

Freshwater Biodiversity

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Status

Globally

- Freshwater biodiversity is most threatened, declining at a faster rate than on land or in the sea (Convention on Biological Diversity).
- ‘The Biodiversity crisis in freshwaters has deepened’ - represents an ‘Invisible tragedy’(Reid et al. (2018)
- There have been alarming freshwater biodiversity losses globally since the 1970s (Reid et al. 2018 & Living Planet Report)
- Four key groups (Odonata, Plecoptera, Trichoptera and Ephemeroptera) have already lost a considerable proportion of species (Sánchez-Bayo et al. 2019).
- Impacts on freshwater quality impacts the delivery of ecosystem goods and services that human wellbeing depend on.
- Lack of specific goals and measures to address conservation of freshwater biodiversity at large (Reid et al. 2019).

Ireland

- 21% Odonata are ‘Threatened’ or ‘Near Threatened’ (2011 Red List)
24% Ephemeroptera are ‘Threatened’ or ‘Near Threatened’ (2012 Red List)
Coleoptera - 8 ‘Regionally Extinct’, 8 ‘Critically endangered’, 11 ‘Endangered’, 22 ‘Vulnerable’, 24 ‘Near ‘ = 30% (2009 Red List)
- No more recent updated Red Lists are available.
- Lack of data on the status of many micro- and macroinvertebrate species.

Living Planet Report - https://c402277.ssl.cf1.rackcdn.com/publications/1187/files/original/LPR2018_Full_Report_Spreads.pdf

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.

Sánchez-Bayo, F., & Wyckhuys, K. A. G. (2019). Worldwide decline of the entomofauna: A review of its drivers. *Biological Conservation* 232, 8–27.

Trends

Globally

- Freshwater Living Planet Index shows an 83% decline since 1970.
- Wetland loss since the beginning of the 1700s has been estimated to be more than 50% and as high as 87% (Davidson 2014).
- In Europe, it has been estimated that 80% of natural riparian habitats has disappeared during the past 200 years (Naiman et al. 1993).

Ireland

- Significant water quality challenges are present (Trodd et al. 2018)
- Continuing decline in water quality – 3% deterioration since 2015 (Trodd et al. 2018).
- 44% of water bodies are at moderate status or worse = biodiversity loss & ecosystem services degradation.
- Further loss of high-status river sites- now 17%, compared to 31.6% in the 1987–1990 period.
- **Declines are outpacing efforts to address the problems (Trodd et al. 2018)**

Davidson, N. C. (2014) How much wetland has the world lost? Long-term and recent trends in global wetland area. *Marine and Freshwater Research* 65: 934–941 (2014).

Naiman RJ, Decamps H, Pollock M. (1993). The role of riparian corridors in maintaining regional biodiversity. *Ecological Applications* 3: 209–212.

Trodd, W. and O'Boyle, S. (2018) Water Quality in 2017: *An Indicators Report*. Environmental Protection Agency. Ireland.

Drivers & Pressures/Stressors (Threats)

- Diffuse and point source pollution from agriculture
- Diffuse pollution from forestry operations
- Point source pollution from wastewater treatments plants/septic tanks and industry
- Habitat degradation due to flow regulation and drainage, and fragmentation by barriers
- Elevated fine sediment is a key stressor
- Invasive species are problematic in some areas.
- Most freshwaters are impacted by various combinations of co-occurring stressors (nutrients, acidity, sediment, priority & dangerous substances, pathogens, etc.) sometimes leading to unexpected 'ecological surprises'.
- Emerging contaminant (e.g. antimicrobial compounds, including antibiotics and personal-care-product additives) are a growing concern.
- Climate change is set to add further direct and indirect impacts.

Fanning, A., Craig, M., Webster, P., Bradley, C., Tierney, D., Wilkes, R., Mannix, A., Treacy, P., Kelly, F., Geoghegan, R., Kent, T., and M. Mageean, M. (2017) Water Quality in Ireland 2010–2015. EPA, Wexford.

Flitcroft, R., Boon, P.J., Cooperman, M. S., Harrison, I. J., & Bignoli, D. J. (2019). Theory and practice to conserve freshwater biodiversity in the Anthropocene, *Aquatic Conservation: Marine and Freshwater Ecosystems*, 1013–1021.

Kleijn, D. and Sutherland, W. J. (2019) How effective are European agri-environment schemes in conserving and promoting biodiversity? *Journal of Applied Ecology* 2003, 40, 947–969

Threats to freshwater biodiversity are not projected to ease in the near future, thus highlighting the urgency of identifying effective measures to reduce pressures & priority catchments & networks for action.

Solutions – challenging & context dependent

- Treat the cause and not the symptoms.
- Adopt a ‘multi-stressor perspective’.
- Identify ‘dominant stressors and any hierarchical effects of co-occurring stressors in order to target sequential approaches to mitigation and management’ (Reid et al. 2018).
- Prioritise mitigation of fine sediment pollution (Davis et al. 2018)
- Capitalise on the pollutant-capture potential of riparian buffers.
- Focus particular attention on the small stream network.
- Establish the current status of freshwater biodiversity in Ireland.
- Improve the design of biodiversity monitoring programmes (Kleijn & Sutherland 2019) to address the limited evidence/studies of freshwater biodiversity conservation success (Flitcroft et al. 2019).

Davis, S. J., Ó hUallacháin, D., Mellander, P. E., Kelly, A. M., Matthaei, C. D., Piggott, J. J., & Kelly-Quinn, M. (2018). Multiple-stressor effects of sediment, phosphorus and nitrogen on stream macroinvertebrate communities. *Science of the Total Environment*, 637-638, 577-587.

Flitcroft, R., Boon, P. J., Cooperman, M. S., Harrison, I. J., & Bignoli, D. J. (2019). Theory and practice to conserve freshwater biodiversity in the Anthropocene, *Aquatic Conservation: Marine and Freshwater Ecosystems*, 1013–1021.

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