Recommendations to AHTEG for the Disaggregation of Headline Indicator 3.1 Coverage of Protected and Conserved Areas, to Monitor Status of Inland Waters

Overview

In July 2023, The Nature Conservancy, together with WWF, Conservation International, IUCN, Ramsar, UNEP and additional members of the emerging Freshwater Challenge, shared initial recommendations for the AHTEG's consideration to account for inland water ecosystems and biodiversity in the K-M GBF Monitoring Framework and to meet the AHTEG's objective of addressing critical gaps.[1] Building from these recommendations and with general support of the Convention on Wetlands Scientific and Review Panel (STRP) and UNEP-WCMC, we are pleased to submit the following recommendations for measuring baselines and tracking progress for inland waters under Target 3 *Headline Indicator 3.1. Coverage of protected areas and other area-based conservation measures.*

The recommendations below focus on **disaggregating and tracking *coverage* of the inland waters realm and biomes (including rivers and streams) by protected areas (PAs) and other area-based conservation measures (OECMs).** The detailed methodology is provided in Attachment A.

We provide these recommendations while acknowledging that **to fully assess progress toward protecting inland waters under Target 3, all components of the headline and component indicators need to be adjusted to represent inland waters, including effectiveness, aquatic connectivity[2] and areas important for biodiversity.** In this regard, TNC supports the review and actionable recommendations submitted by the STRP and UNEP-WCMC and looks forward to working with the SBSTTA, CBD Secretariat, and partners to produce methodologies for effectiveness, connectivity and areas important for biodiversity over the K-M GBF implementation period.

Evidence-based gap

The K-M GBF monitoring framework draft headline indicator 3.1[3] includes evidence-based gaps for the inland waters. Specifically, the proposed indicator tracks coverage of area-based conservation measures for terrestrial and inland waters jointly, and for marine separately. Several recent **publications by UN Water, Ramsar, GEOBON, IUCN and others underscore that meeting the GBF 2030 vision, mission and goals, including "to halt and reverse biodiversity loss," will require explicitly tracking progress for inland waters** in the area-based biodiversity (T1-3) and sustainable use and benefits-sharing targets, among others[1] and include in their rationale:

[1] Comment #2955 Indicators for Goal A and Targets 1-8, August 14, 2023, with attachments. Discussion forum on the monitoring framework for the Kunming-Montreal Global Biodiversity Framework (cbd.int) -

[2] Current methodologies focus on terrestrial connectivity and do not represent the needs of aquatic biodiversity

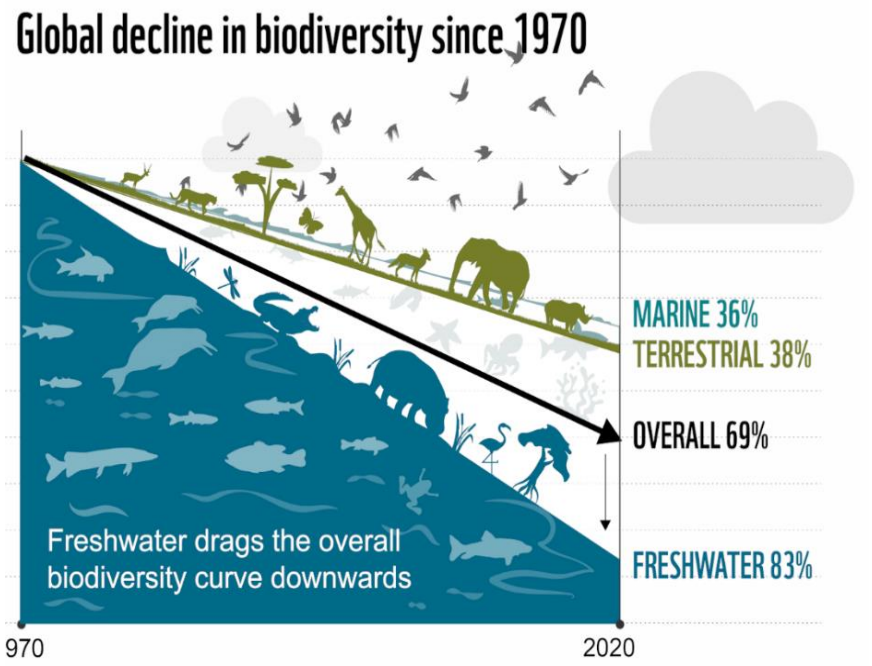
[3] https://www.post-2020indicators.org/metadata/headline/3-1

- Inland waters cover a small fraction of the planet, and they and their dependent biodiversity are among the most threatened.[4] Dependent freshwater species populations are declining at twice the rate of marine and terrestrial ecosystems and almost one in three freshwater species is threatened by extinction (Figure 1).
- The impacts of inland waters ecosystem loss and degradation reverberate in the services they provide, including drought- and flood-risk reduction, water supply provisioning, climate change mitigation and adaption, and food security.
- Lumping the measurement for inland waters with terrestrial areas will not provide an indicative or meaningful indicator, especially but not only because inland water ecosystems, including lakes, rivers, peatlands and other wetlands, cover *a small fraction* of total global area.
- An indicator for tracking inland waters independently will provide information that the global community needs to allocate implementation resources effectively towards under-represented and high-priority ecosystems.

Text Box 1. 2030 K-M GBF Mission and **Figure 1.** Decline in monitored populations of vertebrate species since 1970 (WWF Living Planet Index 2022).

The 2030 mission of the Kunming-Montreal Global Biodiversity Framework:

"To take urgent action to halt and reverse biodiversity loss to put nature on a path to recovery for the benefit of people and planet by conserving and sustainably using biodiversity and by ensuring the fair and equitable sharing of benefits from the use of genetic resources, while providing the necessary means of implementation."



[4] https://www.nature.org/content/dam/tnc/nature/en/documents/Pathway_for_Inland_Waters_Nov_2022.pdf

Approach to develop a methodology for coverage of inland waters

Preceding COP-15, two expert workshops were held in 2022 including representatives from IUCN, UN Water, UNEP WCMC's Protected Planet team, and others to review best available data to (1) represent the extent of inland waters and (2) define coverage. **The determination from these workshops was that sufficient data are available to develop and apply a method to estimate coverage of inland waters by PAs and OECMs** that is simple, has clear caveats, and can serve as a foundation that can accommodate growth and complexity over time (including methods to assess component indicators of effectiveness, connectivity and areas important for biodiversity).[5]

In 2023, building from the workshop findings and recommendations, TNC contracted with Confluvio Consulting, Inc. to (a) compare available global datasets for inland waters coverage and (b) develop, test, and iterate two indicator methodologies for disaggregating global coverage – one for inland waters (measured in area), and the second for rivers and streams (measured in length). Data and indicator development were coordinated with UNEP-WCMC and Ramsar STRP. Further documentation is available upon request.

Consistent with workshop and expert recommendations, the methodology was designed with the following foundational principles:

- ✓ Align with the UN CBD definition of inland waters,[6]
- ✓ Follow and build from the well-established methodology of tracking global coverage of protected areas under the Aichi Target 11 and KMGBF Target 3,
- ✓ Be readily implementable with a foundation for growth and complexity,
- ✓ Use best available global data,
- ✓ Allow for downscaling by providing a methodology and tools for tailored calculations at regional, sub-national and national scales,
- ✓ Avoid double-counting,
- ✓ Disaggregate to track change across different biomes (e.g. rivers and streams, lakes, peatlands, inland mangroves, man-made wetlands), and
- ✓ Be compatible and not redundant with inland waters indicators for other multilateral environmental agreements.

High-level overview of recommended methodology

The recommended methodology proposes to **disaggregate the coverage of inland waters by realm and by biomes.** The method requires two data types (1) spatial data on the extent of area-based protections and (2) spatial data on the extent of inland water ecosystems. All data are readily available.

- Spatial data to represent the extent of protected and conserved areas: WDPA, WD-OECM

[5] IUCN WDPA, Equilibrium Research, TNC, WWF, IUCN SSC, 2022. Pathways for Inland Waters in the 30x30 Target: A draft technical report prepared for COP-15. pp 79-86. https://www.nature.org/content/dam/tnc/nature/en/documents/Pathway_for_Inland_Waters_Nov_2022.pdf

[6] UN CBD defines "Inland waters" as aquatic-influenced environments located within land boundaries. This includes those located in coastal areas, even where adjacent to marine environments. Inland water systems can be fresh, saline or a mix of the two (brackishwater). https://www.cbd.int/waters/inland-waters#inland%20waters

- Spatial data to represent the extent of inland water areas: for global analyses, or in the absence of preferred data at regional, national, or subnational scales, **we recommend using the Global Lakes and Wetlands Database v2[7] (GLWD v2) and RiverATLAS**.[8] Please see Attachment 1 for the detailed methodology.
    - **Rationale for using these data sources:**
        - **Inland waters realm - GLWD v2 (Lehner et al. 2024):** Confluvio Consulting (2024) reviewed 34 global datasets representing lake, river and other wetland data sources for their coverage, accuracy and representation. Based on this assessment, they incorporated 18 datasets in addition to novel data analyses to develop a global database of the extent of lakes, rivers and wetlands at a 15 arc-second resolution. This resulting product harmonizes and integrates newly available ground- and satellite-based data products. Building from GLWD v1 (Lehner and Doll 2008), the classification of GLWD v2 is consistent with the foundational principles of the coverage indicator in that it was designed to avoid double-counting of surface water features while differentiating between natural and non-natural lakes, rivers of multiple sizes, and distinguishing several other wetland types. This includes incorporating data on seasonality; inundation vs. saturation; vegetation cover; salinity; natural vs. non-natural origins; and a stratification of landscape position and water source.
        - **Rivers and streams biome – RiverATLAS (Linke et al. 2019):** While the extent of rivers can technically be measured in area, rivers function as linear and directional ecosystems. Therefore, datasets that can accommodate both directionality (up- and downstream connections) and length are often more appropriate for river representation and measurement. In addition, given the resolution of global datasets representing area, even the best available global data often fail to capture the presence and extent of headwaters and small streams that may be only meters wide and/or nested under dense canopy cover. The RiverATLAS (2019) dataset provides a global distribution of linear river drainage networks at high spatial resolution. The dataset is founded in HydroATLAS, which includes hydro-environmental characteristics that retain topographic information to allow for upstream-downstream functionality. This functionality and analytical foundation will be critical for building from coverage estimates to include conservation effectiveness and aquatic connectivity.

The following is a high-level overview of the methodology to disaggregate by realm and by the 'rivers and streams' biome.

- Disaggregation by inland waters realm: Percent coverage of inland waters = Total inland waters area (GLWD v2) within protected and conserved area (PCA) boundaries (WDPA, WD-OECM)/Total inland waters area (GLWD v2) (Figure 2).
- Disaggregation by the rivers and streams biome: Percent coverage of rivers and streams = Total length of rivers and streams (RiverATLAS) within PCA boundaries (WDPA, WD-OECM)/Total length of rivers and streams (RiverATLAS) (Figure 3).

[7] https://www.hydrosheds.org/products/glwd
[8] https://www.hydrosheds.org/hydroatlas

- Freshwater ecoregions - Abell et al., 2008 is recommended for representing freshwater ecoregions.

Please see Attachment 1 for detailed recommendations including biome recommendations for lakes and wetlands, and artificial wetlands.

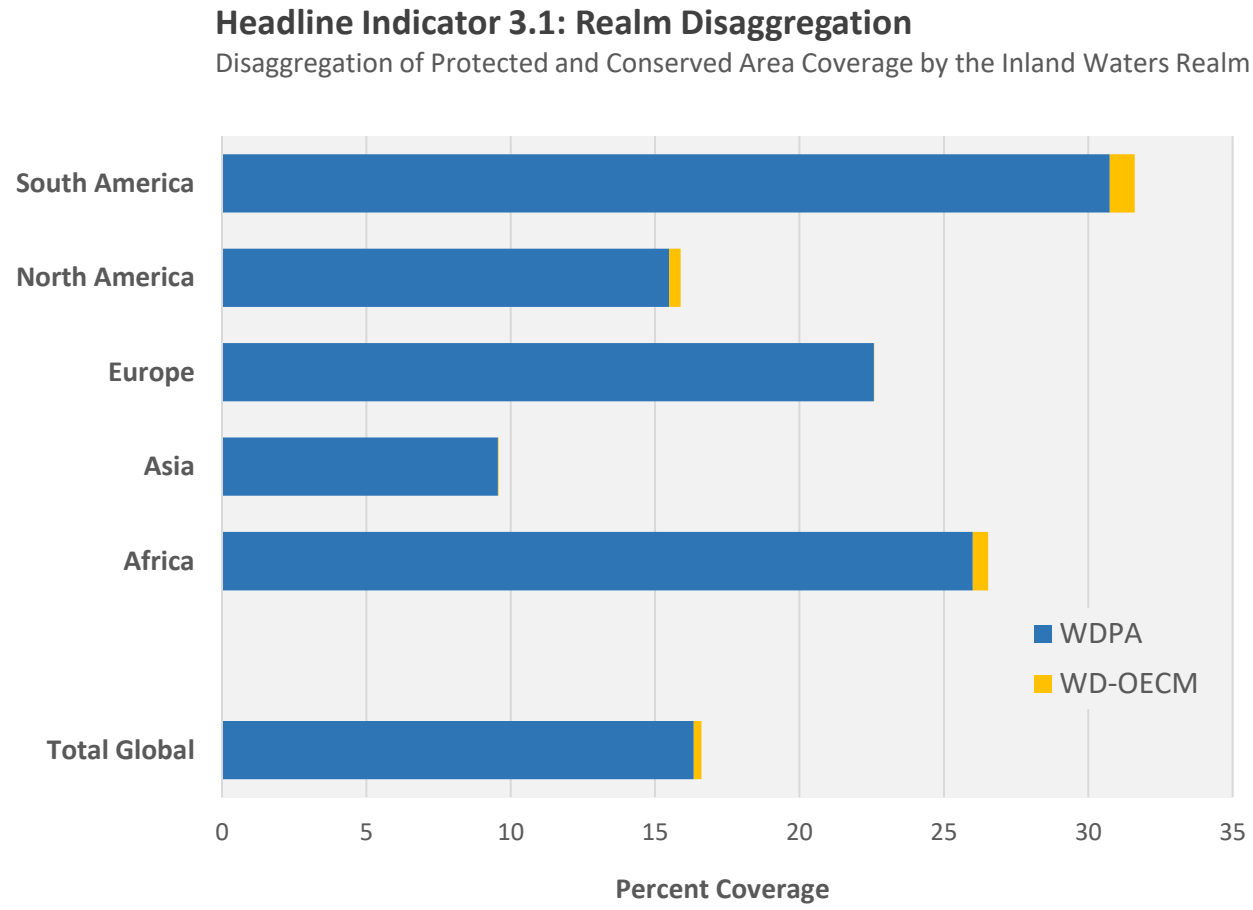


Figure 2. Disaggregation by realm - Continental and global coverage of inland waters within WDPA and WD-OECMs (Analysis by Confluvio Consulting, 2024)

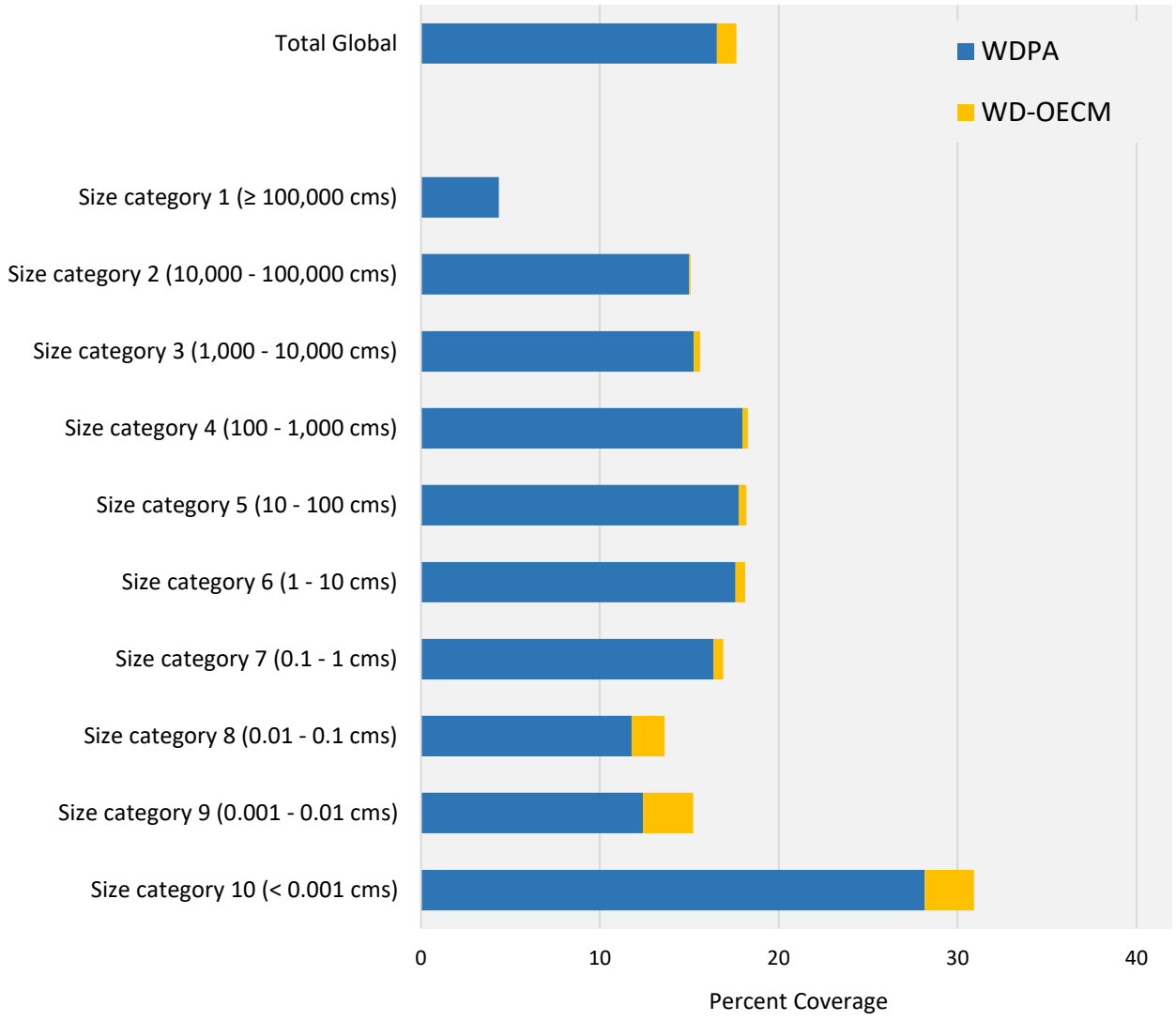


Figure 3. Illustration of Disaggregation by Biome - Coverage of rivers and streams (Analysis by Confluvio Consulting, 2024)

Attachment A: Disaggregating the inland waters realm and biomes -- recommended methodology for Headline Indicator 3.1 metadata

I. Disaggregation of coverage by the inland waters realm

Representing Protected areas + OECMs + Ramsar site area boundaries:

1. Follow the established methodology and datasets for intersecting the global protected areas (WDPA) flat layer and OECM (WD-OECM) flat layer with the base map of the world (Brooks et al. 2016) and converting to an equal area projection (Mollweide).
2. Include protected areas and OECMs classified as 'terrestrial' *and* those areas classified as 'marine'.[9]

Representing inland waters realm extent and total area:

1. For the global analyses and reporting, or in the absence of better data at regional, national, or sub-national scales, use the Global Lakes and Wetlands Database version 2[10] (GLWD v2) to represent extent and area of all inland waters (including lakes, rivers, wetlands including peatlands, etc).

2. Overlay the approved base map of the world to mask or remove wetland areas that occur outside of the 'land area' or terrestrial country boundaries. This step slightly adjusts the extent of the GLWD dataset to align with the CBD definition of inland waters biome by removing some areas and ecosystems that may fall within the marine or coastal biome definition. A more accurate base map is under development by UNEP-WCMC and will replace the current base map (Brooks et al. 2016) once complete.

Calculating percent coverage of inland waters biome by protected and conserved areas (PCA):

Overlay protected area boundaries in Step 1 with inland waters areas from Step 2. Conduct the assessment of overlap in raster format at 1 arc-second (~30m) to retain the high resolution of protected and conserved area extents. Calculate PCA coverage independently and then cumulatively by:

1. Inland water coverage by protected areas (%) = total area of inland waters within the boundaries of the global protected areas flat layer (km2)/ total area of inland waters (km2)
2. Inland waters coverage by OECMs (%) = total area of inland waters within OECM flat layer (km2) / total area of inland waters (km2)
3. Total global coverage of inland waters by protected and conserved areas (%) = (total area of inland waters within protected areas flat layer (km2) (Step 1) + total area of inland waters within OECM flat layer (km2) (Step 2)) / total area of inland waters (km2).
4. Reporting. To avoid double-counting of inland water areas under both inland waters and terrestrial, inland waters coverage can be reported as a subset of the combined terrestrial and inland waters coverage.

[9] The polygons on many protected areas and OECMs extend inland and can include inland waters as defined by UN CBD.

[10] https://www.hydrosheds.org/products/glwd

II. Disaggregation of coverage by inland waters biomes

This disaggregation can be produced by intersecting the dissolved version of the protected and conserved area spatial representations described above with inland waters biomes (Lehner et al. 2024, Linke et al. 2019, and the Global Ecosystem Typology) and further by ecoregions (Abell et al. 2008).

Consistent with IUCN's Global Ecosystem Typology, we recommend disaggregating and tracking coverage of inland waters by (1) rivers and streams (2) lakes and wetlands, and (3) artificial wetlands, using best available global datasets. All datasets presented below are available and initial global calculations for the proposed disaggregation methodology have been conducted. Specifically:

Rivers and streams

1. For global analyses, or in the absence of better data at regional, national, or sub-national scales, use the vectorized linear river network of RiverATLAS (Linke et al. 2019).
2. Calculate river length totals and coverage percentages by summing the length of all respective river segments (rather than counting the number of river reaches). Conduct the calculations in vector format by intersecting the river network of RiverATLAS with the polygons of protected areas to measure the percentage of river length that occurs inside of the polygons.
3. River/stream coverage can be reported as a single value and may be further disaggregated by river size classes.

Lakes and wetlands (naturally occurring)

1. For global analyses, or in the absence of better data at regional, national, or sub-national scales, use the GLWD v2 (Lehner et al., 2024).
2. Lakes and wetlands - Overlay PCA the spatial datasets described above with the GLWD v2 wetland types (excluding river classes and artificial wetlands). Use the clipped data layer described above that uses the base map to account for CBD inland waters definition. Conduct calculations in raster format by intersecting each type with the polygons of protected areas to measure the total area that falls inside of the boundary.
3. Lakes and wetlands coverage can be reported as a single value and may be further disaggregated by ecosystem type.

   Note: The GLWD v2 and Global Ecosystem Typology represent rivers and stream classes using area-based data sets (km2). The area-based coverage calculation could be seamlessly calculated as part of the method described above and used to supplement information from the length-based methodology. Please see rationale on page 4 for using the length-based methodology and data in the as the primary approach to represent the rivers and streams biome.

Artificial lakes and wetlands (e.g. reservoirs, rice paddies). Consistent with IUCN's Global Ecosystem Typology, coverage of artificial wetlands should be reported separately from coverage of other inland waters biome types.

1. For global analyses, or in the absence of better data at regional, national, or sub-national scales, use GLWD v2 (Lehner et al., 2024).

2. Overlay PCA the spatial datasets described above with 2 GLWD v2 wetland types of reservoirs and rice paddies. Use the clipped data layer described above that uses the base map to account for CBD inland waters definition. Conduct calculations in raster format by intersecting each type with the polygons of protected areas to measure the total area that falls inside of the boundary.

3. Artificial wetlands coverage can be reported as a single value and may be further disaggregated by reservoirs and rice paddies.

Data References

ABELL, R.A., et al. (2008). Michele L. Thieme, Carmen Revenga, Mark Bryer, Maurice Kottelat, Nina Bogutskaya, Brian Coad, Nick Mandrak, Salvador Contreras Balderas, William Bussing, Melanie L. J. Stiassny, Paul Skelton, Gerald R. Allen, Peter Unmack, Alexander Naseka, Rebecca Ng, Nikolai Sindorf, James Robertson, Eric Armijo, Jonathan V. Higgins, Thomas J. Heibel, Eric Wikramanayake, David Olson, Hugo L. López, Roberto E. Reis, John G. Lundberg, Mark H. Sabaj Pérez, Paulo Petry, Freshwater Ecoregions of the World: A New Map of Biogeographic Units for Freshwater Biodiversity Conservation, *BioScience*, Volume 58, Issue 5, May 2008, Pages 403–414, https://doi.org/10.1641/B580507

LEHNER, Lehner, B., Anand, M., Fluet-Chouinard, E., Tan, F., Aires, F., Allen, G.H., Bousquet, P., Canadell, J.G., Davidson, N., Finlayson, C.M., Gumbricht, T., Hilarides, L., Hugelius, G., Jackson, R.B., Korver, M.C., McIntyre, P.B., Matthews, E., Nagy, S., Olefeldt, D., Pavelsky, T., Pekel, J.-F., Poulter, B., Prigent, C., Wang, J., Worthington, T.A., Yamazaki, D., Thieme, M. (in review, 2024). Mapping the world's inland waters: an update to the Global Lakes and Wetlands Database (GLWD v2). https://www.hydrosheds.org/products/glwd

LINKE, S., Lehner, B., Ouellet Dallaire, C., Ariwi, J., Grill, G., Anand, M., Beames, P., Burchard-Levine, V., Maxwell, S., Moidu, H., Tan, F., Thieme, M. (2019). Global hydro-environmental sub-basin and river reach characteristics at high spatial resolution. Scientific Data 6: 283. doi: https://doi.org/10.1038/s41597-019-0300-6