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ENDOHELMINTHS OF FISHES FROM THE MID-DALMATIAN REGION OF THE ADRIATIC SEA (A REVIEW)

ENDOHELMINTI RIBA SREDNJEDALMATINSKOG PODRUČJA JADRANSKOG MORA (PREGLED)

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Results of studies of helminthofauna from the mid-Dalmatian area in the 1982-1989 period are presented. A total of 34 endohelminth species were recorded: 16 Trematoda Digenea, 5 Cestoda, 11 Nematoda (some determined only up to the level of genus) and 2 Acanthocephala. Several new species were established for the study area and the Adriatic, as well as the new hosts of many endohelminth species. A total of 97 endohelminth species have been established by the earlier studies in this area (since 1938): 62 Trematoda Digenea, 7 Cestoda, 23 Nematoda (some determined only up to the level of genus), 5 Acanthocephala. Trematoda Monogenea have not been studied.

INTRODUCTION

This review of endohelminths of fishes from the mid-Dalmatian area was made on the basis of the results of our extensive research in the 1982-1989 period. Some results of this research have already been published (Hristovski and Jardas, 1982; Jardas and Hristovski, 1985) or are under preparation. This review is intended to give a summary of the results of realized studies of fish helminthofauna in the mid-Dalmatian area in the mentioned period, to present some general observations in this respect and to stress the need of future investigations.

Some earlier authors studied the endohelminth fauna of fish from this area, as well. They were mainly strangers. So Janiszewska (1949) reported the results of studies of nematodes of some fishes from the area of Split, and later (Janiszews

k a , 1953) those of digeneous trematodes in fishes from the same area and probably from the same material (collected in 1938). This authoress gave the list of found helminths, their hosts and descriptions of some less known species along with the report of the new species for the Adriatic and European seas. Further on, helminths were studied in the same area by S e y in 1966, the results being published in several papers (S e y , 1968, 1970, 1970a, 1970b). The first three papers present a list of recorded endohelminths (Trematoda, 1968; Trematoda and Cestoda, 1970, and Nematoda and Acanthocephala, 1970a), their hosts and descriptions of some species. The fourth paper (1970b) reports on the new genus and species for the science (*Collarina triglae*). The same author also recorded a number of species of Trematoda, Cestoda and Nematoda new for the Adriatic.

STUDY AREA

Fish for studies of helminthofauna were caught from the channels of the middle Adriatic, that is mid-Dalmatian channels, Split Channel, Brač Channel, Hvar Channel, Korčula Channel and Neretva Channel as well as from the Bay of mali Ston and close to the Vis Island (Fig. 1).

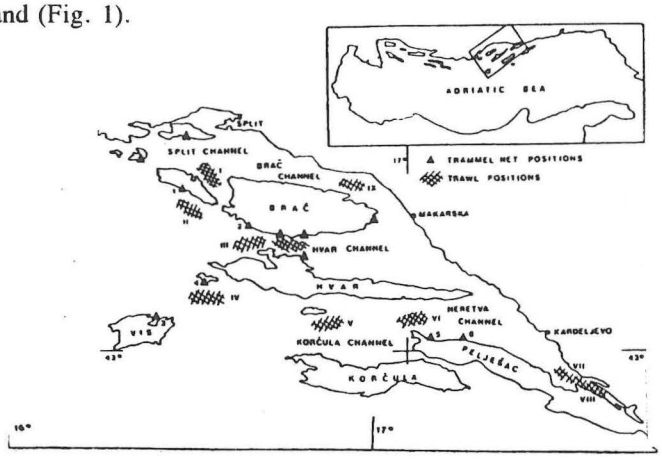

Fig. 1. Study area

MATERIAL

A total of 71 fish species were analyzed (466 specimens); 60 species (432 specimens) of the class Osteichthyes and 11 species (34 specimens) of the class Selachii (Chondrichthyes). The sample contained mainly the benthic and benthopelagic species of the continental shelf, characteristic of smooth trawling grounds and coastal areas.

The review of analyzed fish species, their presence in the material, length ranges and

study dynamics was given in Table 1.

RESULTS

The endohelminths were recorded in 55 (77.5%) analyzed fish species. Trematoda Digenea were found in 19 (26.8%), Cestoda in 9 (12.7%), Nematoda in 42 (59.2%) and Acanthocephala in 2 fish species (2.8%). A total of 34 endohelminth species were recorded: 16 Trematoda Digenea, 5 Cestoda, 11 Nematoda (some were determined up to the level of genus) and 2 Acanthocephala (Table 2).

Trematoda:

Trematoda were found in a large number of fish species. However, some species were found in a single or at maximum several hosts such as *Helicometra fasciata, Anisocoelium capitellatum, Monorchis monorchis* (Table 2). Five species were for the first time recorded from this area (*Acanthochasmus inerme, Hemiurus communis, Lecithaster confusus, Sterrhurus musculus, Lintonium vibex*) of which *Lintonium vibex* was new for the Adriatic. New hosts were established for some Trematoda from the mid-Dalmatian area.

Cestoda:

Cestoda were found mainly in cartilaginous fishes. Only *Acanthobothrium floridensis* was found in a larger number of hosts (Table 2). The species *Calliobothrium filicolle* is new for the Adriatic. New hosts were established for some species from the study area.

Nematoda:

Nematoda are the most frequent fish parasites even though their number of species is smaller than in some other helminth groups. They were particularly frequently found in the species of genus *Hysterothylacium*. The species *H. fabri* was recorded from 23 fish species, and *H. aduncum* from 5 species, or both species from a total of 25 species. Apart from these two species, only the larvae of *Anisakis* and *Contracaecum clavatum* (Table 2) were rather frequent. Two species were for the first time recorded from the middle Dalmatia (*Anisakis simplex, Echinocephalus uncinatus*) and new hosts were established for almost all the species from this area.

Acanthocephala:

Of Acanthocephala two species were recorded, both in two species of cartilaginous fishes (Table 2).

* * *

Taking into account all earlier published results for the mid-Dalmatian area, a total of 97 endohelminth species have been recorded. Some (Nematoda) were determined only up to the level of genus. A total of 62 Trematoda Digenea species were established, 7 Cestoda, 23 Nematoda (6 were determined up to the level of genus) and 5 Acanthocephala.

Trematoda Monogenea have not yet been studied in this area.

ENDOHELMINTI RIBA SREDNJEDALMATINSKOG PODRUČJA JADRANSKOG MORA (PREGLED)

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KRATKI SADRŽAJ

Iznose se rezultati helmintoloških istraživanja na području srednje Dalmacije u periodu 1982-1989. Ustanovljene su 34 vrste endohelminata Trematoda Digenea 16 vrsta, Cestoda 5 vrsta, Nematoda 11 vrsta (neke određene samo do roda) i Acanthocephala 2 vrste. Ustanovljeno je nekoliko novih vrsta za istraživano područje i Jadran, te novi domaćini mnogih vrsta endohelminata. U dosadašnjim helmintološkim istraživanjima na tom području (od 1938) ustanovljeno je 97 vrsta endohelminata: Trematoda Digenea 62 vrste, Cestoda 7 vrsta, Nematoda 23 vrste (neke određene samo do roda), Acanthocephala5vrsta. Trematoda Monogenea nisu istraživani.

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Table 1.

Species	The number of analyzed specimens 1982	1983	1989	Total	Length range (cm)
Alosa fallax nilotica		1		1	24.5
Antonogadus megalokynodon		2		2	11.0-13.5
Argentina sphyraena		6	4	10	14.0-18.0
Arnoglosus laterna		6		6	8.0-14.0
Blennius ocellaris		2		2	15.5
Boops boops		3		3	17.5-24.0
Buglossidium luteum		3		3	11.0-12.0
Callionymus maculatus		10	2	12	8.5-10.0
Cepola rubescens		8	3	11	25.0-38.0
Chromis chromis	1	3		4	10.5-12.5
Citharus linguatula	8	10	10	28	8.5-19.5
Conger conger		1		1	57.0
Coris julis	1			1	20.5
Dasyatis pastinaca		2		2	49.0-58.0
Dentex dentex		2		2	69.0-72.0
Dentex gibosus		14		14	11.0-16.5
Diplodus annularis	6	1	2	9	9.3-16.5
Diplodus puntazzo		1	2	3	16.0-18.0
Diplodus vulgaris	6	8	2	16	15.0-23.0
Engraulis encrasicolus		1		1	12.0
Gobius cobitis			1	1	12.9
Gobius niger		2		2	12.0-14.0
Labrus merula	2	4		6	19.5-30.5
Lepidopus caudatus		1		1	54.5
Lesueurigobius friesii		8		8	6.5-7.5
Lithognathus mormyrus		2		2	32.5-33.0
Lophius budegassa		2		2	22.5-24.5
Lophius piscatorius		3		3	13.5-24.5
Mrluccius merluccius		5	10	15	22.5-34.5
Microchirus variegatus		8		8	11.5-15.5
Monochirus hispidus	2		1	3	10.0-13.5
Mullus barbatus	8	5		13	14.5-20.0
Mullus surmuletus	1	2	2	5	16.0-26.5
Mustelus asterias		3		3	77.0-125.0
Mustelus mustelus		1		1	130.0
Myliobatis aquila		2		2	65.0-80.0
Pagellus acarne		3	1	4	13.0-18.0
Pagellus erythrinus		4		4	18.0-23.5
Parablennius gattorugine	3		1	4	18.5-20.5
Phrynorhombus regius		1		1	9.0
Raja clavata		2		2	58.0-75.0
Raja miraletus		4		4	30.0-33.5
Sardina pilchardus		2	2	4	15.5-16.5
Sarpa salpa		3		3	23.0-27.5
Sciaena umbra	8	5		13	19.0-42.5
Scomber scombrus		3		3	30.0-33.0
Scorpaena notata	7	5		12	12.5-17.0
Scorpaena porcus	35	1	10	46	14.0-20.5

Table 1. continued

Scorpaena scrofa	21	1		22	16.0-35.5
Scyliorhinus canicula		4		4	37.5-41.0
Scyliorhinus stellaris		2		2	57.0-71.0
Serranus hepatus	8			8	8.0-9.5
Serranus scriba	2	3	4	9	12.0-19.5
Solea vulgaris		4		4	30.5-34.5
Sparus aurata	1			1	39.0
Spicara flexuosa	8	3	2	13	14.0-18.0
Spicara maena	1	2		3	17.5-21.0
Spondyliosoma cantharus		3		3	15.0-15.5
Squalus acanthias			4	4	...
Squalus blainvillei		5		5	38.0-52.0
Symphodus mediterraneus	3			3	10.0-14.5
Symphodus ocellatus		1	1	2	9.0-10.5
Symphodus tinca	13	1	1	15	18.0-31.0
Torpedo marmorata	2	2	1	5	18.0-39.5
Trachinus draco		1	1	2	20.0-21.5
Trachurus mediterraneus		7	9	16	10.0-26.0
Trachurus trachurus		1		1	24.0
Trigloporus lastoviza		4		4	15.5-21.0
Trisopterus minutus capelanus		6		6	17.0-22.0
Uranoscopus scaber	12	3	5	20	12.5-29.0
Zeus faber	2	2	4	8	11.0-41.0

Table 2. List of found endohelminths and their hosts in the mid-Dalmatian area (1982 - 1989)

TREMATODA DIGENEA:	
Anisocladium fallax	*Uranoscopus scaber*
Anisocoelium capitellatum	*Mullus surmuletus*
	Uranoscopus scaber
Aphallus tubarium	*Dentex dentex*
Haplocladus typicus	*Cepola rubescens*
Helicometra fasciata	*Scorpaena notata*
	**Scorpaena porcus*
	Serranus scriba
***Hemiurus communis*	*Pagellus erythrinus*
***Lecithaster confusus*	*Scomber scombrus*
Lepidopedon elongatum	**Spicara maena*
***Lintonium vibex*	*Buglossidium luteum*
Lomosoma wardi	*Microchirus variegatus*
Monorchis monorchis	*Diplodus vulgaris*
	Parablennius gattorugine
Opechona bacillaris	*Scomber scombrus*
Opecoeloides furcatus	**Serranus hepatus*
Podocotyle atomon	**Gobius niger*
	**Lesueurigobius friesii*
Stephanostomum cesticillus	*Lophius piscatorius*
***Sterrhurus musculus*	*Symphodus tinca*
CESTODA:	
***Acanthobothrium floridensis*	*Mustelus asterias*
	Myliobatis aquila
	Raja clavata
	Scyliorhinus stellaris
Bothriocephalus andresii	*Citharus linguatula*
Bothriocephalus scorpii	**Arnoglossus laterna*
	**Mustelus mustelus*
(**)Calliobothrium filicolle	*Squalus acanthias*
Cleistobothrium crassiceps	*Merluccius merluccius*
NEMATODA:	
Anisakis simplex	*Trachurus mediterraneus*
Anisakis sp. (larvae)	**Callionymus maculatus*
	**Cepola rubescens*
	**Serranus hepatus*
	Trachurus mediterraneus
	**Trigloporus lastoviza*
Contracaecum clavatum (larvae)	**Lophius budegassa*
	Lophius piscatorius
	Mullus barbatus
	**Mullus surmuletus*
	**Pagellus acarne*
	**Sciaena umbra*
Contracaecum sp. (larvae)	**Raja miraletus*

Table 2. continued

Cucullanus longicollis	*Mullus barbatus*
	Mullus surmuletus
Cucullanus sp. (larvae)	**Diplodus vulgaris*
	**Coris julis*
	**Sciaena umbra*
Echinocephalus uncinatus	**Dasyatis pastinaca*
	**Myliobatis aquila*
Hysterothylacium aduncum (larvae)	**Citharus linguatula*
	Diplodus annularis
	Diplodus vulgaris
	**Scorpaena porcus*
	Zeus faber
Hysterothylacium fabri (larvae)	**Antonogadus megalokynodom*
	**Argentina sphyraena*
	**Arnoglossus laterna*
	**Buglossidium luteum*
	**Chromis chromis*
	Citharus linguatula
	Conger conger
	**Dentex dentex*
	**Diplodus annularis*
	**Lepidopus caudatus*
	**Merluccius merluccius*
	**Phrynorhombus regius*
	**Sciaena umbra*
	**Scorpaena porcus*
	**Scorpaena scrofa*
	Serranus scriba
	**Spicara flexuosa*
	Spicara maena
	**Symphodus mediterraneus*
	**Symphodus tinca*
	Trachinus draco
	Trachurus trachurus
	Uranoscopus scaber
Proleptus obtusus	*Scyliorhinus canicula*
Raphidascaris sp. (larvae)	**Dentex gibbosus*
	Solea vulgaris
ACANTHOCEPHALUS:	
Acanthocephaloides incrassatus	**Squalus blainvillei*
Acanthocephaloides propinquus	**Mustelus asterias*

* New hosts for the area of middle Adriatic

** New endohelminth species for the middle Adriatic or for the Adriatic (**)

Table 3. List of hosts and their parasites in the mid - Dalmatian area (1982 - 1989)

Host	Parasite
Antonogadus megalokynodon	*Hysterothylacium fabri* (larvae)
Argentina sphyraena	*Hysterothylacium fabri* (larvae)
Arnoglossus laterna	*Hysterothylacium fabri* (larvae)
	Bothriocephalus scorpii
Buglossidium luteum	*Hysterothylacium fabri* (larvae)
	Lintoniumvibex
Callionymus maculatus	*Anisakis* sp. (larvae)
Cepola rubescens	*Anisakis sp.* (larvae)
	Haplocladus typicus
Chromis chromis	*Hysterothylacium fabri* (larvae)
Citharus linguatula	*Hysterothylacium aduncum* (larvae)
	Hysterothylaciumfabri (larvae)
	Bothriocephalus andresi
Conger conger	*Hysterothylacium fabri* (larvae)
Coris julis	*Cucullanus* sp. (larvae)
Dasyatis pastinaca	*Echinocephalus uncinatus*
Dentex dentex	*Acanthochasmus inerme*
	Hysterothylacium fabri (larvae)
Dentex gibbosus	*Raphidascaris* sp. (larvae)
Diplodus annularis	*Hysterothylacium aduncum* (larvae)
	Hysterothylacium fabri (larvae)
Diplodus vulgaris	*Hysterothylacium aduncum* (larvae)
	Monorchis monorchis
Gobius niger	
Lepidopus caudatus	*Podocotyle atomon*
Lesueurigobius friesii	*Hysterothylacium fabri* (larvae)
Lophius budegassa	*Podocotyle atomon*
Lophius piscatorius	*Contracaecum clavatum* (larvae)
	Contracaecum clavatum (larvae)
Merluccius merluccius	*Stephanostomum cesticillus*
	Cleistobothrium crassiceps
Microchirus variegatus	*Hysterothylacium fabri* (larvae)
Mullus barbatus	*Lomosoma wardi*
	Contracaecum clavatum (larvae)
Mullus surmuletus	*Cucullanus longicollis*
Mustellus asterias	*Anisocoelium capitellatum* (larvae)
	Acanthobothrium floridensis
Mustelus mustelus	*Acanthocephalloides propinquus*
	Bothriocephalus scorpii

Table 3, continued

Myliobatis aquila	*Acanthobothrium floridensis*
	Echinocephalus uncinatus
Pagellus acarne	*Contracaecum clavatum* (larvae)
Pagellus erythrinus	Hemiurus communis
Parablennius gattorugine	Monorchis monorchis
Phrynorhombus regius	*Hysterothylacium fabri* (larvae)
Raja clavata	*Acanthobothrium floridensis*
Raja miraletus	*Contracaecum sp.* (larvae)
Sciaena umbra	*Contracaecum clavatum* (larvae)
	Contracaecum sp. (larvae)
	Hysterothylacium fabri(larvae)
Scomber scombrus	*Lecithaster confusus*
	Opechona bacillaris
Scorpaena notata	*Helicometra fasciata*
Scorpaena porcus	*Helicometra fasciata*
	Hysterothylacium aduncum (larvae)
	Hysterothylacium fabri (larvae)
Scorpaena scrofa	*Hysterothylacium fabri* (larvae)
Scyliorhinus canicula	*Proleptus optusus*
Scyliorhinus stellaris	*Acanthobothrium floridensis*
Serranus hepatus	*Anisakis* sp. (larvae)
	Opecoeloides furcatus
Serranus scriba	*Helicometra fasciata*
	Hysterothylacium fabri (larvae)
Solea vulgaris	*Raphidascaris* sp. (larvae)
Spicara flexuosa	*Hysterothylacium fabri* (larvae)
Spicara maena	*Hysterothylacium fabri* (larvae)
	Lepidopedon elongatum
Squalus acanthias	*Calliobothrium filicolle*
Squalus blainvillei	*Acanthocephalloides incrassatus*
Symphodus mediterraneus	*Hysterothylacium fabri* (larvae)
Symphodus tinca	*Hysterothylacuim fabri* (larvae)
	Sterrhurus musculus
Trachinus draco	*Hysterothylacium fabri* (larvae)
Trachurus mediterraneus	*Anisakis simplex*
	Anisakis sp. (larvae)
Trachurus trachurus	*Hysterothylacium fabri* (larvae)
Trigloporus lastoviza	*Anisakis* sp. (larvae)
Uranoscopus scaber	*Anisocladium fallax*
	Anisocoelium capitellatum
	Hysterothylacium fabri (larvae)
Zeus faber	*Hysterothylacium fabri* (larvae)