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Age and growth rate of the brown bullhead (Ictalurus nebulosus Le Sueur, 1819) in back—waters of the innundation area of the river Elbe in Czechoslovakia

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The presented work continued with the observation of Frank (1955) who examined the age and growth rate of brown bullheads at the same localities in the years 1951—1953. The aim of this work was to find out the changes in the growth rate of the brown bullhead population as related to variable conditions.

I am especialy grateful to my teacher Assist. Prof. Dr. Ota Oliva for suggesting the topic, guidance throughout the execution of the study and criticizing the manuscript, to Dr. S. Frank for his continual advices.

Material

I had to my disposal 359 brown bullheads from the following localities:

Locality	Date	Number of Fishes
Velká Arazimova	26. 4. 1953	1
Řehákova bouda	28. 2. 1954	3
Procházkova tůň	6. 1955	5
Procházkova tůň	22. 5. 1955	5
Procházkova tůň	29. 8. 1956	10
Procházkova tůň	14. 7. 1960	46
Poltruba	17. 7. 1955	50
Poltruba	30. 7. 1955	30
Poltruba	7. 9. 1955	209

These are all back-waters situated in the inundation area of the river Elbe near the village Čelákovice. The material is deposited in the Laboratory of Ichthyology, Charles University, Prague.

Methods

Methods of determination of age and growth rate of fishes by means of scales (survey of methods see in Balon 1955, Čugunova 1959 and Hol-

čík 1960), otholiths and certian bony parts (rewiew in Čugunov 1926, Menon 1950 and Čugunova 1959) are frequently used.

In the works available for me, for determination of the age of cat-fishes there were used vertebrae (Lewis 1949, Hooper 1949, Appelget and Smith 1951, Galtsoff 1952, Bizjajev 1952, Hruška and Oliva 1953, Forney 1955, Frank 1955, Marzolf 1955) and cross sections of pectoral and dorsal fin spines (Sneed 1950, Hall and Jenkins 1952, Hruška and Oliva 1953, Finnel and Jenkins 1954, Frank 1955, Forney 1955, Marzolf 1955, Jenkins 1956, and Muncy 1959).

Since the determination of age of bullheads according to the cros sections of pectoral fin spines appears largely inexact (Frank 1955) and growth data derived from vertebral measurement are more uniform and in better agreement with the empirical data (Marzolf 1955), I determined the age and growth of bullheads according to their vertebra's increments. Therefore, I mention below works only dealing with the age determination according to the vertebrae.

Several authors observed growth rings on the vertebrae immediately after drying (Lewis 1949, Marzolf 1955, Forney 1955) others improved the visibility of these growth rings in various ways: Heincke (1904) operated on the vertebrae with absolute alcohol and then degreased them in benzine or ether (in some cases he used for clearing still glycerine), Hooper (1949) improved the visibility of the growth rings on operating with 2 % NaClO, Appelget and Smith (1951) by a 0,7 % pepsin and 0,2 % HCl treatment, Hruška and Oliva (1953) by xylol (after previous smoothening of the vertebrae surface), Frank (1955) by acetone, Galltsoff (1952) stained the growth rings with alizarin Red S. The authors measured the vertebrae either by means of an ocular micrometer under a binocular microscope, wherely they measured the vertebrae radius (Marzolf 1955) or diameter (Frank 1955), or they projected the vertebrae surface with an projector and measured them with a millimeter measure (Appelget and Smith 1951). Aikawa (1938) cut the vertebrae centrum longitudinaly at its middle and measured the growth rings „in situ".

I measured the fishes with $\pm$0,5 mm exactitude (total length) and weighted — the fishes heavier than 5 g ones with $\pm$ 0,5 g exactitude und others with $\pm$0,001 g exactitude. In the material issued from the poissoned back-water Poltruba (in the year 1955) one part of the fishes was in decomposition, these were not measured. I relived the vertebrae in the following way: Closely before the dorsal fin basis I divided the vertebral column with a vertical cut. From the vertebral column so removed I took three vertebra. After cleaning from muscles and chord remainders, I put the vertebrae into test tubes and filled them with 75 % alcohol. In very small fishes I placed in the test tubes the whole anterior vertebral column part and separated the vertebrae only by their measuring under a binocular microscope. The growth rings on the vertebra were weekly visible. Therefore I strove for improving their visibility by decreasing them in acetone and benzine. The growth rings were then better visible, until the vertebrae were wet, what only lasted for a moment, because both liquids evaporate quickly. Degreasing during 24 hours in 3 % solution of tertiary potassium phosphate proved itself best (this solution used Clemens, 1951,

on improving the visibility of bands on otholith cross sections). During the observation the vertebra were invariably wet (what was more advantageous), and moreover, the solution has whitened moderatly the vertebra. I observed the vertebra's under a binocular microscope by reflected light at 15-fold enlargement (in very small fishes at 24-fold enlargement). I measured the lateral diameters of the vertebra's bodies and of the individual annual rings by means of an ocular micrometer.

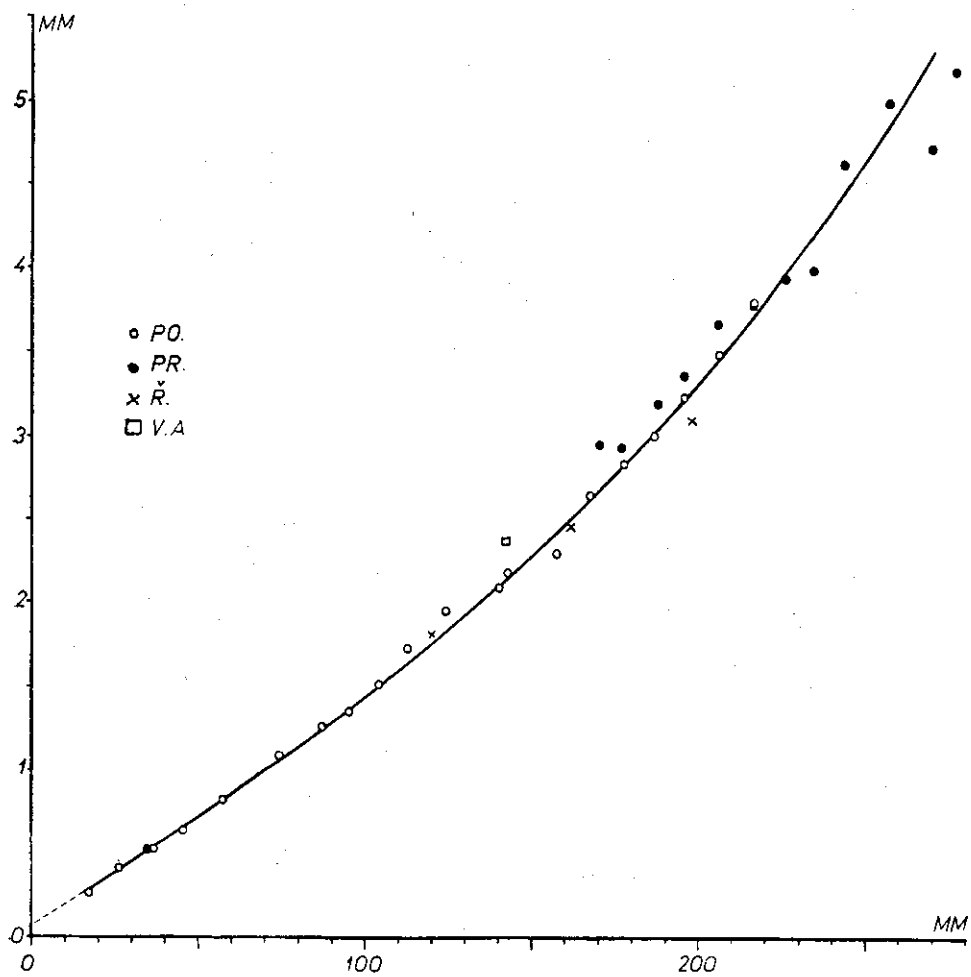

Fig. 1. Relation between total length and the diameter of vertebra.
PO— the back-water Poltruba
PR— the back-water Procházkova tůň
Ř— the back-water Řehákova bouda
V. A. — the back-water Velká Arazimova
x— body length in mm
y— vertebra's diameter

The relation between the length of body and vertebra's diameter appeared unlinear (fig. 1). Tehrefore it was impossible to lenghten the curve beyond the limits of the estabilished values, to obtain a correction value by using the R. Lee's method, because that led to negative values (a similar case is described by Frank 1958). The difference between the real values and their graphical demonstration is probably originated by the circumstance that the gristly bases of vertebra bodies are not formed from one point but riquire around the notochord, which becomes then supressed by them. After graphical logarithming the vertebra diameters and body lengths I obtained the nomogram which you see on fig. 2. However, the

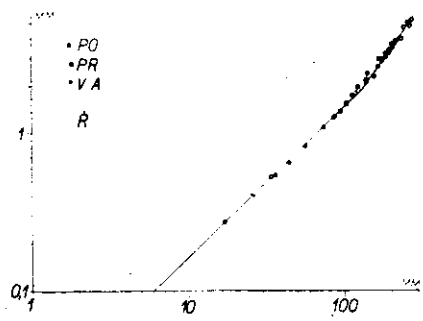

Fig. 2. Relation betwen the total length and diameter of vertebra in the logarithmic measure.
(Explanation of the abbreviations is the same as in the fig. 1.)

individual points dit not lie along the same line, but along two lines. Any lengthening of the straight lines was doubteful. The „otrezok" (in Russian, intereept on the length axis) for the lower line was 6 mm, for the upper one 15 mm (Raney and Webster, 1940, indicate that 3 days old bullheads measured 9,9 mm). The use of the Monastyrskij's logarithmic method shoved itself in the given place as dubious (see likewise Holčík 1960). Therefore I calculated the growth rate by means of E. Lea's method. Values of the first years of older fishes diminished with their increasing age (so-called „Phenomenon of Rosa Lee"), therefore, I corrected the values obteined by the Lea's method by means of Segerstråle's correction curve (Fig 3 and Tab. 1). In comparing of the growth of bullheads from different periods and localities, I calculated the growth characteristic (see Balon, 1964) according to the formule:

$$C_{th} = \frac{\log l_n - \log l_{n-1}}{0{,}43429} \cdot l_{n-1}$$

For orientative establishment of the age groups of bullhead populations from the back-water Poltruba (poisened in autumn 1955) I used the length-frequency method. I was obliged to find out the age individual curve tops (Fig. 4) according to the ages ascertained in the vertebrae.

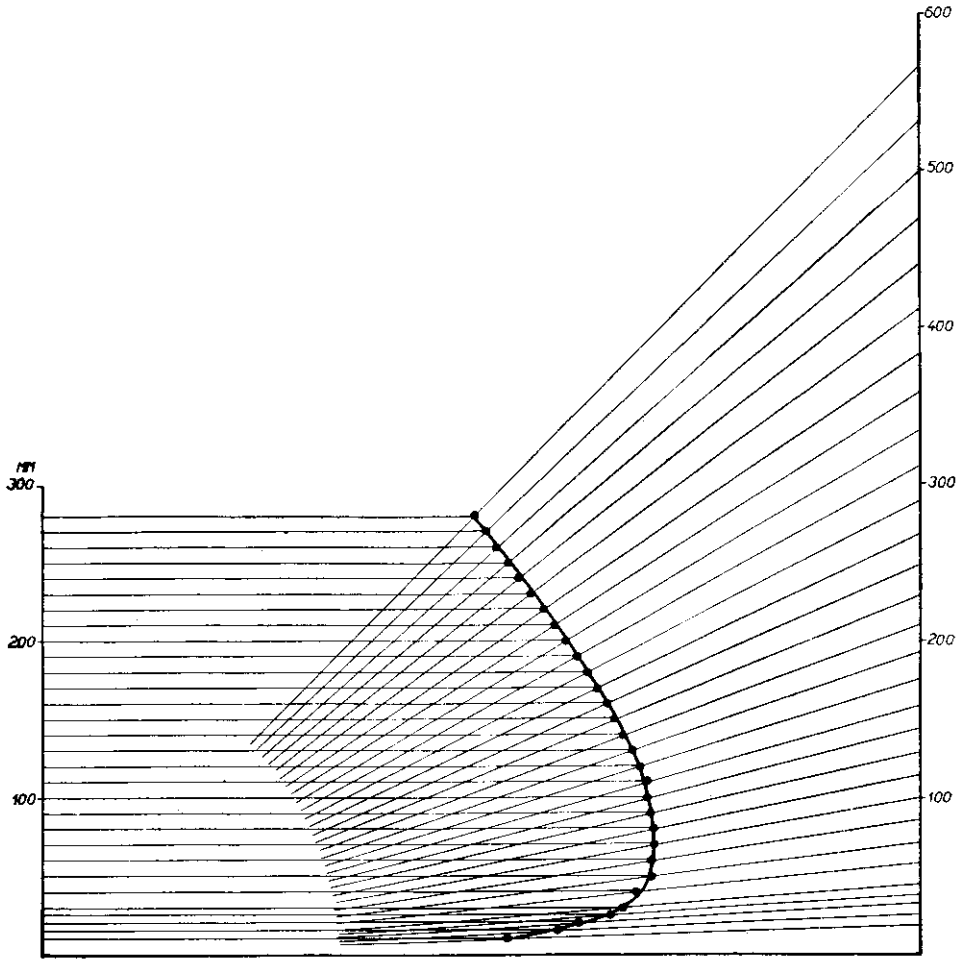

Fig. 3. Segerstråle's correction curve for the brown bullheads from the Elbe river basin

Results of back calculations of the bullhead's growth

The most rapid growth has been recorded in the back-water Procházkova tůň (14. 7. 1960), the sowest in the back-water Poltruba (7. 9. 1955). The results of the age and growth analyses are sumarised in the tables 2,3 and 4. Remarkable is the very fast growth of the bullheads during their first year of life. In the back-water Poltruba a remarkable difference appears in the growth rate of the fishes of 0 year class (Tab. 2). The presence of two length groups (as seen of fig. 4) may be caused by different ways of gathering the smaller ones were caught by strainers, the bigger ones were gathered after having been poisoned.

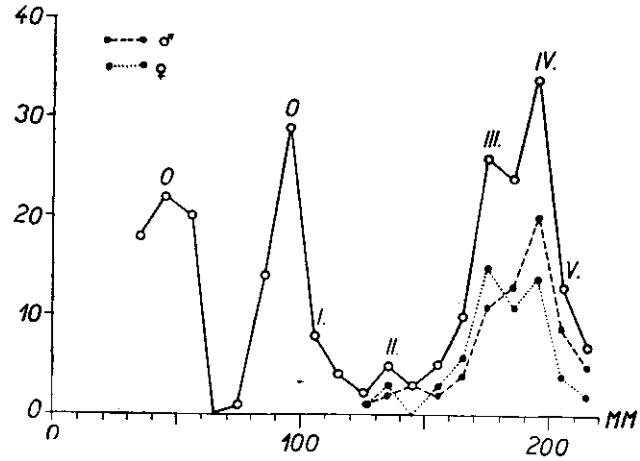

Fig. 4. Quantitative, age and sex composition of brown bullhead's population in the back-water Poltruba (7. 9. 1955)

Weight — length relationship

is demonstrated on Fig. 5. The back calculation of weights was accomplished by the method of Tjurin (1927). The body length and weight values were plotted on the bilogarithmic net (Fig. 6.). The author took here as the value of the intercept on the length axis the length of the fish when it was weighing 0,01 gram. The length was then 9 mm. The back calculation of weights for the previous years of life has been executed by means of the Monastyrskij's logarithmical board. The results are shown in the tables 7,8 and 9. From them it may be seen that bullheads from the back-water Procházkova have the best weight increments, while those from the back-water Poltruba the worst ones what is in agreement with the growth ratios.

Discussion

Comparing the statements about the growing of the bullheads in the back-water Poltruba during the years 1952 still 1955 we find out that the growth is slowed down in this back-water. It is evident that it is on account of the conditions becoming worse in the back-water which is caused by overabundance of fish and of want of food (Status of population see in paper Oliva, 1957). It is necessary to note that in the back-water was not carried out the fishing.

In the back-water Procházkova tůň there is clearly visible the improving of the growing of the bullhead. This is certainly connected with the gradually planting of beasts of prey (pike, wels) and also with the prohibition of fishing from 1954, when the territory on which the mentioned

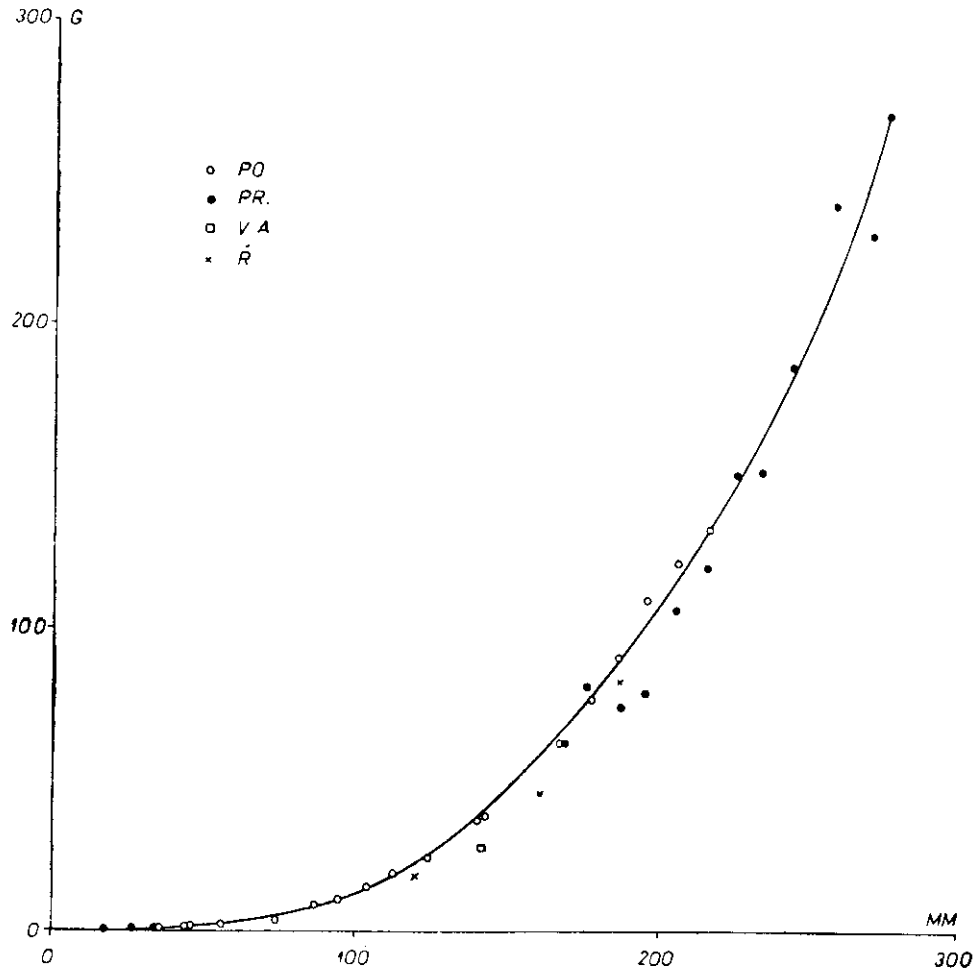

Fig 5. Length-weight relationship of brown bullhead. (Explanations of abbreviations see in the fig. 1.)

back-waters are, was proclaimed as a protected area (Oliva, 1957).

After the poisoning of the back-water Poltruba in the year 1955 there was stated by direct counting 2056 grown up bullheads on one hectar (i. e. 2,97 % from the amount of all fish in the back-water;Oliva, 1960), at the same time were evaluated by the Schnabel's method 6760 bullheads on one hectar (overcounted according the statement by Oliva, 1957). The abundant presence in comparison to other fishes was not found out. A three times greater amount of bullhead per hectar in the back-water Procházkova tůň does not testify that there would be a greater amount of fishes in the total (that would be visible at their growth — but the bullheads were growing in both back-waters approximately equally), it is

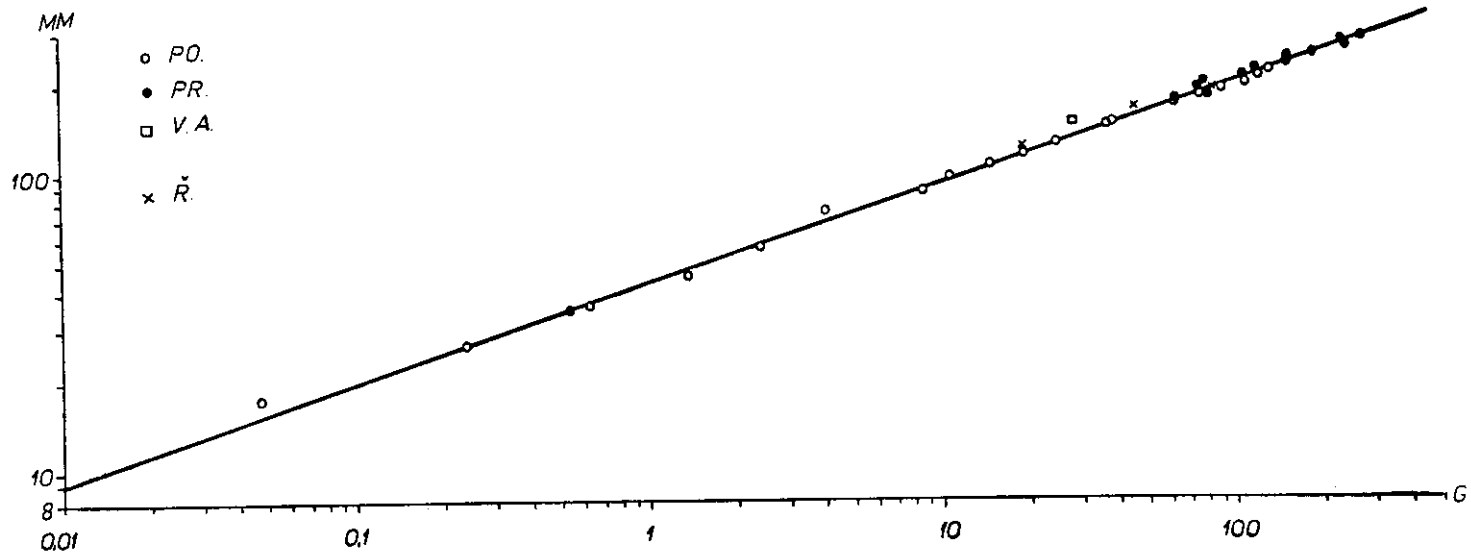

Fig. 6. Length-weigth relationship of brown bullheads in the logarithmic measure. (Explanation of abbreviations see in the fig. 1.)

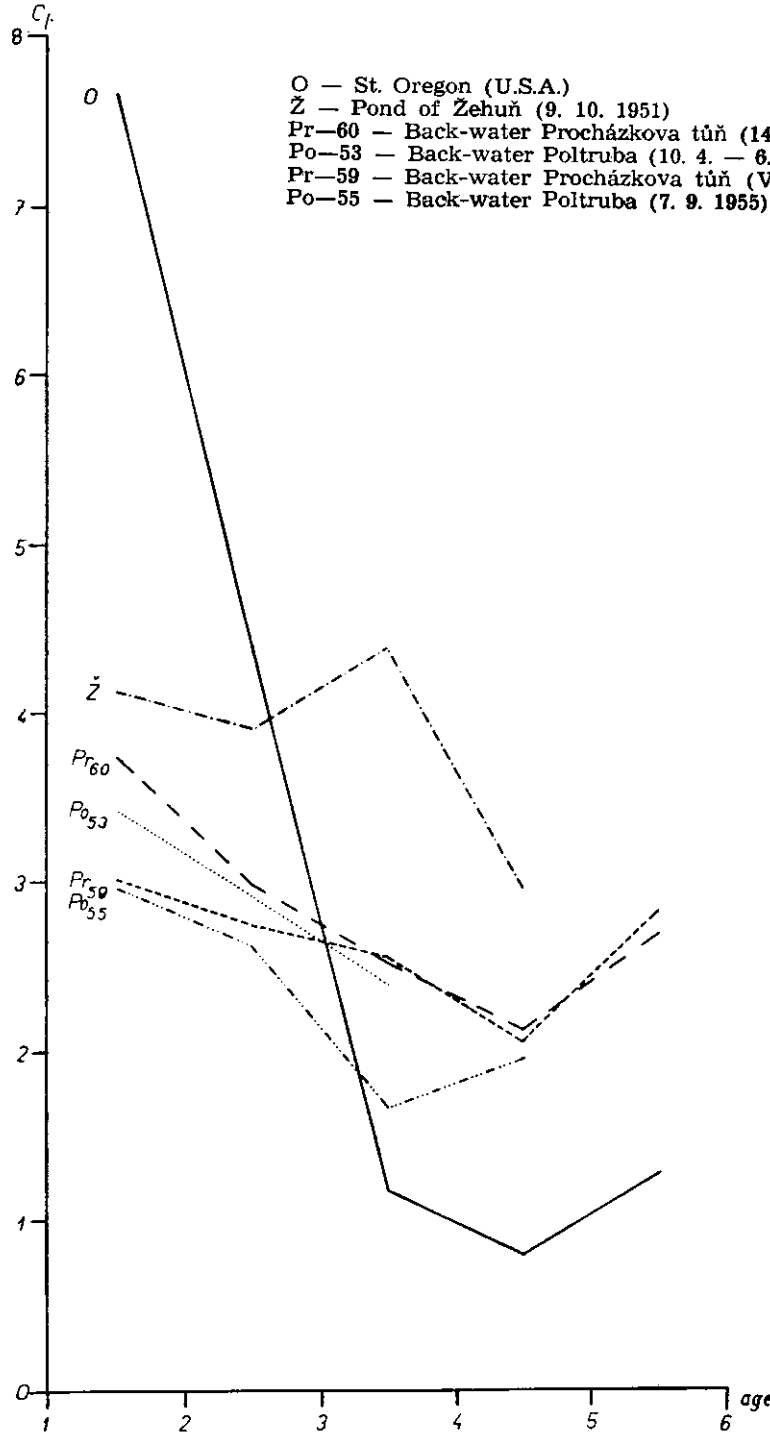

Fig. 7. Growth characteristic of brown bullheades of some waters

evident that the betst of prey which were constant replaced into the back–water, decimated the state of white fishes and not the bullhead. This is also corresponding to the statements of Ivlev and Protasov (1948) who are writing that in the lake Orechovo (White Russian SSR) were the bullheads are yet living several years, practically only those remained as well as the pikes.

The different speed of growing of the O years class specimens is given also by other authors too. Raney and Webster (1940) state the length of the body of the bullhead as 35—48 mm in August, 5—79 mm in September, 41—93 in October. Carlander (1951, 1952) for Ameiurus melas melas: 15—99 mm in August and 33—58 in September.

In all Elbian back-waters are the bullheads well increasing in the first year o life. The same was observed also with other fish in the back-waters around the Elbe (Oliva 1958, Frank 1958, 1958 a, Čihář and Frank 1958), which is in connection with the trophical conditions (Hensel, 1963).

More detailed statements about the growth of the bullhead in North America are not known .These ones hich I am showing in tab. 5, I took over from Carlander's work (1950, 1953). The lengths of the body of the bullhead in the first two years of life as it is given by Embody (1915, 1921) correspond to our conditions. But according to Lewis (1950)and Oregon St. Game Comm. (1952) the bullhead is growing much quicker in this native country than with us. In further years the increases are very small and the characteristic features of the growing are very low. It semms therefore that in good conditions the bullhead is albe to grow as well as in his native country.

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Vek a rýchlosť rastu sumčeka (Ictalurus nebulosus Le Seuer, 1819) v jazierkach inundačného územia rieky Labe v Československu

K. HENSEL

Súhrn

Autor sledoval rast 359 sumčekov (Ictalurus nebulosus) z jazierok inundačného územia stredného toku Labe pri Čelákoviciach.

Vek určoval podľa prírastkov na stavcoch, ktoré boli preparované za pomoci terciárneho fosforečnanu sodného (3 % roztoku) a merané pod binokulárnou lupou (laterálne priemery).

Pomer dĺžky tiel a priemerov stavcov bol nelineárny, pričom ani po nanesení hodnôt na bilogaritmickú sieťku neležali jednotlivé body pozdĺž jednej priamky, ale dvoch. Preto bol rast spätne prepočítavaný pomocou metódy E. Lea a výsledné hodnoty korigované pomocou Segerstrálého korekčnej krivky. Váhy pre predošlé roky života boli vypočítané pomocou Tjurinovej metódy.

Autor prišiel k nasledujúcim uzáverom:

1. V jazierku Poltruba sa v rokoch 1953—1955 následkom zhoršených podmienok spôsobených nadmerným prerybnením burinnými rybami a z toho vyplývajúcim nedostatkom potravy rast sumčekov značne spomalil.
2. V jazierku Procházkova tůň sa rast sumčekov postupne zlepšuje. Zlepšovanie rastu prevdepodobne súvisí s vysadzovaním dravých rýb.
3. Na všetkých sledovaných lokalitách je pozorovaný veľmi dobrý rast v prvom roku života, čo úzko súvisí s trofickými pomermi v jazierkach.
4. Pozoruhodná je rozdielna rýchlosť rastu tohoročkov, ktorá je ostatne uvádzaná i inými autormi.
5. Ukazuje sa, že v dobrých podmienkach môžu sumčeky rásť práve tak dobre ako vo svojej domovine. Celkove horší rast sumčekov v Polabí sa dá vysvetliť prerybnením burinnými rybami a z toho vyplývajúcim nedostatkom potr
6. Váhové prírastky odpovedajú pomerom v raste.

Возраст и темп роста американского сомика (Ictalurus nebulosus Le Sueur, 1819) в пойменной области среднего течения реки Лабе в Чехословакии

К. ГЕНЗЕЛЬ

Резюме

Автором исследован возраст и темп роста 359 американских сомиков (Ictalurus nebulosus) из озерец пойменной области среднего течения р. Лабе (Ельбе) у города Челаковице в средней Чехии.

Возраст сомиков был определен по годичным приростам позвонков, препарированных при помощи трехпроцентного раствора тринатрийфосфата и измеренных под бинокулярной лупой (латеральные средние).

Отношение длины тел и средных позвонков оказалось нелинейным, причем даже после нанесения стоимостей на билогарифмическую сеть отдельные точки не были расположенны вдоль одной прямой, но вдоль двух. Поэтому был рост пересчитан обратно по методу Э. Леа а результирующие стоимости корректированы при помощи коррекционной кривой по Segerstråle.. Весы за предыдущие года жизни были исчислены по методу Тюрина.

Автор пришел к следующим выводам:

1. Рост сомиков в озерце Полтруба значительно замедлился в течение гг. 1953—1955 вследствие чрезмерного переполнения озерца сорными рыбами и вытекающим из того недостатком питания.

2. В озерце Прохазкова тунь (заводь) обнаружено постепенное улучшение роста сомиков. Улучшение роста связано по всей вероятности с трофическими условиями озерца.

3. Во всех обследуемых локалитетах наблюдается очень хороший рост в первом году жизни, что тесно связано с трофическими условиями озерец.

4. Замечательной является разная скорость роста первогодков, которая впрочем подчеркивается и другими авторами.

5. Оказывается, что сомики могут в хороших условиях расти совсем так удачно, как и в своей родине. Во общем можно пояснить ухудшение роста сомиков лабской области переполнением озерец сорными рыбами и вытекающим из того недостатком питания.

6. Приросты веса соответствуют приростам роста.

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Total length in mm	Vertebra's diameter	Ordinate length for construction on of correction curve
10	0,19	19
15	0,25	25
20	0,32	32
25	0,39	39
30	0,45	45
40	0,59	59
50	0,72	72
60	0,86	86
70	1,00	100
80	1,14	114
90	1,29	129
100	1,44	144
110	1,59	159
120	1,76	176
130	1,93	193
140	2,10	210
150	2,29	229
160	2,48	248
170	2,68	268
180	2,89	289
190	3,11	311
200	3,34	334
210	3,59	359
220	3,84	384
230	4,12	412
240	4,40	440
250	4,69	469
260	5,00	500
270	5,32	532
280	5,67	567

Tab. 1. Graphically interpolated diametes of vertebrae of brown bullheads for construction of Segerstråle's correction curve.

Age group	Number of fish	Total length in mm		Weight in g		Vertebra's diameter in mm		Year of life					Date
		Ave.	Ranges	Average	Ranges	Ave.	Ranges	1	2	3	4	5	
0+	50	17	12—21	0,047	0,010—0,094	0,27							17. 5. 1955
0+	30	26,4	21—34	0,236	0,104—0,422	0,41	0,36—0,45						30. 7. 1955
0+	60	46,2	32—60	1,5	0,45—3,05	0,65[1])	0,45—0,91						
0+	42	92,4	74—104	9,8	4—14	1,32	1,09—1,45						
1+	11	108,7	97—127	16,9	11—26	1,68	1,45—2,09	86					
2+	10	151	140—168	37[2])	36—38	2,29	2,09—2,54	99	130				7. 9. 1955
3+	42	180,2	166—196	77,9[3])	62—95	2,87	2,36—3,27	99	135	166			
4+	33	195	180—210	105,3[4])	83—120	3,23	2,91— 3,73	99	131	163	182		
5+	11	208,2	192—217	123,6[5])	98—145	3,76	3,64—3,91	99	128	151	173	198	
							Average:	96,4	131	160	177,5	198	
	289						Increments:	96,4	34,6	29	17,5	20,5	

1. Measured only in 30 specimens
2. Weighted only 3 specimens
3. Weighted only 9 specimens
4. Weighted only 9 specimens
5. Weighted only 5 specimens
6. All specimens from out left of back- ter Poltruba

Tab. 2. Growth of brown bullhead in ıe back-water Poltruba.

Age group	Number of fishes	Total length in mm		Weight in g		Vertebra's diameter		Year of life						Date
		average	ranges	average	ranges	average	ranges	1	2	3	4	5	6	
0+	10	34,2	30,5—37	0,54	0,32—0,68	0,52	0,45—0,59							29. 8. 1956
3+	5	174	169—180	83,2	65—99	2,91	2,82—3,09	94	129	166				22. 5. 1955
							Increments:	94	35	37				
4+	1	217		140		3,64		110	152	178	204			
5+	1	220		140		4,27		92	119	146	176	200		
6+	3	256,3	242—273	263,7	200—280	4,91	4,45—5,18	92	129	167	194	226	243	VI. 1959
	5						Average:	98	133,3	163,7	191,3	213	243	
							Increments:	98	35,3	30,4	27,6	21,7	30	
3+	13	186,8	170—198	73,6	55,5—89	3,17	2,91—3,45	95	135	170				
4+	23	213,3	189—231	118,8	66—165	3,73	3,36—4,09	104	145	175	203			
5+	5	231,8	213—246	151,6	93—190	4,36	3,91—4,91	99	140	174	195	219		
6+	5	264	252—280	226	210—260	4,96	4,63—5,45	109	152	186	212	232	254	14. 7. 1960
	46						Average:	101,7	143	176,2	203,3	225,5	254	
							Increments:	101,7	41,3	33,2	27,1	22,2	28,5	

Tab. 3. Growth of brown bullheads in back-water Procházkova tůň

Age group	Nr. of fish	Total length in mm	Weight in g	Vertebras diameter in mm	Year of life			Locality and date
					1	2	3	
2+	1	142	28	2,36	95	133		Veľká Arazimova 26. 4. 1953
				Increments:	95	38		
1+	1	120	19	1,81	99			Řehákova bouda 28. 2. 1954
2+	1	161	46	2,45	108	142		
3+	1	187	83	3,09	100	142	169	
				Average:	102,3	142	169	
				Increments:	102,3	39,7	27	

Tab. 4. Growth of brown bullhead in back-waters Velká Arazimova and Řehákova bouda

Age group	Number of fishes	Total length in mm	Weight in g	Year of life			Date and locality
				1	2	3	
2+	1	142	28	9	23		Velká Arazimova 26. 4. 1953
1+	1	120	19	13			Řehákova bouda 28. 2. 1954
2+	1	161	46	14	32		
1+	1	187	83	13	36	63	
			Average:	13,3	34	63	
			Increments:	13,3	20,7	29	

Tab. 9. The back calculated average weights of brown bullheads from the back-waters Velká Arazimova and Řehákova bouda

Locality and date	Averages total lengths on the end of single years of growth in mm					
	1	2	3	4	5	6
Žehuň 9. 10. 1951 (Frank, 1955)	93,8	145,5	190,3	239,5	271	
Procházkova tůň 14. 7. 1960	101,7	143	176,2	203,3	225,5	254
Řeháková bouda 28. 2. 1954	102,3	142	169			
Procházkova tůň VI. 1959	98	133,3	163,7	191,3	213	243
Poltruba 7. 9. 1955	96,4	131	160	177,5	198	
Velká Arazimova 26. 4. 1953	95	133				
Procházkova tůň 22. 5. 1955	94	129	166			
Labe (near Kersko) VIII. 1951 (Frank, 1955)	82,5	126				
Labe (near Hradec) IX. 1951 (Frank, 1955)	78,7	118,6	159	200		
Poltruba 10. 4. — 6. 6. 1953 (Frank, 1955)	75,7	119	152	178		
Poltruba summer 1952 (Frank, 1955)	76	113				
St. Oregon (U.S.A.) (Oreg. St. G. Comm. 1952)	76	208	257	269	277	290
St. Iowa (U.S.A.)) Levis, 1950)	—	216	246			
U.S.A. (Embody, 1921)	76					
U.S.A. (Embody, 1915)	76—102	127—152				

Tab. 5. Rewiew on growth rate of brown bullheads in various reservoirs

Locality and date	Growth characteristic					
	1	2	3	4	5	6
Žehuň 9. 10. 1951 (Frank, 1955)	4,12	3,90	4,38	2,96		
Procházkova tůň 14. 7. 1960	3,74	2,98	2,52	2,11	2,68	
Labe (near Kersko) VIII. 1951 (Frank, 1955)	3,49					
Poltruba 10. 4. — 6. 6. 1953 (Frank, 1955)	3,42	2,91	2,40			
Řehákova bouda 28. 2. 1954	3,35	2,47				
Labe (near Hradec) IX. 1951 (Frank, 1955)	3,23	3,48	3,65			
Veľká Arazimova 26. 4. 1953	3,20	2,74	2,55	2,05	2,81	
Procházkova tůň VI. 1959	3,01					
Polruba summer, 1952 Frank, 1955)	3,01					
Procházkova tůň 22. 5. 1955	2,97	3,25				
Poltruba 7. 9. 1955	2,96	2,62	1,66	1,94		
St. Oregon (U.S.A.) (Oreg. St. G. Comm., 1952)	7,65	4,40	1,17	0,79	1,27	
St. Iowa (U.S.A.) (Lewis, 1950)	—	2,81				

Tab. 6. Growth charakteristic of brown bullheads in various reservoirs

Age group	Number of fishes	Total length in mm		' Weight in g		Year of life					Date
		average	ranges	average	ranges	1	2	3	4	5	
0+	50	17	12— 21	0,047	0,010—0,094						17. 7. 1955
0+	30	26,4	21— 34	0,236	0,104—0,422						30. 7. 1955
0+	60	46,2	32— 60	1,5	0,45—3,05						
0+	42	92,4	74—104	9,8	4—14						
1+	11	108,7	97—127	16,9	11— 26	8					
2+	10	151	140—168	37 [1]	36— 38	11	24				7. 9. 1955
3+	42	180,2	166—196	77,9[2]	62— 95	13	32	59			
4+	33	195	180—210	105,3[3]	83—120	14	32	62	85		
5+	11	208,2	192—217	123,6[4]	98—145	13	29	46	70	105	
	289				Average:	11,8	29,2	55,7	77,5	105	
					Increments:	11,8	17,4	26,5	21,8	27,5	

1. weighted only 3 specimens
2. weighted only 9 specimens
3. weighted only 9 specimens
4. weighted only 5 specimens

Tab. 7. The back calculated average weights of brown bullheads from the back water Poltruba

Age group	Number of fishes	Total length in mm		Weight in g		Year of life						Date
		average	ranges	average	ranges	1	2	3	4	5	6	
3+	5	174	169—180	83,2	65—99	13	34	72				22. 5. 1955
0+	10	34,2	30,5—37	0,54	0,32—0,68							29. 8. 1956
4+	1	217		140		18	48	77	120			
5+	1	220		140		10,3	23	41	72	105		
6+	3	256,3	242—273	263,7	200—280	11	31	69	104	190	240	VI. 1959
					Average:	13,1	34	62,3	98,7	147,5	240	
					Increments:	13,1	20,9	28,3	36,4	48,8	92,5	
3+	13	186,8	170—198	73,6	55,5—89	10	28	55				
4+	23	213,3	189—231	118,8	64—165	15	39	69	104			
5+	5	231,8	213—246	151,6	93—190	12,5	35	66	93	140		14. 7. 1960
6+	5	246	252—280	226	210—260	17	45	80	118	155	210	
					Average:	13,6	36,7	67,5	105	147,5	210	
					Increments:	13,6	23,1	30,8	37,5	42,5	62,5	

Tab. 8. The back calculated average weights of brown bullheads from the backwater Prochádzkova tůň