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Lernaeocera branchialis (L., 1767) on cod in Baltic waters

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ABSTRACT: Field surveys have shown a limited distribution of *L. branchialis* in Baltic waters due to heterogenic salinity. The parasite is not suited as "natural" tagging of the cod population in these waters.

INTRODUCTION

The parasitic copepod *Lernaeocera branchialis* (L.) on cod in Nordic waters was described for the first time by Strøm (1762).

There are two parasitic stages in the life cycle of *L. branchialis*. The first stage is found on species in several families (Sundnes, 1970). In the first period of development, the parasite goes through several developmental stages until copulation takes place. After copulation the female swims freely until it attaches to the final host. Only the female has this second stage of development. The male dies after copulation.

This second stage is mainly found on gadoid fish, but also other fish families can be final hosts for *L. branchialis* (Kabata, 1958).

The mature female has easily detectable "egg strings" (Fig. 1) which are segmented, embryos being continuously released from these.

The parasite has a pathogenic effect on the cod that varies in degrees. The pathogenic effect is dependent on the size of the fish as well as on ecological conditions in the specific cod population (Sundnes, 1970; Kahn, 1994).

This paper presents some observations on *L. branchialis* parasitizing cod in Baltic waters. The possibility to use the parasite as a "natural" tag of cod populations in these waters is also briefly discussed. Sherman & Wise (1961) considered that *L. branchialis* could be a "natural" tag of fish populations in the New England area, while the findings of Arntz (1972) concerning *L. branchialis* infecting fishes in the Kiel Bay do not justify its use as a "natural" tag in these waters. In Atlantic waters the host penetrates further south than the parasite on both sides of the ocean. The ecological background for the limited southern distribution of the parasite in Atlantic waters is not known. In Baltic waters, in conditions of heterogenic salinity, the limited distribution of the parasite could be due to lack of osmoregulation in the parasite (Sundnes, 1970). These experimental findings of Sundnes (loc. cit.) indicated that the parasite would not thrive in salinity below 18 ‰.

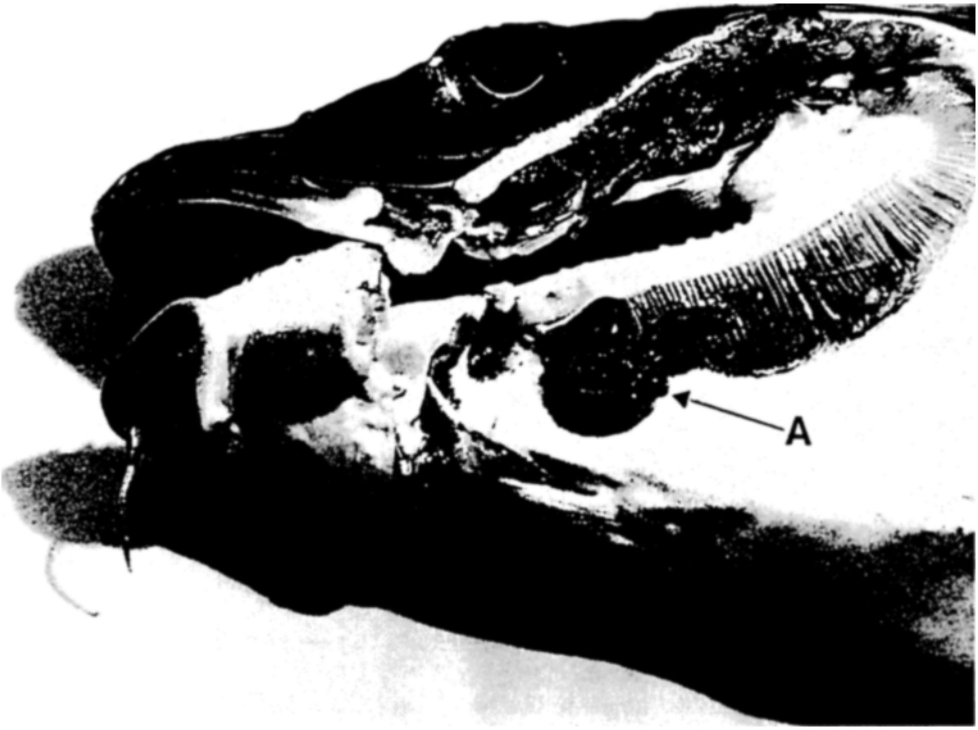

Fig. 1. Cod infected with *Lernaeocera branchialis* (A) with developed "egg" strings

RESULTS AND CONCLUSION

During a survey in Baltic waters in 1972 with R. V. "Alkor" from the Institut für Meereskunde in Kiel, 2356 cod were examined from 7 trawl stations (cf. Fig. 2 and Table 1). At the westernmost station in the fished area, only one *Lernaeocera branchialis* was found among 1081 cod. At this locality the salinity of the water was 24.5 ‰. At the other trawl stations no parasites were found. No salinity data east of 15 E were taken on this survey. Arntz (1972) found the same situation in Kiel bay where an infection rate in cod of 0.1 % was found.

He concluded his findings were possible because of an inflow of salt water from the Kattegat. Our finding of an infection rate of 0.1 % at station 7 must be considered to be a coincidence.

In 1985, a field survey was performed in the coastal waters off the Norrby laboratory (University of Umeå, Sweden). Twenty-three cod were caught by gillnets for parasite analyses and osmolality measurements. The salinity was 4.8 ‰ and 5.9 ‰ at 0 and 22 meters depth, respectively. Even in these salinities the cod had normal osmolality (Table 2). Two specimen of cod (fish no. 6 and 11), both females, had significant lower osmolality. One

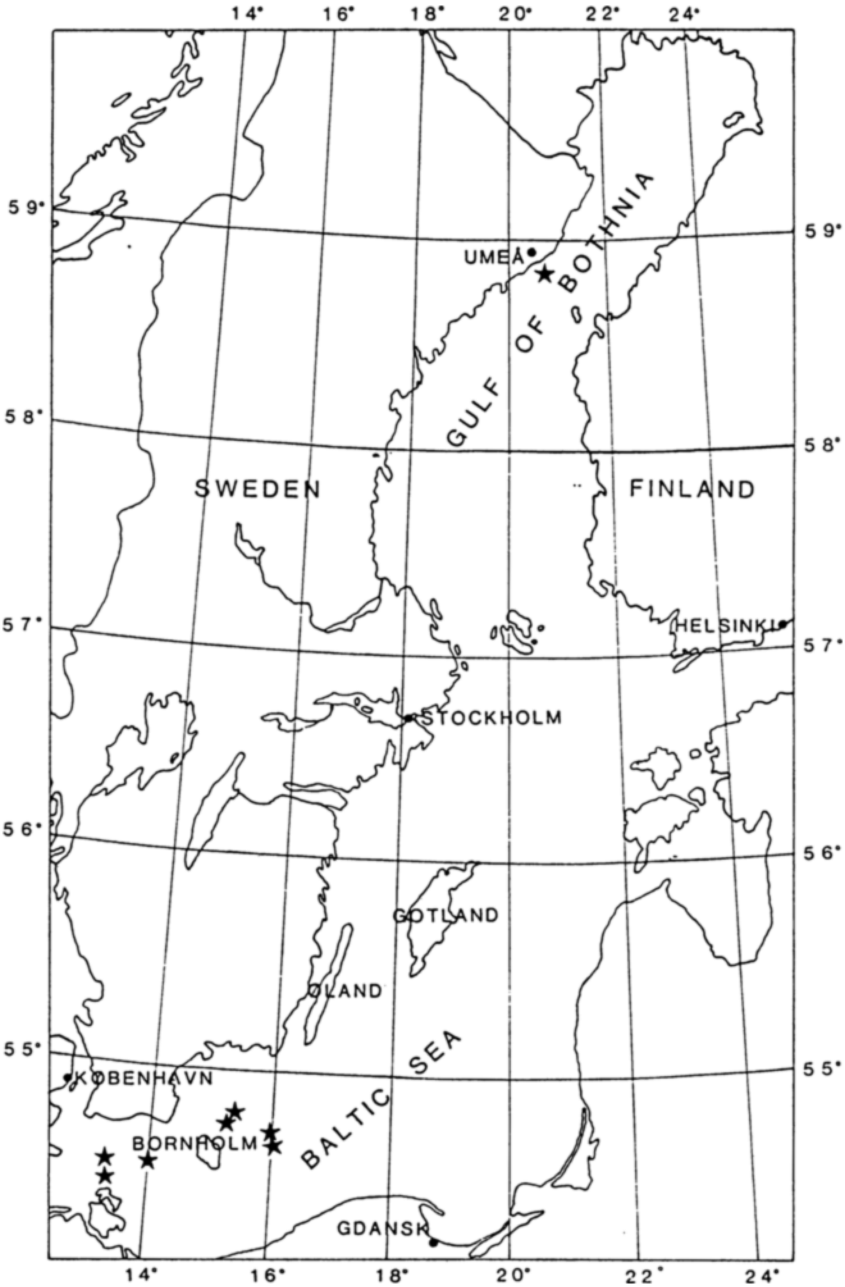

Fig. 2. Map of Baltic waters with fishing locations (★) in the Bornholm area and in the vicinity of Umeå

Table 1. Cod examined for *L. branchialis* in the Baltic Sea

Date	Locality	Position	Depth	Salinity	Temp. (°C)	*L. branchialis*	N. of cod	Smallest fish (cm)	Largest fish (cm)
31. 5.	The depth of Bornholm					0	91	14	61
1. 6.	"	55°08'N 16°00'E	86 m			0	310	14	71
2. 6.	"	55°27'N 15°15'E	90 m			0	248	17	64
2. 6.	"	55°29'N 15°18'E	pelagic			0	4	–	–
4. 6.	"	55°01'N 13°59'E		16.9	5.4	0	156	9	62
4. 6.	"	54°56'N 13°21'E	45 m	18.4	9.8	0	466	12	73
5. 6.	Vejsnäs-Rinne	54°41'N 13°21'E	40 m	24.5	8.3	1	1081	12	70
	Total					1	2356	12	73

Table 2. Osmolality in cod off the Norrby Laboratory

Fish no.	Sex	Body length (cm)	m. Osm	*L. branchialis*
1	Female	62	382	0
2	"	59	382	0
3	"	67	338	0
4	"	76	316	0
5	"	68	357	0
6	"	73	289	0
7	"	73	329	0
8	"	56	346	0
9	"	59	333	0
10	"	62	365	0
11	"	61	288	0
12	"	61	356	0
13	"	56	368	0
14	Male	59	310	0
15	"	55	355	0
16	"	56	354	0
17	"	79	307	0
18	"	66	368	0
19	"	64	312	0
20	"	57	360	0
21	"	72	316	0
22	"	53	331	0
23	"	41	346	0
24	"	61	354	0
25	"	58	370	0
26	"	76	340	0
27	"	61	356	0
28	"	56	368	0

had abnormal gonads and the other a liver in a pathological condition. This may reduce their ability to hold stable osmolality.

Panikkar & Sproston (1941) postulate that *L. branchialis* can keep up with a stable osmolality due to the connection to the host and its body liquids. The present findings however demonstrate that the parasite is dependent on the salinity of the surrounding water. Waters of salinity below 20 ‰ are important ecological factors for the osmolality of the parasite, thereby limiting the distribution of the parasite. The host, however, can penetrate through the salinity barriers into waters of salinity less than 5 ‰ and still maintain normal osmolality. The "tagging" value of this parasite on the cod population is low in these waters.

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