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## Short communication

# Diseases and parasites of Baltic cod (*Gadus morhua*) from the Mecklenburg Bight to the Estonian coast

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During the 1994 BMB/ICES Sea-going Workshop "Fish Diseases and Parasites in the Baltic Sea", the prevalences of skin ulcers, pseudobranchial swellings (X-cell disease), skeletal deformities, and the parasites *Cryptocotyle lingua* and *Lernaeocera branchialis* were recorded in cod in 11 areas from the Mecklenburg Bight in the southwest to the Estonian coast in the northeast of the Baltic Sea. Prevalences were highest in the western part, except for skeletal deformities, which were highest in the central part. The spatial distribution of pseudobranchial swellings, *C. lingua* and *L. branchialis* appeared to be restricted to areas with salinity above 8. Skin ulcers were mainly observed in German waters, while skeletal deformities were most abundant in the Polish, Russian, and Lithuanian coastal zones.



Key words: Baltic Sea, cod, skin ulcer, pseudobranchial swelling, skeletal deformities, *Cryptocotyle*, *Lernaeocera*.

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## Introduction

Observations of fish diseases in the Baltic Sea started in the beginning of this century (Bergman, 1912). Studies have been mainly focused on local coastal areas (Bagge and Bagge, 1956; Berner and Mattheis, 1959; Möller, 1981). More recently, intensive large-scale studies of spatial and temporal trends in fish diseases and parasites focused on the western part of the Baltic Sea (Dethlefsen and Watermann, 1982; Dethlefsen and Lang, 1994; Lang and Dethlefsen, 1994). Most of the work has concentrated on flounder (*Platichthys flesus*) and cod (*Gadus morhua*), but direct comparisons of the different results obtained are difficult because of the various methodologies applied.

With the objectives to intercalibrate and document the methodology applied in fish disease investigations in the North Sea, two sea-going workshops have been accomplished in 1984 and 1988 under the auspices of the International Council for the Exploration of the Sea (Dethlefsen *et al.*, 1986; ICES, 1989). In order to evaluate the applicability of the experiences obtained from the North Sea on the situation in the Baltic Sea and to provide scientific background data for future fish disease studies in this area, a BMB/ICES Sea-going Workshop was held in 1994 (Lang and Mellergaard, 1999). The results dealing with the prevalence and spatial distribution of diseases and parasites in cod are presented here.

## Material and methods

Fishing was carried out at 36 stations representative of 11 sampling areas (Fig. 1; for details see Lang and Mellergaard, 1999). The target was to examine at least 150 cod to allow detection of a prevalence of 2% with 95% confidence level (Martin *et al.*, 1987). However, in

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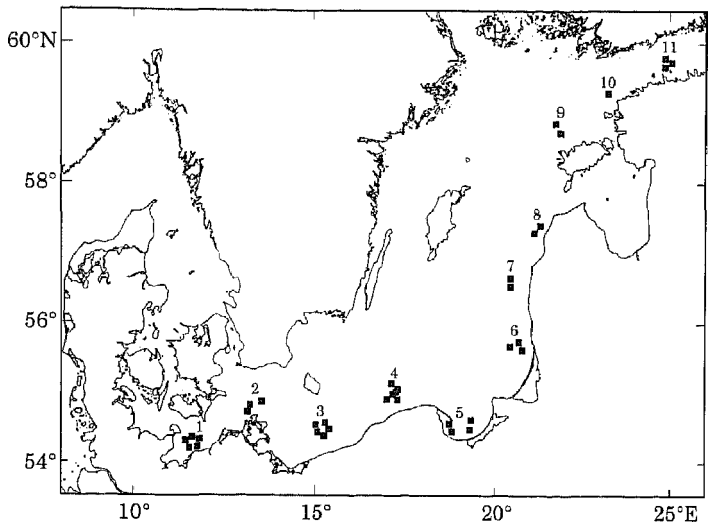


Figure 1. BMB/ICES Sea-going Workshop "Fish Diseases and Parasites in the Baltic Sea", 25 November to 8 December 1994: Map showing the trawling stations fished and sampling areas distinguished (1–11).

practice the total catch of cod was examined, except for a few hauls with large catches when subsamples were taken. On an area basis (Table 1), the target was exceeded in Areas 1–8 with the exception of Area 5 (Gulf of Gdansk). Very few cod were caught in Areas 9–11. Thus, a total of 3241 cod were examined according to the methodological guidelines given in ICES (1989) and Bucke *et al.* (1996) for the presence of the following diseases and parasites: acute and healing skin ulcers, pseudobranchial swellings (X-cell disease), skeletal deformities (including scoliosis, lordosis, vertebral compression, and pug-head), *Cryptocotyle lingua* (metacercariae in the skin), and *Lernaeocera branchialis*.

The length distribution of cod summed over all areas revealed three major peaks (Fig. 2). Therefore, the data were analysed with respect to three different length groups (<22 cm; 22–34 cm; >35 cm), which broadly correspond to age groups 1, 2, and 3+ (Berner *et al.*, 1987). The length classes were not evenly distributed over the different areas (Table 1): small cod dominated in Areas 1 and 2, medium sized cod in Areas 5–8, and large cod in Areas 3 and 4.

## Results and discussion (Table 1)

### Skin ulcers

Skin ulcers were mainly acute or healing and did not show the sequential development described for the ulcus-syndrome (Jensen and Larsen, 1979) or for fishing gear-induced skin ulcers (Mellergaard and Bagge, 1998). The results of a bacteriological examination of two of the ulcerated cod were inconclusive and the aetiological background (primary mechanical lesions with secondary bacterial infection or primary bacterial infection) remains uncertain. They were observed in four areas with the highest prevalences in Areas 3 and 4, which is in agreement with earlier data (Dethlefsen and Lang, 1994), and only in the two largest size classes. Increased susceptibility of older fish to diseases has also been observed in common dab, *Limanda limanda* (Mellergaard and Nielsen, 1995). Studies off the Polish coast in 1982–1993 (Draganik *et al.*, 1994) have shown prevalences from 0.5 to 15%.

### Pseudobranchial swellings

Pseudobranchial swellings (X-cell disease) were only found in Areas 1 and 2 and observed in all length groups. The low prevalences confirmed earlier information. Although Dethlefsen and Watermann (1982) report on a few observations of pseudobranchial swellings east of 13°E (prevalence<1%), most observations have been made west of this limit (Dethlefsen and Watermann, 1982; Dethlefsen and Lang, 1994; Thulin *et al.*, 1989), indicating that salinity may play a role in the distribution. An amoebal infection has been suggested as the causal factor of this lesion (Dawe *et al.*, 1979; Watermann and Dethlefsen, 1982).

### Skeletal deformities

Skeletal deformities were observed in Areas 2–6, with highest prevalences in the Gulf of Gdansk (Area 5) and off the Latvian coast (Area 6). The lesion was most abundant in two largest length groups. Prevalences were relatively low compared to previous investigations, which reported values up to 3% between the

Table 1. Total number of cod examined (n) and number affected by skin ulcer (SU), pseudobranchial swellings (PS), skeletal deformities (SD), *Cryptocotyle lingua* (Cl), and *Lexnaeocera branchialis* (Lb) by area, and by length group. Prevalences in parentheses.

| Area | n | SU | PS | SD | Cl | Lb |
|---|---|---|---|---|---|---|
| (A) Total | | | | | | |
| 1 | 707 | 0 | 5 (0.7%) | 0 | 155 (21.9%) | 7 (1.0%) |
| 2 | 660 | 9 (1.4%) | 1 (0.2%) | 1 (0.2%) | 11 (1.7%) | 1 (0.2%) |
| 3 | 502 | 16 (3.2%) | 0 | 2 (0.4%) | 0 | 0 |
| 4 | 390 | 15 (3.8%) | 0 | 3 (0.8%) | 0 | 1 (0.3%) |
| 5 | 53 | 0 | 0 | 2 (3.8%) | 0 | 0 |
| 6 | 143 | 0 | 0 | 4 (2.8%) | 0 | 0 |
| 7 | 554 | 1 (0.2%) | 0 | 6 (1.1%) | 0 | 0 |
| 8 | 225 | 0 | 0 | 0 | 0 | 0 |
| 9 | 3 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 4 | 0 | 0 | 0 | 0 | 0 |
| Total | 3241 | 41 (1.3%) | 6 (0.2%) | 18 (0.6%) | 166 (5.1%) | 9 (0.3%) |
| (B) Length group <22 cm | | | | | | |
| 1 | 549 | 0 | 2 (0.4%) | 0 | 127 (23.1%) | 2 (0.4%) |
| 2 | 361 | 0 | 1 (0.3%) | 0 | 10 (2.8%) | 0 |
| 3 | 170 | 0 | 0 | 0 | 0 | 0 |
| 4 | 8 | 0 | 0 | 0 | 0 | 0 |
| 5 | 2 | 0 | 0 | 0 | 0 | 0 |
| 6 | 8 | 0 | 0 | 1 (12.5%) | 0 | 0 |
| 7 | 21 | 0 | 0 | 0 | 0 | 0 |
| 8 | 4 | 0 | 0 | 0 | 0 | 0 |
| 9 | 1 | 0 | 0 | 0 | 0 | 0 |
| 11 | 1 | 0 | 0 | 0 | 0 | 0 |
| (C) Length group 22–35 cm | | | | | | |
| 1 | 90 | 0 | 2 (2.2%) | 0 | 13 (14.4%) | 4 (4.4%) |
| 2 | 108 | 5 (4.6%) | 0 | 0 | 1 (0.9%) | 1 (0.9%) |
| 3 | 95 | 2 (2.1%) | 0 | 1 (1.1%) | 0 | 0 |
| 4 | 65 | 7 (10.8%) | 0 | 0 | 0 | 0 |
| 5 | 43 | 0 | 0 | 2 (4.7%) | 0 | 0 |
| 6 | 117 | 0 | 0 | 3 (2.6%) | 0 | 0 |
| 7 | 462 | 1 (0.2%) | 0 | 2 (0.4%) | 0 | 0 |
| 8 | 215 | 0 | 0 | 0 | 0 | 0 |
| 9 | 1 | 0 | 0 | 0 | 0 | 0 |
| (D) Length group >35 cm | | | | | | |
| 1 | 68 | 0 | 1 (1.5%) | 0 | 15 (22.1%) | 1 (1.5%) |
| 2 | 191 | 4 (2.1%) | 0 | 1 (0.5%) | 0 | 0 |
| 3 | 237 | 14 (5.9%) | 0 | 1 (0.4%) | 0 | 0 |
| 4 | 317 | 8 (2.5%) | 0 | 3 (0.9%) | 0 | 1 (0.3%) |
| 5 | 8 | 0 | 0 | 0 | 0 | 0 |
| 6 | 18 | 0 | 0 | 0 | 0 | 0 |
| 7 | 72 | 0 | 0 | 4 (5.5%) | 0 | 0 |
| 8 | 6 | 0 | 0 | 0 | 0 | 0 |
| 9 | 1 | 0 | 0 | 0 | 0 | 0 |
| 11 | 3 | 0 | 0 | 0 | 0 | 0 |

Mecklenburg Bight and Bornholm (Dethlefsen and Watermann, 1982; Berzins, 1943). This may be due to a high abundance of small fish, which were largely unaffected in the present investigation. Skeletal deformities may be induced by high input of heavy metals (Bengtsson, 1975). The major part of the pollution load entering the Baltic Proper originates from riverine input from Poland (Draganik *et al.*, 1994) where the highest prevalence was also observed. However, the causal connection remains speculative. Although increased cadmium levels have been observed in cod with skeletal deformities, Lang and Dethlefsen (1987) did not establish a significant cause-effect relationship between the two factors.

### *Cryptocotyle lingua*

Metacercariae of this digenean parasite were only observed in Areas 1 and 2 and all length groups were rather evenly infested. The observed spatial distribution

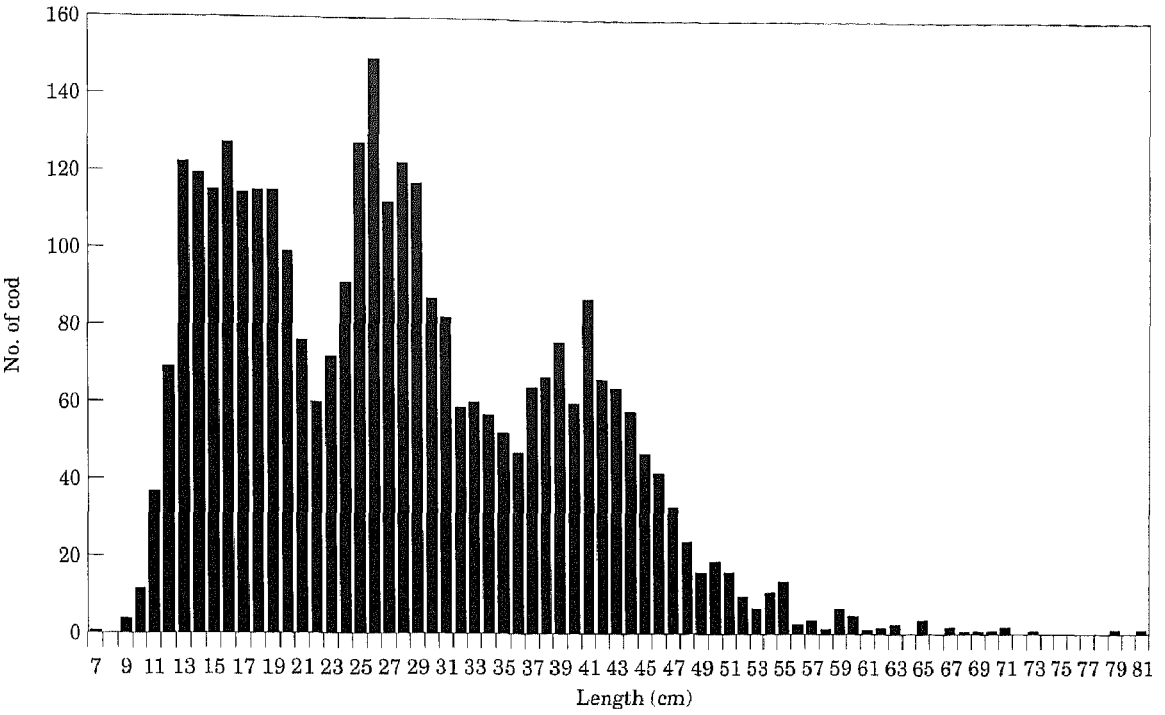


Figure 2. Length distribution of the cod examined summed over all areas.

probably reflected the abundance of its intermediate host, *Littorina littorea*. The easternmost distribution limit of this snail corresponds approximately to 13°E (Johansen, 1916).

### *Lernaeocera branchialis*

*Lernaeocera branchialis* was only observed in Areas 1, 2, and 5, but prevalences were low. Lang (1989) found a considerably higher mean prevalence (4.9%) over a period of 6 years in the westernmost Baltic (ICES Area 22). The distribution of this crustacean gill parasite also seems to be largely determined by salinity, which varied from approximately 20 in area 1 to 8 in Area 5 (Lang and Mellergaard, 1999). Thulin *et al.* (1989) reported a rapid decrease in prevalence when salinity decreased below 10, with highest rates at coastal areas.

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