United States Department of the Interior, Fred A. Seaton, Secretary
Fish and Wildlife Service, Arnie J. Suomela, Commissioner

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# BLUE-SAC DISEASE OF FISH

(Also known as dropsy, yolk sac disease and Hydrocoele embryonalis)

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## INTRODUCTION

Blue-sac disease is an abnormal condition of sac fry and is probably the most common ailment of fish of this age.

## IDENTIFICATION

Affected fry exhibit an abnormal collection of fluid surrounding the yolk sac. Typically it begins posteriorly and gradually envelops the yolk sac. The fluid often appears to be bluish. Exophthalmus (popeye) is usually present. Fry are lethargic and generally lighter in color than normal brood mates. White spots are often present in or on the yolk. Tiny hemorrhages occur in head, thoracic, and vitelline blood vessels. Blue-sac diseased fry tend to accumulate in quiet areas such as centers of trays or baskets or at lower ends of troughs.

## CAUSE OF THE DISEASE

Blue-sac disease is not an infectious condition although bacteria may be found as opportunists in some diseased individuals. It is the result of physiological response to unfavorable environmental conditions. It has been experimentally induced by allowing metabolic wastes to accumulate around developing eggs and fry, and by adding synthetic nitrogenous compounds (ammonia and urea) to otherwise normal hatchery water which supplied incubating eggs and fry. The disease has its inception in the egg, but is usually not identified until hatching or later.

## SOURCE AND RESERVOIR OF INFECTION

Not applicable.

## MODE OF TRANSMISSION

Not applicable.

## INCUBATION PERIOD

Not applicable.

## PERIOD OF COMMUNICABILITY

Not applicable.

## SUSCEPTIBILITY AND RESISTANCE

Most accounts of blue-sac disease concern salmonid fishes, but the condition has also been identified in coregonids, a perch, and a catostomid. Among cultured trouts there is an indication that brook trout fry (Salvelinus) are more prone to blue-sac disease than are the other species.

## RANGE

Blue-sac disease is not known to have any geographic restrictions.

## OCCURRENCE

It is of chief concern in the hatchery, but it also occurs in the wild.

## METHODS OF CONTROL

Successful control of blue-sac disease depends upon prevention. This is accomplished by assuring a positive flow of water past incubating eggs and fry. Cleanliness is important, because debris can clog screens and obstruct water flow. In addition, decomposition of organic matter can contribute products similar to the metabolic wastes of incubating eggs and fry. Fungusing, overcrowding and collecting air bubbles can also impede water flow and establish conditions favorable to inducing the disease. Single, slanted trays of long-mesh screen are preferred for incubation to avoid blue-sac disease. In theory, the battery method of egg incubation (Clark-Williams) offers the greatest blue-sac disease hazard. Eggs which are shipped continue to develop and excrete waste products. Large amounts of ice should always be above such eggs so that temperature will be kept low, but perhaps what is more important, so that adequate meltwater will wash the eggs throughout their period out of water. The course of the disease may be influenced by many factors. Under favorable conditions mildly to moderately affected lots will usually yield some recoveries.

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## ANNOTATED BIBLIOGRAPHY


Davis, H. S.
1953. Culture and Diseases of Game Fishes. Univ. of Calif. Press, Berkeley and Los Aneles, 332 pp., illus.
(pp. 294-295) A brief account of information and opinion on blue-sac disease based upon literature appearing before 1940. At the present time this information is out of date.

Dieterich, Elizabeth
1939. Die Hydrocoele Embryonalis (Dotterblasenwassersucht) der Salmoniden., Zeitschrift für Fischerei, Vol. XXXVI, H. 4, S. 605-642.
Best of the early papers on blue-sac disease. European literature is reviewed and the authoress reports on a number of experiments of her own. Excellent illustrations are included. This paper is intended for the serious student; it should be consulted by anyone intending to do research on the disease.

*Wolf, Ken
1954. Progress report on blue-sac disease. Prog. Fish-Cult., Vol. 16, No. 2, pp. 51-59, illus.
A preliminary report of the author's investigations. This appeared before the cause of blue-sac disease was established. Symptoms are given and there is a list of species known to be affected. Physical injuries as possible causes are discussed.

* 1957. Blue-sac investigations: Microbiology and laboratory induction. Prog. Fish-Cult., Vol. 19, No.1, pp. 14-18.
Evidence is cited against a microbiological cause. Methods and results of experiments are given. Results are discussed in the light of normal occurrences. Recommendations for control are given.

*Wolf, Ken
1957. Experimental induction of blue-sac disease. Trans. Am. Fish. Soc., Vol. 66, pp. 61-70.
A report of experiments whereby blue-sac disease was induced. Methods and results are given. Symptoms are presented in the introduction, and an attempt is made to correlate experimental findings with hatchery occurrences. The most important references are included in a bibliography.

* Papers indicated by an asterisk are of special importance to practical fish culturists.