

Biological survey of lakes and reservoirs from Sardinia and Piedmont (Italy), a georeferenced dataset from the project LIFE INHABIT

Martina Austoni,^{1*} Angela Boggero,¹ Lyudmila Kamburska,^{1,2} Antonella Lugliè,^{2,3} Aldo Marchetto,^{1,2} Alessandro Oggioni,⁴ Bachisio M. Padedda,^{2,3} Pietro Volta,¹ Silvia Zaupa¹

¹National Research Council, Water Research Institute (CNR-IRSA), Largo Tonolli 50, 28922 Verbania Pallanza; ²National Biodiversity Future Center (NBFC), 90133 Palermo; ³Department of Architecture, Design and City planning, University of Sassari, via Piandanna 4, 07100 Sassari; ⁴National Research Council, Institute for Electromagnetic Sensing of the Environment (CNR-IREA), Via A. Corti 12, 20133 Milan, Italy

ABSTRACT

We report a georeferenced dataset of a biological survey carried out in lakes and reservoirs in Piedmont and Sardinia regions (Italy), that includes fish fauna, macroinvertebrates, macrophytes, and phytoplankton. This survey was carried out to test the standardised protocols adopted with the National Decree 260/210 by the Italian Ministry of the Environment, Land and Sea for the assessment of the ecological status of lakes and the ecological potential of reservoirs for satisfying the requirements of the European Water Framework Directive (WFD) 2000/60/EC. Occurrence data have been uploaded to the Global Biodiversity Information Facility (GBIF).

INTRODUCTION

In 2010 and 2011, a biological survey was carried out in six lakes and six reservoirs in Piedmont and Sardinia regions (Italy) to develop and test the protocols and the biological quality indices needed for the application in

Italy of the Water Framework Directive (WFD) 2000/60/EC. This activity was supported by the European Union, through the LIFE+ funding scheme (project INHABIT (Local hydro-morphology, habitat and RBMPs: new measures to improve ecological quality in South European rivers and lakes, LIFE08 ENV/IT/000413). During the project, a database of the biological samples and results was implemented. The database also included a small number of occurrences related to the same lakes and reservoirs originated from previous activities.

As data from freshwater sites in these areas are still not common in GBIF, we decided to share the content of the project database, uploading the data on the GBIF facility. This can represent, for example, an opportunity to compare data from regions with different climatic conditions.

Summary statistics

The 3549 georeferenced occurrence records at the species level or higher rank have been uploaded to the GBIF website (<https://www.gbif.org>), for a total of 455 taxa collected during 831 sampling events.

Dataset description

The dataset was structured based on the Darwin Core Standard (Wieczorek *et al.*, 2012), with each row containing a record of the occurrence of a taxon from a sample. The columns report the original and updated taxon name, and additional taxonomic information. Information on sampling is stored in the event list.

Object name: Biological survey of lakes and reservoirs from Sardinia and Piedmont (Italy)

Data set citation: Biological survey of lakes and reservoirs from Sardinia and Piedmont (Italy), a georeferenced dataset from the project LIFE INHABIT

Character encoding: UTF-8

Corresponding author: martina.austoni@cnr.it

Key words: fish fauna; GBIF; Italy; macroinvertebrates; macrophytes; phytoplankton.

Contributions: all authors contributed equally.

Citation: Austoni M, Boggero A, Kamburska L, Lugliè A, Marchetto A, Oggioni A, et al. Biological survey of lakes and reservoirs from Sardinia and Piedmont (Italy), a georeferenced dataset from the project LIFE INHABIT. *J. Limnol.* 2023;82:2114.

Edited by: Diego Fontaneto, *National Research Council, Water Research Institute (CNR-IRSA), Verbania Pallanza, Italy.*

Received: 13 December 2022.

Accepted: 17 March 2023.

Publisher's note: all claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article or claim that may be made by its manufacturer is not guaranteed or endorsed by the publisher.

©Copyright: the Author(s), 2023

Licensee PAGEPress, Italy

J. Limnol., 2023; 82(s1):2114

DOI: 10.4081/jlimnol.2023.2114

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0).

Format name: csv

Format version: 1.0

Distribution (permanent link): <https://www.gbif.org/dataset/c50c1582-d527-4ee3-a204-349d8241961a>

Date of creation: 15 October 2022

Date of last revision: 13 December 2022

Date of publication: 13 December 2022

Update policy: GBIF policy rules

Language: English

Licence of use: both access and use are free to any user (CC-BY 4.0). The authors would appreciate users providing a link to the original dataset) or citing the present paper when using the data in research projects. Stakeholders interested in additional information can contact authors via the contact information provided in the metadata.

Metadata language: English

Metadata managers: Martina Austoni (martina.austoni@cnr.it), Lyudmila Kamburska (lyudmila.kamburska@i-rsa.cnr.it)

Management details

Project title: Biological survey of lakes and reservoirs from Sardinia and Piedmont (Italy), a georeferenced dataset from the project LIFE INHABIT.

Database manager: Lyudmila Kamburska

Temporal coverage: from 2006-06-22 to 2012-11-07

Record basis: database of the LIFE INHABIT project

IT specialists: Lyudmila Kamburska and Aldo Marchetto

Funding grants: European Union, project LIFE INHABIT (Local hydro-morphology, habitat and RBMPs: new measures to improve ecological quality in South European rivers and lakes LIFE08 ENV/IT/000413) and of the National Biodiversity Future Centre (NBFC) to Consiglio Nazionale delle Ricerche, funded by the Italian Ministry

of University and Research, PNRR, Missione 4 Componente 2, “Dalla ricerca all’impresa”, Investimento 1.4, Project CN00000033.

Geographic coverage

Study area: The thirteen sample water bodies are distributed in two Italian regions: Sardinia (five reservoirs and the only one natural lake of the island) and Piedmont (five lakes and two reservoirs) (Fig. 1, Tab. 1). The following



Fig. 1. Location of the 13 sampling water bodies distributed in two Italian regions: Sardinia and Piedmont.

Tab.1. Selected characteristics of the study lakes and reservoirs.

	Lake	Reservoir	Altitude (m asl)	Lake surface (km ²)	Catchment surface (km ²)	Volume (106 m ³)
Avigliana	X		356	0.58	8.1	4.5
Baratz	X		32	0.46	12.0	2.3
Bidighinzu		X	330	1.67	52.0	12.5
Candia	X		226	1.35	7.5	8.1
Liscia		X	178	5.80	285	105
Mergozzo	X		194	1.83	10.4	82.9
Morasco		X	1815	0.57	38.8	18.2
Posada		X	43	2.80	615	28.0
Serru'		x	2240	0.58	18.0	14.5
Sirio	X		271	0.30	1.4	5.4
Sos Canales		X	708	0.33	17.0	5.1
Torrei		X	867	0.17	10.7	1.0
Viverone	X		230	5.58	25.7	125

sites are part of the Long-Term Ecological Research (eLTER) Network: Candia (<https://deims.org/c7fe4203-24b1-4d11-a573-99b99204fede>), Bidighinzu (<https://deims.org/67757ba9-c40c-4e2c-bdad-bc26905a738e>) and Sos Canales (<https://deims.org/e8374da3-1644-460b-bd4c-bf669514dd22>). Data are georeferenced according to “WGS 84” datum. Tab. 1 reports some selected characteristics of the study lakes.

Bounding box: min Longitude: 7.12 – min Latitude 40.06 – max Longitude: 9.61 – max Latitude: 46.43.

Sampling design: Fish fauna was sampled using both standard nets (Pokorny-Site, Czech Republic) and electrofishing. Macroinvertebrate were generally sampled during both stratification and mixing lakes and reservoirs periods using a grab on soft sediments along transect connecting the shores to the maximum depths covering three characteristic lake areas (littoral, sublittoral and profundal). Macrophytes were sampled along transects from the shore to the maximum depth where macrophytes were still present. Phytoplankton was sampled three to six times during the year 2011 (2010 for Lake Candia, only) from a boat at maximum depth point.

Habitat type: Pelagic and littoral areas of lakes and reservoirs.

Biogeographic region: Within the Palearctic realm, according to the definitions of the European Environmental Agency (2017), the dataset covers two European biogeographical regions: Alpine and Mediterranean.

Country: Italy.

Quality control for geographic data: Reliability of coordinates was checked in Google maps to identify the correctness of sites. Geographic coordinate format, coordinates within country/provincial boundaries, and the absence of anomalous ASCII characters in the dataset were also double checked.

Sampling protocols

Fish: Fish fauna was sampled using both standard nets (Pokorny-Site, Czech Republic) and electrofishing. Pelagic nets were 27.5 m long and 6 m high and were formed by 9 panels with mesh-sizes with ranging from 8 to 55 mm. Benthic nets were 30 m long, 1.5 m high and were formed by 12 panels with mesh-sizes with ranging from 5.5 to 55 mm. Nets were set at 7 p.m. and raised at 7.30 a.m. Electrofishing was performed from a boat using “Point Abundance Sampling Electrofishing” (PASE), i.e. sampling along the shore, at a maximum water depth of 1.5 m, during daylight with a 15 s sampling period.

Macroinvertebrates: Sampling was carried out in the form of a stratified sampling, working on transects with sampling sites arranged to give equal coverage of the different habitats and different depths. Each sampling site was located along transects connecting the shoreline to the maximum depth of the water body, covering three main depth

areas (littoral, sublittoral and profundal). Each sample consisted of 3 grab replicates per site of a total of 9 replicates per each transect. Sampling was performed using a grab with an area of 0.0225 m² of lake bottom. The collected samples are washed through a 250 µm mesh size sieving net to eliminate the sediment finest fractions, then preserved with formalin (5%) in plastic bottles. The sample treatment in the lab included sorting the whole sample under a stereomicroscope and subdivision of the organisms into main taxonomic groups.

Macrophytes: Percentage of coverage was obtained by visual inspection from the four corners of a boat along a transect from the shore to the maximal deep where macrophytes were still visible.

Phytoplankton: Phytoplankton samples were taken from mid-lake stations, as integrated samples of euphotic water column. Phytoplankton organisms were counted using the Utermöhl technique (Utermöhl, 1958) classifying the taxa at species level, where possible. For biovolume, linear dimensions of at least 30 cells per species was measured in each sample to calculate cell volume according to the norm CEN 15204 (European Committee for Standardization, 2006). Then, each taxon was associated to a geometric shape following Hillebrand *et al.* (1999), and Sun and Liu (2003). Total biovolume was calculated from the sum of the biovolumes of each taxon in the sample (cell number x specific cell volume).

Taxonomic coverage

General description: The dataset covers four lentic assemblages: fish fauna, macroinvertebrates, macrophytes and phytoplankton for a total of 455 taxa.

Fish fauna only includes Actinopterygii (35 species). Specimen originally classified as *Esox lucius* Linnaeus, 1758, were assigned to *Esox sp.* because of the later description in the study area of *Esox cisalpinus* Bianco & Delmastro, 2011 (Bianco & Delmastro, 2011).

Macroinvertebrates include Annelida Clitellata (39 taxa) and Arthropoda Insecta (85 taxa) with Mollusca Gastropoda (5 taxa) and Mollusca Bivalvia, Platyhelminthes Tricladida and Arthropoda Arachnida (1 taxon each).

Macrophytes include Tracheophyta (17 species) and benthic Charophyta (1 species).

Phytoplankton includes 270 taxa: Cyanobacteria (51 taxa), Plantae (planktonic Charophyta, 24 taxa, and Chlorophyta, 94 taxa), Protozoa Choanozoa (Euglenozoa, 7 taxa, and Choanozoa, 1 taxa) and Chromista (Bacillariophyta, 39 taxa, Cryptista, 13 taxa, Haptophyta, 2 taxa, Katablepharidophyta, 2 taxa, Miozoa, 13 taxa, and Ochrophyta, 24 taxa).

Taxonomic ranks: Data are generally reported as species, but occurrences reported at genus and higher rank level are also included in the dataset.

Taxonomic methods: All original names reported during the

project are included and reported in the column “original-Name”. All scientific names are updated to the currently accepted nomenclature, using both Algaebase (Guiry and Guiry, 2022) and the taxonomic backbone of GBIF.

Taxon specialists: Martina Austoni (phytoplankton), Angela Boggero (macrobenthos), Antonella Lugliè (phytoplankton), Alessandro Oggioni (macrophyte), Bachisio M. Padedda (phytoplankton), Pietro Volta (fish fauna), Silvia Zaupa (macrobenthos).

Quality control for taxonomic data: Nomenclature validation and cleaning were based on the global algal database AlgaeBase (Guiry and Guiry, 2022) and on the taxonomic backbone of GBIF.

Data availability

All georeferenced occurrence data are available at GBIF: DOI 10.15468/gcqhshj.

ACKNOWLEDGEMENTS

We acknowledge the inspiration that the GBIF and the Journal of Limnology initiative for datasets in freshwater biodiversity gave us to finalise the dataset. Thanks to all colleagues who helped in the field work and to GBIF staff (Dr. Marie Grosjean) for facilitating the uploading of data. Andrea Cardini was pivotal during the initial discussions on the study. The authors acknowledge the support of the European Union, project LIFE INHABIT (*Idromorfologia locale, habitat e Piani di Gestione: nuove misure per migliorare la qualità ecologica in fiumi e laghi sud europei*, LIFE08 ENV/IT/000413). Authors A.M. and L.K., acknowledge the support of NBFC to Consiglio Nazionale delle Ricerche; A.L. and B.M.P. acknowledge the support of NBFC to University of Sassari, funded by the Italian Ministry of University and Research, PNRR,

Missione 4, Componente 2, "Dalla ricerca all'impresa", Investimento 1.4 Project CN00000033). We remember with deep affection, esteem and gratitude the figure of Dr. Giuseppe Morabito, who dedicated all his professional and human commitment to phytoplankton ecology.

REFERENCES

- Bianco PG, Delmastro GB, 2011. [Recenti novità tassonomiche riguardanti i pesci d'acqua dolce autoctoni in Italia e descrizione di una nuova specie di luccio]. *Researches on Wildlife Conservation*. IGF Publishing 2:1-13.
- European Committee for Standardization. CEN 15204:2006. Water quality - Guidance standard on the enumeration of phytoplankton using inverted microscopy (Utermöhl technique). Available from: <https://www.en-standard.eu/bs-en-15204-2006-water-quality-guidance-standard-on-the-enumeration-of-phytoplankton-using-inverted-microscopy-utermohl-technique/>
- European Environmental Agency, 2017. Biogeographical regions in Europe. European Topic Centre on Biological Diversity (ETC/BD). Permalink: 3431629fe50049a7b995d125aad9c71d. Available from: <https://www.eea.europa.eu/data-and-maps/figures/biogeographical-regions-in-europe-2>
- Guiry MD, Guiry GM, 2022. AlgaeBase. Accessed on: 1 December 2022. National University of Ireland, Galway. Available from: <https://www.algaebase.org>
- Hillebrand H, Dürsele, CD, Kirschtel D, Pollinger U, Zohary T, 1999. Biovolume calculation for pelagic and benthic microalgae. *J. Phycol.* 35:403–424.
- Sun J, Liu DY, 2003. Geometric models for calculating cell biovolume and surface area for phytoplankton. *J. Plankton Res.* 25:1331–1346.
- Utermöhl H, 1958. [Zur Vervollkommung der quantitative Phytoplankton-Methodik]. *Mitt. Int. Ver. Limnol.* 9:1-38.
- Wieczorek J, Bloom D, Guralnick R, Blum S, Döring M, Giovanni R, Robertson T, Vieglais D, 2012. Darwin Core: an evolving community-developed biodiversity data standard. *PLoS One* 7:e29715.