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Fish systematics

VARIABILITY OF TAXONOMIC FEATURES IN SOME PERCH (*PERCA FLUVIATILIS* LINNAEUS, 1758) POPULATIONS FROM FRESHWATER RESERVOIRS OF NORTHERN POLAND

ZMIENNOŚĆ CECH TAKSONOMICZNYCH KILKU POPULACJI OKONIA (*PERCA FLUVIATILIS* LINNAEUS, 1758) ZE ZBIORNIKÓW ŚRÓDLĄDOWYCH POLSKI PÓŁNOCNEJ

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The paper presents an analysis of taxonomic features from one river and six different lake populations of perch (*Perca fluviatilis* L.). Values and variability of meristic features were determined, as also their relations with individual body length. Morphology and meristic features of lake perch populations were compared with river population of this species.

INTRODUCTION

According to the latest systematics perch (*Perca fluviatilis* L.) represents one of the three species belonging to *Perca* genus (Thorpe, 1977 a; Collette and Bănărescu, 1977). The other two are: American yellow perch (*Perca flavescens* Mitchill, 1814) and *Perca schrenki* Kessler, 1874. Distribution range of *Perca schrenki* is limited to the Alakul and Balkhash Lake systems in eastern Kazakh, i.e. to typical refuge water bodies. Perch in this area got isolated in the Tertiary period and developed an original form, considerably differing from other *Perca species* (Zadin, 1949). *Perca fluviatilis* L. and *Perca flavescens*

Mitchill inhabit Eurasian and North American inland waters of similar geographic latitude. Additionally, *Perca fluviatilis* L. has been introduced into the inland waters of Australia, New Zealand and North Africa (Fig. 1).

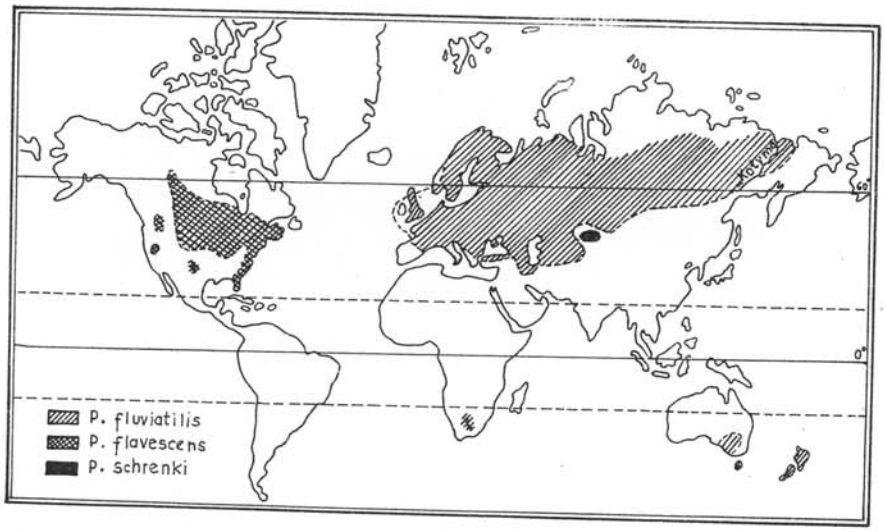

Fig. 1. Geographic distribution of *Perca* species (after Thorpe 1977, Collette and Bănărescu 1977)

Due to geographic isolation, lasting since Pleistocene or early Holocene (Čihar 1975), yellow perch developed specific features, different from European perch. These are, among others: strong scale cover over the cheeks and opercular bones, lower number of rays in fins, lower number of branchial spines (*sp. branch.*) and vertebrae. Differences between American and European perch are noted only with respect to morphologic features, as both species are in most cases biologically equivalent (Thorpe 1977 b). Distribution of both species is limited by similar reaction to temperature, flow rate, water salinity and dissolved oxygen content. Also gonad development during maturation is similar, as well as spawning time and behaviour, and larval development. Both species have similar growth rate, feeding behaviour, and characteristic canibalism.

Since geographic isolation does not permit for natural cross-breeding of American and European perch, and thus for gene transformation, it is very difficult to interpret and apply biological concept of the species. Untill recently the two were treated as sub-species: *Perca fluviatilis fluviatilis* L, and *Perca fluviatilis flavescens* Mitchill (Berg 1949, Čihar 1975, Pokrovskij 1951, Svetovidov and Dorofeeva 1963, McPhail and Lindsey 1970). However, they were finally classified as separate species basing on different position of os praedorsalis (Collette and Bănărescu 1977) (Fig. 2).

Perch, together with roach (*Rutilus rutilus* L.), belongs to the most popular species in Polish waters. It inhabits fresh and brackish waters of the Baltic coast, rivers and lakes of various types. Despite its popularity, there are no Polish papers on taxonomic features of this species and their variability. Values of some meristic features were presented by

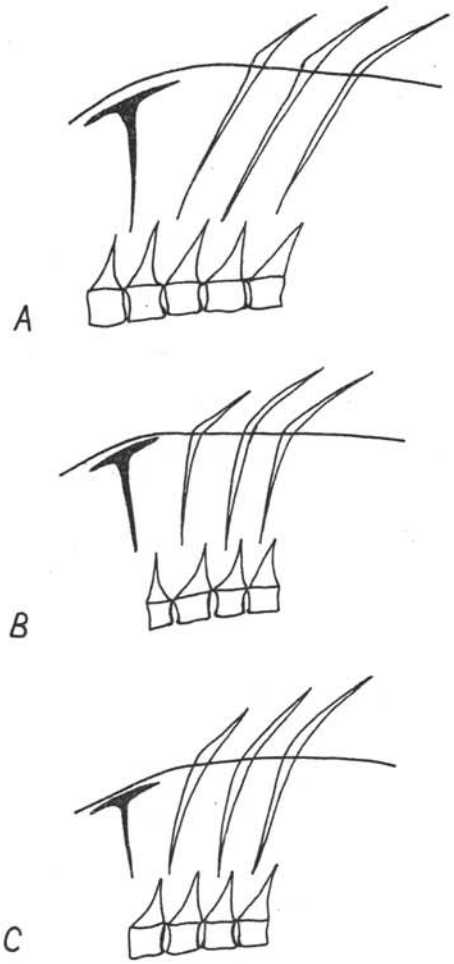

Fig. 2. Locations of *os praedorsalis* (in black) relative to the neural spines of the first four vertebrae and the pterygiophores supporting the anterior three dorsal spines in the species of *Perca*. A – *P. flavescens*, B – *P. fluviatilis*, C – *P. schrenki* (after Collette and Bănărescu 1977)

Suskiewicz (1961) in a paper describing perch population in Goczałkowice Dam Reservoir. Data given in the most popular key to Polish fish species by Gąsowska (1962) were based on Berg (1949), and thus refer to perch in the USSR.

The present paper is of an inventory – documentary character. Its objective was to supply more knowledge on the taxonomic features of Polish ichthyofauna on a populational level. The following problems were posed:

1. Verification of the species feature which allowed Collette and Bănărescu to distinguish between American and European perch.
2. Determination of the range and variability of meristic features in perch.
3. Determination of the relationship between these features and body length.

4. Attempt to distinguish a population, or group of populations which would be characterized by specific meristic features or morphology.

MATERIAL AND METHODS

Materials for studies were collected in 1977–1980 from commercial fish catches carried out in lakes: Isąg, Wadąg, Ukiel, Szymon Mały, Iłgi, Piekło, and in Vistula River near Bydgoszcz. The lakes were limnologically different. Their morphometry and fishery characteristics are presented in Table 1. Environmental data were taken from Olszewski and Paschalski (1959), Olszewski et al. (1978), and descriptions made by State Fish Farms. Dates of sampling, size of samples, size and weight distribution of sampled fish are given in Table 2. Age of fishes was determined from scales. Rate of growth was calculated according to Dahl-Lea method, with a correction (perch curve worked out by Żuromska 1961).

Number of rays was calculated for the following fins: first dorsal (D_1), second dorsal (D_2), anal (A), ventral (V), and pectoral (P). Calculations embraced also: number of scales in the lateral line (1.1.), number of vertebrae (vt.), and number of branchial spines (*sp. branch.*). Location of os praedorsalis was determined upin x-ray photographs. Structure of the opercular bone was compared taking into consideration also number of sharp dents below the spine axis. Comparative analysis was carried out for both sexes together as perch does not exhibit sexual dimorphism (Pokrovskij 1951, Basim 1972, Gjarulajtis 1976).

Average values of meristic features and their variability (m, V) were calculated for each population. Differences between particular populations were determined with the Student's t test. Coefficients of correlation between meristic features and body length, and between particular features were also calculated.

RESULTS

Rate of growth

Rate of fish growth reflects general habitat conditions for the species, and thus provides additional information on the environment (Tab. 1). Consequently, rate of growth was assessed for each perch population.

Most rapid growth took place in the first year of perch life. By the end of this year fishes grew to the length of 6.1–7.0 cm. In the second year average increase in length amounted to 3 cm. In the consecutive years of fish life average increase was about 2 cm annually (Tab. 3). Rate of perch growth was similar in all waters except Lake Wadąg. In this lake older individuals (since the third year of life) were characterized by more rapid growth. Data collected in course of the studies do not confirm the relationship between

Table 1

Morphometric and fishery characteristics of the lakes under study

Water body	Vistula	Isąg	Wadąg	Ukiel	Szymon Mały	Iłgi	Piekło
Surface area (ha)	559.0	395.7	494.5	427.7	28.3	32.5	36.2
Volume (thousand m^3)	17 680	56611	62869	43611	–	231	441
Maximal depth (m)	8.0	54.5	35.5	43.0	3.5	2.0	2.7
Average depth (m)	3.0	14.2	12.7	10.6	1.7	0.7	1.2
Fishery type	bream lake	vendace lake	vendace lake	vendace lake	bream-pike lake	bream-pike lake	bream-pike lake
Fishery yield in the year of sampling (kg/ha)	15.3	48.0	34.2	42.0	19.3	16.1	20.1
Perch yield (kg/ha)	–	1.63	0.50	2.25	0.53	3.29	2.32
Limnological type	eutrophic	a-mesotrophic	b-mesotrophic	eutrophic	eutrophic	eutrophic	approaching dystrophy

Table 2

Dates of catches, numbers, body length (l. c.) and weight of perch under study

Water body	Date of sampling	♀ + ♂ n	♀	l. c. range (cm)	Range of body weight
Vistula River near Bydgoszcz	18.11.1977	95	70	14.8 – 31.4	70 – 400
Lake Isąg	19.02.1980	77	52	11.3 – 20.3	40 – 170
Lake Wadąg	30.06.1977	73	56	15.9 – 27.8	90 – 600
Lake Ukiel	10.11.1979	68	55	13.3 – 21.5	45 – 255
Lake Szymon Mały	14.12.1977	93	35	11.2 – 20.3	20 –210
Lake Iłgi	11.01.1980	95	66	11.2 – 14.1	20 – 60
Lake Piekło	19.01.1980	94	73	11.0 – 15.8	20 – 85
Total	1977 – 1980	594	407	11.0 – 31.4	20 – 600

Table 3

Comparison of body growth (*longitudo corporis*) in age classes of perch from waters under study

Water body	n		Body length increments (in cm) from corrected scale – reading							
			l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8
Vistula River	94	$\bar{x}$	6.1	9.0	11.8	14.2	16.3	18.6	20.3	24.0
		±m	0.623	0.992	1.034	2.005	1.963	2.646	0.382	0.993
Lake Iśąg	77	$\bar{x}$	7.0	9.9	12.7	14.8	16.6			
		±m	0.672	0.895	1.081	1.010	1.064			
Lake Wadąg	73	$\bar{x}$	7.0	10.0	13.3	16.3	19.1	21.9	23.9	26.5
		±m	0.591	0.850	0.992	1.123	1.074	1.205	1.067	0.598
Lake Ukiel	68	$\bar{x}$	6.5	9.6	12.6	15.2	17.6			
		±m	0.542	0.984	1.136	1.051	0.863			
Lake Szymon Mały	93	$\bar{x}$	6.7	10.2	13.1	15.2				
		±m	0.547	0.870	0.809	2.400				
Lake Iłgi	95	$\bar{x}$	6.1	9.0	11.2					
		±m	0.567	0.915	0.677					
Lake Piekło	94	$\bar{x}$	6.2	9.2	11.5					
		±m	0.495	0.766	0.900					

lake trophy and rate of growth, as suggested by Hartmann (1978, 1979) and Leach et al. (1977). Rate of perch growth in the populations under study is presented in Fig. 3 together with data for other Polish inland waters. As it is seen, rate of growth does not deviate from average values characteristic for this species.

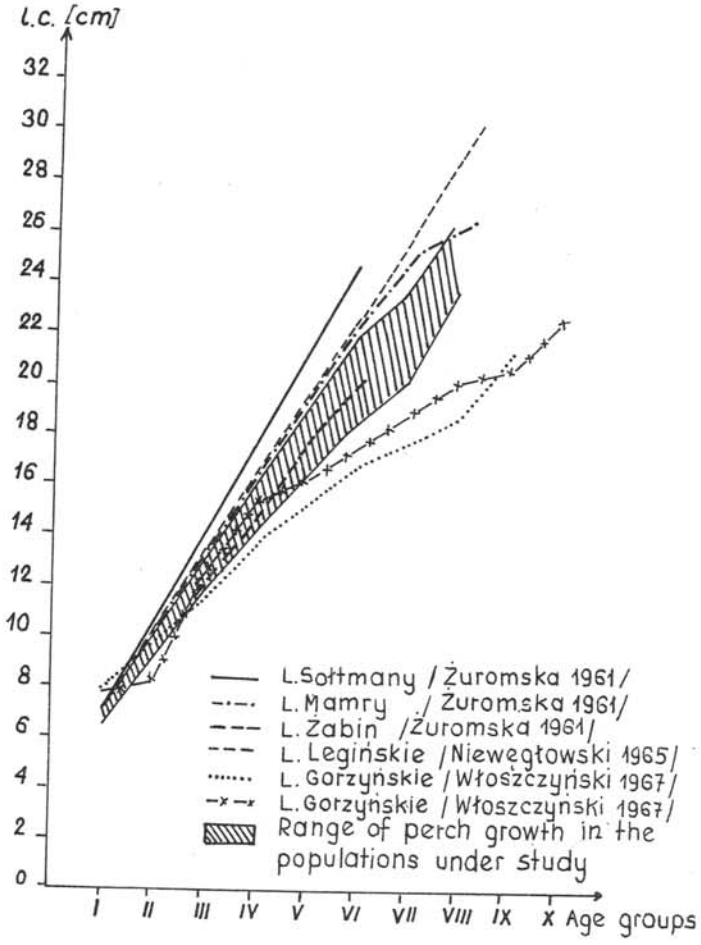

Fig. 3. Rate of perch growth in the populations under study in relation to growth in other Polish fresh waters

Species feature

Species feature of *Perca fluviatilis* L. was well developed in most specimens. Predorsal bone (*os praedorsalis*) was located before the neural spine of the first vertebra and pterygiophore supporting the first dorsal spine extended between the first and second neural spines (Fig. 2 B). Location of these bones was different in only three females from Lake Iłgi (Fig. 4). These exceptions were treated as anomalies, although they might suggest similarity to Perca flavescens Mitchill.

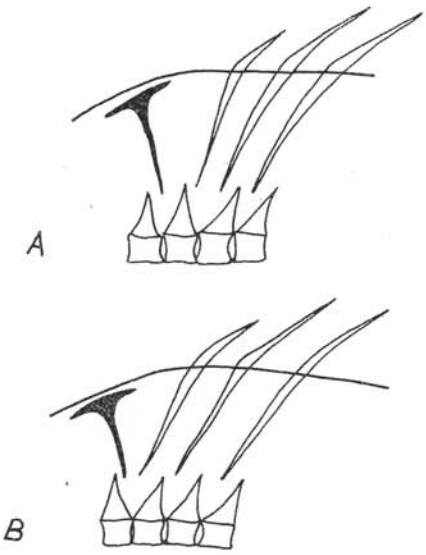

Fig. 4. Anomalies in the location of os praedorsalis

Morphology

Fishes from lake populations were similar as regards their clouring, number of dark vertical bars (6–8), and structure of the opercular bone. On the other hand, river perch population differed from lake populations. In perch from Vistula River dark vertical bars were usually merged together. Additional sharp dents (1–4 in number) were found in the opercular bone in over 40% of specimens. In lake fishes these dents were not present (Fig. 5). Additional sample, taken in August 1981 from a dam reservoir near Włocławek, confirmed the fact that in perch from Vistula River opercular bone was characterized by specific structure. From among 59 sampled specimens, 19 had opercular bones with one additional dent, and 15 specimens had opercular bones with 2, 3 or 4 additional dents. These specimens respresented 63% of the fish sample.

Meristic features

Number of rays in the first dorsal fin (D_1) represents a relatively constant species feature, as illustrated by low coefficient of variability, V, and analysis of the significance of differences between mean values (Tab. 4, 5). In lake perch populations (B, C, D, E, F, G) differences between mean values were in most cases insignificant. This resulted from the fact that lake fishes usually had 15 rays in the D_1. Perch from Vistula River had only 14 rays in the first dorsal fin, this being a significant difference compared with lake populations (Fig. 6, Tab. 5).

Second dorsal fin (D_2), which contain both hard spines (D_2d) and soft rays (D_2m),

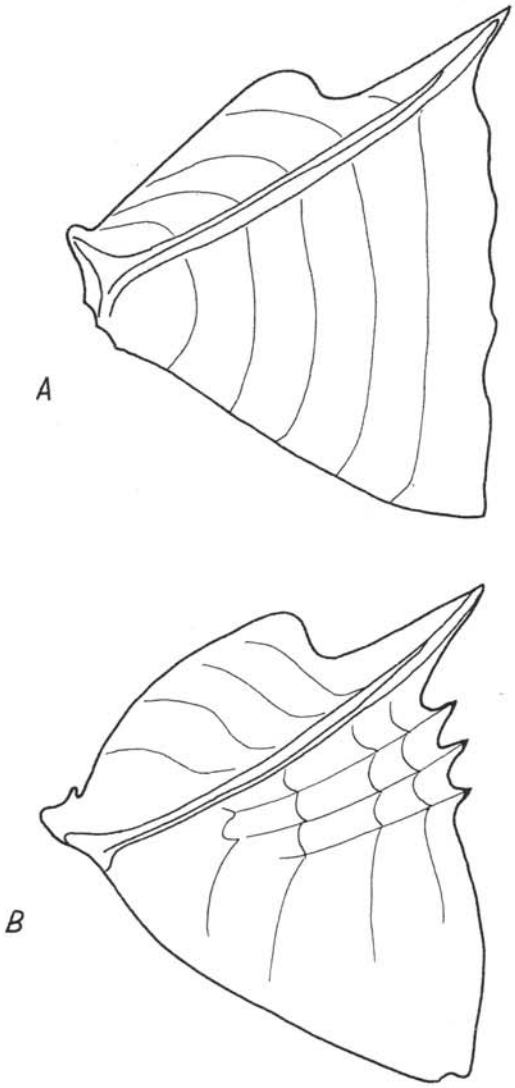

Fig. 5. Types of opercular bones. A – os operculum of perch from lakes, B – os operculum with additional dents in perch from Vistula River

were much more differentiated (Tab. 4, 5). Number of hard spines was 1 to 3, of soft rays – 11 to 16. In populations from Vistula River and Lake Wadąg fishes with 13 soft rays in the second dorsal fin were most frequent. In the remaining populations number of soft rays in this fin was usually 14 (Fig. 6).

Anal fin (A) had always 2 hard spines. 96% of individuals had 8 or 9 soft rays in this fin, at a range of 7 to 10 (Fig. 7). Test for the significance of differences confirmed that in perch this feature is characterized by low variability (Tab. 5).

Table 4

Range ($x_1 - x_n$), mean values ($\bar{x}$), standard deviation (m) and coefficients of variability (V) of meristic features in perch populations

feature symbol	Vistula River n=94				Lake Isąg n=77				Lake Wadąg n=73				Lake Ukiel n=68			
	x_1-x_n	$\bar{x}$	m	V	x_1-x_n	$\bar{x}$	m	V	x_1-x_n	$\bar{x}$	m	V	x_1-x_n	$\bar{x}$	m	V
D_1	13–16	14.4	0.681	4.7	13–16	14.7	0.637	4.3	14–15	14.7	0.491	3.3	14–16	14.8	0.601	4.1
D_2d.	2–3	2.4	0.491	20.5	1–2	1.6	0.491	30.5	1–3	2.4	0.589	24.9	1–2	1.4	0.485	35.5
D_2m.	11–15	13.2	0.755	5.6	13–16	14.1	0.507	3.6	12–14	13.5	0.551	4.2	13–16	14.2	0.682	4.8
A	7–10	8.8	0.535	6.0	7–10	8.7	0.608	7.0	7–9	8.2	0.500	6.1	8–10	8.6	0.543	6.3
P	12–14	12.9	0.398	3.1	13–15	14.2	0.579	4.1	12–15	13.2	0.815	6.2	13–17	13.7	0.811	5.9
l. l.	55–67	61.0	2.561	4.2	63–80	71.1	3.977	5.6	62–77	66.8	2.685	4.0	59–69	64.9	2.692	4.1
vt.	40–42	41.1	0.640	1.6	40–43	41.2	0.643	1.6	40–43	41.4	0.717	1.7	40–43	41.5	0.635	1.5
sp. branch.	19–25	22.3	1.363	6.1	22–29	25.3	1.242	4.9	21–27	24.2	1.374	5.7	23–29	26.1	1.424	5.4
	Lake Szymon Mały n=93				Lake Iłgi n=95				Lake Piekło n=94							
D_1	14–16	15.2	0.517	3.4	13–16	14.6	0.582	4.0	13–15	14.9	0.530	3.6				
D_2d.	1–3	2.0	0.374	19.0	1–2	1.6	0.484	29.7	1–3	1.7	0.520	31.3				
D_2m.	12–15	14.0	0.579	4.1	13–15	14.1	0.603	4.3	13–15	14.1	0.535	3.8				
A	7–10	8.5	0.500	6.4	7–10	8.7	0.579	6.4	8–10	8.6	0.517	6.0				
P	12–15	13.3	0.598	4.9	11–15	13.6	0.627	4.6	12–15	13.6	0.535	3.9				
l. l.	54–69	61,7	2.901	4.7	60–73	66.9	2.664	4.0	56–73	64.1	3.777	4.2				
vt.	40–42	41.3	0.625	1.5	40–43	42.0	0.757	1.8	41–43	41.7	0.580	1.4				
sp. branch.	19–27	23.1	1.949	8.4	23–28	25.7	1.051	4.1	21–28	25.0	1.605	6.4				

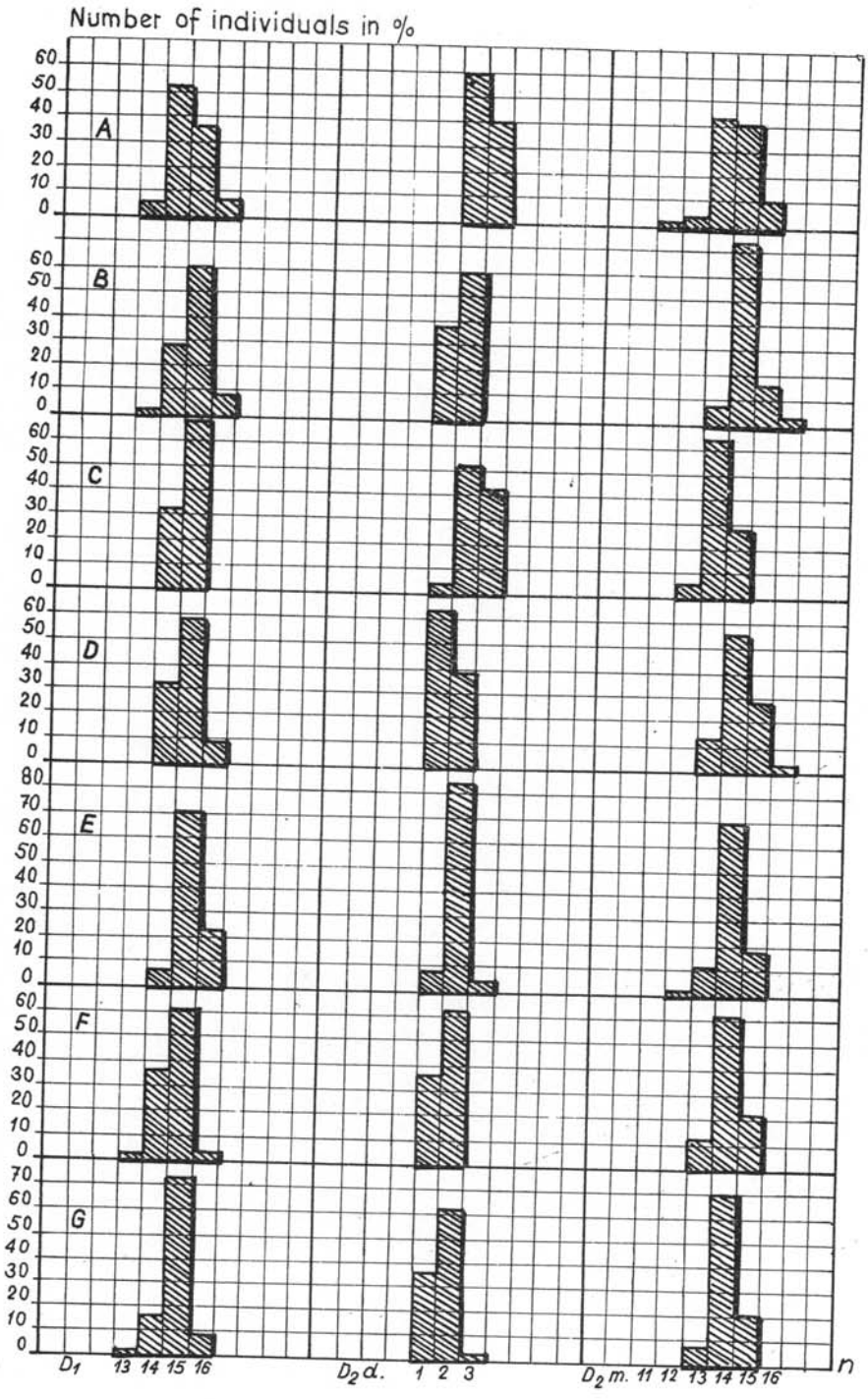

Fig. 6. Number of rays in the dorsal fins

Table 5

Analysis of the significance of differences between mean values of meristic features in perch populations under study ($t_{0,05}$ = 1.980)

features		D_2d.								l.l.						
		A	B	C	D	E	F	G		A	B	C	D	E	F	G
	A		10.317	n.s.	13.100	6.625	10.676	9.901			−19.842	−14.143	−9.125	n.s.	−15.229	−6.475
	B	−2.868		8.535	−2.966	5.348	n.s.	n.s.		B	−16.377		−7.562	−10.811	−17.621	−8.263	−11.677
D_1	C	−2.648	n.s.		10.895	5.314	8.849	8.211	P	C	−2.673	−8.431		4.341	11.607	n.s.	5.226
	D	−3.056	n.s.	n.s.		8.793	−3.403	−3.604		D	−7.808	−4.071	−3.623		−6.962	−4.665	n.s.
	E	−8.025	4.731	−5.815	4.457		5.284	4.624		E	−5.319	−9.164	n.s.	−3.235		−12.594	−4.814
	F	−2.108	n.s.	n.s.	n.s.	6.428		n.s.		F	−8.355	−6.337	−3.428	n.s.	−2.728		5.772
	G	−5.108	n.s.	−2.552	n.s.	3.338	n.s.			G	−9.383	−6.827	−3.698	n.s.	−3.015	n.s.	
		A								sp. branch.						
		A	B	C	D	E	F	G			A	B	C	D	E	F	G
	A		n.s.	−8.282	2.412	4.771	n.s.	3.311		A		−14.530	−8.545	−17.092	−3.191	−18.979	−12.763
	B	−5.072		−5.846	n.s.	−2.688	n.s.	n.s.		B	n.s.		−5.151	3.856	−8.339	2.459	−1.990
	C	−3.387	−10.024		−5.284	−3.610	−6.594	−5.261		C	−2.588	n.s.		−8.290	3.865	−8.186	−4.023
D_2m.	D	−5.142	n.s.	−9.111		n.s.	n.s.	n.s.	vt.	D	−3.955	−2.970	n.s.		−10.746	2.190	4.138
	E	−4.727	n.s.	−9.261	n.s.		−3.137	n.s.		E	−2.322	n.s.	n.s.	n.s.		−11.297	−7.615
	F	−5.314	n.s.	−9.773	n.s.	n.s.		n.s.		F	−8.406	7.105	−5.077	−4.044	−6.341		2.968
	G	−5.878	n.s.	−10.850	n.s.	n.s.	n.s.			G	−6.889	5.638	−3.396	−2.201	−4.524	2.485	

n.s. – statistically insignificant

A Vistula River
B Lake Isąg
C Lake Wadąg
D Lake Ukiel
E Lake Szymon Mały
F Lake Iłgi
G Lake Piekło

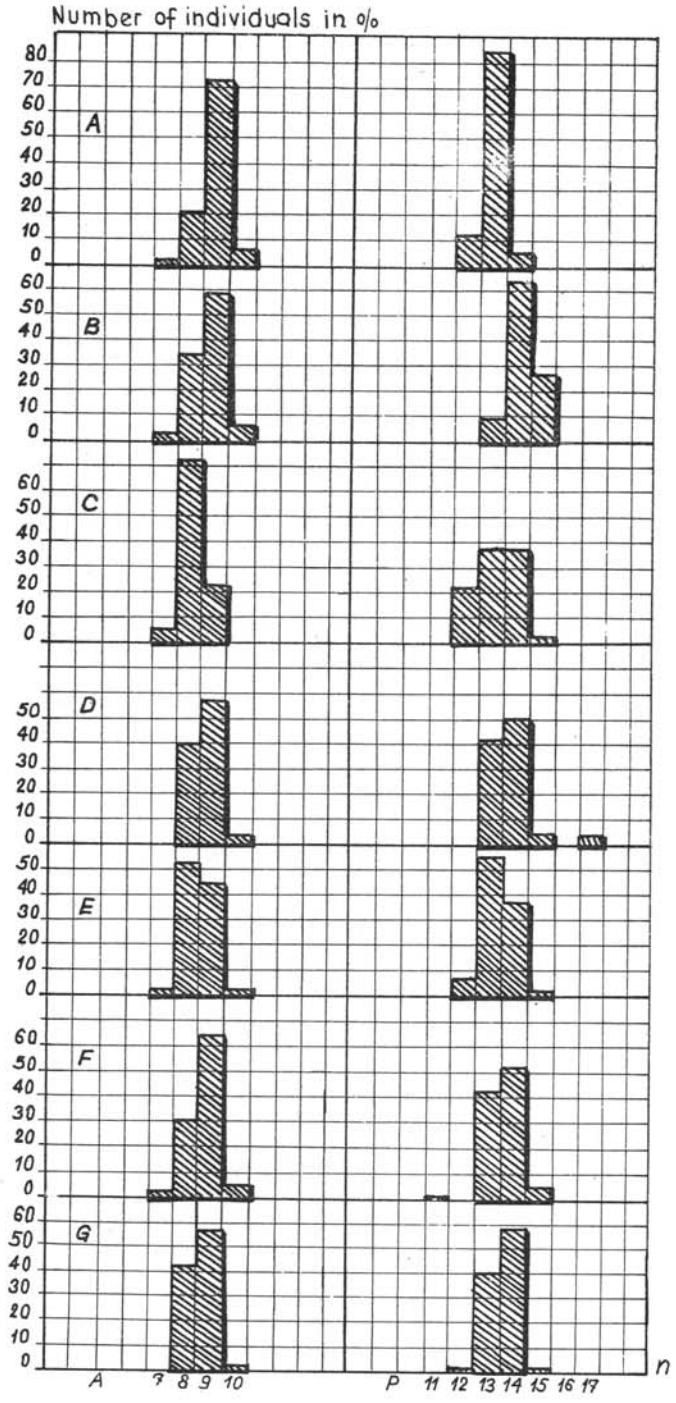

Fig. 7. Number of rays (soft) in the anal and pectoral fin

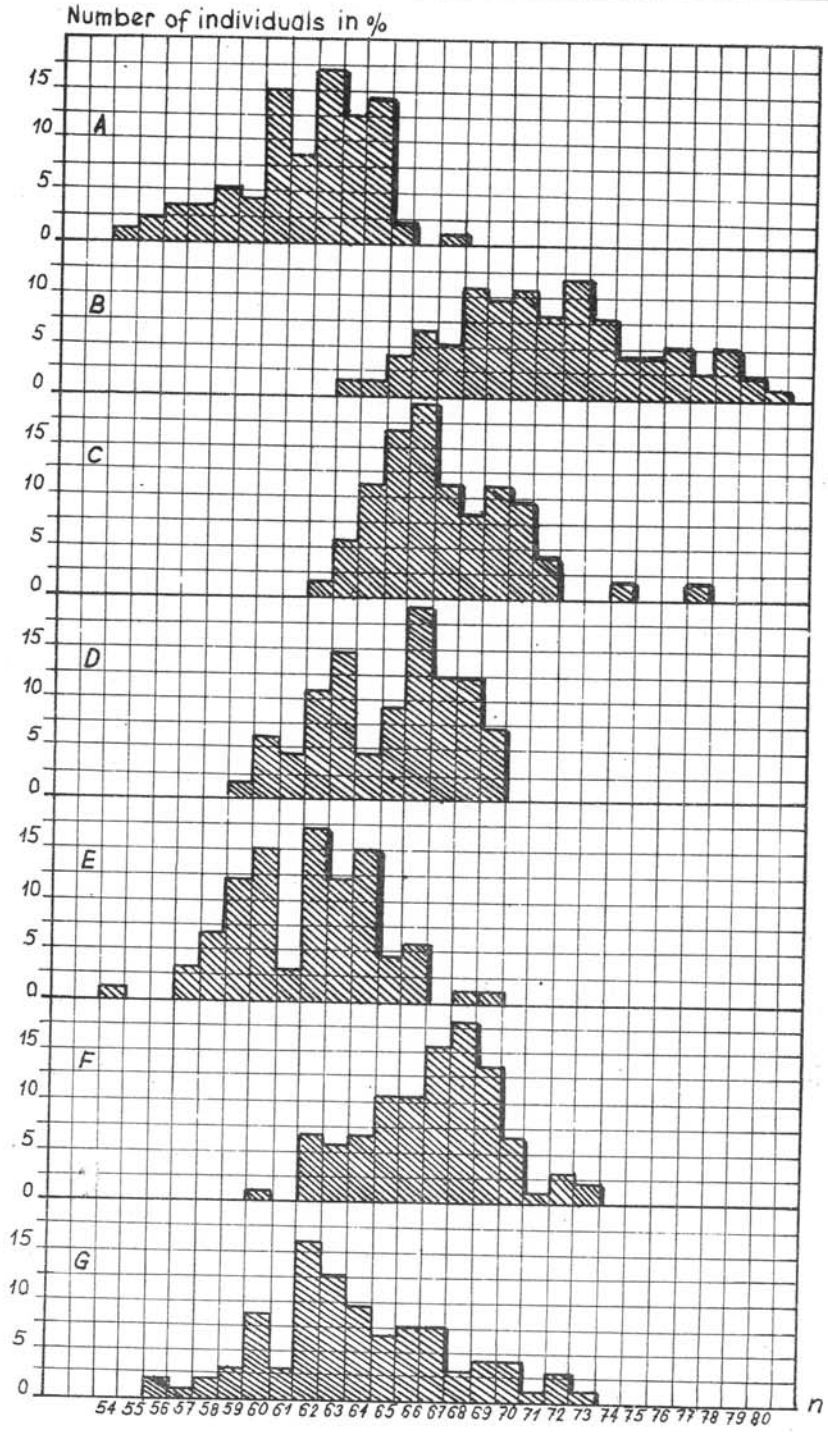

Fig. 8. Number of scales in the lateral line

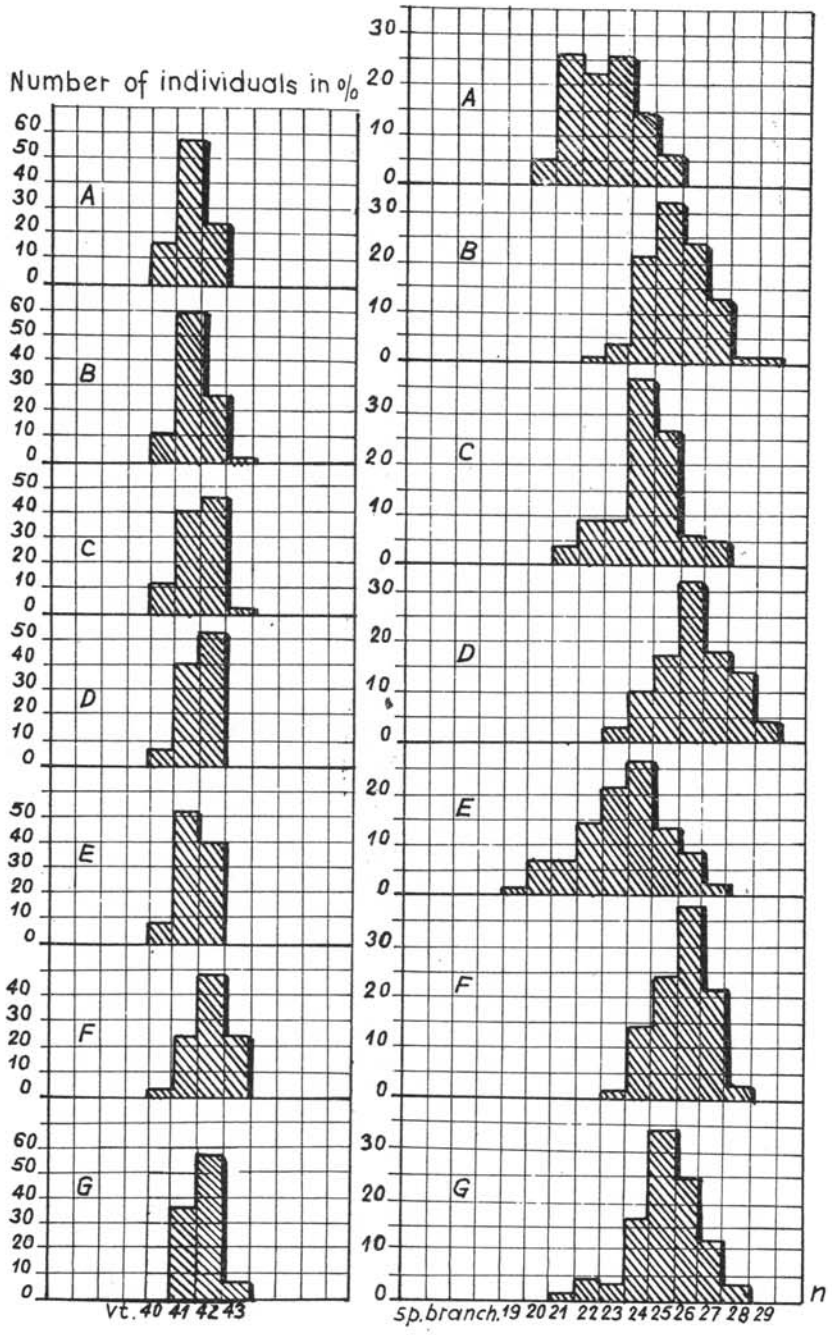

Fig. 9. Number of the vertebrae and sp. branch

Table 6

Coefficients of correlation ($r_{0,05}$) between meristic features and body length (l.c.) in perch

features	Vistula r = 0.205	Isąg r = 0.232	Wadąg r = 0.232	Ukiel r = 0.250	Szymon Mały r = 0.205	Iłgi r = 0.205	Piekło r = 0.205
D_1	−0.032	0.068	0.127	−0.017	0.188	−0.056	0.170
D_2d.	0.065	0.045	0.246*	0.069	0.137	0.047	0.049
D_2m.	−0.049	0.060	0.100	0.012	0.050	−0.051	−0.229
A	−0.058	0.119	−0.113	−0.022	0.061	0.011	0.013
P	0.268*	0.280*	0.104	0.041	−0.002	0.059	0.205
l.l.	0.356*	0.202	0.178	0.215	0.415*	0.068	0.083
vt.	0.232*	−0.093	0.089	−0.078	0.125	0.369*	0.112
sp. branch.	−0.113	−0.027	0.139	−0.150	0.010	0.015	0.214

* – significant correlation

Ventral fin (V) in all specimens had 1 hard spine and 5 soft rays.

Number of rays in the pectoral fin (P) varied within a wide range (11–17) and was characterized by high variability (Tab. 4, 5). 88% of all fishes had 13 or 14 rays in this fin (Fig. 7).

Number of scales in the lateral line (l.l.) was characterized by considerable variability and a wide range (54–80) (Fig. 8). The lowest mean value of this feature was found in perch from Vistula River, the highest – in perch from Lake Isąg (Tab. 4). All perch populations differed significantly with respect to this feature (Tab. 5).

Number of vertebrae (vt.) was constant for each perch population under study. Differences between particular populations were also insignificant. Fishes from Vistula River, Lake Isąg and Lake Szymon Mały usually had 41 vertebrae, while fishes from other populations had 42 vertebrae (Fig. 9).

Number of branchial spines was a most variable feature in perch. Average values of this feature were significantly different in all perch populations under study. There were no two populations in which this would be similar. The lowest number of sp. branch. was found in perch from Vistula River, the highest – in perch from Lake Ukiel (Tab. 4, 5, Fig. 9).

Comparing values of particular meristic features in perch it appears that perch population from Vistula River was characterized by the lowest values. This population had the lowest number of rays in the dorsal and pectoral fins, of vertebrae, scales in the lateral line, and the lowest number of sp. branch.

No significant connection was found between values of particular features and fish body length (Tab. 6).

DISCUSSION

Average values of meristic features were compared with data of other authors (Tab. 7). Water reservoirs in the table were arranged according to diminishing geographic latitude. This way it was possible to verify opinions on variability of meristic features in relation to geographic location. According to Vladykov (1934) number of segments and their components in fish is negatively correlated to temperature of the environment. This opinion is in an agreement with commonly accepted rule of Jordan that in cold waters number of vertebrae is higher and particular specimens are bigger than in warm waters. Works by Taning (1952), Orska (1956), Carside (1966 a, b), based on experimental data, confirm the opinion on the effect of temperature on vertebrae numbers. At lower temperature rate of development decreases, resulting in an increased number of vertebrae. It was observed that some fish species in artificially heated Konin lakes complex had lower values of some meristic features, in this of vertebrae number (Gąsowska 1968, Szczyglińska 1980).

Comparing meristic features in perch from water bodies of different geographic location it is readily seen (Tab. 7) that their values decrease from north to south. This

Table 7

Meristic features of perch populations under study in comparison to the data by other authors

Geographical latitude	Water body	D_1	D_2	A	P	l.l.	vt.	sp. branch
61–63°	Lake Onega	XIV–XVI	I–III 12–17	II(7)8–10	13–16	62–74	41–42(43)	22–28
	Pokrovskij (1951)	15.2	16.2	8.5	14.8	67.5	41.9	25.0
60°	Gulf of Finland	XIV–XVI	I–II 13–15	II 7–9	–	57–71	40–46	19–26
	Basim (1972)	14.5	1.3 14.0	8.2		65.0	42.6	22.9
55°	Kuron Bay	XIV–XVI	I–III 12–16	II 7–10	–	56–64	40–42	22–26
	Gjarulajtis (1976)	14.6	1.9 14.2	8.5		59.9	40.7	23.8
55°	Lakes Kamyś-Samarskie	XIV–XV	II–III 12–15	II 7–9	–	60–66	40–42	23–25
53–54°	Vistula River	XIII–XVI	II–III(11)12–15	II(7)8–10	12–13(14)	(54–57)58–64(65–67)	40–42	(19–20)21–25
		14.4	2.4 13.2	8.8	12.9	61.0	41.1	22.3
53–54°	Lake Isąg	(XIII)XIV–XVI	I–II 13–15	II(7)8–10	13–15	(63–65)66–73(74–80)	40–43	22–29
		14.7	1.6 14.1	8.7	14.2	71.1	41.2	25.3
53–54°	Lake Wadąg	IIV–XV	I–III 12–14	II 7–9	12–14(15)	63–70(71–74)	40–42(43)	21–26(27)
		14.7	2.4 13.5	8.2	13.2	66.8	41.4	24.2
53–54°	Lake Ukiel	XIV–XVI	I–II 13–15	II 8–9(10)	13–14(15–17)	(59–61)62–69	(40)41–42	(23)24–29
		14.8	1.4 14.2	8.6	13.7	64.9	41.5	26.1
53–54°	Lake Szymon Mały	XIV–XVI	I–III(12)13–15	II(7)8–9(10)	(12)13–14(15)	(54-57)58–66(68–69)	40–42	(19)20–26(27)
		15.2	2.0 14.0	8.5	13.3	61.7	41.3	23.1
53–54°	Lake Iłgi	(XIII)XIV–XV(XVI)	I–II 13–15	II(7)8–9(10)	13–14(15)	(60)62–70(71–73)	(40)41–43	(23)24–27(28)
		14.6	1.6 14.1	8.7	13.6	66.9	42.0	25.7
53–54°	Lake Piekło	(XIII)XIV–XVI	I–II(III) 13–15	II 8–9(10)	(12)13–14(15)	(56–59)60–70(71–73)	41–43	(21–23)24–27(28)
		14.9	1.7 14.1	8.6	13.6	64.1	41.7	25.0
53–54°	Lake Śniardwy	XIV–XVI	II(12)13–15(16–17)	II 8–9(10)	(12)13–15	(63)64–72(73)	(40)41–43	16–19(20)
	Szczyglińska (1980)	15.2	14.2	8.7	13.9	68.4	41.8	17.9
52,5°	Lake Licheń	(XIII)XIV–XVI	II(12)13–15	II 8–9(10)	(12)13–15(16)	(60–63)64–70	(40)41–42	(15)16–18(19)
	Szczyglińska (1980)	14.6	13.7	8.6	14.3	67.2	41.4	16.9
50°	Goczałkowice Dam Reservoir	(XII)XIII–XVI(XVII)	I 14–15	II 8–9	–	57–72	–	–
	Suskiewicz (1961)							
47°	Dnieper River System	XIII–XV(XVI)	I–II 12–15(16)	II(7)8–10(11)	9–15	54–66(68)	37–44	–
	Żukov (1965)	14.1	14.2	8–9	11.8	61.0	41.5	

statement refers most of all to such features as: number of rays in dorsal and pectoral fins, number of scales in the lateral line, and number of vertebrae. Perch from a northern Lake Onega and from the Gulf of Finland had noticeably higher values of these features than perch from the Dnieper River catchment area. Meristic features in perch from Polish waters had intermediate values.

Differences in the number of vertebrae between populations from distant waters are not significant, of no more than 1 vertebra only. Within particular populations this feature is characterized by very low variability. This results from the fact that vertebrae are formed very early, so that their number is determined already during egg incubation (Taning 1946). Low variability of the number of vertebrae was found also in *Pelecus cultratus* and ruffe by Terlecki (1980 a b), and in pike-perch by Terlecki, Buze (1980).

Low variability of the number of rays in the first dorsal fin, and higher variability in case of the second dorsal and pectoral fins is also in agreement with the results by others authors (Tab. 7).

In fishes scales are formed and ossified later than fins and vertebrae (Vladykov 1937, Nagięć 1977, 1979). Thus, they are more affected by environmental factors. Number of scales in the lateral line is characterized by considerable variability, frequently determined by and negatively correlated with the temperature (Vladykov 1934). This trend became apparent in comparing perch from waters situated more to the north. In these waters mean number of scales in the lateral line was higher (Lake Onega – 67.5, Gulf of Finland – 65.0) than in perch from the Dnieper River system (61.0).

In perch number of *sp. branch.* seeems to be considerably differentiated, as illustrated both by my own results and those of other authors (Tab. 7). Vladykov (1934) presented several opinions on this variability and stated that in most cases there was a positive correlation between number of *sp. branch.* and values of other meristic features. Number of branchial spines can change also under the effect of temperature and salinity. Many authors are of the opinion that this feature is related to fish age. Increase of the number of *sp. branch.* as the fish grows can be connected with simultanous growth of the branchial arch, upon which new spines develop (Tiščenko 1976). Such correlation was found, among others, for whitefish by Tiščenko (1976), and in ruffe by Terlecki (1980 b), as also in crucian carp by Čihar (1958). Pokrovskij (1951) suggested that in perch number of *sp. branch.* was similar in small and big specimens, only their length changed with fish age. My studies suggest that there is no correlation between the number of branchial spines and body length in perch, and that this feature is characterized by considerable variability.

CONCLUSIONS

Values of meristic features for perch (*Perca fluviatilis* L.) in Polish waters are as follows: D_1 (XIII) XIV-XVI, D_2 I-III (11) 12–15, A II (7) 8–9 (10), V I5, P 12–15 (16–17), 1.1. (54–57) 58–73 (74–80), vt. 40–43, *sp. branch.* (19) 20–29. These values

differ from those given for perch by Gąsowska (1962) in the „Key to Polish vertebrates". This statement refers to the following features: number of rays in the first dorsal fin (XIII-XVII), number of vertebrae (36–43) and number of *sp. branch* (14–20).

In perch invariable taxonomic features are: number of rays in the ventral fin (I 5), and number of spines in the anal fin (II). Low variability was found as regards number of rays in the first and second dorsal fin, number of soft rays in the anal fin . and number of vertebrae. Other features, i.e. number of rays in the pectoral fin and number of scales in the lateral line are characterized by slightly higher variability. The highest variabilities were observed with respect to the number of branchial spines, which varied within a wide range, and mean values of particular populations were also significantly different. No correlation was found between values of meristic features and body length.

Perch population from Vistula River differed from all lake populations of this species. Perch from Vistula River was smaller than lake fishes, this being in agreement with the opinions on body appearance of river fishes. Furthermore, perch from Vistula River had lower number of rays in the dorsal and pectoral fins, lower number of scales in the lateral line, and lower number of vertebrae and branchial spines than lake fishes. Opercular bone in perch from Vistula River frequently (40%) had additional dents below the opercular spine. Such structure of opercular bones was found only in river fishes.

Species feature described by Collette and Bănărescu (1977) was typical for *Perca fluviatilis* L. Different structure of the predorsal bone was noted only in three specimens from Lake Iłgi, and it was treated as an anomaly.

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ANNA SZCZYGLIŃSKA

ZMIENNOŚĆ CECH TAKSONOMICZNYCH KILKU POPULACJI OKONIA (*PERCA FLUVIATILIS* LINNAEUS, 1758) ZE ZBIORNIKÓW ŚRÓDLĄDOWYCH POLSKI PÓŁNOCNEJ

STRESZCZENIE

W pracy po raz pierwszy na terenie Polski dokonano inwentaryzacji cech merystycznych okonia (*Perca fluviatilis* L.). Obserwacje przeprowadzono na materiale pozyskanym w latach 1977–1980 z sześciu zróżnicowanych limnologicznie jezior i z rzeki Wisły pod Bydgoszczą. Na podstawie cech merystycznych 594 osobników określono wartości liczbowe cech. Można je przedstawić następującym wzorem: D_1 (XIII) XIV-XVI, D_2 I-III (11) 12–15, A II (7) 8-9 (10), VI 5, P 12–15 (16–17), 1.1. (54–57) 58–73 (74–80), vt. 40–43, *sp. branch.* (19) 20–29. Najbardziej zmienną cechą merystyczną okonia jest liczba wyrostków filtracyjnych, przy czym jej wartość nie zależy od długości ciała osobnika. Nie stwierdzono również związków istotnie statystycznych między pozostałymi cechami. a długością ciała.

Populacja rzeczna odróżnia się od populacji jeziorowych zespołem cech taksonomiczych, między innymi nieco odmienną budową *operculum* i mniejszymi wartościami cech merystycznych.

Analiza rentgenogramów wykazała u większości badanych okoni typowe dla gatunku *Perca fluviatilis* L. położenie *os praedorsalis*. Znalezione odstępstwa mają charakter anomalii, choć mogą sugerować podobieństwo do *Perca flavescens* Mitchill.

Анна Щиглиньска

ИЗМЕНЧИВОСТЬ ТАКСОНОМИЧЕСКИХ ПРИЗНАКОВ ПОПУЛЯЦИЙ ОКУНЯ (PERCA FLUVIATILIS LINNAEUS,1755) ИЗ ПРЕСНОВОДНЫХ ВОДОЁМОВ СЕВЕРНОЙ ПОЛЬШИ

Р е з ю м е

В работе впервые на территории Польши осуществлена инвентаризация меристических признаков окуня (Perca fluviatilis L.). Наблюдения проведены на материале, полученном в 1977-1980 годах из шести лимнологически дифференцированных озёр и из реки Висла под Быдгощью. На основе меристических признаков 594 особей определены их численные значения. Можно их представить по следующей формуле: D_1(XIII)XIV-XVI, D_2 I-III(11) 12-15, A II(7)8--9(10), V I 5, P 12-15(16-17), l.l. (54-57) 58-73 (74-80), vt. 40-43, sp. branch. (19) 20-29. **Наиболее изменчивым меристическим признаком окуня является число фильтрационных тычинок, причём их значение не зависит от длины тела особи. Не установлены также связи, статистически существенные, между остальными признаками и длиной тела.**

Речная популяция окуня отличается от озёрных популяций рядом таксономических признаков, как например, несколько отличающимся строением operculum **и меньшими значениями меристических признаков.**

Анализ рентгенограммов выявил у большинства исследуемых окуней типичное для вида Perca fluviatilis L. **положение** os praedorsalis. **Установленные отклонения имеют характер аномалии, либо позволяют думать о схожести с** Perca flavescens Mitchill.

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