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Title: The dynamics of the fecundity of fishes, for example the roach, Rutilus rutilus (L.). [Conclusions and figure/table captions only].

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The dynamics of the fecundity of fishes, for example the roach Rutilus rutilus (L.). [Conclusions and figure/table captions only.]

Vopr. Ikhtiol. 3, 1, 67-83 1963

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Conclusions:

- 1.) The comparative ecological analysis of the fecundity of different populations and of different generations of a population should give age groups, taking into account their length.
- 2.) The level of fecundity of the subspecies of roach is narrowly connected with the rate of growth. The absolute fecundity of fast-growing subspecies, Caspian roach Rutilus rutilus caspicus (Jak.), Azov roach R.r. heckeli (Norm.), some populations of Siberian roach R.r. lacustris (Pall.) and European roach R. rutilus (L.), is greater than that of the slow-growing sub species -river roach R.r. fluviatilis (Jak.) and the river population of the typical roach R. rutilus (L.). The absolute fecundity of the dwarf type, Usboi roach R.r. uzboicus Berg.) is also low.
- 3.) The relative fecundity characterises the intensity of reproductive capacity of the individual and changes in different conditions. In fast growing fish it is higher than in slow growing ones, but the dwarf type, in spite of a lower growth rate, is characterized by high reproductive capacity.
- 4.) An improvement of conditions for fattening populations of river roach in reservoirs (Uchinsk Reservoir after the addition of Dreissena, Mozhaisk Reservoir in the first year of flooding) provides a high rate of growth in these populations and an increase in their absolute and relative fecundities.
- 5.) The amount of roe cast by individuals of the same age in different years is determined mostly by the rate of growth upto puberty. The growth rate after puberty influences the supply of nutritious substances in the eggs, increasing their weight.
- 6.) In every generation the individual is distinguished by the growth rate and therefore by the fecundity. The fast-growing individual becomes mature at an earlier age, but dies earlier. The absolute and relative fecundities of females which reach puberty a year later (connected with lower growth rate) are less than those of the fast-growing individuals of the same age. But the slow-growing live longer and produce more eggs than the fast-growing.
- 7.) Fecundity is a characteristic indication and like other characteristic indications it adapts to changes in the provision of food. In this way the necessary conditions for the existence of the species - unity with the surroundings - are preserved.

Table 1.

Comparison of the absolute fecundity (AF) of roach of length 19-20 cm from various bodies of water.

Body of Water	Number of eggs 1000's	Predominant Age years.
River Moskva	11.8 - 24.9	7 -8
Mozhaisk Reservoir	19.1 - 37.0	5 -6
Uchinsk Reservoir	18.4 - 23.0	4 -5
River Vyatka	20.6 - 28.2	8 -9
Middle Volga	18.4 - 23.5	over 7
Rybinsk Reservoir	19.4 - 31.0	8 -9
Caspian roach of the western parts of the North Caspia	28.4 - 34.0	3 -4

Table 2.

Absolute fecundity of sub species of roach, 1000 eggs.

Subspecies	Range of fecundity	Fecundity of predominant age- groups in population
<u>Rutilus rutilus caspicus</u>	9.9 - 147.8	40.3 - 61.7
<u>R.r. heckeli</u>	13.0 - 123.0	19.0 - 71.0
<u>R.r. rutilus</u>	2.1 - 75.0	3.3 - 57.4
<u>R.r. fluviatilis</u>	1.1 - 72.1	3.4 - 18.4
<u>R.r. lacustris</u>	4.1 - 85.0	5.9 - 85.0
<u>R.r. aratensis morpha phragmiteti</u>	3.184- 47.840	8.1 - 21.8
<u>R.r. uzbaicus</u>	0.9 - 15.8	4.7 - 12.2
<u>R.r. bucharensis</u>	4.5 - 14.2	9.5

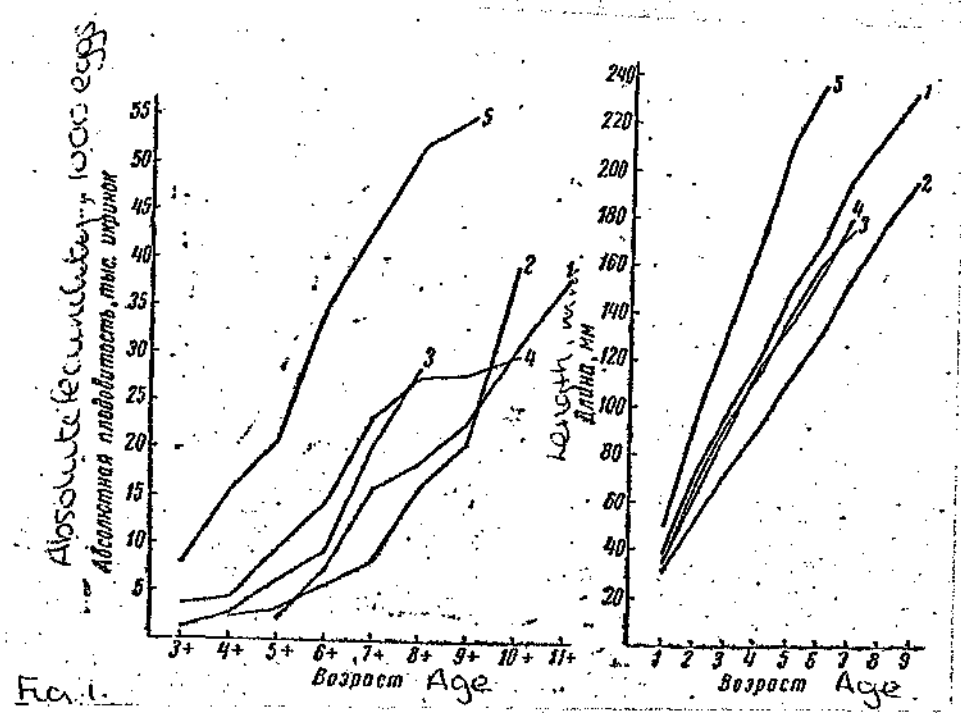


Fig. 1. Absolute fecundity and growth rate of roach of waters in the European parts of the USSR 1 - R Moskva (our figures), 2 - R Vyatka (Druagin, 1928) 3 - Middle Volga (Lukin & Shteinfeld, 1949; Koroleva, 1960); 4 - Rybinsk Reservoir (Zakharova, 1956; Sergeev et al, 1956; Svetovidova, 1960), 5 - Uchinsk Reservoir (our figures.)

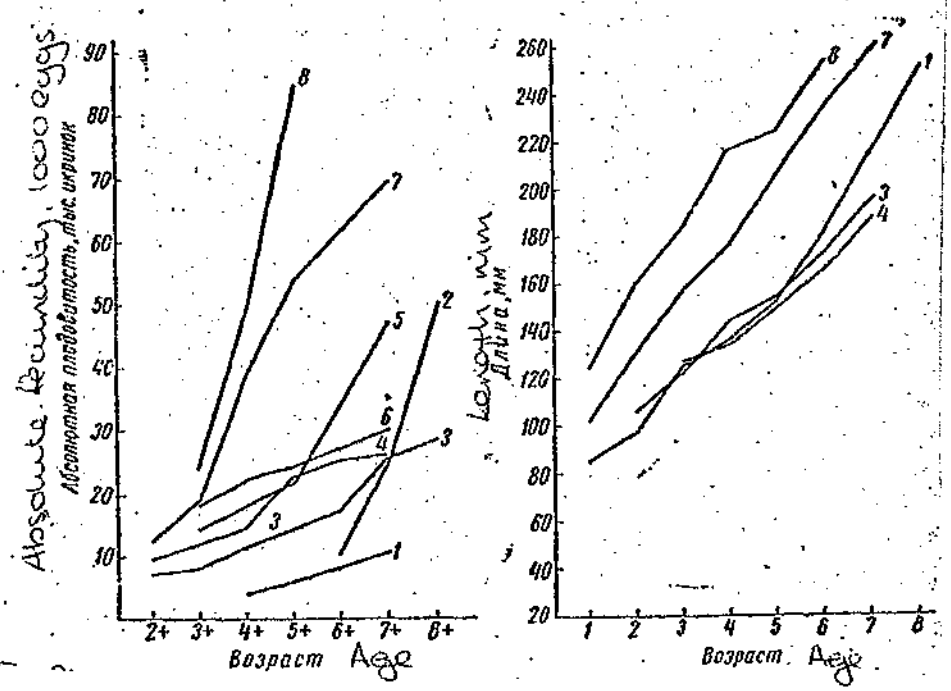


Fig. 2. Absolute fecundity and growth rate of Siberian roach in various bodies of water 1 - R. Ob (Loganzen & Petkevich, 1958), 2 - Ufaley Lake (Troitskaya, 1941), 3 - Posol'sk Sor, Baikal (Kartushin, 1958), 4 - Istoksk Sor, Baikal (Kartushin, 1958), 5 - Hay Kurya, R. Tom (Manadeeva, 1953); 6 - Lake Beloe, Minusinsk (Manadeeva 1953); 7 - Head waters of R.Ob (Manadeeva, 1953); 8 - Lake Kotokel' (Kartushin, 1958).

Table 3.

Comparison of the relative fecundity of various subspecies of roach and various populations.

Subspecies and populations	Absolute fecundity	Relative fecundity	Growth rate
Semi-diadromous types of roach			
Caspian roach <u>R.r. caspius</u>	High	226	High
Azov roach <u>R.r. heckeli</u>	High	170	High
Roach which spend all their lives in freshwater.			
<u>Typical roach R.rutilus rutilus</u>			
R. Moskva	Low	106	Low
R. Vyatka	Low	131	Low
Rybinsk Reservoir	Low	128	Low
Uchinsk Reservoir	High	140	High
<u>River roach R.r. fluviatilis</u>			
Middle Volga	Low	133	Low
<u>Siberian roach R.r. lacustris</u>			
R. Ob'	Low	64	Low
Lake Ufalei	Average	122	Low
Hay Kurya, R. Tom.	Average	168	Average
Lake Baikal			
Posol'sk sor	Average	224	Average
Istoksk sor	Average	274	Average
Lake Kotokel'	High	232	High
Head waters of the R. Ob'	High	290	High
<u>Aral reed roach R.r. aratensis morpha phragmiteti</u>			
Usbai roach <u>R.r. uzboicus</u>	Low	185	Low

Table 4.

Fecundity of roach of the same age in the Uchinsk Reservoir in different years, depending on their growth,

Year	L ₁	L ₃	Average annual increase after reaching puberty mm.	Absolute fecundity 1000 eggs	Correlation of fecundity of fish of different generations	Relative fecundity $\frac{\text{number of eggs}}{\text{weight of smaller fish.}}$	weight of eggs mg.	n
4 year olds								
1936	46	126	36	11.6	1.0	168	0.90	30
1960	42	131	47	18.5	1.6	195	1.02	7
1961	42	127	41	13.4	1.2	168	0.90	11
5 year olds								
1958	45	124	38	25.7	2.0	183	1.04	12
1960	39	109	42	20.5	1.6	172	1.12	4
1961	37	100	34	13.0	1.0	163	0.80	8
6 year olds								
1958	53	152	31	57.4	2.2	196	1.07	12
1960	40	110	33	25.9	1.0	170	1.34	16
1961	42.6	125.5	29	28.0	1.1	187	1.17	5

Table 5.

Growth rate of fish of the same generation but with different fecundity in the Uchinsk Reservoir. (Observations made in 1958 and 1960).

growth rate	1954 generation					1952 generation 6 year olds.		
	4 year olds			6 year olds.		AF-34.8 1000 eggs	AF-47.0 1000 eggs	AF-76.0 1000 eggs
	AF-7.8 1000 eggs	AF-12.0 1000 eggs	AF-18.8 1000 eggs	AF-20.0 1000 eggs	AF-30.7 1000 eggs			
L ₁	43	45	57	38	42	49	54	55
L ₂	80	87	104	70	78	92	101	110
L ₃	119	123	151	105	114	140	156	166
L ₄	153	163	182	141	147	188	190	218
L ₅	-	-	-	172	188	217	220	251
L ₆	-	-	-	202	213	234	239	270

Table 6.

Changes of fecundity index of fish of the same generation.

Growth rate								Fecundity		Weight of eggs mg.	Rate of reaching fecundity	n
L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇	L ₈	absolute 1000's	relative			
1953 Generation												
47	83	111	142	175	-	-	-	16.6	150	1.12	1.0	3
35	76	112	131	168	195	212	-	28.6	172	1.22	2.3	1
37	69	105	133	162	190	207	221	36.0	197	1.20	1.3	3
1954 Generation												
43	80	119	153	-	-	-	-	7.8	140	0.90	1.0	7
42	78	114	147	188	213	-	-	30.7	191	1.28	3.9	9
45	76	109	154	188	217	233	-	35.3	159	1.13	1.2	3

Table 7.

Comparison of fecundity index of fish of different growth rates.

Age years	Average growing fish				Fast growing fish			
	AF	RF	Weight of eggs mg.	Rate of reaching fecundity	AF	RF	Weight of eggs mg.	Rate of reaching fecundity
3	-	-	-	-	7.6	168	0.77	1.0
4	7.8	140	0.90	1.0	21.4	197	1.03	2.7
5	19.2	167	1.02	2.5	34.6	191	1.03	1.6
6	26.5	174	1.23	1.4	36.0	230	1.13	1.1
7	32.0	165	1.17	1.2	-	-	-	-
8	36.0	197	1.20	1.2	-	-	-	-

Table 8.

Growth and fecundity of roach in R. Moskva (1960) and in Mozhaisk Reservoir (1961).

Age years	Length mm	Increase (by calculation)		Fecundity		Weight of eggs mg	n.
		Linear mm	Weight g.	Absolute 1000's	Relative		
<u>R. Moskva.</u>							
4		5					
5	121	19	43	2.5	88	1.25	1
6	163	21	57	7.3	106	1.29	1
7	190			15.7	135	1.36	4
	(181-198)	17	36	(12.3-21.6)			
8	202			18.6	131	1.43	10
	(187-222)	15	18	(11.8-27.6)			
9	207			22.8	148	1.39	8
	(196-231)	14	123	(16.0-41.4)			
10	234			30.2	120	1.50	2
	(199-270)	31	52	(16.2-44.2)			
11	266			38.0	124	1.20	1
<u>Mozhaisk Reservoir</u>							
3	149			7.9	158	1.01	1
4	181	85	-	22.5	229	1.05	6
	(150-205)	83	-	(10.7-30.4)			
5	197			28.0	191	1.18	6
	(187-213)	71	154	(19.1-38.3)			
6	206			33.0	199	1.22	8
	(190-228)	64	187	(19.5-45.0)			
7	222			40.3	194	1.26	10
	(200-250)	59	164.2	(25.2-60.0)			
8	227			45.4	206	1.31	8
	(197-255)	54	250	(26.1-62.2)			
9	256			91.9	304	1.05	1
10	237	41	139	55.3	225	1.36	1
11	258	45	148	88.5	274	1.29	3
	(255-260)			(73 - 101)			

Table 9.

Rate of increase of fecundity of the roach with age in different bodies of water.

Age years	R. Moskva	Reservoirs.	
		Uchinsk	Mozhaisk
3	-	2.0	2.9
4	-	1.3	1.3
5	2.5	1.7	1.2
6	2.0	1.3	1.1
7	1.3	1.2	2.0
8	1.2	1.0	-
9	1.3	-	1.5
10	1.3	-	-

Table 10.

Changes of population fecundity of the roach.

Year	Uchinsk Reservoir			R. Moskva			Mozhaisk Reservoir.		
	Average AF	Av. age of Population	Population fecundity	Average AF	Average age of Population	Population fecundity	Average AF	Average age of Population	Populatio fecundity
1958	29.15	4.98	5.85	-	-	-	-	-	-
1960	24.36	5.57	4.37	20.09	8.26	2.42	-	-	-
1961	18.75	4.97	3.77	-	-	-	41.56	6.65	6.25

Notice

Please note that these translations were produced to assist the scientific staff of the FBA (Freshwater Biological Association) in their research. These translations were done by scientific staff with relevant language skills and not by professional translators.