ALLOMETRIC GROWTH, ESPECIALLY OF THE OLFACTORY NERVE, IN TWO SPECIES OF PERCIDAE: *STIZOSTEDION LUCIOPERCA* AND *PERCA FLUVIATILIS* (PISCES)

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Abstract. Allometric growth, especially of the olfactory nerve, in two species of percidae: S*tizostedion lucioperca* and *Perca fluviatilis* (Pisces). Our paper outlines, for the two species of Percidae, the allometric growths of some formations like the encephalon, head, muzzle and body at different age periods .As it comes from the text, tables and graphs, the studied formations growth is allometrical, with a diminished rhythm for the encephalon and faster for the other formations; the faster rhythm is for the olfactory nerve.

Keywords: Pisces, Percidae, allometric growth, olfactory nerve.

Rezumat. Consideraţii privind creşterea alometrică, în special cea a nervilor olfactivi, la două specii de percidae: S*tizostedion lucioperca* şi P*erca fluviatilis* (Pisces). Lucrarea ilustrează creşterea alometrică a unor formaţiuni (cap, bot, encefal, nerv olfactiv) la două specii de Percidae(Stizostedion lucioperca şi Perca fluviatilis). Aşa cum rezultă din text, tabele şi grafice, alungirea formaţiunilor luate în studiu este alometrică, realizându-se cu un ritm mai redus pentru encefal şi mai rapid pentru celelalte formaţiuni; ritmul cel mai rapid de creştere îl prezintă nervul olfactiv.

Cuvinte cheie: Peşti, Percidae, creştere alometrică, nerv olfactiv.

Introduction

The great specific variety of the teleosteens' encephalon, connected to its form and size, and also to the proportion of its components, is due to multiple causes, especially to the systemic position and the species way of life (Necrasov *et al*., 1955).

The allometric growths of the encephalon and especially of the olfactory tract in relation to the individual's length, to the head and muzzle's length of four species of *Cyprinidae* were emphasized in a previous paper (Hutanu & Haimovici, 2002).

The current paper is a follow-up of the above-mentioned one, as it points out the growth rhythm of the olfactory nerve in relation to the encephalon, the head and the muzzle growth of the two species of *Percidae.*

Material and Methods

The study material is made up of different size individuals belonging to the two species of the Percidae family commonly met in Romanian waters. 21 *Stizostedion lucioperca* individuals and 12 *Perca fluviatilis* individuals have been analyzed. Both species are predators.

For each individual we have measured (in mm), the standard length (L), the head length (Lh), the muzzle length (Lm – that is the distance between anterior extremity of the head and the anterior margin of the orbit), the encephalon length (L enc) and the olfactory nerve length (L olf.n., that is the right one).

Results and Discussion

In table 1 we have listed the length and its variation of the body, head, muzzle, while for encephalon and the olfactory nerve we have also added the variation amplitude:

Table 1. The value of the lengths and their variability for every species (mm).

Species	L		Lh		Lm		L enc			L olf.n.		
	min	max	min	max	Min	max	min	max	ampl. var.	min	max	ampl. var.
Stizostedion lucioperca	226	410	65	120	15	28	12.7	17.2	4.5	22	39.1	17.1
Perca fluviatilis	52	235	15	73	4	18	5.8	13.3	7.5	5	18.3	13.3

It is well known that with fish, the growth is continuous, but it has different rhythms before and after the sexual maturity. For every species, the sexual maturity is related to a certain body length, too. That is why we have analyzed, for different length (age) groups, the growth rhythm of the head, muzzle, encephalon and olfactory nerve. These values are listed in table 2 and presented graphically in figure 1.

Table 2. The length averages for age (length) categories.

Species	Age categories (mm)	L olf.n. (mm)	L enc. (mm)	Lm (mm)	Lh (mm)
Stizostedion lucioperca	201-250	23.45	13.50	17.00	71.50
	251-300	26.76	14.08	18.18	76.75
	301-350	34.61	15.23	22.25	94.37
	351-400	37.40	15.60	24.00	105.00
	401-450	38.60	17.20	27.50	115.50
Perca fluviatilis	50-100	5.70	6.42	5.25	20.75
	101-200	12.24	10.74	10.80	45.80
	201-300	17.23	12.60	15.26	68.33

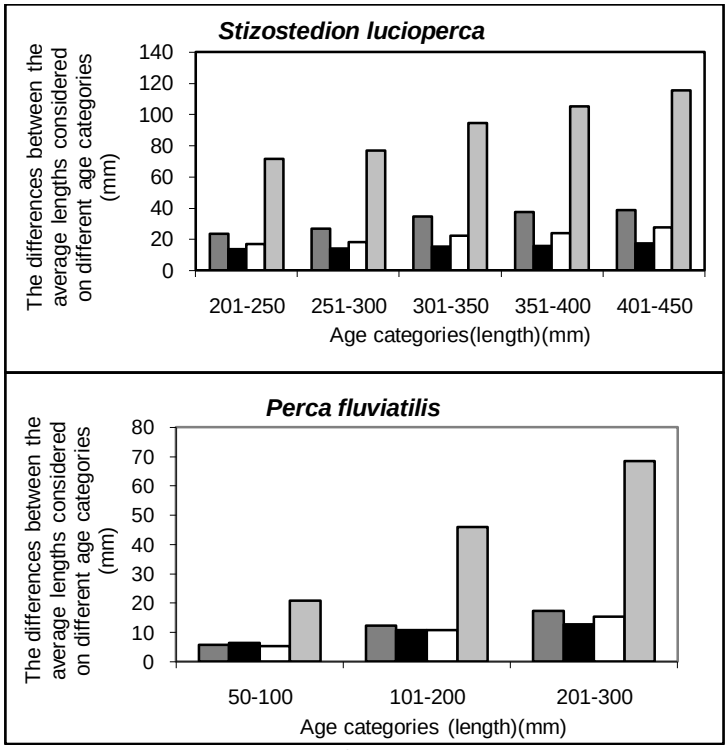

Figure 1. The growth rhythms: dark grey – olfactory nerve, black – encephalon, white – muzzle, light grey – head.

For *Perca fluviatilis* the length (age) categories are expressed in bigger values because this species is a middle size percid, while *Stizostedion lucioperca* is a bigger sized species.

In the case of *Stizostedion lucioperca* we can notice that for the small size individuals (201 -300 mm) the olfactory nerve had the fastest growth rhythm (14%), whereas the head and the muzzle lengthened on average by 7%. The faster growth of the olfactory nerve in comparison to the head and the muzzle's, took place in the detriment of the encephalon, which lengthened by 4% on average. However, the slower growth in length of the encephalon is compensated by the faster growth in width. Thus, the measurements of the encephalic morphologic segments showed a faster growth rhythm in width, especially for bi- twin tubers. It is known that these tubers contain the visual centers, which are entirely vital for a predator species.

The average results of the measurements for the mesencephalon of different age (length) groups are listed in Table 3.

Table 3. The average values of the mesencephalon length and width for different age (length) categories in mm for *Stizostedion lucioperca.*

Age categories	Mezencephalon length average	Mezencephalon width average
201-250	4.10	6.10
251-300	4.56	6.36
301-350	4.78	6.96
351-400	4.80	6.60
401-450	5.10	7.05

For this species the fastest growth rhythm of the olfactory nerve is correlated with the growth of the body length from 301 mm to 350 mm, when they lengthened by 30%. Also, when the encephalon, the muzzle and the head lengthen, this shows the fastest growth rhythm. This coincides with the age of 3 years old, when sexual maturity is reached. After this age, the olfactory nerve, the encephalon, the muzzle and the head still grow, however the rhythm is much slower.

In the case of *Perca fluviatilis*, also a predator, the fastest growth rhythm for all four formations is recorded when the length of the body grows from 100 mm to 200 mm, so that for the olfactory nerve this growth is 35 % of the initial one; the encephalon growth rhythm is slower than the rhythm of the other components (only 40%) in this period.

It is known that both species are predators, relying especially on eyesight for spotting and catching the prey, that is why of all the encephalon components, the mesencephalon with the bi-twin tubers is the most developed component. One can also notice that for this species too the encephalon records a bigger growth in the width of the mesencephalon (the bi-twin tubers) than its growth in length.

The average results of the measurements conducted for the mesencephalon of different age (length) groups are listed in table 4.

In what concerns the next age (length) group, between 201 mm and 300 mm, the growth rhythms of the four components slow down, with a still fast growth rhythm of the olfactory nerve (approximately 29%). One can notice that the *Perca fluviatilis* individuals reach their sexual maturity sometime before 3 years old that is in the proximity of the standard length of 200 mm.

Table 4. The average values of the length and width of the mesencephalon of different age (length) groups in mm for *Perca fluviatilis*.

Age categories	Mezencephalon length average	Mezencephalon width average
50-100	2.95	4.35
101-200	4.72	6.88
201-300	6.03	7.83

It is obvious that the lengthen (growth) of all the studied parts is an allometric one, similar to the situation recorded for the four Cyprinidae species (Hutanu & Haimovici, 2002). The fastest growth rhythm, allometrically positive is recorded for the olfactory nerve (similar to the olfactory tract of the *Cyprinidae),* while the slowest growth is recorded for the encephalon.

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