THE USE OF FISH DISEASES IN MARINE POLLUTION EFFECTS MONITORING PROGRAMMES

WITH A SURVEY OF A PRELIMINARY STUDY IN THE LITTLE BELT

By N. O. Christensen

During recent years there has been a pronounced change of attitude in the study of marine pollution.

While earlier principally a registration and an evaluation of the concentration of various contaminants in the water and the sediment was the main object, recently there is a tendency more and more to pay attention to the effects of the contaminants on the aquatic organisms.

Contributing to this development was the forming of a special working group on diseases in marine fishes and shellfish and various conferences sponsored by ICES.

In the report of the pathobiology panel of the meeting at Beaufort N.C. 1979 (*Sindermann et al.* 1980) it is stated: "Of the many diseases and disease signs that have been suggested or demonstrated to have an association with pollution some are amenable at present for use in pollution monitoring programs others will require additional exploratory work and further data accumulation. Several disease categories – ulcers, fin erosions, tumors and skeletal anomalies – are considered available for near term application to monitoring programs.

Cytologic, cytogenetic and embryologic anomalies and changes in immune responses have good potential but require further field testing. Lymphocystis and certain invertebrate viruses may also prove to be useful indices of pollution after further exploratory work."

It is essential in the evaluation of the biological effects of pollution to realise that the effects of the various contaminants are included in a complex of causes and that the effect often is indirect. Often the effects are summarized in the term "environmental stress".

The relative effect of the factors leading to disease have been illustrated by *Snieszko* in scheme 1. which shows that the organism, the pathogen and the environment each play a role to determine the development of disease or not.

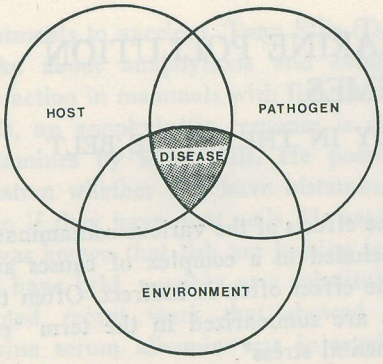
A biological effects monitoring according to the above statement has been performed by various researchers in USA, France, Germany, U.K. and Denmark and interesting evidence has been obtained, especially concerning skin ulcers, fin erosions, tumors, lymphocystis and skeletal anomalies.

Skin ulcers have been observed in many fish species both in coastal areas and at high sea. A connection between some types of ulcers and water pollution has been suspected but in general not proven.

The ulcus syndrome in cod (Gadus morhua) has especially been described from Danish waters and the German Bight. The disease has characteristic seasonal variations and there seems to be a connection with organic (carbohydrate) pollution of the sea water and ample growth of potential fish pathogens (Vibrio spp.) in sediment and seawater.

The disease starts with small papules in the skin, which develop into vesicles and small erosions (fig. 1) and later in small or larger ulcers (fig. 2), which may show healing tendency.

Bull. Eur. Ass. Fish Pathologists 1981, *1*, 7—9.



The complex nature of disease (acc. to Snieszko).

The etiology of the disease is complex. A virus (iridovirus?) seems involved in the initial stage, while the further course may be determined by pollution conditioned lower resistance in the fish and a higher infection pressure.

As mentioned ulcers occur in other fish species also. In flatfish ulcers may be located both on the upper and lower surface. The ulcers are often with sharp edges and a lively red bottom, where the underlying tissue is uncovered (fig. 3). The hypothesis has been put forward that such ulcers may be caused mechanically by snails or crabs.

In dab (Limanda limanda) the ulcers look different, being smaller, not sharply delineated and more superficial (fig. 4). Some preliminary studies indicate that the development of these ulcers also pass a papulous stage.

In the German Bight it has been found that the prevalence of these ulcers during winter is higher in coastal waters than at deep sea, while during summer there is no difference.

The etiology of ulcers especially in dab should be considered parallelly to the etiology of the ulcus syndrome of cod. The available information, however, do not allow any final conclusions.

In eel (Anguilla anguilla) skin ulcers is a rather common finding. These ulcers seem to occur under two different circumstances 1) as the socalled spring ulcer disease or eel furunculosis (fig. 5 and 6) which only occurs at water temperatures below 10°C, especially in spring time with rising temperatures, and 2) in connection with red disease of eel, which is a summer phenomenon. In the etiology various aquatic bacteria: Vibrio, Aeromonas etc. are involved. Also environmental-climatic-factors seem to be involved.

Fin erosion – fin rot – is a characteristic disease complex involving the fins giving rise to erosions, epithelial changes, exposure and loss of fin rays. It may affect all fins of the fish, in demersal fish most often the finborders and the tail fin and in pelagic fish especially the tail fin. The etiology of fin erosion seems very complex involving chemical compounds affecting skin and cuticula, marginal oxygen concentrations and on top of this secondary bacterial infections in some cases. Under practical circumstances it is difficult to distinguish fin erosion from mechanical (net) damages. In the latter case the fins are split and bleedings occur. In fin erosions proper epithelial changes with light or dark colour and exposure or loss of fin rays occur.

Various types of tumors, papillomas (fig. 9) carcinomas and sarcomas have been described in fish. As it is well known that several polluting factors are carcinogenic and as high prevalence of tumors have been reported in polluted areas, it seems natural to include these in monitoring programs.

Lymphocystis is a disease with tumorlike changes in the skin (fig. 10) consisting of proliferated connective tissue cells of a size up to 2 mm. The disease occurs in many fish species but especially in flat fish. The cause of the disease is an iridovirus and it is supposed that the disease may be transmitted by copepods.

Diseases in marine fishes which might be used for pollution effects monitoring purposes

I. Ulcus diseases.

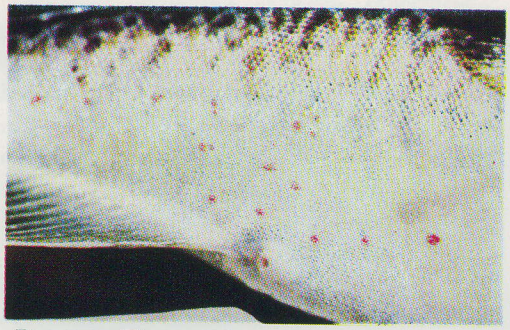


Figure 1. Ulcus syndrome in cod Gadus morhua. Stage 1. Multiple papules with haemorrhages.

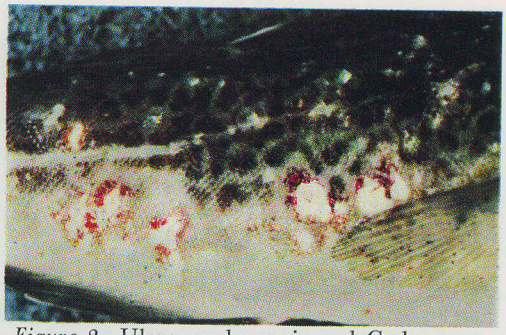


Figure 2. Ulcus syndrome in cod Gadus morhua. Stage 3. Early ulcus stage.

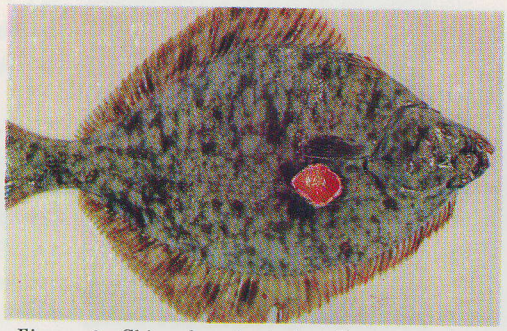


Figure 3. Skin ulcer in turbot Psetta maxima. Lively red ulcus on the dorsal surface with a thin whitish marginal zone.

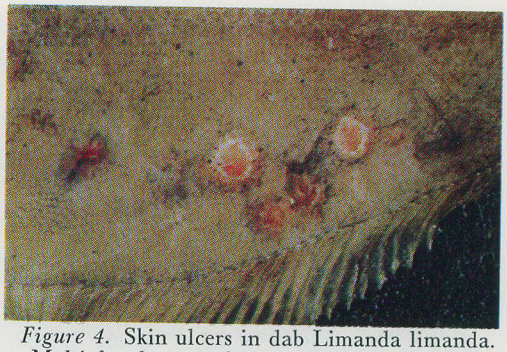


Figure 4. Skin ulcers in dab Limanda limanda. Multiple ulcers with slightly elevated edges.

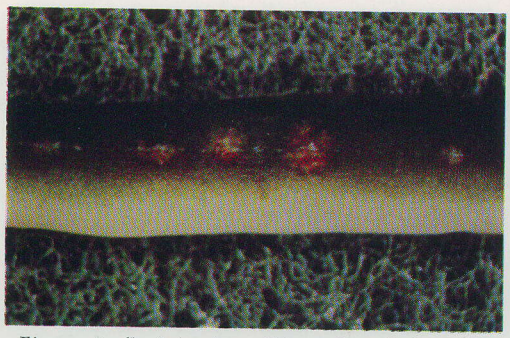


Figure 5. Spring ulcer disease in eel Anguilla anguilla. Several ulcers with central necrosis and haemorrhagic marginal zone.

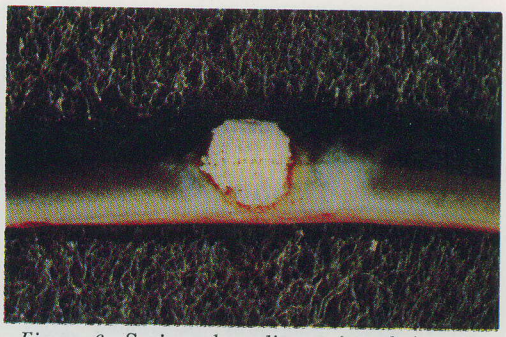


Figure 6. Spring ulcer disease in eel Anguilla anguilla. Large ulcer with central necrosis and narrow haemorrhagic marginal zone.

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Diseases in marine fishes which might be used for pollution effects monitoring purposes

II. Fin erosion, tumors, lymphocystis and skeleton deformities.

Figure 7. Fin erosion in flounder Platichtys flesus. Haemorrhages and dyscoloration of the skin of the candal fin and commencing necrosis.

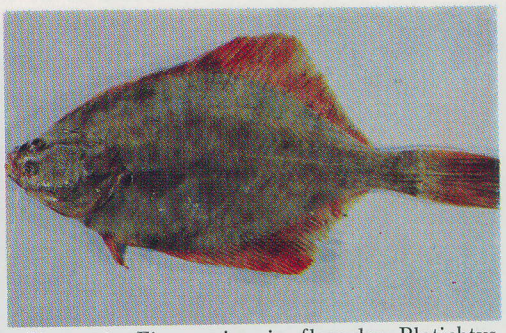

Figure 8. Fin erosion in flounder Platichtys flesus. Changes in both the dorsal, anal and caudal fins.

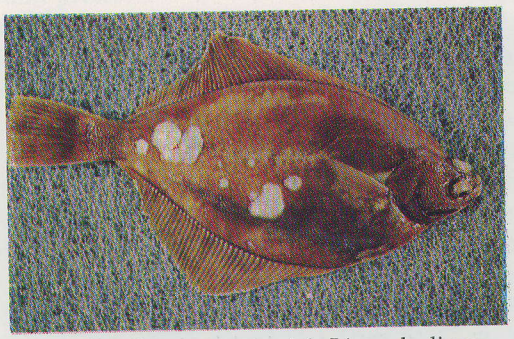

Figure 9. Skin tumor in dab Limanda limanda. Typical papillomas of white colour.

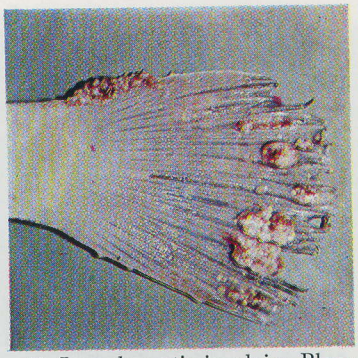

Figure 10. Lymphocystis in plaice Pleuronectes platessa. Numerous nodules of varying size.

Figure 11. Skeletal anomaly in cod Gadus morhua. S formed curvature of the spinal column.

Figure 12. Skeletal anomaly in cod Gadus morhua. X ray picture of fish with curved spinal column.

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A high prevalence of the disease has been described in loaded areas, but the final inclusion of the disease in monitoring programs demands further studies.

Skeletal anomalies concern especially the vertebral column and may consist in S-formed bendings-scoliosis- or kypholordosis (fig. 11) and shortening of the vertebral column due to flattening of the vertebrae (platyspondylia). X-ray examination is a valuable tool in the study of these conditions (fig. 12).

These anomalies occur in natural populations, but from USA, Japan, W. Germany high prevalences have been observed in polluted areas. A connection with chlorinated hydrocarbons, heavy metals etc. has been indicated, hypotheses which are supported by experimental evidence.

Therefore these anomalies are considered as valuable tools in monitoring programmes.

In this connection it is found appropriate to summarize a systematic study of the principal fish species in Lillebælt performed in 1979 (Anon 1981). A total of 20.956 fish – 7734 cod, 1474 plaice, 2686 flounder, 8966 dab, 94 eel and two turbot were examined.

The following pathological changes were found. Skin ulcers.

The ulcus syndrome in cod had an overall prevalence of 19.8 per cent principally in smaller fish.

820 fish were classified according to stages. Stage 1: 63 per cent, stage 2: 17 per cent, stage 3: 13 per cent, stage 4: one per cent and stage 5: 6 per cent.

There was a clear seasonal variation. April 5.1 per cent, July 0 (only 9 fish caught), September 18.5 per cent, October 25.4 per cent and November 23.4 per cent.

Skin ulcers in plaice were found in 0.5 per cent and in flounder in 2.1 per cent.

In dab skin ulcers were found in 0.9 per cent and in one turbot multiple skin ulcers occurred.

Fin erosion which was not specifically differentiated – traumatic changes included. The prevalence was: plaice 1.7 per cent, flounder 0.5 per cent, and dab 1.7 per cent. Not observed in cod.

Papillomatosis in dab was found in 0.5 per cent.

Lymphocystis was found in plaice in 3.1 per cent, in flounder in 5.9 per cent and in dab in 1.7 per cent.

Skeletal deformities was a very rare finding. In the total material such anomalies were found in 5 cods, 2 plaice, 3 flounders and 3 dabs.

These investigations must be considered preliminary but it is planned to repeat them with regular intervals and also to perform similar studies in other Danish waters.

These studies will be performed in collaboration with The Danish Institute for Fisheries and Marine Research and may contribute to our knowledge of seasonal and year by year variations of pathological conditions in fish, and thereby also give a better understanding of the importance of possible pollution factors.

References

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