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THE BLACK SPOT DISEASE IN *CRANGON CRANGON* (L.) OF THE GERMAN BIGHT

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- ABSTRACT -

The abundance of black spot disease of brown shrimp (*Crangon crangon* (L.)) was investigated in the German Bight from 1986 to 1988. Highest prevalences of these cuticular lesions were found in the inner German Bight, mainly in the estuaries of Elbe and Weser, with a maximum infection rate of 58%. Prevalence of disease was higher in larger specimens than in smaller ones. Disease intensity and infection rate were highest in late summer and autumn.

- INTRODUCTION -

The black spot disease is a necrotic shell disease of crustaceans first described by HESS (1937) and MANN & PIEPLOW (1938). The characteristic colouration of this shell disease prompted the use of terms such as "pitted shell disease", "burn spots", "corroded spots", "black spot disease" or "black necrosis".

Histological examinations of diseased specimens showed, that all layers of the exoskeleton were eroded. Affected portions were brittle and easily fragmented, cracking and pitting of calcified layers occurred. Underlying tissues were often necrotic. This actual shell erosion seems to involve activity of chitinoclastic bacteria, with subsequent secondary infection of underlying tissue by facultative pathogens. An initial preparation of the exoskeleton by mechanical, chemical or microbial action is probably significant. Further particulars about pathology of black spots can be found in COOK & LOFTON (1973), GOPALAN & YOUNG

(1975), SINDERMANN (1977,1989), BAROSS et al. (1978), DOUGHTIE et al. (1983).

Black spot disease has been frequently observed in many different freshwater and marine crustacean species (Tab.1). First references about diseased shrimps (*Crangon crangon* (L.) in the North Sea were given bei MEIXNER (1967) and others, listed in Tab.2. This paper reports on the occurrence of black spot disease in *Crangon crangon* (L.) of the German Bight from 1986 to 1988. The investigation was carried out in the "Bundesforschungsanstalt für Fischerei" Cuxhaven F.R.G. and financial supported by the "Umweltstiftung WWF" Bremen F.R.G. (KNUST, 1988).

- MATERIALS AND METHODS -

From October 1986 to April 1988 samples from the area of the Elbe estuary were taken monthly by commercial fishermen. In January 1987 and 1988 sampling was carried out in the coastal waters of the German Bight near the 20m depth contourline (Fig.4 ,5) and a third time in August 1987 on the traditional fishing grounds of the commercial shrimp fisheries in the German wadden sea (Fig.6). To stop bacterial activity, shrimps were boiled immediately after collection. The samples were examined on board or in laboratory with a magnifying glass. A total of about 16000 shrimps were examined.

- RESULTS -

1. Infection rates and body size

In all samples the prevalence of disease was higher in larger specimens than in smaller ones. In April 1987 (Elbe estuary) the disease levels ranged from 4.4% in shrimps with 25mm total body length to 34.6% in animals with 60mm body length (Fig.1)(Fig.2).

2. Seasonal periodicity of disease frequency

In the Elbe estuary infection rate and the mean disease intensity (mean number of black spot per diseased individual) were measured monthly. The infection rate as well as the mean disease intensity showed distinct seasonal periodicities. In all size groups the infection rate was lowest from May to June and highest in late summer and autumn (Fig.2). The mean disease intensity increased slightly during the year and was highest in December with a mean number of 3.4 black spots per diseased individual (Fig.3).

3. Regional distribution

In winter catches (January 1987 and January 1988) the highest disease prevalences were found in the inner German Bight close to the estuaries of Elbe and Weser. The lowest were measured in the north of the German Bight and west off the "Ostfriesischen Inseln". In January 1987 the values ranged from 23.1% to 40.6%; in January 1988 from 5.4% to 27.8% (Fig.4 and 5).

In August 1987 the infection rates ranged from 23.5% to 57.8%. Areas with highest incidence of disease were observed in the estuaries of the rivers Elbe, Weser and Ems. The lowest infection rates were found in the north off the "Nordfriesischen Inseln" wadden and west off Borkum (Fig.6).

- DISCUSSION -

MEIXNER (1967,1968,1969), SCHLOTFELD (1972), DETHLEFSEN (1981) and SEITZ (1984) also investigated black spot disease in *Crangon crangon* (L.) off the German Bight (Tab.2). They observed lower infection rates than in this investigation, but this should not be interpreted as an increase of disease prevalence in the German Bight since 1967. The reason may be found in different methods of investigation. MEIXNER (1967) looked only for black scabs at the stumps of lost appendages and SCHLOTFELD (1972) only for greater ulcerative black spots. All four authors examined the shrimps without using magnifying glasses so that early stages of small black spots may be overlooked.

SCHLOTFELD (1972) and NOTTAGE (1982) described distinct seasonal periodicities of disease prevalence similar to those found in the Elbe estuary. SCHLOTFELD (1972) found maximum infection rates in shrimp from the eastern part of the German Bight in summer, NOTTAGE (1982) measured maximum rates in autumn in shrimp from the Irish Sea. This seasonal trend seems to be typical for diseases influenced by bacteria. WOLTHAUS (1984) reported a comparable seasonal periodicity for fin erosion and ulceration in dab (*Limanda limanda* (L.)) off the German Bight.

SINDERMANN (1989) considered the black spot disease in some way as the invertebrate analogue of fin erosion in fish and described the disease as the consequence of a disturbed balance between process of chitin maintenance and repair and the activities of chitinoclastic microorganisms. Environmental changes affect normal shell formation or favoring the growth of chitin-utilizing microbes. Such disturbances may be consequences of pollution. A number of recent publications report on an association of disease prevalence and environmental pollution in estuarine and

coastal waters (YOUNG & PEARCE, 1975; ESTRELLA, 1984). A detailed review of shell disease in crustaceans resulted in the general conclusion that "...prevalences have been found to be high in crustaceans from polluted sites; prevalences show trends similar to those of black gill syndrome, which also has a statistical association with extent of pollution. Experimental exposures of crustaceans to contaminated sediments, heavy metals, biocides, petroleum derivatives can result in the appearance of black gill syndrome, often accompanied by shell disease."(ANONYMOUS, 1989 cited in SINDERMANN, 1989).

In the German Bight the black spot disease in brown shrimp is common. Diseased animals were found at all stations. Areas with relative high disease prevalences were localized in the inner German Bight close to the estuarine areas of the rivers Elbe, Weser and Ems. These areas are considered as highly polluted. A comparison with the contamination of surface sediment with heavy metals in the German Wadden Sea, measured by SCHWEDHELM (1984), showed a statistiely significant association between high black spot disease prevalence and increase concentrations of lead in the sediments (Fig.7).

- CONCLUSION -

The frequent occurrence of black spot disease in the German Bight, the high disease prevalences and the possible influence by human activities indicate that investigations about the black spot disease should be continue. Brown shrimp (*Crangon crangon* (L.)) seems to be qualified for monitoring this disease because expansive migration along the coast was not recorded (TIEWS, 1970).

Tab. 1 : DISSEMINATION OF BLACK SPOT DISEASE IN CRUSTCEANS

SPECIES	AREA	REFERENCE	
Amphipoda	Irish Sea	NOTTAGE	(1982)
Callinectes sapidus	Atlantic coast USA	COOK & LOFTON	(1973)
Cancer irroratus	Atlantic coast USA	SAWER et.al.	(1985)
	New Yorker Bight	YOUNG & PEARCE	(1975)
Cancer pagurus	Irish coastal waters	AYRES & EDWARDS	(1982)
	Southern North Sea	KNUST	(1988)
Carcinus maenas	French coastal waters	RAMIREZ-REREZ	(1980)
	Irish Sea	NOTTAGE	(1982)
Chionoecetes tanneri	Pazific coast USA	BAROSS et.al.	(1978)
Corystes cassivelaunus	Irish Sea	NOTTAGE	(1982)
Crangon allmani	German Bight	KNUST	(1988)
	Irish Sea	NOTTAGE	(1982)
Crangon crangon	Belgish coastal waters	VERVOOT et.al.	(1980)
	German Bight	DETHLEFSEN	(1981)
		KNUST	(1988)
		MEIXNER	(1967)
		SCHLOTFELD	(1972)
		SEITZ	(1984)
	Irish Sea	ABBOTT & PERKINS	(1977)
		NOTTAGE	(1982)
		PERKINS	(1974)
Crangon septemspinosa	New York Bight	GOPALAN & YOUNG	(1975)
Homarus americanus	New York Bight	YOUNG & PEARCE	(1975)
Metapendaeus monoceros	Bangladesh	KHAN et.al.	(1984)
Macrobrachium rosenbergii	(freshwater)	BURNS et.al	(1979)
Macropipus holsatus	Irish Sea	NOTTAGE	(1982)
	Southern North Sea	KNUST	(1988)
Pandalus montagui	Irish Sea	NOTTAGE	(1982)
Penaeus spp.	Atlantic coast USA	COOK & LOFTON	(1973)

Tab. 2 : BLACK SPOT DISEASE PREVALANCES IN BROWN SHRIMP (*Crangon crangon* (L.))

REFERENCE		AREA	DISEASE PREVALENCE
MEIXNER	(1967)	east German Bight	16%
SCHLOTFELD	(1972)	east German Bight	1% - 9%
VERVOORT et.al.	(1980)	Belgish coastal waters	16% - 35%
DETHLEFSEN	(1981)	Elbe estuary	2% - 23%
NOTTAGE	(1982)	Irish Sea	5% - 26%
SEITZ	(1984)	east German Bight	10% - 16%
		Elbe estuary	14% - 17%
		southwest German Bight	20% - 22%

Fig.1: BLACK SPOT DISEASE PREVALENCE IN *CRANGON CRANGON* (L.)
- DIFFERENT SIZE GROUPS -

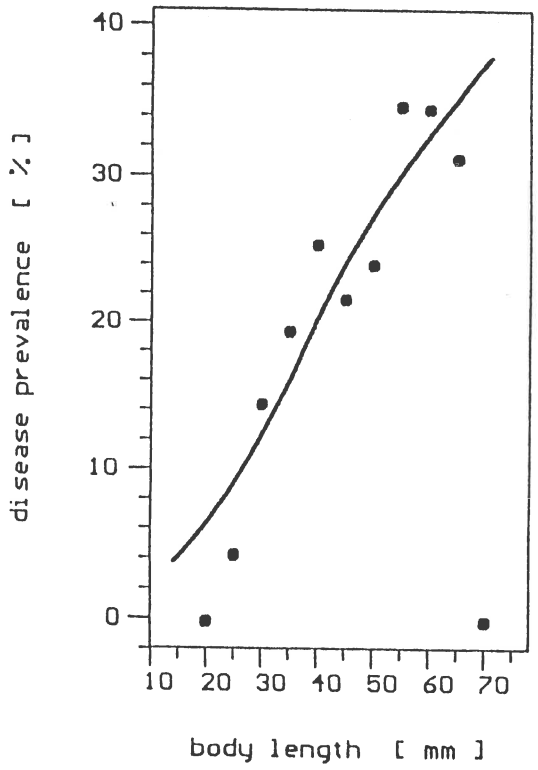


Fig.2: SEASONAL PERIODICITY OF BLACK SPOT DISEASE PREVALENCE IN *CRANGON CRANGON* (L.)
- ELBE ESTUARY 1987 -

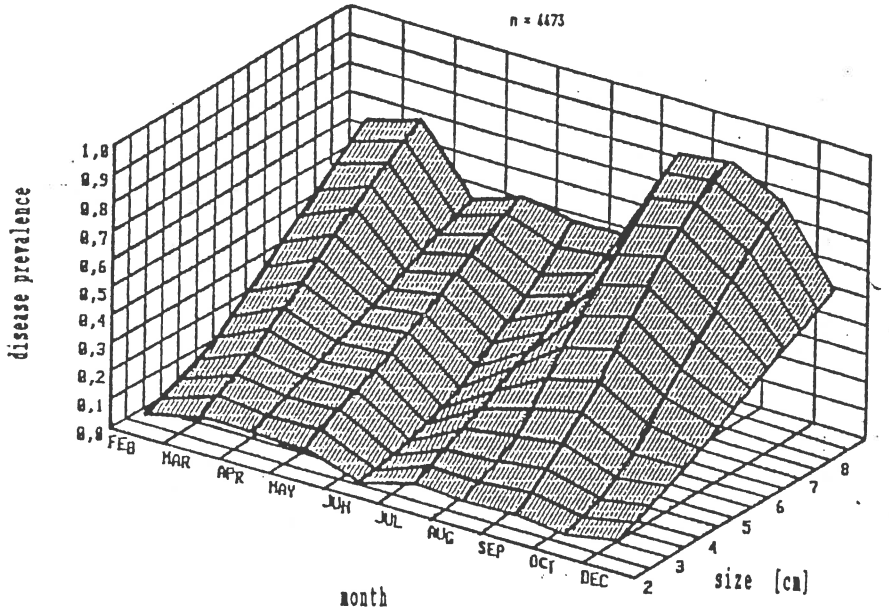


Fig.3: DISEASE INTENSITY OF BLACK SPOT IN *CRANGON CRANGON* (L.)
- ELBE ESTUARY 1987-1988 -

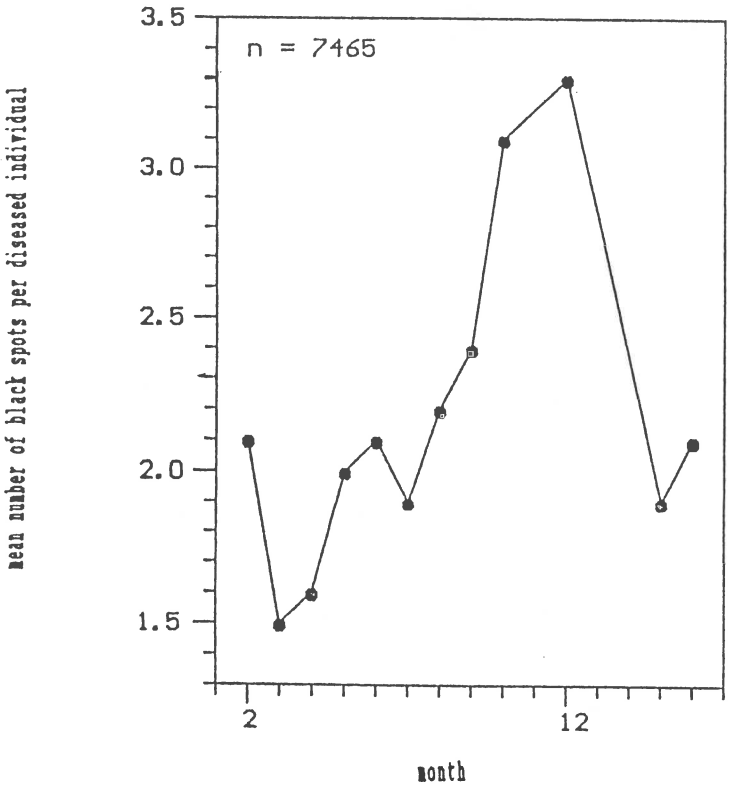


Fig.4: BLACK SPOT DISEASE PREVALENCE IN *CRANGON CRANGON* (L.) OF THE GERMAN BIGHT
- JANUARY 1987-

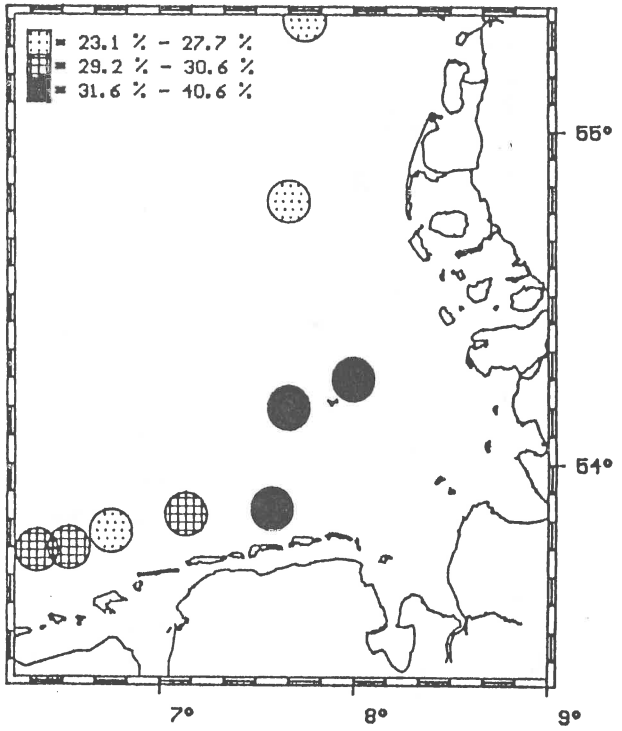


Fig.6: BLACK SPOT DISEASE PREVALENCE IN *CRANGON CRANGON* (L.) OF THE GERMAN BIGHT
- AUGUST 1987-

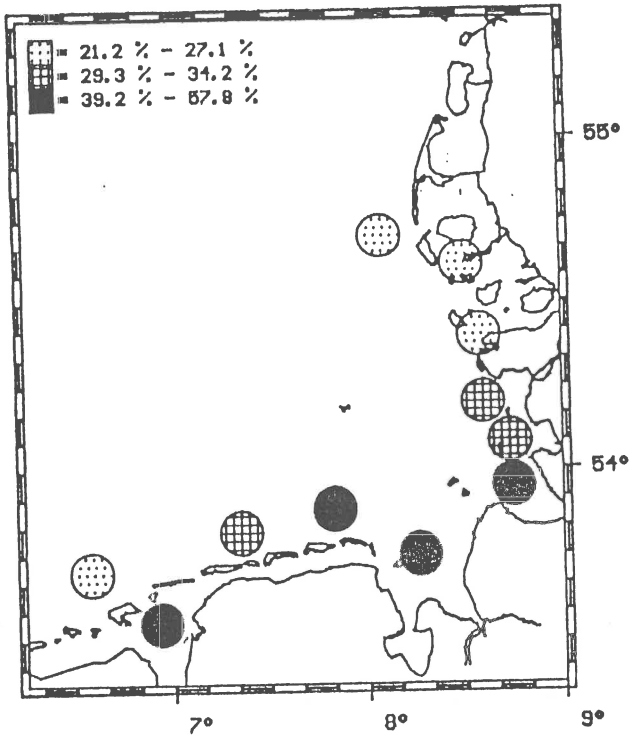


Fig.5: BLACK SPOT DISEASE PREVALENCE IN *CRANGON CRANGON* (L.) OF THE GERMAN BIGHT
- JANUARY 1988-

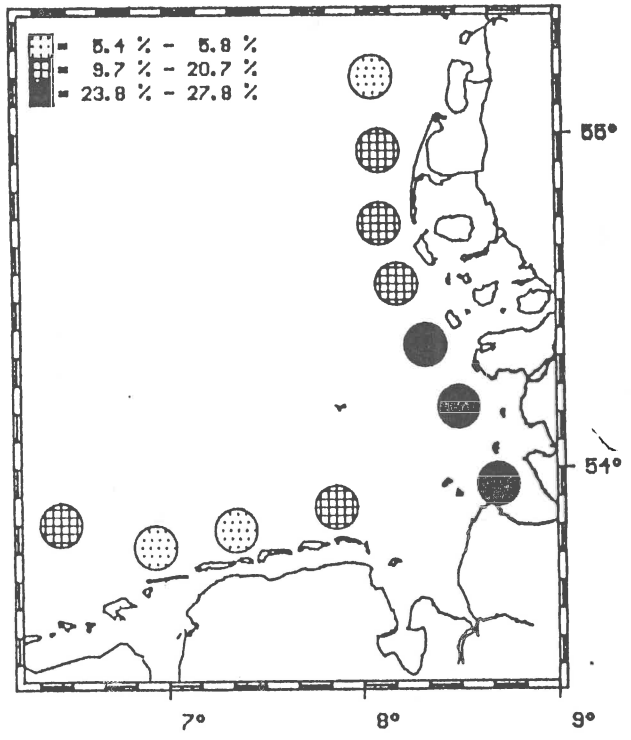
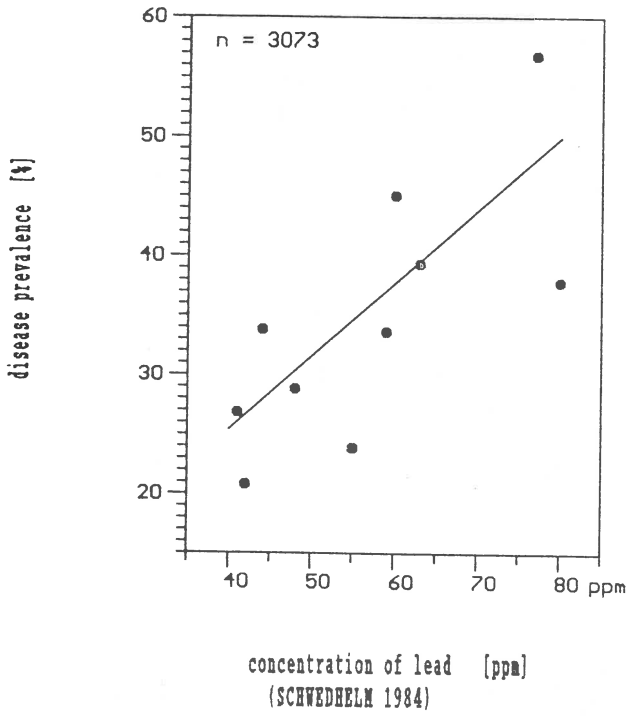


Fig.7: BLACK SPOT DISEASE PREVALENCE IN *CRANGON CRANGON* (L.) AND CONCENTRATION OF LEAD IN THE SEDIMENTS

- GERMAN BIGHT -



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