

Rajmund TRZEBIATOWSKI, Teresa Lilia LESZCZEWICZ

Fish Biology

A CONTRIBUTION TO KNOWLEDGE OF BIOLOGY AND ECONOMIC IMPORTANCE
OF *Aspius aspius* (L.) OF THE SZCZECIN FIRTH

PRZYCZYNEK DO ZNAJOMOŚCI BIOLOGII I ZNACZENIA GOSPODARCZEGO
BOLENIA *Aspius aspius* (L.) Z ZALEWU SZCZECIŃSKIEGO

Institute of Marine Biological Resources Exploitation and Protection

Growth and feeding habits of *Aspius aspius* (L.) of the Szczecin Firth, based on study of materials collected in 1972, and 1974–1975, are presented.

Growth was studied with the aid of back calculations, while Lagler's method was applied to following the length-weight relationship. Investigations on feeding of the Szczecin Firth *Aspius aspius* were restricted to food composition and occurrence frequency of the food items. Additionally, growth and feeding of the Szczecin Firth *Aspius aspius* were compared to those of the species occurring in other water bodies.

INTRODUCTION

Aspius aspius (L.) is not a particularly common fish species in Polish waters. It most often unhabits the central sections of large rivers and also is a part of ichthyofauna of the firths. Owing to its limited distribution and economical importance, the investigators' attention was seldom focused on it. A review of the literature indicates only the river Vistula *Aspius aspius* to be relatively well-known (Pliszka et al., 1951; Backiel, 1964b; Horoszewicz, 1964). The Szczecin Firth *A. aspius* has not so far enjoyed any greater attention being paid to it.

Of the cyprinid fishes occurring in Poland, *A. aspius* — disregarding carp — is the one of the quickest growth (Backiel, 1964a). However, due to its bony and not very tasteful flesh, the species is not particularly sought by fishermen and consumers; only the anglers recognize it as a valuable and attractive object of their activities.

The present paper is aimed at gaining a closer insight into some elements of biology of the Szczecin Firth *A. aspius*, particular attention being concentrated upon the growth rate and feeding as well as on its role and economic importance in this water body.

MATERIAL AND METHODS OF STUDY

The materials to be studied were collected in 1972 and 1974–1975 from the Szczecin Firth, mainly from draw net catches, little use being made of the hoop net catches.

Table 1

Characteristics of the material collected	
Number of measured and weighed fishes	233
Number of fishes yielding scales	233
Number of fishes yielding alimentary canals	154
Length range of fishes examined	25–71 cm
Weight range of fishes examined	256–6000 g
Age	III–XVI

The fishes comprising a sample were measured (l.t.) to the nearest 0.1 cm and weighed (1 g accuracy). Annual increments on 5–6 scales were determined using a measuring microscope. More detailed data are given in Table 1.

Alimentary cannals collected were preserved in 4% formalin, their contents were examined under a binocular microscope. The food composition was determined mainly from scales, pharyngeal bones (*ossa pharyngealia inferiora*), and preopercular bones (*praeopercula*) found. The studies on the *A. aspius* feeding were restricted only to determining the quantitative composition of food and occurrence frequency of food items.

A scale radius — body length relationship in *A. aspius* was studied using a regression method. Growth rate was back-calculated (no corrections) and also the von Bertalanffy method was applied. A length — weight relationship for *Aspius aspius* was determined with a method suggested by Lagler (1956).

The catches of *Aspius aspius* obtained during the last decade (1965–1975) were summarized basing on the statistical data supplied by the Szczecin Maritime Bureau.

RESULTS OF STUDIES

Catches. *Aspius aspius* plays no significant role in the Polish inland fishery, which is indicated by catches recorded within 1965–1974 as well as by the percentage contribution to the total catch, amounting to 0.79% in 1965 and decreasing to 0.14% in 1974 (Table 2).

Table 2

Aspius aspius catches in the Szczecin Firth within 1965–1974

Year	Total catch (t)	A.aspius catch (t)	A.aspius contribution to total catch (%)
1965	1.625	12.834	0.79
1966	1.042	8.131	0.78
1967	2.234	11.616	0.52
1968	3.021	10.273	0.34
1969	2.792	6.142	0.22
1970	2.414	8.690	0.36
1971	3.043	10.414	0.34
1972	3.366	9.087	0.27
1973	3.308	5.293	0.16
1974	3.691	5.167	0.14

During the last decade the absolute catches of *Aspius aspius* obtained from the Firth were fluctuating, but simultaneously they showed a clearly decreasing tendency as far as their contribution to the total catch was concerned. Since the German statistics place *A. aspius* jointly with other fish species rather than treating it separately, it is impossible to state the absolute amounts of catches obtained from this water body. In the Firth catches *A. aspius* is regarded as a by-catch, while the species significance definitely increases in the Vistula between San and Narew, where it contributed 4% of the commercial catch in the years 1956–1957 (Horoszewicz, 1964).

Aspius aspius of the Szczecin Firth is exploited unevenly throughout the year; the least amounts are obtained in winter, a slight increase being noted in late spring (April – May) and the largest catches with an August maximum from July to November (Fig. 1).

Fish length and age. Assuming a 1 cm class interval, the materials examined were distributed among 42 length classes covering the range of 25–71 cm. The classes 33–42 cm were the most abundant ones, while some of the classes were non-existent altogether.

The age of fish examined ranged from 3 to 16 years (Table 3). The table shows a predomination of 4 year-old individuals in the Szczecin Firth catches (41.2%), followed by the 5- and 3-year-old ones (19.8 and 13.8%, respectively). Since the fishes are caught by gear of a certain mesh size, no younger age group is represented.

According to Backiel (1964b), 4-, 5- and 6-year-old fishes are caught most often in Vistula. In the river Ural, the *Aspius aspius* stock is dominated by the 4-year-old ones with a smaller contribution of the 5-year-old fishes in spring, while in autumn 3-year-old males and 4-year-old females prevail (Berg, 1949). Similar is the situation in the Lake Brailei (Rumania), where 3- and 4-year-old fishes are most common in catches (Paradopol, 1958).

Scale radius – body length relationship. The relationship was followed using the Rosa Lee – modified Dahl-Lea method. The value of „c” was determined from the regression

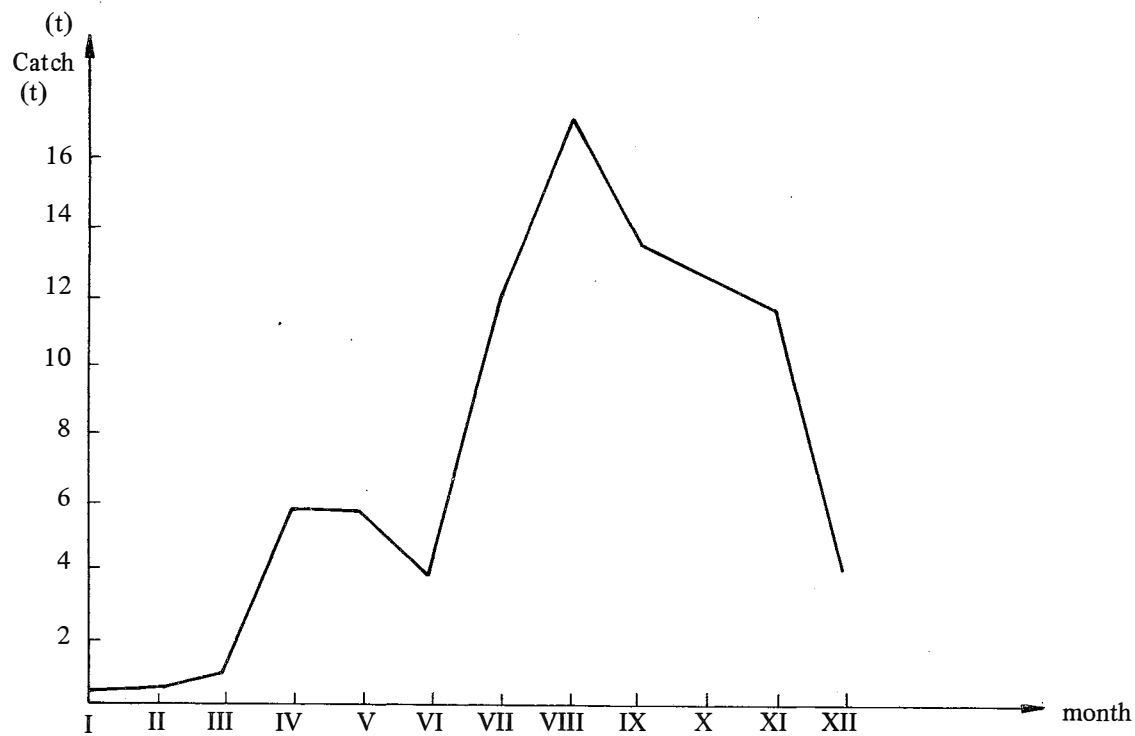


Fig. 1. Seasonal fluctuations in Polish catches of *Aspius aspius* in Szczecin Firth within 1965–74

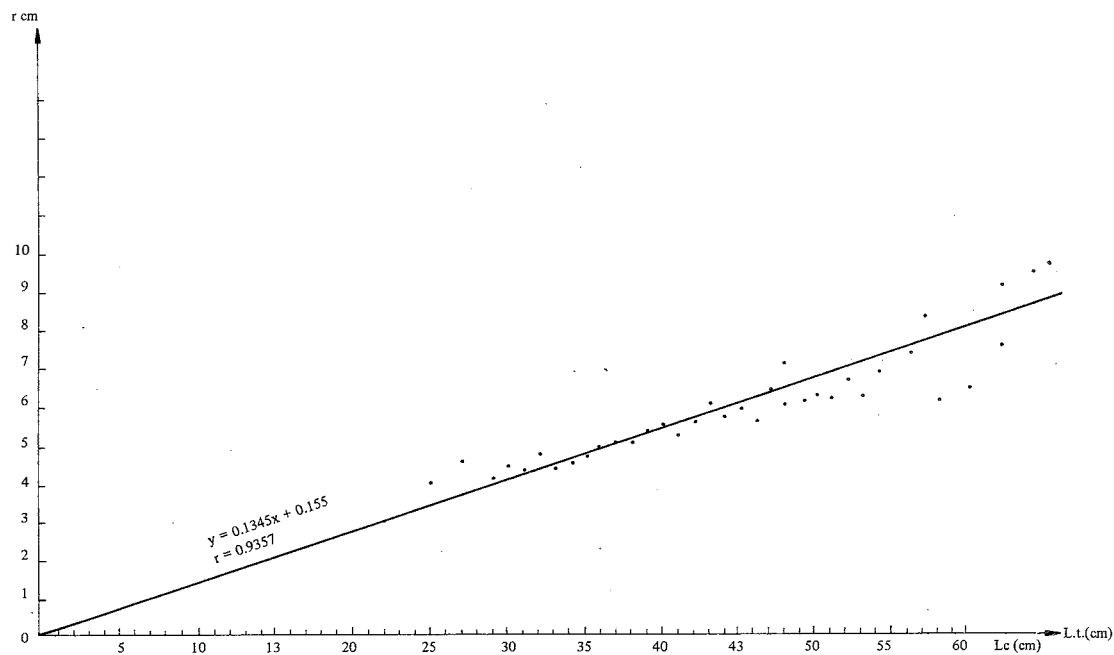


Fig. 2. Scale radius – body length (l.t.) relationships in *Aspius aspius*

Table 3

Age composition of fish studied

Age	n	%	Age	n	%
3+	32	13.8	10+	1	0.4
4+	96	41.2	11+	1	0.4
5+	46	19.8	12+	1	0.4
6+	19	8.2	13+	4	1.7
7+	14	6.0	14+	1	0.4
8+	8	3.4	15+	1	0.4
9+	7	3.0	16+	2	0.9
Total				233	100.0

equation which describes the scale radius – fish body length relationship. The equation parameters were calculated from the appropriate formulae. The correlation coefficient was:

$$r = 0.9357$$

The regression equation, when brought to the form of $y = ax + b$, is thus:

$$y = 0.1345x + 0.155$$

The scale radius – body length relationship is presented in Fig. 2. The relationship can be regarded as proportional, since the straight line representing it crosses the y-axis close to the origin. The correction factor „c”, due to its low value, was omitted when back-calculating the fish length, which was further supported by a better opportunity to compare the results obtained here to those given by other workers. It should be noted that the other authors (Backiel, 1964b; Puškin, 1968) also made their back calculations following the straightforward proportion without applying any correction factors.

Growth rate. Using the data derived from back calculations on scales (Dahl-Lea method), the growth rate of fish examined was computed with an aid of the von Bertalanffy equation, the parameters of which were as follows:

$$L = 72.12 \text{ cm}, k = 0.1715, t_0 = 0.1674$$

The equation in the form of

$$L_t = 72.12[1 - e^{-0.1715(t - 0.1674)}]$$

was used to calculate the growth rate of the Szczecin Firth *A. aspius*. Table 4 presents data describing the *A. aspius* growth rate values obtained from back calculations and from the von Bertalanffy equation. The equation indicates the first two years of life as a period of the fastest growth (Table 4). Starting with the third year, the increments decrease down to the minimum in the last years of life (Fig. 3). Since our own observations as well as those by other authors (Backiel, 1964b; Puškin, 1968) showed the difference between growth rates of females and males not to exceed 1 cm, the idea of analyzing the two sexes separately was rejected.

Table 4

Length growth rate

Method of calculations	Length (l.t.) in individual years															
	l ₁	l ₂	l ₃	l ₄	l ₅	l ₆	l ₇	l ₈	l ₉	l ₁₀	l ₁₁	l ₁₂	l ₁₃	l ₁₄	l ₁₅	l ₁₆
back calculations	8.91	17.59	26.88	34.49	40.47	45.87	49.86	54.39	57.29	59.15	61.05	62.34	64.29	64.82	64.53	63.10
von Bertalanffy equation	9.62	19.49	27.78	34.78	40.67	45.63	49.81	53.33	56.20	58.79	60.89	62.66	64.16	65.41	66.47	67.26

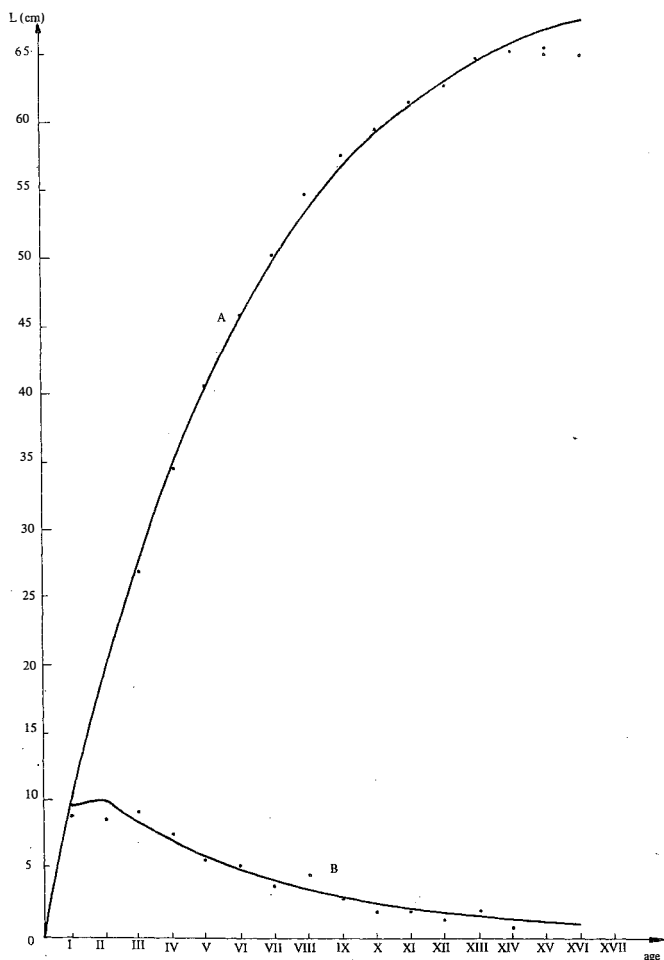


Fig. 3. Growth (A) and growth increments (B) in *Aspius aspius*, calculated as in von Bertalanffy equation (soil line) and back – calculated on scales (points)

Length and weight of fish body. The Szczecin Firth *Aspius aspius* length – weight relationship was calculated from the formula:

$$W = k \cdot L^n$$

where W = total weight of fish (g), L = body length (cm), k and n are coefficients.

Using the least square method, k and n were calculated from the formula given by Lagler (1956) to result:

$$k = 0.01061$$

$$n = 3.1227$$

Having applied these values to the formula, the *Aspius aspius* length – weight relationship was expressed by the following equation:

$$W = 0.01061 \cdot L^{3.1227}$$

Theoretical weights for each length class of *Aspius aspius* were calculated and presented on a graph (Fig. 4). The results of direct measurements are also included in the graph.

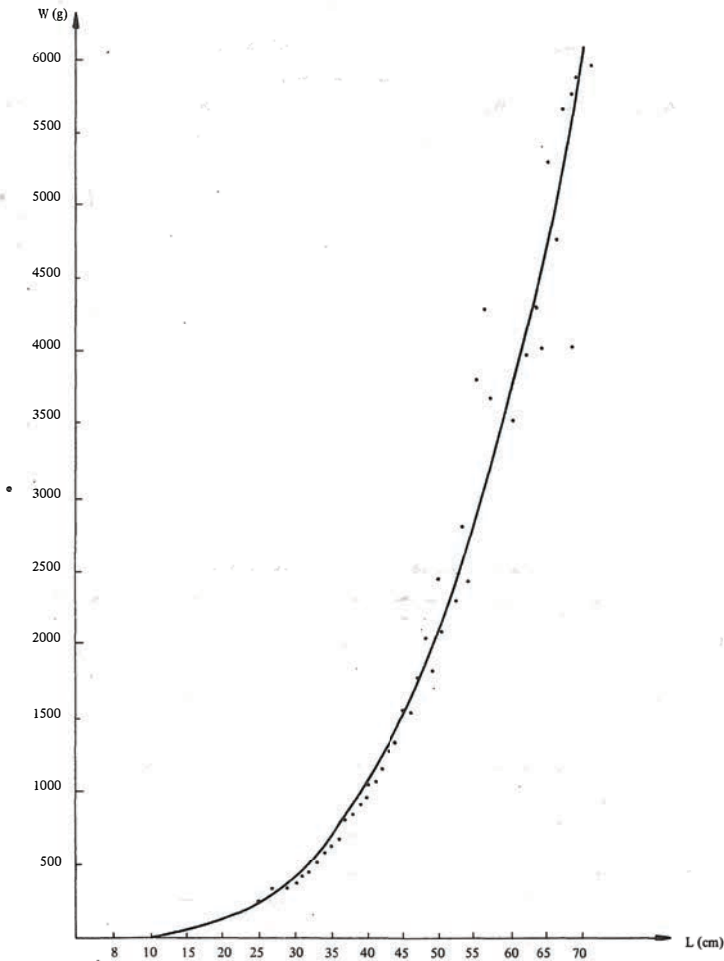


Fig. 4. Length – weight relationship in *Aspius aspius*, points denote true weights at corresponding length classes

Growth of weight. The growth of *Aspius aspius* weight during subsequent years of life was determined making use of the relationship

$$W = 0.01061 \cdot L^{3.1227}$$

The body length values derived from the von Bertalanffy equation were utilized in the computations.

The data comprised in Table 5 indicate the highest weight increments in the Szczecin Firth *Aspius aspius* to be maintained until the seventh year of life, the following years showing gradual decreases in the increments.

Table 5

Weight growth increments in *Aspius aspius*

Age	Mean weight (g)	Weight increment (g)	Age	Mean weight (g)	Weight increment (g)
I	12.47	12.47	IX	3102.0	482.0
II	113.1	100.63	X	3554.0	452.0
III	342.1	229.0	XI	3965.0	411.0
IV	689.8	347.7	XII	4337.0	372.0
V	1125.0	435.2	XIII	4670.0	333.0
VI	1613.0	488.0	XIV	4961.0	291.0
VII	2118.0	505.0	XV	5217.0	256.0
VIII	2620.0	502.0	XVI	5413.0	196.0

Table 6

Characteristics of materials collected

Month Material	VIII	XI	XII	II	III
Number of alimentary canals	56	19	10	34	35
Number of filled canals	52	8	1	—	17
Number of empty canals	4	11	9	34	18
Percentage of filled canals	92.9	42.1	10.0	—	48.6
Percentage of empty canals	7.1	57.9	90.0	100	51.4

Feeding. 154 alimentary canals were collected for studies on the Szczecin Firth *A. aspius* feeding. The filled: empty canals ratio was 78:76. i.e., there were 50.6% of filled guts and 49.4% of empty ones. Similar were the results obtained by Horoszewicz (1964) for the river Vistula *A. aspius*, where 40% of the guts were filled and 60% empty. Table 6 presents the percentage composition of filled and empty guts in samples collected in various months of the year.

The figures given in Table 6 show that no feeding occurred in February. In March some fishes (48.6%) started to feed, this being indicated by their filled alimentary canals. The highest amount (92.9%) of filled canals was found in August. Most fishes (57.9%) ceased to feed in November, their number increasing (90%) in December.

The food composition of *Aspius aspius* was investigated by the occurrence frequency expressed as a percentage of all the filled guts.

Aspius aspius in the Szczecin Firth feeds exclusively on fish; no other items were found in food. The dominant species in the food is smelt reaching a 49% frequency occurrence. The next places are occupied by roach (32.1%), stickleback (25.6%), perch, bleak, and ruff (Table 7).

Table 7

Food composition of the Szczecin Firth *Aspius aspius*

Food item	smelt	roach	stickleback	perch	bleak	ruff
Number of canals containing the item	38	25	20	9	5	1
Occurrence frequency (%)	49.0	32.1	25.6	11.6	6.4	1.3

Table 8

Seasonal changes in food of the Szczecin Firth *A. aspius*

Food item Month		smelt	roach	stickleback	perch	bleak	ruff
August	n	12	25	19	9	5	1
	o.f.	23.1	48.1	36.5	17.3	9.6	1.9
November	n	8	—	—	—	—	—
	o.f.	100.0	—	—	—	—	—
December	n	1	—	—	—	—	—
	o.f.	100.0	—	—	—	—	—
March	n	17	—	1	—	—	—
	o.f.	100.0	—	5.9	—	—	—

n = number of guts containing the item,

o.f. = occurrence frequency (%).

Additionally, some seasonal changes were observed in feeding of the Szczecin Firth *Aspius aspius*. While the food is more diversified in summer (August), in the remaining months (November – March) the fish has to rely almost exclusively on smelt (Table 8).

An increase in abundance of *Aspius aspius* of the Gostawice–Ślesin range lakes indicates that the species is of warm-water nature (Frieske, 1972), its activity and feeding intensity increasing with water temperature (Puškin, 1968). Therefore the broadest food spectrum is observed in summer (Table 8). During this season the food most frequently contains roach (48.1%), then stickleback (36.5%), smelt (23.1%), perch (17.3%), bleak (9.6%), and ruff (1.9%). In November and December, *A. aspius* consumed exclusively smelt (Table 8). In March smelt was found in every gut examined, ruff being spotted only in one of them.

The food composition of *Aspius aspius* is an evidence of a typically predatory feeding habits of the species. Its uptake of fish species of negligible value, rather abundant in the Szczecin Firth, partially controls their occurrence. Only a very numerous stock of *A. aspius* could hamper the development of pikeperch, for which smelt is also a main food component in the Szczecin Firth (Wiktor, 1954).

DISCUSSION OF RESULTS

When comparing the food composition of *Aspius aspius* from various water bodies, some differences in feeding become obvious. Insofar as smelt is the most frequent food item for *A. aspius* from the Szczecin Firth, roach and stickleback following in order of importance, bleak predominates in food of *A. aspius* from other water bodies. For example, in the Vistula *A. aspius* food, bleak prevails, *Gobio gobio* (L.), *Leuciscus cephalus* (L.), and *Chondrostoma nasus* (L.) supplementing the diet (Horoszewicz, 1964).

In the Kama reservoir bleak is also the basic food component, while in the delta of Volga additionally, apart from bleak, *Leucaspis delineatus* (Heck.) and other small fish are found as well (Puškin, 1968).

Plant remains in stomachs were found by Pliszka et al. (1951), while Kasztanis (1975) observed insects fallen upon the water surface to be consumed. Insofar as the Szczecin Firth *A. aspius* alimentary canals contained only six fish species, Horoszewicz (1964) found 17 in, for instance, *A. aspius* from the river Vistula. Such narrow food spectrum as that found in the Firth *A. aspius* presumably results from different environmental conditions, and also is related to a greater availability of smelt. Only in summer, when a considerable dispersal of smelt takes place (Kraczkiewicz, 1969), *A. aspius* consumes other fish species.

A general principle states that the greater spread of sizes of prey available to a given predator, the greater the number of species comprising its diet (Horoszewicz, 1964). *Aspius aspius*, when compared to pike and pikeperch, displays greatly limited abilities of consuming larger prey. Thus most often it feeds on small fish, regardless of its own size (Backiel, 1964b). Only seldom fish longer than 8 cm are consumed. The largest prey

found in the course of the studies presented was a perch individual of 7 cm length, the remaining diet items measuring less.

Food competition between *Aspius aspius* and pikeperch, the latter also relying mainly on smelt (Kraczkiewicz, 1969), seems to be negligible, as the first makes up only 0.14% of commercial catch. In the central Vistula *A. aspius* contributes more to the catch. In Backiel's opinion (1964b), the population of *Aspius aspius* in Vistula should not be exposed to limiting efforts of man in spite of a certain convergence in the diet with pikeperch, since the habitats of the two species are different.

The growth rate of *A. aspius* from the Szczecin Firth, as compared to other water bodies, is regarded as good. Only in the rivers Ilmen, Don, Ural, Ammer, and Chiemse, as well as in the Tienski and Szapsugski reservoirs, do the fishes grow faster, the growth rate being lower in the remaining water bodies.

The fish populations in the Szczecin Firth show, in general, very good growth rates and delayed sexual maturation (Pęczalska, 1972). An abundant food basis, viz.. numerous stocks of smelt and bleak, creates very advantageous conditions for the development of predators (Wiktor, 1960). Among the other factors, the ones mentioned could possibly account for a remarkably long age of *Aspius aspius* in the Firth.

The representatives of every age class within the range of 3–16 years were found in the material studied. The oldest mentioned in the available literature fishes were those from the river Kama, reaching 11 years of life (Puškin, 1968). In the Szczecin Firth, only pikeperch (Kraczkiewicz, 1969), pike (Wiktor and Żukowski, 1962), and lavaret (Pęczalska, 1962) show better growth rates than *A. aspius*. Weight increments observed in *Aspius aspius* of the Firth are also good in comparison to other water bodies, particularly so in older age groups. A particular increase is observed up to the seventh year of life, during which time the increments are larger than those recorded in the Vistula *A. aspius* showing a significant growth till the ninth year (Backiel, 1964b). In spite of larger weight increments in the ninth year of life of the Vistula *A. aspius*, its overall weight is smaller. A faster growth of weight is seen only in *A. aspius* from the lake Ilmen and Ural rivers (until the fifth year) and Don (until the third year) as well as in the Lake Langen *Aspius aspius* in the first year of life (Bauch, 1963).

CONCLUSIONS

The studies described allow the following conclusions to be drawn:

1. A decreasing tendency is found in *Aspius aspius* catches in the Szczecin Firth during the last ten years.
2. 4-, 5-, and 3-year-old *Aspius aspius* individuals were most numerous in commercial catches, the percentages contributed amounting to 41.2, 19.7, and 13.8, respectively.
3. Individuals belonging to the length classes (l.t.) from 33 to 42 cm, making up 54.5% of the material, were found most frequently in catches.
4. The Szczecin Firth *Aspius aspius* is a long-lived species; the oldest individuals' age reaches 16 years.

5. The growth rate of the Szczecin Firth *Aspius aspius* is high. Length increments are largest in the second year of life and then decrease.
6. Weight increments increase till the seventh year of life, being still fairly large until the eleventh year and decreasing thereafter.
7. The most frequent items in the Szczecin Firth *Aspius aspius* diet were: smelt, roach, stickleback, perch, bleak, and ruff.
8. The greatest diversity of food is observed in summer. In this season, *Aspius aspius* fed most often on roach, smelt, and stickleback. Smelt prevailed in food over the remaining seasons of the year.

REFERENCES

- Backiel T., 1964a: Populacja ryb w systemie rzeki Drwęcy. [Population dynamics in the Drwęca River basin]—Rocz. Nauk. Rol. 84-B-2.
- Backiel T., 1964b: Wzrost i próba oceny śmiertelności boleni łowionych w Wiśle. [Growth and tentative mortality evaluation for *Aspius aspius* (L.) angled in the Vistula].—Rocz. Nauk. Rol. 84-B-2.
- Bauch G., 1963: Die einheimischen süßwasserfische. Neuman Verlag, Redebau u Berlin.
- Berg L., 1949: Ryby presnych wod SSSR i sopredelnych stran. Izd. A.N. SSSR, Moskva—Leningrad.
- Cihar J., 1960: Zvýšení množství dravých ryb je v zájmu rybářského obhospodarování Slapské údolní nádrže.—Sečk. Ryb., Nr 8.
- Frieske Z., 1972: Wpływ wód podgrzanych na eksploatację rybacką jezior pasma goławicko-ślesieńskiego. Krajowa konferencja naukowo-techniczna pt. „Rola wód podgrzanych w produkcji rybackiej”. Sekcja rybacka, Konin. [Influence of heat-plant water on fishery exploitation in lakes of the Goławice—Ślesin thread. National Scientific and Technical Conference entitled: „Lead of heat-plant waters in fisheries” Fisheries Section. Konin].
- Horoszewicz L., 1960: Wartość kości gardłowych dolnych (ossa pharyngea inferiora) jako kryteriów gatunkowego oznaczania ryb karpiowatych (Cyprinidae). [The Value of the lower pharyngeal bones (ossa pharyngea inferiora) as a criterion for Cyprinid fish (Cyprinidae) specific identification.]. —Rocz. Nauk. Rol. 84B-2.
- Horoszewicz L., 1964: Pokarm ryb drapieżnych w Wiśle. [Feed of predatory fish in the Vistula].—Rocz. Nauk. Rol. 84-B-2.
- Kasztanis J., 1975: Boleń — ryba nieuchwytna. [*Aspius aspius* (L.) — the fugitive fish]. Wiad. Wędk., nr 3.
- Kraczkiewicz W., 1969: Sandacz Zalewu Szczecińskiego i jego znaczenie w gospodarce rybackiej. [Perch-pike of Szczecin-Firth and its significance in fisheries economy.].—Gosp. Ryb., nr 9.
- Lagler K.T., 1956: Freshwater Fishery Biology (WMC). Brown Company (2).
- Oliva O., Frank S., 1959: Příspěvek z poznání rustu ryb ve Slapské nádrži. Cesk. Ryb., nr 7.
- Paradopol M., 1958: Studiul comparativ al creşterii avatului (*Aspius aspius* L.), Rosicarei (*Scardinus erythrophthalmus* L.), si caracudei (*Carassius carassius*) in Balta Brailei.—An. Univ. ”C.I. Parhon”.
- Pęczalska A., 1962: Badania nad sieją *Coregonus Lavaretus lavaretus* L. Zatoki Pomorskiej i Zalewu Szczecińskiego w latach 1956–1958. [Research on the lavaret, *Coregonus lavaretus lavaretus* L. of the Pomeranian Bay and Szczecin-Firth 1956–1958].—Prace MIR. 11/A.
- Pęczalska A., 1972: Ichtiofauna Zalewu Szczecińskiego. [Fish fauna of Szczecin-Firth].—Studia i materiały oceanograficzne, nr 3.
- Pliszka F., Backiel T., Dziekońska J., Kossakowski J., Włodek S., 1951: Badania nad odżywianiem się ryb w Wiśle. [Inquiries on fish feeding in the Vistula].—Roczn. Nauk. Rol. 57.

- Puškin J.A., 1968: O roste žerecha *Aspius* (L.) Kamskowo wodochraniliszcza. – Woprosy ichtologii 8, 1(68).
- Romanowski S., 1952: Podstawy statystyki matematycznej. [Foundations of mathematical statistics]. – PWN Kraków.
- Wiktor J., 1954: Analiza stada sandacza na Zalewie Szczecińskim. [Analysis of perch-pike population in Szczecin-Firth]. – Prace MIR, 7.
- Wiktor J., 1960: Zarys warunków biologicznych Zalewu Szczecińskiego. [Outline of a biological conditions in Szczecin-Firth]. – Polskie Archiwum Hydrologii. 7.
- Wiktor J., Żukowski Cz., 1962: Szczupak w gospodarce Zalewu Szczecińskiego w latach 1948–1957. [Pike in Szczecin-Firth economy 1948–1957]. – Prace MIR, 11/A.
- Żukowski Cz., 1962: Badania nad leszczem Zalewu Szczecińskiego i Zatoki Pomorskiej w latach 1953–1955. [Investigation on the bream in Szczecin-Firth and the Pomeranian Bay 1953–1955]. – Prace MIR, 11/A.

Translated: mgr Teresa Radziejewska

PRZYCZYNEK DO ZNAJOMOŚCI BIOLOGII I ZNACZENIA GOSPODARCZEGO BOLENIA (*ASPIUS ASPIDUS* L.) Z ZALEWU SZCZECIŃSKIEGO

Streszczenie

Zamierzeniem pracy było zbadanie tempa wzrostu i odżywiania się bolenia z Zalewu Szczecińskiego a także zbadanie wielkości jego połówów. Materiał do badań zbierano w latach 1972, 1974–1975. Pochodził on głównie z połówów niewodnych a częściowo z połówów innym sprzętem rybackim. Badanie nad odżywianiem się bolenia ograniczono do analizy składu jakościowego pokarmu oraz określenia częstości występowania poszczególnych jego składników. Wyznaczono zależność pomiędzy promieniem łuski a długością ciała ryb oraz wykreślono prostą regresji. Tempo wzrostu bolenia badano metodą odczytów wstecznych bez stosowania poprawek metodą von Bertalanffy'ego. Określono zależność między długością i ciężarem ciała metodą podaną przez Laglera (1956). Połowcy opracowano na podstawie statystyki Szczecińskiego Urzędu Morskiego.

Stwierdzono, że połowy bolenia na Zalewie Szczecińskim na przestrzeni ostatnich dziesięciu lat wykazują tendencję spadkową. O ile jeszcze w 1965 roku boleń w połowach stanowił 0,79% to w 1974 roku udział jego zmalał do 0,14%.

W połowach najliczniej występowały osobniki 4-letnie (41,2%), a następnie 5-letnie (19,7%), i 3-letnie (13,8%). Najwięcej ryb w próbach przypadało na klasy długości od 33 do 42 cm (l.c.). Stanowiły one 54,5% zebranego materiału. Stwierdzono, że boleń z Zalewu Szczecińskiego jest rybą długowieczną. Najstarsze osobniki miały 16 lat. Tempo wzrostu bolenia z Zalewu Szczecińskiego jest szybkie. Przyrosty długości są największe w pierwszych dwóch latach życia, w następnych zaś maleją. Przyrosty ciężaru ciała wzrastają do ósmego roku życia, później stopniowo obniżają się. Boleń z Zalewu Szczecińskiego odżywia się głównie stynką, w mniejszym stopniu płocią, ciernikiem, okoniem, ukleją i jazgarzem. Największe zróżnicowanie pokarmu stwierdzono latem. W tym okresie dominowała płoć, stynka i ciernik. W pozostałych okresach pokarm bolenia był jednostronny i składał się prawie wyłącznie ze stynki.

К ВОПРОСУ О БИОЛОГИИ И ХОЗЯЙСТВЕННОМ ЗНАЧЕНИИ
ЖЕРЕХА (*ASPIUS ASPIUS* L.) ИЗ ЩЕЦИНСКОГО ЗАЛИВА

Р е з ю м е

Целью работы было исследование темпа роста и питания жереха из Щецинского залива, а также размеров его лова. Материал для исследований собирали в 1972, 1974 и 1975 гг. Получали его, главным образом, из неводных уловов и частично, из уловов другими орудиями лова.

Исследования питания жерена были сведены к анализу качественного состава корма и определения частоты встречаемости отдельных его компонентов.

В результате исследований установлена и определена зависимость между радиусом чешуи и длиной тела рыб, а также построена прямая регрессии. Темп роста жереха исследовали методом обратных вычислений без применения поправок по методу фон Берталанфи. Определена зависимость между длиной и весом тела по методу, представленному Лаглером (1956). Уловы подсчитаны на основе статических данных Щецинского морского управления.

Установлено, что уловы жереха в Щецинском заливе на протяжении последних десяти лет проявляют тенденцию к снижению. Если ещё в 1956 г. жерех в уловах составлял 0,79%, то в 1974 г. его удельный вес в уловах снизился до 0,14%.

В уловах наиболее многочисленно были представлены 4-летние особи (4,2%), а затем 5-летние (19,7%) и 3-летние (13,8%). Больше всего рыб в пробах приходилось на размерные группы от 33 до 42 см (1.с.). Они составляли 54,5% собранного материала. Установлено, что жерех из Щецинского залива является рыбой долговечной: встречались особи возрастом 16 лет. Темп роста жереха из Щецинского залива большой. Наиболее интенсивный прирост длины наблюдается в первые два года жизни; в последующие же годы темп роста замедляется. Быстрый темп прироста наблюдается до восьмого года жизни, а затем постепенно снижается.

Жерех из Щецинского залива питается главным образом корюшкой, в меньшей мере плотвой, колюшкой, окунем, уклейкой и ершом. Наиболее разнообразным корм является летом. В этот период преобладают плотва, корюшка и колюшка. В остальное время года корм жереха является однообразным и состоит, в основном, почти из корюшки.

Received: 25 V 1976 г.

Address:

Doc. dr Rajmund Trzebiatowski
Instytut Akwakultury i Techniki Rybackiej AR
71-550 Szczecin, ul. Kazimierza Królewicza 4
Polska — Poland