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The parasites of two sympatric gobies *Pomatoschistus minutus* and *P. lozanoi* in the Belgian coastal waters

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Samenvatting

Grondels van de bijvangst van een commerciële garnaalvisser werden verzameld in het Westdiep (Noordzee). Het voorkomen en de intensiteit van infectie met een aantal parasieten werd genoteerd. Zowel *Pomatoschistus minutus* als *P. lozanoi* fungeren als eindgastheer voor *Lernaeocera minuta* en voor *Asymphylodora demeli.* De hogere intensiteit van infectie met *A. demeli* bij *P. minutus* zou een gevolg kunnen zijn van de voedsel niche segregatie tussen de twee grondelsoorten. Beide soorten fungeren ook als intermediaire gastheer voor *Bothriocephalus scorpii* en voor *Hysterothylacium aduncum*, belangrijke parasieten van commerciële vissoorten.
Trefwoorden : *Pomatoschistus*, parasieten, Noordzee.

Abstract

Sand gobies were obtained from the bycatch of a commercial shrimp trawler in the Westdiep area, Southern Bight of the North Sea. Prevalence and infection rate of their helminth and crustacean parasites were recorded. Both species, *Pomatoschistus minutus* and *P. lozanoi*, are final hosts for *Lernaeocera minuta* and *Asymphylodora demeli.* The higher infection rate of *A. demeli* in *P. minutus* juveniles may be linked to the food resource partitioning between the goby species. Both species are also intermediate hosts to *Bothriocephalus scorpii* and *Hysterothylacium aduncum*, important parasites of commercial fish species.
Key-words : *Pomatoschistus*, parasites, North Sea.

Introduction

Sand gobies of the *Pomatoschistus minutus* complex (WEBB, 1980) are the most abundant fish in the Belgian coastal waters (REDANT, 1977). Two species from this complex, *Pomatoschistus minutus* PALLAS, 1770 and *P. lozanoi* DE BUEN, 1923, occur sympatrically in the Westdiep area west of Nieuwpoort, and show a distinct partitioning of food resource : *Pomatoschistus minutus* feeds mostly on benthic and epibenthic animals, while *P. lozanoi* specializes on mysids (HAMERLYNCK *et al.*, 1986). In the North Sea west of Texel, *Pomatoschistus minutus* spawns from March to June, *P. lozanoi* from May to August. They are repeat spawners, producing several batches of eggs. Nearly all adults of both species die within a few weeks after spawning (FONDS, 1973). In the Westdiep area young *P. minutus* appear in the catches in July, young *P. lozanoi* in August (HAMERLYNCK *et al.*, 1986).

Most studies of parasites of fish populations have been limited to commercially important fish stocks. The present knowledge covers less than 2% of fish species (KINNE, 1984). The parasite fauna of *Pomatoschistus minutus* has been described in the Baltic by MARKOWSKI (1935a) and KOTER (1962). They noted the occurrence of 4 species of digenean trematodes, 4 species of cestodes, 2 species of acanthocephalans and 2 species of nematodes. FONDS (1973) recorded *Asymphylodora demeli* MARKOWSKI, 1935, *Bothriocephalus scorpii* (MULLER, 1776) and *Hysterothylacium aduncum* (= *Contracaecum aduncum*) (RUDOLPHI, 1802) from the stomachs of *P. minutus* and *P. lozanoi* from the Wadden Sea.
This paper provides data on the incidence and infection rate of helminth and crustacean parasites in sand gobies from the Westdiep area.

Materials and methods

Monthly samples were obtained from the bycatch of a commercial shrimp trawler operating in the Westdiep-Trapegeer area off Nieuwpoort from May through December 1984, and in June and August 1985. In April 1985 fish from the same area were obtained from the Fisheries Research Institute, Ostend.
On board all fish were anaesthetized in a Benzocaïne solution in sea water and preserved in neutralized formaldehyde (7% final concentration) within 15 minutes after capture. Some 1400 fish, out of a total of 12725, were examined for parasites on the gills, in the abdominal cavity and in the gut. The number of parasites per individual was recorded.

Results

Four different species of parasites, the life cycle of which is given in Table I, were found in *Pomatoschistus minutus* and *P. lozanoi.* Adult and mature specimens of *Asymphylodora demeli* were found in the intestine and the rectum. Larval stages (plerocercoids) of the cestode *Bothriocephalus scorpii* were collected from

Table I : Life cycle of the helminth and crustacean parasites of *Pomatoschistus minutus* and *Pomatoschistus lozanoi* (after MARKOWSKI, 1935a, 1935b, REIMER, 1973, KINNE, 1984).

Parasite species	First intermediate host	Second intermediate host	Final host
Asymphylodora demeli (Trematoda)	unknown	Several spp. of gastropods	*Pomatoschistus minutus* *Pomatoschistus lozanoi* *Rutilus rutilus* *Nereis diversicolor* (Annelida, Polychaeta)
Bothriocephalus scorpii (Cestoda)	*Eurytemora hirundo* (Crustacea, Copepoda)	*Pomatoschistus minutus* *Pomatoschistus lozanoi*	*Pleuronectes flesus* *Rhombus maximus* *Myoxocephalus scorpius*
Hysterothylacium aduncum (Nematoda)	Several spp. of invertebrates	*Pomatoschistus minutus* *Pomatoschistus lozanoi* (and other spp. of fishes)	Several spp. of fishes
Lernaeocera minuta (Crustacea, Copepoda)	unknown		*Pomatoschistus minutus* *Pomatoschistus lozanoi*

the stomach and immature specimens of the nematode *Hysterothylacium aduncum* were recovered from the abdominal cavity. Adult *Lernaeocera minuta* (SCOTT, 1900) (Crustacea, Copepoda) were attached to the gills and the gill arches, only rarely to the pectoral fins.

The prevalence and mean intensity of infection of *Pomatoschistus minutus* and *P. lozanoi* with *A. demeli* is shown in Table II. It can be seen that the younger *P. minutus* (caught in July and August 1984) harboured a high number of *Asymphylodora* specimens. Spawning fish of this species show a high prevalence but a relatively low intensity of infection with *A. demeli.* Older *P. lozanoi* are more heavily infected with *A. demeli* than younger fish. The highest infection level was reached in August 1985 (27 parasites per fish).

In Table III the infection level of *P. minutus* and *P. lozanoi* with *B. scorpii, H. aduncum* and *L. minuta* is shown. In autumn a relatively low number of *P. minutus* is infected with a high number of *B. scorpii. H. aduncum* is present in the abdominal cavity throughout the year, but highest infection levels were recorded in ripe *P. minutus* in spring. *L. minuta* seems to infect older, post-spawning *P. minutus.*
Because of the smaller number of parasite specimens collected from *P. lozanoi* no distinct seasonal pattern in the occurrence of parasites can be found. However, it is clear from Table III that *B. scorpii* is particularly abundant in the younger stages, while infection levels for *H. aduncum* and *L. minuta* are low during that period. The infection level with *L. minuta* reaches a maximum in late spring (June, 1984).

Table II : Prevalence and mean intensity of infection of *Asymphylodora demeli* in the gobies *Pomatoschistus minutus* and *Pomatoschistus lozanoi.*

	Pomatoschistus minutus				*Pomatoschistus lozanoi*			
Date	Number of fish	Mean length (mm)	Prevalence (%)	Mean intensity (number/fish)	Number of fish	Mean length (mm)	Prevalence (%)	Mean intensity (number/fish)
17.05.'84	51	53.8	98.0	14.1	53	48.7	96.3	8.7
20.07.'84	82	34.8	96.0	136.7	79	48.0	64.6	1.8
17.08.'84	30	46.6	92.9	101.6	30	47.1	86.7	5.8
28.09.'84	338	48.2	77.2	29.3	111	40.7	47.8	0.7
30.10.'84	90	42.4	44.5	11.9	80	41.3	27.5	0.4
13.12.'84	60	44.7	41.6	6.9	36	45.4	41.7	0.4
18.04.'85	22	47.0	90.9	4.0	30	46.9	93.2	3.4
09.08.'85	56	43.8	94.6	65.4	59	44.5	98.4	27.2

Table III : Prevalence of *Bothriocephalus scorpii, Hysterothylacium aduncum* and *Lernaeocera minuta* in *Pomatoschistus minutus* and *P. lozanoi* (in %). The mean intensity of infection (number of parasites/infected fish) is given between brackets.

	Pomatoschistus minutus				*Pomatoschistus lozanoi*			
Date	Number of fish	*B. scorpii*	*H. aduncum*	*L. minuta*	Number of fish	*B. scorpii*	*H. aduncum*	*L. minuta*
17.05.'84	51	7.8(1.0)	21.6(1.7)	39.2(1.7)	53	5.7(1.3)	15.1(1.0)	9.4(1.2)
20.07.'84	82	0	4.8(1.0)	0	79	0	16.5(1.6)	10.1(1.3)
17.08.'84	30	3.3(1.0)	3.5(1.0)	0	30	0	13.3(1.7)	3.3(1.0)
28.09.'84	338	14.3(1.8)	2.0(1.0)	0.8(1.0)	111	19.8(1.3)	1.8(1.0)	0.9(1.0)
30.10.'84	90	13.3(1.3)	6.7(1.0)	1.1(1.0)	80	18.8(1.2)	2.5(1.0)	0
13.12.'84	60	10.0(1.0)	10.0(1.2)	5.0(1.0)	36	25.0(1.2)	2.8(1.2)	0
18.04.'85	22	9.1(1.0)	13.6(1.0)	4.5(1.0)	30	20.0(1.2)	6.7(1.0)	0
01.06.'85	-	-	-	-	21	21.7(1.9)	1.7(1.0)	25.0(1.2)
09.08.'85	56	0	3.6(1.0)	0	59	11.9(1.3)	10.2(1.2)	8.5(1.0)

Discussion

Infective stages of parasites enter the appropriate host most often through the food web (KENNEDY, 1975). This implies that infection levels may be closely related to the availability in the plankton or the benthos of specific food items which serve as intermediate hosts. Seasonal patterns in incidence of infestation and in parasite burden may then be the result of the seasonal occurrence of intermediate hosts.

Asymphylodora demeli infects juvenile *P. minutus* massively in early summer (July, 1984). The early postlarvae of both goby species are zooplanktivores (HAMERLYNCK, unpubl. data). As juvenile *P. lozanoi* are much less affected, this would suggest the intermediate host almost disappears from the zooplankton before *P. lozanoi* juveniles start to hatch, thus before June. The first intermediate host in *Asymphylodora* species remains unknown. Metacercariae were found in a number of gastropods belonging to the brackish water fauna (MARKOWSKI, 1935a). The different infection rate of *P. minutus* and *P. lozanoi* with *A. demeli* could be due to the food resource partitioning and not to the temporal segregation of spawning. The parasite is found in the Baltic, in the Southern Bight of the North Sea and in gobies from the West coast of Portugal (HAMERLYNCK, unpubl. dta), thus *A. demeli* seems to be very widespread indeed. Elucidation of its life cycle could provide an explanation for the zoogeography of this parasite species.

Infection rates of *P. minutus* and *P. lozanoi* with *Bothriocephalus scorpii* are highest in autumn. The intermediate host, *Eurytemora hirundo*, mentioned by MARKOWSKI (1935b) is never recorded in any stomach, *Eurytemora* species being restricted to brackish habitats. Probably a marine calanoid copepod could also serve as intermediate host.

The complete life cycle of *Lernaeocera minuta* remains unknown. According to MANN (1964) *L. minuta* causes a loss of weight, induces obvious changes in fat and water content of muscle and other tissues and lowers the haemoglobin content when attached to *P. minutus*. From our results it may be suggested that *L. minuta* typically invades spent *P. minutus*, exacerbating the low condition due to spawning activities.

Conclusions

Sand gobies are the final hosts for *Lernaeocera minuta* and *Asymphylodora demeli*, from the Baltic down to Portugal. The life cycles of both these parasites have not yet been elucidated. The two other parasite species found, *Hysterothylacium aduncum* and *Bothriocephalus scorpii*, both have piscivorous fish as final hosts and as gobies constitute one of the most important food sources for a number of commercial fishes (REDANT, 1977) they may be the main intermediate host in the Belgian coastal area.

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