ACTA VET. BRNO, 51, 1982: 83—93

SURVEY OF THE HEALTH STATUS OF FISH IN WATER RESERVOIRS OF THE MORAVA RIVER BASIN

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Received March 31, 1981

Abstract

Lucký Z., K. Král: *Survey of the Health Status of Fish in Water Reservoirs of the Morava River Basin.* Acta vet. Brno, 52, 1983: 83—93.

In the years 1979—1980 the health status of fish in water reservoirs having a controlled stock was investigated. The study was carried out in 9 water reservoirs situated in the basin of the river Morava, each supplied by different natural water sources, and supervised by the Podnik Povodí Moravy enterprise.

Necropsy and a parasitological examination were used to assess health status of 281 fish specimens representing 19 species.

A total of 58 diseases were diagnosed: 3 infectious diseases caused by 2 bacterial and one fungus species and 55 invasive diseases produced by many different species (19 protozoan, 19 monogenean trematode, 1 plerocercoid, 4 metacercariae, 6 tapeworm, 2 nematode, 1 spiny-headed helminth, one mollusc larvae, and 2 arthropod).

All infectious diseases deteriorated markedly the health status of the affected fish. Parasites producing the most serious pathological changes were *Hexamita salmonis*, *Trichophrya piscium*, *Chilodonella cyprini*, *Tetraonchus monenteron*, *Gyrodactylus salaris*, *G. luciopercae*, *Diplostomum spathaceum*, *Tylodelphis clavata*, *Triaenophorus nodulosus* and *Ergasilus sieboldii*.

A detailed evaluation of the results is provided along with suggestions for measures aimed at fish disease control, successful management of the water reservoirs, and protection of the environment.

Infectious fish disease, parasitic disease, water reservoirs.

In the years 1979—1980 a survey of fish diseases and their causative agents was conducted in fish from the basin of the river Morava (belonging to the Danube river basin). Monitoring the health status of fish in these water reservoirs along with regulating their stocking rate and species distribution are of enormous economic and biological significance.

This complex problem has to date been studied by few workers in this country. Attention was concentrated primarily upon causative agents of fish parasitism in several dam lakes along with faunistic investigations of fish parasites (Ergens 1956; Přibyslavský et al. 1966; Jílek and Lucký 1967; Přibyslavský and Lucký 1967).

Materials and Methods

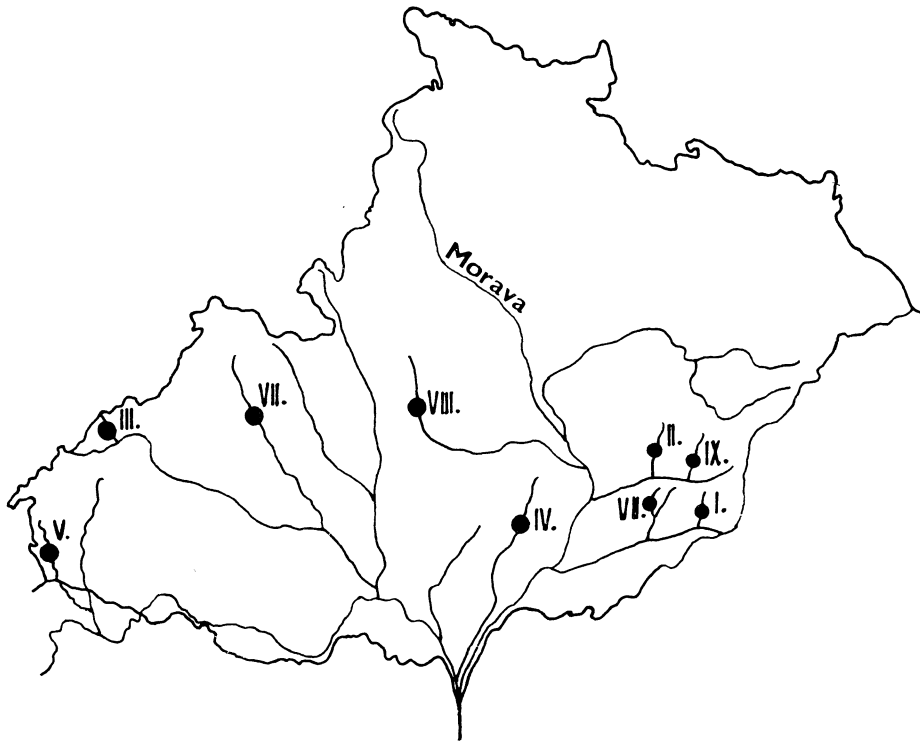
The health status of the fish was investigated in 9 water reservoirs. Characteristic features of these reservoirs are given in Table 1.

From these reservoirs a total of 281 fish specimens representing 19 species were examined during the years 1979 and 1980. All species are listed in Table 2 and further data are provided. The fish were caught in nets and by pole fishing. They were transported to the laboratory packed in ice and examined within 24 hours after catching.

Table 1

Basic data about the water reservoirs under study

Water reservoir	Locality (district)	Surface area in km²	Fish population character	Water supply	Fish population character
I. Bojkovice	Uh. Hradiště	0.138	coarse fish mixed	Kolelačský brook	trout
II. Fryšták	Gottwaldov	0.530	coarse fish	Fryštácký brook	trout
III. Hubenov	Jihlava	0.448	coarse fish	Maršovský brook	trout
IV. Koryčany	Kroměříž	0.331	coarse fish	Kyjovka	trout
V. Landštejn	J. Hradec	0.337	coarse fish	Pstruhovec	trout
VI. Ludkovice	Gottwaldov	0.119	mixed	Ludkovický brook	trout
VII. Mostiště	Žďár n. Sáz.	0.884	coarse fish	Oslava	mixed
VIII. Opatovice	Vyškov	0.675	mixed	Malá Haná	trout
IX. Slušovice	Gottwaldov	0.725	trout	Dřevnice	trout



Map of the Morava river basin showing the distribution of the water reservoirs: I. Bojkovice, II. Fryšták, III. Hubenov, IV. Koryčany, V. Landštejn, VI. Ludkovice, VII. Mostiště, VIII. Opatovice, IX. Slušovice.

The health status assessment of the fish was based on results of necropsy and a parasitological examination according to Lucký (1976) of the skin, gills, body cavity, stomach and intestine, liver, spleen, musculature, eyes and kidneys.

Pathological findings and causative agents of parasitism were determined with reference to the works of Dyk (1961), Bychowski et al. (1962), Ergens and Lom (1970), Fijan (1974) and Lucký (1978).

The extensity of invasions (i.e. the total number of affected fish) or diseases (or their causative agents) are expressed in per cent even when only one fish was examined. The intensity of invasion

is expressed either by the relative number of parasites in the microscopic field at a given magnification (see Table 3) or, with helminths, molluscs and arthropods, the actual numbers are presented.

Mild invasions by only moderately pathogenic parasites were rated as O. Local, single pathological changes of the invaded organs resulting in minor damage (e.g. mild hyperplasia or encapsulation) were rated as 1. Pathological changes resulting in serious lesions of the organ caused by a rather massive invasion of parasites were rated as 2. Marked changes with damage and necrosis in the organs were rated as 3, and lesions impairing the overall health condition of the fish were rated as 4.

Results and Discussion

The present results are summarized in Tables 2 and 3. Table 2 provides information about occurrence of diseases and their causative agents in the individual water reservoirs. Table 3 presents a list of fish diseases and their causative agents according to the zoological system.

All investigated water reservoirs are situated in the basin of the river Morava and they were built on well stocked streams. Later they were further stocked with various fish species without veterinary supervision.

In the two years of the study (1979, 1980), a total of 58 diseases and causative agents were diagnosed. They impaired the health status of the fish to various degrees.

The infectious diseases erythrodermatitis and saprolegniosis were diagnosed in several reservoirs; myxobacteriosis was found in one reservoir. All infectious diseases deteriorated the health status of the fish, but did not cause any increase in their death rates.

The parasitic fauna diagnosed in the fish was extensive. These different species were identified: 19 protozoan, 19 monogenean trematodes, 4 metacercariae, 1 spiny-headed helminth, 1 mollusc, and 2 arthopods. These findings are not surprising from the faunistic point of view as in fish taken from both running and still waters we earlier found 134 parasitic species in 2067 fish representing 36 species (Lucký and Dyk 1964). We conclude that nowadays the collection of parasites in the above-mentioned river basin has greatly increased, e.g. according to the data reported by Ergens and Lom (1970) a total of 300—400 fish parasites can be expected to occur in the basin of the river Morava.

Several of the fish parasites found in the investigated reservoirs had impaired the health status of the fish markedly. Among the protozoan species, the most severe pathological lesions were caused by *Hexamita salmonis* in the brown trout, and *Chilodonella cyprini* in the pike. Other protozoan species occurred rather sporadically and caused no serious pathological changes in the affected fish. Not even the highly pathogenic *Ichthyophthirius multifiliis* produced disease in the water environment of reservoirs with lesser concentrations of fish.

The majority of monogenean trematodes caused only local changes on the gills and skin of the affected fish. Heavier infestations resulting in pathological lesions and severe consequences to the fish with high oxygen demands were observed with the species *Tetraonchus monenteron* in the pike, *Gyrodactylus salaris* in the brown trout, and *Gyrodactylus luciopercae* in the pike perch.

Serious damage was produced by metacercariae of *Diplostomum spathaceum* and *Tylodelphis clavata* invading fish eyes, causing "pop-eye" or lens opacity and leading to blindness and starvation when present in larger numbers. Metacercariae of both trematode species are common parasites infesting many fishes in both running and still waters. In the locality under study, they were found in

Table 2

Occurrence of causative agents of fish diseases in the individual water reservoirs in the years 1979 and 1980

Causative agent of the disease	Fish species (host)	No. of fish examined	Date	Extensity in %	Intensity minimum–maximum	Degree of the disease
I. water reservoir: BOJKOVICE						
Myxobolus exiguus	Rutilus rutilus	2	9.80	50	4	1
Trichodina domerguei f. acuta	Cyprinus c.	2	6.79	100	1–3 (100×)	1
	Stizostedion lucioperca	1	9.80	100	1–3 (100×)	1
Dactylogyrus anchoratus	Cyprinus c.	2	6.79	100	4–6	1
Gyrodactylus luciopercae	Stizostedion lucioperca	1	9.80	100	85	3–4
Glochidium	Scardinius e.	5	6.79	80	10–45	2
II. water reservoir: FRYŠTÁK						
Erytrodermatitis	Alburnus alburnus	5	9.79	20		2
Saprolegniosis	Blicca bj.	2	6.80	100		2
Myxobolus cycloides	Rutilus rutilus	3	6.80	30	7 (cysts)	1
Trichodina nigra	Rutilus rutilus	3	6.80	30	2–5 (100×)	1
		5	9.79	20	1–3 (100×)	1
Apiosoma piscicola	Alburnus alburnus	5	9.79	20	0–1 (100×)	1
Dactylogyrus rutili	Rutilus rutilus	5	9.79	100	10–25	2
		3	6.80	100	15–20	2
Dactylogyrus nanus	Rutilus rutilus	3	6.80	100	2–4	1
Dactylogyrus sphyrna	Blicca bjoerkna	1	9.79	100	12	2
		2	6.80	100	18–20	2
Gyrodactylus decorus	Blicca bjoerkna	2	6.80	100	35–40	2
Gyrodactylus gracilihamatus	Alburnus alburnus	3	6.80	100	25–35	2
Gyrodactylus prostae	Rutilus rutilus	3	6.80	65	25–45	2–1
Diplozoon homoin	Alburnus alburnus	15	7.80	7	3	2
Diplozoon paradoxum	Rutilus r.	5	9.79	20	2	1
	Rutilus r.	3	6 80	65	2–5	2
Diplostomum spathaceum	Blicca bj.	2	6.80	100	2–4	2
Proteocephalus torulosus	Alburnus alburnus	15	7.80	20	1–3	3
Nematoda sp. juv.	Alburnus alburnus	15	7.80	20	1–2	0
Ergasilus sieboldi	Blicca bj.	1	9.79	100	3	1
	Blicca bj.	8	6.7.80	80	10–40	2–3
	Alburnus a.	15	7.80	100	2–18	1–2
III. water reservoir: HUBENOV						
Skin myxobacteriosis	Perca fluviatilis	21	7.79	80		3
Saprolegniosis	Esox lucius	10	5.80	100		4
Hexamita salmonis	Salmo trutta	1	7.79	100	30 (100×)	4
Dermocystidium percae	Perca fluviatilis	10	8.80	60	2–3 cysts	1
Trichodina sp.	Perca fluv.	2	5.79	100	2–6 (100×)	1
Trichodinella epizootica	Perca fluv.	2	5.79	100	10–150 (100×)	2
Apiosoma piscicola	Perca fluv.	2	5.79	50	4–5 (100×)	1
Trichophrya piscium	Salmo trutta	1	7.79	100	60–100 (100×)	3
	Perca fluv.	21	7.79	90	30–80 (100×)	3
Gyrodactylus salaris	Salmo trutta	1	7.79	100	30	3
Tylodelphys clavata	Perca fluv.	10	8.80	100	20–173	3
Proteocephalus percae	Perca fluv.	10	8.80	50	1–5	3
	Perca fluv.	2	5.79	100	2–8	3
	Perca fluv.	21	7.79	90	10–22	3
Triaenophorus nodulosus	Perca fluv.	2	5.79	50	4–14	3
	Perca fluv.	21	7.79	20	4–15	3
	Perca fluv.	10	8.80	100	2–20	3
Hydrozetes lacustris(?)	Perca fluv.	10	8.80	10	2	0

Table 2 continued

Causative agent of the disease	Fish species (host)	No. of fish examined	Date	Extensity in %	Intensity minimum – maximum	Degree of the disease
IV. water reservoir: KORYČANY						
Saprolegniosis	Perca fluv.	2	7.79	100		2
	Rutilus r.	2	7.79	100		2
	Blicca bj.	1	7.79	100		2
Chilodonella cyprini	Cyprinus c.	1	5.80	100	1 – 2 (100 ×)	2
Apiosoma piscicola	Scardinius e.	5	11.79	20	1 – 2 (100 ×)	0
Trichodina nigra	Rutilus r.	2	7.79	100	2 – 3 (100 ×)	1
Trichodinella	Perca fluv.	2	7.79	100	30 – 40 (100 ×)	2
epizootica	Cyprinus c.	1	5.80	100	4 – 8 (100 ×)	1
Dactylogyrus extensus	Cyprinus c.	1	5.80	100	75	2
Dactylogyrus difformis	Scardinius e.	12	5.6.80	100	15 – 40	2
Dactylogyrus rutili	Rutilus r.	3	7.9.79	100	10 – 15	2
Dactylogyrus sphyrna	Blicca bj.	7	5.6.80	60	30 – 80	2
	Blicca bj.	1	7.79	100	10	2
Diplostomum	Aspius asp.	6	11.79	100	2 – 6	3
spathaceum	Cyprinus c.	1	5.80	100	2	1
Caryophyllaeides	Rutilus r.	2	7.79	50	2	2
fennica	Blicca bj.	7	5.6.80	15	21	2
Triaenophorus nodulosus pl.	Perca fluv.	2	7.79	100	4 – 7	3
Ergasilus sieboldi	Perca fluv.	2	7.79	100	4 – 12	2
	Cyprinus c.	1	5.80	100	8	1
Glochidium	Perca fluv.	2	7.79	100	12 – 23	2
	Blicca bj.	5	6.80	50	50	2
V. water reservoir: LUDKOVICE						
Erytrodermatitis	Rutilus r.	10	9.80	20		3
Myxobolus exiguus	Leuciscus cephalus	1	6.79	100	40	2
Apiosoma piscicola	Leuciscus c.	1	6.79	100	1 – 3 (100 ×)	0
	Perca fluv.	10	9.80	50	1 – 3 (100 ×)	0
Trichodinella epizootica	Perca fluv.	10	9.80	100	1 – 5 (100 ×)	1
Dactylogyrus rutili	Rutilus r.	10	9.80	70	7 – 20	2
Diplostomum spathaceum	Rutilus r.	10	9.80	100	8 – 20	2
Tylodelphys clavata	Perca fluv.	10	9.80	60	28 – 85	2 – 3
	Rutilus r.	10	9.80	100	10 – 17	2
Nematoda sp. juv.	Leuciscus c.	1	6.79	100	2	0
	Rutilus r.	10	9.80	30	1 – 4	0
Ergasilus sieboldi	Tinca tinca	1	9.80	100	23	2
	Leuciscus c.	1	9.80	100	7	1
	Rutilus r.	10	9.80	20	3 – 6	1
VI. water reservoir: LANDŠTEJN						
Dermocystidium sp.	Perca fluv.	12	9.80	80	1 – 3 (100 ×)	1
Chilodonella cyprini	Esox lucius	1	5.79	100	20 – 40 (100 ×)	3
Trichodina domerguei f. esocis	Esox lucius	1	5.79	100	2 – 10 (100 ×)	1
Tetraonchus monenteron	Esox lucius	1	5.79	100	400	3
Triaenophorus nodulosus	Esox lucius	1	5.79	100	19	3
Triaenophorus	Perca fluv.	12	11.80	80	3 – 7	3
nodulosus pl.	Perca fluv.	1	5.79	100	3	2
Ergasilus sieboldi	Perca fluv.	12	11.80	25	1 – 2	1
VII. water reservoir: MOSTIŠTĚ						
Myxobolus sp.	Stizostedion lucioperca	7	10.79	80	10 – 20	1
Chilodonella cyprini	Stizostedion lucioperca	7	10.79	100	2 – 5 (100 ×)	1
Trichodina domerguei f. acuta	Stizostedion lucioperca	7	10.79	100	2 – 4 (100 ×)	1
Dactylogyrus auriculatus	Abramis brama	17	6.80	95	3 – 10	1

Table 2 continued

Causative agent of the disease	Fish species (host)	No. of fish examined	Date	Extensity in %	Intensity minimum – maximum	Degree of the disease
Dactylogyrus zandti	Abramis brama	17	6.80	100	8 – 46	1
Ancyrocephalus paradoxus	Stizostedion lucioperca	7	10.79	20	3	1
	Stizostedion l.	6	11.80	35	2 – 4	1
Diplostomum spathaceum	Stizostedion l.	7	10.79	42	2 – 7	2
	Abramis brama	17	6.80	23	1 – 3	1
	Stizostedion.	6	11.80	33	1 – 3	2
Tylodelphys clavata	Stizostedion l.	14	10.79	100	4 – 21	1 – 2
Apophalus sp.	Abramis brama	17	6.80	6	3	1
Camallanus truncatus	Stizostedion l.	14	10.79	28	1 – 3	2
	Stizostedion l.	6	11.80	50	1 – 2	2
Neoechinorhynchus rutili	Abramis brama	17	6.80	10	2	1
VIII. water reservoir: OPATOVICE						
Erytrodermatitis	Esox lucius	2	5.79	50		3
	Esox lucius	1	5.80	100		3
Myxobolus dispar	Rutilus rut.	9	5.79	10	12	1
Chilodonella cyprini	Perca fluv.	2	5.80	100	1 – 2 (100 ×)	1
Ichthyophthirius multifiliis	Rutilus r.	9	5.79	70	10 – 35	2 – 3
Trichodina sp.	Rutilus r.	9	5.79	100	1 – 2 (100 ×)	1
	Tinca tinca	1	5.79	100	rarely	0
	Esox lucius	2	5.79	100	rarely	0
Trichodina domerguei f. acuta	Rutilus r.	5	5.80	60	1 – 2 (100 ×)	1
Trichodinella epizootica	Perca fluv.	1	5.79	100	1 – 3 (100 ×)	1
Apiosoma pisciola	Rutilus r.	9	5.79	50	0 – 1 (100 ×)	0 – 1
Apiosoma campanulata	Perca fluv.	1	5.79	100	1 – 3 (100 ×)	1
Dactylogyrus rutili	Rutilus r.	9	5.79	80	10 – 20	2
	Rutilus r.	3	9.79	65	9 – 19	2
	Rutilus r.	5	5.80	100	20 – 40	2
Dactylogyrus sphyrna	Rutilus r.	9	5.79	20	10 – 25	2
Ancyrocephalus paradoxus	Stizostedion lucioperca	1	5.80	100	4	1
Tetraonchus monenteron	Esox lucius	2	5.79	100	30 – 44	2
	Esox lucius	1	5.80	100	30	2
Gyrodactylus gracilihamatus	Rutilus r.	9	5.79	65	40 – 60	2 – 3
	Rutilus r.	3	9.79	65	35 – 60	2 – 3
Gyrodactylus lucii	Esox lucius	2	5.79	50	7	1
Gyrodactylus tincae	Tinca tinca	1	5.79	100	50	2
Diplostomum spathaceum	Rutilus r.	9	5.79	10	2	0 – 1
	Stizostedion l.	1	5.80	100	3	1
	Rutilus r.	5	5.80	40	1 – 5	1
Tylodephys clavata	Rutilus r.	9	5.79	30	4 – 12	2
	Rutilus r.	5	5.80	20	5	2
Raphidascaris acus	Esox lucius	2	5.79	50	4	2
Raphidascaris acus larv.	Salmo trutta	2	9.79	50	1	1
Ergasilus sieboldi	Esox lucius	2	5.79	100	3 – 7	1
	Tinca tinca	1	5.79	100	123	3
	Rutilus r.	5	5.80	40	2 – 4	1
IX. water reservoir: SLUŠOVICE						
Erytrodermatitis	Phoxinus phox.	8	9.79	12		2
Myxobolus lomi (?)	Phoxinus phox.	8	9.79	12	2 – 4	1
Myxosoma dujardini	Leuciscus cephal.	1	5.80	100	2	1
Myxosoma undulata	Phoxinus phox.	8	9.79	12	3	1
Chilodonella cyprini	Salmo trutta	4	9.79	100	1 – 5 (100 ×)	2
	Salmo irideus	3	9.79	100	1 – 5 (100 ×)	2
	Salvelinus font.	4	6.79	100	10 – 15 (100 ×)	3
Apiosoma piscicola	Salmo irideus	3	6.79	30	1 – 2 (100 ×)	1
Trichodina sp.	Salmo trutta	4	9.79	25	1 – 2 (100 ×)	1
	Phoxinus phox.	2	5.80	50	1 – 2 (100 ×)	0
Caryophyllaeus brachycollis	Leuciscus ceph.	1	5.80	100	1	2

Table 2 continued

Causative agent of the disease	Fish species (host)	No. of fish examined	Date	Extensity in %	Intensity minimum–maximum	Degree of the disease
Proteocephalus sagittus	Nemachilus barbatulus	2	5.80	100	4–5	3
Apatemon cobitis	Nemachilus barbatulus	2	5.80	50	4	2
Diplostomum spathaceum	Salmo irideus	3	9.79	30	2–4	2
	Salvelinus font.	5	9.79	20	1–4	2
	Salmo irideus	2	5.80	100	2–6	2
Tylodelphys clavata	Salvelinus font.	5	9.79	60	11–20	3
	Phoxinus phox.	8	9.79	100	3–18	3
	Salmo trutta	1	5.80	100	2	1
Raphidascaris acus	Nemachilus bar.	6	6.79	30	2–3	2
	Nemachilus bar.	2	5.80	50	4	2

but two reservoirs (Bojkovice and Landštejn), both situated far from nesting sites of water birds. In the remaining reservoirs the eye metacercariae occurred frequently and caused serious lesions in the brook trout, perch, pike perch, and minnow.

All tapeworm species affected the health status and growth performance of the fish stock. The most sever effects were caused by *Triaenophorus nodulosus*, especiall its plerocersoids in the perch. Both the extensity and intensity of infestations were usually high and lesions in the liver parenchyma were extensive. Other parasitic helminths were found only occasionally and caused no significant pathological changes.

Among parasitic arthropods, the species *Ergasilus sieboldii* was most often diagnosed. Mild lesions caused by this parasite were found in the tench and silver bream.

Results of the present field study show that the health status of stock fish in these reservoirs, as defined by the Veterinary Act No. 66/61 Sb., is fairly good. No dangerous epizootics requiring veterinary public health measures were diagnosed. The etiology of fish erythrodermatitis is not fully understood as yet so that it cannot be included among the dangerous epizootic diseases. Infectious diseases diagnosed in this study did not reach a level that could threaten the fish stock in the reservoirs.

The numerous collection of parasites may be explained by fish aquaculture management methods and a rather wide geographical distribution of the reservoirs even though they belong to one river basin. Several parasitic species, especially the monogenean trematodes, are highly species-specific.

Direct chemotherapeutic and preventive measures aiming at fish disease control in these reservoirs are impracticable from the public health point of view. Occurrence of this wide variety of causative agents can best be controlled by management means. Fish in good condition are more resistant to disease and combat it better. It is necessary therefore to maintain proper stock density and a balance of individual fish species; the overstocking of one species may result in outbreaks of species-specific infectious diseases. Prior to planting, the fish fry should be carefully inspected by a veterinarian to ensure that only healthy fingerlings are used. These measures can substantially reduce the occurrence of protozoan, trematode and arthropod parasitic species.

Similar measures are implemented in the control of helminths requiring intermediate or definitive hosts for their complete life cycle. The dynamics of several helminthoses is often directly related to density and species density of the inter-

Table 3

Review of diseases and causative agents diagnosed in fish from water reservoirs in the years 1979 and 1980

No.	Disease (causative agent)	In 1979			In 1980		
		Water reservoir	Fish species	Degree of the disease	Water reservoir	Fish species	Degree of the disease
1.	Erythrodermatitis	II	Alburnus a.	3	V	Rutilus r.	3
		VIII	Esox lucius	3	VIII	Esox lucius	3
		IX	Phoxinus p.	2			
2.	Skin myxobacteriosis	III	Perca fluv.	3			
3.	Skin saprolegniosis	IV	Perca fluv.	3	II	Blicca bj.	2
			Blicca bj.	3	III	Perca fluv.	3
			Rutilus r.	3		Esox lucius	4
4.	Hexamita salmonis	III	Salmo trutta	4			
5.	Dermocystidium perceae (?)				III	Perca fluv.	1
					VI	Perca fluv.	1
6.	Myxobolus cycloides				II	Rutilus r.	1
7.	Myxobolus exiguus	V	Leuciscus c.	2	I	Rutilus r.	1
8.	Myxobolus dispar	VIII	Rutilus r.	2			
9.	Myxobolus lomi(?)	IX	Phoxinus p.	1			
10.	Myxobolus sp.	VII	Stizosted. l.	1			
11.	Myxosoma undulata				IX	Phoxinus phox.	1
12.	Myxosoma dujardini				IX	Leuciscus c.	1
13.	Apiosoma campanulata	VIII	Perca fluv.	1			
14.	Apiosoma piscicola	II	Alburnus a.	1	V	Perca fluv.	1
		III	Perca fluv.	1			
		IV	Scardinius e.	1			
		V	Leuciscus c.	1			
		VIII	Rutilus r.	1			
		IX	Salmo irid.	1			
15.	Trichophrya piscium	III	Salmo trutta	3			
			Perca fluv.	3			
16.	Trichodina domerguei f. acuta	I	Cyprinus c.	1	I	Stizosted. l.	1
		VII	Stizosted. l.	1	VIII	Rutilus r.	1
17.	Trichodina domerguei f. nigra	II	Rutilus r.	1	II	Rutilus r.	1
		IV	Rutilus r.	1			
18.	Trichodina domerguei f. esocis	VI	Esox lucius	1			
19.	Trichodina sp.	III	Perca fluv.	1	IX	Phoxinus p.	1
		VIII	Rutilus r.	1			
		IX	Salmo trut.	1			
20.	Trichodinella epizootica	III	Perca fluv.	2	III	Perca fluv.	1
		IV	Perca fluv.	2	IV	Cyprinus c.	1
		VIII	Perca fluv.	1	V	Perca fluv.	1
21.	Chilodonella cyprini	VI	Esox lucius	3	IV	Cyprinus c.	2
		VII	Perca fluv.	1	VIII	Perca fluv.	1
		IX	Salmo trutta	2			
			Salmo irideus	2			
			Salvelinus f.	3			
22.	Ichthyophthirius multifiliis	VIII	Esox lucius	1			
			Tinca tinca	1			
			Rutilus r.	2			
23.	Dactylogyrus anchoratus	I	Cyprinus c.	1			
24.	Dactylogyrus auriculatus				VII	Abramis brama	1
25.	Dactylogyrus difformis				IV	Scardinius er.	2
26.	Dactylogyrus extensus				IV	Cyprinus c.	2
27.	Dactylogyrus nanus				II	Rutilus r.	2
28.	Dactylogyrus rutili	II	Rutilus r.	2	II	Rutilus r.	2
		IV	Rutilus r.	2	VIII	Rutilus r.	2
		VIII	Rutilus r.	2	V	Rutilus r.	2
29.	Dactylogyrus sphyrna	II	Blicca bj.	2	IV	Blicca bj.	1–2
		IV	Blicca bj.	2	II	Blicca bj.	2
		VIII	Rutilus r.	2			
30.	Dactylogyrus zandti				VII	Abramis br.	1

Table 3 continued

No.	Disease (causative agent)	In 1979			In 1980		
		Water reservoir	Fish species	Degree of the disease	Water reservoir	Fish species	Degree of the disease
31.	Tetraonchus monenteron	VI	Esox lucius	3	VIII	Esox lucius	2
		VIII	Esox lucius	2			
32.	Ancyrocephalus paradoxus	VIII	Stizosted. l.	2	VII	Stizosted. l.	3
					VIII	Stizosted. l.	1
33.	Gyrodactylus decorus				II	Blicca bj.	2
34.	Gyrodactylus gracilihamatus	VIII	Rutilus r.	3	II	Alburnus al.	2
35.	Gyrodactylus lucii	VIII	Esox lucius	1			
36.	Gyrodactylus luciopercae				I	Stizosted. l.	3–4
37.	Gyrodactylus prostae				II	Rutilus r.	1
38.	Gyrodactylus salaris	III	Salmo trutta	3			
39.	Gyrodactylus tincae	VIII	Tinca tinca	2			
40.	Diplozoon paradoxum	II	Rutilus r.	1	II	Rutilus r.	2
41.	Diplozoon homoin				II	Alburnus a.	2
42.	Apatemon cobitis				IX	Nemachilus b.	2
43.	Apophalus sp. (?)				VII	Abramis b.	1
44.	Diplostomum spathaceum	III	Aspius asp.	3	II	Blicca bj.	2
		VII	Stizosted. l.	2	IV	Cyprinus c.	1
		VIII	Rutilus r.	1	V	Rutilus r.	2
		IX	Salvelinus f.	2	VII	Stizosted. l.	2
			Salmo irid.	2		Abramis b.	1
					VIII	Stizosted. l.	2
						Rutilus r.	2
					IX	Salmo irid.	1–2
45.	Tylodephys clavata	VII	Stizosted. l.	3	III	Perca fluv.	3–4
		VIII	Rutilus r.	2	V	Perca fluv.	1–3
		IX	Salvelinus f.	3	VII	Stizosted. l.	2
			Phoxinus p.	3	VIII	Rutilus r.	2
					IX	Stizosted. l.	1
46.	Proteocephalus percae	III	Perca fluv.	3	III	Perca fluv.	3
47.	Proteocephalus torulosus				II	Alburnus a.	3
48.	Proteocephalus sagittus				IX	Nemachilus b.	3
49.	Caryophyllaeides fennica	IV	Rutilus r.	3	IV	Blicca bj.	2
50.	Caryophyllaeus brachicolis				IX	Leucisces c.	1
51.	Triaenophorus nodulosus	VI	Esox lucius	3			
52.	Triaenophorus nod. plerocerkoid	III	Perca fluv.	4	III	Perca fluv.	3–4
		IV	Perca fluv.	3	VI	Perca fluv.	3
		VI	Perca fluv.	3			
53.	Raphidascaris acus	VIII	Salmo trut.	2	IX	Nemachilus b.	2
		IX	Nemachilus	2			
54.	Camallanus truncatus	VII	Stizosted. l.	2	VII	Stizosted. l.	2
55.	Neoechinorhynchus rutili				VII	Abramis b.	1
56.	Ergasilus sieboldi	II	Blicca bj.	1	II	Blicca bj.	3
						Alburnus a.	2
		IV	Perca fluv.	2	IV	Cyprinus c.	1
		VIII	Esox lucius	1	V	Tinca tinca	2
			Tinca tinca	4		Rutilus r.	1
					VI	Perca fluv.	1
					VIII	Rutilus r.	1
57.	Hydrozetes lacustris (?)				III	Perca fluv.	1
58.	Glochidium	I	Scardinius e.	2			
		IV	Blicca bj.	2	IV	Blicca bj.	1
			Perca fluv.	2			

mediate host organisms. In some reservoirs, as suggested by our results, the density of water birds should be controlled. They often carry trematodes whose metacercariae can infest the fish. Indeed, this study has shown a high incidence of eye metacercariasis in the fish. The incidence could be reduced by controlling the nesting sites of water birds (black-headed gulls) at or near the reservoir, as eradication of the first intermediate hosts — molluscs — is impracticable. Such measures should be adopted for specialized fish-rearing ponds. They could also be adapted to water reservoirs. However, one must here consider more complex matters of ecology, especially the protection of wild birds. On the other hand, water birds do catch and remove injured and diseased fish floating near the water surface.

Heavy tapeworm infestations were found in the pike caused by *Triaenophorus nodulosus* and by its plerocercoids in the perch. The later fish is the most common intermediate host of *T. nodulus*. The perch stock should be more strictly monitored in coarse-fish holding reservoirs with pike planted regularly to eliminate those small cyprinid fish that feed on small water algae. If under such aquaculture schemes, the perch proved to be more efficient, the pike should be replaced by a different predatory species, e. g. the pike perch.

Výzkum zdravotního stavu ryb ve vodárenských nádržích v povodí řeky Moravy

V letech 1979—1980 byl sledován zdravotní stav ryb ve vodárenských nádržích, na kterých je obsádka ryb druhově upravována a početně regulována. Výzkum byl prováděn na 9 nádržích v povodí řeky Moravy, napájených různými přírodními vodními zdroji, které jsou rybářsky obhospodařovány Podnikem Povodí Moravy.

Patologickoanatomickou pitvou a parasitologickým vyšetřením byl posouzen zdravotní stav 281 kusů ryb 19 druhů.

Bylo diagnostikováno 58 chorob, z toho 3 infekční choroby — 2 bakteriózy a 1 mykóza, 55 invasních chorob působených 19 druhy prvoků, 19 druhy monogenetických motolic, 4 druhy metacerkarií, 6 druhy tasemnic, 2 druhy hlístic, 1 druhem kmene vrtejši, larvami mlžů a 2 druhy členovců.

Všechny infekční choroby výrazně zhoršily zdravotní stav postižených ryb. Z cizopasníků se výrazně uplatnili *Hexamita salmonis*, *Trichophrya piscium*, *Chilodonella cyprini*, *Tetraonchus monenteron*, *Gyrodactylus salaris*, *G. luciopercae*, *Diplostomum spathaceum*, *Tylodelphys clavata*, *Triaenophorus nodulusus* a *Ergasilus sieboldi*.

Při podrobném zhodnocení všech zjištěných chorob ryb a jejich původců jsou v obsáhlé diskusi naznačena reálná opatření k výraznému snížení výskytu jednotlivých chorob ryb při dalším rybářském obhospodařování nádrží s přihlédnutím i k potřebám ochrany přírody.

Исследование состояния здоровья рыб в водоемах бассейна реки Морава

В период 1979—1980 гг. проводились наблюдения за состоянием здоровья рыб в водоемах, в которых рыбы регулируются по видам и численности. Исследования проводились в 9 водоемах бассейна реки Морава, питаемых раз-

ными естественными источниками, о которых с точки зрения рыбоводства заботится предприятие Поводи Моравы.

Патологоанатомическим вскрытием и паразитологическим исследованием проводилась оценка здоровья 281 головы рыб 19 видов.

Был поставлен диагноз 58 болезней, из этого 3 инфекционных болезни — 2 бактериоза и 1 микоз, 55 инвазионных болезней, вызванных 19 видами протистов, 19 видами моногенетических двуусток, 4 видами метацеркариев, 6 видами солитеров, 1 видом плероцеркоида, 2 видами нематод, 1 видом штамма скребни, личинками моллюсков и 2 видами суставчатоногих.

Все инфекционные болезни существенным образом ухудшили состояние здоровья пораженных рыб. Из паразитов занимали важное место *Hexamita salmonis, Trichophrya piscium, Chilodonella cyprini, Tetraonchus monenteron, Gyrodactylus salaris, G. luciopercae, Diplostomum spathaceum, Tylodelphys clavata Triaenophorus nodulosus, Ergasilus sieboldi.*

После подробной оценки всех выявленных болезней рыб и их возбудителей в обширной дискуссии намечаются реальные меры, направленные на существенное ограничение отдельных болезней в области рыбного хозяйства с учетом потребностей охраны природы.

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