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# Notes on the Distribution of “Black Spot” Shell Disease in Crustacean Fisheries

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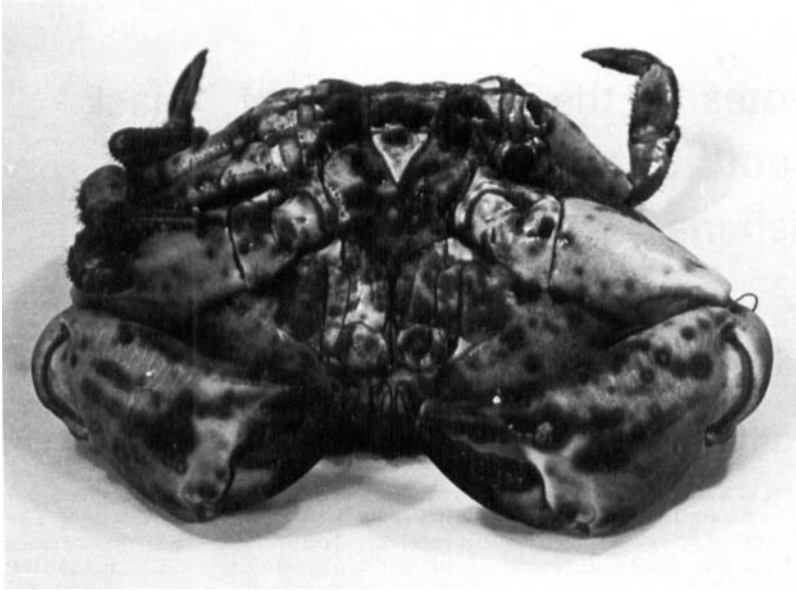
“Black Spot” a necrotic shell disease in crustacea, is a naturally occurring condition in crabs (*Cancer pagurus*) and is more common in older animals, where the moult frequency is reduced. The results of field observations in various commercial crab fisheries suggest that the incidence of “Black Spot” shell disease is higher in lightly fished populations (e.g. S.W. Ireland) than in established fisheries, where intensive exploitation results in the removal of larger (older) crabs from the stock. These observations are used to explain suggestions by other workers that the incidence of shell necrosis is high in areas used for dumping sewage sludge where fishing intensity is low.

## INTRODUCTION

Shell disease of marine crustaceans is characterized by black necrotic lesions on the exoskeleton which are usually associated with pitting on the inside of the exoskeleton. In the context of this paper we are reporting on the incidence of such necrosis in the edible crab, *Cancer pagurus* which manifests itself as a condition known as “Black Spot”. This is usually evident as discreet black patches on the exoskeleton which in severe cases may become deeply pitted to penetrate the underlying soft tissues of the crab (Figures 1 and 2). Similar conditions of shell necrosis have been reported in *Carcinus maenas* (Perkins, 1967), *Callinectes sapidus* (Cook and Lofton, 1973), *Homarus americanus* (Young and Pearce, 1975) and *Crangon crangon* (Perkins, 1974; Schlotfeldt, 1972).

A number of microorganisms have been associated with shell disease of crustacea but chitinolytic bacteria of the genera *Vibrio*, *Beneckea*, *Aeromonas* and *Pseudomonas* are generally thought to be responsible. Fungi,

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**FIGURE 1** A crab (*Cancer*) badly infected with "black spot" shell necrosis. (MAFF Crown copyright.)



**FIGURE 2** Circles of "black spot" shell disease with some pitting of the shell on a crab's cheliped. (MAFF Crown copyright.)

particularly *Fusarium sp.* have been isolated from lesions in marine penaeid shrimps (Lightner, 1975) and freshwater prawns, *Macrobrachium rosenbergii* (Burns *et al.*, 1979) and may infect lesions produced by shell disease of bacterial origin (Fisher *et al.*, 1978).

The incidence of black necrosis, particularly in *Crangon sp.* has been connected with organic and industrial pollution (Gopalan and Young, 1975; Schlotfeldt, 1972) and more recently Young and Pearce (1975) and Roald *et al.* (1981) have suggested a higher incidence of shell disease in the lobster *Homarus* (spp.) and rock crab (*Cancer irroratus*) near areas used for dumping sewage sludge.

In our experience shell necrosis or "Black Spot" in *Cancer pagurus* is a naturally occurring condition and is normally more evident in old animals. Pearson (1908) writes of "grannie" crabs, which were predominantly female crabs with dirty and discoloured shells occurring around the Isle of Man. Although male crabs reached a similar size Pearson noted that the moult frequency of female crabs was considerably less than that for males and it is likely therefore that any necrosis would be lost from the male crabs at ecdysis. It was also reported by Pearson that "grannie" crabs had a bitter taste and powerful purgative effect such that fishermen thought they were diseased and killed them on capture. Crabs with "Black Spot" have been observed in all the commercial fisheries of England and Wales. Some of these animals may be so badly pitted that underlying soft tissues are discoloured and the commercial value so reduced that fishermen reject them.

## FIELD OBSERVATIONS

During surveys of Irish crab stocks Edwards (1979) observed that between 5 and 7% of commercial crab batches had to be rejected because of shell necrosis (Table I). These observations were made in S.W. Ireland (Co. Cork) on newly exploited stocks and in areas where there was no industrial or dumping activity. Most of the crabs rejected were larger (older) animals which had obviously not moulted for some time (Table II). In areas where fishing activity is more intense or has been developed for a considerable period of time, large, old crabs are gradually removed from the fishery and usually form only a small proportion of commercial catches. Thus in typical exploited fisheries of this nature in England, the incidence of crabs badly affected by "Black Spot" which are rejected is usually less than 1% (Table I) reflecting the effects of intensive exploitation in removing large crabs and in some areas the reduction in the proportion of discard crabs by killing upon capture. For example, in the Norfolk fishery for crabs, which is

heavily exploited, the majority of the catch will be at or below the minimum size limit (115 mm) when moult frequency is high. Although these smaller crabs may well develop necrotic lesions the affected shell is cast before the necrosis becomes advanced and readily observed: few crabs with "Black Spot" have been recorded in this fishery (Table I).

Studies by Abbott (1977) on black necrosis in the shrimp *Crangon crangon* indicated a tendency for small shrimps to be less affected than large ones and this also may be due to differences in moult frequency. Taylor

TABLE I

Incidence of crabs rejected from commercial catches due to "Black Spot" disease in England and Ireland

Area	Date sampled	No examined	% rejected
S.W. Ireland (Roaring Water Bay)	1969-70	750	5
W. Ireland (Co. Galway)	1970	1000	7
Yorkshire	1965	700	<1
Yorkshire	1974	300	<1
Norfolk	1965	500	<1
Norfolk	1980	300	<1
Dorset	1980	520	1.6

TABLE II

Size range (carapace width) of *Cancer* rejected due to "Black Spot" disease in Roaring Water Bay, Co. Cork during trips with commercial potting boats in 1969-70

Carapace width (mm)	Commercial-sized crabs caught	Numbers recorded as rejected
115-124	53	—
125-134	120	—
135-144	155	2
145-154	172	11
155-164	135	13
165-174	75	10
175-184	30	1
185-194	8	—
195-204	2	—
205>	0	—
Totals	750	37 (5%)

(1948) found an incidence of less than 0.1% infection in exploited populations of Canadian lobsters, thus supporting the view that moult frequency influences the incidence of shell necrosis.

### LABORATORY OBSERVATIONS

Laboratory tests by us have shown that crabs free from shell disease develop "Black Spot" when held in tanks over a period of 6 to 12 months. Chitino-clastic bacteria (and fungi) are widely distributed in the marine environment and abrasion of the crabs exoskeleton by contact with tank surfaces together with physical damage arising from fighting and contact between animals offers bacteria a ready portal of entry to the chitinous material of the exoskeleton. Pearson (1908) suggested that where the interval between moults was less than two years "dirty and discoloured" shells were not evident. In our laboratory studies it is likely that the development of "Black Spot" is accelerated and evident at an earlier stage.

### DISCUSSION

Stewart (1980) has suggested several possible explanations for the often contradictory views on the causes of shell disease, namely:

- 1) that the syndrome is not the result of invasion by a specific pathogen, but may be caused by a number of different microorganisms acting in concert or succession differently on different host species;
- 2) the disease is not microbial in origin but rather a result of opportunistic microorganisms exploiting an injury or poor physiological state of the host;
- 3) the environmental conditions may be precipitating and predisposing factors.

Our own observations have not resolved any of these questions directly but we have shown that the incidence of "Black Spot" in the edible crab is significantly higher in populations of old, adult animals where the moult frequency is much reduced. Such animals are typically found in new or developing fisheries where fishing effort has not yet reduced the average size of animals within the population.

In addition, during 15 years of research on crabs by one of us (EE) observations on English and Irish stocks have identified very localized areas in which the population is dominated by old, crippled crabs, many of which are badly affected by "Black Spot" necrosis. Fishermen refer to these areas

as "hospital grounds" and do not usually exploit them commercially. Thus there is considerable evidence that severity of shell necrosis is associated with the frequency of moulting, and that necrosis is more common in unexploited stocks, or those subjected to low levels of exploitation, i.e. where crabs live longer.

Normally, sewage sludge dumping takes place only in areas away from commercially exploited fisheries so that where disposal does take place in areas where crabs and lobsters continue to live, fishing activity is already low or non-existent and a relatively high incidence of shell necrosis would be expected. It is not clear from the evidence available whether or not the incidence of shell necrosis in unexploited stocks is greater where sludge dumping takes place.

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