Fish occurrence in the middle Volga and upper Don regions (Russia)

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Abstract

Background

In ichthyological publications from both Russia as a whole, and from the study region, lack of data indicating the actual results of observations in a specific place all result in publication of a generalised analysis. Although our publications contain such data, they are, however, not convenient for users performing global analysis. The main purpose of publishing a database is to make our data available in the global biodiversity system to a wide range of users. Dataset represents a significant addition to the distribution of species in this area. The data can be used to analyse future changes in ichthyofauna, as well as to help the authorities to manage their territory more efficiently.

This publication describes a dataset that contains information on fish encounters in the Upper Don basin and the middle Volga (centre of the European part of Russia) over a 30-year period (1990-2020). The dataset contains information on 6400 occurrences of 394341

specimens of 56 species, 99.9% of specimens being identified to the species level. A total of 883 sites were studied, of which 253 were in lentic biotopes (lakes - 121, ponds - 123, backwater - 5, reservoir - 3, pit - 1), 630 were in lotic (rivers - 628, stream - 1, channel - 1). One collecting site has an average of 7.2 species (from 1-21 species per location). Only those species that form self-reproducing populations are given. The dataset is a compilation of data from several working author groups. All observations have precise geo-referencing with the names of water bodies (rivers, lakes etc.).

New information

All presented data are published in the form of a database for the first time. Some data form the basis of previously-published works (3998 observations, 62%) and some are published for the first time (2402 observations, 38%). A large amount of data comes from small water bodies that have been neglected by previous researchers.

Keywords

Cephalaspidomorphi, Actinopterygii, database, Volga river, Don river

Introduction

In recent years, the ichthyofauna of the rivers and reservoirs of many regions has changed significantly. This is due to a decrease in precipitation, the destruction of small river beds, the regulation of the flow of medium and large rivers, eutrophication, toxicity and thermification of water bodies and streams, water abstraction, peat extraction and light pollution (Ruban and Khodorevskaya 2011, Brüning et al. 2015, Boznak et al. 2019, Jimenez-Ojeda et al. 2019, Ling et al. 2017, Sowińska-Świerkosz and Kolejko 2019). All these processes lead to a reduction in diversity of indigenous species, disruptions in structure and functioning of freshwater ecosystems, communities and populations of fish species, to degradation and simplification of biota and to a reduction in number of optimal habitats (Brosse et al. 2011German 2019, Busarova et al. 2019). Alien species which, in some cases, have a significant impact on ichthyofauna of a particular reservoir and the region as a whole, are very important (Kirilenko and Shemonaev 2017, Brandner et al. 2018, Čolić et al. 2018, Ruchin et al. 2019). In the studied region, appearance of *Carassius gibelio, Rhynchocypris percnurus* or *Perccottus glenii* in an isolated reservoir led to the almost complete disappearance of previously-existing species (*Leucaspius delineatus*, *Carassius carassius*, *Misgurnus fossilis*, *Rutilus rutilus*) (Artaev and Ruchin 2017, Ruchin et al. 2016). In many administrative regions of Russia, due to various reasons associated with the negative state of the country's economy with the ensuing consequences, an inventory of the ichthyofauna has not been carried out since the 1990s. Our studies have shown that the distribution and abundance of many species differs significantly from the data of the last century (Ruchin et al. 2007, Ruchin et al. 2008, Ruchin et al. 2009, Artaev and Ruchin 2016, Ivanchev et al. 2013b, Sarycheva et al. 2014, Ivancheva et al. 2014).

The studied region is located at the centre of the European part of Russia, is densely populated and located in the immediate vicinity of Moscow, the administrative centre of Russia. Studies on the regional ichthyofauna have been carrying out quite intensively since the 1920s. We conducted a detailed analysis and generalisation of them in previous works (Artaev and Ruchin 2017, Ivanchev and Ivancheva 2010, Ivanchev et al. 2013a, Ruchin et al. 2016).

At the present stage of research, the main difference in this project is the study of a large number of different water bodies, including the smallest ones that were not represented in earlier studies, with detailed indication of species, habitats and dates. Previous efforts have usually presented only analyses and made certain conclusions on water bodies (Dushin 1967, Fedorov 1962, Fedorov 1970).

Information from this dataset is the basis of a number of published monographs and articles (Artaev and Ruchin 2017, Ivanchev and Ivancheva 2010, Ivanchev et al. 2013a, Ruchin et al. 2016). It contains a compilation of data from several research groups (Fig. 1).
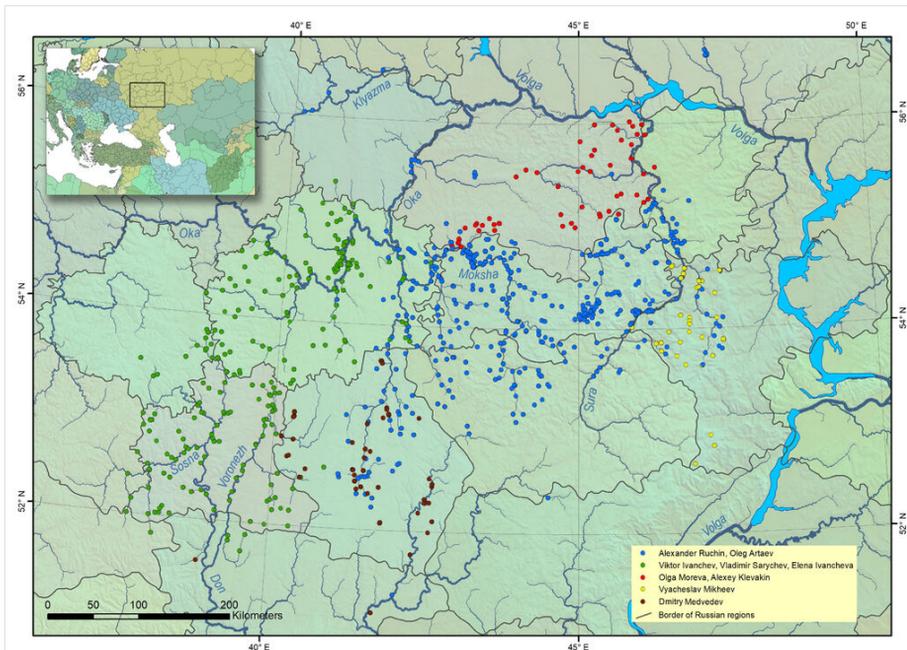

Figure 1. doi
Collecting sites in the middle Volga and upper Don regions, explored by various working groups. Map was created in ArcGIS 10.8 software (www.esri.com).

Project description

Title: Fish occurrence in middle Volga and upper Don regions (Russia)

Sampling methods

Study extent: The dataset contains information on 6400 occurrences (one species in a definite place at a definite time) of 394290 specimens encompasing 56 species made over the past 30 years (1990-2020). The study area is about 280000 km^2.

Sampling description: Fish were caught by various types of fishing gear (fry drag, seine nets, frame nets, gillnets with different mesh sizes, float and bottom fishing rods, spinning). The surveyed stream reaches were 200-500 m long and 3-10 m wide. The determination took place directly at the place of capture or fish were fixed in a 10% formalin and the determination was carried out in a laboratories (Mordovia State Nature Reserve, Oka Nature Reserve, Galichya Gora Nature Reserve and Nizhny Novgoros branch of the State Research Institute on Lake and River Fisheries). About 2-3% speciments was stored in the collection of the Mordovia State Nature Reserve.

Quality control: Each observation contained fundamental information, such as location (coordinates), date, name of water bodies, name of observer and name of identifier. A large part of the coordinates was determined directly on site with the help of a GPS device. In other cases, Google Maps (2020) were used. The names of water bodies were given from topographic maps (Anonymous 2020) or determined according to local residents. Species were determined by Reshetnikov (2010), Reshetnikov et al. (2003) and Kottelat and Freyhof 2007), considering recent taxonomic compilations proposed by Fricke et al. 2020.

Geographic coverage

Description: The dataset contains data on fish occurrences within the territory of 15 Russian regions: the Republic of Mordovia, the Chuvash Republic, the Republic of Mari-El, Vladimir, Ryazan, Tula, Tambov, Penza, Ulyanovsk, Oryol, Voronezh, Kursk, Saratov, Ulyanovsk and Nizhny Novgorod Regions. The main observations are concentrated in the Don basin above Voronezh, in the middle reaches of the Oka basin, the Moksha basin and the middle and lower reaches of the Sura river (Fig. 1).

The study area is located on the East European Plain. In the east, there is Volga Upland with maximum heights of up to 350 m above sea level and in the West, there is Central Russian Upland (up to 300 m above sea level). Between, there is the Oksko-Don Plain (up to 180 m above sea level). Minimum heights of the study area are the Don in Voronezh (90 m) and the Volga in Nizhny Novgorod (70 m). The territory is located in the temperate climate zone. The total duration of the period with average daily air temperature below feezing point is 140-150 days per year. The study area is divided into two different basins - the Black Sea basin (Don River watershed) and the basin of the inland Caspian Sea (Volga River watershed). All rivers of the region are typically lowland and belong to the East European type. Its main characteristic is seasonal flow, such as distinct spring floods, relatively low summer and winter water levels, as well as increased run-off in autumn. In summer, sometimes the water level rises as a result of heavy rain. The rivers have a mixed supply, snowmelt, which accounts for most of the annual run-off, as well as from

precipitation and groundwater. The vast majority of the lakes are oxbows. Most of them are located in the Oka-Don lowland. In the north (mainly in the Nizhny Novgorod Region in the Piana and Tesha watershed), there is a small number of karst lakes. There are also a small number of aeolian and suffosion lakes. Ponds were formed on many rivers after the construction of dams (Kuznetsov 1974, Okorokov et al. 2003, Savrasova 1998, Yamashkin 1998, Krivtsov 2008).

Coordinates: 51.89 and 57.421 Latitude; 37.441 and 48.999 Longitude.

Taxonomic coverage

Description: Taxonomic diversity of the study area is represented by 56 species (55 ray-finned fishes and one lamprey species) belonging to 16 families of nine orders. Given the scale of focused research on fauna, this is an almost exhaustive list of species that form natural self-reproducing populations.

Temporal coverage

Notes: May 1990 through to May 2020

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Data resources

Data package title: Fish occurrence in middle Volga and upper Don regions (Russia)

Resource link: https://www.gbif.org/dataset/e79ec95a-a90f-4f99-819c-8e4ec58e6bd3

Alternative identifiers: https://doi.org/10.15468/ru9p9j

Number of data sets: 1

Data set name: Fish occurrence in middle Volga and upper Don regions (Russia)

Data format: Darwin Core

Description: Published and unpublished author's data on fish occurrence in middle Volga and upper Don regions (Russia)

Column label	Column description
occurrenceID	The Globally Unique Identifier number for the recored
basisOfRecord	The specific nature of the data record: HumanObservation
eventDate	date format as YYYY-MM-DD
year	Year of the event was recorded
month	The month of the event was recorded
day	The integer day of the month on which the Event occurred
scientificName	The full scientific name including the genus name and the lowest level of taxonomic rank with the authority
kingdom	The full scientific name of the kingdom in which the taxon is classified
decimalLatitude	The geographic latitude of location in decimal degrees
decimalLongitude	The geographic longitude of location in decimal degrees
geodeticDatum	The geodetic datum for coordinates: WGS84
country	The name of the country (Russia)
identifiedBy	A list of names of people, who assigned the Taxon to the subject
recordedBy	A person or group responsible for recording the original Occurrence
associatedReferences	Bibliographic reference of literature associated with the Occurrence
waterBody	The name of the water body in which the Location occurs

Additional information

This dataset provides reliable records that contribute to increasing knowledge on the distribution of fish species on middle Volga and upper Don regions. The dataset contains information on 6400 occurrences of 56 species that form self-reproducing populations (Artaev et al. 2020, Table 1).

Table 1.

Taxonomic composition of the dataset, number of observations and individuals. Taxonomy follows Fricke et al. (2020).

Taxa	Number of observations	Number of speciments
Cephalaspidomorphi		
Petromyzontiformes		
Petromyzontidae		

Taxa	Number of observations	Number of speciments
Eudontomyzon mariae (Berg, 1931)	18	23
Actinopterygii		
Acipenseriformes		
Acipenseridae		
Acipenser ruthenus Linnaeus, 1758	12	32
Cypriniformes		
Acheilognathidae		
Rhodeus amarus (Bloch, 1782)	248	47860
Cobitidae		
Cobitis melanoleuca Nichols, 1925	95	531
Cobitis sp.	11	92
Cobitis taenia Linnaeus, 1758	205	1262
Cobitis tanaitica Băcescu & Mayer, 1969	2	3
Misgurnus fossilis (Linnaeus, 1758)	37	232
Sabanejewia aurata (De Filippi, 1863)	3	17
Sabanejewia baltica Witkowski, 1994	22	216
Cyprinidae		
Carassius carassius (Linnaeus, 1758)	57	917
Carassius gibelio (Bloch, 1782)	202	4771
Cyprinus carpio Linnaeus, 1758	36	2628
Gobionidae		
Gobio brevicirris Fowler, 1976	102	7804
Gobio volgensis Vasil'eva, Mendel, Vasil'ev, Lusk & Lusková, 2008	307	10066
Pseudorasbora parva (Temminck & Schlegel 1846)	13	193
Romanogobio albipinnatus (Lukasch, 1933)	102	8904
Leuciscidae		
Abramis ballerus (Linnaeus, 1758)	23	2372
Abramis brama (Linnaeus, 1758)	164	19154
Alburnoides rossicus Berg, 1924	94	3035

Taxa	Number of observations	Number of speciments
Alburnus alburnus (Linnaeus, 1758)	446	50049
Alburnus chalcoides (Güldenstädt 1772)	1	1
Ballerus sapa (Pallas, 1814)	27	129
Blicca bjoerkna (Linnaeus, 1758)	193	21905
Chondrostoma variabile Yakovlev, 1870	48	2581
Leucaspius delineatus (Heckel, 1843)	296	29988
Leuciscus aspius (Linnaeus, 1758)	84	522
Leuciscus danilewskii (Kessler 1877)	20	494
Leuciscus idus (Linnaeus, 1758)	175	1348
Leuciscus leuciscus (Linnaeus, 1758)	331	20571
Leuciscus sp.	5	214
Pelecus cultratus (Linnaeus, 1758)	12	79
Phoxinus phoxinus (Linnaeus, 1758)	82	21391
Rhynchocypris percnurus (Pallas, 1814)	39	3744
Rutilus frisii (Nordmann, 1840)	6	1225
Rutilus rutilus (Linnaeus, 1758)	580	69016
Scardinius erythrophthalmus (Linnaeus, 1758)	158	7194
Squalius cephalus (Linnaeus, 1758)	315	10655
Vimba vimba (Linnaeus 1758)	34	1334
Nemacheilidae		
Barbatula barbatula (Linnaeus, 1758)	298	3494
Tincidae		
Tinca tinca (Linnaeus, 1758)	48	202
Esociformes		
Esocidae		
Esox lucius Linnaeus 1758	424	4486
Gadiformes		
Lotidae		
Lota lota (Linnaeus, 1758)	78	183
Perciformes		

Taxa	Number of observations	Number of speciments
Gobiidae		
Benthophilus stellatus (Sauvage 1874)	2	15
Neogobius fluviatilis (Pallas, 1814)	48	862
Neogobius melanostomus (Pallas, 1814)	7	110
Proterorhinus marmoratus (Pallas 1814)	36	826
Odontobutidae		
Perccottus glenii Dybowski, 1877	175	8683
Percidae		
Gymnocephalus acerina (Gmelin, 1789)	4	336
Gymnocephalus cernua (Linnaeus, 1758)	171	5685
Perca fluviatilis Linnaeus, 1758	449	16634
Sander lucioperca (Linnaeus, 1758)	29	217
Sander volgensis (Gmelin, 1789)	1	1
Salmoniformes		
Salmonidae		
Salmo trutta Linnaeus, 1758	1	1
Scorpaeniformes		
Cottidae		
Cottus koshewnikowi Gratzianov, 1907	6	24
Siluriformes		
Siluridae		
Silurus glanis Linnaeus, 1758	18	30

Author contributions

All authors contributed equally to the data collection. The first author wrote the manuscript with the contribution of all authors.

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