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Fish Biology

**A CONTRIBUTION TO STUDIES ON THE BIOLOGY OF
VIMB – *VIMBA VIMBA VIMBA* (L.) FROM THE REGA RIVER**

**PRZYCZYNEK DO BADAŃ NAD BIOLOGIĄ CERTY
VIMBA VIMBA VIMBA (L.) Z RZEKI REGI**

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Some biological features of the spawning stock of vimb *Vimba vimba vimba* (L.) reproducing in the Rega river are discussed in the present paper. The investigated material comprising 845 individuals was collected within the years 1970–1972 from the spawning ground situated near Trzebiatów. The age analysis of the stock revealed that 8 years old fishes prevailed in 1970 and 1971, while in 1972 5 years old ones were predominating. The Rega vimb growth rate is higher than that of the fishes from the other water bodies. Particular high growth rate has been noted for the first 7 years of life. Some symptoms of the stock rejuvenation occurred within the period investigated.

INTRODUCTION

Vimb, *Vimba vimba vimba* (L.) is a semi-migratory fish encountered in most East-European rivers. During the trophic period it concentrates on the feeding grounds in the vicinity of river mouths. It is also frequently found in lakes, firths and in the coastal brackish waters of the sea. According to *Bontemps* (1971), this species distribution range is rather wide-spread. It covers the Baltic catchment area east of Kattegat, southern Sweden (to 62°N) and Finland (to 63°N), the Gulf of Finland, Neva river, Ladoga, Pskov and Peipus Lakes.

As mentioned by *Wyczęśławcew* (1936,1938,1939), the pre-war vimb catches from the Lower Vistula were rather large. More recently a marked drop in the vimb population has been observed over the area of Poland. Small quantities of this fish are caught in the Vistula basin, Pomeranian Gulf, Szczecin and Vistula Firths, and in certain tributaries of the Odra river.

The vimb spawning migration is held in spring (April – May), a month before the spawning itself. For the spawning purposes the vimbs enter streams with clear water and fast current, and deposit eggs on stony and gravel beds. The population of vimbs feeding in the Pomeranian Gulf spawns in certain rivers inflowing to the Szczecin Firth and directly to the Gulf.

The Rega river has also a pretty numerous spawning stock of vimb. This stock is a basic source of roe collected by the Polish Angling Union for the purposes of the autumn fry release. This is one of the reasons of studying this stock, the studies being aimed at obtaining more detailed informations on some of its biological features.

MATERIAL AND METHOD

Materials for investigations were collected within the years 1970–1972 from the vimb spawning ground in the Rega river near Trzebiatów. They comprised 845 spawners with the body length (*longitudo corporis*) ranging from 24.5 to 40.5 cm and the total length (*longitudo totalis*) range of 29.5–48.5 cm. The samples collected in 1970, 1971 and 1972 contained 182, 357 and 306 individuals, respectively. Apart from the body length and weight measurements, scales were collected for age determinations.

In order to estimate the Rega vimb individual and relative fecundities, 29 gonads of females of various lengths were collected. The weight method was used to determine the individual fecundity.

RESULTS AND DISCUSSION

The vimb spawning in Rega takes place on two spawning grounds. The first one is located near the Trzebiatów power station, the other one lies up the river near the Rejowice power station (Fig. 1). The Trzebiatów spawning ground occupies an area of 0.4 hectares, stretching along 200 m of the river bottom. The bottom surface is stony, with pebbles and gravels, covered with a concrete plate near the power station. The nature of the bottom, fast current and strong water mixing combined act in favour of the vimb reproduction. The Rejowice spawning ground occupies much larger area. In addition, the two spawning grounds serve as breeding sites for the other fish species.

While migrating from the sea to the Trzebiatów spawning ground, the vimbs cover the distance of about 20 km. Due to their incomplected gonad maturation, however, they do not enter the spawning ground at once, but stop at about 1 km below.

As the observations made so far indicate, an advanced state of gonad maturity at one side, and the water temperature increase at the other are both the factors controlling the vimb spawning migration. For instance, in 1973, because of an early and warm spring, vimb appeared on the Trzebiatów spawning ground as early as in mid-March.

Fig. 1. Location of the vimb spawning grounds (+) in the Rega river

The vimb breeding in Rega usually takes place in late May or in the beginning of June. The spawning itself begins most often in the early morning, when the water temperature is $16-18^{\circ}\text{C}$. The spawners gathered in the spawning site form groups consisting of several individuals, one female being always accompanied by a few males. The similar observations were made by Suhanova et al. (1970). They noted that the vimbs from Niemen formed spawning groups of 1 female and 2–5 males. The females are the first to appear on the spawning ground; rubbing their body against the substrate they clean algae and mud off the stones. The females entering the spawning ground are immediately surrounded by the males. The spawning as a rule is very boisterous, accompanied by the water splash, vigorous swimming and movements of fishes. Fertilized eggs drifting with the current fall upon the stony – gravel bottom and, owing to their viscosity, become attached to the substrate.

After the spawning has been completed, the females usually swim away from the ground.

The observations indicate that only mature vimb specimens of age ranging within 4–11 years undertake the spawning migration in the Rega river (Table 1). Table 1

Table 1

Age composition of the Rega vimb spawning stock in the years 1970–1972

Sex	Year	Percentage of each age group								Percentage of males and females in the stock
		IV	V	VI	VII	VIII	IX	X	XI	
Males	1970	2.0	14.9	8.9	18.8	40.6	11.9	2.9	—	55.5
	1971	9.6	13.1	13.9	20.9	29.2	12.0	1.3	—	64.3
	1972	3.9	37.7	17.6	8.8	13.9	13.7	3.9	0.5	67.3
Females	1970	—	3.7	3.7	18.5	56.9	16.0	1.2	—	44.5
	1971	2.3	14.1	10.9	18.0	42.2	11.7	0.8	—	35.7
	1972	—	31.4	11.8	14.7	11.8	13.7	13.7	2.9	32.7

shows that 8 years old individuals predominated in the vimb spawning stock in the years 1970–1971, while in 1972 the 5 years old fish prevailed. The fourth age group almost exclusively comprised males, females being rarely encountered. This indicates that males reach the maturity state in their fourth year of life, i.e., a year earlier than females.

The age composition of the spawning stock in 1972 differed from that in previous years presumably due to the fact that more numerous 5 years old fishes began to spawn.

Studies carried out in the years 1970–1972 revealed that in the vimb spawning stock in Rega males outnumbered females (Table 1). Percentage of males with a tendency to grow amounted to 55.5–67.3%, that of females ranged within 32.7–44.5%. These results seem to be similar to those given by Suhanova et al. (1970) who found out that in the Tarnawa river percentages of males and females in the vimb spawning stock were 56 and 44%, respectively. Suhanova et al. (1970) stated also that the vimb females, after completing the spawning, swam down the river; some of them stopped at deeper localities until the rest of eggs would ripen, the other part entered the sea. The vimb males stayed longer on the spawning ground.

The present authors' results show that some females caught from the Trzebiatów spawning ground contain eggs in two different developmental stages, whereas the other fishes are completely spent or "tough". These data would indicate that females could spawn once or twice a season, the litter number depending chiefly upon the atmospheric conditions prevailing during this period.

Table 2 indicates that mean weights and lengths of females were greater than those of males throughout the period investigated. Moreover, a constant decrease in mean length of fishes from the spawning stock, both males and females, was noted in subsequent years. This would indicate to the stock rejuvenation resulting perhaps either from the over-fishing of the older generations or from a positive effect of introducing the autumn fry. This introducing has been carried out for several years (Pęczalska, 1972). Further studies are needed, however, to explain this problem.

Table 2

Numbers, mean lengths (longitudo corporis and l. totalis) and weights of the Rega vimb spawners caught in the years 1970–1972

Sex	Year	Number of fishes (ind.)	Mean weight (g)	Mean length (cm)	
				l. c.	l. t.
Males	1970	101	480	32.2	38.1
	1971	229	500	31.6	37.8
	1972	206	490	30.1	36.2
Females	1970	81	650	34.7	44.0
	1971	128	590	34.2	40.6
	1972	100	630	32.7	38.9

The detailed analysis of the annual increment rings on scales showed that the Rega vimbs had been growing very fast until their seventh year of life, then decreasing their growth rate. Significant distances between the rings till the seventh year would be an evidence of this as well as their more dense arrangement in the following years. Compared to the fishes from the other water bodies, the vimbs from Rega, even before reaching maturity, have greater body lengths than, say, the Vistula vimbs (Bontemps, 1971).

The percentage of each 2 cm length class in the vimb spawning stock from Rega is presented in Fig. 2. To make the comparison available, the Bontemps' data (1971), concerning vimb from the Vistula spawning stock of Świbno and Tczew, are presented as well. These graphs indicate to generally larger sizes of the Rega vimb spawners.

Fig. 2. Comparison between the length composition (l.c.) of the vimb spawning stock from Rega (1970-1972) and that of Vistula (1961-1963)

The body weight range of vimb spawners collected within 1970-1972 from the Trzebiatów spawning ground amounted to 190-1160 g. The mean body weight varied for

each sample investigated (Table 2) and corresponded to the mean body weights of fishes caught in 1963 in the Lower Vistula, surpassing however those of spawners from San river caught in the years 1955–1957 (**Bontemps**, 1964, 1969, 1971).

The differences between the mean body weights of males and those of females (Table 2) are undoubtedly confined to a slightly higher growth rates of the latter as well as to considerable degree of filling the body cavity with ripe gonads.

Figure 3 illustrates the percentage of spawners in the weight classes. In 1972 only 3 females were found to belong to the interval of 1100–1200 g, no vimb individual being noted in the 1000–1100 g class. The difference between the spawners' weights for each weight class amounted to 180–200 g, what was found to be considerable. It was even more so for the Vistula vimbs, this difference reaching 250 g (**Bontemps**, 1960, 1971).

Fig. 3. Percentages of vimb spawners from Rega within each length class

Pliszka (1951) and **Bontemps** (1964, 1969, 1971) noted the deterioration of the Vistula vimb condition during the spawning migration, resulting both from limited feeding and utilization of the food reserves accumulated while feeding in the sea. This deterioration was calculated to be a 20 per cent decrease in the body weight.

The length – weight relationship for vimb in every 2 cm length class is given in Fig. 4. A curve representing such a relationship for vimb from the Gdańsk Bay, caught in September and October 1958 (**Bontemps**, 1971), is presented for comparison. These latter data, however, concern fishes caught during their intense feeding, and this undoubtedly affect their specimen's weight.

When comparing the weight increase rate for vimb from Rega with that for fishes from Vistula and the Parnawska Bay (**Bontemps**, 1971), it can be concluded that this factor is highest for the Rega vimbs (particularly so until the seventh year of life) and lowest for the Parnawska Bay fishes (Fig. 5).

Among the Rega vimb spawners, besides the spent fishes, the non-spent ones also occurred, having their gonads in the fifth or sixth maturity stage (according to the Meier's maturity scale). Many females had uneven roe varying in size, while these variations were not observed in the other fishes. It was also found out that ovaries of the examined Rega vimbs of 25–38 cm length and 350–1150 g weight contained various numbers of eggs, from 33,800 to 139,800. The individual fecundity estimated from 29 gonads amounted to 77 500 eggs. Number of eggs per 1 kg of fish varied from 80 000 to 159 200, the mean value being 114 600. Examination of the other populations gave similar results. **Morawska** (1964) estimated the individual fecundity of the Vistula vimbs with the body length

Fig. 4. Length – weight relationship of the vimb from Rega and that from the Gdańsk Bay

range of 25.0–38.0 cm to vary from 40 000 to 100 000 eggs, the mean value being 66 000. Suhanova et al. (1970) gave the values of the individual fecundity of the Niemen vimbs within the range of 38 000–130 000 eggs (the mean value 73,600).

Because of different gonad stages of the spawners collected from Rega as well as considerable losses of eggs while handling, no attempt to establish the vimb economic fecundity was made. It could be done approximately, using the Polish Angling Union data. They indicated that 101 females caught in 1966 in Rega gave 3 276 000 eggs, i.e., 32 400 eggs per 1 female in average. Some what different data are presented by Suhanova et al. (1970). The mean economic fecundity of the Niemen vimbs with the body lengths of 24–39 cm amounted only to 16 200 eggs. These authors indicated that the vimbs

Fig. 5. Comparison between growth rates of vimb from Rega, Vistula and the Parnawska Bay

mentioned spawned with 3 litters so the egg number was low when taken only but once. The Rega vimbs usually deposit eggs in 2 litters so the number of eggs taken for the artificial fertilization ("on dry") can be much greater. Jaskowski (1960) found out that the economic fecundity of vimb from Warta averaged to 150 000 eggs per 1 kg of fish.

SUMMARY

1. The vimbs from the Rega river begin their spawning migration in early spring, the migration being undertaken by 4 to 11 years old individuals with body lengths ratio (l. corporis/l. totalis) ranging from 24.5/29.5 cm to 40.5/48.5 cm.

2. In the spawning stock males outnumber females, percentage ranges for males and females being 55.5–67.3% and 32.7–44.5%, respectively; the males reach sexual maturity at the age of four, while the females of five.

3. The Rega vimb growth rate is highest within the first 7 years of life, then decreases. Compared to fishes from the other water bodies, it has greater weight increment. Females are always larger than males of the same age group.

4. The individual fecundity of the investigated Rega Vimbs of the body lengths ranging within 25.0–38.0 cm amounts to 33 800–139 000 eggs (the mean value 77 500), while its relative fecundity ranges from 81 000 to 159 000 eggs per 1 kg of fish (the mean value 114 600).

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PRZYZCZYNEK DO BADAŃ NAD BIOLOGIĄ CERTY (VIMBA VIMBA VIMBA L.) Z RZEKI REGI

Streszczenie

W pracy omówiono niektóre właściwości biologiczne stada tarłowego certy (Vimba vimba L.) odbywającej tarło w rzece Redze. Materiał do badań (845 szt.) zebrano w latach 1970–1972 na tarlisku k.Trzebiatowa.

W rzece Redze certy rozpoczyna wędrówkę rozrodczą wiosną na krótko przed rozrodem. W stadzie tarłowym spotyka się osobniki w wieku od 4 do 11 lat. Wśród tarlaków przeważają samce, które dojrzewają o rok wcześniej (w 4 roku życia) od samic. Certy z rzeki Regi do 7 roku życia rośnie

stosunkowo szybko, później zaś nieco wolniej. W porównaniu z tempem wzrostu certy z innych zbiorników osiąga ona większe przyrosty ciężaru. Długość ciała (l.c.) większości tarlaków mieściła się w granicach 28–36 cm. Wśród osobników z tego samego rocznika samice są zawsze większe od samców.

Rozpiętość ciężaru poławianych cert w analizowanym okresie wahała się w granicach od 190 do 1160 g, przy czym większość osobników mieściła się w przedziale od 300 do 800 g.

Zróżnicowany stan gonad większości samic wskazuje, że certy z rzeki Regi odbywają jedno- lub dwumiotowe tarło. Płodność osobnicza samic o długości 25,0–38,0 cm waha się od 33,8 do 139,8 tys. jaj (średnio 77,5 tys.), natomiast płodność względna mieści się w przedziale od 80,0 do 159,2 tys. jaj na 1 kg ciała (średnio 114 600 szt.).

К ВОПРОСУ ОБ ИССЛЕДОВАНИИ БИОЛОГИИ РЫБЦА *Vimba vimba vimba* (L.) В РЕКЕ РЕГА

Р е з ю м е

В работе рассмотрены некоторые биологические особенности нерестового стада рыба- *Vimba vimba vimba* (L.), нерестящегося в реке Рега. Материал для исследований (845 штук) был собран в 1970–1972 г.г. на нерестилищах в районе Тшебятова.

В реке Рега рыбец начинает нерестовую миграцию весной, незадолго до икрометания. В нерестовом стаде встречаются особи в возрасте от 4 до 11 лет. Среди нерестовиков преобладают самцы, которые созревают на год раньше (в 4 году жизни), чем самки. Рыбец из реки Рега до 7 года жизни растёт относительно быстро, в последующие годы – медленнее. По сравнению с темпом роста рыба из других водоёмов он достигает большего прироста веса. Длина тела (l.c.) у большинства нерестовиков составляла от 28 до 36 см. Среди особей одного и того же года самки всегда больше самцов.

Вес вылавливаемого рыба в анализируемый период колебался в границах от 190 до 1160 граммов, причём большинство особей имело вес от 300 до 800 граммов. Неодинаковое состояние гонад у большинства самок указывает на то, что рыбец из р. Рега нерестится в один или в два приёма. Индивидуальная плодовитость самок длиной 25,0–38,0 см колеблется от 33,8 до 139,8 тыс. икринок (в среднем 77,5 тыс.), в то время как относительная плодовитость составляет от 80,0 до 159,2 тыс. икринок на 1 кг веса тела (в среднем 114,6 тыс. икринок).

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