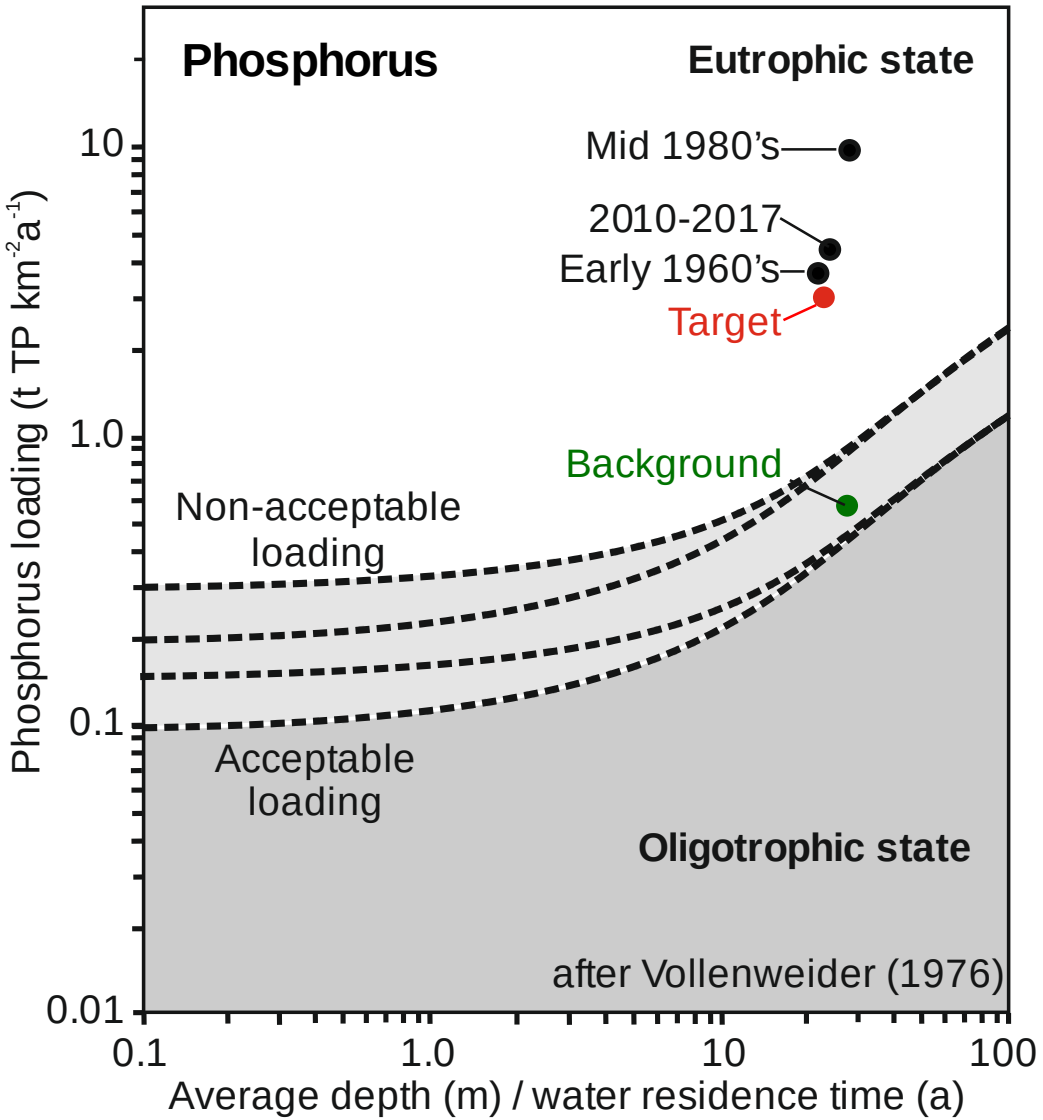


- Additional load reductions are necessary to reach acceptable loads and a good status in the river.
  (according to the Water Framework Directive (2.6 mg N/l N, 0.1 mg P/l) as well as the Baltic Sea Action Plan)
- Potentially a good water quality could be reached, but this would require the implementation of expensive measures.
- Taking into account the present economic development and intensified agriculture it seems not realistic that a good status in the river will be reached.

Would a good water quality status in the river ensure a good status in the coastal Oder Lagoon?

Schernewski et al. (2012): Ecology and Society (updated)

4. Eutrophication – perspectives for the Oder/Szczecin Lagoon



- A good water quality in the river does not cause a good quality in the lagoon
- The Oder Lagoon is naturally eutrophied
- A good ecological status in the lagoon requires addition internal measures in the lagoon.

Schernewski et al. (2012): Ecology and Society (updated)

Conclusions

- River basin management = coastal water management = Baltic Sea management.
- River basins and watersheds have to be taken into account in Integrated Coastal Zone Management (ICZM) approaches. Often, ICZM cannot be restricted to the coastal zone.
- Integrated river basin - coastal management approaches have to be future oriented. Climate Change, economic transitions and agricultural changes in the basin have strong effects on the coasts.
- However, with respect to water quality, river basin management sometimes is not sufficient to reach a “good quality” coastal waters. Supporting measures in the coastal zone might be necessary.

Thank you for your attention!

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