The Danube Fish Database: documenting species distributions across a major European river basin

Authors

Yusdiel Torres-Cambas[1]*, András Ambrus[2], Miklós Bán[3], Bálint Bánó[4], Anthony Basooma[5], Vanessa Bremerich[1], Florian Borgwardt[5,12], Maša Čarf[6], Irina Cernisencu[7], Gorčin Cvijanović[8], István Czeglédi[4], Sami Domisch[1], Tibor Erős[4], Zoltán Fehér[9], Vivien Füstös[10], Juergen Geist[11], Thomas Hein[5,12], Milica Jaćimović[8], Sonja C. Jähnig[1,13], Béla Kiss[14], Maroš Kubala[15], Klaudija Lebar[16], Borislava Kostadinova Margaritova[17], Matej Marusic[18], Paul Meulenbroek[5,12], Stoyan Dobrev Mihov[17], Attila Mozsár[4], Zoltán Müller[14], Christoffer Nagel[11], Iulian Nichersu[7], Dušan Nikolić[8], Sandi Orlic[19], Joachim Pander[11], Polona Pengal[20], Marina Piria[21], László Polyák[14], Bálint Preiszner[4], Simon Rusjan[15], Márton Sallai[22], Zoltán Sallai[23], Péter Sály[24], Andrea Samu[9], Brigitte Sasano[25], Astrid Schmidt-Kloiber[5], András Sevcsik[26], Marija Smederevac-Lalić[8], András Specziár[4], Twan Stoffers[1], Zoltán Szalóky[24], Renáta Szita[27], Gábor Takács[27], Péter Takács[4], Maxim Teichert[25], Milcho Todorov[28], Balázs Tóth[26], Theodora Trichkova[28], Damir Valić[19], Zoltán Vitál[22], Martin Tschikof[5,12]

Affiliations

1. Leibniz Institute of Freshwater Ecology and Inland Fisheries, Department of Community and Ecosystem Ecology, Müggelseedamm 310, D-12489 Berlin, Germany
2. Independent Researcher, Jurisich u. 16., H-9495 Kópháza, Hungary
3. HUN-REN DE Behavioural Ecology Research Group, University of Debrecen, H-4010 Debrecen, Egyetem tér 1
4. HUN-REN Balaton Limnological Research Institute, Tihany H-8237, Hungary
5. BOKU University, Institute of Hydrobiology and Aquatic Ecosystem Management, Gregor-Mendel-Strasse 33, 1180 Vienna, Austria
6. Fisheries Research Institute of Slovenia, Spodnje Gameljne 61a, 1211 Ljubljana – Šmartno, Slovenia
7. Danube Delta National Institute for Research and Development, 165 Babadag Street, Tulcea 820112, Romania
8. University of Belgrade – Institute for Multidisciplinary Research, Department of Biology and Inland Waters Protection, Kneza Višeslava 1, 11030 Belgrade, Serbia
9. WWF Hungary, Budapest, 1141 Álmos vezér útja 69/A
10. HUN-REN–BME Water Management Research Group, Budapest H-1111, Hungary
11. Aquatic Systems Biology Unit, Technical University of Munich (Technische Universität München), Mühlenweg 22, 85354 Freising-Weihenstephan, Germany
12. Christian Doppler Laboratory for Meta Ecosystem Dynamics in Riverine Landscapes, BOKU University, Vienna, Institute of Hydrobiology and Aquatic Ecosystem Management, 1180 Vienna, Austria
13. Geography Department, Humboldt-Universität zu Berlin, 10099 Berlin, Germany
14. BioAquaPro Ltd., Debrecen, H-4032, Hungary
15. Water Research Institute, Nábr. arm. gen. L. Svobodu 5 (7), 812 49 Bratislava
16. University of Ljubljana, Faculty of Civil and Geodetic Engineering, Jamova 2, 1000 Ljubljana, Slovenia
17. WWF Bulgaria, 147 Knyaz Boris I Str., Floor 1, Sofia 1000, Bulgaria
18. DANUBEPARKS, Danube River Network of Protected Areas
19. Ruđer Bošković Institute, Bijenička cesta 54, 10000 Zagreb, Croatia
20. Institute for Ichthyological and Ecological Research, Business Unit Ljubljana, Staretova ulica 1, 1233 Dob, Slovenia
21. University of Zagreb Faculty of Agriculture, Department of Fisheries, Apiculture, Wildlife Management and Special Zoology, Zagreb, Croatia
22. Hungarian University of Agriculture and Life Sciences, Institute of Aquaculture and Environmental Safety, Research Center for Fisheries and Aquaculture, Szarvas, Hungary
23. Vaskos Csabak Bt., Békésszentandrás, Hungary
24. HUN-REN Institute of Aquatic Ecology, Centre for Ecological Research, Budapest, H-1113, Hungary
25. Federal Agency for Water Management, Institute for Aquatic Ecology and Fisheries Management, Scharfling 18, 5310 Mondsee, Austria
26. Duna-Ipoly National Park Directorate, Budapest H-1121, Hungary
27. Fertő-Hanság National Park Directorate, Sarród, H-9435, Hungary
28. Bulgarian Academy of Sciences, Institute of Biodiversity and Ecosystem Research, 1 Tsar Osvoboditel Blvd., 1000 Sofia, Bulgaria

---

Corresponding author:
Yusdiel Torres-Cambas (yusdiel.torres-cambas@igb-berlin.de

List of fields and definitions used in a database of fish occurrence records from the Danube River Basin. Terms and definitions are according to Darwin Core standards (dc, http://www.tdwg.org/standards/450), Freshwater Core Template at Freshwater Biodiversity Data Portal (fwct, https://data.freshwaterbiodiversity.eu/) , Global Biodiversity Information Facility (gbif, https://www.gbif.org) and Amatulli et al. (2022).

Category	Field	Definition
Identification and Classification	scientificName [dc]	The full scientific name, with authorship and date information if known.
	genus [dc]	The full scientific name of the genus in which the taxon is classified.
	family [dc]	The full scientific name of the family in which the taxon is classified.
	order [dc]	The full scientific name of the order in which the taxon is classified.
	verbatimIdentification [dc]	A string representing the taxonomic identification as it appeared in the original record.
	identificationRemarks [dc]	Comments or notes about the process or conditions of identification, or any other information relevant to the identification of the taxon.
Occurrence Information	occurrenceID [dc]	A globally unique identifier for an individual occurrence record
	materialSampleID [dc]	A globally unique identifier for a physical sample or collection of material related to an occurrence.
	basisOfRecord [dc]	The specific nature of the data record. Categories “PreservedSpecimen”, “MaterialCitation” and “HumanObservation”.
	occurrenceRemarks [dc]	Comments or notes about the occurrence. In this case, whether or not the occurrence could be an environmental outlier detected by 10 outlier detections methods (i.e. kmeans, local outlier factor, isolation forest, Z-score, semi-interquartile range, Hampel filter, reverse jack knifing, One Class support vector machines, adjusted boxplots, and interquartile range).
	individualCount [dc]	The number of individuals present at the time of the occurrence
	lifeStage [dc]	The age class or life stage of the organism(s) at the time the occurrence was recorded.
Temporal Information	day [dc]	The integer day of the month on which the event occurred.
	month [dc]	The integer month in which the event occurred.
	year [dc]	The four-digit year in which the event occurred, according to the Common Era Calendar.
Collector and Identifier Information	recordedBy [dc]	A person, group, or organization responsible for recording the original occurrence.

Category	Field	Definition
	identifiedBy [dc]	A list (concatenated and separated) of names of people, groups, or organizations who assigned the Taxon to the subject.
Geospatial Information	waterBody [fwct]	The name of the water body in which the location occurs.
	subcatchmentID [Amatulli et al. (2022)]	Identification number for each subcatchment in the Danube River Basin[1]. A subcatchment is the land area that drains into a stream reach.
	locality [dc]	The specific description of the place.
	decimalLatitude [dc]	The geographic latitude (in decimal degrees, using the spatial reference system given in geodeticDatum) of the geographic center of a location. Positive values are north of the Equator, negative values are south of it. Legal values lie between -90 and 90, inclusive.
	decimalLongitude [dc]	The geographic longitude (in decimal degrees, using the spatial reference system given in geodeticDatum) of the geographic center of a location. Positive values are east of the Greenwich Meridian, negative values are west of it. Legal values lie between -180 and 180, inclusive.
	geodeticDatum [dc]	The ellipsoid, geodetic datum, or spatial reference system (SRS) upon which the geographic coordinates given in decimalLatitude and decimalLongitude as based.
	coordinatePrecision [dc]	Precision of the coordinates provided for a specific occurrence record. e.g.: coordinatePrecision = 0.0001 (Coordinates are precise to approximately 11 meters at the equator.)
	coordinateUncertaintyInMeters [dc]	The radius of uncertainty around the given geographic coordinates, indicating the potential error in the location of an occurrence.
Georeferencing Information	georeferenceProtocol [dc]	The methods or protocols used to determine the geographic coordinates of an occurrence. Specify the method used for determining the location of the occurrence, such as manual georeferencing from maps, GPS devices, or automated systems.
	georeferenceSources [dc]	A list (concatenated and separated) of maps, gazetteers, or other resources used to georeference the location, described specifically enough to allow anyone in the future to use the same resources.
Collection and Dataset Information	catalogNumber [dc]	An identifier (preferably unique) for the record within the data set or collection.
	collectionCode [dc]	Term used to identify the specific collection within an institution or repository where a specimen, observation, or occurrence record is cataloged.

Category	Field	Definition
	institutionCode [dc]	The name (or acronym) in use by the institution having custody of the object(s) or information referred to in the record.
	datasetName [dc]	The name identifying the data set from which the record was derived.
	samplingProtocol [dc]	The names of, references to, or descriptions of the methods or protocols used.
Bibliographic and Reference Information	reference [dc]	A related resource that is referenced, cited, or otherwise pointed to by the described resource. Link to academic papers, datasets, or authoritative publications that support the information provided in the occurrence record. e,g, a DOI linking to a study, a citation to a paper, a link to the original dataset.
	bibliographicCitation [dc]	A bibliographic reference for the resource. The intended usage of bibliographicCitation, is to provide the preferred way to cite the resource itself.
	gbifId [gbif]	Identification number of the occurrence record at the Global Biodiversity Information Facility (GBIF) database.

Amatulli, G., Garcia Marquez, J., Sethi, T., Kiesel, J., Grigoropoulou, A., Üblacker, M. M., Shen, L. Q., & Domisch, S. (2022). Hydrography90m: a new high-resolution global hydrographic dataset. *Earth Syst. Sci. Data*, *14*, 4525–4550. https://doi.org/10.5194/essd-14-4525-2022

Contributors to individual datasets in a database of fish occurrence records from the Danube River Basin

Dataset	Name	Affiliation	E-mail
WWF_HU	Zoltán Fehér	WWF_HUngary, Budapest, 1141 Álmos vezér útja 69/A	zoltan.feher@wwf.hu
WWF_HU	Renáta Szita	Fertő-Hanság National Park Directorate, Rév-Kócsagvár, Sarród, H-9435, Hungary	szita.renata@fhnp.hu
WWF_HU	Gábor Takács	Fertő-Hanság National Park Directorate, Rév-Kócsagvár, Sarród, H-9435, Hungary	takacs.gabor@fhnp.hu
WWF_HU	Zoltán Sallai	Vaskos Csabak Bt. Anna-Ligeti lakópark 24. H-5561 Békésszentandrás, Hungary	csabak@csabak.hu
WWF_HU	András Ambrus	Jurisich u. 16., H-9495 Kópháza, Hungary	ambrus.andras@gmail.com
WWF_HU	Tibor Erős	HUN-REN Balaton Limnological Research Institute, Klebelsberg Kuno utca 3, Tihany H-8237, Hungary	eros.tibor@blki.hu
WWF_HU	István Czeglédi	HUN-REN Balaton Limnological Research Institute, Klebelsberg Kuno utca 3, Tihany H-8237, Hungary	czegledi.istvan@blki.hu
WWF_HU	Bálint Preiszner	HUN-REN Balaton Limnological Research Institute, Klebelsberg Kuno utca 3, Tihany H-8237, Hungary	preiszner.balint@blki.hu
WWF_HU	Péter Sály	HUN-REN Institute of Aquatic Ecology, Centre for Ecological Research, 29 Karolina Road, Budapest, H-1113, Hungary	saly.peter@ecolres.hu
WWF_HU	Zoltán Szalóky	HUN-REN Institute of Aquatic Ecology, Centre for Ecological Research, 29 Karolina Road, Budapest, H-1113, Hungary	szaloky.zoltan@ecolres.hu
WWF_HU	Balázs Tóth	Duna-Ipoly National Park Directorate, Költő utca 21, Budapest H-1121, Hungary	zingelzingel@gmail.com
WWF_HU	András Sevcsik	Duna-Ipoly National Park Directorate, Költő utca 21, Budapest H-1121, Hungary	hiuzhaz@dinpi.hu
WWF_HU	Vivien Füstös	HUN-REN–BME Water Management Research Group, Műegyetem Rakpart 3, Budapest H-1111, Hungary	fustos.vivien@emk.bme.hu
WWF_HU	Zoltán Müller	BioAquaPro Ltd. Kosztolányi Dezső u. 42., Debrecen, H-4032, Hungary	mullerz@bioaquapro.hu
WWF_HU	Béla Kiss	BioAquaPro Ltd. Kosztolányi Dezső u. 42., Debrecen, H-4032, Hungary	bkiss@bioaquapro.hu
WWF_HU	László Polyák	BioAquaPro Ltd. Kosztolányi Dezső u. 42., Debrecen, H-4032, Hungary	polyaklaszlo@gmail.com
WWF_HU	Péter Takács	HUN-REN Balaton Limnological Research Institute, Klebelsberg Kuno utca 3, Tihany H-8237, Hungary	takacs.peter@blki.hu
WWF_HU	Miklós Bán	HUN-REN DE Behavioural Ecology Research Group, Department of Evolutionary Zoology, University of	banm@vocs.unideb

Dataset	Name	Affiliation	E-mail
		Debrecen H-4010 Debrecen, Egyetem tér 1.	
Erös	Tibor Erős	HUN-REN Balaton Limnological Research Institute, Klebelsberg Kuno utca 3, Tihany H-8237, Hungary	eros.tibor@blki.hu
Erös	István Czeglédi	HUN-REN Balaton Limnological Research Institute, Klebelsberg Kuno utca 3, Tihany H-8237, Hungary	czegledi.istvan@blki.hu
Erös	Bálint Preiszner	HUN-REN Balaton Limnological Research Institute, Klebelsberg Kuno utca 3, Tihany H-8237, Hungary	preiszner.balint@blki.hu
Erös	Péter Takács	HUN-REN Balaton Limnological Research Institute, Klebelsberg Kuno utca 3, Tihany H-8237, Hungary	takacs.peter@blki.hu
Erös	András Specziár	HUN-REN Balaton Limnological Research Institute, Klebelsberg Kuno utca 3, Tihany H-8237, Hungary	specziar.andras@blki.hu
Erös	Attila Mozsár	HUN-REN Balaton Limnological Research Institute, Klebelsberg Kuno utca 3, Tihany H-8237, Hungary	mozsar.attila@blki.hu
Erös	Bálint Bánó	HUN-REN Balaton Limnological Research Institute, Klebelsberg Kuno utca 3, Tihany H-8237, Hungary	bano.balint@blki.hu
Erös	Péter Sály	HUN-REN Institute of Aquatic Ecology, Centre for Ecological Research, 29 Karolina Road, Budapest, H-1113, Hungary	saly.peter@ecolres.hu
Erös	Zoltán Szalóky	HUN-REN Institute of Aquatic Ecology, Centre for Ecological Research, 29 Karolina Road, Budapest, H-1113, Hungary	szaloky.zoltan@ecolres.hu
UL_FGG	Simon Rusjan	University of Ljubljana	Simon.Rusjan@fgg.uni-lj.si
UL_FGG	Klaudija Lebar	University of Ljubljana	Klaudija.Lebar@fgg.uni-lj.si
UL_FGG	Maša Čarf	Fisheries Research Institute of Slovenia	masa.carf@zzrs.si
GZÜV	Maxim Teichert	Federal Agency for Water Management	maxim.teichert@baw.at
GZÜV, JDS	Paul Meulenbroek	BOKU University Vienna, Institute for hydrobiology and aquatic ecosystem Management	paul.meulenbroek@boku.ac.at
GZÜV	Martin Tschikof	BOKU University Vienna, Institute for hydrobiology and aquatic ecosystem Management	martin.tschikof@boku.ac.at
GZÜV	Thomas Hein	BOKU University Vienna, Institute for hydrobiology and aquatic ecosystem Management	thomas.hein@boku.ac.at
GZÜV, EFI+,JDS	Anthony Basooma	BOKU University Vienna, Institute for hydrobiology and aquatic ecosystem Management	anthony.basooma@boku.ac.at
IBER-BAS	Theodora Trichkova	Bulgarian Academy of Sciences, Institute of Biodiversity and Ecosystem Research	trichkova@gmail.com

Dataset	Name	Affiliation	E-mail
IBER-BAS	Milcho Todorov	Bulgarian Academy of Sciences, Institute of Biodiversity and Ecosystem Research	
RBI - DANUBEPARKS	Matej Marusic	DANUBEPARKS, Danube River Network of Protected Areas	m.marusic@danubeparks.org
RBI - DANUBEPARKS	Sandi Orlic	Ruđer Bošković Institute, Bijenička cesta 54, 10000 Zagreb, Croatia	Sandi.Orlic@irb.hr
INCDDD	Irina Cernisencu	Danube Delta National Institute for Research and Development	irina.cernisencu@ddni.ro
INCDDD	Iulian Nichersu	Danube Delta National Institute for Research and Development	iulian.nichersu@ddni.ro
VUVH	Maros Kubala	Comenius University Bratislava	maros.kubala@vuvh.sk
GBIF	Yusdiel Torres-Cambas	Leibniz Institute of Freshwater Ecology and Inland Fisheries	yusdiel.torres-cambas@igb-berlin.de
UB-IMSI	Marija Smederevac-Lalic	University of Belgrade, Institute for Multidisciplinary Research, Kneza Viseslava 1, 11030 Belgrade, Serbia	marijasmederevac@imsi.bg.ac.rs
UB-IMSI	Dusan Nikolic	University of Belgrade, Institute for Multidisciplinary Research, Kneza Viseslava 1, 11030 Belgrade, Serbia	dusan@imsi.rs
UB-IMSI	Gorcin Cvijanovic	University of Belgrade, Institute for Multidisciplinary Research, Kneza Viseslava 1, 11030 Belgrade, Serbia	mitrandir@imsi.rs
UB-IMSI	Milica Jacimovic	University of Belgrade, Institute for Multidisciplinary Research, Kneza Viseslava 1, 11030 Belgrade, Serbia	mpucar@imsi.rs
TUM	Joachim Pander	Aquatic Systems Biology Unit, Technical University of Munich, Muehlenweg 22, D-85354 Freising, Germany.	joachim.pander@tum.de
TUM	Jürgen Geist	Aquatic Systems Biology Unit, Technical University of Munich, Muehlenweg 22, D-85354 Freising, Germany.	geist@tum.de
TUM	Twan Stoffers	Leibniz Institute of Freshwater Ecology and Inland Fisheries	twan.stoffers@igb-berlin.de
TUM	Christoffer Nagel	Aquatic Systems Biology Unit, Technical University of Munich, Muehlenweg 22, D-85354 Freising, Germany.	christoffer.nagel@tum.de
RBI - DANUBEPARKS	Damir Valić	Ruđer Bošković Institute, Bijenička cesta 54, 10000 Zagreb, Croatia	damir.valic@irb.hr
Sallai-Vital	Zoltán Vitál	Hungarian Univeristy of Agriculture and Life Sciences	Vital.Zoltan@uni-mate.hu
Sallai-Vital	Márton Sallai	Hungarian Univeristy of Agriculture and Life Sciences	sallai.marton@uni-mate.hu
GZÜV	Brigitte Sasano	Federal Agency for Water Management, Austria	brigitte.sasano@baw.at
IUCN-REVIVO	Polona Pengal	Institute for Ichthyological and Ecological Research, Business Unit Ljubljana, Staretova ulica 1, 1233 Dob, Slovenia	polona.pengal@ozivimo.si
WWF_Bulgaria	Borislava Kostadinova Margaritova	WWF Bulgaria, 147 Knyaz Boris I Str., Floor 1, Sofia 1000, Bulgaria	bmargaritova@wwf.bg

Dataset	Name	Affiliation	E-mail
WWF_Bulgaria	Stoyan Dobrev Mihov	WWF Bulgaria, 147 Knyaz Boris I Str., Floor 1, Sofia 1000, Bulgaria	smihov@wwf.bg