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Fish biology

CYCLOSTOMATES AND FISHES OF THE DRAWA RIVER WITHIN THE LIMITS OF THE DRAWIEŃSKI NATIONAL PARK

KRĄGŁOUSTE I RYBY RZEKI DRAWY W OBSZARZE DRAWIEŃSKIEGO PARKU NARODOWEGO

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Part of the lower Drawa River between Dubie Lake and the Płociczna River mouth, stretching for a distance of 38.8 km, belongs to the Drawieński National Park, established in 1990. Electrofishing conducted on the 8 river stretches within the park limits yielded a total of 26 fish species and one cyclostomate species. The leading species appeared to be the roach, with the domination level reaching 56.16%. The other abundant species were: burbot (D = 7.81%), silver bream (D = 6.88%), and perch (D = 5.95%). The remaining species occurred in smaller numbers. The Drawa River within the Park limits is inhabited by 3 species of the family Cyprinidae: minnow—*Phoxinus phoxinus*, schneider—*Alburnoides bipunctatus*, and bitterling—*Rhodeus sericeus amarus*, all under strict protection and one cyclostomate species of the family Petromyzonidae—river lamprey—*Lampetra fluviatilis*, protected at the stage of larval development.

INTRODUCTION

The principal objective of a national park is to study and learn, also to preserve the integrity of the natural systems of a given area, including conditions of their existence, as well as to reconstruct deformed and extinct links within the indigenous nature (Anon. 1991). Such objective, also regarding cyclostomates and fishes, has been undertaken by, established in 1990, the Drawieński National Park, situated in the lower stretch of the Drawa River (Fig. 1a). The present study on the species composition of the cyclostomates and fishes inhabiting the Drawa within the limits of the Drawieński National Park was based on the catches conducted in the fall of 1994 and the summer of 1995.

The drainage area of the Drawa River, covering 3 198.4 km^2 (Anon. 1949) is situated in the western part of Polish Pomerania. In its upper stretch it covers the western part of the Drawa Lake District, while in the middle and lower stretch—the western part of the Wałcz

Lake District and the eastern part of the Myślibórz Lake District. The Drawa, after flowing the distance of 199 km empties to the lower Noteć River as a quaternary tributary of the Odra River (Fig. 1b).

The section of the Drawa being a part of the Drawieński National Park stretches from Dubie Lake to the mouth of its left bank tributary—the Płociczna River and covers 38.8 km (Fig. 1c). The above-mentioned section of the river, constituting 19.5% of its length, is situated within 27.3–66.1 km from its merging point with the Noteć River.

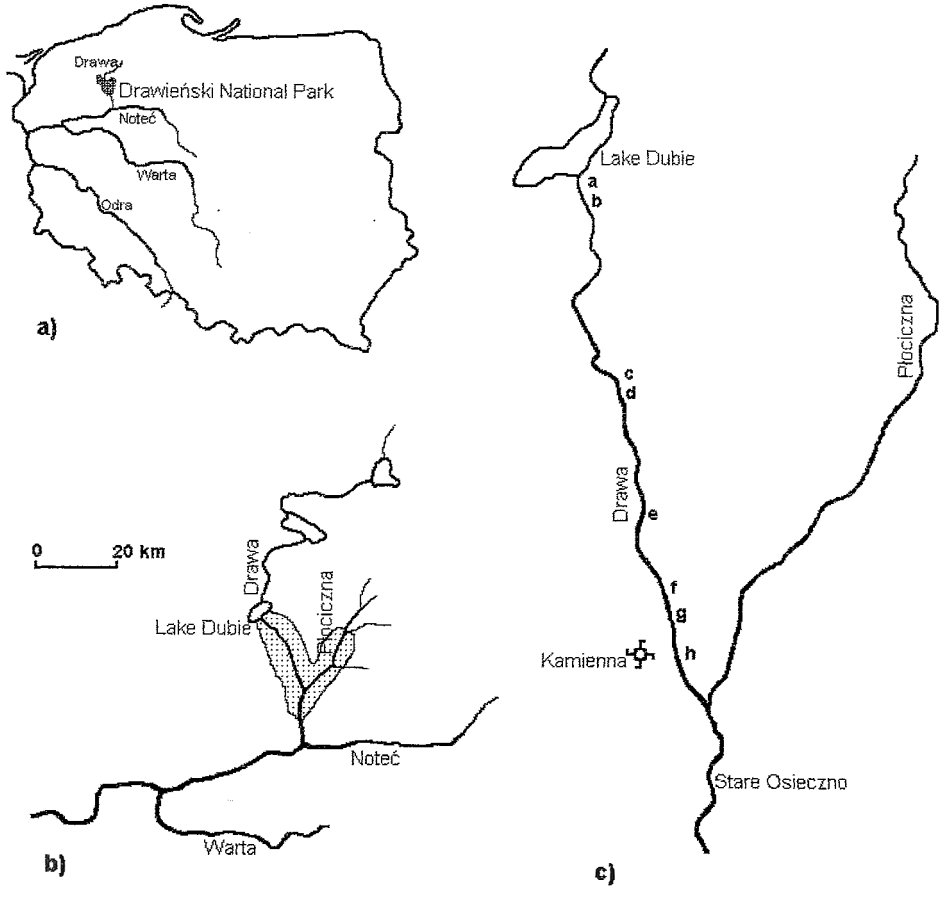

Fig. 1. Drawieński National Park; a) location in Poland; b) location in the drainage basin of the Drawa River; c) map of the Drawa River within the limits of the Drawieński National Park (a–h—sampling sections).

The Drawa, within the Drawieński National Park, flows in its decisive part through dense, mostly coniferous, forest complexes. Its channel has distinctly marked, steep banks, sometimes covered with roots of deciduous trees, mostly black alder. The river bottom is little diversified, flat, sandy with small gravel and stone areas. The river is in most cases 21 m wide and 1.5 m deep. Speed of the current in the lower part of the river reaches 1.2 m/s. In the lower part of the river belonging to the Drawieński National Park there is a reservoir of the hydroelectric power plant in Kamienna with its backwater reaching 2 600–3 000 m. The Drawa within the Drawieński National Park, with the exception of the Kamienna Reservoir, has retained its natural character, with relatively clear, transparent water. The average vertical drop rate from the sources to the emptying point to the Noteć River was 0.70‰ (Przybył 1976). The amount of the water that the river carries is estimated for 5.7 m^3/s at average lower water levels, 20.0 m^3/s at average, and 36.0 m^3/s at average high water levels.

The information on the occurrence of the cyclostomates and fishes in the Drawa or in its river basin according to Rolik and Rembiszewski (1975) and the other authors are relatively numerous (Bartel 1971, 1976; Bartel et al. 1984; Borne 1882; Brylińska 1986; Chełkowska 1982; Chełkowska and Chełkowski 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976; Chełkowski 1966, 1967a, 1967b, 1970, 1971, 1975, 1977, 1985, 1986, 1987, 1987a, 1988, 1989; Chełkowski and Chełkowska 1974, 1978, 1979, 1980, 1981, 1983, 1984, 1985, 1986, 1992; Chełkowski et al. 1994; Christensen and Johansson 1975; Chrzan 1947, 1961, 1962, 1964, 1969; Czaplicki 1962; Gąsowska 1962; Gerhard 1893; Grotrian 1901, 1905, 1907; Iwaszkiewicz 1959, 1966; Jaskowski 1962; Jaworek 1964; Kaj 1948, 1952, 1953, 1954, 1958, 1958a; Kaj and Walczak 1954; Kordaszewski 1947; Kulmatycki 1926; Paladino 1961; Polański 1962; Przybył 1976; Schulz 1912; Seligo 1890, 1891, 1895, 1896, 1896, 1902; Staff 1950; Stankiewicz 1949; Wilkosz 1902, 1904; Żarnecki 1962).

Cyclostomates and fishes of the Drawa have not been objects of more extensive studies (Penczak et al. 1995). Preliminary data on the species composition and abundance of cyclostomates and fishes in the lower Drawa, in the stretch between the weir of the hydroelectric utility in Kamienna and Stare Osieczno were acquired by electrofishing device in November 1986 (Chełkowski 1987), 1988 (Chełkowski 1989), and 1989 (Chełkowski—unpublished data). The above mentioned catches were associated with the Atlantic salmon (*Salmo salar* L.) inventory on their spawning grounds in this part of the Drawa.

MATERIAL AND METHODS

The material for this study has been acquired using the electrofishing device PAP-2, equipped with an attachment transforming AC to DC current using voltage of 220 V and intensity of 3–6 A. The catches were performed with one anode-linked dip net from a boat

passively floating downstream (Backiel 1964; Penczak 1987). They were done at day time, both in the mid-flow and the coastal areas in 8 sections (sites) marked a to h of the Drawa within the limits of the Drawieński National Park. The sampling sections of the river were generally 500 m long (Penczak 1967; Backiel and Penczak 1989; Koszaliński et al. 1989; Witkowski et al. 1991) with single exception of the section h having multiple length of 3 500 m. In the latter case, the data gathered during inventory of the salmon on their spawning grounds were used. The combined length of the eight sampling sections was 7 km, which constituted 18.04% of the Drawa within the limits of the Drawieński National Park. The timetable of the catches, location and physiographic description of the sampling sections of the fishes and cyclostomates in the Drawa is shown in the Table 1 and Fig. 1c. The identification of the acquired material was based on a number of publications (Staff 1950; Gąsowska 1962; Brylińska 1986; Rolik and Rembiszewski 1987). The identification was followed by counting the number of specimens for each species (n), their combined weight, length in mm, and individual weight in g (Brylińska 1986). Only for the roach, schneider, and the common bream, the individual weight of every first, fifth, tenth (and so on) fish in each 1-cm length class had been registered. The catches with the electrofishing device yielded individual material within the length range of 19–750 mm and the weight range of 0.30–4 720.00 g. During the studying of the collected material particular attention was paid to two principal biocoenotic indices: domination structure of the species in individual sampling sections of the Drawa River (D)[1] and the occurrence constancy (C)[2] (Koszaliński et al. 1989; Witkowski et al. 1991, 1992; Kusznierz et al. 1994). In addition to that, the recorded species of fishes and cyclostomates were divided into ecological reproductive guilds (Balon 1964, 1975, 1981; Rolik and Rembiszewski (1987). The present report gives also data on the combined weight of individual fish species and its percentage share in the combined biomass of all collected fishes (W)[3] (Skóra and Włodek 1989; Skóra et al. 1994). The systematic arrangement of the species in the present paper follows that of Rolik and Rembiszewski (1987) for cyclostomates and Brylińska (1986) for fishes. For the species with their sample size of $n > 6$, the arithmetic mean with standard error ($\bar{x} \pm m$), coefficient of variation (V) and the ranges of weight and length was presented. Smaller samples were given only arithmetic mean and the ranges. The data were computed using Microsoft Excel 5.0.

[1] $D = (n_i/N \times 100)$ where: n_i—number of specimens of the species "i" in the sample; N—number of all specimens in the sample.

[2] $C = (N_a/N_n \times 100)$ where: N_a—number of sites where this species occurs; N_n—total number of sites.

[3] $W = (m_i/M \times 100)$ where: m_i—combined weight of all specimens of a given species acquired in the Drawa; M— combined weight of all specimens acquired in the Drawa.

Table 1

Location and description of the sampling sites of the fishes and cyclostomates in the Drawa River within the limits of the Drawieński National Park

No.	River stretch (sampling site)	Date of catch	Localization of the river stretch	Length of stretch [km]	Average width [m]	Average depth [m]	Speed of current [m/s]	Substrate description	River bed shape	Aquatic plants	Bank vegetation	Description of the neighbouring land
1	a	19 Sep 95	Dubie Lake–railway bridge on the route Drawno–Choszczno	0.5	26	1.5	1.1	s	s-b	f	deciduous forest	coniferous forest arable land
2	b	19 Sep 95	Railway bridge on the route Drawno–Choszczno–road bridge on the route Drawno–Borowiec	0.5	21	1.5	1.2	s	s-b	absent	deciduous forest	coniferous forest arable land
3	c	20 Sep 95	SW of town Konotop–mouth of the Słopica	0.5	20	1.5	1.2	s g st	s-b	absent	deciduous forest	coniferous forest
4	d	20 Sep 95	Road bridge on the route Drawno–Zatom– mouth of the Korytnica	0.5	21	1.5	1.2	s	s-b	absent	deciduous forest	coniferous forest
5	e	24 Sep 95	Road bridge on the route Sitnica–Moczele–beginning of the reservation "Brzezina"	0.5	21	1.5	1.2	s	s-b	absent	deciduous forest	coniferous forest
6	f	23 Aug 95	Upper part of the reservoir in Kamienna, above the ledge	0.5	60	1.8	0.7	s m	s-b	f	deciduous forest	mixed forest (deciduous-coniferous)
7	g	22 Aug 95	Lower part of the reservoir in Kamienna, below the ledge	0.5	90	2.5	—	m	s-b	wc	deciduous forest	mixed forest (deciduous-coniferous
8	h	21 Nov 94	Weir in Kamienna– mouth of the Płociczna	3.5	20	1.6	1.2	s g sk	s-b	absent	deciduous forest	coniferous forest arable land

s—sand; g—gravel; st—stones; m—mud; s-b—steep-bank river chanel; f—predominantly: floating vegatation, in longitudianl zones;
wc—predominantly: vegetation filling the entire water-column, in longitudinal zones.

RESULTS

The results were presented in Tables 2–5.

Table 2

Results of catches at the sites a–h of the Drawa River

Family—species	a	b	c	d	e	f	g	h	Total
Salmonidae									
Brown trout—*Salmo trutta* m. *trutta* L.								1	1
Brown trout stream morphotype—*Salmo trutta* m. *fario* L.			3					4	7
Thymallidae									
Grayling—*Thymallus thymallus* (L.)			1	1				1	3
Esocidae									
Pike—*Esox lucius* L.	1	1	1	1	4	6	2	1	17
Cyprinidae									
Roach—*Rutilus rutilus* (L.)	286	265	10	4	4	29	62	1	661
Dace—*Leuciscus leuciscus* (L.)		1	14	1	3			4	23
Chub—*Leuciscus cephalus* (L.)	3	6	5	11	2	4	10	3	44
Minnow—*Phoxinus phoxinus* (L.)						2	7		9
Tench—*Tinca tinca* (L.)							1	1	2
Gudgeon—*Gobio gobio* (L.)	1		6	2	4	5		5	23
Barbel—*Barbus barbus* (L.)			5						5
Bleak—*Alburnus alburnus* (L.)	3	12				3	4		22
Schneider—*Alburnoides bipunctatus* (Bloch)			43	12	17			1	73
Silver bream—*Blicca bjoerkna* (L.)	8	73							81
Common bream—*Abramis brama* (L.)	1					10	4		15
Zanthe—*Vimba vimba* (L.)	2	3							5
Bitterling—*Rhodeus sericeus amarus* (Bloch)					1		3		4
Siluridae									
Wels—*Silurus glanis* L.			1						1
Anguillidae									
European eel—*Anguilla anguilla* (L.)	1			1		1	1		4
Gadidae									
Burbot—*Lota lota* (L.)	9	7	8	2	26	8	10	22	92
Percidae									
Perch—*Perca fluviatilis* L.	10	13	6		11	14	11	5	70
Ruffe—*Gymnocephalus cernuus* (L.)	1				1	1		1	4
Cottidae									
Miller's thumb—*Cottus gobio* L.	1		2		6	2			11
Total	327	381	105	35	79	85	115	50	1177

Sampling section a (0.5 km long) of the Drawa yielded a total of 327 fishes belonging to 13 species, section b (0.5 km long) yielded a total of 381 fishes belonging to 9 species, section c (0.5 km long) gave 105 fishes belonging to 13 species, section d (0.5 km long)—35 fishes belonging to 9 species, section e (0.5 km long)—79 fishes belonging to 11 species, section f (0.5 km long)—85 fishes belonging to 12 species, section g (0.5 km long)—115 fishes of 11 species, and in the section h (3.5 km long) a total of 50 fishes was acquired belonging to 13 species. Catches conducted in the eight sections of the Drawa within the limits of the Drawieński National Park yielded a total of 1 177 identified fishes weighing

54 144.6 g, belonging to 23 species, assigned to 9 families. The catches did not yield any Cyclostomata representatives.

Table 3

Occurrence frequency (n), domination (*D*), and the combined biomass shares (*W*) of the fish species acquired in the Drawa within the limits of the Drawieński National Park

No.	Species	Number of specimens	*D*-index [%]	Biomass [g]	*W*-index [%]
1	Brown trout—*Salmo trutta* m. *trutta L.*	1	0.09	3 250.0	5.69
2	Brown trout stream morphotype—*Salmo trutta* m. *fario* L.	7	0.59	1 038.3	1.82
3	Grayling—*Thymallus thymallus* (L.)	3	0.26	313.7	0.55
4	Pike—*Esox lucius* L.	17	1.44	7 594.6	13.29
5	Roach—*Rutilus rutilus* (L.)	661	56.16	17 471.2	30.57
6	Dace—*Leuciscus leuciscus* (L.)	23	1.95	1 520.6	2.66
7	Chub—*Leuciscus cephalus* (L.)	44	3.74	8 506.7	14.89
8	Minnow—*Phoxinus phoxinus* (L.)	9	0.76	6.7	0.01
9	Tench—*Tinca tinca* (L.)	2	0.17	422.4	0.74
10	Gudgeon—*Gobio gobio* (L.)	23	1.95	196.1	0.34
11	Barbel—*Barbus barbus* (L.)	5	0.43	2 031.5	3.56
12	Bleak—*Alburnus alburnus* (L.)	22	1.87	68.6	0.12
13	Schneider—*Alburnoides bipunctatus* (Bloch)	73	6.20	442.7	0.77
14	Silver bream—*Blicca bjoerkna* (L.)	81	6.88	4 687.4	8.20
15	Common bream—*Abramis brama* (L.)	15	1.27	816.0	1.43
16	Zanthe—*Vimba vimba* (L.)	5	0.43	1 303.6	2.28
17	Bitterling—*Rhodeus sericeus amarus* (Bloch)	4	0.34	10.0	0.02
18	Wels—*Silurus glanis* L.	1	0.09	79.5	0.14
19	European eel—*Anguilla anguilla* (L.)	4	0.34	1 353.6	2.37
20	Burbot—*Lota lota* (L.)	92	7.82	4 018.7	7.03
21	Perch—*Perca fluviatilis* L.	70	5.95	1 887.1	3.30
22	Ruffe—*Gymnocephalus cernuus* (L.)	4	0.34	78.7	0.14
23	Miller's thumb—*Cottus gobio* L.	11	0.93	46.9	0.08
	Total	1 177	100.00	57 144.6	100.00

The most abundant, in the respect of species number, was the family Cyprinidae having 13 representatives. Next in the row were families: Salmonidae and Percidae with two representatives each. Families Thymallidae, Esocidae, Siluridae, Anguillidae, Gadidae, and Cottidae. The highest number of fish individuals belonged to the family Cyprinidae (n = 967; 82.16%), the second highest—to the family Gadidae (n = 92; 7.82%) and Percidae (n = 74; 6.29%). Smaller numbers were recorded for the families: Esocidae (n = 17; 1.44%), Cottidae (n = 11; 0.94%), and Salmonidae (n = 8; 0.68%). The smallest numbers of fish individuals were recorded for the families: Anguillidae (n = 4; 0.34%), Thymallidae (n = 3; 0.25%), and Siluridae (n = 1; 0.08%).

Table 4

Domination index (*D*) of the fish species at individual sites in the Drawa River

No.	Species	Site								Range
		a	b	c	d	e	f	g	h	
1	Brown trout—*Salmo trutta* m. *trutta L.*	—	—	—	—	—	—	—	2.0	2.0
2	Brown trout stream morphotype—*Salmo trutta m. fario* L.	—	—	2.9	—	—	—	—	8.0	2.9–8.0
3	Grayling—*Thymallus thymallus* (L.)	—	—	1.0	2.9	—	—	—	2.0	1.0–2.9
4	Pike—*Esox lucius* L.	0.3	0.3	1.0	2.9	5.1	7.1	1.7	2.0	0.3–7.1
5	Roach—*Rutilus rutilus* (L.)	87.5	69.5	9.5	11.5	5.1	34.1	53.9	2.0	2.0–87.5
6	Dace—*Leuciscus leuciscus* (L.)	—	0.3	13.3	2.9	3.8	—	—	8.0	0.3–13.3
7	Chub—*Leuciscus cephalus* (L.)	0.9	1.6	4.7	31.5	2.5	4.7	8.7	6.0	0.9–31.5
8	Minnow—*Phoxinus phoxinus* (L.)	—	—	—	—	—	2.3	6.1	—	2.3–6.1
9	Tench—*Tinca tinca* (L.)	—	—	—	—	—	—	0.9	2.0	0.9–2.0
10	Gudgeon—*Gobio gobio* (L.)	0.3	—	5.7	5.7	5.0	5.9	—	10.0	0.3–10.0
11	Barbel—*Barbus barbus* (L.)	—	—	4.8	—	—	—	—	—	4.8
12	Bleak—*Alburnus alburnus* (L.)	0.9	3.1	—	—	—	3.5	3.5	—	0.9–3.5
13	Schneider—*Alburnoides bipunctatus* (Bloch)	—	—	40.9	34.3	21.5	—	—	2.0	2.0–40.9
14	Silver bream—*Blicca bjoerkna* (L.)	2.4	19.2	—	—	—	—	—	—	2.4–19.2
15	Common bream—*Abramis brama* (L.)	0.3	—	—	—	—	11.8	3.5	—	0.3–11.8
16	Zanthe—*Vimba vimba* (L.)	0.6	0.8	—	—	—	—	—	—	0.6–0.8
17	Bitterling—*Rhodeus sericeus amarus* (Bloch)	—	—	—	—	1.3	—	2.6	—	1.3–2.6
18	Wels—*Silurus glanis* L.	—	—	1.0	—	—	—	—	—	1.0
19	European eel—*Anguilla anguilla* (L.)	0.3	—	—	2.9	—	1.2	0.8	—	0.3–2.9
20	Burbot—*Lota lota* (L.)	2.8	1.8	7.6	5.4	32.9	9.4	8.7	44.0	1.8–44.0
21	Perch—*Perca fluviatilis* L.	3.1	3.4	5.7	—	13.9	16.5	9.6	10.0	3.1–16.5
22	Ruffe—*Gymnocephalus cernuus* (L.)	0.3	—	—	—	1.3	1.2	—	2.0	0.3–2.0
23	Miller's thumb—*Cottus gobio* L.	0.3	—	1.9	—	7.6	2.3	—	—	0.3–7.6
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

Table 5

Constancy index (*C*) and domination index (*D*) of the fish species acquired in the Drawa representing individual reproductive guilds

No.	Species (groupped in families)	*C* [%]	*D* [%]	Reproductive guild
1	Brown trout—*Salmo trutta* m. *trutta* L.	12.5	0.09	lithophilous 13.43%
2	Brown trout stream morphotype—*Salmo trutta* m. *fario* L.	25.0	0.59	
3	Grayling— *Thymallus thymallus* (L.)	37.5	0.26	
4	Chub—*Leuciscus cephalus* (L.)	100.0	3.74	
5	Minnow—*Phoxinus phoxinus* (L.)	25.0	0.76	
6	Barbel—*Barbus barbus* (L.)	12.5	0.43	
7	Schneider—*Alburnoides bipunctatus* (Bloch)	50.0	6.20	
8	Zanthe—*Vimba vimba* (L.)	25.0	0.43	
9	Miller's thumb—*Cottus gobio* (L.)	50.0	0.93	
1	Dace—*Leuciscus leuciscus* (L.)	62.5	1.95	indifferent 15.12%
2	Silver bream—*Blicca bjoerkna* (L.)	25.0	6.88	
3	Perch—*Perca fluviatilis* L.	87.5	5.95	
4	Ruffe—*Gymnocephalus cernuus* (L.)	50.0	0.34	
1	Pike—*Esox lucius* L.	100.0	1.44	phitophilous 61.0%
2	Roach—*Rutilus rutilus* (L.)	100.0	56.16	
3	Tench—*Tinca tinca* (L.)	25.0	0.17	
4	Bleak—*Alburnus alburnus* (L.)	50.0	1.87	
5	Common bream—*Abramis brama* (L.)	37.5	1.27	
6	Wels—*Silurus glanis* L.	12.5	0.09	
1	Bitterling—*Rhodeus sericeus amarus* (Bloch)	25.0	0.34	ostracophilous 0.34%
1	Gudgeon—*Gobio gobio* (L.)	75.0	1.95	psammophilous 1.95%
1	Burbot—*Lota lota* (L.)	100.0	7.82	pelagophilous 7.82%
1	European eel—*Anguilla anguilla* (L.)	50.0	0.34	specjal 0.34%
	Total [%]		100.00	100.00

Family Salmonidae

The catches in the Drawa yielded the brown trout and the brown trout stream morphotype belonging to the family Salmonidae.

Brown trout—*Salmo trutta* morpha *trutta* L.

Site: h	*D*: 2.00% (on site); 0.09% (in the Drawa)
n = 1	fork length: 750 mm
C = 12.5%	weight: 3 250 g
W = 5.69%	

Only one trout was collected in the section h and it was on 21 November 1994. It was partly spawn female showing typical coloration for a brown trout during spawning season. The specimen presently described has been acquired in the Drawa from the spawning grounds of the Atlantic salmon. From this stretch of Drawa the fishes have open way down to the Baltic Sea, with the exception of thermal barrage caused by discharge of post-cooling

waters of the Dolna Odra power plant in Gryfino. Out of all fishes caught in the Drawa and presently described, the above-mentioned trout was the longest and the second heaviest. Despite the single occurrence in the catches the share of the trout in the combined biomass of the studied fishes was rather high and it amounted 5.69%. The domination index was 2.00% for the site and 0.09% for the Drawa. The occurrence constancy index for this species reached 12.5%.

Brown trout stream morphotype—*Salmo trutta* morpha *fario* L.

Sites: c, h	*D*: 2.9–8.0% (at the sites); 0.59% (in the Drawa)
n = 7	fork length: $\bar{x} \pm m$ = 218.6 ± 28.59 mm; *V* = 46.6; range 135–318 mm
C = 25%	weight: $\bar{x} \pm m$ = 148.3 ± 48.92 g; *V* = 87.25; range: 29.0–347.6 g
W = 1.82%	

The brown trout stream morphotype belongs to the group of fishes sporadically occurring in the catches from the waters of the Drawa River, belonging to the Drawieński National Park. It was acquired in the present survey from two collection sites. In total the catches yielded 7 specimens of this species. The occurrence constancy index for the brown trout stream morphotype was 25 and the domination index for the river was 0.59%. The brown trout stream morphotype was collected in the sections of the river with the bottom substrate consisting of gravel and stones.

Family Thymallidae

Grayling—*Thymallus thymallus* (L.)

Sites: c, d, h	*D*: 1.0–2.9% (at the sites); 0.26% (in the Drawa)
n = 3	fork length: $\bar{x}$ = 193 mm; range 100–307 mm
C = 37.5%	weight: $\bar{x}$ = 104.6 g; range 19.5–244.19 g
W = 0.55%	

The grayling was a rare fish in the catches. Its occurrence was limited to three collection sites, with a single fish acquired at each of those sites. The occurrence constancy index was 37.5%, while its domination index in the Drawa reached 0.26%.

Family Esocidae

Pike—*Esox lucius* L.

Sites: a, b, c, d, e, f, g, h	*D*: 0.3–7.1% (at the sites); 1.44% (in the Drawa)
n = 17	standard length: $\bar{x} \pm m$ = 255.3 ± 38.67 mm; *V* = 62; range 84–721 mm
C = 100%	weight: $\bar{x} \pm m$ = 446.8 ± 272.43; *V* = 251.42; range 4.7–4720 g
W = 13.25%	

The pike in the Drawa River occurred at all the collection sites, which corresponds with the constancy index 100. The domination index ranged from 0.3–7.1% for individual sites, reaching 1.4% for the entire stretch of the Drawa studied. The highest value of the index was reported from the site f covering the upper part of the reservoir of the hydroelectric plant in Kamienna, and at the site e located right below the above-mentioned site. On the former site the domination index was 7.1%, while on the latter—5.1%. The highest individual weight of the fish, in the present survey, was recorded from a pike weighing 4270 g. It was caught in the Kamienna Reservoir in the meander of the eastern part of the wing dam narrowing the Drawa flow. The pike constituted a high share of the combined biomass of the studied fishes (W = 13.25%) and positioned itself on the third place following the roach and chub.

Family Cyprinidae

Out of a total of 13 fish species, belonging to the family Cyprinidae and inhabiting Drawa within the limits of the Drawieński National Park, the particular attention should be paid to:

Minnow—*Phoxinus phoxinus* (L.)

Sites: f, g	D: 2.3–6.1% (at the sites); 0.76% (in the Drawa)
n = 9	standard length: $\bar{x} \pm m$ = 39.1 ± 1.49 mm; V = 11.39; range 32–46 mm
C = 25%	weight: $\bar{x} \pm m$ = 0.7 ± 0.09 g; V = 36.86; range 0.3–1.2 g
W = 0.01%	

The minnow occurred in the area of the stony and sandy shoals parallel to the wing dam narrowing the channel of the Drawa. The wing dam is located on the division line between f and g sites within the area of the reservoir of the Kamienna hydroelectric plant at the distance of 0.8 km from the weir crest backing up the water to form a 2.6-km-long impounding reservoir. Its construction, including the correctional sill, was completed in 1984. The population of the minnow at the site described was relatively abundant, which could be concluded from the visual observations. The individual weight of the minnow equaling 0.3 g was the lowest among the fishes being presently surveyed. The minnow also constituted the smallest share of the combined biomass of all the fish species studied (W = 0.01%). The above-mentioned site of the minnow, considering its defined location, should be covered by the reservation conservation measures.

Schneider —*Alburnoides bipunctatus* (Bloch)

Sites: c, d, e, h	*D*: 2.0–40.9% (at the sites); 6.2% (in the Drawa)
n = 73	standard length: $\bar{x} \pm m$ = 66.8 ± 2.75 mm; *V* = 35.19; range 31–108 mm
C = 50%	weight: $\bar{x}$ = 6.1 g (based on n = 43); $\bar{x} \pm m$ = 8.9 ± 0.88 g; *V* = 64.27; range: 0.4–20.0 g
W = 0.77%	

The schneider occurred more frequently in the catches than minnow. The catches yielded a total of 73 fish of this species. The domination index of the schneider at 4 sites of its occurrence ranged in wide limits, from 2.00% at the site h to the value of 40.9% at the site c. The latter site as well as the site d had the schneider as the dominant species. Similarly frequent, although on the second place, behind the burbot, the schneider occurred at the site e where the domination index reached 21.5%. The quantities of the schneider caught, placed it on the fourth position behind the roach, burbot, and the carp. The occurrence constancy index for the schneider was 50 and the domination index for the Drawa—6.2%.

Bitterling—*Rhodeus sericeus amarus* (Bloch)

Sites: e, g	*D*: 1.3–2.6% (at the sites); 0.34% (in the Drawa)
n = 4	standard length: $\bar{x}$ = 50 mm; range 47–53 mm
C = 25%	weight: $\bar{x}$ = 2.5 g; range 2.4–2.9 g
W = 0.02%	

The bitterling represents a species rarely occurring in the Drawa and the rarest in the group of the protected cyprinid fishes. It occurred at two sites e and g. In the former, located in the lotic part of the Drawa, the catches yielded 1 fish. At the latter site, located in the lentic part of the Drawa, encompassed by the Kamienna Reservoir, the catches yielded 3 bitterling. Summing up—a total of 4 specimens of this species was presently surveyed. The occurrence constancy index for the bitterling was 25% and the domination index for the Drawa River was 0.34%.

Roach—*Rutilus rutilus* (L.)

Sites: a, b, c, d, e, f, g, h	*D*: 2.0–87.5% (at the sites); 56.16% (in the Drawa)
n = 661	standard length: $\bar{x} \pm m$ = 101.2 ± 1.19 mm; *V* = 30.23; range 19–255 mm
C = 100%	weight: $\bar{x}$ = 26.4 g (based on n = 132); $\bar{x} \pm m$ = 33.9 ± 3.70 g; *V* = 125.4; range 0.5–350.5 g
W = 30.57%	

The roach represents a species occurring most frequently in the Drawa waters within the limits of the Drawieński National Park. It occurred at all sites. That is why the occurrence constancy index has reached 100. The domination index at individual sites ranged in wide limits from 2% at the site h to 87.5% at the site a. At the four sites: a, b, f, and g the roach occurred as the dominant. In this number at the sites: a, b, and g the domination exceeded 50% of the acquired fishes (D = 53.9–87.5%). On the other hand the domination index for the Drawa River reached 56.16%. In view of the above it is clear that more than a half of the fishes surveyed were the roach. A roach 19 mm long (standard length) turned out to be the smallest fish studied. Share of the roach in the combined biomass of the fishes surveyed, was the largest and equaled 30.57%.

Dace—*Leuciscus leuciscus* L.

Sites: b, c, d, e, h	D: 0.3–13.3% (at the sites); 1.95% (in the Drawa)
n = 23	standard length: $\bar{x} \pm m$ = 151.5 ± 9.18 mm; V = 29.05; range 34–216 mm
C = 26.5%	weight: $\bar{x} \pm m$ = 66.1 ± 8.9; V = 64.55; range 0.5–173.5 g
W = 2.66%	

The dace occurred at five sampling sites. In all, the catches yielded 23 specimens of this species. The occurrence constancy index for the dace was 26.5% and the domination index for the Drawa was 1.95%

Chub—*Leuciscus cephalus* (L.)

Sites: a, b, c, d, e, f, g, h	D: 0.9–31.5% (at the sites); 3.74% (in the Drawa)
n = 44	standard length: $\bar{x} \pm m$ = 192.6 ± 10.80 mm; V = 37.21; range 44–338 mm
C = 100%	weight: $\bar{x} \pm m$ = 193.3 ± 30.42 g; V = 104.38; range 3.0–980.0 g
W = 14.89%	

The chub occurred at all collection sites which gives the occurrence constancy index 100%. The domination index at the individual sites ranged in wide limits from 0.9 to 31.5%. In the Drawa River it was 3.74%. At the site d the chub occurred as the second most abundant species, in the respect of its quantities, with the domination index 31.5%. The share of the chub in the combined biomass of the fishes caught in the Drawa was high (W = 14.89%) and it was the second highest after that of the roach.

Tench—*Tinca tinca* (L.)

Sites: g, h	*D*: 0.9–2% (at the sites); 0.17% (in the Drawa)
n = 2	standard length: $\bar{x}$ = 177 mm; range 120–223 mm
C = 25%	weight: $\bar{x}$ = 212.2 g; range 49.0–373 g
W = 0.74%	

The tench occurred in the waters of The Drawa within the limits of the Drawieński National Park rarely and there were very few of them. The catches yielded 2 tench. The larger one (in the respect of length and weight), was acquired at the site g of the Drawa covering the reservoir of the Kamienna hydroelectric plant. The second, smaller tench, was supplied by the analysis of the stomach content of a pike caught at the site h of the Drawa. The occurrence constancy index for the tench was 25%, while its domination index for the Drawa was 0.17%

Gudgeon—*Gobio gobio* (L.)

Sites: a, c, d, e, f, h	*D*: 0.3–10% (at the sites); 1.95% (in the Drawa)
n = 23	standard length: $\bar{x} \pm m$ = 77.0 ± 5.25 mm; *V* = 34.67; range 38–113 mm
C = 75%	weight: $\bar{x} \pm m$ = 8.5 + 1.83 g; *V* = 102.83; range 1.0–27.0 g
W = 0.34%	

The gudgeon occurred at 6 sites out of 8 studied. That is why its occurrence constancy index has reached high value (*C* = 75%). The gudgeon was not abundant in the catches and its domination index at individual sites fits in the limits of 0.3–10.0%. For the Drawa it reached 1.95%.

Barbel—*Barbus barbus* (L.)

Site: c	*D*: 4.8% (on site); 0.43% (in the Drawa)
n = 5	standard length: $\bar{x}$ =273 mm; range 194–434 mm
C = 12.5%	weight: $\bar{x}$ = 406.3 g; range 125.8–1126.0 g
W = 3.56%	

The barbel occurred at one site only and in small quantities (n = 5). This influenced small values of the occurrence constancy index and the domination index for the river (*C* = 12.5%; *D* = 0.43%).

Bleak—*Alburnus alburnus* (L.)

Sites: a, b, f, g	*D*: 0.9–3.5% (at the sites); 1.87% (in the Drawa)
n = 22	standard length: $\bar{x} \pm m$ = 54.8 ± 4.86 mm; *V* = 41.62; range 29–114 mm
C = 50%	weight: $\bar{x} \pm m$ = 3.1 ± 1.12 g; *V* = 167.91; range 0.5–18.4 g
W = 0.12%	

The bleak occurred in the Drawa at four sites, in this number on two (a and b) connected directly with Dubie Lake and in the other two (f and g) constituting a part of the Kamienna hydroelectric plant reservoir. The catches yielded a total of 22 fish of this species. The occurrence constancy index for the Drawa was 50%, while the domination index was 1.87%.

Silver bream—*Blicca bjoerkna* (L.)

Sites: a, b	*D*: 2.4–19.2% (at the sites); 6.88% (in the Drawa)
n = 81	standard length: $\bar{x} \pm m$ = 130.2 ± 3.06 mm; *V* = 21.18; range 94–228 mm
C = 25%	weight: $\bar{x} \pm m$ = 57.9 ± 5.36 g; *V* = 83.41; range 16.2–304.9 g
W = 8.20%	

The silver bream occurred only at 2 sequential, upper sites of the Drawa: a and b connected directly with Dubie Lake. In the combined catch from the Drawa, the silver bream occurred relatively frequently (n = 81), placing itself on the third place following the roach and the burbot. At the site b the silver bream was, in the respect of frequency on the second place after the common bream, while at the site a it was fourth after the roach, perch, and the burbot. The occurrence constancy index for the silver bream was 25%, while the domination index for the river was 6.88%.

Common bream—*Abramis brama* (L.)

Sites: a, f, g	*D*: 0.3–11.8% (at the sites); 1.27% (in the Drawa)
n = 15	standard length: $\bar{x} \pm m$ = 83.4 ± 13.35 mm; *V* = 62.0; range 45–206 mm
C = 37.5%	weight: $\bar{x}$ = 54.4 g (based on n = 9); $\bar{x} \pm m$ = 64.7 + 25.47 g; *V* = 118.1; range 3.3–216.6 g
W = 1.43%	

The common bream in the waters of the Drawa within the limits of the Drawieński National Park was rather not an abundant species and it was rarely encountered. The common bream occurred at 3, out of eight, sites studied, in this number at the site a connected with Dubie Lake and at two sites f and g constituting a part of the Kamienna hydroelectric plant reservoir. The occurrence constancy index for the Drawa equals 37.5%, while the domination for the river reached value of 1.27%.

Zanthe—*Vimba vimba* (L.)

Sites: a, b	*D*: 0.6–0.8% (at the sites); 0.43% (in the Drawa)
n = 5	standard length: $\bar{x}$ = 235 mm; range 124–295 mm
C = 25%	weight: $\bar{x}$ = 260.7 g; range 28.4–469.4 g
W = 2.28%	

The zanthe occurred in low quantities at two sequential sites of the Drawa situated directly below Dubie Lake. A total of 5 fish of this species was acquired. The occurrence constancy index for the zanthe was 25%, while the domination index was 0.43% for the Drawa.

Family Siluridae

Wels—*Silurus glanis*

Site: c	*D*: 1% (on site); 0.09% (in the Drawa)
n = 1	total length: 206 mm
C = 12.5%	weight: 79.5 g
W = 0.14%	

The catches yielded only one wels, 206 mm long, weighing 79.5 g. The occurrence constancy index for the wels was 12.5% and the domination index for the Drawa was 0.09%.

Family Anguillidae

European eel—*Anguilla anguilla* (L.)

Sites: a, d, f, g	*D*: 0.3–2.9% (at the sites); 0.34% (in the Drawa)
n = 4	total length: $\bar{x}$ = 537 mm; range 400–685 mm
C = 12.4%	weight: $\bar{x}$ = 338.4 g; range 90–775 g
W = 2.37%	

The eel occurred in the catches at four sites, with single specimens from each site. It is then a rare species in the waters of the Drawa, within the Drawieński National Park. The visual observations, however, suggest that in spring, relatively high numbers of juvenile eels occur in the area of the fish ladder, in particular in the raft launching slip, located at the crown of the weir in Kamienna. The occurrence constancy index was 12.4% and the domination index in the Drawa was 0.34%.

Family Gadidae

Burbot—*Lota lota* (L.)

Sites: a, b, c, d, e, f, g, h	*D*: 1.8–44.0% (at the sites), 7.82% (in the Drawa)
n = 92	standard length: $\bar{x} \pm m$ = 161.3 ± 4.30 mm; *V* = 25.58; range 68–289 mm
C = 100%	weight: $\bar{x} \pm m$ = 44.1 ± 3.4 g; *V* = 73.92; range 3.5–174.5 g
W = 7.03%	

The burbot in the waters of the Drawa is an abundant and frequently encountered species. In the respect of the quantities of the acquired specimens, the burbot placed itself on the second position, following the roach. It occurred at all collection sites, alike the pike, roach and the chub. That is why the occurrence constancy index for this species was 100 and the domination index for the Drawa was 7.8%. The values of the quantitative domination of the burbot at all eight sites varied, however, in wide limits from 1.8% at the site b to 44.0% on the site h. Burbot was the quantitative dominant at two sites: e and h. At the former site, the domination index was 32.9% and at the site h it was 44.0%. At the latter site the burbot has reached the second highest value of the domination index in the present survey, following the roach. The burbot was particularly abundant at the site e, the latter having steep banks with roots of deciduous trees (black alder). The fish was similarly abundant at the site h located in a meander with steep stone-reinforced bank, slightly above the Kamienna hydroelectric plant. The share of the burbot's weight (*W* = 7.03%) in the combined biomass of the fishes acquired from the Drawa was high and it placed the species on the fourth place after the roach, chub, and the pike.

Family Percidae

The catches in the Drawa yielded two fish-species belonging to the family Percidae: perch and ruffe.

Perch—*Perca fluviatilis* L.

Sites: a, b, c, d, e, f, g, h	*D*: 3.1–16.5% (at the sites); 5.95% (in the Drawa)
n = 70	standard length: $\bar{x} \pm m$ = 102.9 ± 3.93 mm; *V* = 31.98; range 48–172 mm
C = 87.5%	weight: $\bar{x} \pm m$ = 27.0 ± 2.9 g; *V* = 89.85; range 2.4–106.2 g
W = 3.3%	

The perch occurred at seven, out of eight collection sites. That is why the occurrence constancy index was high and reached the value of 87.5%. The domination index of this species for individual sites was in the range of 3.1–16.5%, assuming the value of 5.95% for the Drawa River.

Ruffe—*Gymnocephalus cernuus* (L.)

Sites: a, e, f, h	*D*: 0.3–2.0% (at the sites); 0.34% (in the Drawa)
n = 4	standard length: $\bar{x}$ = 95 mm; range 80–134 mm
C = 50%	weight: $\bar{x}$ = 19.7 g; range 9–45.4 g
W = 0.14%	

The ruffe is among the fish-species rarely occurring in the catches in the Drawa. This species occurred at four sites a, e, f, and h with a single specimen at each site. The occurrence constancy for the Drawa River reached the value of 50% and the domination index—5.95%.

Family Cottidae

Miller's thumb—*Cottus gobio* L.

Sites: a, c, e, f,	*D*: 0.3–7.6% (at the sites); 0.93% (in the Drawa)
n = 11	total length: $\bar{x} \pm m$ = 61.8 ± 6.49 mm; *V* = 34.81; range 32–91 mm
C = 50%	weight: $\bar{x} \pm m$ = 4.3 ± 1.1 g; *V* = 85.59; range 0.5–9.6 g
W = 0.08%	

The Miller's thumb occurred in the catches from four sites. The total of 11 representatives of this species was acquired. The occurrence constancy index for the Miller's thumb was 50%, while the domination index for the Drawa was 0.93%.

Recapitulation of the results

The catches in the Drawa, within the limits of the Drawieński National Park, conducted at the eight collection sites revealed that four of them (a, b, f, and g), in the respect of quantities, had the roach as the distinctly dominant species. Two sites (c and d) showed quantitative domination of the schneider, while at the sites e and h, the quantitative dominant was the burbot (Tab. 4). The second dominants were: the silver bream—at the sites a and b, dace—at the site c, chub—at the site d, schneider—at the sites e, perch—at the sites f and g, and finally gudgeon and perch—at the site h.

Assuming the domination index for the Drawa River as $D>1\%$ and $D<1\%$ one can split the 23 fish-species occurring in the present survey for two groups: with high and low domination respectively. The group of fishes acquired from the Drawa with the highest domination index is lead by the roach. It is followed by the burbot, silver bream, schneider, perch, chub, dace and gudgeon, bleak, pike and the common bream. For the above-mentioned species, the domination index was in the range of 1.27–56.16%. On the other hand the group of the low domination included such species as: the Miller's thumb, minnow, brown trout stream morphotype, barbel and zanthe, bitterling, eel and ruffe, grayling,

brown trout and wels. The domination index of the above-mentioned species was within 0.09–0.93%.

The largest biomass share of the fishes surveyed was that of the roach, followed by the chub, pike, silver bream, and the burbot. The shares (*W*) of the remained 18 fish-species were substantially smaller and ranged from 5.68% in the case of the brown trout to 0.01% in the case of the minnow.

Concluding—the roach turned out to be the dominant item of the ichthyofauna of the Drawa River within the limits of The Drawieński National Park in the respect of both quantities and biomass.

The dominant reproductive guild of the ichthyofauna of the Drawa in the respect of number of species was the lithophilous group (9 species) (Tab. 5). The second numerous was the reproductive guild of the phytophilous fishes (6 species) and the third—the indifferent group (4 species). The remaining reproductive guilds: ostracophilous, psammophilous, pelagophilous and the special group were represented by single fish-species. In the respect of the specimen number, however, the dominant were the indifferent and the lithophilous guilds. Smaller number of fishes represented the following reproductive guilds: pelagophilous. psammophilous, ostracophilous and the special (Tab. 5).

The largest populations were represented: in the phytophilous guild—by the roach, in the indifferent guild—by the silver bream and the perch, in the lithophilous guild—the schneider and the chub, while in the pelagophilous—the burbot.

The material gathered allowed to trace the occurrence constancy of the fish-species in the Drawa within the limits of the Drawieński National Park. It has become evident that four fish-species: the pike, roach, chub and the burbot reached the highest value of the occurrence constancy (100). Smaller values of the occurrence constancy index were represented by the bleak, schneider, eel, ruffe and Miller's thumb, grayling and common bream. On the other hand the values of the occurrence constancy index represented by the remaining nine fish-species inhabiting the Drawa were substantially smaller and ranged from 12.5 to 37.5%. The latter group was composed also of the brown trout stream morphotype, minnow, tench, silver bream, zanthe and bitterling, brown trout, barbel and wels.

The a stretch of the Drawa receives in its upper part, as a left-bank tributary the industrial-communal sewage collector of the town of Drawno. The above-mentioned sewage, since the second half of 1994 go through newly-constructed biological treatment plant. On 19 September 1995, however, the negative impact of the sewage on the Drawa River ichthyofauna was recorded. Namely, there were no fishes caught using electrofishing device in the stretch of 200 m below the dumping site of the treated sewage. On the other hand, there were fishes caught on the opposite side of the river in the part of the river flow not affected by the sewage.

In the crown of the weir creating the reservoir in Kamienna, there are two passes: a raft launching slip and a fish ladder. Currently the timber floating is not performed on the Drawa, so the slip is not in use. However, the 21-chamber fish ladder is in operation. There is no information available, however, how it is utilized by the fishes.

DISCUSSION

The cyclostomates and fishes inhabiting the lower Drawa were previously a subject of the inventories done by Chełkowski (1987, 1989, and unpublished data). Those surveys covered 3.5-km-long site h of the Drawa, currently belonging the Drawieński National Park, situated between the weir of the hydroelectric plant in Kamienna and the mouth of the Płociczna River, and a 1.9-km-long stretch of the Drawa, currently outside the Park limits, situated between the mouth of the Płociczna and the village of Stare Osieczno (Fig. 1c). The fish-fauna of those two stretches of the Drawa was represented by 20 species of cyclostomates and fishes (Tab. 6). In this number 16 species (brown trout, brown trout stream morphotype, grayling, pike, roach, dace, chub, gudgeon, barbel, bleak, schneider, common bream, zanthe, burbot, perch, and Miller's thumb) occurring in the present survey and 4 species (river lamprey, Atlantic salmon, orfe, and the three-spined stickleback) not presently found. On the other hand, seven species (minnow, tench, silver bream, bitterling, wels, eel, and ruffe) occurring in the Drawa within the limits of the Drawieński National Park, were not reported by the cited-above author. It can be concluded from the above, that the fauna of the Drawa within the limits of the Drawieński National Park includes currently 27 species of fishes and cyclostomates (Tab. 7). Family Cyprinidae is represented by 14 species, Salmonidae—3, Percidae—2, and families: Petromyzonidae, Thymallidae, Esocidae, Siluridae, Anguillidae, Gadidae, Gasterosteidae and Cottidae by 1 species only.

Many species of cyclostomates and fishes currently occurring in the Drawa have already been recorded in the other surveys (Rembiszewski and Rolik 1975).

- The river lamprey was reported by Kaj (1948), Jaskowski (1962), and Chełkowski (1987);
- the Atlantic salmon—by: Borne (1882), Gerhardt (1893), Grotrian (1901, 1905, 1907), Schulz (1912), Kulmatycki (1926), Kardaszewski (1947), Stankiewicz (1949), Staff (1950), Kaj and Walczak (1954), Kaj (1948, 1952, 1953, 1954, 1958a, 1958b), Paladino (1961), Czaplicki (1962), Gąsowska (1962), Jaskowski (1962), Żarnecki (1962), Iwaszkiewicz (1966), Chełkowski (1966, 1967a, 1967b, 1970, 1971, 1975, 1977, 1985, 1986, 1987, 1987a, 1988, 1989), Chełkowska and Chełkowski (1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976), Chełkowski and Chełkowska (1974, 1978, 1979, 1980, 1981, 1983, 1984, 1985, 1986, 1992), Bartel (1971, 1976), Christensen and Johansson (1975),

Przybył (1976), Chełkowska (1982), Bartel et al. (1984), Brylińska (1986), Chełkowski et al. (1994);

- the brown trout—by: Borne (1882), Seligo (1896a), Kaj (1948, 1952, 1954, 1958a), Staff (1950), Kaj and Walczak (1954), Gąsowska (1962), Jaskowski (1962), Chełkowski (1966, 1971, 1987, 1988, 1989), Iwaszkiewicz (1966), Chełkowska and Chełkowski (1969, 1971, 1973), Przybył (1976), Chełkowska (1982), Brylińska (1986);
- the brown trout stream morphotype—Jaskowski (1962), Chełkowski (1987, 1989);
- the grayling—Borne (1882), Schulz (1912), Kaj and Walczak (1954), Iwaszkiewicz (1959), Jaskowski (1962), Polański (1962), Chełkowski (1987, 1989);
- the pike—Jaskowski (1962), Chełkowski (1987, 1989);
- the roach—Jaskowski (1962), Chełkowski (1987, 1989);
- the dace—Borne (1982), Jaskowski (1962), Chełkowski (1987, 1989);
- the chub—Borne (1882), Seligo (1896b, 1902), Wilkosz (1902), Kaj and Walczak (1954), Jaskowski (1962), Chełkowski (1987, 1989);
- the orfe—Jaskowski (1962), Chełkowski (1987);
- the minnow— Seligo (1986b), Kaj (1948, 1958b), Kaj and Walczak (1954), Jaskowski (1962);
- the tench—Borne (1882), Seligo (1896), Jaskowski (1962);
- the gudgeon—Borne (1882), Seligo (1890, 1891, 1895, 1896a, 1902), Chełkowski (1987);
- the barbel—Borne (1882), Schulz (1912), Kardaszewski (1947), Kaj and Walczak (1954), Jaskowski (1962), Chełkowski (1987, 1989);
- the bleak—Jaskowski (1962), Chełkowski (1987),;
- the schneider—Chełkowski (1989);
- the silver bream—Seligo (1896a), Jaskowski (1962);
- the common bream—Seligo (1896a, 1902), Kardaszewski (1947), Jaskowski (1962), Chełkowski (1989);
- the zanthe—Kaj and Walczak (1954), Jaskowski (1962), Jaworek (1964), Chełkowski (1987);
- the wels—Borne (1882), Seligo (1896a), Wilkosz (1904), Jaskowski (1962);
- the burbot—Jaskowski (1962), Chełkowski (1987, 1989);
- the three-spined stickleback—Jaskowski (1962), Chełkowski (1987);
- the perch—Jaskowski (1962), (Chełkowski (1987, 1989);
- the ruffe—Borne (1882), Seligo (1896a), Wilkosz (1902), Jaskowski (1962);
- the Miller's thumb—Seligo (1890), Kaj and Walczak (1954), Kaj (1958a), Jaskowski (1962), Chełkowski (1987, 1989).

Table 6

The list of species of cyclostomates and fishes occurring in the lower Drawa according to the Chełkowski 1987 [1], 1989 [2], and unpublished material [3]

No.	Species	1	2		3	
		18–19 Nov 86	21 Nov 88		21 Nov 89	
			n	*D* [%]	n	*D* [%]
1	River lamprey—*Lampetra fluviatilis* (L.)	1				
2	Atlantic salmon—*Salmo salar* L.	1				
3	Brown trout—*Salmo trutta* m. *trutta* L.	3			6	1.03
4	Brown trout stream morphotype—*Salmo trutta* m. *fario* L.	1	1	0.68	1	0.17
5	Grayling— *Thymallus thymallus* (L.)	+	4	2.72	5	0.86
6	Pike—*Esox lucius* L.	++	29	19.73	9	1.55
7	Roach—*Rutilus rutilus* (L.)	+	16	10.89	72	12.39
8	Dace—*Leuciscus leuciscus* (L.)	+	31	21.09	87	14.98
9	Chub—*Leuciscus cephalus* (L.)	+	32	21.77	24	4.13
10	Orfe—*Leuciscus idus* (L.)	+			1	0.17
11	Gudgeon—*Gobio gobio* (L.)	+			11	1.89
12	Barbel—*Barbus barbus* (L.)	++	6	4.08	12	2.07
13	Bleak—*Alburnus alburnus* (L.)	+				
14	Schneider—*Alburnoides bipunctatus* (Bloch)		2	1.36	147	25.30
15	Common bream—*Abramis brama* (L.)		8	5.44		
16	Zanthe—*Vimba vimba* (L.)	+				
17	Burbot—*Lota lota* (L.)	+	1	0.68	9	1.55
18	Three-spined stickleback—*Gasterosteus aculeatus* L.	+	12	8.16	167	28.75
19	Perch—*Perca fluviatilis* L.	+	4	2.72	14	2.40
20	Miller's thumb—*Cottus gobio* L.	+	1	0.68	16	2.76
	Total		147	100.00	581	100.00

+ —single occurrence; ++ —mass occurrence.

There is no information available in the literature on the occurrence of the bitterling and the eel in the Drawa. Jaskowski (1962), however, recorded the presence of the ell in the Płociczna River which is a left bank tributary of the Drawa. The above confirms that the eel inhabits the former river and the drainage basin of the Drawa.

The Drawa or its drainage basin may be inhabited by a number of additional species of cyclostomates and fishes, not recorded in the present survey. Among them may be: the rudd—*Scardinius erythrophtalmus* L. (Seligo 1896a, Wilkosz 1902), brook lamprey—*Lampetra planeri* (Bloch), asp—*Aspius aspius* (L.), moderlieschen—*Leucaspius delineatus* (Heckel), nasling—*Chondrostoma nasus* (L.), crucian carp—*Carassius carassius* (L.), stone loach—*Nemachelius barbatulus* (L.), spined loach—*Cobbitis taenia* L., pike-perch—*Stizostedion lucioperca* (L.) (Jaskowski 1962).

Table 7

The list of species of cyclostomates and fishes currently occurring in the Drawa within the limits of the Drawieński National Park

No.	Species
1	River lamprey—*Lampetra fluviatilis* (L.)
2	Atlantic salmon—*Salmo salar* L.
3	Brown trout —*Salmo trutta* m. *trutta* L.
4	Brown trout stream morphotype—*Salmo trutta* m. *fario* L.
5	Grayling—*Thymallus thymallus* (L.)
6	Pike—*Esox lucius* L.
7	Roach—*Rutilus rutilus* (L.)
8	Dace—*Leuciscus leuciscus* (L.)
9	Chub—*Leuciscus cephalus* (L.)
10	Orfe—*Leuciscus idus* (L.)
11	Minnow—*Phoxinus phoxinus* (L.)
12	Tench—*Tinca tinca* (L.)
13	Gudgeon—*Gobio gobio* (L.)
14	Barbel—*Barbus barbus* (L.)
15	Bleak—*Alburnus alburnus* (L.)
16	Schneider—*Alburnoides bipunctatus* (Bloch)
17	Silver bream—*Blicca bjoerkna* (L.)
18	Common bream—*Abramis brama* (L.)
19	Zanthe—*Vimba vimba* (L.)
20	Bitterling—*Rhodeus sericeus amarus* (Bloch)
21	Wels—*Silurus glanis* L.
22	European eel—*Anguilla anguilla* (L.)
23	Burbot—*Lota lota* (L.)
24	Three-spined stickleback—*Gasterosteus aculeatus* L.
25	Perch—*Perca fluviatilis* L.
26	Ruffe—*Gymnocephalus cernuus* (L.)
27	Miller's thumb—*Cottus gobio* L.

In the lower stretch of the Drawa within the limits of the Drawieński National Park, at the site h, between the weir of the hydroelectric plant in Kamienna and the mouth of the Płociczna, there are spawning grounds of the Atlantic salmon (*Salmo salar* L.) (Kaj 1953, 1954; Jaskowski 1962; Przybył 1976; Chełkowski and Chełkowska 1986; Chełkowski et al. 1994).

The lack of record of the Atlantic salmon during the catches in November 1988 (Chełkowski 1989), 1989 (Tab. 6), and 1994 (Tab. 1, 2) on this stretch of the river, and at the time of its spawning season, cannot be understood as the ultimate extinction of the Atlantic salmon in the Drawa. On 8 September 1994, the fishermen from Stołczyn (suburb of the city of Szczecin) acquired in the lower Odra River one salmon—male in its spawning colors weighing 16 kg. This specimen, in contradiction to the regulations being in force, was not released, but marketed. Again on 2 and 10 October 1995, the fishermen of the same fisheries base caught in the lower Odra two salmon (males) wearing their spawning colors. The fish weigh 10 and 12 kg. On 14 October the fishermen from Dąbie (suburb of the city

of Szczecin) acquired in Dąbie Lake two salmon (females) weighing about 15 kg each. The salmon caught in 1995, were, in compliance with the regulations in force, released to the water to enable them continuation of their spawning migration. Through this particular trail, including the Szczecin Lagoon, lower Odra River, Warta River, and the Noteć River, sea-grown salmon migrate to the home-river Drawa (Chełkowski et al. 1976; Chełkowski and Chełkowska 1977, 1978b, 1979b, 1980b; Chełkowski 1987b)

The spawning grounds of the salmon were observed as recently as 1981 (Chełkowski et al. 1994). The last salmon was acquired from the Drawa in 1986 (Chełkowski 1987a) (Tab. 6). The dynamics of the brood-stock salmon in the Drawa within 1945–1976 was presented by Chełkowski and Chełkowska (1992).

As an attempt to restitute this valuable fish, a total of 22 843 specimen and again 13 078 specimens was stocked into the Drawa on 7 April 1995 and 24 April 1996 respectively. The fish were released below the weir in Kamienna. They lead their descent from the Latvian river Daugava.

Currently the Atlantic salmon is listed among the protected species in Polish inland waters. The Drawa has been excluded from the protection, because of the need to monitor the restocking experiment (Anon. 1995).

It seems that the population of the grayling in the Drawa is more abundant that it could be concluded from the presently calculated domination index reaching the value of 0.26%. Such presumption is based on the catch lists of the fly-fish contests. Such contests took place in the early falls of six consecutive years between 1990 and 1995 in 9.5-km-long central section of the Drawa belonging to the Drawieński National Park. The catch-lists included the number and the size (total length) of all grayling longer than 300 mm. Smaller fish were, in compliance with the protective regulations in force, released to the water by the anglers (Brylińska 1986). It is evident from the report prepared, that a total of 253 grayling was acquired in 6 years. Individual years yielded from 26 to 99 specimens (Tab. 8). The total length of the grayling caught ranged from 300 to 443 mm. The average length for the whole studies was 355.8 ± 1.6 mm. In the collected material there was only one grayling below the protective size limit, measuring 218 mm.

Another river, which alike the Drawa joins the Noteć River is the Gwda River. Drainage basins of those two rivers collect waters from the central part of the Pomeranian Lake District and direct them, in general terms, from the North to the South towards the Toruń-Eberswalde proglacial river valley. The drainage basin of the Gwda River borders on the west the drainage basin of the Drawa River. Both Gwda and Drawa exhibit many similarities. The fauna of cyclostomates and fishes of the Gwda River includes, after Koszaliński et al. (1989), 32 species. Out of this number, 22 fish-species occur currently in the Drawa within the limits of the Drawieński National Park, namely: the brown trout stream morpho-

type, grayling, pike, roach, dace, chub, orfe, minnow, tench, gudgeon, barbel, bleak, schneider, silver bream, common bream, zanthe, bitterling, eel, burbot, three-spined stickleback, perch, and the Miller's thumb. There are 10 species of cyclostomates and fishes in the Gwda which are absent from the Drawa, namely: the brook lamprey, rainbow trout, rudd, crucian carp, Prussian carp, stone loach, spined loach, weather fish, nine-spined stickleback, and the pike-perch.

Table 8

Length characteristics of the grayling, acquired during fly-fishing championships at the Drawa within the limits of the Drawieński National Park

Date of catch	Time of catch		No. of anglers	n	$\bar{x} \pm m$	δ	V	Length range [mm]
	from–to	hours						
13 Oct 1990	10–14	4	49	26	324.81 ± 6.33	32.25	9.93	218–385
13 Oct 1991	10–14	4	39	40	325.70 ± 4.07	25.73	7.90	300–388
18 Oct 1992	10–14	4	83	99	328.87 ± 2.13	21.19	6.44	300–410
10 Oct 1993	10–14	4	87	32	349.69 ± 2.96	15.72	4.78	329–392
16 Oct 1994	10–14	4	66	32	353.87 ± 4.11	23.27	6.58	330–443
15 Oct 1995	10–14	4	41	24	350.75 ± 4.05	19.85	5.66	330–395
Total		24	365	253	335.82 ± 1.60	25.52	7.60	218–443

In the Gwda River, on the other hand, the above-mentioned authors did not record the presence of: the river lamprey, Atlantic salmon, brown trout, wels, and the ruffe, which species are known to occur in the Drawa. Jaskowski (1962), however, reports the wels from the Gwda river, the fish also known from the Drawa.

In the main flow of the Gwda, according to Koszaliński et al. (1989), the dominant fish was the roach, similarly like it was in the Drawa. The domination index of the roach in the Gwda at 11 sites was within 32.4–77.88%, while in the Drawa at the 8 sites it was within 2–87.5%.

CONCLUSIONS

1. One cyclostomate species and a total of 26 fish species has been presently recorded in the Drawa River within the limits of the Drawieński National Park.
2. The Drawa River within the limits of the Drawieński National Park is inhabited by 3 fish species of the family Cyprinidae: minnow—*Phoxinus phoxinus*, schneider—*Alburnus bipunctatus*, and bitterling—*Rhodeus sericeus amarus*, which are protected species and 1 cyclostomate species of the family Petromyzonidae—river lamprey—*Lampetra fluviatilis*, protected at the time of its larval development.
3. In the group of the protected fishes the most abundant was the schneider (D = 6.2%). In smaller quantities occurred the minnow (D = 0.76%) and the bitterling (D = 0.34%). The river lamprey was represented by 1 grown-up specimen.

4. The roach turned out to be the leading species in the ichthyofauna of the Drawa River within the limits of the Drawieński National Park, reaching the value of the domination index equal 56.16%. The burbot occurred also in high quantities (D = 7.82%), similarly did the silver bream (D = 6.88%), and the perch (D = 5.95%). The remaining species occurred in smaller numbers.
5. The largest share of the combined biomass of the studied fishes was represented by the roach (W = 30.53%). Large shares belonged also to the chub (W = 14.87%), pike (W = 13.27%), and the burbot (W = 7.03%). The remaining species contributed much less.
6. The pike, roach, chub, and the burbot occurred at all sampling sites in the Drawa (C = 100%). Multiple sites yielded: perch (C = 87.5%), gudgeon (C = 75%), dace (C = 62.5%). The occurrence constancy of the schneider, Miller's thumb, and the bleak has reached slightly lower value (C = 50%). The occurrence constancy of the remaining fish species was much lower (C = 12.5–37.5%).

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KRĄGŁOUSTE I RYBY RZEKI DRAWY W OBSZARZE DRAWIEŃSKIEGO PARKU NARODOWEGO

STRESZCZENIE

Część dolnej Drawy, między jeziorem Dubie a ujściem Płocicznej, licząca 38,8 km biegu rzeki, wchodzi w skład utworzonego w 1990 r. Drawieńskiego Parku Narodowego. Elektropołowy przeprowadzone na 8 odcinkach Drawy, wchodzących w skład Parku, dostarczyły 26 gatunków ryb i 1 gatunek krągłoustych. Gatunkiem przewodnim okazała się płoć, a jej stopień dominacji osiągnął wartość 56,16%. Licznie wystąpił także miętus (D = 7,82%), krąp (D = 6,88%) i okoń (D = 5,95%). Pozostałe gatunki wystąpiły w mniejszych ilościach. Rzekę Drawę w obszarze Parku zasiedlają 3 gatunki ryb z rodziny karpiowatych Cyprinidae – strzebla potokowa (*Phoxinus phoxinus*), piekielnica (*Alburnus bipunctatus*) i różanka (*Rhodeus sericeus amarus*) podlegające ochronie oraz 1 gatunek krągłoustych Petrmyzonidae – minóg rzeczny (*Lampetra fluviatilis*) podlegający ochronie w stadium rozwoju larwalnego.

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