

2004

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Andrew J. Mitchell
USDA-ARS, dmitchell@spa.ars.usda.gov

David W. Oates
Nebraska Game and Parks Commission

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**NODULAR MASSES IN THE SWIMBLADDER AND VISCERAL FAT
OF THE WALLEYE, *STIZOSTEDION VITREUM***

Andrew J. Mitchell¹ and David W. Oates²

¹Harry K. Dupree Stuttgart National Aquaculture Research Center
Agricultural Research Service/United States Department Agriculture
Stuttgart, Arkansas 72160
email: dmitchell@spa.ars.usda.gov

²Nebraska Game and Parks Commission
2200 North 33rd Street
Lincoln, NE, 68503

ABSTRACT

In April of 1990, a 1.8 kg walleye was found to contain hard cysts or nodules in the swimbladder and visceral fat. The nodules appeared to be formed around a worm-like mass. The nodules (10 ± 5 mm in diameter) were composed of five to seven layers of tightly packed granules, that were at least partially calcified and the layers were held together by a sticky matrix. The outer coat of the nodule was convoluted with many protuberances. This is a first report of such cysts from fish and they appear to be similar to nodules induced by worms (encysted nematodes) in the intestines of swine and ruminants.

† † †

This paper describes an unusual disease condition found in an adult walleye *Stizostedion vitreum* that was collected from the Merritt Reservoir in northwestern Nebraska.

In April of 1990, a 1.8 kg walleye collected from Merritt Reservoir in northwestern Nebraska was filleted and found to contain hard, nodular, spherical masses from 5 to 15 mm (most were about 10 mm) in diameter attached to the inside of the swimbladder (Figs. 1A, 1B, and 1C). These nodules or cysts had a raspberry-like appearance and several were slightly ovoid in shape. Similar but smoother nodules were also found throughout the visceral fat. Red immobile, worm-like masses (one mass from each nodule) were observed at the center of two nodules. Other nodules contained amorphous masses and a few had red blotches throughout the capsule (Figs. 2A and 2B). The nodules were composed of several layers (five to seven) of tightly packed granules held together in a sticky matrix. The layers could be peeled from one another – the inner-

most layers were more easily separated than the more peripheral layers. The outermost layer or coat appeared to be thinner than the other layers. Material from the nodules reacted slowly with 10% hydrochloric acid (HCl) forming a few bubbles that suggested they were at least partially calcified. It is possible that the sticky matrix limited the HCl reaction.

The two nodules with worm-like masses had inner layers surrounding and taking the shape of the mass (Fig. 2A). Successive layers tended to make the nodules more rounded and the outer layers contained numerous protuberances. Dr. Roger Herman of the National Fisheries Center, Fish Health Laboratory, Leetown, West Virginia, examined histological sections of another group of nodules from the same case and reported that they were granulomas surrounding dead worms. The internal structure of the worms was not clear but they appeared to be nematodes.

These nodules, that appear to have formed around a degenerating parasite (possibly a nematode), are similar to swine and ruminant nodular worm infections that are known to be caused by nematodes (Olsen 1974; Dunn 1978; Merck and Company Inc. 1998). In swine and ruminants, nematode larvae of the family Oesophagostominae become encapsulated in the course of an excessive inflammatory response by the host. The encapsulation then caseates and calcifies, enlarging into a nodule to diameters in excess of 10 mm. The nodules can cause a mechanical obstruction in the intestine. Although none of the nodules from the walleye were found in the alimentary canal the similarity between the nodules in this fish and in those of swine and ruminants is striking.

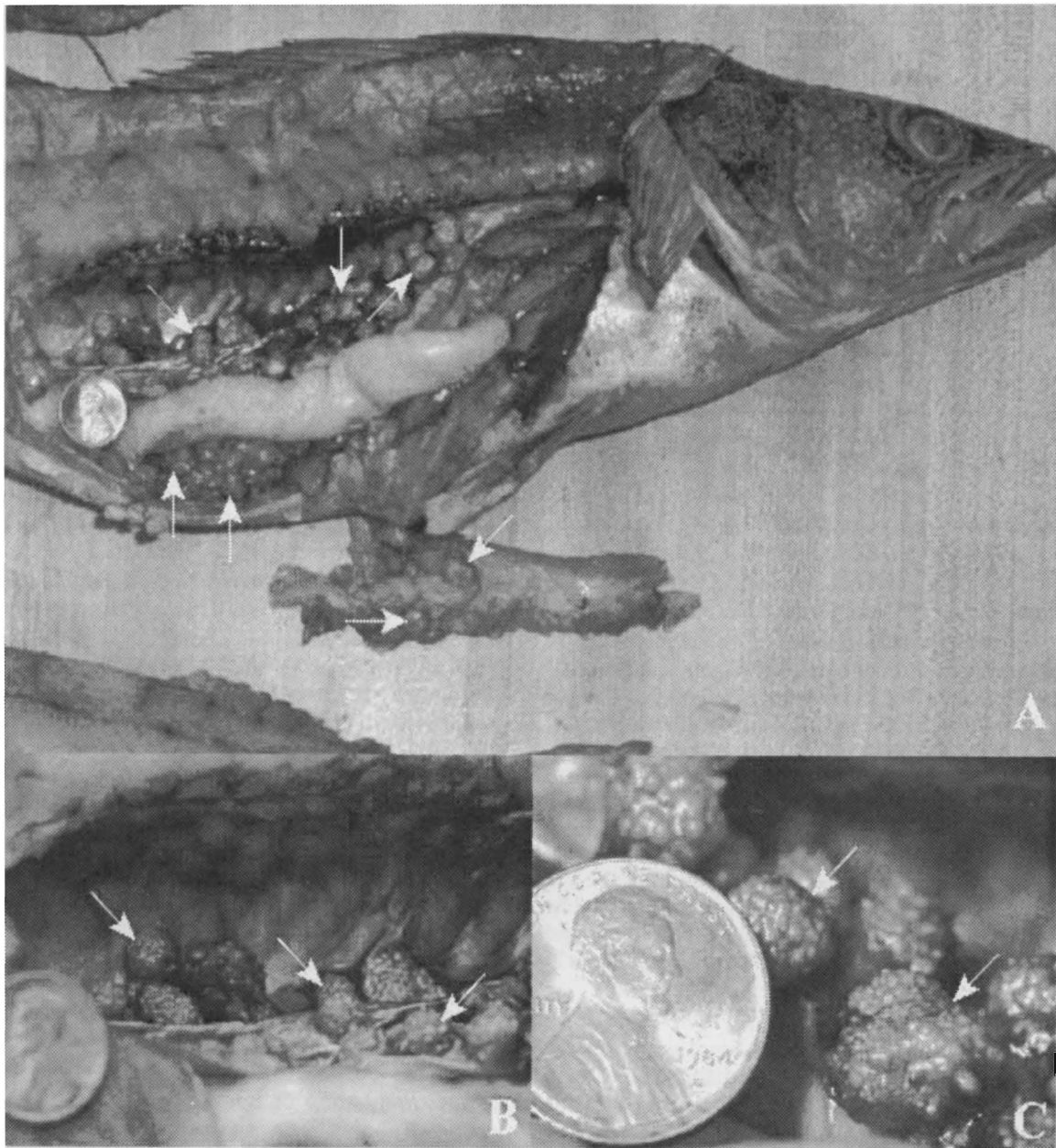
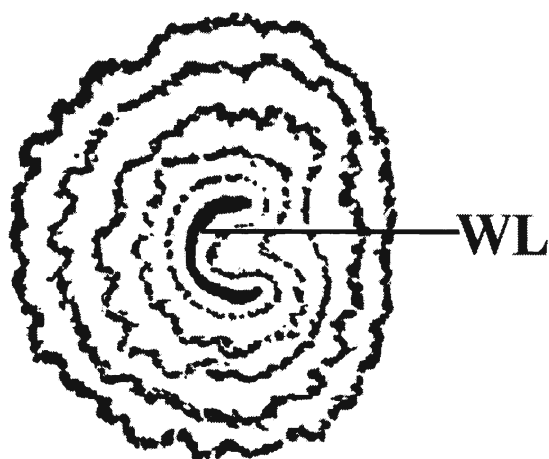


Figure 1. Five to 15 mm raspberry-like nodules found in the swimbladder and visceral fat of walleye (arrows point at nodules). A. View of nodules in swimbladder and on visceral fat. B. Nodules in the swimbladder. C. Close-up showing the numerous protuberances on the outer coat of nodules in the swimbladder.

There are at least 14 nematodes species reported from walleye (Hoffman 1999). One of these 14, *Cystidicola lepisostei*, we cannot find reported in other walleye literature however, it is interesting that other *Cystidicola* do parasitize the swimbladders of salmonids and some are known to be associated with swimbladder lesions. These lesions are described as raised ulcers (1-8 or 1-20 mm in diameter) sometimes encircled by hyperemic mucosa and occasionally with hard, ochre-colored material covering a central crater (Lankester and Smith 1980; Black 1984). The cause of these lesions, although associated with the nematodes, is listed as unknown. These lesion differ from what we

observed and more importantly *Cystidicola* spp. parasitize fish that are physostomous not physoclistous (walleye are physoclistous). Another nematode of the swimbladder, *Anguilla crassus* (an eel swimbladder nematode), is found in European zander *Stizostedion lucioperca*, a sister fish, but, instead of the formation of large hard nodules, an acute inflammatory response, fibrosis, and rupture of the swimbladder is reported (Haenen and van Blanning 1990; Moravec 1994).

The cause of the nodules that we report is also unknown, but if a worm-like parasite is involved nematodes are the most likely candidates. However, repre-



A

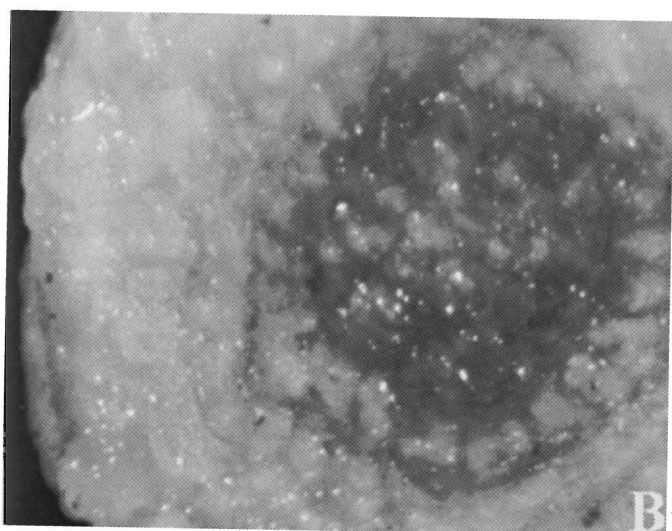


Figure 2. A. Original drawing from the 1990 diagnostic case of the cross-section of a walleye nodule showing a single non-living worm-like mass (WL) surrounded by several layers. B. Cross cut section of a nodule showing some of the layers of tightly packed granules and a centrally located amorphous mass.

sentatives from the trematoda, cestoda, and acanthocephala are also known to be encased in cysts in fish tissues (Hoffman 1999) so it is possible that one of these could have initiated the nodule formation.

In order to determine the cause of the nodules, fresh samples of fish with nodules in different stages of

development will be necessary. Also, histopathological section of the nodules might have produced evidence important in determining origin but no suitable samples are currently available. No additional cases have shown up since 1990. Personal contacts made with those who deal with walleye diseases have yielded no similar findings published or unpublished.

ACKNOWLEDGEMENTS

The authors wish to acknowledge Roger Herman of the National Fisheries Center in Leetown, West Virginia for the histopathological analysis of the worms and Andrew Goodwin, Jerry Ludwig, Joe Marcino, and James Miller for review of early drafts of the manuscript.

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