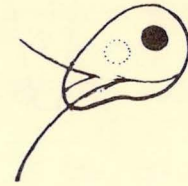


FISH
HEALTH
SECTION

AFS

NEWS
LETTER



Hoffman copy

received in June 1983

Volume 10, Number 3

Peter G. Walker, Editor

July-September, 1982

AMES MEETING SCRAPPED!

FHS MEETING CANCELLED MIDWEST WORKSHOP RESCHEDULED

Due to scheduling problems, money availability for travel and other influencing factors, the FHS/AFS meeting scheduled for April, 1983 in Ames, Iowa has been cancelled. It is anticipated that the FHS meeting will be rescheduled for June, 1984 at a site to be named later. This site will be announced by May, 1983 giving everyone ample time to request funds for attendance.

It is urged that the membership attend and support either the Midwest or Eastern Fish Health Workshops this year. At first scheduled to be held

concurrently with the FHS meeting, the 14th Annual Midwest Fish Disease Workshop has been rescheduled for July 6-7 in the St. Paul area (contact Ellis Wyatt for details). The Eighth Annual Fish Health Workshop will be held at Leetown, West Virginia on June 21-23 (contact Rocco Cipriano).

Any group of members or individuals who have an interest in hosting the 1984 FHS/AFS meeting should contact members of the FHS EXCOM as soon as possible.

We regret that this cancellation was made, but view it as the only viable alternative available at this time. Once again your support of the 1983 regional meetings is urged and your efforts and support to make our 1984 meeting the best ever is requested.

EMMETT'S FIRST ADDRESS

To: Membership of FHS/AFS

From: Emmett Shotts

I would like to thank the membership for the confidence they have expressed in my abilities by electing me as President of AFS. I only hope that my decisions and activities related to FHS/AFS issues will reflect the trust you have seen fit to delegate to me. In the next few paragraphs I would like to review some of the major issues and problems I have encountered in the past couple of months and my comments regarding them. If you don't like my position on some issue, let me know and I'll try to respond. Who knows, maybe we can compromise and have a stronger platform on an issue.

The best way to describe the latter days of July and the month of August was chaos! FHS/AFS reports for the AFS annual meeting were due on short deadlines, etc. The AFS EXCOM meeting at Hilton Head, SC was very enjoyable. I met a lot of new people and heard some new solutions to old problems. I have doubt, however, that my travel budget can stand the midyear AFS EXCOM meeting in conjunction with the 48th North American meeting on March 18-23 in Kansas City, MO. If any of the membership plans to attend this meeting, please contact me. I would like to get someone to attend the EXCOM sessions on March 22, 23 to represent Section interests.

The next issue is the committees. Unless you've heard from me on the appointed chairs of committees, your silence has meant you were willing to continue and I assume you are carrying on the business directed to your specific committee. The only exception to this is the Award Committee where I have asked previous recipients of the Snieszko Award to serve in the selection process. The elected committees are actively working. An issue related to the Technical Procedures Committee came up which was referred to them in its original form. Briefly a heated exchange regarding CCVD antibody procedures is involved. My own thoughts are that probably those using this procedure should, if need be, update and revise the copy currently in the *Blue Book* through the committee. I do not see a need for changing the title of the *Blue Book*, etc. This volume serves as a guide to work by, not a bible of undisputed accuracy. There are working copies of a

supplement for the *Blue Book* addressing certification procedures for coldwater fish which should be ready for inclusion this year.

When I was elected to this job, plans were already being made for a meeting in Ames, Iowa in April. Bill Klontz had suggested a *noninfectious* theme. The local group has been doing a good job, especially in local arrangements; however, after careful consideration and consultation, I have decided to *cancel* this meeting. My reasons are many, but they basically boil down to a matter of dollars and time. Considering the availability of funds for out-of-state travel and the time lag needed by many for approval, I suggest we plan a meeting for June, 1984 at a site to be announced by May, 1983. This will give everyone a chance to get their travel requests done and ample time to put on an excellent program. If any of you wish to put in a bid for the meeting site, please let the members of the FHS EXCOM know as soon as possible. If this delay makes you unhappy and you wish to express yourself, I'll be glad to discuss it with you in DETAIL.

I do not however feel that the lack of a meeting should affect FHS activities. I assume that a Snieszko Award recipient will be named if the committee sees fit and that the FHS membership will participate in local workshops. Two of these that I know about in the coming months are the Midwest meeting scheduled for July 6-7, 1983 in the Minneapolis/St. Paul area and the Eastern meeting scheduled for June 21-23, 1983 at Leetown, West Virginia (more details of these meetings are featured elsewhere in this newsletter).

Say, Pete is having trouble getting items for the Newsletter. We all agreed that we want a good Newsletter and that we wanted this format. So support the effort by sending items to Pete so we have enough meaningful material to print the issues on our time schedule. If we don't have items to print, then we don't print until we do!

I think money is about the only thing I haven't touched on. So, in ending this classic piece of literature, let me run this by the membership. After talking with John Plumb, he seems to think we'll be OK, but close, this year. Our biggest problem, of course, is that the members pay their dues to FHS through AFS and these come in as dribbles of cash all year as membership dues are paid. This of course makes projecting a budget hard. So, if nothing unforeseen arises, we're OK for now; but maybe we'll need an increase in dues next year. Who can say what the economy will do?!

This gives you an idea of what the pulse of the organization is at the present. If you have survived this onslaught of verbosity and think you might try another verse, look for my comments in the next Newsletter.

1983 Vol 11 didn't make it
FHS 1982 10(3)
Asian tape ident - p2 - p5
Schuyler

UPCOMING EVENTS

April 26-27, 1983. *The Annual Meeting of the Fish Health Section/AFS: The Role of Noninfectious Diseases in Fish Health Management*. Location: Iowa State University, Ames, Iowa. Contact: Dr. John Nickum, Iowa Cooperative Fishery Research Unit, Iowa State University, Science II, Ames, Iowa 50011.

May 1-4, 1983. *International Association for Aquatic Animal Medicine*. Location: Queensway Bay Hilton, Long Beach, California. Hosted by: Marineland, Rancho Palos Verdes, California. Contact: Don Dumwalt, P.O. Box 937, Rancho Palos Verdes, California 90270.

May 15-18, 1983. *39th Northeast Fish and Wildlife Conference*. Location: Mount Snow Resort, Dover, Vermont. Contact: Angelo Incerpi, Agency of Environmental Conservation, Fish and Game Department, State Office Building, Montpelier, Vermont 05602.

May 16-27, 1983. Short course: *Diagnosis and Treatment of Diseases of Warmwater Fish* (WL 4124/6124). Location: Mississippi State University, Starkville, Mississippi. Instructors: Dr. Thomas L. Wellborn, Jr. and Dr. Thomas E. Schwedler. Tuition: \$176.00. Application deadline: March 1, 1983. Contact: Dr. Thomas L. Wellborn, Jr., Mississippi Cooperative Extension Service, P.O. Box 5405, Mississippi State, Mississippi 39762.

May 16 - June 3, 1983. Three-week course: *The Culture of North American Molluscs* (principally oysters). Location: Malaspina College, Nanaimo, British Columbia, Canada. Tuition: \$200.00 plus board and room. Contact: Dr. William Pennell, Aquaculture and Fisheries Technology, Malaspina College, 900 Fifth Street, Nanaimo, British Columbia V9R 5S5, Canada.

May 22-27, 1983. *RNRF Symposium on the Application of Remote Sensing to Resource Management*. The Renewable Natural Resources Foundation and the American Society of Photogrammetry have scheduled the following daily tutorials: forestry, wildlife, range (May 23); environmental monitoring (May 24); law, vegetation damage (concurrent sessions on

May 25); water resources - hydrology, fisheries, coastal zone (May 26); and a study tour to Mt. St. Helens (May 27). Location: the Seattle Sheraton Hotel, Seattle, Washington. Contact: Robert B. Scott, Registration Chairman, Washington State Department of Natural Resources, Resource Inventory Section, Mail Stop QW21, Olympia, Washington 98504.

June 21-23, 1983. *Eighth Annual Eastern Fish Health Workshop*. Location: National Fish Health Research Laboratory, Leetown, West Virginia. Sponsors: the National Fish Health Research Laboratory of the U.S. Fish & Wildlife Service and the Oxford Laboratory of the National Marine Fisheries Service. Contact: Dr. Rocco C. Cipriano, National Fish Health Research Laboratory, USFWS, Box 700, Kearneysville, West Virginia 25430.

July 6-7, 1983. *14th Annual Midwest Fish Disease Workshop*. Location: Regency Plaza Hotel, Minneapolis, Minnesota. This meeting was rescheduled after originally being planned for Ames, Iowa on April 26-27, 1983. Contact: Ellis Wyatt, Department of Biology, 1536 Hewitt, Hamlin University, St. Paul, Minnesota 55104.

July 10-14, 1983. *Annual Meeting of the Western Division of AFS*. Location: Jackson Hole, Wyoming. Contact: Earl M. Thomas, Game and Fish Department, Cheyenne, Wyoming 82002.

August 14-20, 1982. *The 113th Annual Meeting of the American Fisheries Society*. Location: the University of Wisconsin at Milwaukee, WI. Contacts: (questions regarding the program) Charles C. Coutant, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830; (questions regarding facilities and meeting arrangements) Fred P. Binkowski, Center for Great Lakes Studies, University of Wisconsin-Milwaukee, P.O. Box 413, Milwaukee, Wisconsin 53201.

October 18, 1983 - May, 1984. Seven month in-residence long course: *Fish Health Management Long Course*. Location: National Fisheries Academy, Leetown, West Virginia. Twenty training slots (at least six will be filled by USFWS personnel). Fee for tuition, books and supplies: \$1,900.00

IDENTIFICATION OF THE ASIAN TAPEWORM

by Andrew J. Mitchell and Glenn L. Hoffman, Fish Farming Experimental Station, USFWS, P.O. Box 860, Stuttgart, Arkansas 72160.

The confirmatory diagnosis in the *Fish Health Blue Book* for *Bothriocephalus opsalichthydis* (formerly *B. acheilognathi*; *B. gowkongensis*) has been questioned by some of our members as to its adequacy. Some North American species including *Marsipometra*, *Glaridacris*, *Atractolytocestus*, *Schistocephalus* and *Eubothrium* species can on occasion be said to have a pit viper or pyramid-shaped scolex (head). To aid in the differentiation of these tapeworms, the following definition and key for *B. opsalichthydis* has been designed by (1) using several characters to build confidence in the identification; (2) using only those characters which can be discerned by simple observation; (3) using characters that differentiate it clearly from the above mentioned species as well as all other tapeworms; and (4) using the least variable and least confusing characters available.

We lean heavily on the morphology of the scolices for identification. Recently Dubnina (1980 *Parazitologicheskii Sbornik* 29:65-83; 1982 *Parazitologiya* 16(1):41-45) emphasized the importance of the scolices in identification and phylogeny.

We would emphasize that anyone who inspects for *B. opsalichthydis* should take the effort to obtain this worm and observe it live or at least preserved. One does not perform BKD or IPN inspections without first being trained in the proper techniques along with the observation of positive diagnostic results; and similarly for tapeworms. A multitude of questions and problems would be eliminated if our inspection personnel were more adequately trained in the look see area of parasitology. A gorilla and an orangutan are very similar in many respects, yet unique enough that one look tells you the difference. So is the case with many parasites including this worm. For those who have had occasion to study *B. opsalichthydis*, there is little chance that any mixup could occur.

Bothriocephalus opsalichthydis is a complete and distinctly segmented, thin tapeworm which can reach a length of over 50 cm, but is usually less than ten. Segmentation is evident on the worm at a length of 1 mm. *Atractolytocestus* and *Glaridacris* species are not segmented.

B. opsalichthydis has a flattened scolex (head) with two bothria (deep, elongated sucking grooves dorsal and ventral as seen in Fig. 1), no hooks, no spines, no suckers (sucking devices surrounded by a muscular fringe, usually circular as seen in Fig. 1) and no proboscides (short tentacles). In the lateral view (normal viewing position of the worm), the scolex takes a

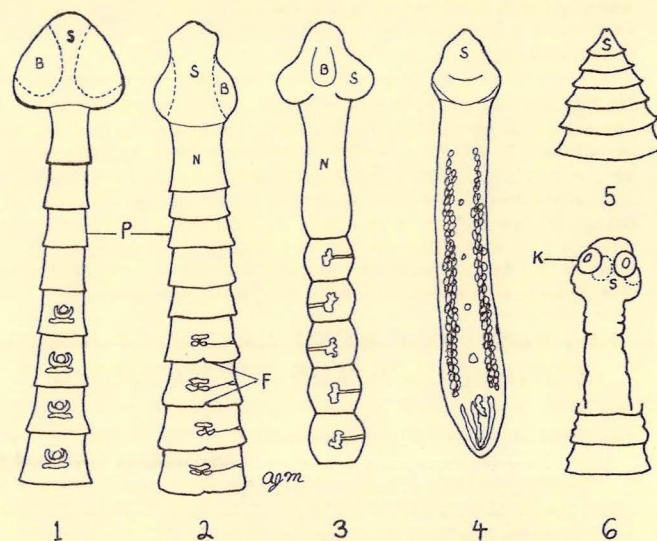


Figure 1. (1) *Bothriocephalus opsalichthydis*; (2) *Eubothrium salvelini*; (3) *Marsipometra parva*; (4) *Glaridacris laruei* (unsegmented); (5) *Schistocephalus solidus*; (6) *Proteocephalus ambloplitis*; B - bothria; F - furrow; K - sucker; N - neck; P - proglottid; S - scolex.

strong pit viper or arrowhead appearance when extended and a balled or fist-shaped appearance when contracted. The posterior portion of the scolex in the lateral view is about 3 to 3½ times the width of the first proglottid (segment) in both the extended and contracted positions. *Marsipometra*, *Eubothrium* and *Schistocephalus* species have scolices less than three times the width of the first segments.

B. opsalichthydis has no neck. The neck, which is present and very obvious on *Marsipometra* species and sometimes present on *Eubothrium* species, is a nonsegmented area posterior to the scolex, anterior to the first obvious segment and two to three times the length of those anterior segments (see Fig. 1).

B. opsalichthydis has no dorsal or median furrow. This furrow, present in *Eubothrium* spp., is not always clearly visible for the full length of the

An application consists of a resume, a statement of career goals and a description of the use to which this training will be put upon completion of the course. Contact: Wendell S. Ogden, Superintendent, National Fisheries Academy, U.S. Fish and Wildlife Service, Box 700, Kearneysville, West Virginia 25430. Telephone: 304-725-8461.

December 4-7, 1983. *45th Midwest Fish and Wildlife Conference*. Location: the Sheraton-St. Louis Hotel, St. Louis, Missouri. Contact: Ollie Torgerson, Missouri Department of Conservation, P.O. Box 180, Jefferson City, Missouri 65102.

The Fisheries Academy of the National Fisheries Center in Leetown, West Virginia is scheduling a variety of aquaculture-related short courses around the country during 1983. Included are the following:

May 9-13, 1983. *Introduction to Fish Health*. Location: Leetown, West Virginia. Closing date for application: 3/25/83. Tuition fee: \$100.00.

June 6-10, 1983. *Fish Genetics and Brood Stock Selection*. Location: Twin Falls, Idaho. Closing date for application: 4/22/83. Tuition fee: \$100.00.

July 18-22, 1983. *Warmwater Fish Culture*. Location: San Marcos, Texas. Closing date for application: 6/3/83. Tuition fee: \$100.00.

August 8-19, 1983. *Pacific Salmon Culture*. Location: Bellingham, Washington. Closing date for application: 6/24/83. Tuition fee: \$180.00.

September 12-16, 1983. *Warmwater Fish Culture*. Location: Orangeburg, South Carolina. Closing date for application: 7/9/83. Tuition fee: \$100.00.

September 12-23, 1983. *Coldwater Fish Culture*. Location: Twin Falls, Idaho. Closing date for application: 7/29/83. Tuition fee: \$180.00.

Two audio-visual training courses are now available in ¾-inch video tapes from the Fisheries Academy: *Fish Marking: Principles and Techniques* (43½ min.) and *Preparing Fish for Shipment to Diagnostic Stations* (16½ min.). The price for these tapes is \$30.00 each.

Application and order forms, a complete course catalog and further information can be obtained from: Fisheries Academy, National Fisheries Center-Leetown, P.O. Box 700, Kearneysville, West Virginia 25430.

DISEASES OF HATCHERY FISH NOW AVAILABLE FROM GPO

Up until this time, copies of the publication, *Diseases of Hatchery Fish*, have been available free of charge. However, due to recent increases in publicity, the supply of copies available for free distribution has been exhausted. To meet the continuing demand, the Government Printing Office in Washington, D.C. has printed a supply of these manuals and we are pleased to announce their availability. They may be obtained directly from:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Stock #024-010-00-622-6
Price: \$5.50 each

Submitted by: James W. Warren, Hatchery Biologist, Fish Disease Control Center, P.O. Box 1595, La Crosse, Wisconsin 54601.

worm, but with careful viewing, short sections of the furrow are definite. The furrow may appear as a small indentation on the posterior edge of several proglottids (see Fig. 1).

Other characters can be used, but are much less clear or involve staining and mounting of specimens. Two are mentioned here (see Fig. 2). The eggs of *B. opsalichthydis* are operculated, whereas those of *Marsipometra* and *Eubothrium* are not. In order to see this, one needs to observe several eggs (10 to 15) at about 400 power, vary the light intensity and maybe the operculum will show up on some of the eggs. This operculum occurs on the more pointed end of the egg which itself is not always obvious. Specimens can also be fixed, stained and mounted so that the internal structure is visible. *B. opsalichthydis* has a median genital pore (Fig. 2) while it is marginal for *Marsipometra* and *Eubothrium*.

KEY FOR THE IDENTIFICATION OF ADULT* *BOTHRIOCEPHALUS OPSALICHTHYDIS*

- 1a Nonsegmented or segmentation indistinct, internal or incomplete Amphiliidae, Gyrocotylidae, Caryophyllidae (including *Glaridacris*** and *Atractolytcestus***), Spathebothriidae, Pseudophyllidae (in part - various genera and species including *Ptychobothrium***) 2
- 1b Segmentation, complete and distinct 2
- 2a Scolex with 4 proboscides (short tentacles) Trypanorhyncha, Pseudophyllidae (mature *Haplobothrium* only) 3
- 2b Scolex without proboscides 3
- 3a Scolex with 4 bothria or 0-5 suckers Lecanicephalidae, Nippotaeniidae, Tetracyphallidae, Proteocephalidae 4
- 3b Scolex with 2 bothria, no suckers 4
- 4a Dorsal - ventral median furrow present *Eubothrium***, *Eubothriodes***, *** 5
- 4b Dorsal-ventral median furrow absent 5
- 5a Neck present Diphyllidae, *Marsipometra* 6

- 5b Neck absent 6
- 6a Scolex not pit viper, triangular, arrow or pyramidal shaped Pseudophyllidae (in part including native North America *Bothriocephalus*) species 7
- 6b Scolex pit viper, triangular, arrow or pyramidal shaped 7
- 7a Wide portion of scolex if less than 3, usually less than 2, times the width of the anterior segments *Fistulicola****, *Echinophallus****, *Schistocephalus* 8
- 7b Wide portion of scolex is 3 or more times the width of the anterior segments 8
- 8a Tapeworms of strictly marine fish *Anoncocephalus* 8
- 8b Tapeworms of freshwater fish ... *Bothriocephalus opsalichthydis* 8

* scolex characteristics are found in the juvenile and usually larval forms
** arrow or pyramidal shaped scolex in some species
*** marine hosts only

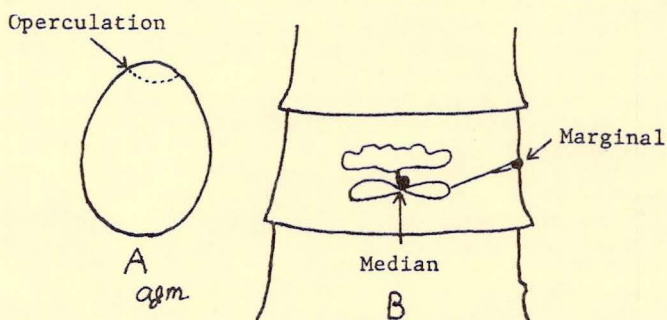


Figure 2. (A) operculated egg of *Bothriocephalus opsalichthydis*; (B) two locations for the genital pore.

USFWS CLEARS THE WAY FOR FORMALIN

The U.S. Fish and Wildlife Service has cleared the way for the lawful use of formalin in fish culture after nine years of intensive research that proves the compound can be used without harm to fish, consumers, or the environment.

"Fish culturists agree that it's almost impossible to raise important food and sport species such as catfish and trout without formalin to control external parasites and fungal infections," said Robert A. Jantzen, the Interior agency's Director. "Thus, our efforts to get this chemical registered have represented one of the Service's primary fishery research responsibilities for nearly a decade."

"This is a major accomplishment for the Service. Now that we have satisfied the stringent requirements of the Food and Drug Administration, formalin can be used for fish disease control by Federal and State hatcheries, as well as by the growing U.S. fish farming industry."

Formalin has been known to fishery experts since 1909, when it was used to control parasites on rainbow trout. In time, the compound became the most widely used chemical in the treatment of fish disease because of its versatility and effectiveness. Use of the drug was lawful until the Federal Food, Drug and Cosmetic Act was amended in 1972, to require registration of all drugs and chemicals used on food animals. After receiving a permit for experimental use, the Service undertook the necessary research to register formalin for fishery use. Now, formalin can be lawfully used by Federal, State, and private fish culturists to control parasites of trout, catfish, salmon, largemouth bass, and bluegills; and to control fungus on salmon, trout, and pike eggs.

"The Service's investment of \$500,000 in formalin research is money well spent," said Jantzen. "Federal and State hatcheries annually produce fish with a market value of \$7-10 million and \$17 million, respectively. In addition, fish farmers did almost \$400 million dollars' worth of business in 1981 as they helped meet the increasing demand for fish by nutrition-conscious Americans."

The most common external parasite that plagues fish is *Ichthyophthirius*, commonly known as "ich." Formalin can cure "ich," which can infect all freshwater species including home aquarium species — a \$60 million industry. All fish are more prone to disease after being handled, as their natural protective coating of slime is gone. Then disease can spread rapidly; for example, *Saprolegnia* fungi can infect and kill virtually all fish or eggs in an enclosure within 24 hours. Both *Saprolegnia* and *Ichtyobodo* ("costia"), which infects fish gills, can be successfully treated with formalin.

Formalin is a liquid formaldehyde solution which is heavily diluted for fish culture use. The standard concentrate is 37 percent formaldehyde, and it is further weakened to a fraction of its original strength before it is used on fish or eggs. The Service investigated possible hazards to fishery workers in the course of its research and found no problems when proper precautions were taken. Jantzen pointed out that recent concerns about urea formaldehyde insulation — which has been banned by the U.S. Consumer Product Safety Commission — do not apply to formalin since the liquid produces practically no vapor to be inhaled.

The Service's formalin-related research has been guided by the agency's National Fishery Research Laboratory at La Crosse, Wisconsin. Studies were designed to answer a broad range of questions about the possible drawbacks of its use. Potential side effects on fish that were ruled out included birth defects, cancer, and chromosomal damage that could cause mutants. Other research measured the amount of residue in treated fish, the compound's effects on plants, and chemical interactions with pollutants and other products in the water. According to Jantzen, no test ever showed that formalin was unsafe or ineffective when used as directed. As part of its efforts to get formalin registered as a fish disease control, the Service drafted instructions for its use for manufacturers to include as package inserts.

Since the Fish and Wildlife Service does not manufacture or sell formalin, qualified companies wishing to market the product for fishery use must file a New Animal Drug Application (NADA) with the FDA. However, interested firms will not be required to do any research and testing since they can refer to the FWS master file now on record at the FDA.

Formalin is the 34th compound to be made available to fish culturists for disease control, anesthesia, and other purposes. Sixteen compounds are currently being developed and pursued by Fish and Wildlife Service for registration.

"Most Service research for registration of compounds for fish culture is supported by limited Federal funds, so our emphasis must remain on a few high priority compounds that are directly related to the needs of fish hatchery managers and commercial culturists," said Jantzen. "In recent years the need for fish disease controls has led to cooperative agreements

between the Service and other Federal and state agencies, and with the chemical and drug industry, to share the workload and costs involved in registration."

The FDA published an official notice in the April 9, 1982, *Federal Register* that registration requirements for formalin had been satisfied by the Fish and Wildlife Service.

Released by James Davis, USFWS, Federal Building, Fort Snelling, Twin Cities, Minnesota 55111 and submitted by Dr. Fred P. Meyer, National Fishery Research Laboratory, P.O. Box 818, La Crosse, Wisconsin 54601.

FHS/AFS FINANCIAL REPORT 09-25-81 to 09-20-82

FHS/AFS General Account

Beginning balance			1,081.21
Credits:			
Membership dues	2401.28		
1981 meeting proceeds	1430.95		
Donation	25.00		
Transfer from certification account	201.00		
Transfer from FCS re 1982 meeting	445.37		
Sale of 1980 proceedings	14.99		
Interest	143.97	5,334.56	6,415.77
Debits:			
General administration	354.66		
Professional Standards Committee	240.04		
Membership & Balloting Committee	320.96		
1982 meeting expense	448.64		
Awards	57.53		
FHS display	704.37		
Newsletter	954.87	3,081.07	3,334.70

FHS/AFS Certification Account

Beginning balance			837.74
Credits:			
Donation	30.00		
Certification fee (1)	50.00		
Spplcation fee (21)	210.00		
Interest	38.72	328.72	1,146.46
Debits:			
Application forms	201.00	201.00	965.46

FHS/AFS Publications Account

Beginning balance			175.09
Credits:			
Interest	8.93	8.93	184.02
Debits:			
None			184.02

SUMMARY: FHS/AFS accounts

	09-25-81	09-20-82
General account	1,081.21	3,334.70
Certification account	837.74	965.46
Publications account	175.09	184.02
TOTAL ASSETS	2,094.04	4,484.18

Paul W. Janeke
Secretary-Treasurer

MAJOR FISH AND WILDLIFE SERVICE AQUACULTURE RELATED PUBLICATIONS

In the Fish and Wildlife Service there are numerous aquaculture-related publications. They cover a wide range of subjects. E.G., fish disease control methods, nutrition and diet, registration of fishery drugs and chemicals, improvement of cultural methods, genetics and breeding,

Tomont -- a cut of something
 Theront -- hunter
 Trophont -- feeder.

reuse and/or treatment of waste water, and evaluation of exotic species for aquaculture. The problem is not so much in finding information, as it is in knowing where to look for it. We hope this list will simplify the task.

Most of the following are available at no charge. A request for inclusion on mailing lists, additional information on availability, subscriptions (where applicable), etc., may be obtained by writing directly to the source office.

Editorial Office

U. S. Fish and Wildlife Service
 Aylesworth Hall, CSU
 Ft. Collins, CO 80523
 ...Fisheries and Wildlife Research
 ...Research Reports
 ...Resource Publications—Fish
 ...Technical Papers
 ...Sport Fishery Abstracts
 ...The Progressive Fish-Culturist

Technical Information Services

National Fisheries Center
 Box 700
 Kearneysville, WV 25430
 ...Fish Health News
 ...Fish Disease Leaflets
 ...List of Aquaculture Training Program
 ...List of Aquaculture Meetings
 ...Annotated Bibliography of Publications of the National Fisheries Center-Leetown 1972 - 1980 (In Press)
 ...Directory of Fish and Wildlife Service Aquaculture Capabilities (In Press)

National Fishery Research Laboratory-Lacrosse

P. O. Box 818
 LaCrosse, WI 54601
 ...Investigations in Fish Control

Scientific Publications Office

National Marine Fisheries Service, NOAA
 Room 336, 1700 Westlake Ave., North
 Seattle, WA 98109
 ...Special Scientific Report-Fisheries
 (Numerous F&WS Contributions)

Fish Farming Experimental Station

P. O. Box 860
 Stuttgart, AR 72160
 ...Third Report to the Fish Farmer
 (In Press)

Division of Hatcheries and Fishery

Resource Management
 U. S. Fish and Wildlife Service
 Washington, DC 20240
 ...Fish Hatchery Management (A Text)
 ...Fish Cultural Development Center Reference List
 ...Fish Hatchery Manual
 ...List of National Fish Hatcheries and Fishery Assistance Offices
 ...Fish Hatchery Biologist and Development Center Reports
 ...Propagation and Distribution of Fishes from National Fish Hatcheries...

Office of Extension Education

U. S. Fish and Wildlife Service
 Washington, DC 20240
 ...Manual for Baitfish Culture in the South

NOTE: Back issues of many service series publications are available from The Publications Unit, U. S. Fish and Wildlife Service, Washington, DC 20240.

Technical Services Staff
 National Fisheries Center
 U. S. Fish and Wildlife Service
 Box 700
 Kearneysville, WV 25430

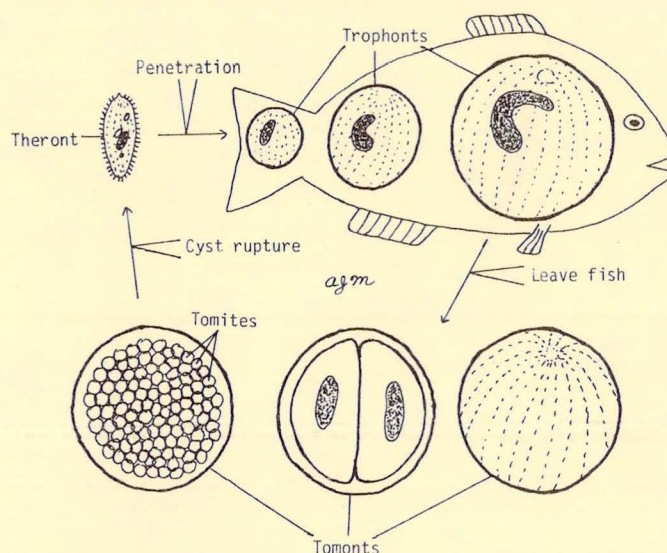
ICHY TERMS

Submitted by Andrew J. Mitchell and Glenn L. Hoffman, Fish Farming Experimental Station, USFWS, P.O. Box 860, Stuttgart, Arkansas 72160.

Questions concerning the proper terminology for the life stages of *Ichthyophthirius multifiliis* have been raised by some. To answer these questions we consulted the works of two leading protozoologists (reference given below) who are considered experts on Ich. A basic agreement of terms was found, but clear-cut definitions of the life cycle stages were not. No precise definitions of the theront, tomont, etc. were found. Terminology such as protomont, trophotomont and therotroph used in Canella's work further reflects the lack of clear beginning or ending points for particular life stages. Similar problems, of course, are common in the life stages of other animals; i.e. at what point does a cercaria become a metacercaria? With these problems left unresolved and maybe never to be resolved, we proceed to make the muddy waters as clear as possible with the accompanying figure and definition. These interpretations are subject to the normal, ever changing, development and sophistication of all terminology.

The *theront* is the small, free living, elongated stage possessing a perfortorium (small, beak-like protrusion) which penetrates the skin or gills of a fish. A very short time after penetration it rounds up and starts feeding. This rounded, feeding, growing, motile stage while in the fish is called a *trophont*. When the fully grown trophont leaves the fish and forms a cyst on the substrate, it is called a *tomont*. The tomont undergoes many divisions (multiple fission) with the resulting small, round cells being called *tomites*. The last division results again in the elongated, infective theront. The theronts rupture the cyst, swim out and seek a fish. Premature rupture of the tomont can cause the release of free tomites which will die.

The Life Cycle of *Ichthyophthirius multifiliis*



The Greek origin of these words may help: *ther* = small animal; *troph* = one who feeds; *tom* = cut (*tomont* = a large cut, *tomite* = a little cut).

References:

- Canella, M.F. and I.R. Canella. 1976. *The Biology of the Ophryoglenina (Histophagous Hymenostome Ciliates)*. Universita degli Studi di Ferrara. 510 pp. Translated for the National Science Foundation and the U.S. Department of the Interior (F&WS) by the Agence Tunisienne de Public-Relations-Tunis-Tunisia.
- Ergens, R. and J. Lom. 1970 *Puvodci Parasitarnich Nemoci Ryb* (Primary Parasitic Diseases of Fishes). Academia Praha. Nakladatelstvi Ceskoslovenske Akademie Ved. 383 pp.

KLONTZ KOURSE REVISITED

Those of us who had the pleasure of attending his short course at the University of Maine nine years ago, eagerly looked forward to the return of the University of Idaho's Dr. G. W. "Bill" Klontz. On August 1-6, 1983, Bill presented his updated *Intensive Coldwater Aquaculture and Fish Health Management Short Course* at Unity College in Unity, Maine. None of us were disappointed.

As always, his lectures were liberally spiced with scores of fish culture tips - some of which brought even the *old timers* to the edges of their seats. But more significant are the great strides that Klontz and his students have made toward a unified, comprehensive approach to aquaculture. By defining the myriad interacting factors that affect salmonid productivity, Dr. Klontz has produced a computerized model with which to study and ultimately refine the science. This plus Bill's well-organized and highly entertaining style made the Klontz Kourse well worth taking in.

PGW



GAS SUPERSATURATION IN HATCHERIES WORKSHOP PLANNED

The Bio-Engineering Section of the American Fisheries Society is planning a one day workshop on gas supersaturation during the annual meeting of the American Fisheries Society on August 14-20, 1983 in Milwaukee. The purpose of the workshop is to provide practicing fish culturists and engineers with current information on the causes, effects and solutions to gas supersaturation problems in aquatic culture systems. The workshop will be conducted as a training course and a workshop syllabus will be prepared. Emphasis will be placed on the effects of low level gas supersaturation and development of criteria for hatcheries. Dissolved gas criteria designed to protect migrating salmonids are totally inadequate to protect hatchery fish. Many health problems in hatcheries may be caused by chronic exposure to low levels of gas supersaturation.

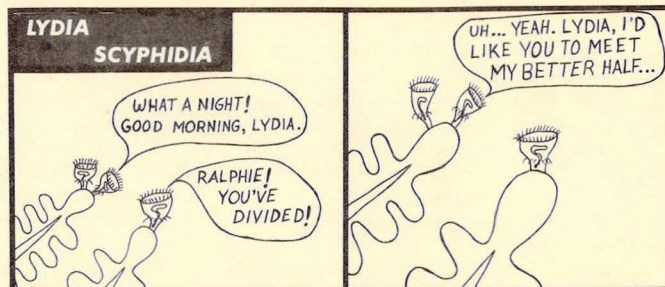
This workshop will be organized into the following topics:

- Physics of Gas Supersaturation
- Measurement of Gas Supersaturation
- Source of Gas Supersaturation
- Effects of Gas Supersaturation
- Removal of Gas Supersaturation
- Current Research and Experience
- Research Needs

Manufacturers of gas supersaturation instrumentation will be invited to demonstrate their equipment. People interested in presenting papers or serving on the steering committee should contact:

John Colt
1303 Lake Blvd.
Davis, California 95616
(916) 756-3558

Attendees of Dr. Klontz's Unity College short course. Front row (left to right): Everett McLaughlin, Norm Philbrick, Mike Duni, Dennis McNeish, Allen Messer, John Veader, Roger Rulifson, Anne Tomalonis; back row (standing): Pete Walker, Larry Burton, Travis Wagner, Mike Boyer, Tom McLaughlin, Jim Lucas, James Tomalonis, Jeff Barrett, Wayne Stempler, Patty Laberge, Chris Hoffman, Lilla Stutz, David Dropkin, Dianne Rennie, Steve Wilson, Kevin Currie, Bill Klontz.



NEWSLETTER ITEMS

Got something to report? We'd sure like to hear from you. Please send items for publication in the *FHS/AFS Newsletter* to:

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