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GASTROPOD COMMUNITIES OF THE RESERVOIRS AND THE RIVERS OF THE CIECHANOWSKA UPLAND

Здійснено аналіз кількості видів щільності, домінантності, стабільності та спільності угруповань гастропод у водному середовищі Цехановського нагір'я (північно-східна частина Польщі), аналіз біорізноманітності угруповань молюсків і подібності серед них, дослідження на користь угруповань молюсків як чинника якості води. Чотири річки: Лидиня, Пельта, Сона, Вкра, 4 старих русла р.Вкра та 9 антропогенних водосховищ були досліджені. Зооценологічний аналіз угруповань молюсків завершив використання індексів домінантності та індексів біорізноманітності: індекс різноманітності Сімсона (D), індекс Івеннеса (L). 27 видів гастропод представлені в річках Цехановського нагір'я. Перша популяція *Ferrissia nautieri* (Mirilli) в Польщі була виявлена в глиняному кар'єрі. Гастроподи у текучій воді можуть бути біоіндикаторами рівня кисню у воді. Якщо рівень кисню у воді збільшується, буде зростати і кількість видів *Viviparus viviparus* (L) та *Radix peregra* можуть бути індикаторами антропогенного пресу.

Aims of research.

1. Analysis of the number of species, density, domination, constancy and commonness of the gastropod communities in the water environments of the Ciechanowska Upland.
2. Analysis biodiversity of the snail communities and similarity among them.
3. Research on the relationship among freshwater snail communities and the certain environmental factor.
4. Research on usefulness of snail communities as a factor of water quality.

The area of research.

The Ciechanowska Upland, one of 7 mezoregions of the Mazowiecka Lowland is located in the northeastern part of Poland. The area of the Ciechanowska Upland amounts to 2 570 km² and is agricultural mainly.

Materials and methods of research.

The research was done in the years 1991-1999. Four rivers: the Lydynia, the Pelta, the Sona, the Wkra, 4 old beds of the Wkra river and 9 anthropogenic reservoirs (clay-pits) were researched. A sampled area was marked out by placing a quadrat frame on the ground. The species of gastropods have been identified according to Gloer and Meier-Brook [5]. The density of the freshwater snails was estimated as a number of individuals per square meter (m²). Species of macrophytes were estimated, too. The mineralogy analysis, organic matter content in the bottom sediments and the physico-chemical factors of water as well as velocity current of running waters were carried out [7; 8]. The zoocenology analysis of snail communities was carried out using dominance, constancy, commonness indices [1;6] and biodiversity indices: Simpson Diversity Index (D), Shannon-Wiener Diversity Index (H'), Evenness Index (J) [2;9;10]. Correlations among gastropods density, number of species, organic matter content in bottom sediments and physico-chemical factors of water were calculated by means of non-parametric test the Spearman Rank Correlation Coefficient r_s . The analysis of of gastropod frequency in particular water environments in terms of bottom sediments and abundance of macrophytes was carried out by means of chi-squared association test (χ^2) [3;4]. The analysis of the similarity of gastropod communities is based on Cluster analysis.

Results.

Comparative analysis of the gastropod communities of the water environments.

27 gastropod species are presented in the rivers of the Ciechanowska Upland. The most numerous and common in the running waters is *Bithynia tentaculata* (L.). The numerous there are also *Radix peregra* (O.F. Mull.) and *Valvata piscinalis* (O.F. Mull.), which density in the Lydynia river scores from 1 to 362 individuals per square metre. In the Wkra river there are smallest number of species then in their tributaries: the Lydynia and the Sona rivers. 23 gastropod species are presented in the Lydynia river. The highest density of gastropods to 808 individuals per square metre is in the Lydynia river at the sandy and stony bottom. The lowest density of gastropods is recorded from the headwater of the Sona river at the stony or sandy and stony bottom. The highest fluctuation in density appeared two common species *Viviparus viviparus* (L.) and *Physafontinalis* (L.) recorded from the old bed of the Wkra river. Their density scores from 14 to 47 individuals per square metre and from 3 to 40 individuals per square metre. The density of gastropods is on a quite level in the old bed of the Wkra river and scores from 42 to 62 individuals per square metre and from 90 to 99 individuals per square metre. The first permanent population of *Ferrissia nautieri* (Mirilli) in Poland has been recorded from the clay-pit. There is only one site of this species at the area of the Ciechanowska Upland. Living specimens of *Ferrissia nautieri* (Mirilli) have been gathered from the submerged stems and leaves of *Typha latifolia* (L.). All of them are ancyloid forms. *Anisus vorticulus* (Trosch), *Physella acuta* (Drap.) and *Ferrissia nautieri* (Mirilli) are presented in the clay-pits, only. *Planorbis carinatus* O. F. Mull., typical of the lakes, has been found in the clay-pit, too, as well as in the Lydynia river. One of the species, *Valvata naticina* Menke, threatened by extinction in Poland, has been presented in water environments of the Ciechanowska Upland.

Analysis data.

The analysis of the Spearman Rank Correlation Coefficient r_s appears statistically highly significant in running waters (tab.1) and in the anthropogenic reservoirs (tab.2):

Tab.1.

The values of the the Spearman Rank Correlation Coefficient r_s

Pair of factors	Value of the Spearman Rank Correlation Coefficient r_s
Density of individuals and the number of species	0,65 p<0,001
Density of individuals and magnezium concentrate	0,44 p<0,05
Number of species and oxygen concentrate	0,45 p<0,05
Density of <i>Viviparus viviparus</i> (L.) and pH level	0,51 p<0,02
Density of <i>Viviparus viviparus</i> (L.) and BOD level	0,51 p<0,02
Density of <i>Viviparus viviparus</i> (L.) and chlorophyll a concentrate	0,56 p<0,01
Density of <i>Radix peregra</i> (O.F. Mull.) and conductivity of water	-0,54 p<0,01
Density of <i>Radix peregra</i> (O.F. Mull.) and calcium concentrate	-0,47 p<0,05
Density of <i>Radix peregra</i> (O..F. Milll.) and sulphates concentrate	-0,47 p<0,05

Tab.2.

The values of the the Spearman Rank Correlation Coefficient r ;

Pair of factors	Value of the Spearman Rank Correlation Coefficient r ;
Density of individuals and the number of species	0,83 p < 0,002
Density of individuals and alkalinity	0,75 p< 0,05
Density of individuals and chlorides	0,82 p< 0,02

The analysis of frequency of gastropods (x^2) in the clay-pits.

There are statistically highly significant positive (+) associations among certain gastropod species and macrophyte or type of bottom sediments ($x^2=53,47$, $p<0,01$) (tab.3).

Tab.3.

Species	Test (x^2) result.				
	Macrophyte,bottom	Sandy-clay	Phragmites Trin.ex Steud	Typha latifolia australis (Cav)	Glyceria (L.) maxima (Hartm.) Holmb.
<i>Bithynia tentaculata</i> (L.)	0	0	+		0
<i>Lymnaea stagnalis</i> (L.)	0	0	0	0	+
<i>Anisus vortex</i> (L.)	0	0	+	0	0
<i>Gyraulus albus</i> (O.F. Mull.)	+	0	0	0	0

Conclusions:

1. Gastropod communities are influenced by type of water environments, type of bottom sediments, certain physico-chemical factors of water and the abundance of macrophytes which are characteristic of eutrophic waters mainly.

2. *Bithynia tentaculata* (L.) is the most numerous, constant and common in running waters ($D=21,3\%$, $C=-69,6\%$, $O=69,5\%$), which density is the highest in the Sona river and scores from 2 to 355 individuals per square metre.

Viviparus viviparus (L.) is the most numerous in old beds of the Wkra river and in the Wkra river. *Lymnaea stagnalis* (L.) is the most numerous, constant and common in the anthropogenic reservoirs ($D=19,7\%$, $C=59,2\%$, $Q=38,5\%$).

3. One of the species, *Valvata naticina* Menke, threatened with extinction in Poland, is presented in water environments of the Ciechanowska Upland.

4. Gastropods in running waters can be biological indicators of oxygen level of water. If the level of oxygen increases, the number of species will increase. *Viviparus viviparus* (L.) and *Radix peregra* (O.F. Mull.) can be indicators of anthropopressure.

5. Certain factor values influence the development of population of gastropods, some of them inhibit their development.

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Lewin I. Сообщества Gastropoda в водохранилищах и реках Цехановского Нагорья.

Осуществлен анализ числа видов, плотности, доминантности, стабильности и общности сообществ гастропод в водной среде Цехановского Нагорья (северо-восточная часть Польши), анализ биоразнообразия сообществ моллюсков и схожести среди них, исследования полезности сообществ моллюсков как фактора качества воды. Четыре реки: Лыдыня, Пельта, Сона, Вкра, 4 старых русла р.Вкра и 9 антропогенных водохранилищ были исследованы. Зооценологический анализ сообществ моллюсков завершил использование индексов доминантности, стабильности, общности и индексов биоразнообразия: индекс разнообразия Симпсона (D), индекс разнообразия Шеннона-Винера (H'), индекс Ивеннеса (J'). 27 видов гастропод представлены в реках Цехановского Нагорья. Первая популяция Ferrissia nautieri (Mirilli) в Польше была обнаружена в глиняном карьере. Гастроподы в текущей воде могут быть биоиндикаторами уровня кислорода в воде. Если уровень кислорода в воде увеличивается, будет возрастать и количество видов Viviparus viviparus (L) и Radix peregra могут быть индикаторами антропогенного пресса.

Lewin Iga. Gastropod communities of the reservoirs and the rivers of the Ciechanowska Upland.

The aims of research were: analysis of the number of species, density, domination, constancy and commonness of the gastropod communities in the water environments of the Ciechanowska Upland (northeastern part of Poland), analysis of biodiversity of the snail communities and similarity among them, research on the relationship among freshwater snail communities and the certain environmental factor, research on usefulness of snail communities as a factor of water quality. Four rivers: the Lydynia, the Pelta, the Sona, the Wkra, 4 old beds of the Wkra river and 9 anthropogenic reservoirs (clay-pits) were researched. The zoocenology analysis of snail communities was carried out using dominance, constancy, commonness indices and biodiversity indices:

Simpson Diversity Index (D), Shannon-Wiener Diversity Index (H'), Evennes Index (J'). 27 gastropod species are presented in the rivers of the Ciechanowska Upland. The first permanent population of Ferrissia wautieri (Mirolli) in Poland has been recorded from the clay-pit. Gastropods in running waters can be biological indicators of oxygen level of water. If the level of oxygen increases, the number of species will increase. Viviparus viviparus (L.) and Radix peregra (O.F. Mull) can be indicators of anthropopressure.