

Morphometric comparisons of pumpkinseed (Centrarchidae) populations in Poland

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The pattern of morphometric differentiation between two populations of non-native pumpkinseed (*Lepomis gibbosus*) inhabiting distinctively different habitats in north-west Poland was examined. Fish were collected in July 2013 at sites that differ mainly in water temperature (Fig. 1): ambient temperature, a downtown Brodowski pond (Pic. 1) (127 specimens), versus artificially elevated temperature, drainage channel heated by a power station, lower Oder River (Pic. 2), (119 specimens) respectively. Morphometric measurements (mm) were taken from each specimen (Fig. 2).



Pic. 1. The Brodowski pond



Pic. 2. Heated-water discharge canal of a power plant, the lower Oder River

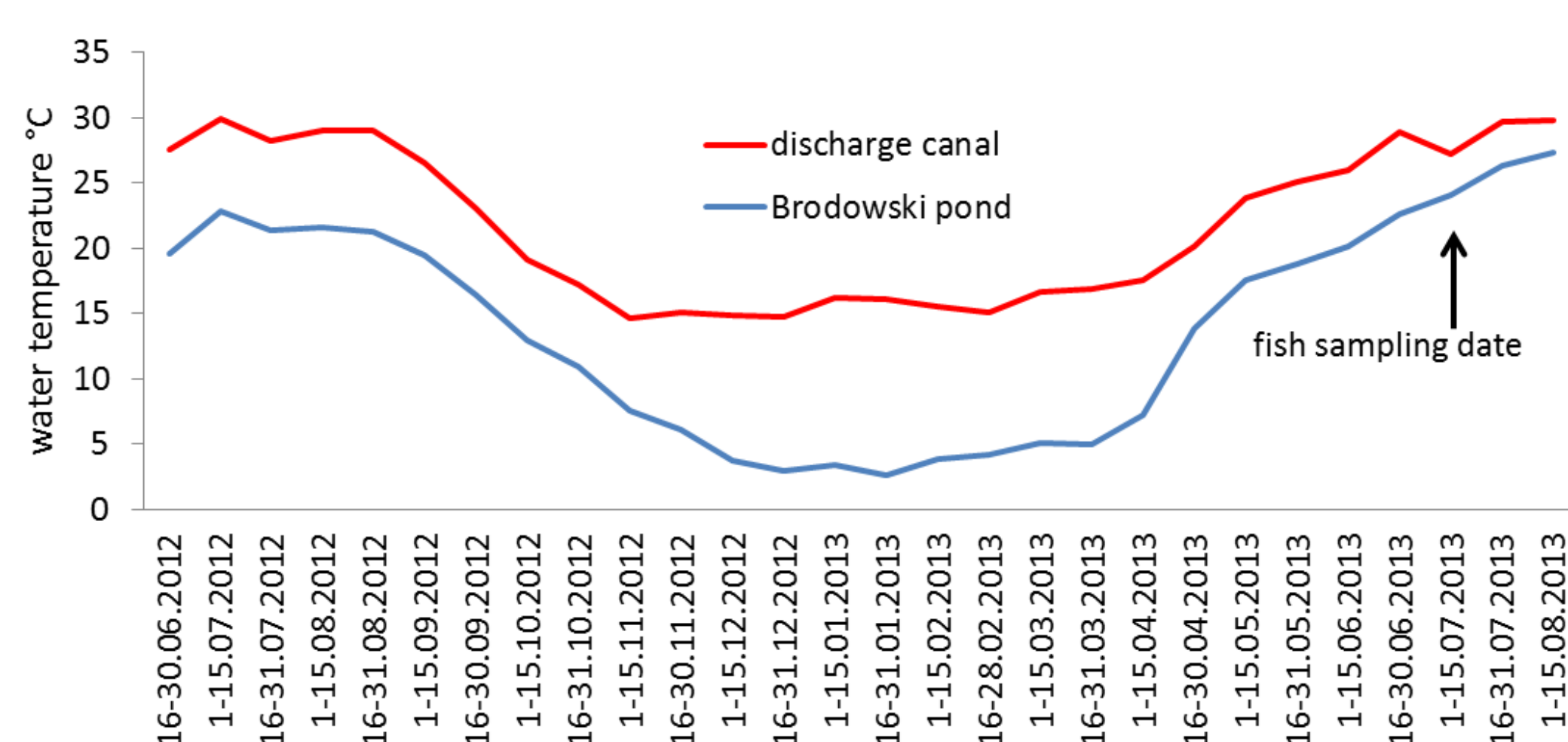


Fig. 1. Mean water temperature at studied sites

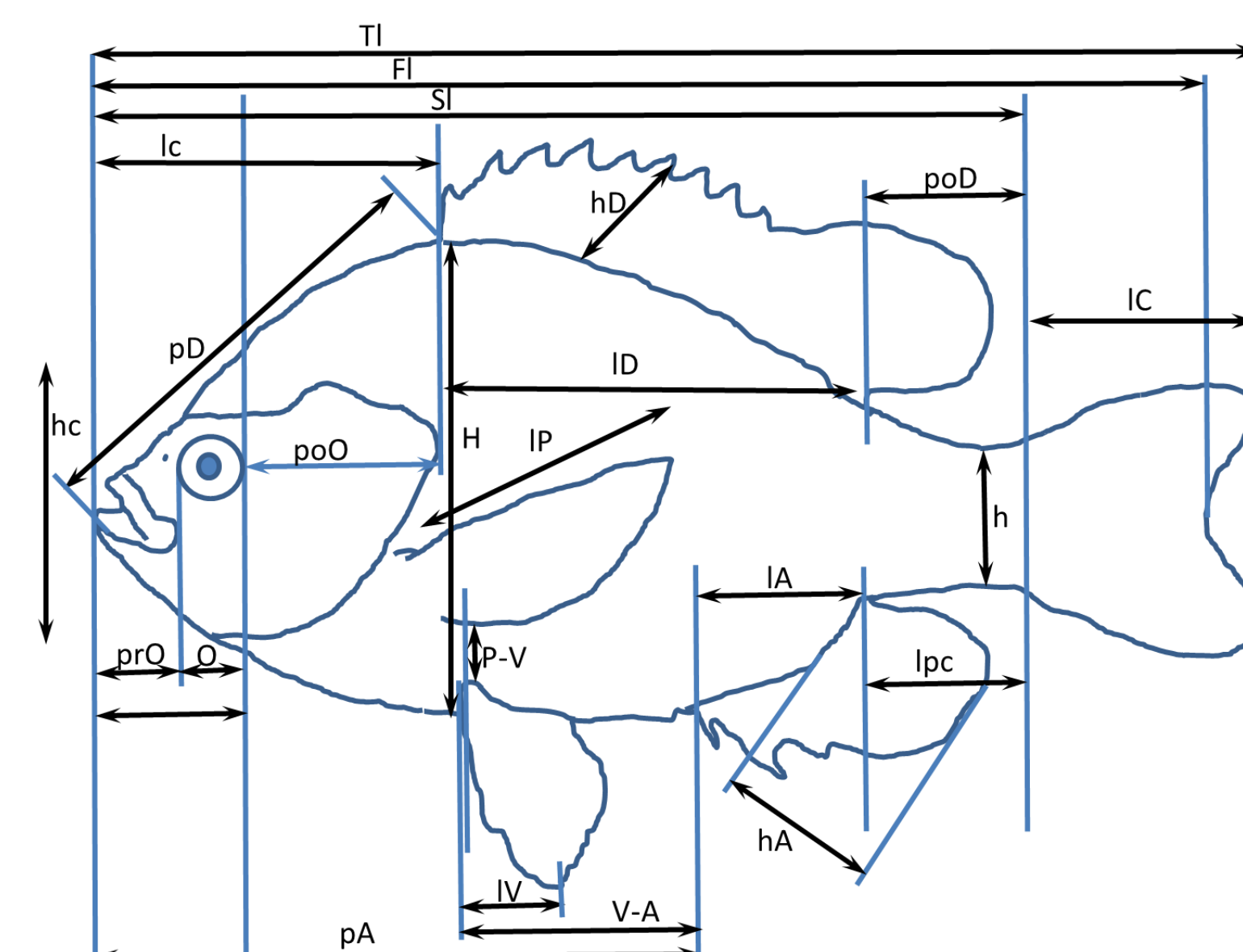


Fig. 2. Measurement design of pumpkinseed

Variable	PC 1	PC 2
lc (lateral length of head)	0,1711	-0,0988
prO (preorbital distance)	0,5706	-0,2853
O (diameter of eye)	-0,6575	0,0558
poO (postorbital distance)	0,8916	0,2376
hc (head depth)	0,7489	0,0411
lac (head width)	0,8166	-0,0369
pD (predorsal distance)	0,4599	-0,4067
poD (postdorsal distance)	0,3244	0,3124
H (maximum body depth)	0,9296	-0,1553
pA (preanal distance)	-0,1208	-0,8296
h (minimum body depth)	0,8214	-0,1108
lpc (length of caudal peduncle)	0,2058	0,3812
IP (length of pectoral fin)	0,4641	-0,1132
IV (length of ventral fin)	0,5144	0,1723
hD (dorsal fin height)	0,3736	0,2026
hA (anal fin height)	0,4627	-0,0300
ID (dorsal fin length)	0,9086	-0,0223
IA (anal fin length)	0,7255	0,3629
P-V (distance between pectoral and anal fin)	0,5555	-0,5376
V-A (distance between ventral and anal fin)	-0,1348	-0,7711
eigen value	7,235	2,387
% of explained variation	36,174	11,935
cumulative % of explained variation	36,174	48,109

Table 1. Eigenvalues and percentage of explained variation by two components of PCA analysis. To remove significant linear correlation between all morphometric characters and standard length, all measurements were size adjusted according formula: $X = X(L_s/L_0)^b$

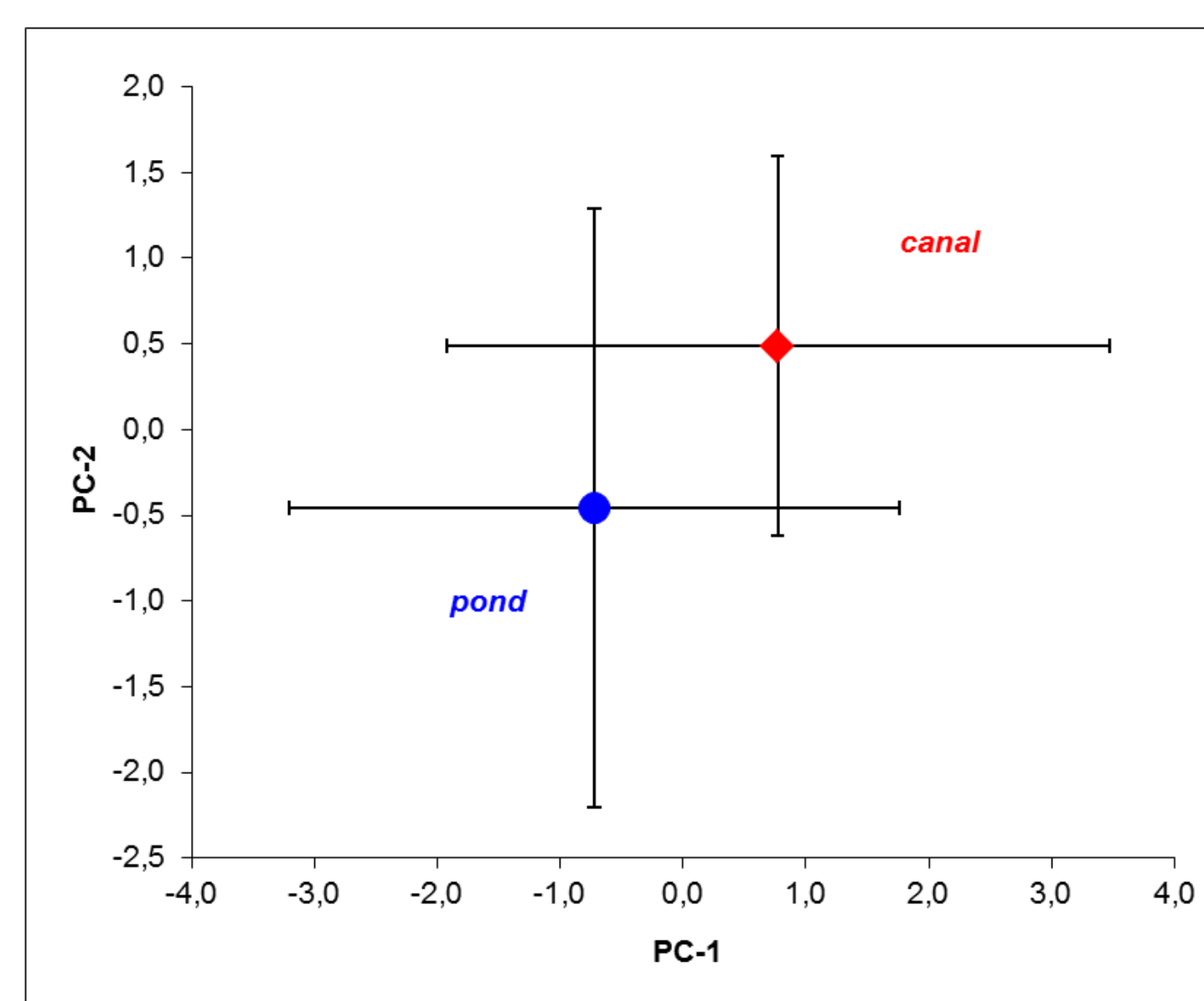


Fig. 3. Comparison of morphological traits of pumpkinseed from pond and canal populations

	n	pond average	SD	canal average	SD	t	p
pc1		-0,72	2,48	0,77	2,70	4,52894	>0.001
pc2		-0,46	1,75	0,49	1,11	5,02726	>0.001

Conditional Effects				
Variable	LambdaA	P	F	% of explained variation
hD	0,51	0,002	260,79	65,3
IP	0,08	0,002	47,31	10,2
IA	0,06	0,002	45,99	7,7
poD	0,03	0,002	23,05	3,8
lac	0,03	0,002	20,35	3,8
poO	0,03	0,002	25,42	3,8
H	0,01	0,004	11,4	1,3
ID	0,01	0,004	9,48	1,3
hA	0	0,044	5	0,0
O	0,01	0,054	4,88	1,3
pA	0	0,03	4,98	0,0
lpc	0	0,06	3,49	0,0
lc	0,01	0,168	1,83	1,3
prO	0	0,204	1,89	0,0
P-V	0	0,178	1,92	0,0
hc	0	0,358	0,89	0,0
V-A	0	0,268	1,35	0,0

Table 2. Canonical variable analysis of differences in morphology of two pumpkinseed populations

In principal component analysis, the first component accounted for 36 % and the second for 12 % of the shape variations between the samples (Table 1, Fig. 3). Plotting the first and second principal components showed that the observed differences were mainly from measurements indicating the possible higher robustness (expressed generally in larger head, higher body, and longer anterior part) of specimens inhabiting warmer water (Fig. 2). Results of canonical variable analysis indicated mostly the differences in size of dorsal fins (Table 2).

As a consequence, larger body size, may promote survival in highly unnatural and unstable environment of artificial warm water discharge canal of power plant.