

The background of the page features several large, stylized, grey-toned silhouettes of fish, including what appear to be muskellunge and other large species, swimming in various directions. The text is overlaid on these silhouettes.

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Gas Bubble Phenomenon in Muskellunge Eggs

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ABSTRACT

Internal gas bubbles developed for two consecutive years in incubating muskellunge (Esox masquinongy) eggs at the Woodruff, Wisconsin, Fish Hatchery. The first year all affected eggs died; the second year most of the affected eggs survived and hatched. It is hypothesized that supersaturation of gases in the heated hatchery water used to incubate the eggs caused the gas bubbles.

GAS BUBBLE PHENOMENON IN MUSKELLUNGE EGGS

INTRODUCTION

In 1967 and 1968 gas bubbles developed in muskellunge (Esox masquinongy) eggs at the Woodruff, Wisconsin Hatchery. This appears to be the first occurrence of this type. In 1967, all eggs with this condition died within 68 hours; in 1968, the phenomenon was not accompanied by heavy mortality.

Gases have previously been reported as the cause of young and adult fish mortalities. Woodbury (1941) reported a fish kill in Lake Waubesa and the Yahara River, Wisconsin, due to extremely high oxygen content in the surface water. Other workers (Phlen, 1924 and Davis, 1961) have reported fish with "gas-bubble diseases" from supersaturation of natural and hatchery waters. Gas bubble disease is recognized by bubbles in the blood and various tissues of fish. Sometimes a "popeye" condition develops. In fry or small fish it is seen as small bubbles in the body cavity and between the fin rays.

OBSERVATIONS

The first internal gas bubbles were observed on May 11, 1967, and were confined to approximately 1,500 muskellunge eggs from a two-quart lot taken on May 4 from wild fish captured in Big Arbor Vitae Lake in Vilas County. A few internal bubbles were also noted in several eggs in a lot taken on May 5 from the same lake. Microscopic examination revealed that the gas bubbles were within the shells (chorions) of the

eggs. The membranes were extensively stretched from the bubbles. Each of the affected eggs usually had only one bubble within it. Squeezing individual eggs with a forceps did not eliminate the bubbles until the eggs were actually crushed. No abnormalities were noted in the embryos; some embryos were observed moving. The position of each internal bubble appeared to have no relation to the location of the embryo.

By May 14, 1967, all eggs with bubbles were dead. This amounted to about 1.5% of the May 4 lot from Big Arbor Vitae Lake. None of the remaining eggs of any lot developed gas bubbles after May 14.

On April 26, 1968, internal gas bubbles were noted in approximately 100 muskellunge eggs from four lots taken on April 14 from the Minocqua Thoroughfare and Squirrel Lake, April 12 from Allequash Lake, and April 13 from the Minocqua Thoroughfare. The eggs with bubbles were transferred to a separate hatchery jar on April 26. These embryos were in a more advanced state of development than those eggs which developed bubbles in 1967. (The 1967 eggs were incubated seven days at the time of bubble formation; the 1968 eggs were incubated 12 to 14 days prior to bubble development.) Many of the 1968 eggs hatched within four to five days of bubble formation. Quantitative survival data was not acquired, but the majority of the 1968 eggs with bubbles hatched to apparently normal fry, and less than 1 percent of the total egg lots had bubbles.

Some May 4, 1967 Big Arbor Vitae, and April 13 and 14, 1968 Minocqua Thoroughfare musky eggs were incubated in separate hatchery jars that developed no bubbles.

Lakes' temperatures when the eggs were taken follow:

<u>Date</u>	<u>Name of Water</u>	<u>Water Temperature Where Eggs Taken</u>
May 4, 1967	Big Arbor Vitae Lake	42°F
April 12, 1968	Allequash Lake	-
April 13, 1968	Minocqua Thoroughfare	50°F
April 14, 1968	Squirrel Lake	43°F
April 14, 1968	Minocqua Thoroughfare	46°F

After the muskellunge eggs were taken from the fish at the various waters, they were immediately fertilized and left to harden for about two hours in pails placed in the lake or stream water. The eggs were then tempered for several hours at the Woodruff Hatchery to approximately 54°F and put on the experimental temperature-control hatching battery. The source of all water for this battery is Madeline Lake via a supply reservoir near the hatchery. For hatching muskellunge, minimum temperatures in the hatching unit are controlled by mixing heated lake water with the regular (unheated) lake water. Water is heated in a pressure type, oil-fired water heater (Aldrich Heat Pak, Model WHO-129-W). Heated water temperatures range from 90°F to 110°F. A minimum water temperature of 54°F was maintained on the hatching battery during the entire incubation periods in 1967 and 1968.

The supply reservoir's water was generally cooler than 54°F during the 1967 and 1968 hatching seasons. As a result, heated waters were almost constantly used for the hatching water on the temperature-control battery. Water temperatures in the hatching jars were nearly constant (54°F to 55°F) during the times of the bubble formation in both years.

As temperatures increase, water is able to hold less dissolved gases. With heating and pressure, supersaturation of various gases can occur (Harvey, 1967), and some gas can escape as bubbles. Tiny bubbles have been noted in the hatching jars of the heated (and sometimes unheated) waters of the Woodruff Hatchery in 1967 and other years. At times, they have been a nuisance as they form on the eggs and fry and "loft" them in the jars.

Other conditions noted at the Woodruff Hatchery at and shortly after the time the gas bubbles appeared in the muskellunge eggs were:

Water temperatures (unheated reservoir water)

<u>1967</u>	<u>1968</u>
44°F - May 10	41°F - April 25
46°F - May 11	44°F - April 26
48°F - May 12	48°F - April 27

Dissolved oxygen (unheated water): 10.0 parts per million at 10:00 a.m., May 12. Other dissolved gases were not determined.

On May 12, 1967, the protozoans clinging to the water delivery tubes of various hatching jars were observed. Most of the protozoans were Acineta sp., Vorticella sp., and Carchesium sp. It was noticeable that the May 4th lot's tube had more protozoans than any of the other jars with the same water source. This tube was replaced with a clean one and no further differences were noted.

DISCUSSION

Exactly what gas(es) constituted the bubbles in the muskellunge eggs is unknown. Supersaturation of any combination of gases occurring in natural waters could be responsible for the gas bubble condition, but nitrogen and oxygen in combination are suspected. It appears likely that the gas bubbles within the eggs diffused from the surrounding medium. The possibility also exists, however, that the gaseous waste-products of respiration were not successfully eliminated, thus contributing to the formation of bubbles.

Sometimes high mortalities occur when muskellunge eggs are hatched at low temperatures (Johnson, 1958). The muskellunge eggs taken from Big Arbor Vitae Lake on May 14, 1967, Squirrel Lake on April 14, 1968 and the Minocqua Thoroughfare on April 13, 1968, were subjected to cool waters (42-46°F), but for less than three hours.

Although the gas bubbles did not cause a serious loss, it is suggested that the problems of "excess" gases in heated hatching water be examined in the future, and precautions developed to prevent or minimize occurrence of internal gas bubbles in the incubating eggs.

LITERATURE CITED

- David, H. S. 1961. Culture and Diseases of Game Fishes. University of California Press 332 pp.
- Harvey, Harold H., 1967. Supersaturation of Lake Water With a Precaution to Hatchery Usage. Trans. Amer. Fish. Soc. 96:194-201.
- Johnson, Leon, 1958. Pond Culture of Muskellunge in Wisconsin. Wis. Cons. Dept. Technical Bulletin No. 17.54 pp.
- Phlen, Marianne 1924. Praktikum der Fischkrankheiten. Stuttgart. E. Schweizerbart'sche Verlagsbuchhandlung. 179 S.
- Woodbury, Lowell A., 1941. A Sudden Mortality of Fishes Accompanying a Supersaturation of Oxygen in Lake Waubesa, Wisconsin. Trans. Amer. Fish Soc. 71:112-117.