

FISH HEALTH NEWSLETTER

American Fisheries Society/Fish Health Section

Volume 32

Number 3

November 2004

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President's Report: **President's Report**

The Fish Health Section was the first special-interest section established by the American Fisheries Society, and it continues to be one of the most active units of the AFS. There are numerous reasons to have a FHS, and many of these relate to enhancement of communication among professionals and students.

The FHS has three lines of electronic communication for members. The Newsletter (if you are reading this, you obviously know about the Newsletter) is edited by Lora Petrie-Hanson. Publishing a Newsletter was one of the original objectives of the FHS and the Newsletter was once mailed to members. Now the newsletter is published electronically and is available from another arm (fin?) of the FHS communication team, our website. Ben LaFrentz is our new website editor, and when you downloaded this issue of the Newsletter, I'm sure you noticed the revised format for the website. The FHS also has a listserv that delivers FHSupdates to your email inbox. Jerri Bartholomew prepares the FHSupdates, but they can only be delivered if your email address is correct. If your email address changes, please send your new address to Jerri (jerri.bartholomew@oregonstate.edu) and also update your address on the AFS membership directory (<http://portaltools.fisheries.org/PortalTools/Directory/Index.cfm>). To get full benefit from your FHS membership, you need to use all of the FHS communication tools: Newsletter, Website, and Listserv.

Another aspect of FHS communication is the *Journal of Aquatic Animal Health*. One of the lesser-known benefits of AFS membership is waiver of page charges in the *Journal of Aquatic Animal Health*. Page charges are \$75 per printed page, but our members can request partial or full subsidy of page charges if grant or agency funds are unavailable. Manuscript reviews are unaffected by a need for subsidy. With the electronic review system and the change to dating articles when they become available on-line (beginning in 2005), publication in the *Journal of Aquatic Animal Health* is affordable and rapid.

The highlight of the FHS year is always the FHS annual meeting. For 2004, the FHS annual meeting was held 26-28 July in Shepherdstown, West Virginia. Vicki Blazer did an outstanding job organizing the meeting. John Schachte received the Snieszko Distinguished Service Award, the highest award presented by the FHS. A Special Achievement Award was presented to Steve Kaattari for his service as an editor of the *Journal of Aquatic Animal Health*. A Special Achievement Award was also presented to the Eagle Fish Health Lab of the Idaho Department of Fish and Game for their work in resolving problems with the ELISA for bacterial kidney disease. Snieszko Student Travel Awards were presented to Leslie Grabowski, John Drennan (both from U. of Idaho), and Shasta McClenahan (Auburn University). The Best

Student Paper award was won by Deborah Cartwright, a student at the University of Georgia conducting research at the Leetown Fish Health Lab. After the annual meeting, the continuing education committee presented a workshop on Fish Parasitology.

Fish health was also an important part of the 2004 American Fisheries Society meeting, held 21-26 July in Madison, Wisconsin. Sue Marcquenski chaired an outstanding session on fish health. A workshop on FDA approval of new drugs for fish was presented by Roz Schnick, with an emphasis on Aqu-S. At the business meeting, the award for the Best Paper in the *Journal of Aquatic Animal Health* for 2003 was presented to Mathew McEntire, Luke Iwanowicz, and Andrew Goodwin for their paper entitled: Molecular, Physical, and Clinical Evidence that Golden Shiner Virus and Grass Carp Reovirus Are Variants of the Same Virus.

During the AFS meeting, a reduced price for dues was approved for members from developing countries. For \$5, a citizen of a developing country can be a member of AFS and receive all benefits of membership except the subscription to *Fisheries* (the fee is \$25 with *Fisheries*). This will in turn make a membership in the FHS more affordable; total cost of a membership in FHS (including AFS dues) will now be only \$20, less than one-fifth of the previous cost. Students from developing countries will pay only \$12 for membership in both the FHS and AFS. I encourage you to spread this news to your colleagues in developing countries.

The 2005 FHS annual meeting will be in Minneapolis, Minnesota. This meeting promises to be another great FHS event, and a continuing education workshop will be held after the meeting. Details about the FHS annual meeting are included in this Newsletter. It's time to start planning your trip to Minnesota for July 2005 (don't worry, most of the snow will be melted by then).

John Grizzle

Fish Health Section Standing Committees 2004-05

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John Grizzle, President	334-844-3474	844-9208	jgrizzle@acesag.auburn.edu
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Ken Cain, Secretary/Treasurer	208-885-7608	885-9080	kcain@uidaho.edu
Scott Foott, Chair Professional Standards	530-365-4271	365-7150	scott_foott@fws.gov
Diane Elliott, Chair Technical Standards	206-526-6282	526-6654	diane_elliott@usgs.gov
Non-voting			
Chairs of other committees			
Editors of JAAH			
Editors of Newsletter			
Standing Committees			
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Dave Groman	902-566-0864		groman@upei.ca

Website

Benjamin LaFrentz, website editor	208-885-5018	885-9080	lafrentz@uidaho.edu
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Meetings and Workshops:

Fish Histology and Histopathology

Final Announcement

Course Description: This intermediate course provides training in histology and histopathology of fin fish. Tissue collection, processing, and staining are discussed, with emphasis on how they may differ from mammalian techniques. The course instructors utilize salmon and trout as models to illustrate normal fin fish histology and tissue response to infectious and non-infectious agents. Examples from other fish species are also included. Tips on digital photography of histology slides are also provided.

Course Instructors: Jerry Heidel (OSU), Charlie Smith (Rangen, Inc.), Vicki Blazer (USGS), Elizabeth MacConnell (USFWS), Marilyn Blair (USFWS), John Morrison (USFWS) and Sonia Mumford (USFWS)

Online Registration is available at National Conservation Training Center Website: <http://training.fws.gov>

For further information about course content, etc., contact Sonia Mumford at sonia_mumford@r1.fws.gov or call (360)753-9046.

Location: Olympia, WA

Dates: January 24 - 28, 2005

Course Code: FIS1350

Cost: \$850

Closing Date for Registration: November 24, 2004

College Credit is available through Shepherd College

Depending on specific the state, veterinary continuing education credits are available, please inquire at least one month prior to the course

2005 Annual Meeting of the Fish Health Section/American Fisheries Society. The 2005 Annual Meeting of the Fish Health Section/American Fisheries Society will be held in Minneapolis, MN during 27-29 July 2005. Registration will be held on the evening of Tuesday 26 July. A Continuing Education session is being planned for Saturday 30 July. The meeting will be held at the Ramada Inn Airport at the Mall of America. This location is 2 miles from the Minneapolis/St. Paul International Airport. Complementary shuttle service to the motel is available as is complementary shuttle service to the Mall of the America, located approximately 0.5 miles from the motel. Attendees are encouraged to mention the Fish Health Section Meeting when they book their rooms at the motel, as a block of rooms has been set aside. Additional information on the meeting location may be found at the motel web site: http://www.ramada.com/Ramada/control/Booking/property_info?propertyId=14208&brandInfo=RA The host for the meeting is Joe Marcino (joe.marcino@dnr.state.mn.us). The scientific program is being organized by Paul Bowser (prb4@cornell.edu). For further information and instructions for abstract submissions will be posted on the Fish Health Section Web Site.

First Announcement: 6th Symposium on Diseases in Asian Aquaculture (DAAVI)

The Fish Health Section (FHS) of the Asian Fisheries Society is proud to announce the "6th Symposium on Diseases in Asian Aquaculture (DAA VI)" with the theme "Aquatic Animal Health – Facing New Challenges" to be held on 25-28 October 2005 in Colombo, Sri Lanka. A workshop, a training course, an expert consultation and the 7th Triennial General Meeting (TGM-7) of FHS are being planned in conjunction with DAA VI. Details will be made available through a dedicated website to be launched in October.

Five previous Symposia (Bali – 1990, Phuket – 1993, Bangkok – 1996, Cebu – 1999 and Brisbane – 2002), each brought together more than 200 aquatic animal health scientists, students, government researchers and industry personnel from some 30 countries to discuss disease related problems affecting aquaculture production and to find solutions for them. Please visit the FHS website at <http://afs-fhs.seafdec.org.ph/> for more detailed information about the society and DAA.

Expressions of interest to participate or request for inclusion in the mailing list may be sent to Dr. Melba B. Reantaso at Melba.Reantaso@fao.org using the subject: DAA VI.

Workshop: Antibiotic Resistance in Asian Aquaculture Environment

Chiang Mai, Thailand

24-25 February 2005

Expression of interest and abstract deadline: 30 September 2004

(Acceptance notification by 30 November 2004)

Registration deadline: 15 December 2004

Paper submission deadline: 15 January 2005

For further information, contact:

Dr. Supranee Chinabut

Department of Fisheries

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THAILAND

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Website: www.medinfo.dist.unige.it/Asiaresist/Workshop

Announcements:

**JOHN L. FRYER MEMORIAL LECTURE
AND RECEPTION**



December 10, 2004
LaSells Stewart Conference Center
Oregon State University
Corvallis, Oregon 97331

John Louis Fryer
July 4 1929 – August 31, 2004

A memorial lecture and reception to honor the life of John L. Fryer will take place at the LaSells Stewart Conference Center on the campus of Oregon State University beginning at 4:00 pm on December 10, 2004. The memorial lecture will be given by Dr. Rita Colwell, past Director of the National Science Foundation and a close friend of John and his family. A reception will follow the lecture and begin at approximately 5:00 pm at the same location. The reception will honor the many aspects of Dr. Fryer's life including remarks from his family and from military and academic colleagues. The reception will include ample time for all participants to share in informal exchanges about their memories of John Fryer. Food and beverages sufficient for the evening meal will be served during the reception.

Tentative Schedule of Events

- 1:30 pm Building dedication ceremony at Salmon Disease Laboratory
- 3:45 pm Attendees begin to arrive at LaSells Stewart Conference Center
- 4:00 pm Memorial Lecture "The Future of Marine Biotechnology" – Dr. Rita Colwell
- 5:00 pm Reception

If you plan to attend the Reception, please R.S.V.P by November 22, 2004 by contacting: Dr. Jerri Bartholomew, Dept. of Microbiology, Nash Hall 220, Oregon State University, Corvallis, Oregon 97331. Fax: 541 737-0496; email: jerri.bartholomew@oregonstate.edu

Update: Journal of Aquatic Animal Health

At the recent AFS-FHS and AFS meetings a number of items concerning the Journal of Aquatic Animal Health were discussed.

- 1) It was suggested and both editors are agreeable that we institute a new category of manuscripts – case reports. These would be short communications describing new diseases, histological findings etc. that have not been experimentally studied or perhaps even identified, but that may be important observations to share.
- 2) Issues have been late due to lack of submissions, timely returns of revisions etc., however will soon be caught up.
- 3) Beginning in January 2005, AFS publications will go to online publication. More on this will be released by the AFS Editorial office soon. Subscribers to a particular journal will have online access and will continue to receive the paper copy as well. Papers will be published online as they are completed and so publication will be considerably faster and will primarily depend on the author's time to revision and returning page proofs. Papers will be paginated and published online as they are completed. Hence, they will be fully citable. When an issue is filled the paper copy will be printed.
- 4) Authors concerned with page charges should remember that members of AFS and/or the FHS can request a waiver of page charges and to our knowledge this request has never been turned down.

AquaVet® I Course Announcement

We are please to announce that *AQUAVET*® I – An Introduction to Aquatic Veterinary Medicine will be offered by *AQUAVET*® in 2005. The course is designed for veterinary students and veterinarians who have an interest in applying their veterinary training to aquatic animals. The course will be presented at the Marine Biological Laboratory in Woods Hole, Massachusetts. The course dates are May 15 – June 11, 2005. The combined tuition, room, and board fee for the 4 week course has been set at \$1,600 for full time veterinary students, and at \$2,800 for veterinarians. Through the generosity of a program benefactor, a \$200 scholarship will be applied to partially off set the fee for all full time veterinary students resulting in a net tuition of \$1,400 for such accepted full time veterinary students this year.

In addition, we anticipate a limited number of summer research opportunities during an 8 week period following the course. Students selected as *AQUAVET*® Summer Research Fellows are not required to pay tuition or room and board fees for the 8 weeks of the research program itself. In addition, research students will receive a stipend of \$1,000 for the research period. At least one Fellowship will be restricted to aquaculture related projects.

Detailed information about the course is available on our web site. Applications for admission will be due on January 15, 2005 and may be obtained by accessing the program web site from which the application form may be downloaded for completion and submission by mail. On line applications will not be acceptable. Please visit our web site at:

Please note that "AQUAVET I - An Introduction to Aquatic Veterinary Medicine" is designed primarily for veterinary students. "AQUAVET II - Comparative Pathology of Aquatic Animals" is a histopathology course that would be appropriate for veterinary students and graduate students with a background in aquatic animal health as well as individuals who are currently actively involved in aquatic animal health as a part of their employment.

AquaVet® II Course Announcement

We are please to announce that an advanced course in Comparative Pathology of Aquatic Animals will be offered by *AQUAVET*® in 2005. This course will be oriented toward the pathology of vertebrates and invertebrates: commonly used as laboratory animals; encountered in display aquaria; and of importance in aquaculture enterprises. Representative species from each category will serve to demonstrate features of commonly observed diseases. The course is designed for veterinary students and veterinarians who have participated in *AQUAVET*® I or have had comparable experiences in aquatic animal medicine and pathology. The course will be presented at the Marine Biological Laboratory in Woods Hole, Massachusetts. The course dates are May 15 - May 28, 2005. The combined tuition, room, and board fee for the 2 week course has been set at \$900 for full time veterinary students and at \$1,500 for veterinarians.

In addition, we anticipate a limited number of summer research opportunities during an 8-10 week period following the course. Students selected as *AQUAVET*[®] Summer Research Fellows are not required to pay tuition or room and board fees for the 8-10 weeks of the research program itself. In addition, research students will receive a stipend of \$1,000 for the research period. At least one Fellowship will be restricted to aquaculture related projects.

Detailed information about the course is available on our web site. Applications for admission will be due on January 15, 2005 and may be obtained by accessing the program web site from which the application form may be downloaded for completion and submission by mail. On line applications will not be acceptable. Please visit our web site at: <http://www.aquavet.info>

Bacteria from Fish and Other Aquatic Animals: A Practical Identification Manual

Nicky B Buller, Animal Health Laboratories, Department of Agriculture,
Western Australia

For researchers and diagnostic laboratories in veterinary science, aquaculture and related aquatic sciences, and microbiology this is the only published text available where all relevant material is referenced together.

Including 16 pages of colour plates to aid identification.

This manual enables the isolation and identification of bacteria that are found in aquatic animals (particularly fish). The emphasis is on bacteria from farmed aquatic animals (fish, molluscs and crustacea) but some attention is also given to other marine and freshwater animals such as mammals and birds, both captive (as in zoos) or wild, as well as aquarium fish.

From the Foreword:

"Assembling this manual was a monumental task and its author, Nicky B Buller, is to be highly commended for providing this invaluable addition to aquatic microbiology" J A Plumb, Auburn University, Alabama, USA

Publication Date: February 2004

Number of Pages: 352 Pages

Binding: Spiral Bound

ISBN: 0851997384

Price: £65.00 (US\$120.00) – Available from a variety of sources including CABI Publishing, Amazon.com

Anatomy and Histology of the Channel Catfish

This book was published by Auburn University in 1976 and has been reprinted in a CD version that will be sold through the AFS Bookstore (<http://www.fisheries.org/html/publications/catbooks/x70902.shtml#Summary>). Price for AFS members is \$29.00 and for nonmembers is \$32.00. For additional information contact John Grizzle, grizzjm@auburn.edu.

Aquatic Living Resources: Special Issue on Bivalve Diseases

This special issue (Vol. 17, N°4, 2004) is devoted to Bivalve Diseases and includes recent insights and future trends about viruses, perkinsosis, marteiliosis, vibriosis, bacterial diseases, MSX disease, and microcell parasites. For more information on content and ordering, visit the following web site: <http://cva.iim.csic.es/publicacion/arl/bivalvediseasesinfodiscount1.pdf>.

New Risk Analysis Documents Dealing With Aquatic Animal Movement Are Available From APEC (Asian-Pacific Economic Cooperation) Fisheries Working Group

http://www.apec.org/apec/publications/all_publications/fisheries_working.html

Manual on Risk Analysis for the Safe Movement of Aquatic Animals, May 2004

This Manual was prepared as an output of the Asia-Pacific Economic Cooperation (APEC) Fisheries Working Group (FWG) project APEC FWG 01/2002 "Capacity and Awareness Building on Import Risk Analysis (IRA) for Aquatic Animals." The manual specifically addresses the risks associated with spread of aquatic animal pathogens with movement of live aquatic animals and their products.

APEC# 203-FS-03.1, ISBN974-92182-4-8, 74pp

PDF Downloads [300KB]

Capacity and Awareness Building on Import Risk Analysis (IRA) for Aquatic Animals, Proceedings, May 2004

The project's purpose was to strengthen and facilitate trade in aquaculture products in the APEC Region and improve public health protection in APEC economies through improving human capacity, standardizing approaches, and establishing networking that will facilitate exchange of information, experience and expertise. This report, which contains 26 technical presentations, is divided into four parts: (a) Background for Risk Analysis, (b) The Risk Analysis Process, (c) Risk Analysis and the World Trade Organization: Economies Experiences and (d) Strategies for Aquatic Animal Health.

APEC#203-FS-01.2, ISBN974-92215-1-6, 221pp, PDF Downloads [1.32MB]

First Report of Koi Herpesvirus in Wild Common Carp in the Western Hemisphere

Jeffery S. Terhune¹, John M. Grizzle¹, Karl Hayden¹, Shasta D. McClenahan¹, Scott D. Lamprecht², and Miller G. White²

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Koi herpesvirus (KHV) is a recently discovered virus infecting koi and common carp *Cyprinus carpio* (Hedrick et al. 2000; Gilad et al. 2002). Most cases of KHV disease have been reported in the ornamental fish industry and farmed common carp, but KHV has been reported in wild populations of common carp in the United Kingdom (Denham 2003) and Japan (Sano et al., in press).

During April and May 2004, thousands of wild common carp died in the Santee-Cooper Reservoir system in South Carolina. Dead common carp were observed over a distance of more than 72 km in both Lake Marion and Lake Moultrie, which comprise the 60,000-ha Santee-Cooper Reservoir system, and below the reservoirs in the Santee River. The only species that appeared to be affected was common carp, and most dead fish were over 2 kg. Moribund fish were rarely observed, but between May 5 and May 28, 2004, 3 live common carp were captured having ventrally located reddened areas of skin and severe necrosis of the gills in all fish. Temperature at the collection sites ranged from 24-26°C. There were no indications that pollutants or low concentrations of dissolved oxygen were contributing factors.

The first fish was collected by electrofishing on May 5 in the vicinity of the original reported mortalities in the Santee River. Fish 2 was a moribund fish collected by dip net on May 25 independent of electrofishing activities in the reservoir. These fish were shipped on ice to Auburn University; fish 1 was necropsied 48 h after collection and fish 2 was necropsied 1 day after collection. Fish 3 was also collected by electrofishing on May 28 in the same area where fish 2 was found. The fish was placed on ice and necropsied at the Dennis Wildlife Center, Bonneau, SC, about 9 h after collection. For fish 3, samples for bacteriology were refrigerated and samples for virology were frozen in Hanks' balanced salt solution until June 1.

Flavobacterium columnare was observed in wet mount preparations and also isolated on Hsu-Shotts agar from gill samples of all fish. Liver, spleen, and trunk kidney from all fish were streaked onto BHI agar and Hsu-Shotts agar; bacteria isolated were *Pseudomonas putrefaciens* and *Serratia* sp. from fish 1, and *Flavobacterium columnare* from the spleen of fish 3. No bacteria were isolated from internal organs of fish 2.

No histological lesions were observed in the liver, spleen, and trunk kidney of fish 2 and fish 3. Gills were examined only from fish 3, and they had severe necrosis of the epithelium in association with filamentous bacteria and inflammation in deeper portions of the gill filaments. Fish 1 was not examined histologically.

Samples of spleen and trunk kidney from fish 1 were homogenized together, filtered, and the filtrate used to inoculate fathead minnow (FHM) cells, epithelioma papulosum cyprini (EPC) cells, and koi fin (KF-1) cells. Spleen and trunk kidney from fish 2 were homogenized separately, filtered and used to inoculate cell lines as above. Spleen and trunk kidney from fish 3 were homogenized separately and incubated on FHM and EPC cell lines only. Cells were incubated at 20°C for 7 d (fish 2), 14 d (fish 1), or 21 d (fish 3). For all samples, the initial cell culture results were negative for cytopathic effect (CPE). A blind passage was performed for each sample on the same cell lines. A second, third, and fourth blind passage was also performed for each sample on KF-1 cells only, but no CPE was observed.

Spleen and trunk kidney from each fish (pooled for fish 1) and gill from fish 2 were tested for KHV with a polymerase chain reaction (PCR) assay as described by Gray et al. (2002). A negative control common carp was collected from the Auburn University Fisheries Research Station, Auburn, AL, and positive control KHV DNA was provided by A. Goodwin (University of Arkansas at Pine Bluff, Pine Bluff, AR). All samples from the 3 fish collected during the outbreak were positive for KHV, but the band was weak for the spleen of fish 2 (Figure 1). The negative control fish was negative in the PCR.

To our knowledge, this is the first report of KHV in wild common carp other than in the UK and Japan. However, the role that KHV played in this fish-kill is uncertain. Histological lesions characteristic of KHV disease (Hedrick et al. 2000; Perelberg et al. 2003) were not observed in any of the fish. *Flavobacterium columnare* was observed in both wet mounts and histological preparations of gills. Additionally, *F. columnare* was isolated on agar plates from both from the gills and internal organs. It is possible, however, that branchial necrosis may have initially been caused by the virus and provided a site for bacterial colonization.

Cell culture assays did not detect virus in the fish collected. However, the cell culture results may have been compromised because of the length of time between collection and inoculation of cell lines for fish 1 and 2 and freezing of the organs from fish 3 (A. Goodwin, personal communication, University of Arkansas at Pine Bluff, Pine Bluff, AR). Alternatively, the concentration of virus could have been below detectable levels for cell culture techniques.

It is plausible that a synergistic effect between KHV and columnaris disease was the cause of mortality. This hypothesis is suggested due to the magnitude of the die-off which is unusual for columnaris disease in a wild population. Also, the only fish species reported to be affected was the common carp, which is consistent with reports that other species are resistant to KHV (Perelberg et al 2003).

How and when KHV was introduced to this reservoir system is unknown. Based on these findings and the reports from other countries, wild populations of common carp seem to be at risk for infection by KHV. This could have an economic impact where common carp have recreational value or are harvested commercially.

References

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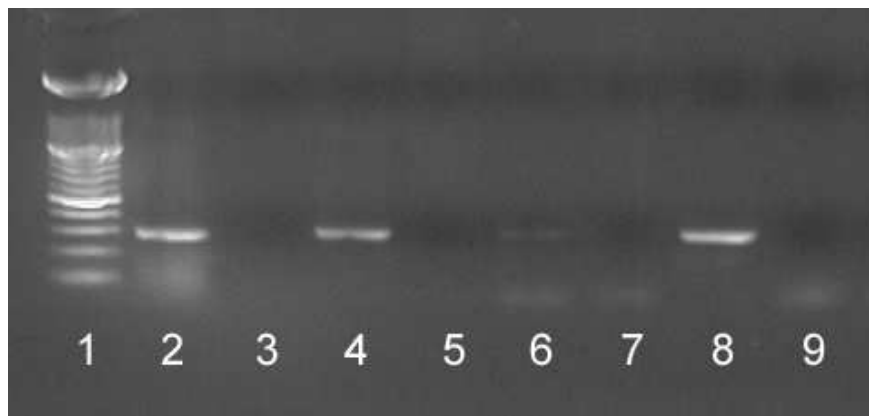


Figure 1. Detection by PCR of koi herpesvirus (KHV) DNA in a common carp from the Santee-Cooper Reservoir system, South Carolina, is indicated by the bands (290 base-pairs) in lanes 4 (trunk kidney), 6 (spleen), and 8 (gill). Lane 1, molecular mass markers; lane 2, positive control KHV DNA; lanes 3 (trunk kidney), 5 (spleen), and 7 (gill) are samples from a negative control common carp; and lane 9, negative control containing PCR reagents alone.

Nocardia-like Filamentous Bacteria Causes Mortality in Juvenile Snake River Cutthroat Trout.

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The Auburn Wyoming Fish Hatchery is nestled in the scenic Webster Range on the Idaho-Wyoming border just south of Jackson Hole. From August 24th to October 24, 2003, the hatchery was experiencing 30 mortalities a day in one lot of juvenile (3 month old, 1.8 inch) Snake River Cutthroat Trout. Infected fish showed few signs of disease, with only the cessation of feeding and hovering at the raceway's surface before dying. Similar lots of juvenile cutthroats being reared at the hatchery showed no signs of the disease and had no unusual mortality; even those fed the same semi-moist feed. However, the infected lot had been handled frequently prior to the outbreak.

Samples were sent to the Wyoming Game and Fish Laboratory for necropsy and disease analysis. The infected fish displayed greatly distended abdomens accompanied with yellow to white discoloration. No external parasites were observed. Internally there appeared to be numerous white fungal nodules associated with and invading the stomach and pyloric caeca. What initially seemed to be an internal fungus was later identified as a bacterium. This fact was revealed by the growth of small white colonies with filamentous projections that grew on TSA medium in test tubes after a few days at 22° C.

Fish samples were preserved and submitted to Charlie Smith in Bozeman, MT for histopathological examination along with a culture of this rare filamentous bacterium. This culture was submitted to the Montana State Veterinary Diagnostic Laboratory in Bozeman. The bacterium was identified as a filamentous, Gram-positive, lightly acid-fast organism. Initial identification was narrowed down to a *Nocardia*-like bacterium given the colony morphology and staining characteristics of the individual organism. The microbiologist at the laboratory in Bozeman would not state for certain that the organism was *Nocardia* because it is extremely difficult to identify, and he was not able to get additional cultures of the organism to grow to do further testing.

Histopathological examination of sections of three whole fish demonstrated large masses of filamentous bacteria invading and destroying the muscular wall of intestine and stomach, as well as adipose and pancreatic tissue (figure 1). The swimbladder and hematopoietic tissue located in head kidney, were also severely infected and destroyed. In one fish, the organism had invaded and destroyed the choroid located behind one of the eyes. Necrotic changes were apparent in liver tissue, but few bacteria were present.

Nocardia is the causative agent of nocardiosis, a localized systemic bacterial infection that affects freshwater and marine fishes worldwide. Two species have been identified as pathogenic, *Nocardia asteroides* and *Nocardia kampfachi*. *N. asteroides* is a gram-positive, aerobic bacillus, that is weakly acid-fast and may form aerial hyphae during culture. *N. kampfachi* also forms aerial hyphae, and is gram-positive, non-motile and weakly acid-fast. *N. kampfachi*, however, will only survive for four hours in a nutrient solution at 50° C and will not grow at 10° C or 37° C.

Infection with either bacterium leads to the growth of compact masses in internal organs that may be confused with actinomyces mold. *Nocardia* infections are typically associated with emaciation, anemia, granulomas around the mouth, ulcerations of the dorsal fin, and distended abdomens. Internal signs of nocardiosis are: whitish nodules on the kidney, liver or spleen; atrophied or hemorrhagic testes and discolored, granular kidneys.

Currently there is no treatment for nocardiosis, but given the close relationship with myxobacteria similar treatments for these organisms may prove useful. Routes of infection have yet to be empirically determined, but one possible route is that pelletized feed may contain plant or soil constituents contaminated with the widely distributed *Nocardia* bacteria. As such, changing the infected fish's feed may also be an effective treatment. This was the case with the lot of Snake River Cutthroat at the Auburn Hatchery. Changing the diet from a semi-moist feed to a vitamin-enriched dry feed alleviated the symptoms and reduced mortality rates.

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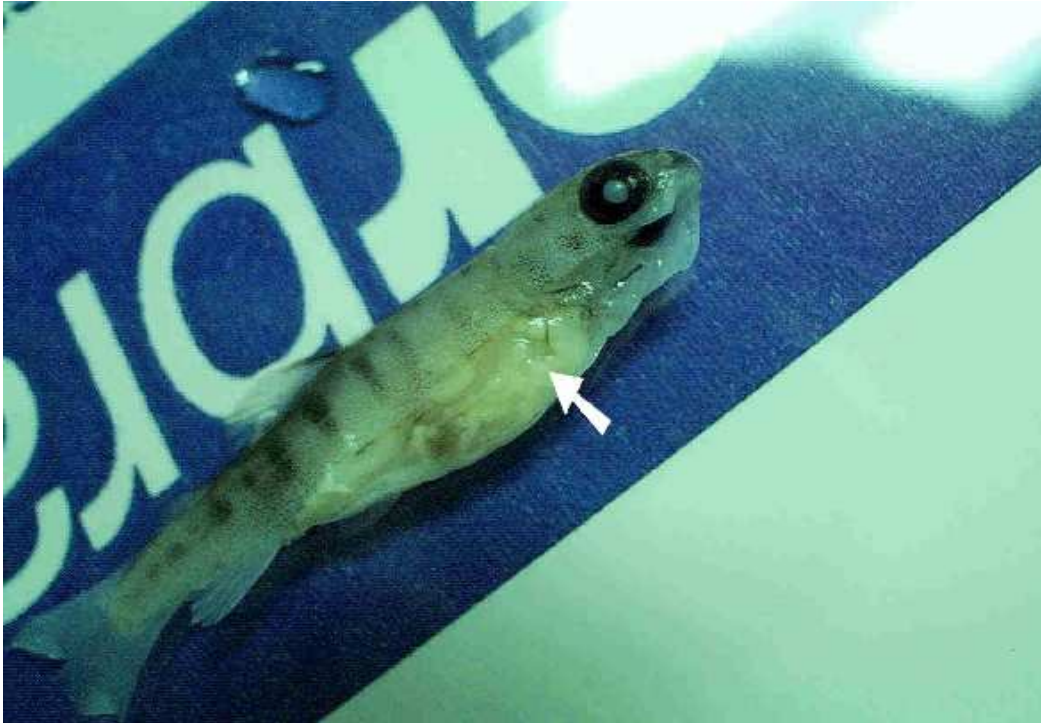


Figure 1. Juvenile Snake River Cutthroat Trout with distended abdomen.
Note apparent granulomatous masses covering abdomen (arrow).

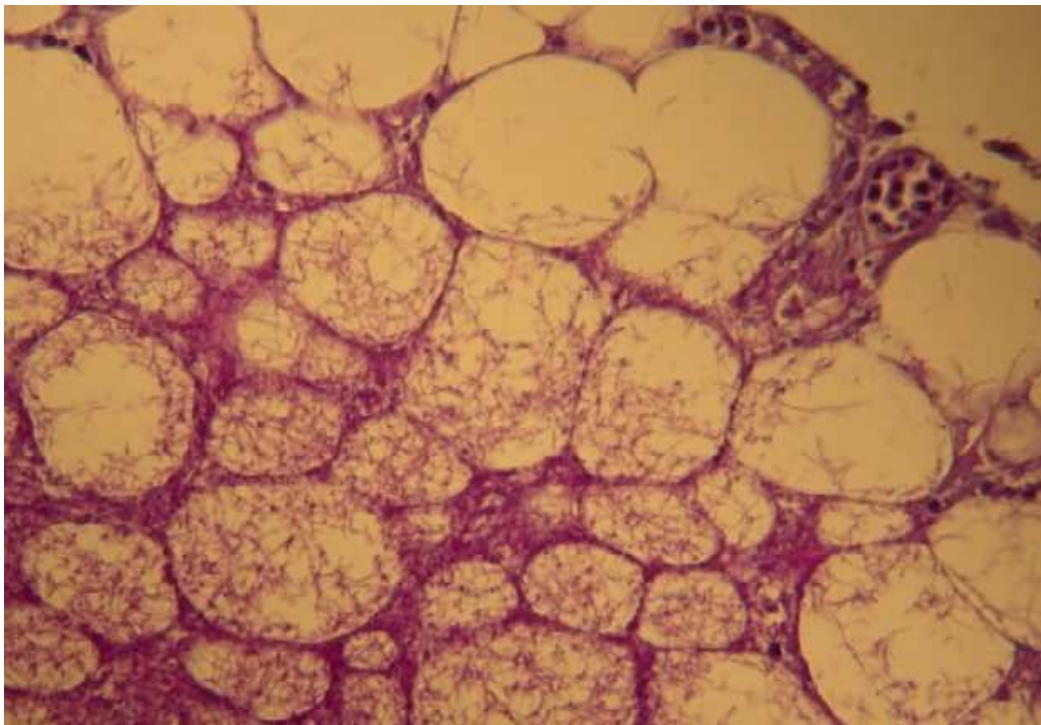


Figure 2. Long *Nocardia*-like filamentous bacteria invading adipose and pancreatic tissue.
Hematoxylin-PAS. X500

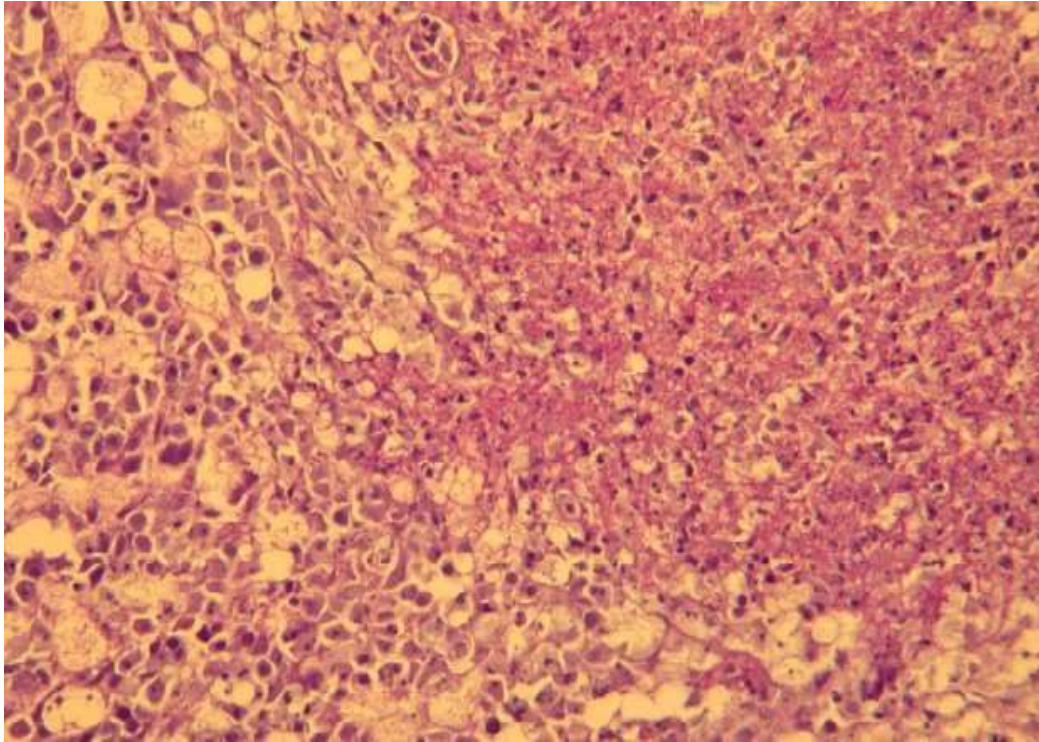


Figure 3. Filamentous bacteria have invaded and destroyed hematopoietic tissue on right of photo. More normal tissue is present on left. Hematoxylin, PAS X500.

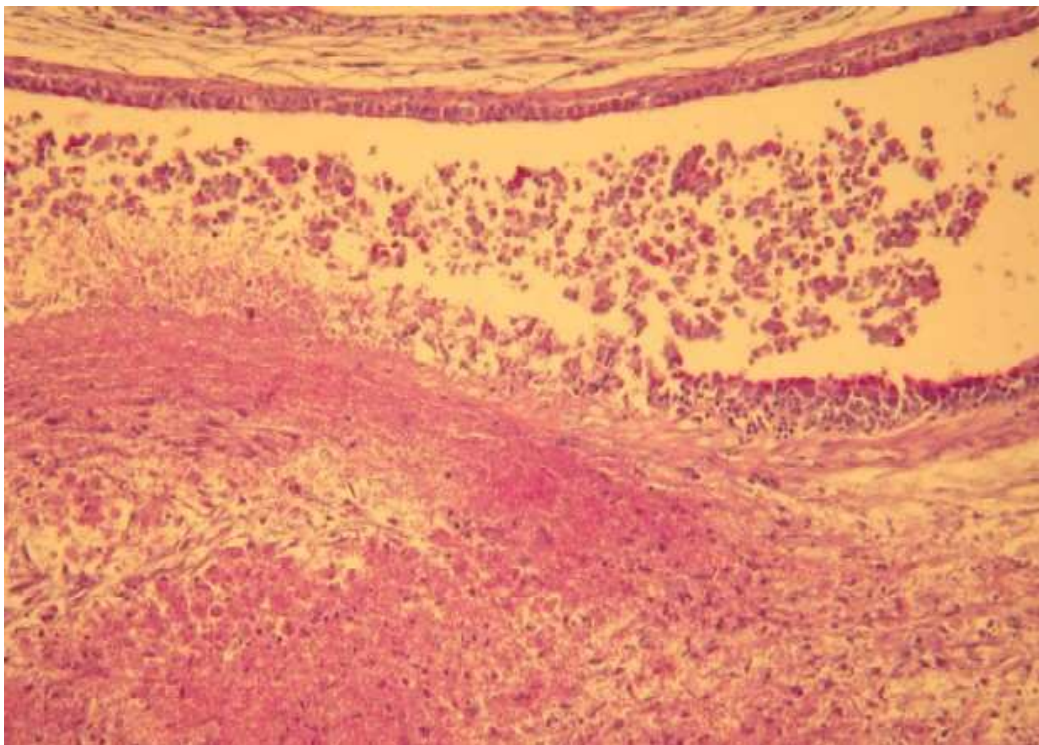


Figure 4. Bacteria have invaded and destroyed the muscular and epithelial layers of the swimbladder. More normal swimbladder on right shows necrotic epithelial cells that have been sloughed into the lumen. Hematoxylin, PAS X125.



Figure 5. Bacteria have invaded and destroyed muscular layers of intestine.
Hematoxylin, PAS X250.

Fish Health Newsletter – Editorial Policy

The *Fish Health Newsletter* is a quarterly electronic publication of the Fish Health Section of the American Fisheries Society and is available for downloading in Adobe pdf file format. Submissions on any topic of interest to fish health specialists and preliminary case reports are encouraged with the understanding the material is not peer- reviewed. Abstracts submitted to the *Journal of Aquatic Animal Health* are also encouraged. Submissions must be formatted in Microsoft Word, WordPerfect, or Rich Text Format, and can be sent by electronic mail or via 3.5” floppy disk to the editor’s address below. **Graphics files should be sent separately in jpeg format.**

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