ACTA ICHTHYOLOGICA ET PISCATORIA
Vol. XVIII Fasc. 1 Szczecin 1988

Rajmund TRZEBIATOWSKI, Tomasz HEESE**, Jerzy WISZNIEWSKI**

FORMS OF WHITEFISH, *COREGONUS LAVARETUS* (L.) IN LAKE MIEDWIE
FORMY SIEI *COREGONUS LAVARETUS* (L.) JEZIORA MIEDWIE

*Institute of Aquaculture and Fishing
Techniques
**Institute of Ichthyology
Szczecin

The whitefish (*Coregonus lavaretus*) of the Lake Miedwie was studied. Based on gill raker counts, three forms of the species are discerned: *lavaretus, maraena*, and *generosus*. The *maraena* form individuals showed the highest growth rate. The other two forms grew more slowly, their growth rates being similar to each other. The *maraena* and *generosus* forms fed on both plankton and benthos, while *lavaretus consumed* betnhos only.

INTRODUCTION

The increasing standard of life of the society results in a growing demand for high quality products. Among freshwater fish species, only the valuable ones are sought more and more. The whitefish, *Coregonus lavaretus* (L.) is one of such species. It occurs, albeit in declining abundance, in water bodies of northern Poland. Problems concerning the whitefish fishery in lakes involve obtaining suitable stocking material as well as deteriorating water quality.

The data on the Lake Miedwie whitefish reported in this study should be, at present, regarded as historical as the species is extinct in the Lake. The ecological catastrophe which took place in the Lake in summer 1975 (Stankiewicz and Mutko, 1978) resulted in a complete deoxygenation of water below 12 m depth and a mass mortality of the indigenous whitefish ensued. Single specimens were being sporadically caught until as late as 1985 (Mastyński, 1986). One should, however, consider the importance of these data which demonstrate the Lake Miedwie potential for whitefish production in the area.

The Lake Miedwie whitefish was frequently dealt with by researchers interested in coregonids. Lityński (1932), Thienemann (1935), Wiese (1938), Steinmann (1951) and Gąsowska (1965, 1967) published a number of interesting information.

The present work is aimed at determining the taxonomic structure, food, and growth rate of the Lake Miedwie whitefish population.

MATERIAL AND METHODS

The fish individuals examined were caught in the Lake Miedwie between August 3, 1973 and May 15, 1974 (Table 1) with both moved (smelt trawl, seine) and stationary (Peter net) gears. A total of 373 individuals about 68% of which were caught in autumn – winter were examined.

Table 1

Number of whitefish individuals caught in various months

Year	1973					1974				
Month	VIII	IX	X	XI	XII	I	II	III	IV	V
No. of whitefish individuals	15	21	46	75	119	54	19	11	8	5
Total	373									

The meristic analysis to distinguish taxonomic forms was based on the gill raker count (as determined from the first gill arch), number of scales along the lateral line, and number of scales above and below the lateral line.

The fish individuals examined measured (total length) from 16.2 to 70.2 cm. The fish were weighed to 5 g. Fish age was determined from scales taken from above the lateral line between the dorsal and adipose fins. Growth rate was calculated from direct measurements.

The food analysis involved composition of food and frequency of planktonic and benthic organisms in diet. Food organisms were identified with the aid of a freshwater fauna key (Rybak, 1971).

AREA OF STUDY

The Lake Miedwie is one of the largest West Pomeranian lakes (Fig. 1). At present the Lake is a rudiment of a huge water body existing in the place 120 years ago and occupies on third of the latter's area. The Lake covers 3527 hectares; its maximum and mean depths are 43.8 and 19.3 m, respectively. Until recently, the Lake was classified as

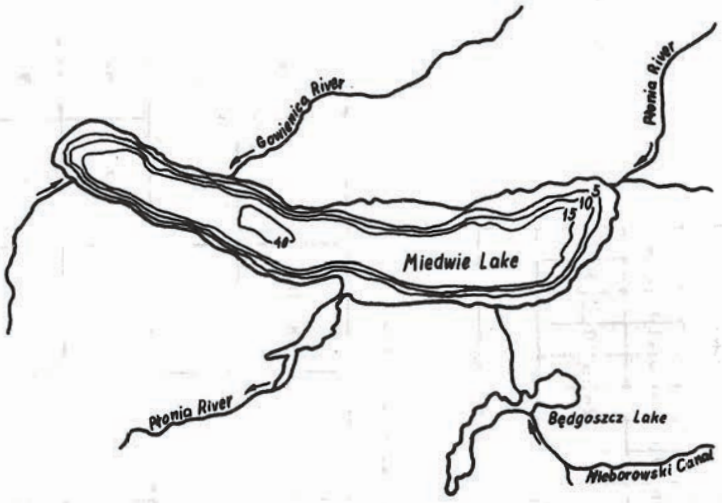

Fig. 1. Lake Miedwie, with bathymetric data

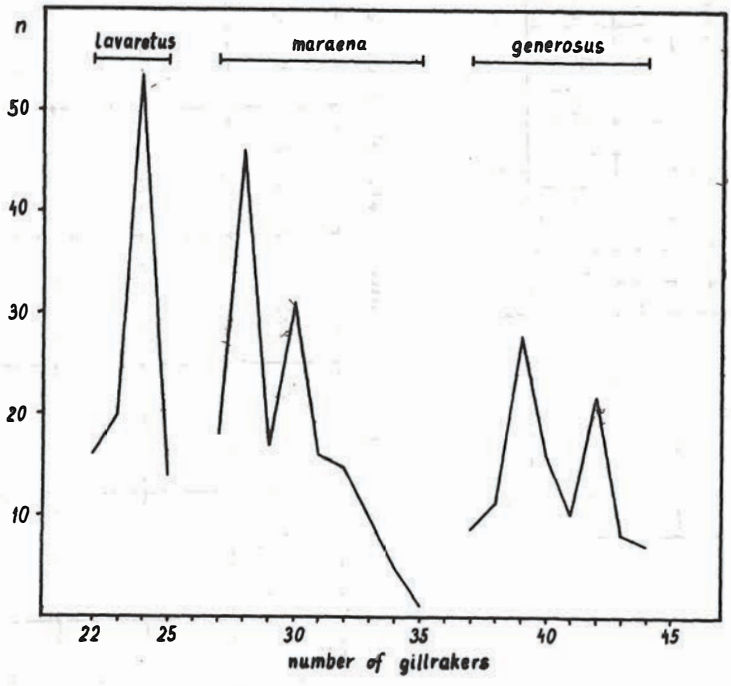

Fig. 2. Distribution of gill raker counts (n = 373)

Table 2

Frequency of occurrence of whitefish with different gill raker counts

Whitefish form	*lavaretus*					*maraena*										*generosus*								
Gill rakers	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
No. of individuals	16	20	54	14	–	18	46	17	31	16	15	10	5	1	–	8	11	28	16	10	22	8	7
Mean	23.6					29.6										40.3								

Table 3

Frequency of occurrence of whitefish with different number of scales along lateral line

No. of scales / Form	79–81	82–84	85–87	88–90	91–93	94–96	97–99	100–102	n	mean
lavaretus	2	6	39	23	19	11	4	–	104	88.5
maraena	–	10	30	53	42	24	–	–	159	89.0
generosus	–	–	8	10	32	42	12	6	110	94.5

mesotrophic; at present, as demonstrated by oxygen conditions and contents of phosphates and ammonia in the hypolimnion,, increasing eutrophication is observed (Tadajewski and Mutko, 1980). The process is reflected in changes in the hypolimnion oxygen content (1 m above the bottom) during the peak summer stagnation: from 6 mg O_2/dm^3 in 1963 to 0.8 mg O_2/dm^3 in 1978 (Tadajewski and Mutko, 1980).

RESULTS

1. Gill raker counts

The analysis of gill raker counts demonstrated the existence of three forms in the population, the forms differing markedly in their counts (Table 2; Fig. 2). Following Berg

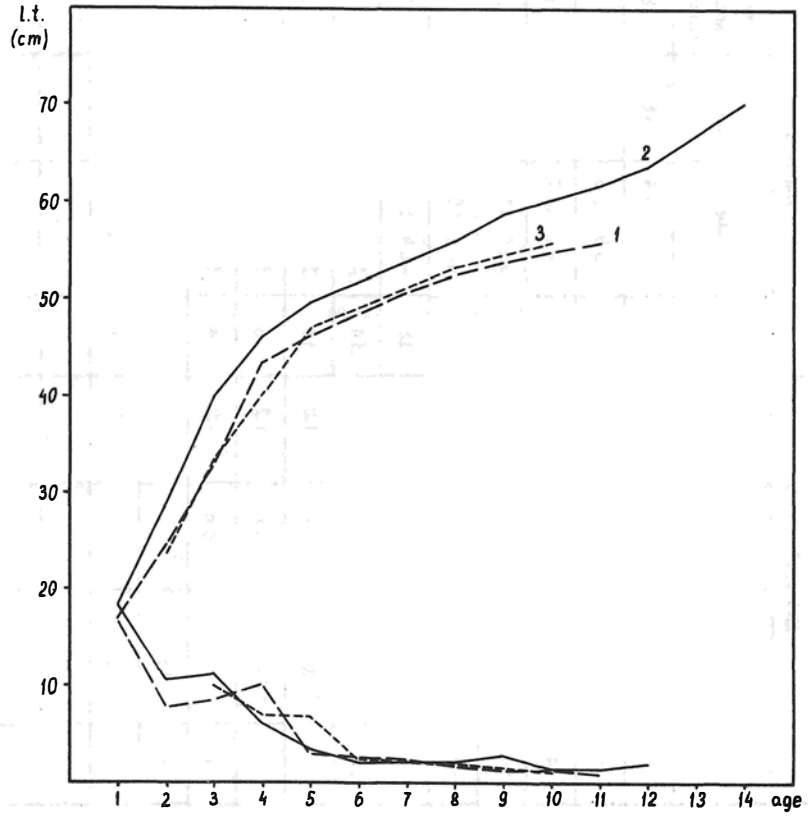

Fig. 3. Growth rate of three whitefish forms and their mean annual increments
1 = *f. lavaretus;* 2 = *f. maraena;* 3 = *f. generosus*

Table 4

Total length (l.t., cm) growth rate in different whitefish

forms	*lavaretus*				*maraena*				*generosus*			
age group	n	range	mean	mean annual increment	n	range	mean	mean annual increment	n	range	mean	mean annual increment
I	5	15.1–18.5	16.8	16.8	19	16.2–20.4	18.3	18.3	–	–	–	–
II	8	22.1–27.1	24.6	7.8	17	23.9–32.5	28.7	10.4	11	22.5–24.5	23.5	–
III	14	29.1–37.1	33.1	8.5	24	34.1–48.7	39.9	11.2	14	30.1–36.7	33.4	9.9
IV	15	41.5–44.9	43.2	10.1	20	44.2–47.8	46.0	6.1	7	38.3–41.1	40.2	6.8
V	13	44.4–48.0	46.2	3.0	15	48.1–50.8	49.5	3.5	26	44.4–49.4	46.9	6.7
VI	23	47.1–49.9	48.5	2.3	18	46.9–53.6	51.6	2.1	23	47.4–50.6	49.0	2.1
VII	16	50.1–51.1	50.6	2.1	14	52.7–54.9	53.8	2.2	20	49.2–53.3	51.2	2.2
VIII	5	51.0–53.8	52.4	1.8	18	54.0–57.8	55.9	2.1	7	52.4–54.1	53.1	1.9
IX	3	52.8–54.2	53.6	1.2	6	58.0–59.4	58.7	2.8	1	54.5	54.5	1.4
X	1	54.8	54.8	1.2	4	59.1–61.3	60.2	1.5	1	55.6	55.6	1.1
XI	1	55.7	55.7	0.9	2	60.8–62.4	61.6	1.4	–	–	–	–
XII	–	–	–	–	1	63.6	63.6	2.0	–	–	–	–
XIII	–	–	–	–	–	–	–	–	–	–	–	–
XIV	–	–	–	–	1	70.2	70.2	–	–	–	–	–

(1948) and Kaj (1962), three subspecies can be separated: *Coregonus lavaretus maraena* (Bloch, 1779), *C.l.generosus* (Peters, 1875), and *C.l.lavaretus* (L., 1758).

At the present state of knowledge on the intraspecific structure of *Coregonus lavaretus*, it is difficult to accept the division into subspecies. It is more practical and purposeful to regard the three groups as forms (Heese, 1985).

The sample examined consisted in 43% of the maraena, in 29% of the generosus, and in 28% of the lavaretus individuals.

2. Number of scales

The scale analysis (Table 3) demonstrated similarity between the *lavaretus* and *maraena* individuals. Those belonging to forma generosus have 6 scales more, on the average, along the lateral line, which indirectly evidences the presence of finer scales in this form. The scale formulae of all the three forms are as follows:

lavaretus	79–98	$\frac{8-13}{8-11}$
maraena	82–96	$\frac{8-12}{9-13}$
generosus	87–102	$\frac{9-12}{10-14}$

3. Length and weight growth

Table 4 and Fig. 3 present data on growth rates of the whitefish forms distinguished. The highest growth rate was observed in the maraena form, while the two other forms grew more slowly and at a rate similar to each other. The difference in growth rate of the *maraena* and other individuals amounted to about 3–5 cm.

All the three forms showed the highest mean annual increments to occur in the first four years of life, before attaining sexual maturity (Fig. 3), after which time the annual increments dropped markedly.

Data on weight growth vs. fish age (Table 5) set off, too, the maraena individuals as the fastest growing ones. On the other hand, the weight-total length relationship is similar in the maraena and generosus individuals (Fig. 4), the relationship increasing faster in forma lavaretus, which presumably resulted from different body proportions or better condition during measurements. The logarithmic and exponential equations describing the relationship in the three forms are as follows:

lavaretus	log	$W = 2.8976 \log L - 1.7546$
		$W = 0.017595\ L^{2.8976}$
maraena	log	$W = 2.9449 \log L - 1.9070$
		$W = 0.01238\ L^{2.9449}$
generosus	log	$W = 2.3869 \log L - 0.9027$
		$W = 0.12511\ L^{2.3869}$

Table 5

Total weight (g) growth rate in different whitefish forms

form	*lavaretus*				*maraena*				*generosus*			
age group	n	range	mean	mean annual increment	n	range	mean	mean annual inctement	n	range	mean	mean annual increment
I	5	41–78	59	59	19	43–85	64	64	–	–	–	–
II	8	180–300	224	165	17	207–390	299	235	11	221–259	240	–
III	14	480–600	520	296	24	246–706	526	227	14	480–650	555	315
IV	15	640–780	710	190	20	665–885	775	249	7	700–1000	850	295
V	13	810–1128	919	209	15	925–1175	1050	275	26	970–1128	1049	199
VI	23	1190–1310	1250	331	18	1250–1430	1340	290	23	1136–1268	1201	152
VII	16	1423–1567	1495	245	14	1597–1663	1630	290	20	1387–1539	1463	262
VIII	5	1581–1821	1751	256	18	1798–1992	1895	265	7	1648–1750	1699	236
IX	3	1904–2004	1954	203	6	2005–2295	2150	255	1	1883	1883	184
X	1	2178	2178	224	4	2190–2374	2332	182	1	2090	2090	207
XI	1	2314	2314	136	2	2410–2590	2500	168	–	–	–	–
XII	–	–	–	–	1	2613	2613	113	–	–	–	–

4. Food

The whitefish food was analysed mostly qualitatively, the food items being ascribed to plankton or benthos (Table 6). The *maraena* and *generosus* individuals fed on both the planktonic and benthic organisms, the plankters in the first being less abundant and diverse. On the other hand, no planktonic animals were found in the food of forma lavaretus. Fig. 5 presents differences in food composition.

The diet of larger whitefish (longer than 40 cm) included also fish, mainly smelt and ruff, and sporadically the montée eel. Moreover, fish eggs, presumably those of conspecifics, were found in stomachs as well.

Table 6

Food composition of whitefish studied (frequency of occurrence of principal food groups)

From	Plankton	Benthos	Other
lavaretus		Chironomidae larvae, Asellus, Chaoborus, Bithynia, Valvata, Piscicola, Pisidium, Dreissena Ostracoda, Chydorus, Alona, Diptera	shells, sand, detritus – ruff, eggs, fragments of vascular plants
%	0	86	14
maraena	Daphnia, Mesocyclops, Diaptomus, Leptodora	Sialis, Theodoxus, Chironomidae, larvae, Asellus, Chaoborus, Bithinia, Valvata, Piscidium, Dreissena, Piscicola, Ostracoda, Chydorus, Alona, Diptera	Melosira, Gloeotrichia, detritus, sand, whitefish eggs, smelt, ruff, montee eel
%	13	65	22
generosus	Cyclops, Mesocyclops, Daphnia, Bythotrephes, Leptodora, Eudiaptomus, Leptocerus	Chironomidae larvae, Asellus, Theodoxus, Pallasea, Phyllopoda	detritus, sand, shells, smelt, fragments of vascular plants
%	61	28	11

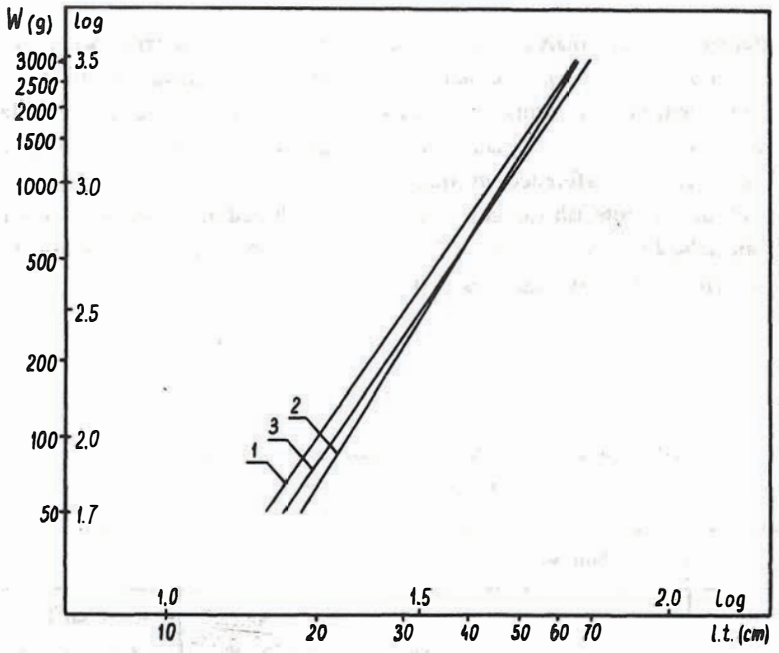

Fig. 4. Weight growth rate as dependent on total length (l.t.).
1 = *f. lavaretus;* 2 = *f. maraena;* 3 = *f. generosus* (graphs plotted in log scale)

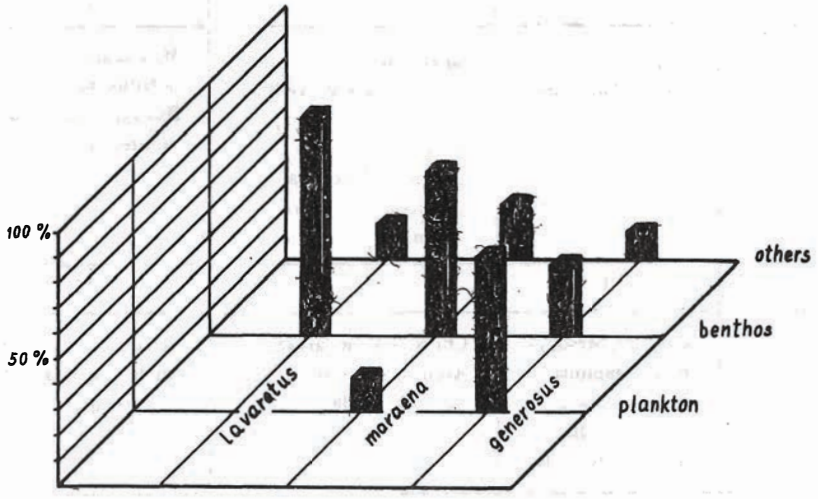

Fig. 5. Frequency of occurrence of different food items in various whitefish forms

DISCUSSION

Forma maraena is the most interesting whitefish form among those discerned. The form is indigenous in the Lake Miedwie, thus its present extinction is still more regrettable.

The results of studies on the Lake Miedwie whitefish presented evidence a large potential of the Lake for coregonid production. Growth rate of the whitefish forms discussed is one of the highest in Poland, which is mainly an effect of environmental conditions. Marciak (1967), too, considers the habitat as a rather important factor for whitefish growth.

The analysis of the whitefish food composition demonstrates the species, ability to consume diverse food. There was a certain trend toward a dependence of the planktonic to benthic items ratio on the density of the fish filtration apparatus. Stomach contents of the whitefish with the lowest gill raker count (*f. lavaretus*) lacked plankters. On the other hand, the largest quantities of plankton were found in the fish possessing a dense filtration apparatus (*f. generosus*). This is then a rather clear indication that the gill raker count determines the domination of planktonic or benthic items in diet. Food availability is another important factor, limited – in the case of whitefish – by water oxygenation. According to Kaj (1955), this is a key factor for whitefish feeding in the Gorzyń lakes. In summer, the whitefish could have been fished with the Peter net within the epilimnion only, while in autumn, after the water column had been mixed, the whitefish were caught at depths down to 18 m.

Table 7

Comparison of mean gill raker counts and contributions of various whitefish forms in the present study and in Gąsowska (1965)

Whitefish form	Gąsowska (1965)		Authors data 1973–1974	
	% contribution	mean gill raker count	% contribution	mean gill raker count
lavaretus	0.5	–	28	23.6
maraena	50	31.0	43	29.6
generosus	49.5	39.4	29	40.3

Table 7 compares the results obtained in the present study with earlier data reported by Gąsowska (1965). The basic difference concerns the respective contributions of the whitefish forms occurring in the Lake, mainly *lavaretus* and *generosus*. A comparison of gill raker counts demonstrates that the *maraena* and *generosus* forms have retained their specific mean counts. No comparison was possible for forma lavaretus due to the lack of a representative sample in Gąsowska (1965)

Table 8

Comparison between Lake Medwie f. maraena and migratory whitefish of Szczecin Lagoon

Character	f. maraena, Lake Miedwie			Migratory whitefish, Szczecin Lagoon (data from Heese, 1986)		
	n	range	mean	n	range	mean
gill rakers	159	27–35	29.6	267	22–35	29.0
scales along lateral line	159	82–96	89.0	267	80–98	89.1

A number of authors (Svärdson, 1952, 1970; Himberg, 1970; Rešetnikov, 1980) stress the fact of hybridisation between various whitefish forms, intermediate values of gill raker count being the effect.

Within the recent years (1983–1985) a migratory form of whitefish spawning in the Szczecin Lagoon was studied (Heese, 1987). The data obtained on gill raker counts and number of scales along the lateral line are similar to those found for the Lake Miedwie forma *maraena* (Table 8). The Lake is connected with the Lagoon via the river Płonia and Lake Dąbie. One should, however, remember that – according to Pęczalska (1962) – the mean gill raker count in the Szczecin Lagoon whitefish was 26 (the range of 23–33). The data may evidence the introgression of forma *maraena* to the Szczecin Lagoon whitefish population due to, mainly, stocking operations. A hatchery in Goleniów (located in the vicinity of the Lagoon) produced whitefish hatch and fry within 1962–1972; fertilised eggs were supplied to the hatchery from the Lake Miedwie and the Lagoon, a situation which facilitated mixing of the stocking material.

Additionally, the presence in the Lake Miedwie of forma *lavaretus* having 22–25 gill rakers is interesting as no population with such a sparse filtration apparatus was recorded in the Szczecin Lagoon. Similarly to the generosus individuals, the form in question had been presumably introduced during earlier stocking operations.

It is the present author's opinion that a next attempt to stock the Lake Miedwie with whitefish should involve mainly forms with dense filtration apparatus. During a prolonged summer stagnation, the benthos-feeding *lavaretus* individuals suffered of the lack of suitable feeding condition, which was confirmed by poor filling of their stomachs during summer.

REFERENCES

Berg L.S., 1948: Ryby presnych vod SSSR i sopredelnych stran. Izd, AN SSSR, T. I, Moskva. (in Russian)

Gąsowska M., 1965: Aktualne formy siei jeziora Miedwie. [Current forms of whitefish in Lake Miedwie]. Gosp. rybna, 1:3–5.

Gąsowska M., 1967: Analytic survey of Coregonids of three Polish Lakes: Miedwie, Pełcz and Wielkie Okonińskie. Ann Zool., Warszawa, 24,3: 343–359.

Heese T., 1985: Charakterystyka morfologiczna i biologiczna siei Coregonus lavaretus (L., 1758) Zatoki Pomorskiej. [Morphological and biological characteristics of whitefish, Coregonus lavaretus (L., 1758) of the Pomeranian Bay. Ph.D.Thesis]. Praca doktorska, Bibl. AR Szczecin.

Heese T., 1987: Morfologia dwóch form plastycznych siei Coregonus lavaretus (L.) występujących w Zatoce Pomorskiej i Zalewie Szczecińskim. [Morphology of two plastic forms of whitefish Coregonus lavaretus (L.) ocourring in the Pomeranian Bay and Szczecin Lagoon]. Acta Ichthyol. et Pisc. XVII,1: 3–28.

Himberg K.J.M., 1970: A systematic and zoogeographic study of some North European coregonids. In: Biology of Coregonid fishes. Winnipeg, Univ. Manitoba Press: 219–250.

Kaj J., 1955: Sieja jezior Międzychodzkich. [Whitefish of the Międzychód lakes]. PWN, Poznań.

Kaj J., 1962: Salmonidae, Thymallidae, Osmeridae. Klucze do oznaczania kręgowców Polski, część I – Krągłouste i Ryby, Cyclostomi et Pisces, pod red. M. Gąsowskiej. [Salmonidae, Thymallidae, Osmeridae. Keys to identification vertebrates of Poland. Part 1. Cyclostomates and Fish (Cyclostomi et Pisces]. Edited by M. Gąsowska. PWN Warszawa – Kraków.

Lityński A., 1932: Sieja wigierska. Przyczynek morfologiczno-biologiczny. [The Lake Wigry whitewhish. Adcontribution to its morphology and biology]. Arch. Hydrob. i Ryb., 6: 1–40.

Marciniak Z., 1967: Zasady oceny wzrostu siei. [Principles of whitefish growth evaluation]. Gosp. rybna, 12: 8–10.

Mastyński J., 1986: Coregonidy w jeziorze Miedwie. [Coregonids in Lake Miedwie. In: Proceedings of 13th Conference of Polish Hydrobiologists, Sczecin, 16–19 September 1986].

Pęczalska A., 1962: Badania nad sieją (Coregonus lavaretus L.) Zatoki Pomorskiej i Zalewu Szczecińskiego w latach 1956–1958. [Studies on whitefish (Coregonus lavaretus L.) of the Pomeranian Bay and Szczecin Lagoon in 1956–1958]. Prace MIR, 11-A: 287–320.

Pęczalska A., 1966: Sieja Zatoki Pomorskiej (Coregonus lavaretus L.) [The Pomeranian Bay whitefish (Coregonus lavaretus L.). Ph.D.Thesis]. Praca doktorska, Bibl. ART Olsztyn.

Rešetnikov Ju.S., 1980: Ekologija i sistematyka sigovych ryb. Izd. Nauka, Moskwa. (in Russian)

Rybak J.I. 1971: Przewodnik do rozpoznawania niektórych bezkręgowych zwierząt słodkowodnych. [A guide to identification of some freshwater invertebrates]. Zakł. Ekol. PAN, Warszawa.

Stankiewicz E.B., Mutko T., 1978: Od eutrofizacji do degradacji na przykładzie kilku akwenów w woj. szczecińskim. [From eutrophication to degradation as exemplified by several water bodies in the Szczecin District]. Gosp. rybna, 1: 4–7.

Steinmann P., 1951: Monographie der Schweizerischen Koregonen. Teil III. Schweizer. Z. Hydrobiol., 13,1: 54–156.

Svärdson G., 1952: The Coregonid problem. IV. The significance of scales and gill rakers. Rep. Inst. Freshwater Res. Drottningholm, 33: 204–232.

Svärdson G., 1970: Significance of introgression in Coregonid evolution. In: Biology of Coregonid Fishes. Winnipeg, Univ. Manitoba Press, 33–59.

Tadajewski A., Mutko T., 1980: Charakterystyka hydrochemiczna jeziora Miedwie ze szczególnym uwzględnieniem stopnia jego zeutrofizowania. Materiały Sesji Naukowej „Optymalizacja produkcji rolniczej na obszarze zlewni rzeki Płoni z zachowaniem czystości wód jeziora Miedwie". [Hydrochemistry of Lake Miedwie with a particular reference to eutrophication. Conference Proceedings: Optimisation of agricultural production within River Płonie drainage, with preservation of Lake Miedwie water purity]. Wyd. AR Szczecin: 44–58.

Thienemann A., 1935: Der Schnäpel (Coregonus lavaretus balticus) in Vorpommern. Sonderdruck aus Dohrniana, 14: 85–91.

Wiese A., 1938: Die Grossmaranen Ostpreussens. Fisch. 35: 475–539.

Translated: Dr. T. Radziejewska Received: 87.05.29

R. Trzebiatowski, T. Heese, J. Wiszniewski

FORMY SIEI *COREGONUS LAVARETUS* (L.) JEZIORA MIEDWIE

STRESZCZENIE

Ryby do badań (n = 373) pobrano z jeziora Miedwie w okresie od 3.08.1973 do 15.05.1974. W oparciu o liczbę wyrostków filtracyjnych stwierdzono trzy różne formy tego gatunku: *lavaretus*, *maraena* i *generosus* (odpowiednio średnia liczba wyrostków filtracyjnych wynosi 23,6; 29,6 i 40,3). W pobranej próbie procentowo najliczniej reprezentowana była forma *maraena* 43%, następnie *generosus* 29% i *lavaretus* 28%.

Najszybszy wzrost obserwuje się u formy *maraena*, natomiast formy *lavaretus* i *generosus* rosły wolniej i w podobnym do siebie tempie. Wszystkie trzy formy siei najwyższe średnie przyrosty roczne miały w pierwszych 4 latach życia do osiągnięcia dojrzałości płciowej. Tempo wzrostu omawianych form należy do jednych z najwyższych w Polsce, na co głównie wpłynęły warunki środowiska.

Analiza składu zjadanego pokarmu świadczy o wielożerności siei i możliwości zjadania różnorodnego pokarmu. Sieje o najmniejszej liczbie wyrostków filtracyjnych (*f. lavaretus*) nie posiadały w badanych żołądkach organizmów planktonowych. Z kolei najwięcej planktonu stwierdzono u ryb z gęstym aparatem filtracyjnym (*f. generosus*). Charakter tego odżywiania świadczy o dominacji poszczególnych składników pokarmowych w zależności od ilości wyrostków filtracyjnych.

Prezentowane w oparcowaniu wyniki badań nad sieją jeziora Miedwie należy już dzisiaj uznać za historyczne, gdyż obecnie gatunek ten w omawianym zbiorniku całkowicie zanikł. W 1975 roku miała tu miejsce katastrofa ekologiczna powodująca całkowite odtlenienie wody poniżej 12 m i masowe śnięcia siei. Pojedyncze okazy sporadycznie łowiono jeszcze w 1985 r. Stąd wynika znaczenie powyższych danych świadczących o możliwościach produkcyjnych w tym akwenie.

Najbardziej interesującą i szczególną formą siei z wyróżnionych jest forma *maraena*. Forma ta w jeziorze Miedwie ma swoje pierwotne siedlisko i jej obecny zanik jest tym bardziej dotkliwy.

Zdaniem autorów pracy, przy ponownej próbie zarybienia jeziora Miedwie należy przede wszystkim uwzględnić formy siei o dużej liczbie wyrostków filtracyjnych. Badana forma *lavaretus*, żywiąca się głównie fauną denną, w czasie przedłużającej się stagnacji letniej nie miała właściwych dla siebie warunków pokarmowych. Potwierdzeniem tego był fakt słabo napełnionych przewodów pokarmowych tej formy w okresie lata.

Authors' address:

Prof. Dr Rajmund Trzebiatowski
Instytut Akwakultury i Techniki Rybackiej
Akademia Rolnicza
ul. Kazimierza Królewicza 4
71–550 Szczecin
Polska (Poland)