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An overview of recruitment patterns of roach *Rutilus rutilus* (L.) between 1969 and 2001 in the rivers of England and their influence on population abundance

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Abstract

Annual roach recruitment success was variable in the rivers of England between 1969 and 2001. Spatial and temporal patterns revealed common phases of weak and strong recruitment. Strong recruitment periods were 1975/77, 1983/85, 1989/90 and 1995/96.

The recruitment mechanism appeared to be climate driven, with temperature and discharge the major variables in determining the recruitment strength of a cohort. The key phase appeared to be during the first year of life of the cohort and in particular during critical periods in their growth year when susceptibility to displacement by increased discharge was determined by their actual body length.

The recruitment pattern produced a similar numerical population abundance trend, with increased abundance following the successful recruitment of a strong year class. This was in contrast to biomass, which was relatively stable.

Key words: Roach, recruitment, year class, year class strengths

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Assessment of anthropogenic influences on littoral-zone aquatic communities of Lake Texoma, Oklahoma-Texas, USA

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Abstract

From 1999-2001, we evaluated the effects of anthropogenic activities in and around Lake Texoma, Oklahoma-Texas, on the structure of littoral-zone fish and benthic invertebrate assemblages at 20 potentially impacted sites relative to paired reference sites. Spatial structuring of both assemblages was strongly related to variables associated with water clarity, water-column chlorophyll-*a* levels, and degree of site exposure to wind and waves. Fish assemblages at reference sites and impact sites exhibited minor differences, but none that were considered indicative of severe anthropogenic stress. Conversely, benthic invertebrates exhibited greater differences between reference and impact sites. Procrustean analyses and Mantel tests indicated little concordance between reference site and impact site benthic invertebrate assemblages. Greater abundances of oligochaetes at impact sites and greater abundances of chironomids at reference sites contributed most to these differences, with the largest assemblage differences found at sites influenced by agriculture and sanitary dumps. Despite the fact that fishes and benthic invertebrates were structured along similar environmental gradients, little concordance was observed between assemblages. Wide annual fluctuations in the dominant taxa of each assemblage contributed most to the general discordance. Furthermore, discordant fish and invertebrate assemblages likely resulted because responses of each assemblage to anthropogenic impacts occurred at different scales of space and time.

Key words: reservoirs, fishes, benthic macroinvertebrates, multitaxon assessment, assemblage structure, environmental impact, Procrustean analysis, Mantel test

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Artificial wetlands – yes or no?

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Abstract

Fluvial activity of streams is a significant factor maintaining high aquatic habitat diversity in flood plains. In the Czech Republic, river regulation, flood control and controlled discharges disrupted the original connections between rivers and alluvial wetlands. The dynamic system between river and flood plain was destroyed and fish diversity decreased. Decisions are required regarding retention of flood plain biodiversity at its present low level, with possible local extinctions, or supporting species to recolonise restored habitats. A solution is necessary that will enable wetlands to be restored while keeping flood controls in place. Artificial wetlands appear to be an achievable measure. Various types of wetlands can be made, such as pools, small lakes or channels. Along the regulated rivers there are pits used for gaining material for flood control works, which can be easily used to support biodiversity as well.

For our research we chose fish as a significant bioindicator of the quality of artificial wetlands. We focused on three different artificial lakes located in the Morava River catchment. In the studied wetlands, the species richness varied from 9 to 16 fish species including some rare ones, such as *Leucaspius delineatus* (Heckel 1843), *Rhodeus sericeus* (Pallas 1776) or *Gymnocephalus cernuus* (L.). In two of the wetlands we found abundant populations of *Abramis ballerus* (L.), which is considered to be an indicator of good quality of the artificial wetland.

Key words: flood plain, artificial wetlands, fish communities, biodiversity

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Impact of impoundment (1985-2000) on fish assemblages in a large lowland river

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Abstract

Fish samples collected from the Warta River between 1985 and 2000, pre- and post-impoundment, were examined to determine the impacts of impoundment on fish assemblages. Samples were collected by quantitative electrofishing during spring and autumn at three sites. One site was upstream of a reservoir and the other two sites in the tailwater. Principal Component Analysis detected a range of shifts in multivariate space for fish assemblages from pre- through post-impoundment periods. Fish assemblages in the tailwater were affected by species undergoing population explosions in the reservoir and drifting downstream. Changes in fish assemblages also appeared to be caused by erosion protection practices, pulsed releases of water after installation of the hydroelectric plant and improvements in water quality at both sites. At the upstream site, changes in fish assemblages were of lesser magnitude, except where the site was denuded of bankside vegetation. Canonical Correspondence Analysis was used to determine how gradients of water chemistry parameters were associated with assemblages at the sites. Water chemistry parameters associated with fish assemblages at the downstream sites were pH, dissolved oxygen (DO), suspended matter (first axis) and NH_4 (second axis). At the upstream site, NH_4 and pH (first axis), DO (second axis), and BOD (third axis) were significantly correlated with axes. However, arrow lengths, which reflect the direction and strength of species-environment correlations, were small (about 0.5 s.d.). Percent variance explained by three axes was low (33%), which indicates that fish assemblages may have been influenced by other variables besides water chemistry, i.e. the impact of the dam.

Key words: impoundment, impact, upstream, tailwater, fish assemblages, gradient analysis, PCA, CCA.

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Patterns of fish assemblages in tropical streamlets using SOM algorithm and conventional statistical methods

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Abstract

Six sites located on the Caracu River and five sites located on the Água do Rancho River (small tributaries of the Paraná River, Brazil) were chosen for quantitative electrofishing sampling to examine patterns in fish assemblage structure using the dualism ordination technique developed by Romaniszyn. Canonical correspondence analysis was also used for verification of the data. A similar separation of sites from both streams by both methods confirmed the Romaniszyn method (RD) was useful for the study of ordination. The RD was also tested using Self-Organizing Maps (SOM), which are a variant of the Artificial Neural Network (ANN) methods. Similarly, the SOM confirmed that sites belonging to the two investigated streams were distinct, but also unveiled a minor weakness of the RD resulting from its linear character. However, in spite of this weakness, we recommend the RD for assemblage analysis by scientists unfamiliar with canonical correspondence and ANN analyses.

Key words: Paraná River, tropical fish population, assemblage structure, Self-Organizing Map, canonical correspondence analysis, Romaniszyn diagram

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Decline in migratory fish in the Warta River, Poland

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Abstract

In the upper course of the 808 km long Warta River (a tributary of the Odra River), changes in population parameters (stability of occurrence, numbers and biomass) of diadromous European eel *Anguilla anguilla* (L.) and vimb *Vimba vimba* (L.), and potamodromous nase *Chondrostoma nasus* (L.) and barbel *Barbus barbus* (L.) were studied over the period 1963-98. In the 1960s, all four species formed abundant populations in the Warta, but now are caught sporadically or not at all. The reason for the drastic declines recorded is the marked decrease in water quality observed from the 1960s to the 1980s, and the dam of the Jeziorsko reservoir constructed in 1986 without fish passes. The impoundment caused further elimination of migratory fish in the 1990s even though water quality had improved. Unless effective fish ladders are finally constructed and the water quality is good, the studied species will share the fate of migratory sturgeon and Atlantic salmon, whose natural populations have already died out in Polish waters.

Key words: European eel, vimb, nase, barbel, impoundment, water pollution

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Brown trout migration and flow variability

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Abstract

Flows and numbers of brown trout in a fish ladder were observed from April 1997 to March 1998 in order to examine the assumption that flow and its variance affect both spawning and non-spawning migrations, but in different ways. The ladder was situated in the Ohře River (Central Europe), and the studied stretch had a channelised riverbed, without backwaters, and a regulated discharge regime. For spawning migrations, brown trout preferred low and stable flows. In contrast, high variance in flow appeared to be associated with occurrence of non-spawners in the ladder. Non-spawners formed the higher proportion of brown trout captured overall and occurred mainly in winter, whilst the number of brown trout during the period of spawning migrations in autumn was significantly lower. High flow variability, low water temperatures (2 – 3°C) and insufficient availability of winter cover induced migrations of brown trout during winter.

Key words: brown trout, spawners, non-spawners, fish ladder, regulated and channelised river

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Changes of ploidy and sexuality status of "*Carassius auratus*" populations in the drainage area of the River Dyje (Czech Republic)

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Abstract

Initial populations of *Carassius auratus*, a non-native species that has been increasingly colonising the waters of the Czech Republic since 1976, were unisexual, consisting of triploid females only. They reproduced through gynogeny, utilising males of various cyprinid species. The first males of *C. auratus* in the River Dyje drainage area were observed after 1990. At present, the representation of males in population samples mostly does not exceed 10% and they appear to be absent from certain age groups. Most of the females are triploid, a minor proportion is diploid, and tetraploid individuals occur occasionally. The males are mostly diploid or, rarely, triploid. This species has produced stable populations and has become the dominant fish species in suitable habitats.

Key words: *Carassius auratus*, silver crucian carp, goldfish, ploidy status, sex ratio

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Impact of extreme floods on fishes in rivers and their floodplains

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Abstract

Data are presented on the effects of extreme floods on the fish biota in the floodplain at the confluence of the rivers Morava and Dyje (July to August 1997) and in the floodplain of the Lužnice River (August to December 2002), Czech Republic.

In the area of confluence of the rivers Morava and Dyje, the form of the flood was distinctly affected by the channelisation of the two rivers as well as by the erection of levees. During the floods, we observed active lateral as well as upstream migrations of fish, particularly of *Aspius aspius, Leuciscus idus, Alburnus alburnus, Abramis ballerus* and *Carassius auratus*, and downstream migrations of fish washed out of fishponds. During the flood, mass spawning occurred of fish species showing portional or delayed spawning, such as *C. auratus, Tinca tinca* and *Cyprinus carpio*. In connection with shifts of bottom sediments, we could observe downstream movements of *Cobitis elongatoides* and *Barbatula barbatula*. In the last phase of the flood, the waters retreating from the floodplain contained very low concentrations of dissolved oxygen. In a number of localities, this resulted in fish mortality.

The investigated reach of the Lužnice River, lying in its upper half, is one without any levees. After the floods, a tenfold increase in abundance and fivefold increase in biomass were observed in the fish populations inhabiting the localities under study. This was mainly due to *Rutilus rutilus, Phoxinus phoxinus* and *Gobio gobio*. *Lampetra planeri* and *B. barbatula* occurred there as a result of downstream drift from the headwaters. No negative effects of the extreme floods were observed in the upper reach of the Lužnice River.

Key words: floods, impact on fishes, migration, mortality, abundance, biomass

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Growth of barbel, *Barbus barbus* (L.) in the upper Warta River, Odra River system

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Abstract

The history of the decline in barbel abundance and distribution in the Warta River system is described. This fish, formerly widely distributed in the Warta and its larger tributaries, is nowadays confined mainly to the upper Warta, where it is still relatively abundant, although not common in the fish community. The human alterations of the riverine environment, i.e. habitat modification, pollution and over-exploitation are recognised as the main causes of the decrease in barbel distribution. To assess the condition of the populations, growth of barbel in the upper Warta was studied and compared with data available for other Polish rivers. Among 59 specimens representing 7 age classes (from3+ to 9+), fish of 6+ were dominant. The maximum observed standard length was 58.4 cm (fish at age 9+). The asymptotic length (L_{inf}), as well as the relative growth indices had the second highest values noted in Poland. The average Fulton's condition was not high (FC = 0.844 ± 0.078) and did not vary between age classes. The results suggest that the upper Warta still has suitable habitats for barbel. This population should be protected as a source stock for barbel recolonisation in other parts of the Warta and its tributaries.

Key words: barbel, conservation, growth, condition, weight-length relationship, von Bertalanffy model

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Changes in sterlet (*Acipenser ruthenus* L.) catch and length frequency distribution in the Serbian part of the Danube River during the twentieth century

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Abstract

Data from a sample of 262 sterlet (*Acipenser ruthenus* L.) specimens from the Serbian part of the Danube River were compared with data collected between 1948 and 1967. The recent sample was caught between September 2002 and May 2003 at three localities (km 1173, km 1162 and km 1123) using drag nets. According to pectoral fin spine section analysis, all the specimens were in their first, second and third years of life.

Comparison of the length-frequency distribution of these specimens with the data for the sterlet catch in the period 1948-1967 showed a recent shift towards lower length classes, as well as changes in the shape of the length-frequency distribution curve. The current sterlet catch is mainly based on individuals in their first and second year, while fish from the second, third and fourth years of life were dominant in the past.

Sterlet catches in the lower part of the Danube River (area of Iron Gate I and II) showed maxima of 23 615 kg and 17 960 kg in 1969 and 1984. These maxima were probably connected with dam construction. Total catch and the catch in the lower part of the Danube River showed significant decreases after 1990.

The study indicates unfavourable conditions for sterlet populations in the Serbian part of the Danube River in the second half of the twentieth century. Unfavourable factors include habitat destruction, over-fishing and capture of sexually immature specimens.

A better understanding of sterlet migration and behaviour is necessary for more efficient future protection of this valuable species.

Key words: sterlet, age determination, length frequency analysis, decrease in catch, Danube River

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Alien fish species in the floodplains of the Dyje and the Bodrog rivers

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Abstract

Parts of the Dyje River (Czech Republic) and the Bodrog River (Slovakia), although considerably distant from each other, show very similar species richness of ichthyofauna.

The native ichthyofauna of the lower section of the Dyje River (26.7 km) consists of 38 resident species and occasional ones that have drifted downstream from the headwaters. Of six alien species, only *Carassius auratus* and *Pseudorasbora parva* have become fully acclimated and produce stable populations. Depending upon stocking, *Ctenopharyngodon idella, Hypophthalmichthys nobilis, H. molitrix* and *Anguilla anguilla* occur infrequently. The native, characteristic floodplain species (*Carassius carassius, Tinca tinca,* etc.) are negatively affected by the exotic *C. auratus* in habitats in which it produces very abundant populations.

The native ichthyofauna of the upper part of the Bodrog River (15 km) consists of 40 indigenous species. Occasionally, species that are typical of the headwater sections may drift downstream to this reach. Of the 10 alien species occurring in the Bodrog River, *C. auratus, P. parva, Ameiurus nebulosus, A. melas, Lepomis gibbosus* and *Perccottus glenii* produce stable and permanent populations. The occurrences of *C. idella, H. molitrix, H. nobilis* and *A. anguilla* depend upon stocking. All the exotic species that have produced self-sustaining populations exert a depressive impact on the indigenous species. Of the latter, *Carassius carassius, Leucaspius delineatus, Rhodeus amarus* and the rare endemic *Umbra krameri* are particularly endangered.

Key words: exotic species, suppression of indigenous species,

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Age and growth of European bitterling (*Rhodeus sericeus)* in the Wieprz-Krzna Canal, Poland

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Abstract

The age and growth of bitterling, a small Eurasian cyprinid, were studied in the Wieprz-Krzna Canal, a poorly structured irrigation canal located in eastern Poland. Its population was represented by five age groups (0+ to 4+). Scale annuli were clearly visible and often displayed as irregularities in circuli in the centrolateral part of the scales. The number of annuli detected on scales corresponded to the number of bands seen in the opercular bone; however, the first annulus was difficult to observe in reflected light. The Bhattacharya method followed by modal class progression analysis was useful to validate age. Several normal components were clearly necessary to explain the length-frequency distribution and the most likely solution consisted of 5 age groups with separation index values greater than 2. A comparison of observed and back-calculated lengths showed good agreement. There were no significant differences between mean back-calculated lengths of different sexes. The von Bertalanffy growth function was fitted to length-at-age data and displayed variation in growth rates between sexes. The asymptotic length estimates were suitable for females, for which maximum observed length was 74 mm (weight = 5.46 g) but clearly underestimated for males (for which maximum size was 75 mm and 5.73 g). There were no significant differences between sexes in the slope of the length-weight relationship and the common slope for both sexes (b_c = 3.64) was significantly greater than 3 indicating an allometric growth pattern of bitterling. A spline regression estimated a shift in the weight-length relationship at average maturity size.

Key words. Bitterling, age, growth, scale, weight-length relationship, von Bertalanffy model.

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Morphometric characteristics and growth of *Carassius auratus* in the lower part of the River Dyje (Czech Republic)

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Abstract

The silver crucian carp (*Carassius auratus* Linn.) is non-native to the waters of the Czech Republic. The first individuals of this species penetrated into the area of the confluence of the rivers Morava and Dyje after 1975. In the course of the subsequent 15 years, the species, aided by man, occupied all suitable habitats. *C. auratus* became fully acclimated and produced numerous stable populations, particularly in the lower reaches of the rivers Morava, Dyje, Labe and Odra, and in the aquatic habitats of the adjacent floodplains. Analyses of 60 females from the lower section of the Dyje have shown identity of meristic characters with those found in the initial invasive population, whereas certain differences have been found in plastic characters, the most distinct relating to body height (+3.27%). Growth in length is markedly affected by habitat character. *C. auratus* showed the fastest growth in fishponds and water reservoirs. Studies were made of male and female *C. auratus* showing different ploidy, coming from a natural population. Triploid females showed significantly higher growth rates in length (standard length) than did diploid ones. Similar tendencies were observed in males. No difference was found between the growth in length of males and females showing the same ploidy.

Key words: silver crucian carp, meristic and morphometric parameters, ploidy status, growth