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ON SOME PROBLEMS OF REPRODUCTION OF RUFF, *GYMNOCEPHALUS CERNUUS* (L., 1758) IN THE LAKE DĄBIE

O NIEKTÓRYCH ZAGADNIENIACH REPRODUKCJI JAZGARZA, *GYMNOCEPHALUS CERNUUS* (L., 1758) Z JEZIORA DĄBIE

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Changes in the Lake Dąbie ruff gonad maturity and egg diameter were studied. Absolute and relative fecundity values were calculated. The egg diameter distribution suggests portional spawning. The absolute fecundity was found to range within 13,338–82,233 and was most closely correlated with the total fish weight. No effect of body size, age, and ovary weight on the relative fecundity was found.

INTRODUCTION

In the planned inland fishery, the ruff is generally regarded as an undesirable component of fish fauna and so far the economic importance of the species has not been conspicuous. Nevertheless, a gradual increase in catches of less valuable species has been observed in numerous water bodies, a phenomenon typical of waters subject to intensified eutrophication (Dudziński, 1978; Prejs, 1978). For example, a ruff catch in the Kleiner Haff (GDR), averaged for 1971–1980, was 4 times that of 1967–1970 (Pęczalska, 1971; Bast et al., 1983). In the Lake Dąbie, too, low-value species (mainly ruff and stickleback) almost doubled their contribution to the 1976–1981 catches, compared with the period of 1970–1975 Abdel-Baky, 1983).

These marked changes in catches, reflecting altered composition of fish faunas in various water bodies, as well as the predicted importance of the low-value species, a result of growing eutrophication of inland waters, call for studies – more comprehensive than those carried out at present – on different aspects of biology of those species.

So far, biology of the ruff inhabiting Polish waters has been treated in few papers only, the publications concerning mainly growth (Zawisza, 1953; Adamus et al., 1978) and feeding (Pliszka and Dziekońska, 1953; Leszczyński, 1963; Filuk and Żmudziński, 1965). Reproduction of the species has not been dealt with, if one does not count the results of studies carried out in the Szczecin Lagoon and reported in fragments only (Pęczalska, 1971).

The aim of the present work was to study certain aspects of sexual maturation of the Lake Dąbie ruff and to determine its absolute and relative fecundity.

MATERIALS AND METHODS

Materials were collected within 29 April 1985 – 5 September 1986. All the fishes examined constituted a by-catch in commercial trap catches in the Lake Dąbie, a large (about 52 km^2 area) and shallow (2.8 m average depth) deltaic lake (Prawdzic, 1961) situated in the vicinity of Szczecin. A total of 197 individuals were obtained. They were measured (l.t. and l.c.) to 0.1 cm, weighed to 0.5 g, and sexed. Their gonad maturity stage was determined according to the 8-stage Maier scale. The otoliths were used for age reading. Ovaries and testes, dissected out and cleaned from the surrounding fat, were weighed to 0.05 g in order to determine the gonad maturity coefficient as in the formula

$$G = \frac{g \cdot 100}{W} \tag{1}$$

where: G = gonad maturity coefficient
g = gonad weight
W = total fish weight

Those testes at Maier scale stage 2 were not weighed due to their small size and weight below 0.05 g.

Gonads of 30 females were preserved in 5% formalin to determine their individual absolute fecundity. Before the eggs in an ovary could be counted, those that would be laid in the upcoming spawning should be identified. Preliminary observations under the microscope revealed a mature ruff ovary to contain three types of eggs: a) small, hyaline and colourless; b) larger, opaque, strongly varying in diameter, colour changing with increasing diameter from white or pale yellow to yellow and orange; c) large, partly hyaline, yellow-orange and orange in colour. The diameter of eggs taken from 5 females with gonads at various stages of maturity (4–6) was measured. Before measurement, the formalin-preserved and dried eggs were soaked in water for 48 h. The measurements failed to show any separation in egg diameter relative to the egg type. Detailed histological observations on tench ovaries (Brylińska and Długosz, 1978) showed that only those eggs were laid in the nearest spawning which, prior to spawning (May, June), were strongly vacuolised and contained various amounts of yolk. On the other hand, those oocytes that are at the stage of protoplasmic growth at that time will be laid during the subsequent spawning. Hislop and Hall (1974) and Morse (1980) state, too, that yolk-containing (opaque) eggs will form a generation of a given year, while smaller, hyaline and yolkless ones form a generation of reserve cells to be laid next year. In consequence, the larger opaque eggs (type b) measuring 0.20 mm and more in diameter are considered to go through the process of yolk accumulation (trophoplasmic growth). Thus only they and large, fully mature egg cells (type c) may be taken into account when calculating fecundity.

The number of eggs in an ovary was determined dry by means of weighing. The preserved ovaries were thoroughly rinsed in running water and the eggs carefully removed from them, placed on the blotting paper, any coagulations broken down, and dried for a few days. All the dried eggs were weighed to 5 mg; three subsamples were then taken from each sample and weighed to 0.5 mg. Eggs in two subsamples were counted under the microscope and the following formula was applied to the results:

$$F = \frac{n \cdot A}{a} \quad (2)$$

where: F = number of eggs in ovaries of the female examined (total individual fecundity)
n = number of eggs in a subsample
A = weight of all eggs
a = weight of a subsample

Should the results (F's) for the two subsamples differ by more than 5%, eggs in the third subsample were counted and the formula applied to data from three counts.

The relative fecundity was expressed as number of eggs per 1 g total fish weight.

To evaluate the relationship between fecundity and certain selected ruff parameters, correlation coefficients (r) were calculated and correlations tested for significance using Student's t test with n-2 degrees of freedom. For non-linear regressions, where the regression curve corresponded to an exponential function ($y = ax^b$), correlation coefficients were calculated for regressions transformed to the linear form ($\log y = b \log x + \log a$).

RESULTS AND DISCUSSION

Sexual maturation

Out of 197 individuals examined, one fish (l.c. = 6.3 cm) caught on 18 Sep. 1985 belonged to age group 0 and was identified as a gonad maturity stage 2 male. Almost all the age group 1 individuals, caught exclusively after spawning (mostly in September), had gonads at stages 2–3, which makes it impossible to tell if they participated in the spring spawning or not. The only exception was a female (l.c. = 7.1 cm), caught on 5 June 1986,

Table 1

Gonad maturity (Maier scale) of the Lake Dąbie ruff in 1985 and 1986

Period of study	Sex	Gonad maturity stage														Total	
		II		III		IV		V		VI		VII		VIII			
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
April 3rd decade	♀♀	–	–	–	–	–	–	20	80.0	5	20.0	–	–	–	–	25	100.0
	♂♂	–	–	–	–	–	–	2	100.0	–	–	–	–	–	–	2	100.0
May 1st decade	♀♀	–	–	–	–	5	9.6	28	53.8	16	30.8	3	5.8	–	–	52	100.0
	♂♂	–	–	–	–	1	2.9	11	32.4	10	29.4	12	35.3	–	–	34	100.0
June 1st decade	♀♀	1	12.5	–	–	–	–	–	–	–	–	3	37.5	4	50.0	8	100.0
	♂♂	1	20.0	–	–	–	–	–	–	–	–	–	–	4	80.0	5	100.0
June 2nd decade	♀♀	1	14.3	–	–	–	–	–	–	–	–	1	14.3	5	71.4	7	100.0
	♂♂	3	75.0	–	–	–	–	–	–	–	–	–	–	1	25.0	4	100.0
August 3rd decade	♀♀	4	100.0	–	–	–	–	–	–	–	–	–	–	–	–	4	100.0
	♂♂	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
September 1 st and 2nd decades	♀♀	25	64.1	14	35.9	–	–	–	–	–	–	–	–	–	–	39	100.0
	♂♂	4	23.5	13	76.5	–	–	–	–	–	–	–	–	–	–	17	100.0

Table 2

Gonad maturity coefficients of the Lake Dąbie ruff females

Gonad maturity stage		Body length class, l.c. (cm) 7.0–7.9	8.0–8.9	9.0–9.9	10.0–10.9	11.0–11.9	12.0–12.9	13.0–13.9	14.0–14.9	15.0–15.9	Total
II	n	12	6	4	4	3	1	–	–	–	30
	$\bar{x}$	0.63	0.70	0.72	0.61	0.70	0.56	–	–	–	0.66
	G range	0.42–0.99	0.46–1.00	0.62–0.87	0.40–1.10	0.38–0.91	–	–	–	–	0.38–1.10
III	n	–	5	1	1	2	3	1	–	1	14
	$\bar{x}$	–	1.10	1.33	1.11	0.92	1.12	0.52	–	1.59	1.09
	G range	–	0.63–1.41	–	–	0.65–1.19	0.74–1.48	–	–	–	0.52–1.59
IV	n	–	–	–	1	1	1	1	1	–	5
	$\bar{x}$	–	–	–	3.81	4.13	8.43	7.44	5.17	–	5.80
	G range	–	–	–	–	–	–	–	–	–	3.81–8.43
V	n	2	3	4	9	12	10	4	3	1	48
	$\bar{x}$	8.60	10.14	7.91	10.17	8.86	9.74	9.25	11.91	12.66	9.58
	G range	6.67–10.53	7.14–12.50	5.79–11.05	6.52–14.47	5.31–14.10	5.14–14.75	4.55–12.96	5.05–15.38	–	4.55–15.38
VI	n	–	1	3	1	4	3	5	2	2	21
	$\bar{x}$	–	12.06	12.91	14.29	13.38	13.38	12.67	17.40	16.58	13.81
	G range	–	–	9.52–15.56	–	11.93–16.42	10.63–18.13	10.74–15.32	10.51–24.29	12.68–20.48	9.52–24.29
VII	n	2	1	1	1	–	–	–	2	–	7
	$\bar{x}$	8.09	3.13	8.57	5.56	–	–	–	5.92	–	6.47
	G range	3.33–12.84	–	–	–	–	–	–	4.79–7.04	–	3.13–12.84
VIII	n	–	2	4	1	1	1	–	–	–	9
	$\bar{x}$	–	0.71	0.64	0.98	1.75	1.35	–	–	–	0.90
	G range	–	–	0.31–1.00	–	–	–	–	–	–	0.31–1.75

Table 3

Gonad maturity coefficients of the Lake Dąbie ruff males

Gonad maturity stage		Body length class, l.c. (cm)								Total
		6.0–6.9	7.0–7.9	8.0–8.9	9.0–9.9	10.0–10.9	11.0–11.9	12.0–12.9	13.0–13.9	
III	n	2	5	3	1	1	–	1	–	13
	$\bar{x}$	0.71	0.77	0.52	0.22	0.38	–	0.22	–	0.59
	G range	–	0.50–0.91	0.34–0.74	–	–	–	–	–	0.22–0.91
IV	n	–	–	1	–	–	–	–	–	1
	$\bar{x}$	–	–	3.57	–	–	–	–	–	3.57
	G range	–	–	–	–	–	–	–	–	–
V	n	–	–	–	3	4	3	1	2	13
	$\bar{x}$	–	–	–	4.05	5.69	6.34	7.29	8.64	6.04
	G range	–	–	–	3.14–5.00	1.81–8.70	3.57–10.96	–	8.04–9.25	1.81–10.96
VI	n	–	–	1	2	1	1	4	1	10
	$\bar{x}$	–	–	6.92	5.38	7.20	7.12	8.26	6.04	7.11
	G range	–	–	–	5.26–5.50	–	–	5.36–12.18	–	5.26–12.18
VII	n	–	2	2	4	3	1	–	–	12
	$\bar{x}$	–	5.47	5.05	4.80	4.67	9.33	–	–	5.30
	G range	–	5.00–5.94	3.93–6.17	3.16–6.88	4.23–5.43	–	–	–	3.16–9.33
VIII	n	–	–	1	2	–	–	1	1	5
	$\bar{x}$	–	–	0.78	0.55	–	–	1.61	0.75	0.85
	G range	–	–	–	0.51–0.60	–	–	–	–	0.51–1.61

with gonads at stage 7, which evidences participation in spawning. All the individuals caught before spawning (24) and belonging to age group 2 and older groups had their gonads at stage 4 or 5, that is they were ready to the nearest spawning. Unfortunately, the data presented are not sufficient to determine the age or length at the first spawning. One may, however, infer that some individuals spawn as early as at age 1+. According to Gąsowska (1962) and Brylińska (1986), the ruff in Poland matures at the end of its second year of life. In the river Nadym drainage, the ruff first matures at age 2+ (usually, however, it is 3+ or 4+), having grown to 20–30 g body weight and 110–120 mm length (Kolomin, 1977). On the other hand, Willemsen (1977) found 50% of the Lake Ijssel ruff population to be mature at the first year of life at the total length of 6.5–7.0 cm. Also Fedorova and Vetkasov (1974) report the Lake Ilmen ruff to mature in the first year of life; all the age 1+ individuals they examined in spring had already spawned.

Table 1 presents data on gonad maturity of the ruff examined in different months. In late April females at stage 5 prevailed. In early May the proportion of stage 5 females dropped to 53.8%, and the contribution of stage 6 females increased to 30.8%; in addition, individuals with partly spent ovaries (stage 7) appeared. At the same time, as many as 35.3% of males had their testes at stage 7, the testes of 32.4% and 29.4% of males being at stage 5 and 6, respectively. In early June, no stage 5 or 6 individuals were recorded, fishes at stage 8 prevailing among both females and males. The observations presented indicate that in 1985 and 1986 the Lake Dąbie ruff started spawning in early May, the spawning lasting not longer than until early June. Thus the period of reproduction of the species in the Lake Dąbie does not deviate from that typical of Polish waters: mid-April through end of May (Gąsowska, 1962; Brylińska, 1986). In September, most females (64.1%) had ovaries at stage 2, while the male gonads were more advanced in development (23.5% and 76.5% at stage 2 and 3, respectively). No stage 4 gonads were found at that time.

Apart from the macroscopic appearance of gonads, another indication of their maturity is the gonad maturity coefficient (G). Its values, in relation to gonad maturity stage and fish length, are presented in Tables 2 and 3. The mean value in females (Table 2) was at its lowest (0.66) at stage 2 of the gonad maturity, and slightly higher (1.09) at stage 3. With increasing gonad maturity, G increased, on the average, to 9.58 at stage 5 and to 13.81 at stage 6. Most probably the latter value is an underestimate as at this stage of gonad maturity the sexual products are easily liberated even during the capture of fish, and particularly during the later handling. After spawning an obvious decrease in the coefficient down to 6.47 (stage 7) and 0.9 (stage 8) was observed. The most extensive individual changes in the gonad maturity coefficient (4.55–15.38) were found in stage 5 females. When studying the river Nadym ruff population, Kolomin (1977) found the coefficient in females migrating to spawn to average 15.6 (9.0–22.0), a value close to the maximum for the Lake Dąbie ruff females at stage 5 (Table 2). Males showed clearly lower values of G (Table 3): from an average of 0.57 at stage 3 to 6.04 and 7.11 at stage 5 and 6, respectively (with the same reservation as in the case of females) as well as to 5.3 and 0.85 at stages 7 and 8, respectively.

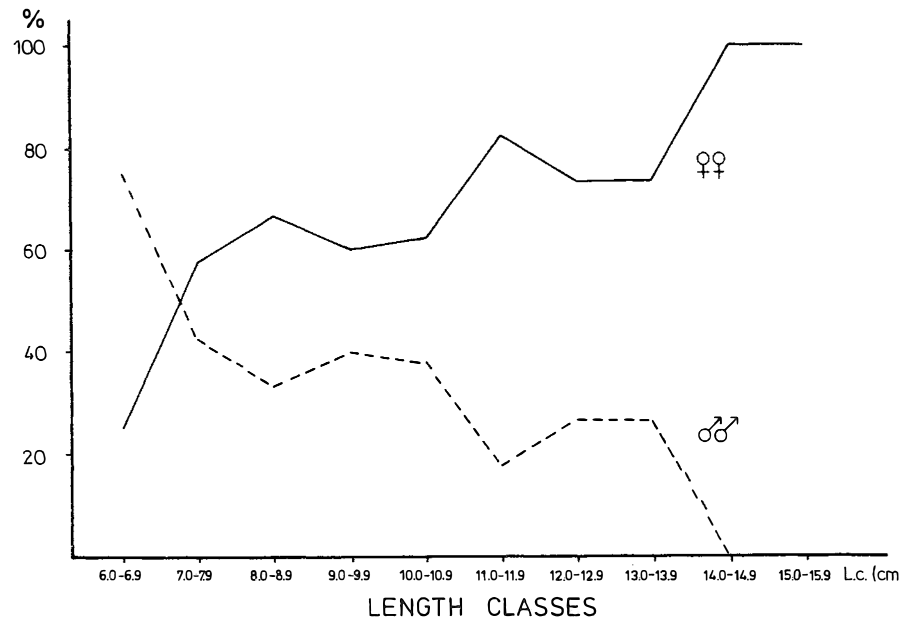

Fig. 1. Male to female ratio in relation to ruff body length

When studying maturation of roach and bream in the Szczecin Lagoon, Pęczalska (1963, 1968) found the relative gonad weight to grow with increasing fish length within a gonad maturity stage, i.e., the maturity coefficient would grow, too. As seen from Table 2, no such conclusion can be drawn from data on the ruff examined. Females at stages 5 and 6, 7.0–13.9 cm long, have similar values of G which show no increase or decrease with changing fish size. It was only the largest females (l.c. ≥ 14.0 cm) that showed higher mean coefficients of gonad maturity. The low abundance of such fish, however, and a wide range of the coefficient (5.0–15.38) allow no unequivocal generalisations to be made.

Sex ratio

Most ruff examined (68.5%) were females. The male to female ratios in the two years were different, 1 : 3.23 in 1985 and 1 : 1.6 in 1986. In spite of a general domination of females, males prevailed in the 6.0–6.9 cm class. The proportion of females increased

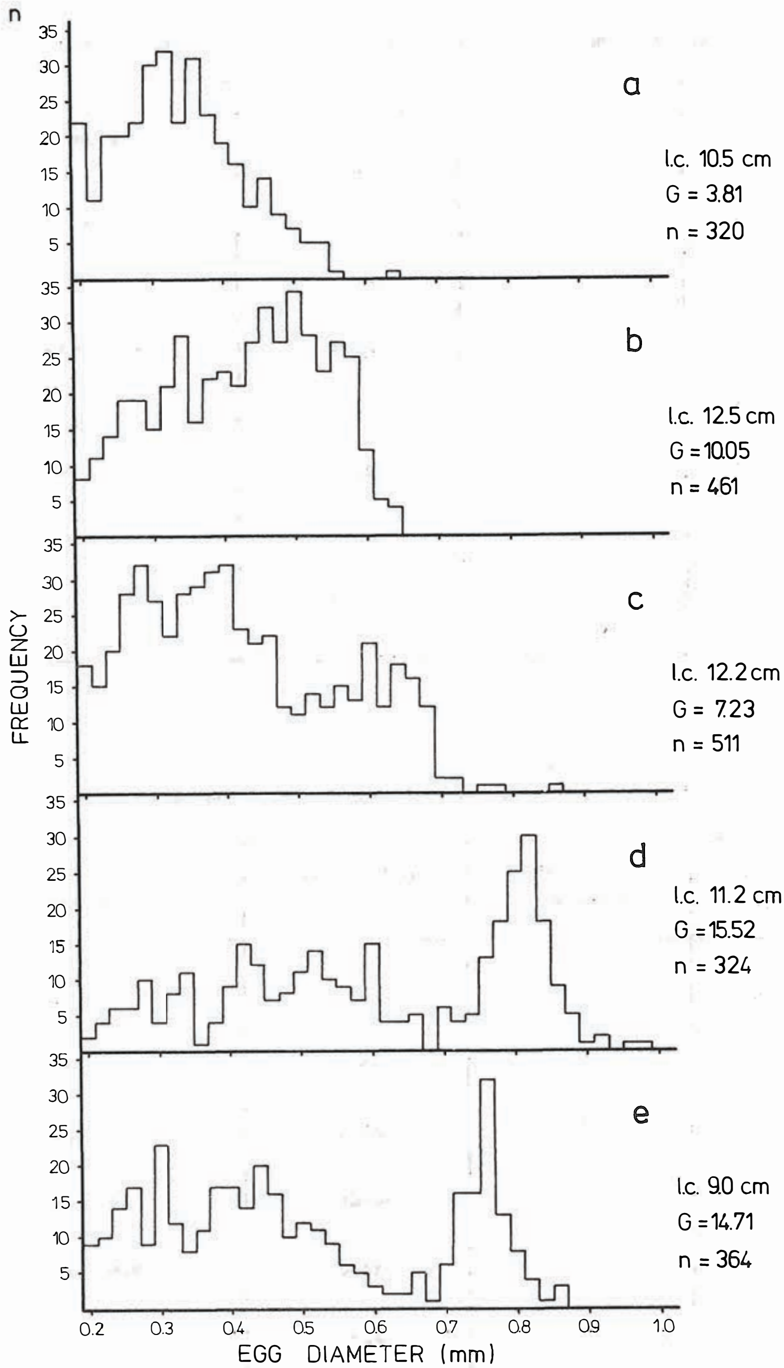

Fig. 2. Egg diameter distribution in ruff ovaries at different gonad maturity stages: 4 (a), 5 (b, c, d), 6 (e)

Table 4

Absolute fecundity of the Lake Dąbie ruff in various body length classes

Body length class l.c. (cm)	No. of fish examined	Mean absolute fecundity	Range of absolute fecundity
8.0– 8.9	2	14976	13338–16613
9.0– 9.9	2	16743	13553–19932
10.0–10.9	5	27802	18251–36840
11.0–11.9	8	29610	19156–39399
12.0–12.9	7	49111	20465–63136
13.0–13.9	4	56287	33168–82233
14.0–14.9	2	41088	39043–43132

Table 5

Absolute fecundity of the Lake Dąbie ruff in various body weight classes

Body weight class (g)	No. of fish examined	Mean absolute fecundity	Range of absolute fecundity
11.0–20.9	4	15859	13338–19932
21.0–30.9	9	27816	18251–36840
31.0–40.9	8	38882	20465–61603
41.0–50.9	5	46920	33168–63136
51.0–60.9	3	49585	39043–66581
61.0–70.9	1	82233	–

with fish growth to 100% in the >14.0 cm class (Fig. 1). Such a gradual increase in numerical predomination of females with fish length (thus with age) is typical of numerous fish species, including percids (Opuszyński, 1979).

Egg diameter distribution

Fig. 2 shows distributions of egg diameter for the ruff females having gonads at various maturity stages. The distribution plotted for a stage 4 female (Fig. 2a)has practically a single peak; the distribution is skewed to the left, which indicates the numerical domination of eggs at the early stage of yolk accumulation. The largest eggs measure 0.64 mm in diameter. In the stage 5 ovaries, large oocytes increase in abundance, in spite of a still low maximum diameter (Fig. 2b), or else two or three groups of eggs differing in diameter are present, the maximum diameter reaching 0.98 mm (Fig. 2c and d). Still more clear-cut is the presence of three groups of eggs of a different diameter, as shown in Fig. 2e presenting egg diameter distribution in a stage 6 ovary. As reported in the literature (Berg, 1949; Fedorova and Vetkasov, 1974), spawning in ruff is prolonged and portional, the eggs being laid in two or three portions (Kolomin, 1977; Brylińska, 1986). The data obtained for the Lake Dąbie ruff point to three portions of eggs being laid by the females, but to confirm this conclusions, egg diameter distributions from a much larger sample of females should be obtained. Kolomin (1977) reports the river Nadym ruff to lay eggs in two portions; the diameter of those in the first portion is 1.03 mm on the average (0.90–1.21), the number of eggs in the first portion being more than 6 times that of the second one.

Absolute fecundity

The absolute fecundity of the Lake Dąbie ruff was found to range from 13,338 in a 8.7 cm long female to 82,233 in a 13.9 cm long one. The absolute fecundity increased with fish size and weight, in spite of large individual differences between females in the same length or weight class (Table 4 and 5). The individual absolute fecundity of the ruff studied can be described as high compared with data reported for several water bodies in the Soviet Union. The average absolute fecundity of individuals aged 4+ to 11+ in the river Nadym was 17,800 eggs (8,000–35,612) (Kolomin, 1977). According to Fedorova and Vetkasov (1974), Driagin's studies on the Lake Ilmen ruff showed 5,598 eggs to be the absolute fecundity of 10 cm long fish, 3,965 eggs only being found in the 8.5 cm long individuals. The river Ob ruff has a much higher fecundity: from 6,900 to 64,665 eggs (Pietlina, 1967 in Kolomin, 1977). Still higher values were shown for the Dneper delta ruff (29,000–104,000), but only relatively large fish (l.t. of 16,5 to 18.7) were examined in that case (Syrovatskaya, 1927 in Berg, 1949), while in the present study 3 females only exceeded 16.0 cm total length. Virtually no fecundity data have been published on ruff of Polish waters except for a remark in Gąsowska (1962) that a ruff female lays 29,000–200,000 eggs; this remark, however, is not backed by any data as to the site of study and type of materials examined.

Figs. 3 and 4 illustrate relationships between fish length and total weight on the one hand and absolute fecundity on the other. In spite of the extensive range of values, correlations between the absolute fecundity and ruff length and weight were found to be statistically significant (at $\alpha = 0.01$). An increase in fecundity with increasing fish length is curvilinear (parabolic); the relationship is expressed by the exponential equation

$$F = 42.713\ l.c.^{2.7068} \quad \text{(Fig. 3)}$$

On the other hand, the scatter of points in Fig. 4 points out to a linear relationship between the absolute fecundity and ruff weight ($F = 1053.4\ W + 382$). The comparison between correlation coefficients of the two relationships shows the absolute fecundity to be more closely correlated with body weight ($r = 0.801$) than with body length ($r = 0.752$). This is typical of numerous fish species (Załachowski, 1961; Brylińska and Bryliński, 1972; Terlecki, 1973; Pimpicka, 1981), although – as pointed out by Białokoz (1973), different populations of the same species may show closer correlations of the absolute individual fecundity and either weight or length of fish. Relationships between the absolute fecundity and ovary weight (Fig. 5) and between the absolute fecundity and age (Fig. 6) were studied as well. Correlations in both cases proved statistically significant ($\alpha = 0.01$), the correlation coefficients indicating a much stronger effect of gonad weight

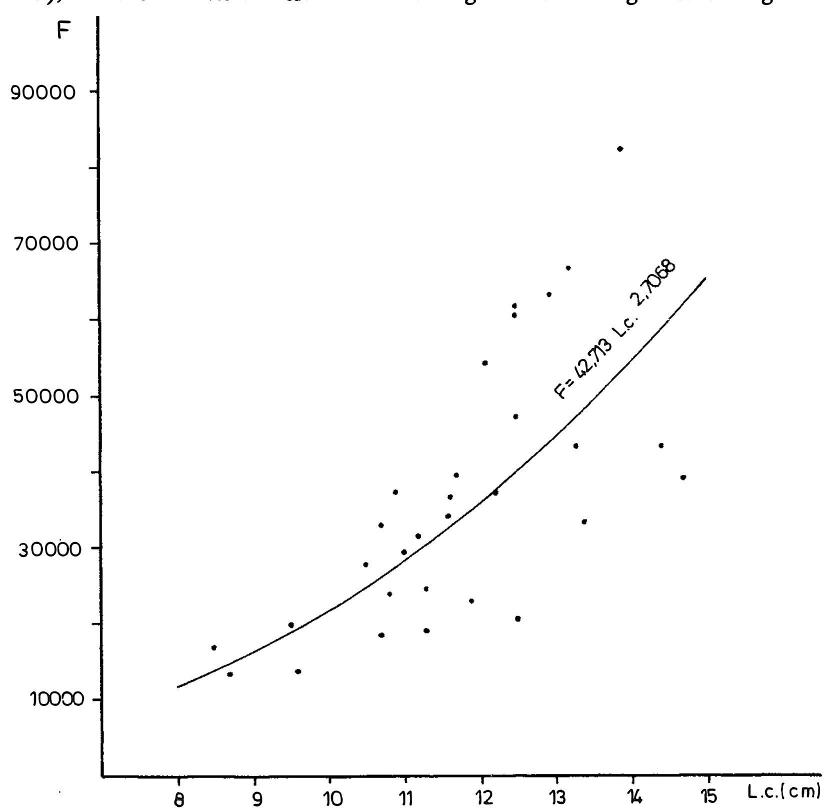

Fig. 3. Relationship between absolute fecundity (F) and body length (l.c.) in the Lake Dąbie ruff

(r = 0.727) than age (r = 0.486). The effect of age alone on fish absolute fecundity is doubtful and, as stated by several authors (e.g. Załachowski, 1961; Brylińska and Bryliński, 1972; Terlecki, 1973; Pimpicka, 1981) is a result of age – dependent increase in body size.

Relative fecundity

The relative fecundity of the ruff examined was found to range within 585–1540 eggs per 1 g body weight, with a mean of 1066.3 eggs/g. As seen from Tables 6 and 7, changes in body length and weight have no effect on the magnitude of the relative fecundity. No significant correlation was found between the relative fecundity and ovary weight (r = 0.174) and age (r = 0.118). According to Zotin (1968), the relative fecundity is constant in a population, i.e., it is independent of fish weight only if the absolute

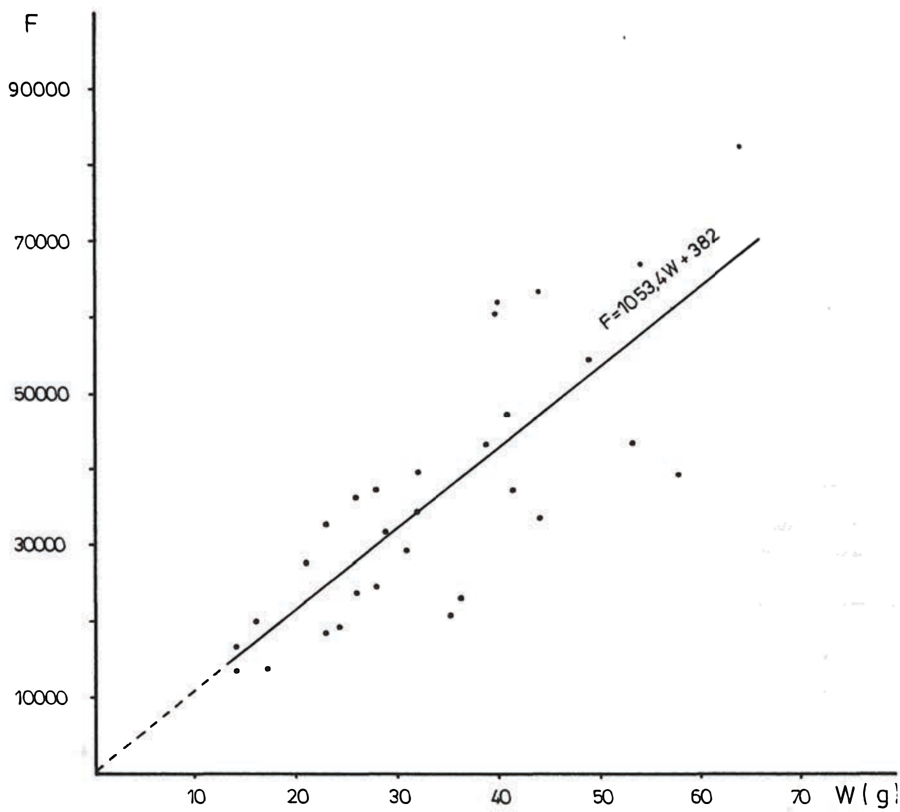

Fig. 4. Relationship between absolute fecundity (F) and weight (W) in the Lake Dąbie ruff

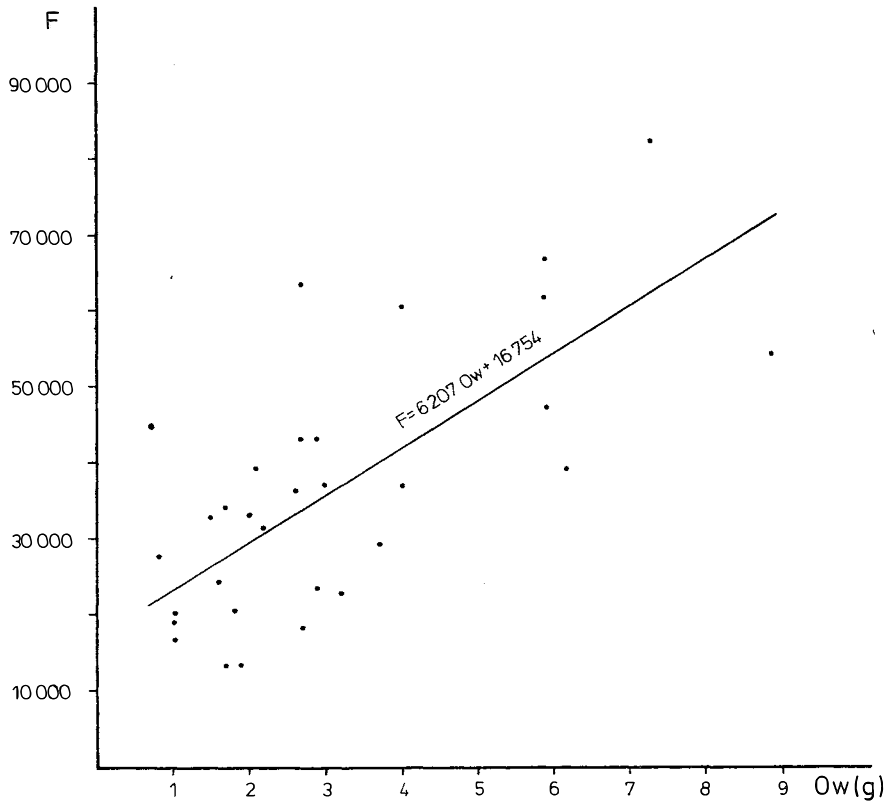

Fig. 5. Relationship between absolute fecundity (F) and ovary weight (Ow) in the Lake Dąbie ruff

Table 6

Relative fecundity of the Lake Dąbie ruff in various body length classes

Body length class, l.c. (cm)	No. of fish examined	Mean relative fecundity	Range of relative fecundity
8.0– 8.9	2	1066	946–1187
9.0– 9.9	2	1017	788–1246
10.0–10.9	5	1151	794–1424
11.0–11.9	8	1000	630–1400
12.0–12.9	7	1173	585–1540
13.0–13.9	4	1093	754–1285
14.0–14.9	2	740	673– 806

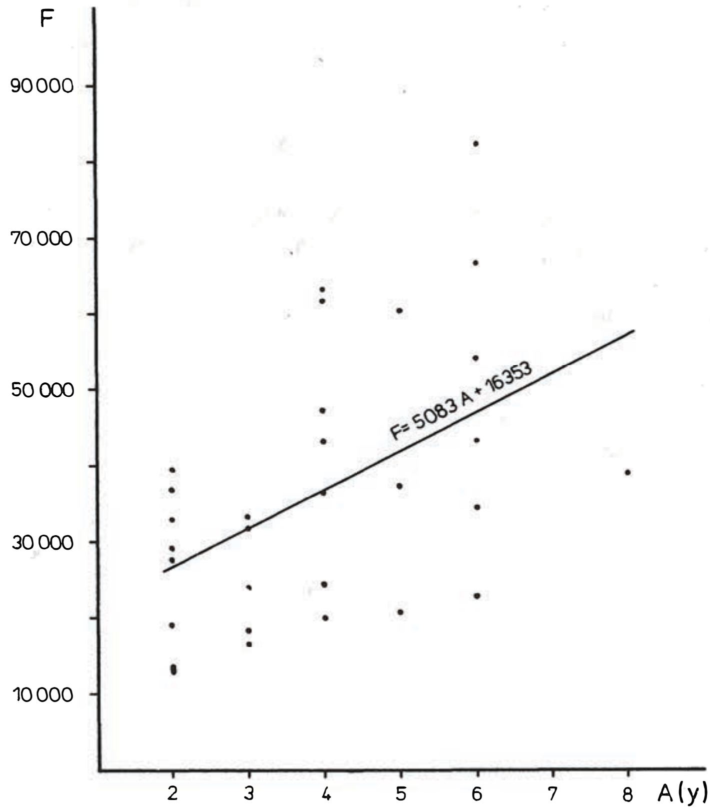

Fig. 6. Relationship between absolute fecundity (F) and age (A) in the Lake Dąbie ruff

Table 7

Relative fecundity of the Lake Dąbie ruff in various body weight classes

Body weight class (g)	No. of fish examined	Mean relative fecundity	Range of relative fecundity
11.0–20.9	4	1042	788–1246
21.0–30.9	9	1100	792–1424
31.0–40.9	8	1076	585–1540
41.0–50.9	5	1065	754–1428
51.0–60.9	3	903	673–1228
61.0–70.9	1	1285	–

fecundity vs. body length regression line intersects the origin of coordinates. The line for the Lake Dąbie ruff does pass close to the origin (Fig. 4). Thus, if Zotin's statement is to be accepted, the relative fecundity in the ruff population studied is indeed constant.

CONCLUSIONS

1. The Lake Dąbie ruff matures early; some fish spawn for the first time at age 1+.
2. The gonad maturity coefficient of females of the same maturity stage does not change with body length.
3. Spawning of the ruff studied is portional, the eggs being most probably laid in three portions.
4. The absolute fecundity was 13,338–82,233 eggs and was higher than in ruff populations from the river Nadym, Lake Ilmen, and river Ob, and slightly lower than that found in the Dneper delta ruff.
5. The absolute fecundity is significantly correlated with total body weight (r = 0.801), body length (r = 0.752), gonad weight (r = 0.727), and age (r = 0.486).
6. The relative fecundity ranged within 585–1540 eggs/g (1066.3 eggs/g on the average) and was independent of body size, gonad weight, and fish age.

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Zbigniew Neja

O NIEKTÓRYCH ZAGADNIENIACH REPRODUKCJI JAZGARZA, *GYMNOCEPHALUS CERNUUS* (L., 1758) Z JEZIORA DĄBIE

STRESZCZENIE

Jazgarze do badań zebrano w okresie od 29.04.1985 do 5.09.1986 r. w jeziorze Dąbie. Badano ich dojrzewanie płciowe, rozmiary ikry w jajnikach oraz płodność absolutną i względną.

Analiza stopnia dojrzałości gonad wykazała, że część ryb już w wieku 1+ przystępuje po raz pierwszy do tarła. Tarło jazgarza w latach 1985 i 1986 rozpoczynało się w pierwszej dekadzie maja i trwało nie dłużej jak do początku czerwca, o czym świadczył stan gonad analizowanych ryb (tab. 1). Współczynnik dojrzałości gonad (G) samic przyjmował wyraźnie wyższe wartości niż u samców we wszystkich stadiach dojrzałości gonad (tab. 2 i 3), nie wykazując rosnącej bądź malejącej tendencji wraz ze zmianą rozmiarów ciała ryb (tab. 2).

Wśród badanych jazgarzy większość stanowiły samice, przy czym ich udział zwiększał się aż do 100% w miarę wzrostu długości ryb (rys. 1).

Wykonane pomiary średnicy dojrzawających jaj u samic w IV-VI stadium dojrzałości gonad wykazały istnienie dwóch, a w przypadku bardziej dojrzałych samic, trzech grup jaj o zróżnicowanej średnicy (rys. 2), co świadczy prawdopodobnie o trzech porcjach ikry składanych podczas tarła przez samice jazgarza w jeziorze Dąbie.

Oszacowana metodą wagową na sucho indywidualna płodność absolutna zawierała się w granicach 13338–82233 jaj, rosnąc wraz ze wzrostem długości i masy ryb (tab. 4 i 5). Stwierdzono, że płodność absolutna jazgarza z badanej populacji jest najsilniej skorelowana z masą ciała (rys. 4), w mniejszym stopniu z długością ciała (rys. 3), masą jajników (rys. 5) i wiekiem (rys. 6).

Płodność względna wahała się od 585 do 1540 jaj na 1 g masy całkowitej ryby (średnio – 1066.3 jaj/g). Wzrost długości i masy ciała nie wpływa na wielkość płodności względnej jazgarza (tab. 6 i 7), jak również brak jest istotnej korelacji między płodnością względną a masą jajników i wiekiem jazgarza.

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