

Water Quality and Biodiversity Pressures in Ireland's Freshwaters

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Structure of the talk – setting the context

- Importance of freshwaters
- What the 21st century brings to freshwater biodiversity
- Ireland's freshwater resources
- Aquatic biodiversity above and below water
- How fares Ireland's freshwater and their biodiversity

Key messages highlighted

Freshwater – the lifeblood of human civilisation carried by the capillaries (streams) and veins (rivers) of the landscape



1. Freshwaters provide essential goods and services = ecosystem services (direct and indirect contributions from ecosystems that provide for human wellbeing and quality of life).

Provisioning	Regulating	Cultural
Water, Aquatic organisms (e.g. fish) for food and other uses	Maintenance of water quality (natural cleansing), Buffering of floods	Recreation Education, Art, Sense of place, Biodiversity

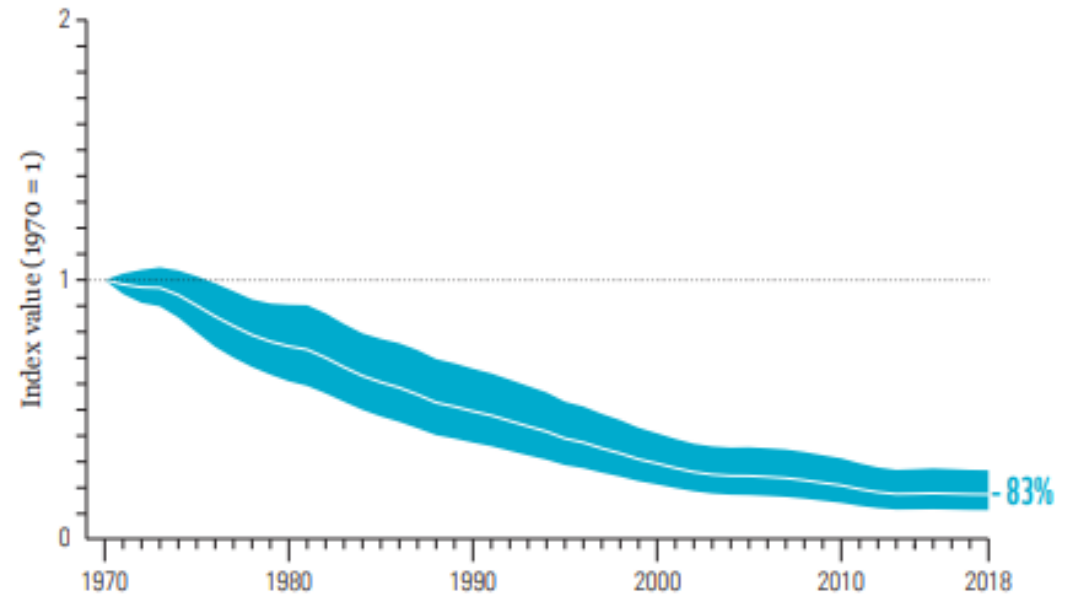
2. Freshwaters are 'living systems' (ecosystems) and the benefits we depend on from freshwaters are provided by biodiversity and their associated ecological processes.

- Globally freshwaters support at least 10% of all known species in less than 1% of Earth's surface.
- At the same time freshwaters are among the most threatened ecosystems on Earth – **losing species faster than on land or in the sea.**



'Invisible tragedy hidden beneath the water surface'

From: Reid, A. J., Carlson, A. K., Creed, I. F., Eliason, E. J., Gell, P. A., Johnson, P. T., ... Cooke, S. J. (2019). Emerging threats and persistent conservation challenges for freshwater biodiversity. *Biological Reviews* 94, 840-873.

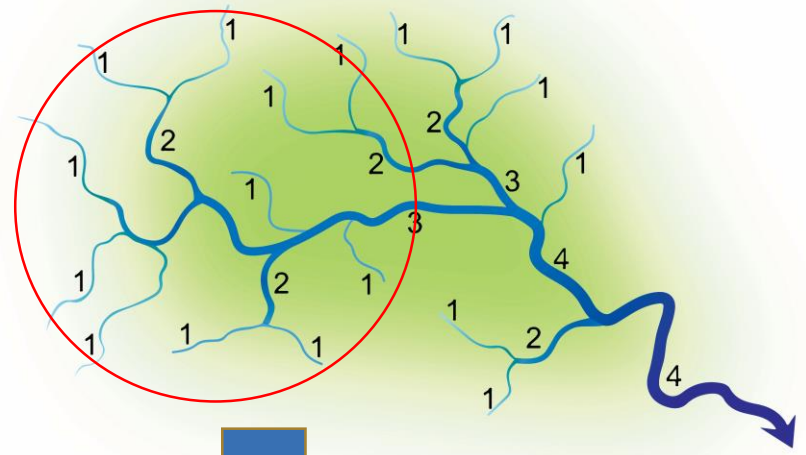


From *Living Planet Report 2022*

https://www.wwf.org.uk/sites/default/files/2022-10/lpr_2022_full_report.pdf



Ireland's Rivers



75%

Headwaters

3. Headwaters are the most vulnerable part of the river network but critical for biodiversity and water quality protection further downstream.



Lakes in Ireland

- 12,200 lakes, 10,000 are less than 5 ha. and over 8,000 are less than 1 ha. in area
- Covers 2% of the land area

4. Small lakes and ponds make a significant contribution to regional biodiversity.

Other Freshwater Habitats

Peatlands

Mountain and Blanket bog

Raised bogs

Fens

Marshes and Swamps

Springs & Seepages



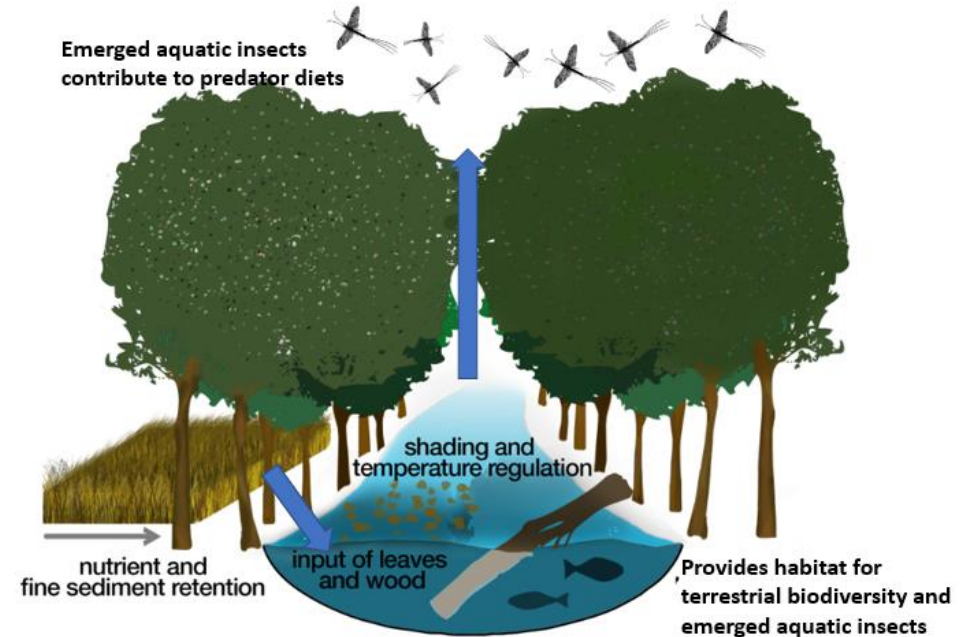
Important Contributions

- 'Kidneys of the landscape'
- Provide multiple other ecosystem services especially carbon sequestration

5. Globally (Ireland is no exception) wetlands are disappearing or being degraded three times faster than forests.

6. Riparian vegetation provides vital benefits for water quality protection and biodiversity

- Important two-way subsidies
 - a) leaf litter fuels aquatic food webs, insects from riparian vegetation are an important part of the diet of salmonids
 - b) Emerged adult aquatic insects contribute to terrestrial predator diets (bats, birds, spiders)
- Riparian vegetation can attenuate diffuse pollution and regulate extremes in temperature (climate change pressure)



Modified from figure in ORCAR Project – Woody Riparian Buffer Tool

7. Degraded or no riparian buffer zones in many catchments in Ireland leave surface waters open receptors for diffuse pollution



Freshwater Biodiversity: above & below the water's surface



Photo: Noel Quinn



Photo: William Clarke



Photo: Jan-Robert Baars



Photo: NPWS



Photo: Jan-Robert Baars



Phytobenthos



Macroinvertebrates

From mites to mayflies,



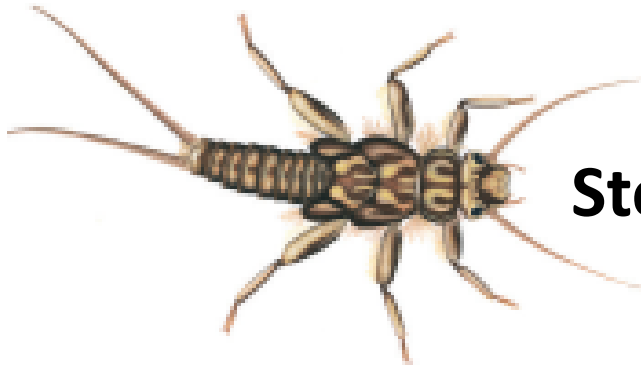
from the beautiful to the amazing

8. Macroinvertebrates perform multiple essential functions in freshwaters from processing of leaf litter and detritus and as prey for fish, other invertebrates, birds and mammals. This also helps maintain clean, clear water.

Mayfly



**EPT – Ephemeroptera (mayflies)
Plecoptera (stoneflies)
Trichoptera (caddisflies)**



Stonefly



Caddisfly



Flies, Beetles & Bugs



**Non-biting
midge
larva**



Water Strider



Illustrations: Aoife Quinn



Photo: Evelyn Moorkens

A special invertebrate – the pearl mussel (flagship species)

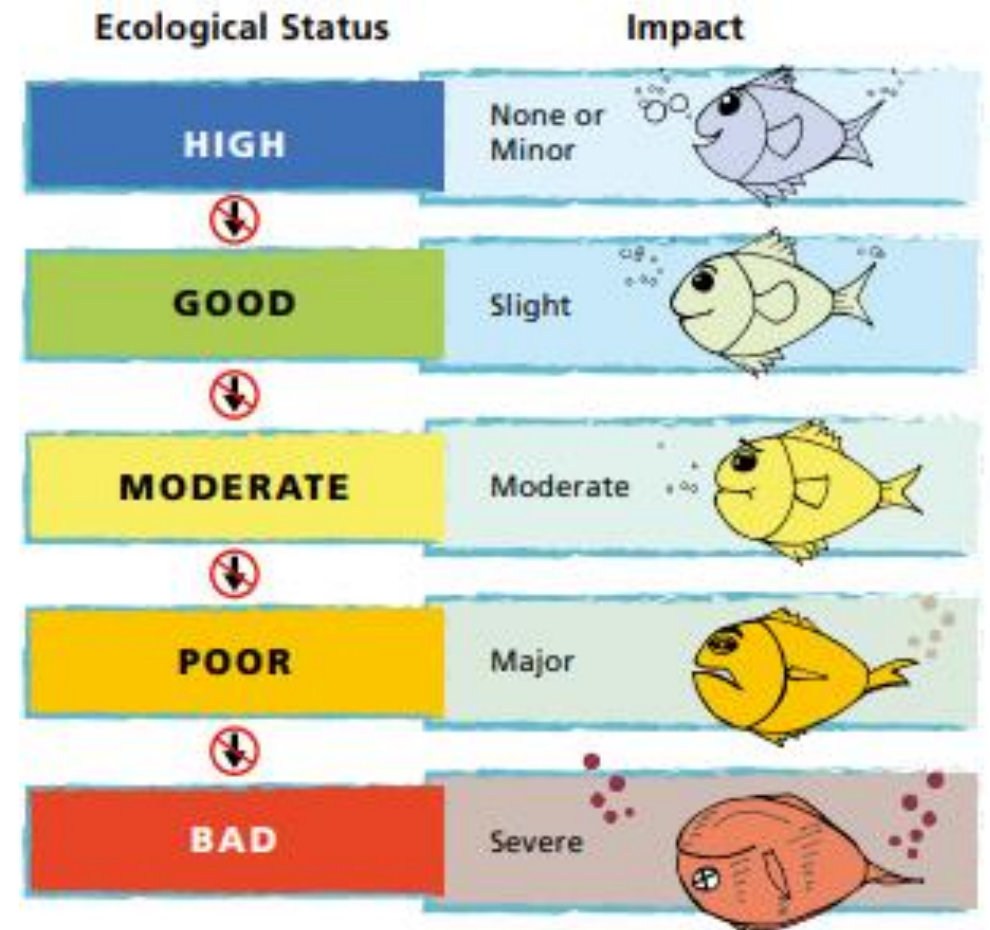
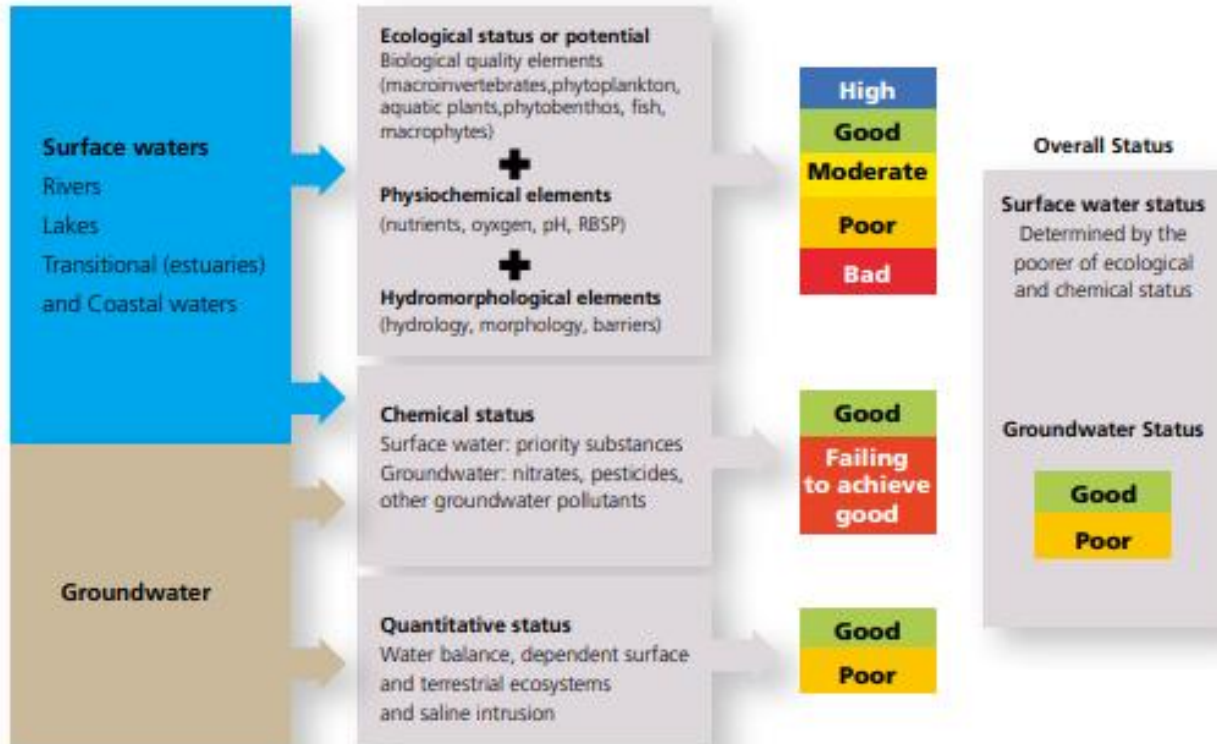
- Lives for up to 120 years in Ireland
- Depends on salmonids to complete their life cycle
- Requires the highest water and habitat quality
- Protected under the Habitats Directive

9. Due to land-use pressures (e.g. land drainage, nutrients and fine sediment inputs) pearl mussels are threatened with extinction.

Macroinvertebrates = 'Canary' in the river

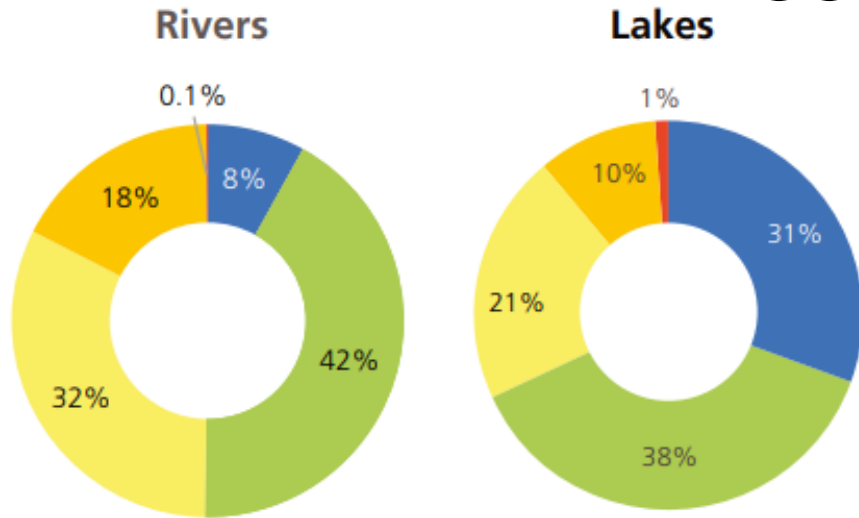


Water Framework Directive has set a target of 'good status for all waters' – target date 2027

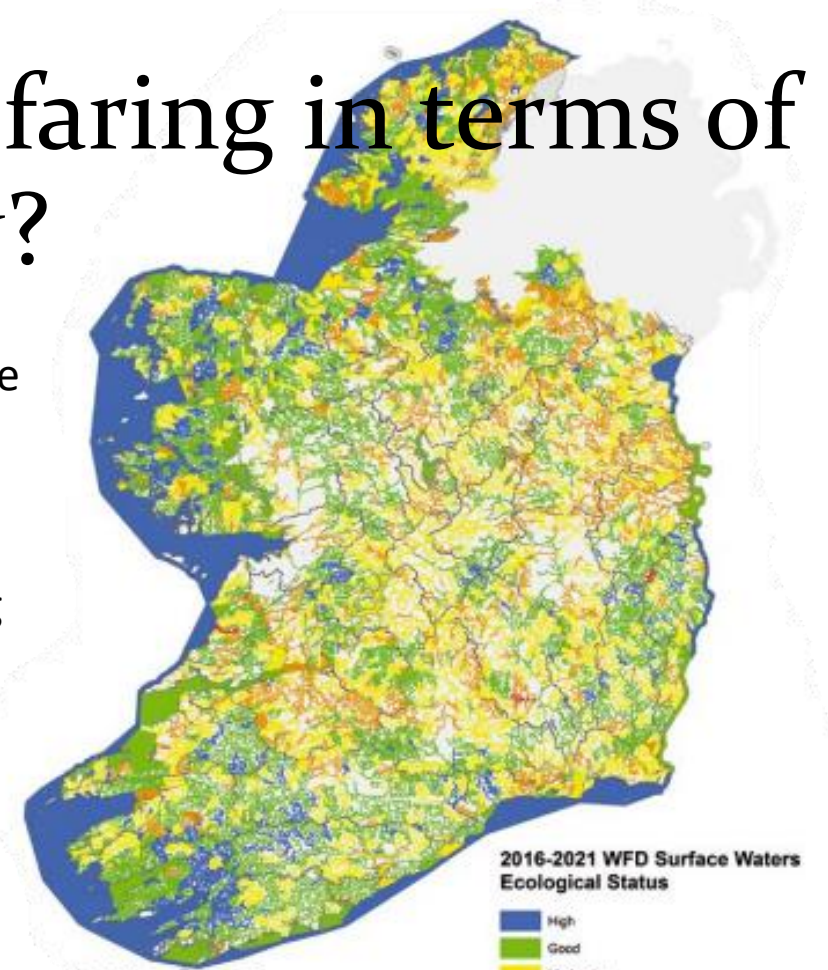


According to the recent EPA report *'the evidence shows clearly shows that the goal of restoring all waters to good status by 2027 will not be achieved'*.

How are Ireland's rivers and lakes faring in terms of ecological quality?



Almost 50% of freshwater aquatic ecosystems in Ireland are in unsatisfactory ecological condition (i.e. not meeting Water Framework Directive objectives and also representing loss of biodiversity from those sites)



From: *Water Quality in Ireland 2016 - 2021*. Environmental Protection Agency

<https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/Water-Quality-in-Ireland-2016-2021-Report.pdf>

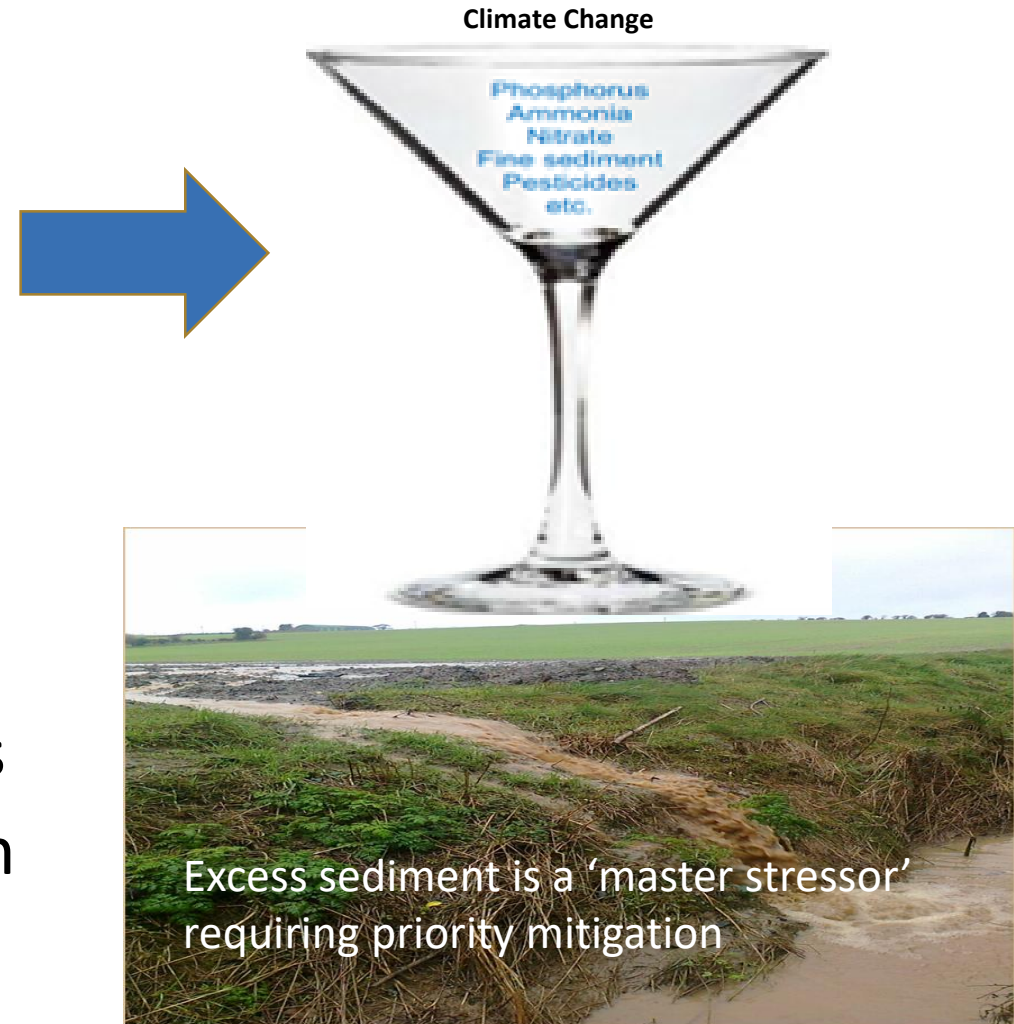
10. *Water quality is continuing to decline – going in the wrong direction – this has implications for biodiversity and the good and services we depend on from freshwaters.*

11. *Declines are outpacing improvements and therefore current efforts to stem pollution are not sufficient.*

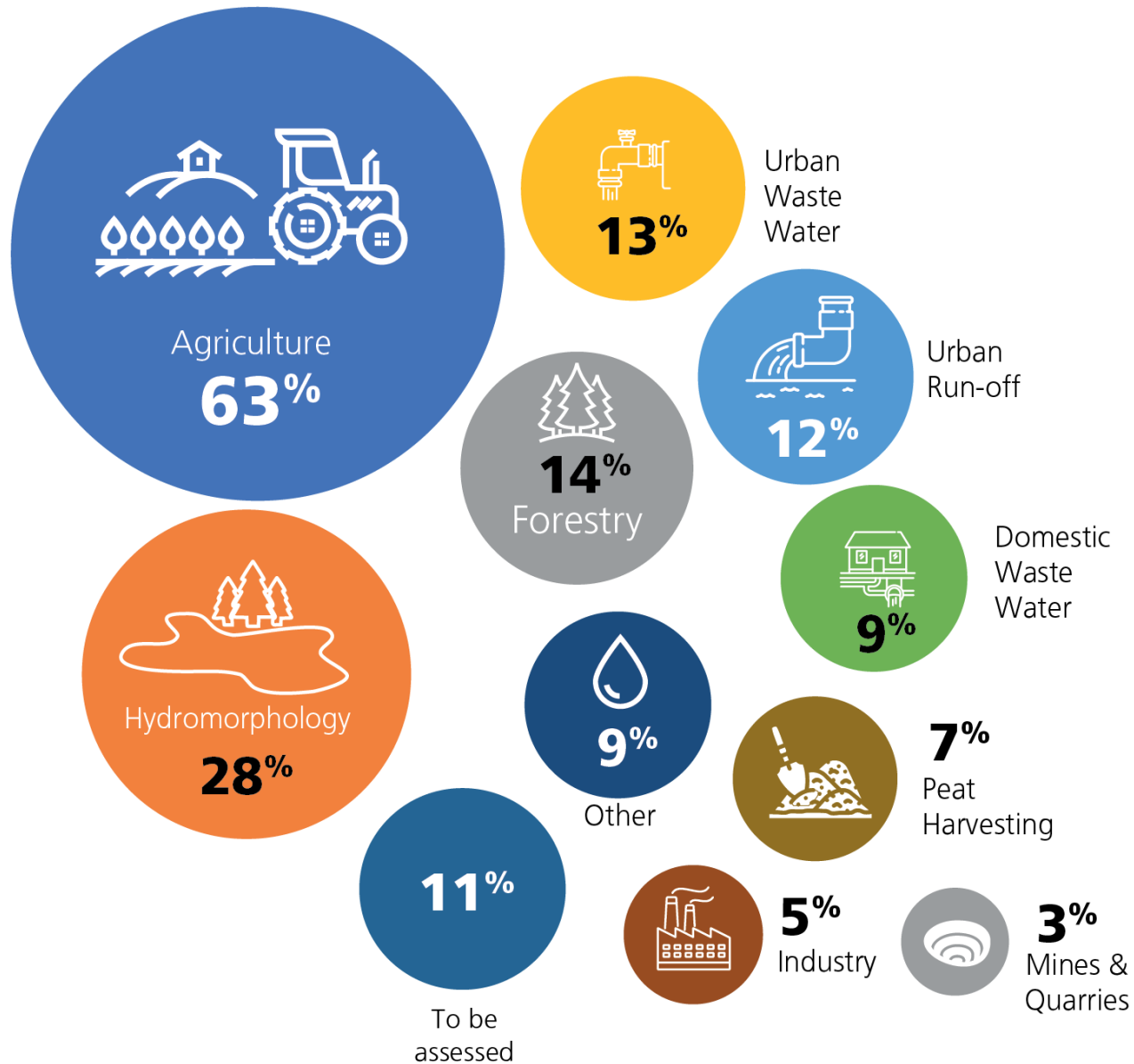
What is the problem?

- Run-off of nutrients, excess fine sediment and pesticides from agricultural lands and farmyards
- Activities such as land drainage, navigational dredging and the presence of barriers such as dams, weirs or culverts in water courses
- Discharges of poorly treated sewage from urban wastewater treatment plants, domestic treatment systems and storm water overflows
- Run-off of nutrients and excess sediment from forestry operations

Multiple stressor (pollutant) cocktails



12. *Ireland's freshwaters are receiving are being impacted by 'cocktails' of multiple stressors (pollutants) delivered along varying pathways often from several sources, requiring the targeting of the right measures in the right place.*



Significant Pressures Impacting Ireland's Freshwaters

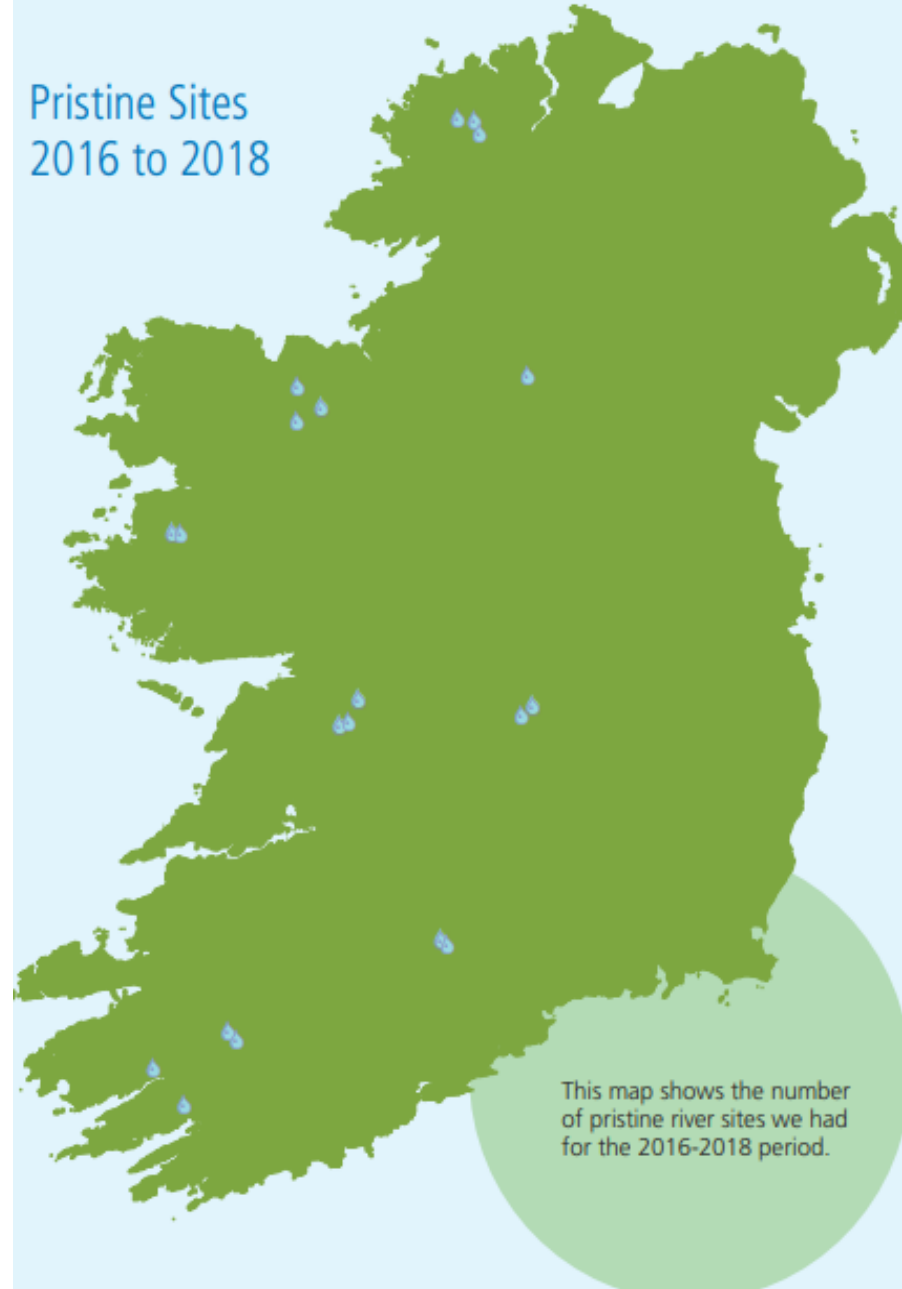
13. *Agriculture is the dominant source of pressure on freshwaters following by hydromorphology, forestry and urban wastewater.*

Pristine Sites
1987 to 1990



The EPA monitors rivers in three yearly cycles. This map shows Ireland's pristine river sites during the 1987 to 1990 period.

Pristine Sites
2016 to 2018



This map shows the number of pristine river sites we had for the 2016-2018 period.

14. *There has been a shocking decline in the number of near pristine (Q5) sites in the EPA monitoring programme since the 1980s*



Red Lists

Least Concern	Near Threatened	Vulnerable	Endangered	Critically Endangered	Extinct in the Wild
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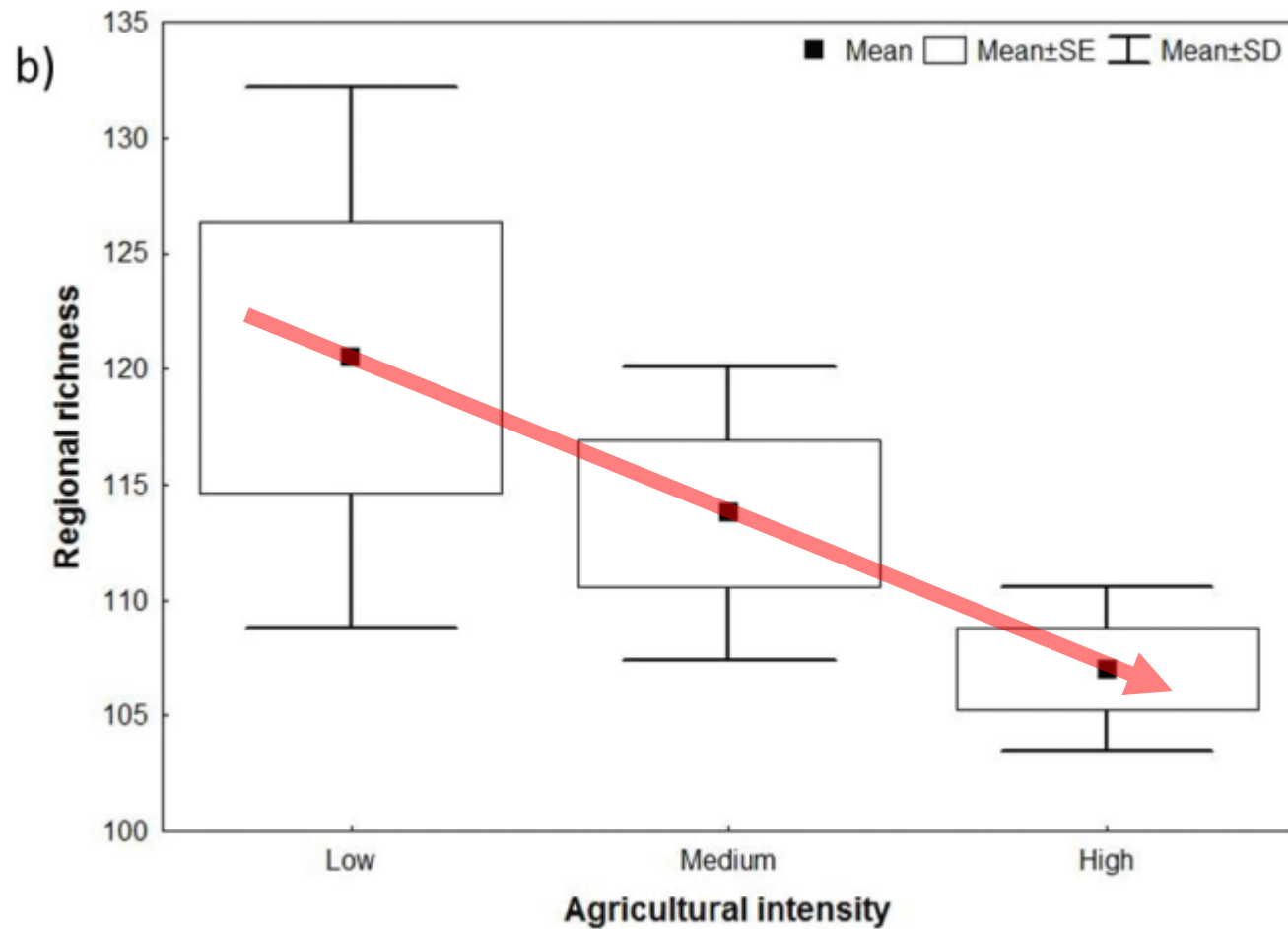
- **Plecoptera**(stoneflies) (Feeley et al. 2020*), ← **20%** Critically endangered or vulnerable plus one extinct
 - **Odonata** (damselflies and dragonflies) (Nelson et al. 2011*), ← **21%** Threatened or Near Threatened
 - **Ephemeroptera** (mayflies) (Kelly-Quinn and Regan 2012*) ← **24%** Threatened or Near Threatened
 - **Water Coleoptera** (water beetles) Foster et al. (2009*) ← 8 Regionally Extinct, 8 Critically endangered, 11 Endangered, 22 Vulnerable, 24 Near Threatened = **30%**
 - **Amphibians, reptiles and freshwater fish** (King et al. 2011*) ← Eel (critically endangered), 5 fish species Vulnerable & 1 Near Threatened – **47%**
 - **Non-marine molluscs** (Byrne et al. 2009*). ↑ 1 Amphibian Endangered – **30%**
- 30%** have a threat status including some critically endangered

*Red Lists available at <https://www.npws.ie/publications/red-lists>

Look at the publication dates!!



15. Between 20% and 30% of the assessed freshwater biodiversity is vulnerable or at worse conservation status.



The mean regional species-level richness of macroinvertebrates in the same streams over four sampling seasons in relation to agricultural intensity (Y axis begins at 100 for clarity, low and medium > high intensity).

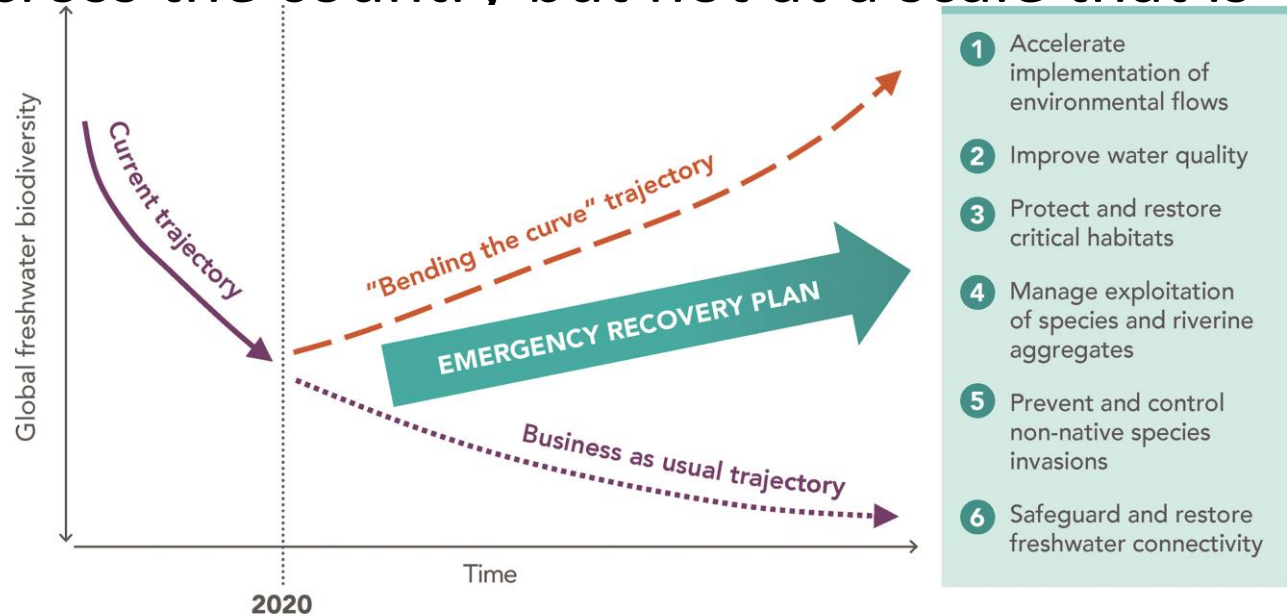
From Kelly-Quinn, M., Feeley, H. and Bradley, C. (2020) Status of freshwater invertebrate biodiversity in Ireland's rivers – time to take stock. *Biology and Environment: Proceedings of the Royal Irish Academy* 2020. DOI: 10.3318/BIOE.2020.09

16. Regional macroinvertebrate diversity decreases with increasing agricultural intensity as does the variety of species found across the region.

Concluding Comments

- Deteriorating water quality needs to be taken more seriously at policy level
- Climate change will exacerbate the challenges to protect water quality and biodiversity
- The consequences for biodiversity and the essential goods and services we depend on need to be taken on board
- Lots of good work and projects across the country but not at a scale that is good enough

17. We need an EMERGENCY RECOVERY PLAN with coordinated actions to bend the curve of declining water quality and biodiversity.



From Tickner et al. (2020)

<https://academic.oup.com/bioscience/article/70/4/330/5732594>

Thank you for your attention

*'We are the first generation that has a clear picture of the value of nature and **our impact on it**. We may be the last that can do something about it.*

We all have a role to play in reversing the losses in nature – but time is running out'

*It requires **governments, businesses and citizens** to rethink how we produce, consume, measure success and value the natural environment.'*

WWF Living Planet Report (2018)

