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Title

Herring Mortalities in the Gulf of St. Lawrence, 1955

Author

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by

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Reports were received about May 25-26, 1955, from a number of sources, indicating a mortality among herring in the Bay of Chaleur area. I was instructed to look into the matter. I left St. Andrews on May 27 with Dr. F. D. McCracken of this Station's staff, reaching Caraquet, N. B., in the evening. In the meantime Dr. Carl Sindermann of the United States Fish and Wildlife Service, had visited Petit Rocher, N. B., examined a few dead herring and reported that he saw no indication of a known disease.

I remained at Caraquet from May 27 to June 2. During this period dead and dying herring were in evidence in the harbour and at the neighbouring points of Shippigan and Grand Anse. On June 2, Mr. Leslie Scattergood and Dr. Carl Sindermann of the United States Fish and Wildlife Service, visited Caraquet and confirmed our findings, which were that the mortality was due to Ichthyosporidium hoferi, a parasitic fungus known to affect herring (Daniel, 1933; Fish, 1934).

Samples examined

Fishery Officer R. H. Burbridge had two samples of herring available for study on the morning of May 28. One lot of 17 herring was dipped on the previous day near the wharf at Caraquet Packers Limited at Middle Caraquet. A second lot of 35 herring was the entire catch of eight $2\frac{3}{4}$-inch mesh gill nets, which were set about three miles off Middle Caraquet on the previous night.

The length frequencies of these two samples were:

Greatest total length (cm.)	Shore sample	Gill-net sample
13 (=5.1 inches)	2	
14	1	
16	1	
23	1	
26	1	
27	2	1
28	1	
29	3	
30	4	2
31		8
32	1	8
33		8
34		3
35 (=13.8 inches)		5

Dying herring were dipped around the Caraquet wharf from May 28 to June 2. A sample of these fish was measured. The length frequency was:

Greatest total length (cm.)	Number
13	1
14	3
15	5
16	4
19	1
20	1
21	1
22	5
23	2
24	1
26	10
27	7
28	2
29	1
30	1
31	2
32	4
34	1

Stage of maturity: Feeding

(a) Caraquet Packers Limited wharf sample, May 27. Three fish (1 male, 2 female) were ripe and unspent. Others were either immature or spawned out. No food in stomachs.

(b) Gill-netted sample, May 27-28. Thirty-two fish were ripe and unspent and had no food in the stomach. Both male and female. Three were immature and the stomachs were filled with food (euphausiids).

(c) Caraquet wharf sample, May 28-June 2. Fish were either immature or spent. No food. Intestine filled with a greenish liquid in some cases.

Evidence of disease

Examination of the internal organs of the sampled herring soon revealed the presence of white pustules on and within the muscle of the ventricle of the heart. All of the fish which were taken near shore, from the smallest to the largest, had this condition. Ten out of the thirty-five gill-netted fish were badly affected. The hearts were much enlarged and showed more superficial pustules than did those from the shore samples. The hearts from the other twenty-five gill-netted fish appeared to be normal in colour and size but, as will be shown later, there was some internal infection.

Maceration of the ventricle of the heart revealed, under the microscope, large numbers of spores, some with hyphal development. The resemblance to Ichythyosporidium hoferi was striking. Such macerations showed that the muscular tissue of the ventricle was largely broken down.

Examination of other viscera revealed that occasionally the liver, spleen and gonads were affected. Superficially no punctures of the skin were noted but Dr. Sindermann demonstrated that scale removal exposed a sandpaper like marking on parts of the skin. If the skin was stripped from the lateral muscle, pus like, whitish patches of the fungus were often found lying beneath the skin.

Photographs of an affected herring are attached: (A) external appearance, (B) general view of viscera showing diseased heart and gonads, (C) enlarged illustration of the same heart.

Behaviour of diseased herring

The behaviour of the herring at Caraquet closely resembles the description given by Forster (1941). The fish were lethargic and were swimming close to the surface in day-time -- an unusual conduct. Their reaction to a dropped stone or a dipnet was slow and weak. Occasionally a fish would turn on its side; sometimes one would gulp at the surface and then slowly settle to bottom. This may have preceded death.

When any of these inshore herring was caught and the heart was exposed immediately, the ventricular beat was either feeble or lacking. Mechanical stimulation elicited very little response. In some cases the auricle continued to beat.

Extent of mortality

During the period of this investigation the mortality appeared to be confined to the Bay of Chaleur. We observed dead and dying fish at Caraquet, Middle Caraquet and Shippigan. When the surface was calm dead herring could be seen on bottom in depths up to 15 feet. They were about 25 feet apart in all directions. Along the beach dead fish were seen every five or six feet. The sick fish swimming about were more numerous than these figures would indicate. This suggests that dying was a slow process.

Dr. Sindermann saw dead herring near Petit Rocher, N. B., and Fishery Officer J. M. Comeau reported on May 27 that he saw many dead herring at Jacquet River ("I could have picked up a full barrel of dead herring in about 100 yards along the coast").

Dr. Sindermann, Mr. Scattergood and Dr. Marcotte reported dead and dying herring at Grand River, Que., and at other points along the northern side of the Bay of Chaleur during late May and early June. They did not see any affected fish at Fox River, Que., where they were handling herring.

Fishery Officer Turbide reported sick herring in the Bathurst area and Officer Curwin did likewise at Grand Anse, N. B. Officer Losier reported that some herring were dying at Tracadie, N. B. Dr. Sindermann had sampled herring at Richibucto, N. B., about May 25 and saw no evidence of disease.

Later reports widened the area of disease incidence. Mr. J. G. Anderson of J. W. and J. Anderson, Ltd., reported that herring were dying at Burnt Church, N. B., through most of June. Dr. E. Corbeil of the Quebec Department of Fisheries, reported considerable mortality at the Magdalen Islands and Mr. P. L. Montreuil, Director of the Marine Biological Station at Grindstone, M. I., has supplied details. His staff noticed diseased herring first on May 15, white nodules being observed in the testes. Dead herring were being washed ashore in late May. Between May 26 and June 9, samples of trap-caught herring had from 32 to 54% infection. The hearts, lateral musculature and gonads were infected; the heart was the most common site of infection. Dying fish were observed throughout June and early July. Fishery Officer L. C. Ripley at River Philip, N. S., reported dead herring from Pictou to Malagash, N. S., about June 8.

Dr. F. D. McCracken was unable to find any dead or dying herring at Caraquet during the week of June 20; but he found up to 100% infection in herring caught in Chaleur Bay, off Belledune Point and up to 25% in Cascapedia Bay, on July 13-14.

Legends for Figures A - C shown on facing page.

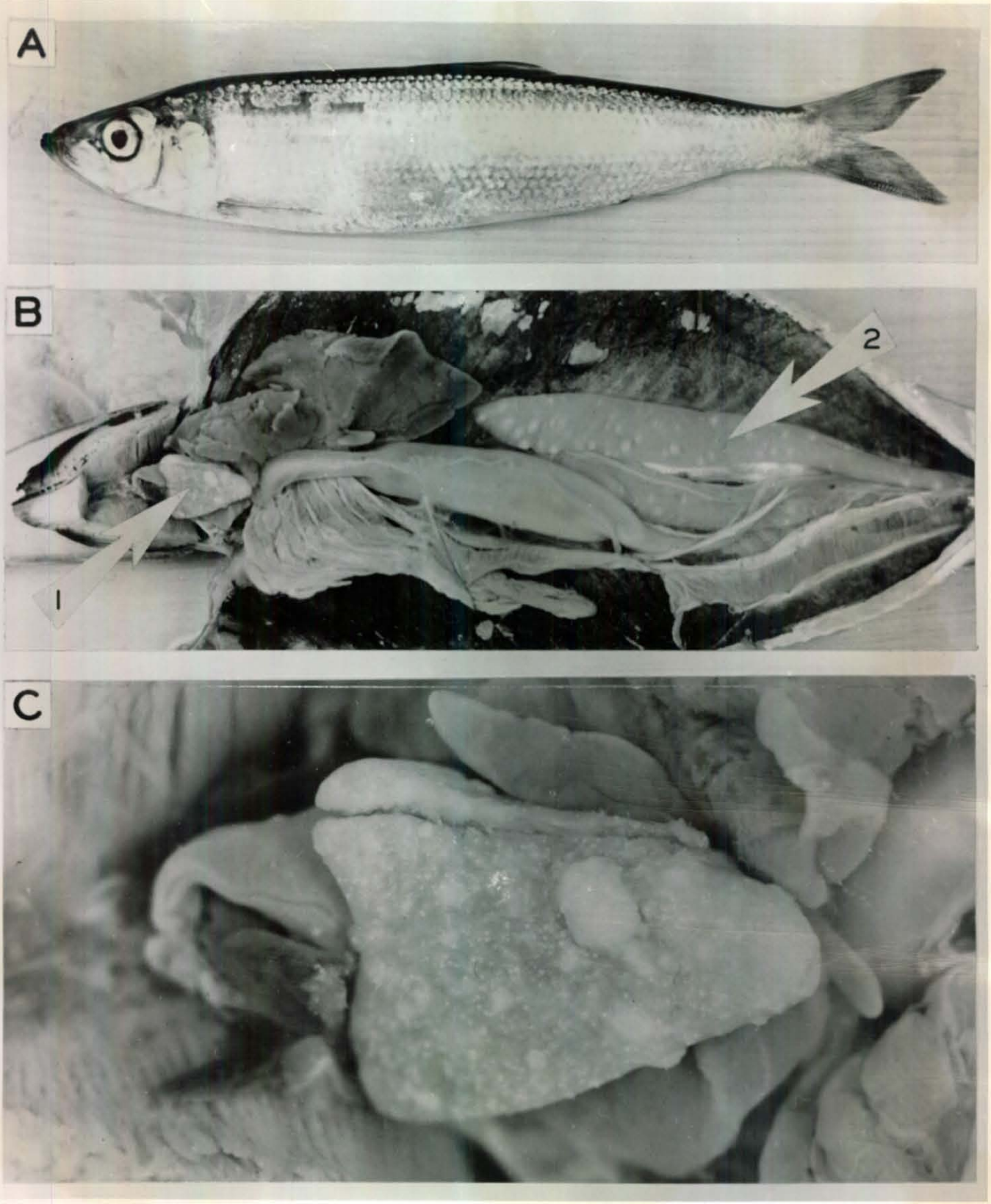
Fig. A - External appearance of diseased herring.

Fig. B - Dissection of diseased herring. Arrow 1 in photograph indicates infected heart; arrow 2 indicates infected testis (white spots).

Fig. C - The same heart, at greater magnification, showing surfacd nodules and deeper foci of infection.

Source of material: Caraquet, N. B.
Magnification: Fig. A X 4/5
Fig. B X 1
Fig. C X 5½

Photography by P. W. G. McMullon.


A
B
2
1
C

Dr. L. Lauzier and Mr. G. M. Somerville saw dead herring floating on the surface while on a hydrographic cruise on C.N.A.V. "Sackville". The observations were made between June 29 and July 9 at (a) Le Fond George and on towards North Point, P.E.I., (b) off Bonaventure Island, (c) 30 miles west of Anticosti Island, and (d) off Havre St. Pierre, Que.

Microscopic studies of herring tissues

Dr. Sindermann has provided duplicate sections of diseased ventricle, lateral musculature, pyloric caecae and gonads, differentially stained. These show extensive destruction, particularly of the heart muscle, in many cases. Other hearts show less damage; Lloyd Powell of this Station's staff has sectioned some hearts from the gill-net sample. Hearts, which superficially appeared normal, showed very little or no infiltration by the fungus. Hearts, which were enlarged and covered with papules, were very badly damaged. See photographs D, E, F, and G.

Infiltration of the fungus in the lateral line muscle was extensive in some fish; it was chiefly confined to the superficial muscles. See photograph H.

Sindermann and Scattergood (1954, p. 14) reported infection of gonads to be rare. Most previous studies have been on immature fish.

Legends for Figures D - K shown on facing page.

In all photographs the fungus tissues appear dark.

Fig. D - Section of ventricle, showing fungus spores at the surface and in the interior of the heart.

Fig. E - Section of the surface of an enlarged and distorted ventricle. Shows spores and hyphal bodies.

Fig. F - Section of the interior of the same ventricle as in Fig. E.

Fig. G - Higher magnification of same ventricle as in Fig. D. Shows spores and germinating spores.

Fig. H - Section of skin and lateral musculature; epidermis to the left, deep muscle to the right. Shows spores and hyphal bodies.

Fig. I - Section of pyloric caecae and gut. Shows hyphal bodies.

Fig. J - Section of ovary, showing spores and hyphal bodies.

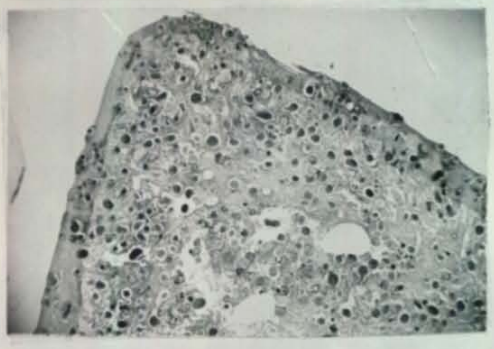
Fig. K - Section of testis, showing spores and hyphal bodies.

Sources of material: Fig. D - I, Caraquet, N. B.
Fig. J - K, Magdalen Islands, Que.

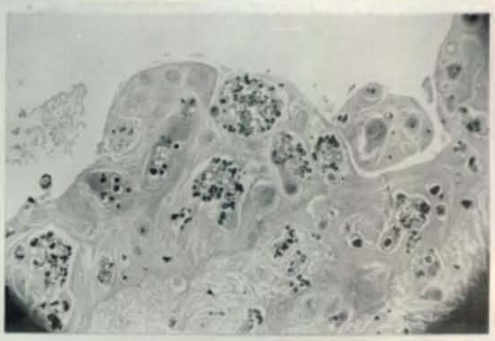
Magnification: Fig. D - F, H - K X12
Fig. G X50

Photography by P. W. G. McMullon.

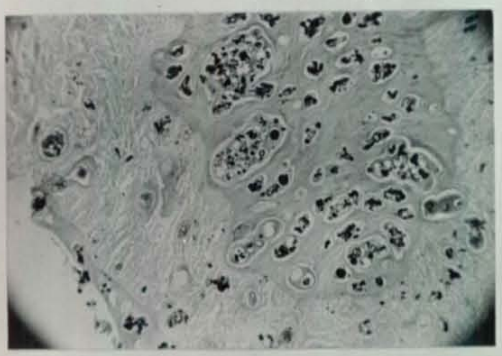
D



E



F

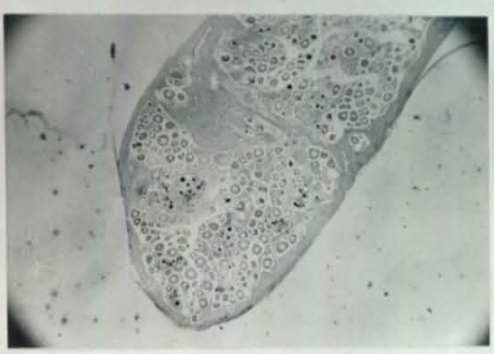


G

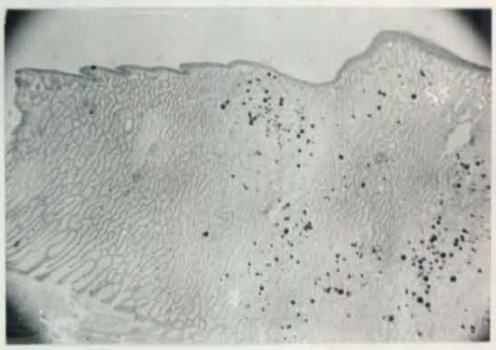
H

I

J



K



Gonads were infected in many herring at the Magdalen Islands and some cases were noted in the Caraquet material. See photographs J and K.

Dr. Sindermann and Mr. Scattergood feel that the death of the severely infected fish is readily explained as due to the fungus rendering the heart incapable of functioning, through tissue destruction. They think that the death of the less seriously infected fish cannot be explained on this basis. Nervous tissues may be affected although Forster (1941) failed to find any fungus stages in the brain. Forster also believed that the fungus does not produce a toxin, because heavily infected fish lived so long.

Other studies

Six specimens of diseased herring from Caraquet were forwarded to Mr. C. H. Castell at the Fisheries Experimental Station at Halifax for culturing of the fungus. Mr. E. B. Vaisey, who plated the infection, reported after ten days that no growth characteristic of Ichthyosporidium appeared although numerous fungi and bacteria did grow on the plates. He used the media recommended by Sindermann and Scattergood (1954). Further trials may be possible if fresh material is secured at Grand River, Que.

Plankton

Dr. Sindermann believes that the present outbreak offers a chance to study the occurrence of the fungus in the planktonts of the region. Tows were taken with No. 18 nets on June 2, outside Caraquet harbour from the Patrol Boat "Osmerus". Dr. McCracken had 12 tows taken in the Bay of Chaleur, off Caraquet, on June 18, using No. 0 and No. 5 nets. A tow taken at Shippigan bell buoy, south of Shippigan Gully, on May 27, has been made available to Dr. Sindermann along with material from the other tows mentioned.

European investigators have found Calanus and other copepods infected with Ichthosporidium (Chatton, 1920; Jepps, 1937). It seems probable that similar findings may result from the examination of plankton animals on this side of the Atlantic.

Acknowledgements

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