Implementation of environmental legislation: E-flows under the EU Water Framework Directive

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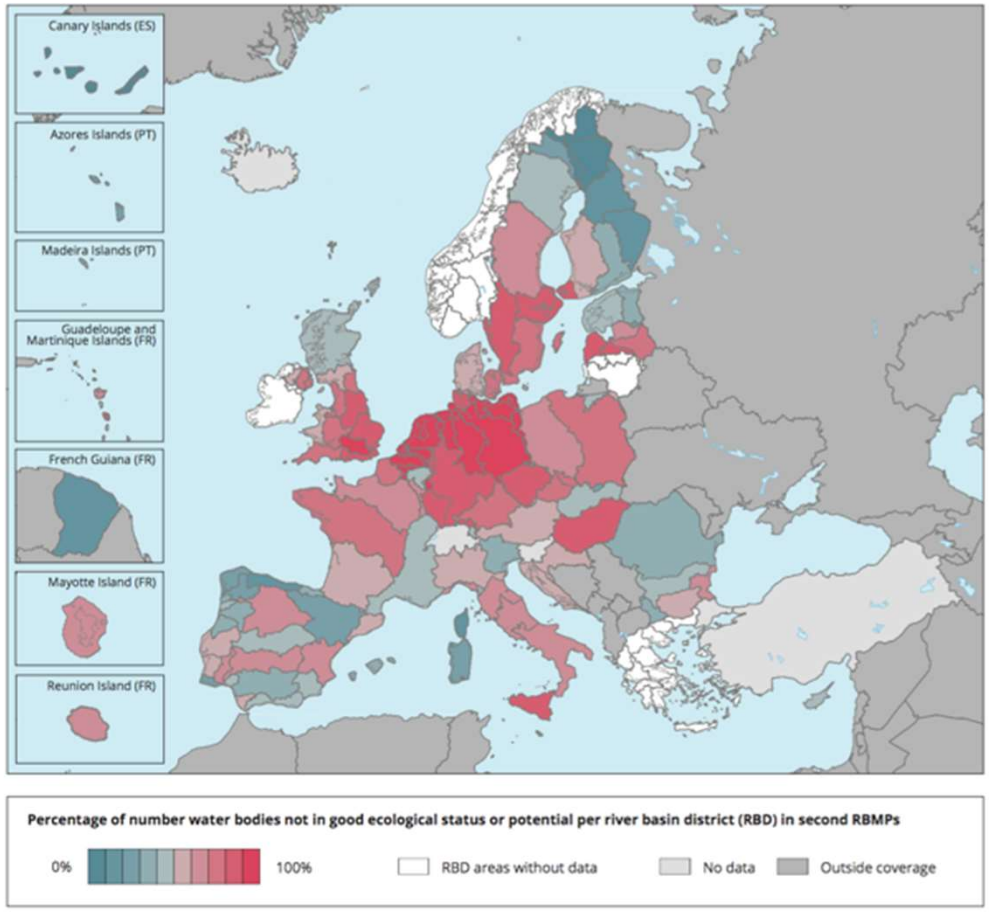
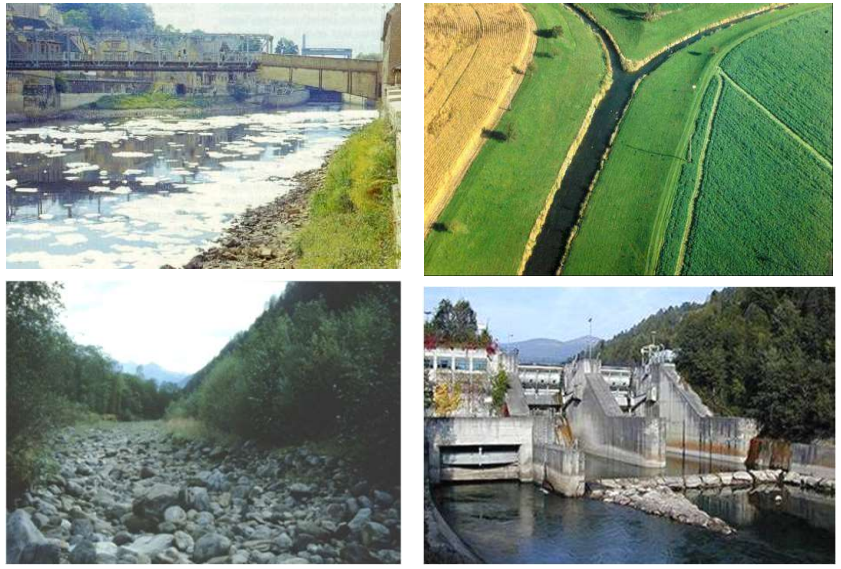
Delhi, 21.10.2019

How is the condition of European freshwaters?



Europe's waters are affected by several pressures
→ **rivers especially** by water pollution, water abstraction, droughts + floods.

Major physical modifications (e.g. channelisation and barriers) **also affect morphology and water flow.**



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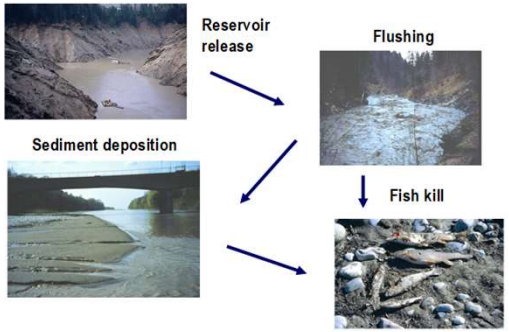
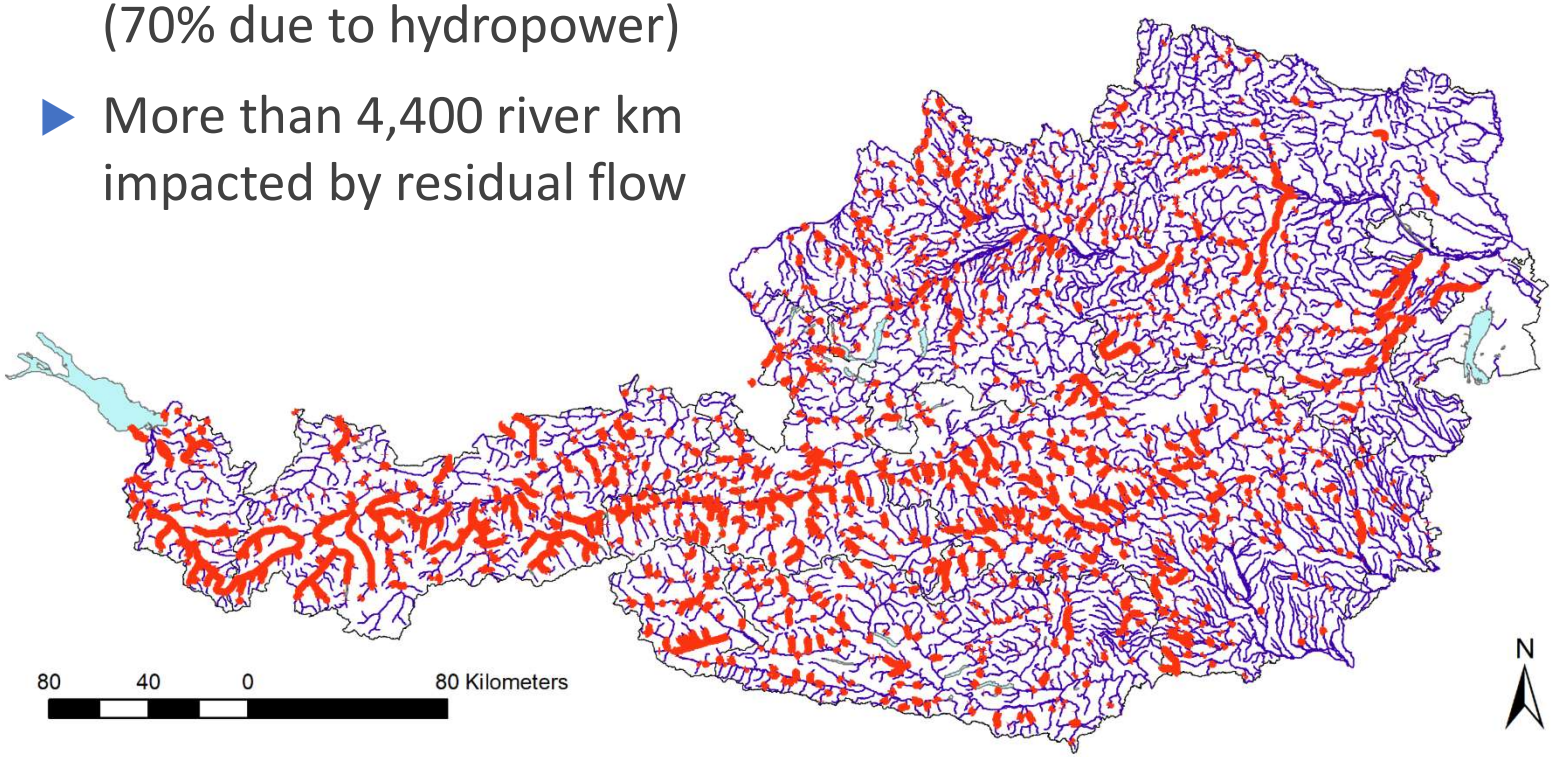
EEA, 2018
https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments

Water abstraction: Status in Austria

- More than 3,000 water abstraction/diversion points (70% due to hydropower)
- More than 4,400 river km impacted by residual flow





Map: D.S. Hayes, Data source: Federal Ministry of Sustainability and Tourism: National River Basin Management Plan (2015).

EU Water Framework Directive (WFD)

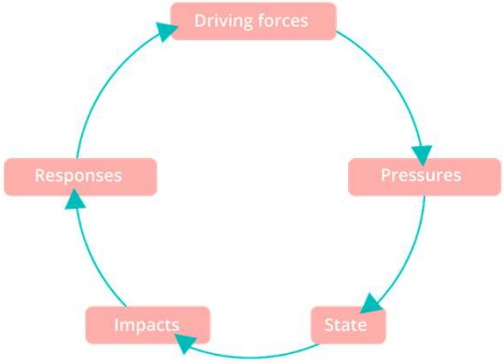
- Is a European Union **directive from the year 2000**

  → „commits all European Union member states
  to **achieve good qualitative and quantitative status** of all water bodies" by 2015, while

  - **preventing deterioration** of water status and
  - to protect human health, water supply, natural ecosystems and biodiversity.

→ Steady **trend of improvement is visible, but more is required**.

- WFD is also a **framework that prescribes steps**
  → e.g. with **River Basin Management Plans (RBMs)** etc.
  to reach this common goal.



https://ec.europa.eu/environment/water/water-framework/index_en.html

https://environmentalizing.home.blog/2019/03/24/decision-support-tool-the-dpsir-framework/

WFD principle

- Europe's waters **need to achieve the good ecological status**
  → this is measured via biological quality elements

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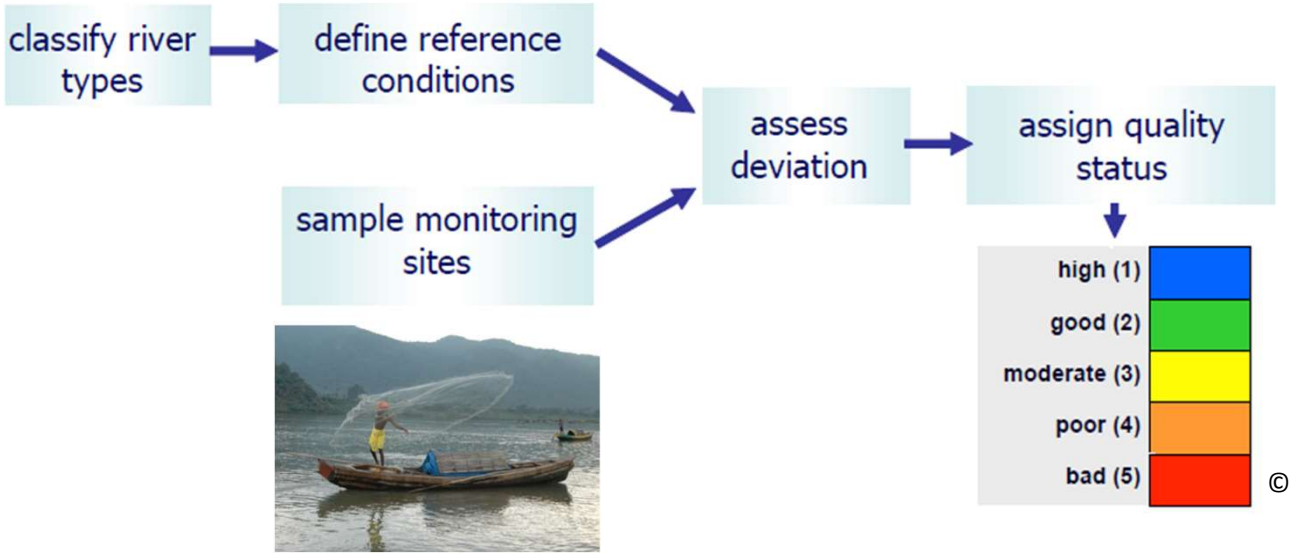

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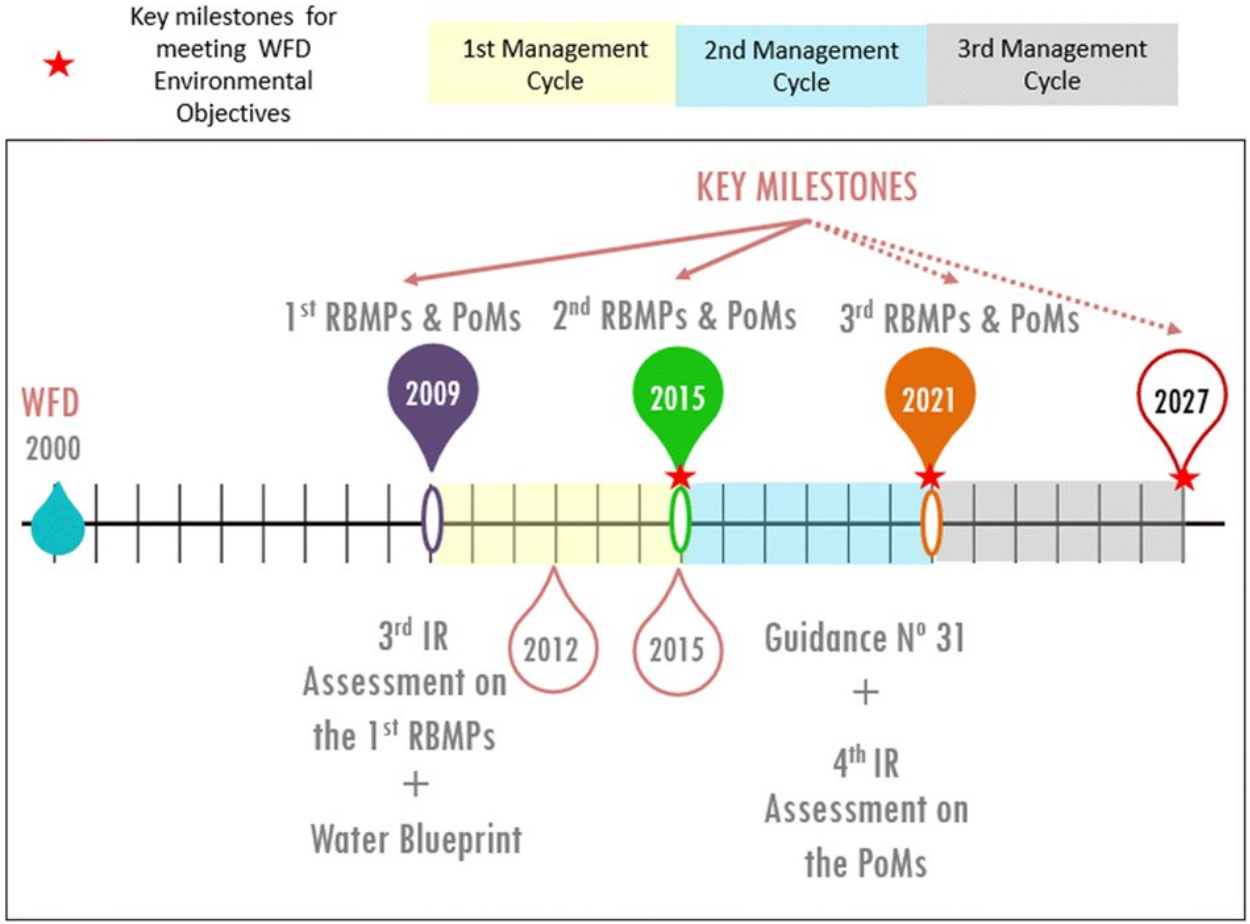
WFD implementation timeframe (RBM)



https://ec.europa.eu/environment/water/blueprint

Figure: Ramos et al. (2018). Water resources management, 32(15), 5115-5149.

https://ec.europa.eu/environment/water/participation/map_mc/map.htm

Conflicting European Directives

RES-e
European Renewable Energy Directive 2009/28/EC

Objectives:
Increase share of energy from renewable sources
with target
figures for 2020 for each MS

WFD
European Water Framework Directive Directive 2000/60/EC

Objectives:
Good ecological status of all water bodies
and
no deterioration of status

- Plus **other related EU legislation:**
  Common Agricultural Policy (CAP),
  Habitats Directive (92/43/EEC) and **Birds Directive** (2009/147/EC) (i.e. Natura 2000),
  Floods Directive (2007/60/EC) etc.

WFD: 2000/60/EC; https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32000L0060
RES: 2009/28/EC; https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32009L0028

Main pressures related to hydropower/ water storage in Europe

- **Water abstraction, transfer to/storage in a reservoir**
  → resulting in depleted river stretches downstream
  → reduced flow quantity and dynamics

- **Hydro peaking**
  → causing artificial rapid flow/water level fluctuations downstream
  → extreme low flow and sudden high flow situations
  → differing significantly from natural flow change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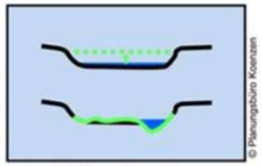
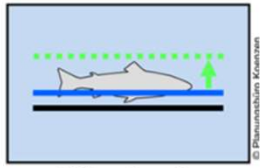
Halleraker et al., 2016; ECOSTAT report
https://ec.europa.eu/jrc/en/publication/working-group-ecostat-report-common-understanding-using-mitigation-measures-reaching-good-ecological

Main flow alterations to be mitigated in European water bodies

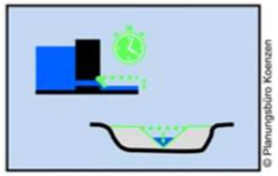
- **Artificially extreme low flows or extended low flows** in rivers downstream of water intake/large dam/reservoir
- **Inadequate fish flows for long distance migratory species** to trigger fish migration
- **Loss, reduction or absence of variable flows** (flow dynamics) for flushing
- **Rapidly changing flows** (including effects of hydro peaking)



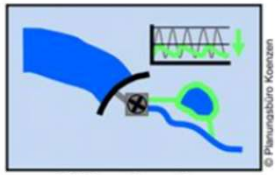
Mitigation for low flow



Mitigation for fish flow



Mitigation for ariable flow



Mitigation for rapidly changing flows

Halleraker et al., 2016; ECOSTAT report
https://ec.europa.eu/jrc/en/publication/working-group-ecostat-report-common-understanding-using-mitigation-measures-reaching-good-ecological

European Guidance Document on ecological flows (2015)

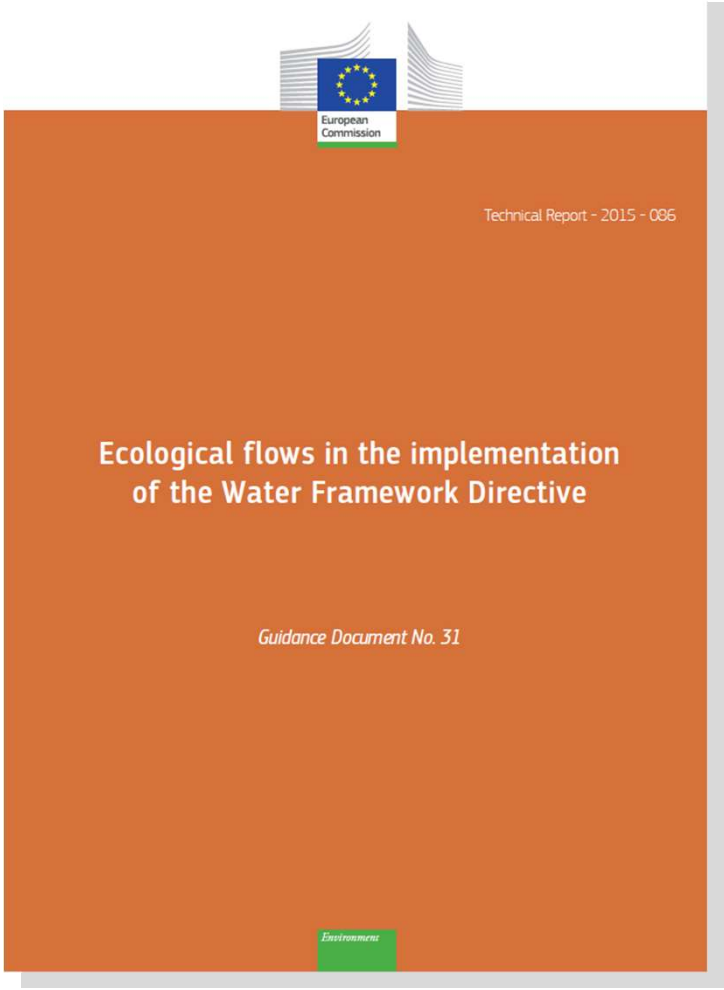
Main goal:

- Stimulate a common uptake of ecological flows:

" A hydrological regime **consistent with the achievement of environmental objectives** of the Water Framework Directive"

Main conclusion:

- Careful assessment of **hydrological needs** together with **mitigation measures** to improve flow/ecological conditions is required



CIS Guidance Document No. 31: https://circabc.europa.eu/sd/a/4063d635-957b-4b6f-bfd4-b51b0acb2570/Guidance%20No%2031%20-%20Ecological%20flows%20(final%20version).pdf

European Guidance Document on ecological flows (2015)

Quantity and dynamics of flow are crucial elements for the achievement of the WFD environmental objectives, which refer to:

- **Non-deterioration** of existing status
- **Achievement of good ecological status** in a natural surface water body
- **Assessment/mitigation of pressures** that cause a deviation from good status

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Recommendations for EU member states

National methodologies or guidelines should include:

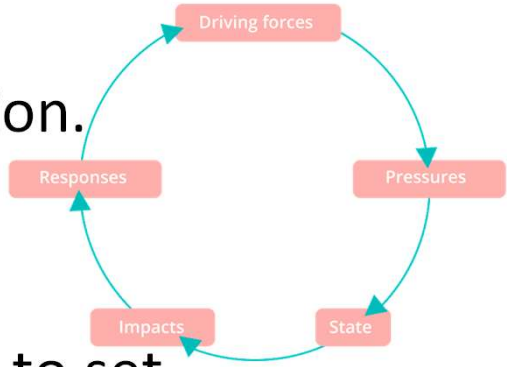
- Conceptual definition of e-flows with clear reference to flow quantity and dynamics
- E-flows as a binding requirement

- Methodological approach and methods for e-flow determination
- Data required for e-flows determination

- Requirements for monitoring and reporting to the competent authorities
- Requirements to ensure the transparency of methodologies and results to all interested parties, including water users

Measures for EU member states

- **Hydrological measures for impacting uses and activities**
  → Targeting drivers and pressures causing the flow alteration.

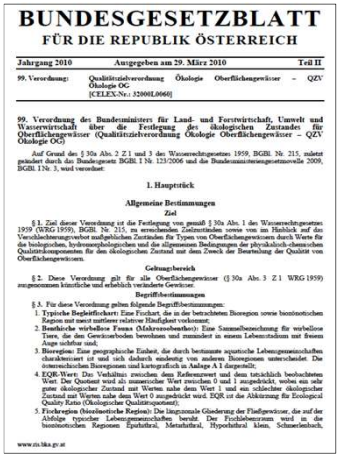


- **Improving knowledge and prioritisation**
  → Better understanding of ecosystems' flow requirements to set consistent and effective ecological flows.

- **Combining with non-hydrological measures**
  → Supplementary measures in addition to basic measures regarding environmental objectives, e.g. negotiated environmental agreements, recreation and restoration of wetlands areas, demand management etc.

https://environmentalizing.home.blog/2019/03/24/decision-support-tool-the-dpsir-framework/

EXAMPLE: E-flows in Austria
The Quality Objective Ordinance Ecology (2010)



BUNDESGESETZBLATT
FÜR DIE REPUBLIK ÖSTERREICH

Jahrgang 2010 — Ausgegeben am 29. März 2010 — Teil II

99. Verordnung: Qualitätszielverordnung Ökologie Oberflächengewässer – QZV Ökologie OG [CELEX-Nr.: 32000L0060]

99. Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Festlegung des ökologischen Zustandes für Oberflächengewässer (Qualitätszielverordnung Ökologie Oberflächengewässer – QZV Ökologie OG)

Auf Grund des § 30a Abs. 2 Z 1 und 3 des Wasserrechtsgesetzes 1959, BGBl. Nr. 215, zuletzt geändert durch das Bundesgesetz BGBl. I Nr. 123/2006 und der Bundesministeriengesetznovelle 2009, BGBl. I Nr. 3, wird verordnet:

1. Hauptstück

Allgemeine Bestimmungen

Ziel

§ 1. Ziel dieser Verordnung ist die Festlegung von gemäß § 30a Abs. 1 des Wasserrechtsgesetzes 1959 (WRG 1959), BGBl. Nr. 215, zu erreichenden Zielzuständen sowie von im Hinblick auf das Verschlechterungsverbot maßgeblichen Zuständen für Typen von Oberflächengewässern durch Werte für die biologischen, hydromorphologischen und die allgemeinen Bedingungen der physikalisch-chemischen Qualitätskomponenten für den ökologischen Zustand mit dem Zweck der Bewertung der Qualität von Oberflächengewässern.

Geltungsbereich

§ 2. Diese Verordnung gilt für alle Oberflächengewässer (§ 30a Abs. 3 Z 1 WRG 1959) ausgenommen künstliche und erheblich veränderte Gewässer.

Begriffsbestimmungen

§ 3. Für diese Verordnung gelten folgende Begriffsbestimmungen:

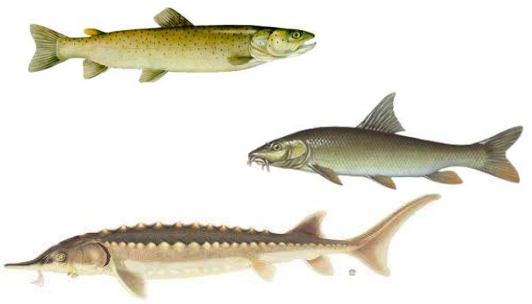
1. Typische Begleitfischart: Eine Fischart, die in der betrachteten Bioregion sowie biozönotischen Region mit meist mittlerer relativer Häufigkeit vorkommt.
2. Benthische wirbellose Fauna (Makrozoobenthos): Eine Sammelbezeichnung für wirbellose Tiere, die den Gewässerboden bewohnen und zumindest in einem Lebensstadium mit freiem Auge sichtbar sind.
3. Bioregion: Eine geographische Einheit, die durch bestimmte aquatische Lebensgemeinschaften charakterisiert ist und sich dadurch eindeutig von anderen Bioregionen unterscheidet. Die österreichischen Bioregionen sind kartografisch in Anlage A 1 dargestellt.
4. EQR-Wert: Der Verhältnis zwischen dem Referenzwert und dem tatsächlich beobachteten Wert. Der Quotient wird als numerischer Wert zwischen 0 und 1 ausgedrückt, wobei ein sehr guter ökologischer Zustand mit Werten nahe dem Wert 1 und ein schlechter ökologischer Zustand mit Werten nahe dem Wert 0 ausgedrückt wird. EQR ist die Abkürzung für Ecological Quality Ratio (Ökologischer Qualitätsquotient).
5. Fließregion (biozönotische Region): Die längszonale Gliederung der Fließgewässer, die auf der Abfolge typischer Lebensgemeinschaften beruht. Der Fischlebensraum wird in die biozönotischen Regionen Epirhithral, Metarhithral, Hyporhithral klein, Schmerlenbach,

www.ris.bka.gv.at

	Natural mean annual flow	
	< 1 m³/s	**> 1 m³/s**
Minimum flow	> Lowest daily flow (natural)	
	> 50% mean annual low flow	> 33% mean annual low flow
Dynamic flow	20% of actual flow	

Dynamic flow to ensure:

- **Seasonality of natural relocation** and type-specific composition of **sediments**
- Sufficient **flow during spawning** migration
- **Diversity of** type-specific, seasonal **habitats** (for different age stages)
- Type-specific **conditions of oxygen and temperature**



https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20006736

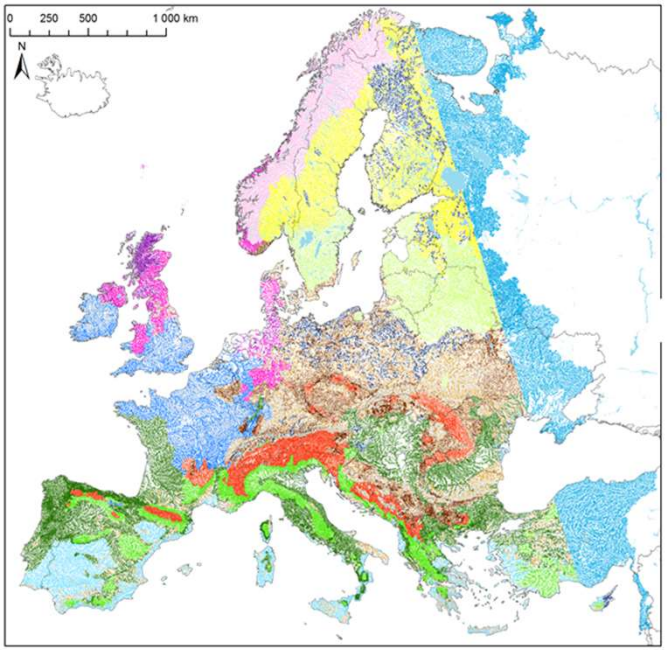
Example for future perspective - EU level

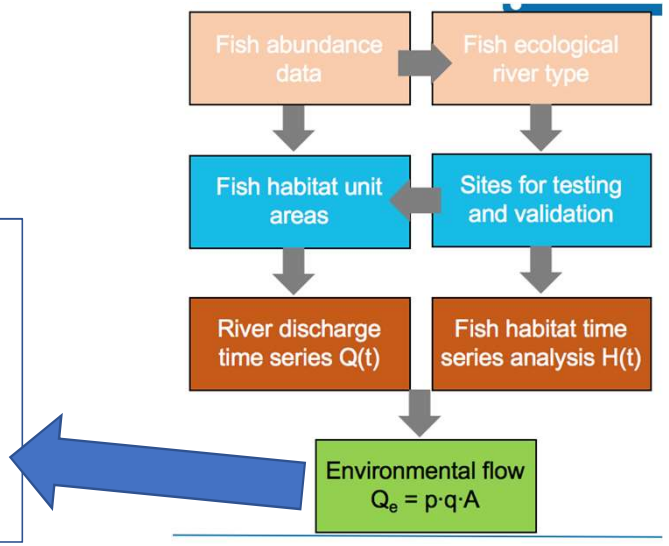
Attempt by H2020 project AMBER (Parasiewicz et al., 2019)

→ Model that responds at biologically relevant scales

- Quantitative assessment of flows and biology
- Biological responses at reach and watershed scales
- Based on watersheds, not political boundaries
- Considers regional hydrogeography and seasonal changes

Pan-European River Types (Macrohabitats)



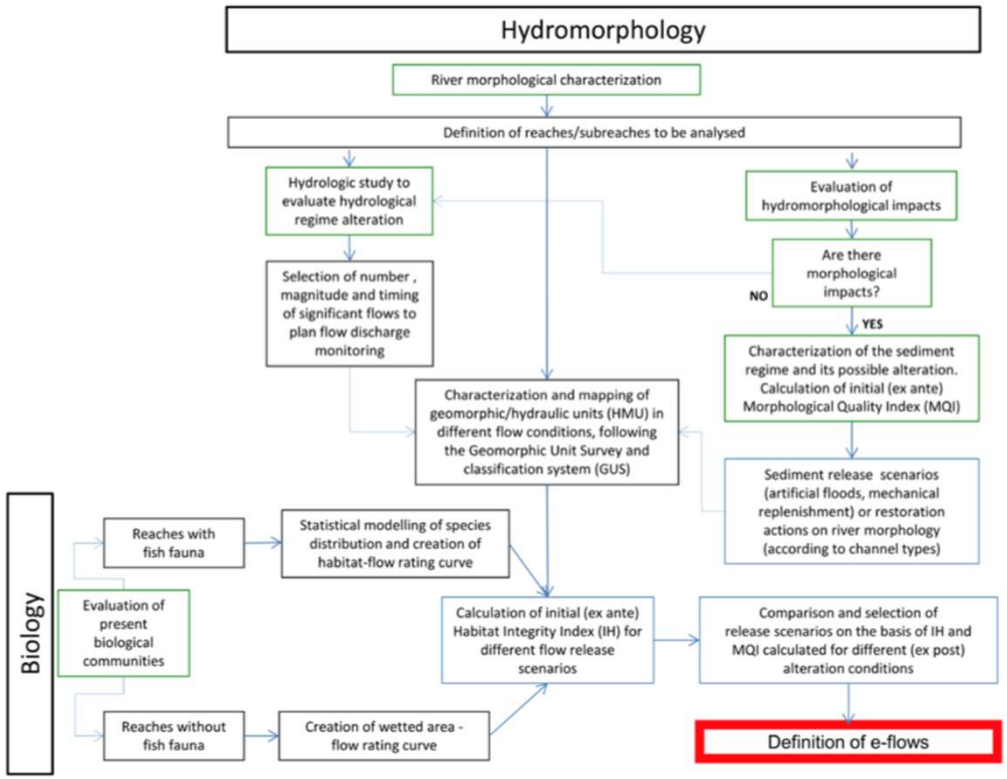


$Q_e = p \cdot q \cdot A$

Q_e = ecological instream flow rate (m^3/s).
p = bioperiod and fish ecological river type index.
q = specific discharge at location ($l/s \cdot km^2$).
A = catchment area at location.

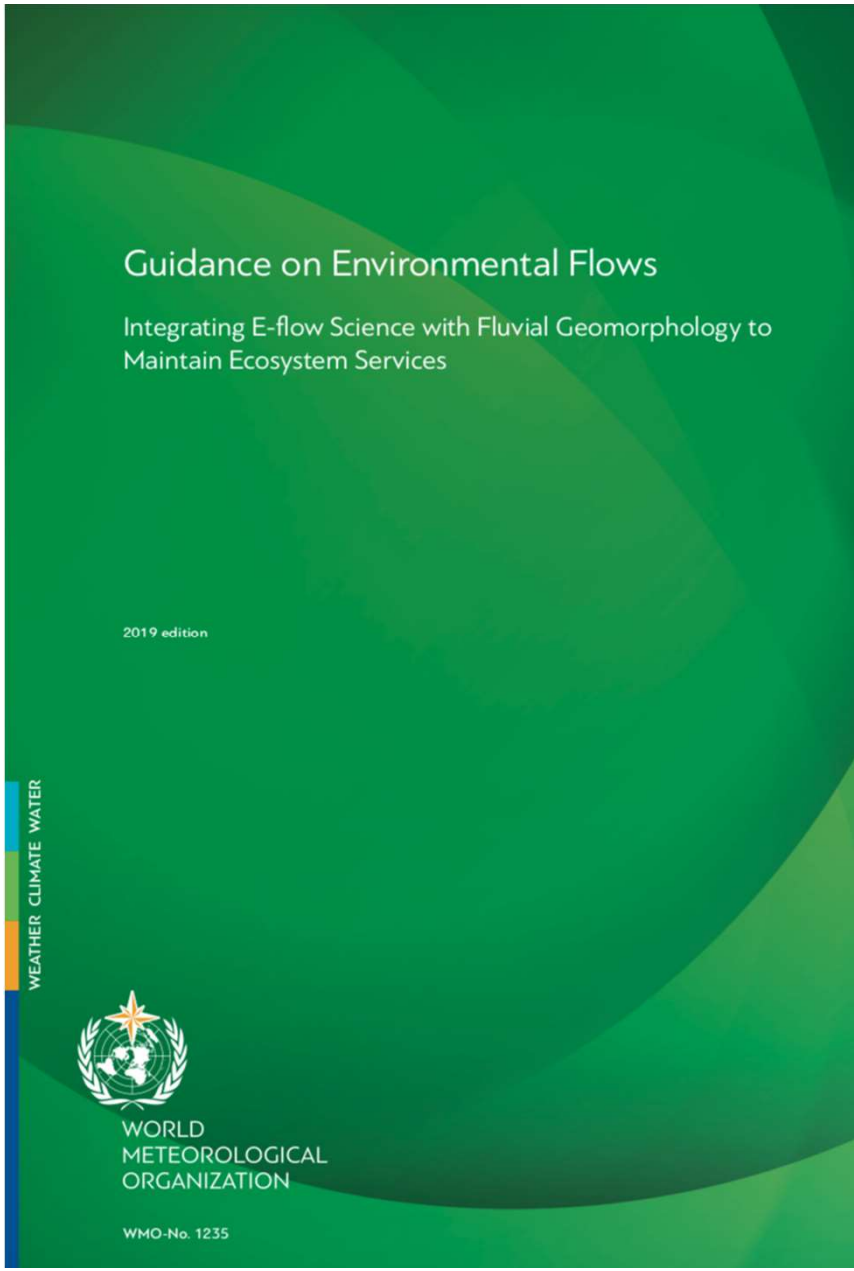
https://amber.international

Linking Hydromorphology & Biology



Bussettini et al., 2019

https://library.wmo.int/doc_num.php?explnum_id=9808



Outlook & conclusions

More efforts required at EU/national level for

- implementation of environmental flows and related monitoring
- development of better link between environmental flows and biological indicators (Ramos et al., 2018)

Blending expertise to India is possible, especially regarding

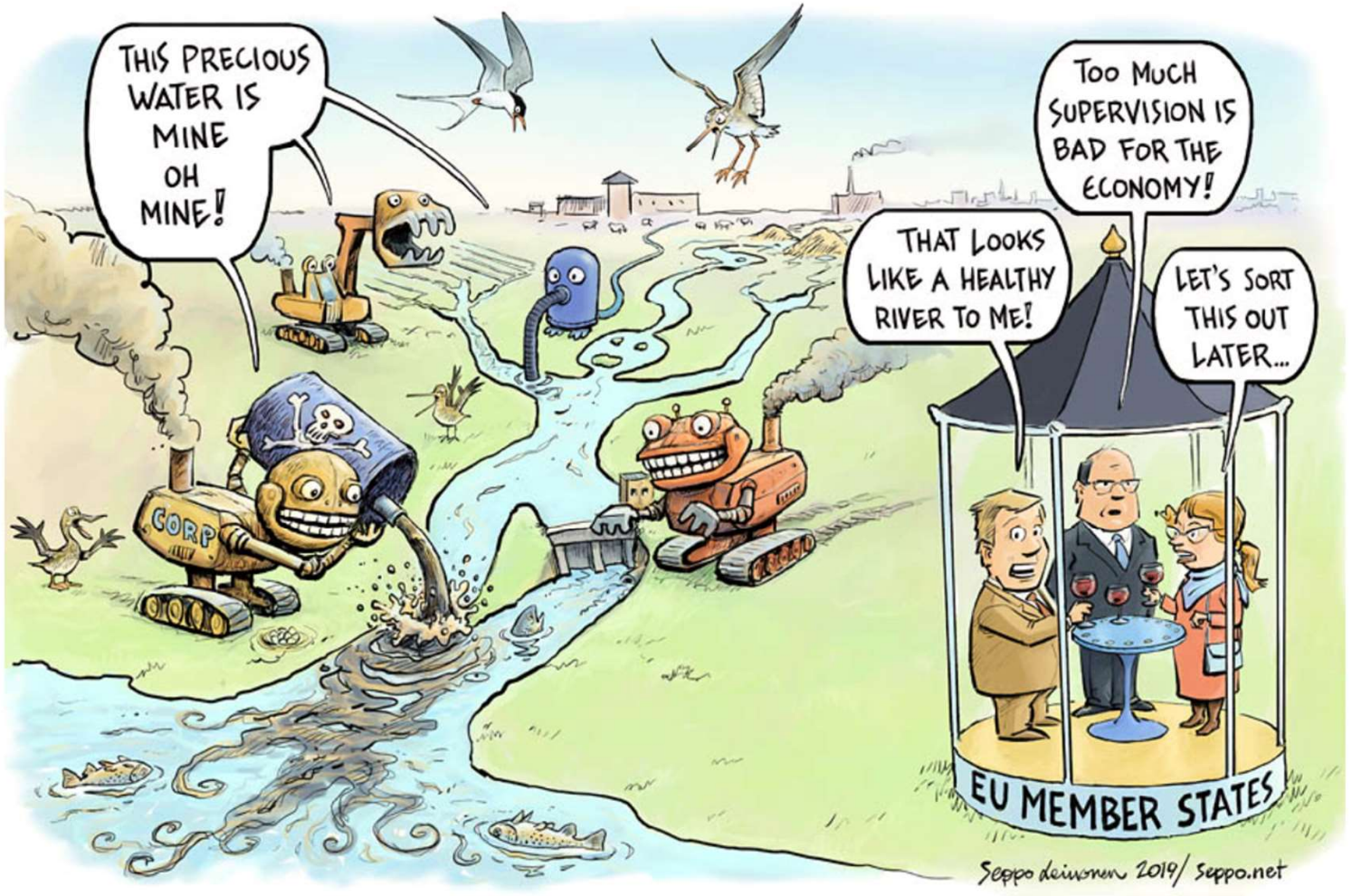
- Basic principles of WFD/EU e-flow guidance
- Related adaptive management & processes
- Failures/mistakes made in Europe

www.icpdr.com

Unsustainable industries are lobbying for devastating changes to the EU water law

Posted on May 19, 2019 by Seppo

We are not perfect at all!



Thank you for your kind attention!

DANUBE River upstream of Vienna, © R. Schinegger