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INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA

Report of ICES Working Group on Pathology
and Diseases in Marine Organisms

HALIFAX, NOVA SCOTIA, CANADA
May 14 - 16th 1984

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REPORT OF THE ICES WORKING GROUP ON PATHOLOGY
AND DISEASES OF MARINE ORGANISMS

Halifax, Nova Scotia, Canada. 14 - 16th May, 1984

INTRODUCTION

The Working Group on Pathology and Diseases of Marine Organisms met in Halifax, Nova Scotia (Canada) from 14 - 16 May 1984, with Dr. E. Egidius as Chairman, to:

- (i) collect more information on the disease status of cultivated and natural stocks,
- (ii) discuss experimental research, as on immunization,
- (iii) consider effects of pollution on diseases,
- (iv) evaluate the results of the sea-going Workshop on Methodology of Fish Disease Surveys (held on board RV "Anton Dohrn" on 2 - 12 January 1984),
- (v) consider the preparation and identification of disease agents.

Dr. J. Stewart welcomed the ICES delegates to the Dept. of Oceans and Fisheries Laboratory at Halifax. As Professor Maurin was unable to attend the meeting, Dr. Emmy Egidius, at the request of ICES, acted as chairman. As a mark of respect to the late Prof. N. O. Christensen, Denmark, who served on the working group since

its inception in 1976 and contributed greatly to the work of the group, a minutes silence was kept. Dr. Sindermann suggested that a number of recommendations which had been made over the last number of years and had tended to become overlooked should be reviewed. It was agreed that this item should be included in the revised agenda. Dr. Egidius suggested that the publications needed detailed discussion and it was agreed to do this.

1. CURRENT STATUS OF DISEASE IN MARINE SPECIES

At the suggestion of Dr. Egidius it was decided to spend less time discussing the known diseases and more time discussing new disease problems.

BELGIUM

A survey of fish diseases on the Belgian continental shelf was out in October 1983 on commercial fish species.

VIRAL DISEASES

Lymphocystis. Flounder showed the highest prevalence of this disease (5.45%) compared to Plaice (0.22%) or Dab (0.25%). Papillomas were only observed in dab (0.5%).

BACTERIAL DISEASES

Mycobacteriosis was observed in cod and a number of bacterial species were isolated from spring eels including Pseudomonas sp., Aeromonas sp., Alcaligenes, Vibrio sp. and Acinetobacter sp. were isolated from eels in the Autumn. Ulcers were observed in Plaice, dab and flounder but not in cod, whiting or sole.

PARASITIC DISEASES

Only protozoan parasites were observed. Intestinal infestations of dab with Glugea stephani were observed in 8.9% of fish examined. This prevalence was similar to that of previous years.

Skeletal abnormalities

Such abnormalities were found in dab (0.1%), flounder (0.4%), cod (1.2%) and whiting (0.6%).

CANADA

The report from Canada was in three parts. Section 1 dealt with the disease status in the Atlantic.

Section I - ATLANTIC AREA

Furunculosis

Although not a new disease the prevalence has increased dramatically in the Saint John River watershed of New Brunswick since the 1983 report. The disease has occurred at two Atlantic Salmon hatcheries and three smolt rearing units. Eradication is underway at all sites. One strain of the organism isolated at two rearing facilities was resistant to Oxytetracycline and was of particular concern. A furunculosis outbreak was also observed in cod held under laboratory conditions. The clinical picture was different from that seen in salmonids and the strain of A. salmonicida was atypical. However the isolate produced typical furunculosis when injected into salmon.

Vibriosis

This disease has not been a serious problem since vaccines have been widely used although V. anguillarum is routinely isolated from Atlantic salmon cage culture sites.

Enteric Redmouth (ERM)

Although Versubua ruckeri can be isolated readily throughout the Atlantic area clinical disease is not observed.

Gaffkemia

As in previous years a monitoring programme for the presence of Aerococcus viridans was carried out in lobsters. In Nova Scotia two out of 22 sites showed signs of Gaffkemia. In Prince Edward Island two out of four sites had a low incidence (1% to 3%) and in New Brunswick two of four sites were positive.

Sea Urchin Mortalities

Heavy mortalities of sea urchins which occurred in 1980 and 1981 have been shown to be due to a Labyrinthomyxa-like organism.

Section II - PACIFIC AREA

Ceratomyxosis

The causative parasite of this disease is now known to be widely distributed in chinook salmon in British Columbia. Recent work has shown that the progress of the disease is accelerated by migration to seawater. The disease has also been recorded for the first time in Pink Salmon in British Columbia.

Proliferative Kidney Disease (PKD)

This disease has been recorded for the first time in Canada in Vancouver where it has been associated with low level mortalities in steelhead trout in freshwater. It is believed that the causal organism may occur naturally on Vancouver Island.

Furunculosis

This disease is widely distributed in the Pacific region of Canada and is a major cause of mortalities in a number of species of cultured salmonids in both fresh and saltwater. Sixty four cases were encountered in 1983.

Bacterial Kidney Disease

Recent work has confirmed that the disease is transmitted in salmonid ova and that water hardening of fertilized ova using Erythromycin phosphate is ineffective. However injection of the drug into the dorsal sinus of brood fish does effectively eliminate the carrier state. The disease occurs in both salt and freshwater and in 1983 was diagnosed on 20 occasions in a variety of salmonid fish species.

Section III - VIRAL ERYTHROCYTIC NECROSIS (VEN)

The virus is routinely observed in various Pacific salmon species and marine fish such as cod, herring, pollock etc. The virus was observed in migrant adult Pink Salmon in the Frazer River in 1983.

DENMARK

Farmed Fish

Viral Haemorrhagic Septicaemia (VHS)

One outbreak of VHS in saltwater reared rainbow trout was diagnosed in 1983.

Furunculosis & Vibriosis

The diseases are a major problem in freshwater and marine farms.

Enteric Redmouth (ERM)

Yersinia ruckeri was identified for the first time in Denmark in rainbow trout but does not appear to be a serious problem.

Proliferative Kidney Disease (PKD)

The disease was observed in seven farms in 1983, as against 2 farms in 1982.

Dactylogyrus sp

Infestations are a problem in intensive culture of eels and are difficult to treat.

Wild Fish

Investigations into the "Ulcer syndrome" of cod continued. The prevalence was less than 2% in Koege Bay and in the Little Belt was approximately 20%. Experiments were carried out to evaluate recapture frequencies of diseased and healthy cod and to estimate the time taken for development of the different stages of the "Ulcer Syndrome" under natural conditions. The tagging of the fish was shown to be an important stress factor in inducing increased susceptibility to disease. The time taken to develop to the third stage of the Ulcer syndrome was shown to be approximately 25 days.

Spring Ulcer disease of eels had a prevalence of 32% in Randers Fjord at the beginning of May and disappeared in June and the disease was not observed in Mariager fjord.

Mycobacteriosis

In the Little Belt 10% of cod examined showed miliary processes in kidney, spleen and liver. Attempts to cultivate acid fast bacteria from diseased fish were successful using Lowenstein's medium but transmission experiments have yet to be undertaken. Growth took about 1 week.

Diseases of Wild Flatfish

A total of 6958 dabs and 5629 plaice were examined during two cruises. Relatively high disease rates were found in the German Bight and in an area of the North Sea approximately 50 - 70 miles off Tyboron. In the latter area British scientists found very low oxygen levels and elimination of all fish life in the Summer of 1981.

FINLAND

The most important progress has been in the disease survey work which was first initiated in September 1983. Until recently the only information available on diseases of natural fish stocks off the Finnish coast were derived from sampling of commercial catches. A survey of commercial species such as cod, flounder and Pike was carried out in the northernmost region of the main basin of the Baltic Sea. The results to date indicate the presence of a variety of disease conditions in the fish population studied.

Ulcers

A high incidence of skin ulceration was observed in Flounder and Pike in excess of 12%.

Pseudobranch tumours

These tumours were recorded at a high level in cod with an overall prevalence of 1.7%.

Lymphocystis

This disease shows the highest prevalence in Flounder in coastal waters.

Pike lymphoma

The high prevalence of this disease in Northern Pike in the SW Archipelago Sea still persists, up to 20% in places. The highest prevalence is seen in areas with highest salinity where the pike is at the extreme limit of its salinity tolerance. The disease is rare in the most coastal areas, even in waters considered highly polluted. Recent studies indicate that the neoplastic cells involved in the tumours are not of a lymphoid nature as previously believed.

Skeletal deformities

These occur most commonly in cod, the overall prevalence being 1.5%. The deformities included scoliosis and lordosis most frequently in association with vertebral compression and deformation of the vertebrae at the level of the second dorsal fin.

FARMED FISH

Vibriosis

Vibriosis is currently the problem of greatest significance for fish farming activities in coastal waters. More than 10 outbreaks were recorded in 1983 from cage farmed trout. However the use of a polyvalent vaccine used mainly as a bath has reduced losses considerably and also the amount of antibiotics used.

Furunculosis

New clinical outbreaks due to achromogenic strains of Aeromonas salmonicida are a cause of concern.

FRANCE

Three reports were received from different laboratories in France.

ISTPM REPORT

Principal activities were directed towards improving diagnostic techniques and their precision and towards acquiring greater knowledge and understanding of molluscan disease processes.

Disease Status of Natural and Cultured Molluscs

New rules governing molluscs going for human consumption require prior storage at an intermediate station. 15,643 oysters were examined out of which 1989 showed Marteilia refringens and 944 showed Bonamia ostreae. The most important findings are that Marteilia has reappeared at high levels in places where oyster stocks have been low. Bonamia persists in areas 1.5 years after oysters were eradicated and despite no new spat being laid down. In experiments carried out in deep water at Concale the disease did not develop where a low density of spat, with less than 1% being diseased, were seeded in an area where oyster culture had not been previously carried on. Both Bonamia and Marteilia have been found in natural oyster stocks outside La Rochelle.

Mortalities in C. Gigas.

The most typical cases have occurred during the Winter in the Archecon basin and at Morbihan. No parasites have been identified even though the lesions in affected oysters from different areas are similar. They are characterised by degeneration of the epithelial cells of the digestive gland. The cases observed seem similar to others observed on the west coast of America and in Japan. Some mortalities seem to be linked to stress conditions due to abnormally high temperatures. Other mortalities of a more localised nature have also been observed during the winter. Also some mortalities have been observed in scallops (Pecten maximus) and in clams (Palourdes). The mortalities in scallops has been linked to high levels of trematodes. In the latter high levels of Rickettsiae were observed.

Tissue Culture

Work has continued on molluscan cell lines. The maintenance of primary cultures has been improved and use of oyster primary

cultures has made the in vitro study of Bonamia ostreae possible. The extracellular growth of the parasite has been studied and compared in different media. Its ultrastructural characteristics have been studied in parallel using EM. Observations in culture confirm that binary fission is the principal mode of reproduction in Bonamia ostreae. Also the isolation of Bonamia by gradient centrifugation is reported. The first such results have been achieved using gradients of 20 - 70% Percoll for 30 minutes centrifugation at 1300 G. By this technique Bonamia ostreae was found in fractions corresponding to concentrations of 50 - 60% percoll.

Research

Transmission experiments.

Experimental infestations were possible using unpurified suspensions of Bonamia ostreae. By this method positive results were obtained in 20% of cases. Temperature did not seem to affect development of infection. However Mediterranean oysters seemed less susceptible to the disease than Atlantic oysters. Transmission experiments were carried out using aged suspensions of the parasite. The disease could be reproduced using strains held at 5°C for 15 days. No infections were obtained using Bonamia derived from primary culture. Using parasites isolated by centrifugation only a single case of experimental infection could be produced up to 28 days after injection.

REPORT - DR. BALOUET, PATHOLOGY DEPT, REGIONAL HOSPITAL, BREST

Oyster Pathology Diseases observed in 1983 and Research Results

It has been shown experimentally that contamination of oysters with Bonamia may take up to 7 - 8 months to occur in some cases. The parasite is still observed in oysters from all parts of Brittany. Marteilia refringens is also still observed in Rade de Brest. No cases of Haemocytic tumours have been seen in 1983 in Brittany.

An extensive study of parasitic lesions in molluscs from the North Brittany coast has been undertaken and has shown an absence of Bonamia in Mytilus, Pecten maximus, Venus and Tapes. Also no parasitic lesions were observed in scallops or clams. Parasitic lesions were seen in other species due to protozoan, trematode and crustacean parasites. These lesions have a wide geographic distribution and a sizeable number of individuals may be affected.

Experimental Nodule Production

Subcutaneous or intraperitoneal injection of inert substances such as talc or BCG in adult rainbow trout led to nodule production after 60 to 90 days, respectively. The nodules are histologically similar to spontaneous nodules described in a number of species whichever substance is injected. After subcutaneous injection diffuse lesions are found on the surface of a number of organs such as intestine, pancreas, liver etc. and in the gills after intraperitoneal injection of BCG.

Viral Diseases

Viral Haemorrhagic Septicaemia (VHS).

No new epizootics occurred on fish farms. Experimental VHS was established in C. Aurata by inoculation.

Bacterial Diseases

Vibriosis

From April 1983 to April 1984 no important outbreaks of vibriosis occurred in commercial salmonid farms although vaccination was not carried out. It is possible that some cases are not diagnosed or are treated using antibiotics without being reported to the laboratory. On the other hand vibriosis frequently occurs in juvenile turbot. The production of a commercial formalised vibrio vaccine by the Merieux Institute is being undertaken using strain 408. The vaccine has been found to be effective following a ten day administration of the vaccine by the oral route.

Enteric Red Mouth (ERM)

The disease has not been observed in commercial fish farms. Experimental infection of a number of species has been carried out. The production of a commercial vaccine by the Merieux Institute is being undertaken.

Photobacterium

No new cases reported.

NETHERLANDS

Wild Fish

Five seagoing disease surveys were carried out. One survey was carried out in the northern and central parts of the North Sea and the others along the Dutch Coast, German Bight and Western Danish waters (DGD area). Some diseases showed strong seasonal variation particularly lymphocystis and Glugea infestation.

Lymphocystis

The disease was most prevalent in flounder with a level of 14.4% in the Autumn off the Dutch Coast. Dab showed a prevalence of 5.3% in Spring and 1.6% in the Autumn in the DGD area. Plaice from the area showed a prevalence of 0.3% in the Spring and 0.1% in the Autumn.

Hyperplasia/papilloma

These were only seen in dab at a level of 3% in Spring reducing to 0.1% in the Autumn in the DGD area.

Bacterial Diseases

Mycobacteriosis

The prevalence of 0.3% in cod in the DGD area was significantly lower than in 1982 (6%).

Ulcers

Ulcers were observed in both flatfish and roundfish. In the DGD area the prevalence in dabs was 1.7% in Spring and 2.5% in Autumn and for plaice 0% and 1.9% respectively. Flounder showed a prevalence of 1.6% in the Autumn survey along the Dutch coast.

In cod ulcers were only recorded from the DGD area with a prevalence of 0.3%.

PARASITIC DISEASES

Protozoan parasites

Glugea stephani infestation of the intestine was observed in flounder, dab and plaice. As in previous years the cranial infestation of flatfish with Myxobolus aeglefini was found in a restricted area north of the mid-Denmark western coastal areas at a level of 20.3% in dab and 27.7% in plaice.

Skeletal abnormalities

The most prevalent abnormalities were those of the vertebral column especially lordosis and compression. Dab from the DGD area showed a 0.2% prevalence of lordosis and flounders from Dutch waters showed a prevalence of 0.2%. Cod from the DGD area showed skeletal deformities, lordosis and compression, at a level of 0.9% in the autumn.

Molluscs

Bonamia

The 1983 results showed no evidence of the disease and this has been the first disease free year since the disease first appeared in 1980.

NORWAY

The status of Furunculosis, BKD and PKD in cultured salmonids remained largely unchanged. Vibriosis still causes significant problems.

New Diseases

Hitra Disease has spread further south down the Norwegian coast and is considered an extremely serious disease problem in salmonid farms. Affected fish show considerable kidney damage and an attempt to produce a vaccine to protect against this disease is underway. The causative organism is a fastidious Vibrio, not V. anguillarum which grows in pure culture at 12 - 15°C. Injection of this organism into trout and salmon produces typical signs of this disease.

Exophiala

Most probably a new species of this fungus causes losses in one specific salmonid farm. Kidney symptoms are rather similar to BKD but the fungus is easily seen in smears.

Icthyobodo (Costia)

This parasite caused serious losses in 1983. It is not known whether the causative organism is a marine parasite or a freshwater parasite carried over into the marine environment.

New Species of fish for farming

In attempts to culture cod, vibriosis has given substantial losses. The bacterium isolated from diseased cod is being studied.

In attempts to culture halibut, fry mortalities have occurred due to an infection with Flexibacter sp.

Wild Fish

The seasonal variation of lymphocystis disease in the Oslofjord is under study.

U.K. (England and Scotland)

Farmed fish and Shellfish.

Most of the diseases previously reported recurred in 1983 - 1984. Those of greatest commercial importance were pancreas disease, furunculosis, vibriosis, dorsal fin erosion, IPN, sea lice and BKD. *Vibrio* vaccines are undergoing trials in a few areas where the disease has been a problem.

Wild Fish (Scotland)

No significant new disease conditions were observed in Scottish waters in 1983. Studies on Icthyophonus in haddock and plaice to the north of Scotland continued. Pseudobranch tumours and skeletal abnormalities show the highest prevalence off the North of Scotland. No differences in disease levels could be distinguished between sludge dump sites, the vicinity of oil fields and areas distant from sources of pollution.

IRELAND

Farmed Fish

Serious losses occurred at a number of farms due to the protozoan parasites Trichodina and Icthyobodo (Costia) affecting the gills of salmon and trout. IPN virus was isolated from rainbow trout at two marine farms and from salmon at another marine farm. Vibriosis caused losses in salmon smolts at two fish farms.

Shellfish

The main flat oyster growing areas were monitored for disease on two occasions during the year. No evidence of Bonamia was observed.

Wildfish

A mycotic condition of cod reported last year has been identified as being due to Geomyces pannorum. One cruise was carried out on the east coast in 1983. The disease levels were generally low.

U.S.A.

Fish Diseases

Research on the IPN like virus, the cause of a serious disease in Atlantic Menhaden has been continued. A virus similar to that found in Menhaden has been found in striped bass and several other species.

Shellfish Diseases

Epizootic levels of haematopoietic neoplasms have recently been observed in soft shell clams (Mya arenaria) in a Massachusetts estuary and in Chesapeake Bay. In the Massachusetts estuary high prevalences were found at a site containing high levels of pollutants such as PCB's and heavy metals. The most serious pathogen of American oysters (C. virginicus), Haplosporidium nelsoni and Perkinsus marinus have recently been encountered in areas of Chesapeake previously unaffected by the pathogen. A major study of infectious hypodermal and haematopoietic necrosis (IHNN), a serious disease of penaeid shrimps in Hawaii, was published in 1983. Transfers of stocks are thought to have disseminated the virus from the west coast of Central and South America.

Pollution Related Disease

The prevalence of tumours in several flatfish species seems to be statistically associated in the levels of pollution in Puget

Sound. Long term trawling surveys have provided extensive data on the distribution and prevalence of fin erosion and other abnormalities of fish.

DISEASE OF CRUSTACEANS

Canada

Work in continuing on the development of a vaccine against Gaffkemia disease of lobsters.

DISEASE OF MOLLUSCS

France

A number of areas being researched at present are mainly related to shellfish importations and the culture of the Bonamia organism. Mytilicola a very important parasite of mussels, has led to significant losses.

Netherlands

All the experimental sites are now clear of Bonamia and it is hoped to plant oysters and recommence commercial production.

Norway

No report of molluscan disease problems were received. The importation of molluscs into Norway is only allowed from one hatchery in Scotland.

U.K.

No report.

U.S.A.

It is forecast that major mortalities in clams in Chesapeake Bay due to epizootic of haematopoietic neoplasms may occur. Due to high salinities in Chesapeake Bay there has been a spread further northwards of the two oyster pathogens Minchinia nelsoni and Dermocystidium.

Nematode Worms of Fish

(Phocanema decipiens)

A Canadian publication has reported an enormous increase in the size of the Phocanema problem in cod and other fish particularly in Cape Breton and the Scotia shelf due to a huge increase in the grey seal population. A number of suggestions have been made to reduce the size of the problem such as culling of the seal population, anthelmintic treatment of seals and even the use of hormonal treatment to reduce the reproductive capacity of the seal population. The presence of the worms has an important economic consequence, costing an estimated £30M in increased processing costs. The presence of larval nematodes is also a problem in other countries such as Norway but no attempts have been made to control the problem. It was pointed out the worm problem is not a public health problem nor a significant fish health problem. It was suggested by the Chairman that this topic should be discussed in detail at a later meeting.

2. PUBLICATIONS

Fiches

Concern was expressed at the delay in publication of the fiches by ICES. It was decided to write to the Secretary General to

stress the importance of publishing the fiches as soon as possible. Further titles for the fourth series of fiches were accepted by the working group. These included Seawater Costiasis - Wooten and McArdle, Lernaeocera branchialis infestation - H. Moller and Eimeria infection of fish - C. Morrison.

Reviews and Index

It was decided that most of the effort of the working group should be put into the production and publication of the fiches and that work on the reviews and index should be placed in abeyance for the present.

Mini Symposium

It was recommended that the papers presented should be published as a Co-operative Research Report.

3. REGISTRY

It was felt that if possible one system of data processing should be used and it was agreed that the various countries could establish the most appropriate system by correspondence.

4. FISH VACCINES

A number of aspects were discussed including safety tests, potency testing etc.

Safety & Potency Testing

It was pointed out that vaccines must be safe for fish but also safe for handlers. Because most of the vaccines derive from

gram negative organisms potential toxicity to users is important. Many countries differ in their safety testing requirements. In the USA fish vaccines must be tested for safety in fish. In Norway safety tests in warm blooded animals are also required. Most countries require potency testing on fish vaccines. In the USA three consecutive batches of vaccine must be tested for potency and safety. The USA also require safety testing in the field but not potency testing. In Canada the production of fish vaccines must meet the biological production standards that apply to mammalian vaccines. It was generally agreed that the same strict standards which apply to mammalian vaccine production should apply to production of fish vaccines.

The possibility of vaccination increasing the carrier rate of certain diseases in fish was also discussed. It was pointed out that in the case of Aeromonas salmonicida, vaccination could increase the carrier rate and thus put at risk susceptible fish in contact with such vaccinated fish. It was felt that the whole subject of host/pathogen interaction needed further discussion at next year's meeting.

5. "ANTON DOHRN" - CRUISE REPORT

The seagoing Workshop in Methodology of Fish Disease Surveys took place on board RV 'Anton Dohrn' from 3 - 12 January 1984. Twelve scientists participated in addition to a research team from the Toxiklogische Laboratorium, Cuxhaven. The report of the cruise identified a number of sources of variability in disease sampling and proposals for improvements were made which are summarised below:

(i) Objective of fish disease surveys

The main objectives of a disease study must be clearly defined prior to commencement of a cruise.

(ii) **Planning of Cruises**

Co-ordination of disease surveys both nationally and internationally is desirable and could be achieved by circulation of cruise plans. The report also recognised the advantage of integrating disease observations into fish stock assessment surveys.

(iii) **Selection of Sampling Stations**

Depending on the type of cruise being undertaken a number of ways of selecting the sampling stations were recommended.

(iv) **Fishing Methods**

Fishing procedures used during the disease surveys should be standardised when possible.

(v) **Sampling**

The degree of precision required by fish disease surveys and the prevalence of the disease being investigated influences the number of samples required. Changes in disease levels over time are considered to be of more significance than absolute levels.

(vi) **Diagnosis of Disease**

Precision of diagnosis was identified as a major source of variability.

(vii) **Computer Entry and Retrieval of Disease Data**

Certain parameters for inclusion into a typical stock assessment computer entry form were recommended. Negative data should always be recorded.

(viii) Evaluation and Presentation of Data

Because the physical and biotic environment could substantially influence disease patterns data from investigation on these should be utilized during the evaluation of disease data. The ICES format for disease reporting needs revision and improvement.

(ix) Target Organs, Pathology and Parasites suitable for disease studies of fish in relation to environmental changes

The workshop considered in detail the problems associated with the attempted use of fish diseases as indicators of changes in the quality of the environment.

A discussion of the cruise report followed. The target organs identified by the workshop were agreed on. Regarding statistical methods, Dr. Misra, a Canadian fisheries statistician, pointed out that although many sophisticated statistical methods were available these were only as good as the raw data. Regarding the use of disease cruises as a tool for assessing the health of the environment it was pointed out that cruises could not provide all the answers and that the techniques used in pathological surveys should not be pushed too far. The report drew attention to the lack of information available on the effect of pollution on parasites of marine fish. Dr. Sindermann pointed out that there was quite an amount of literature on this topic and felt this literature could be usefully reviewed and agreed to do so.

It was recommended that the 'Anton Dohrn' report should be published by ICES with a caveat on the shortcomings of the statistical analysis, methodology etc. It was also recommended that a summary of the report be produced. The working group also felt that the results of the report should be discussed with the WGMPNA. Dr. A. McVicar (UK) was asked to edit the report.

6. IMPACT OF DISEASE ON COMMERCIALLY IMPORTANT SPECIES

No summary of the ICES mini symposium on this topic held during 1983 statutory meeting was available. It was felt that it was necessary to know more about the effect of disease on abundance of fish species. Stock assessment experts can interpret fish population levels in terms of predation, food supply, fishing effort etc. If disease is an important factor in determining stocks then it is important that the relationship be demonstrated. On the other hand in the case of molluscs the impact of disease can be readily calculated. In Canada they are now beginning to look at the effects of disease at the recruitment stage. Although a good deal is known about the effects of some diseases, such as Ichthyophonus it was felt that other diseases and their effects should be investigated.

7. PATHOLOGY WORKSHOP

A number of short presentations were made and microscopic slides examined and discussed.

Metabolic Granulomas - Dr. Balouet

This condition is observed in Turbot at about 18 - 20 months of age and causes mortalities up to 50%. The condition is characterised by white swellings in the skin, eyes, fins and around the mouth of affected fish. The nodules can be up to 5mm in diameter and when cut are chalky in appearance and contain water soluble crystals. The granulomas are similar to those observed in mycobacteriosis and chemical examination of the nodules shows a high level of Tyrosine which is also high in the blood and kidney. So it is thought to be a catabolic disease unrelated to feeding. The disease may be temperature related and appears to be similar to a disease in guinea pigs and a

congenital disease of young children which can be corrected by administration of Vitamin C. Work has also been carried out on production of nodules experimentally using Talc and BCG injection.

Pancreatic Disease - Dr. Munro

The disease continues to cause problems in salmon farming in Scotland. The disease occurs in the first sea year, usually in September about 5 - 6 months after going into the sea. The first histopathological indications of a problem occurring are when the acinar cells of the pancreas become more basophilic and show an absence of zymogen granules. Vacuolation of acinar cells then occurs followed by syncytial formation and widespread necrosis. The endocrine tissue remains normal. Fibrosis then occurs. Most fish do not die but become very thin. The prevalence varies and about 10-15% of fish have to be culled.

Vibriosis in Eels in Ireland - J. McArdle

The first recorded case of Vibriosis in eels occurred in Ireland in 1983 in Wexford harbour on the east coast. Clinically the disease was typical of 'red pest' disease. The occurrence of the disease was linked to the unusually warm Summer experienced in Ireland in 1983. The Vibrio sp. isolated from affected eels was different from the type strain in a number of its biochemical reactions, particularly its inability to attack Arginine and its ability to break down Lysine and Ornithine. The isolate is similar to a vibrio sp. involved in a case of vibriosis in England in 1976.

Epidemiological Aspects of Bonamia Disease in France

- Dr. H. Grizel

Sampling of clean oysters placed in bags in Crach Bay, an infected area, have established a number of important facts about

the disease. It is possible to detect the parasite after 5 months. Also oysters can become infected all the year round and after 10-12 months mortalities can be up to 90%. Significant differences in the level of infection between different strains of oysters have also been observed.

Hitra Disease and Exophiala Infection - Dr. Egidius

Hitra disease or cold water vibriosis was described. Last winter the disease struck very hard in the Bergen region. A slow growing *Vibrio* has been isolated from clinical cases and the disease has been transmitted using this organism. The disease is characterized by widespread hemorrhages.

A disease condition due to a probable new species of the fungus genus *Exophiala* was also described.

8. POLLUTION RELATED DISEASES

The joint meeting proposed by WGMPNA with WGPDMO in 1985 was agreed to. A number of items for an agenda were proposed. Regarding the proposal to produce a disease map of the ICES area, it was felt that a general map might be difficult to produce because of the gaps in the knowledge but that local maps could be produced. Such maps would form part of the agenda for the joint meeting. The proposal to have an analysis of the studies which positively linked the prevalence of diseases with pollution in a marine area was agreed to although the use of the wording 'positively linked' was felt to be a bit strong by the working group.

The agenda for the joint meeting proposed by WGMPNA was broadly agreed to, with some modifications. It was proposed that the agenda would be discussed between the Chairmen of both groups. Once the agenda was finalised, background material would be sought from certain members. The proposed agenda is as follows:

1. The role of environmental, among other factors, in fish disease aetiology, including the possible relationships between contaminant body burdens and disease.
 - 1.1 The types of disease most likely to be environmentally influenced.
 - 1.2 The type of environmental factors most likely to be relevant.
 - 1.3 Other environmental variables that would be useful to support epidemiological studies.
2. Methodology including statistics in evaluating the relationship between pollution and disease.
3. The types of disease most likely to be feasible for inclusion in a monitoring programme.
4. Outcome of epidemiological studies to date particularly on disease 'hot spots' and study of disease maps.
5. Suggestions for further work.

National Reports on Pollution Related Diseases

BELGIUM

A joint study was carried out by Belgium and Holland on livers of eels. Heavy metal and organochlorines were significantly higher in the livers of eels from polluted areas than those from non polluted areas. It was concluded that pollution appeared to have no direct effect on eels but could have an indirect effect by influencing the bacterial composition in the environment.

CANADA

High levels of PCB's in cod livers in the North Atlantic seem to be related to liver lesions. Experimental work showed that at high doses of PCB's gonads of experimental male fish did not develop and gill lesions were also observed.

DENMARK

The prevalence of "ulcus syndrome" was low mainly because few fish in the appropriate age group were caught in 1983. Bacterial levels of water and sediment were shown to be higher in polluted areas than clean areas.

FINLAND

A higher prevalence of skeletal abnormalities was recorded from polluted areas.

FRANCE

The survey of oysters following the 'Amoco Cadiz' spill continues. Levels of oil in oysters from some of the abers are 2 to 3 times higher than normal although the oysters appear to be normal histologically. Research on the effects of PCB's on oyster larvae is being carried out and the main effects noted have been mortalities and also the production of abnormalities. Organostannic compounds have produced shell abnormalities which are reversible.

SWEDEN

The general survey along the Swedish coast was continued and has shown a high incidence of pseudobranch tumours in cod in coastal areas. Also 90% of cod around a nuclear power plant have shown

Diplostomum infection which may be related to high water temperatures and thus may be considered an indirect pollution effect. Finally an abnormal shortening of the tail fin of perch near a pulp factory was recorded. A joint cruise was carried out with Finland to calibrate methodology and joint cruises with Norway and Germany are planned.

U.S.A.

Work on liver tumours in relation to pollution on the west coast is continuing with particular attention to intermediate products of metabolism. On the east coast the work is mainly being concentrated on skin diseases and abnormalities of flatfish although high levels of liver neoplasms are being recorded in certain east coast areas. It is hoped to have further results next year. Finally the results of five years of surveys carried out on a seasonal basis have been published. The findings show that fin erosion was the lesion of choice in these studies and the highest prevalence was recorded from the New York Bight and Massachusetts.

In summary the working group feel that there is much statistically sound evidence relating pollution and disease. It would encourage the continuation of cruise work by member countries but it is also felt that much experimental work on pollution and disease is needed. Whenever possible the working group feels that disease investigations should be carried out in conjunction with pollution studies. Indirect effects of pollution are also felt to be important and these include immunosuppression and increased bacterial loads. The role of statistics in relation to disease and pollution studies is considered to be extremely important. Dr. Dalsgaard and Dr. Stig Møllergaard agreed to discuss with a statistician the particular problems of fish disease statistics and report back to the 1985 meeting.

9. RECOMMENDATIONS

Arising out of the meeting the working group recommend that:

1. The report of the seagoing cruise on the 'Anton Dohrn' should be published as a Co-Operative Research Report under the editorship of Dr. A. McVicar.
2. While recognising the importance of cruises in relation to possible pollution related diseases, the working group feels that experimental work in this field would strongly assist towards its understanding. The working group recommend that member countries initiate experimental work into the area of possible pollution related diseases.
3. The working group on Pathology and disease in marine organisms meet jointly with the working group on marine pollution in the North Atlantic for one day in 1985 to consider in detail the present understanding between pollution and disease according to an agenda worked out by the chairmen of both working groups.
4. It is apparent from a review of existing information that more information is needed about abnormal behaviour and disturbed physiological processes of diseased fish; and that experimental studies on the malfunctions of diseased fish should be carried out, including those that relate to how much malfunctions affect reactions to fishing gear.
5. The working group on Pathology and Diseases of marine organisms will meet in Copenhagen from April 22nd to April 25th 1984 with Dr. E. Egidius as chairman to meet jointly with WGMPNA for one day;
 - (i) to discuss the implications of information supplied to the chairman before Jan 1st 1985 on the current disease status

in member countries and on new disease problems of wild and cultivated fish;

- (ii) to attempt to investigate diseases of early life and larval stages of cultivated fish as a first step towards a greater understanding of the importance of disease in the early stages of wild fish;
- (iii) to encourage work and exchange of information in the field of pathology with the following aims; (a) to classify observations according to the definitions proposed by WGPDMO in 1982 (b) to form and test hypothesis on relationships with putative aetiological factors;
- (iv) to provide sufficient time for discussion of written submissions and to make arrangements for collaborative and co-operative studies on host parasite interactions especially the more fundamental aspects of host defences and the pathological properties of pathogens;
- (v) to review the status of research on pathology induced in fish and shellfish by animal parasites.

Note of Thanks to Prof. C. Maurin

The working expressed their grateful appreciation to Prof. Maurin for his dedicated work as Chairman of the working group for many years. A presentation was arranged through Dr. Egidius.

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