Fish Health Newsletter

Fish Health Section / American Fisheries Society

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President's Report:

During the past months I have enjoyed correspondence with many of you as a result of the listserv "FHS updates". As this has been my vehicle for communicating, I will keep my report here brief.

Inspection manual

The collaborative effort between the FHS and the USFWS to produce a "USFWS/AFS-FHS National Fish Health Inspection Procedures" manual has been a major effort during the past six months. The original USFWS document was reviewed and modified with input from committees with expertise in bacteriology, virology and parasitology, so that it would continue to meet the needs of the USFWS and also meet the needs of the FHS as the new regulatory portion of the Blue Book. These committees have done a great deal of work in the last few months to insure that specific procedures are identified for certifications for intra and interstate movements of fish and import/export inspections – thanks so much for your efforts. A final draft of this document is now in preparation and will be reviewed by the FHS Technical Standards committee as well as by reviewers from the USFWS. In March we will meet again to determine how to proceed with adopting the manual and set in place the process for revision and oversight.

Joint Subcommittee on Aquaculture

On Dec 12-14 the National Aquatic Animal Health (NAAH) Task Force of the Joint Subcommittee on Aquaculture (JSA) met in Silver Springs, MD. The meeting was co-chaired by John Clifford, (USDA/APHIS); Tom Bell (USFWS) and Spencer Garrett (NMFS). The purpose of the meeting was to inform stakeholders on the progress and current activities of federal agencies relative to aquatic animal health for aquaculture and to solicit stakeholder input on the issues, strategies, and projects that can lead to enhanced aquatic animal health. In addition to the Fish Health Section, representatives of the International Association of Fish and Wildlife Agencies, National Association of State Aquaculture Coordinators, National Aquaculture Association, USAHA, AVMA and the aquaculture industry were present. Over the 2 1/2 day meeting, the stakeholders discussed the TF mission and began to lay a framework for development of a National Aquatic Animal Health Plan for Aquaculture and how this plan would be implemented. A set of issues were defined and we began to identify strategies to address these issues. Some of the primary concerns were over issues of certification, the role of USDA/APHIS outside international regulations, and the scope of the proposed regulations. It was clear that the lead agencies are committed to an integrated approach and recognize the needs and expertise of the stakeholders, and this is cause for optimism that these efforts will be successful.

Communications

This marks the first entirely electronic issue of the Newsletter – we hope you like the new format, and will try to help you along with any problems as you get used to the transition. We thank our co-editors, Lora Petrie-Hanson and Bev Dixon. Chris Wilson has "retired" as co-editor, only to devote more time to the website.
As an effort to enhance communications, I have been sending FHS updates on a somewhat regular basis via a listserv maintained by AFS. Many of you have provided me with articles and notices, and I would like to encourage more of you to do so. I can't possibly keep track of everything, and I rely on you to make this communication helpful – so please send your news, comments and suggestions. For those members not receiving the emails, you can be put on the list by sending me a request (bartholj@orst.edu); the same goes for members who would prefer not to receive these updates.

AFS

The FHS was asked to participate in organizing a symposium on "Propagated Organisms in and for Aquatic Resource Management". The symposium was proposed by the Fish Culture Section, and this provides us with an opportunity to collaborate on a topic of importance and interest to both sections. John Grizzle will serve as the FHS representative on the planning committee and you will receive updates in the future.

I hope the New Year finds you all well and ready to meet the challenges of 2002.

Jerri Bartholomew, President

Meetings:

Registration and Call for Abstracts – Fourth International Symposium on Aquatic Animal Health, September 2-6, 2002, New Orleans, Louisiana

The ISAAH will be held at the beautiful Sheraton New Orleans hotel, and will be hosted by the Fish Health Section of the American Fisheries Society and the organizing committee is chaired by Ron Thune.

To be added to the mailing list to receive announcements and the call for papers visit the Symposium web site at www.vetmed.lsu.edu/isaah2002.htm

Requests can also be sent to isaah2002@vetmed.lsu.edu or by regular mail to ISAAH2002, Department of Pathobiological Sciences, School of Veterinary Medicine, Louisiana State University, Baton Rouge, LA, 70803 USA.

The 27th Eastern Fish Health Workshop

The National Fish Health Research Laboratory (Kearneysville, WV) is especially proud to host the 27th Eastern Fish Health Workshop at the Holiday Inn - Mount Pleasant in Charleston, South Carolina. Registration will begin on Monday, 18 March from 500 - 700 pm, followed by three full day sessions, 19, 20, and 21 March 2002.

Continued Education Opportunities

Two Continuing Education opportunities are being planned to be presented in connection with the Eastern Fish Health Workshop. These sessions are being organized through the Continuing Education Committee of the Fish Health Section of the American Fisheries Society. Continuing Education Credit will be provided for those who participate in the sessions. Separate registration fees will be charged for each of these optional CE session.

1. Bothriocephalus and Fish Health Inspections. This will be a 1.5 hour session presented by Andrew Mitchell of the ARS/USDA Laboratory, Stuttgart, AR and Andrew Goodwin of the University of Arkansas at Pine Bluff. Contact person P. R. Bowser (prb4@cornell.edu).

2. Fish Hematology. This will be a 4.0 hour session presented by Jill Arnold of the National Aquarium at Baltimore. Contact person A. Segars (alsegars@hargray.com).

Lodging accommodations must be made with The Holiday Inn - Mount Pleasant at (843) 884-6000 or (800) 290-4004. Check-in time is 3 pm and checkout time is noon. The Holiday Inn has established a special room rate of $79.00 + tax/night for single occupancy ($5.00/night per additional adult). Identify your affiliation with the Eastern Fish Health Workshop to secure reservations at these greatly reduced prices before 21 February 2002.

A $115.00 registration fee (U.S. currency equivalent) includes workshop proceedings, refreshments during breaks, full all you can eat hot buffet breakfasts and luncheons on each day of the proceedings, a get-acquainted reception on Monday evening, and the 27th Anniversary Banquet on Thursday night. Please make checks payable to the "Eastern Fish Health Workshop c/o Rocco Cipriano" and return payment with your completed registration form by 21 February 2002. Contracts for food services necessitate a late registration fee of $135.00 after this date.

For additional information, contact:

Dr. Rocco C. Cipriano, Chairman EFHW National Fish Health Research Laboratory Kearneysville, WV 25430
PHONE: 304/724-4432
FAX: 304/724-4435
E-mail: rocco_cipriano@usgs.gov

Details of past Eastern Fish Health Workshops and most current details of upcoming workshops may be found on the Web Site of the National Fish Health Laboratory, Leetown Science Center, USGS, Leetown, WV

Eighth Biennial Fish Diagnosticians Workshop

The staff of the Stuttgart Laboratory (Harry Dupree Stuttgart National Aquaculture Research Center) are exited to host the Eighth Biennial Fish Diagnosticians Workshop on April 2&3, 2002. The meeting will be one and one-half days as usual, the first being a full day and the second dismissing about noon.

This year's meeting will include sessions on Bolbophorus and other parasite problems (lead by Linda Pote), bacterial problems including columnaris, ESC, and Streptococcus (John Hawk), algal toxins including some maybes (Andy Goodwin), use of disease resistant fish and vaccines in pond fish culture (Bill Wolters), brainstorming session including old unsolved problems (anemia, etc.) and new upcoming ones, (Lester Khoo?), and usage of approved fishery chemicals (Billy Griffin).

There will be a $35.00 registration that includes a catfish luncheon, an evening at the Stuttgart Agricultural Museum with a roast beef dinner, and drinks and snacks for breaks. If we get approximately 60 registrants, the price will also include a continental breakfast at the lab on Tuesday morning, April 2, 2002.

Hotel accommodations can be made at the Best Western Inn (870-673-2575), Holiday Inn Express (870-673-3616), or the Super 8 Motel (870-673-2611). A block of rooms has not been set aside, so please make your reservations as soon as possible.

Andrew J. Mitchell and the staff of the HKDSNARC

Call For Nominations

S.F. Snieszko Distinguished Service Award- the highest award of the FHS. This award is presented to individuals to honor their outstanding accomplishments in the field of fish health. This is a career achievement award.

The nomination must be made by a current member of the FHS to the awards committee. The nomination should consist of a current curriculum vitae of the nominee, a letter of nomination and six letters of recommendation that support the nominee's dedication and contributions to research, teaching and/or service in fish health. **Nominations will be accepted until April 1, 2002**.

Special Achievement Award- award for a significant accomplishment in the field of fish health. This award is presented to a FHS member who has in the past year made a significant accomplishment in basic or applied fish health. The achievement must meet a high standard of science as determined by peer review. Candidates for this award must be nominated by a current FHS member. The letter of nomination should state the accomplishment, its importance to the science of fish health, and the implications of the accomplishment (regional, national or international). Copies of articles and other supporting documents should be submitted with the nomination. The nomination may be submitted any time within one year of the accomplishment to the awards committee.

Send nominations to: Dr. Beverly Dixon, FHS Awards Committee Chair, CA State University, Hayward, CA 94542.

Announcement:

Applications for **S.F. Snieszko Student Travel Award** are being **accepted until May 15, 2002**. This travel award was established to help students attend and present a paper at the FHS annual meeting. Applicants must be AFS/FHS members. Submit a letter of application (including a statement of reason travel support is needed), a curriculum vitae, three letters of recommendation, an itemized budget (travel, meals, lodging and registration) and a copy of the abstract of the paper to be presented. Funds are limited and the award will be based on quality of abstract, importance of the findings, academic and professional achievement and financial need. Send applications to Dr. Beverly Dixon, FHS Awards Committee Chair, CA State University, Hayward, CA 94542.

DRAFT: National Aquatic Animal Health Task Force on Aquaculture

Mission:

To develop and implement the *National Aquatic Animal Health Plan for Aquaculture* in partnership and cooperation with industry, regional organizations, state, local and tribal governments and other stakeholders.

Purpose:

The purpose of the plan is to protect the health of aquatic animals involved in aquaculture and to ensure to the extent possible unimpeded trade of aquatic animals and their products, without incurring unacceptable *risks* to aquatic animal health.

Roles and Responsibilities:

- Develop and implement the *National Aquatic Animal Health Plan for Aquaculture.*
- Recognize a lead Federal agency for the purposes of international aquatic animal health negotiations (with OIE) and agreements while enhancing cooperation and collaboration among the Federal agencies involved.
- Recognize that the members of the task force and their agencies will share leadership because of the unique perspective, history, resources, expertise and authorities each brings to bear on implementing the plan.
- Recommend to the Secretaries of appropriate federal agencies resolutions concerning federal agency roles and authorities regarding aquatic animal health.
- Assess needs and priorities and recommend actions (to Federal, State and Tribal agencies as needed) for improving:
    - Overall protection from exotic pathogens and other pathogens of concern.
    - Diagnostic, inspection and certification services (includes diagnostic tests and reference laboratories).
    - Disease surveillance and reporting.
    - Integrated aquatic animal health management.
    - Research and technology development.
- Assess needs and priorities and recommend actions (to Federal, State and Tribal agencies as needed) needed to facilitate legal movement of aquatic animals and their products.

- Enhance cooperation and collaboration among State (includes both Departments of Agriculture and Natural Resources), Federal and Tribal agencies by doing the following:
    - Clarifying roles and responsibilities among State, Federal and Tribal agencies.
    - Resolve issues that prevent cooperation, collaboration and communication.
    - Review and revise or develop new formal agreements among Federal, State and Tribal agencies.
- Identify the appropriate technical expertise needed to address critical needs in animal health management for aquaculture.

Expected Outcomes:

- Cultured aquatic animals and aquatic animal products continue to be healthy and productive and of high quality.
- Cultured aquatic animals are protected from introductions of exotic pathogens and other pathogens of concern.
- Cultured and wild aquatic animals are protected from the impact of diseases as a result of interactions with each other.
- Adequate surveillance and reporting systems needed to support protection.
- Readily available diagnostic, inspection, and certification services as needed for the aquaculture industry equivalent to those provided to other sectors of animal agriculture.
- Legal movement of aquatic animals and their products facilitated in interstate and international commerce.
- Stable and predictable trading environment.
- Consistent and seamless regulatory environment.
- Improved research and technology development for aquatic animal health management.

FHS Participation in the AAVLD / USAHA Annual Meetings

Scott LaPatra

As you know, the Fish Health Section (FHS) has committed to becoming more involved on issues of importance to the membership. For the last five years I attended and participated in the United States Animal Health Association (USAHA) and the American Association of Veterinary Laboratory Diagnosticians (AAVLD) annual meeting. Last year the meeting was held in Birmingham, Alabama and this year it was held in Hershey, Pennsylvania. For background information, the USAHA is the most well established animal health organization that has approximately 1,400 members and works with a variety animal health entities both nationally, including the United States Department of Agriculture Animal Plant Health Inspection Service (USDA/APHIS), and internationally. The purpose of the AAVLD, which works closely with the USAHA, is the dissemination of information relating to the diagnosis of animal disease, the coordination of the diagnostic activities of regulatory, research and service laboratories, the establishment of accepted guides for the improvement of diagnostic laboratory organizations relative to facilities, equipment and personal qualifications.

The FHS's objectives, interests and goals regarding animal health are very similar to the USAHA. One of the reasons we were in attendance was to offer our expertise and established programs in aquatic animal health and maintain visibility with other groups also interested in aquatic animal medicine. This year the AAVLD and the USAHA Aquaculture Committees met jointly and were chaired by Dr. Randy White representing the AAVLD and myself representing USAHA. With the help of the committee chairs I was again able to get on the agenda and speak about the Sections activities including the changes that were made in the certification categories in order to acknowledge the general training that veterinarians receive and encourage their participation. I also spoke about the collaborative project that was recently undertaken with the USFWS for development of a specific procedural manual for the detection and identification of certain finfish pathogens..

In the past we have also been very successful at passing resolutions in the USAHA Aquaculture Committee which then go before the Executive Committee of the USAHA. Four past resolutions were supported by the Committee and forwarded to USDA/APHIS for comment and included:

1996 Resolution 27: Health Inspections for Interstate Movement of Aquatic Animals
1997 Resolution 28: National Survey of Free-Ranging Aquatic Animals for Free-Ranging Pathogens
1998 Resolution 19: The Use of Advanced Technologies for the Inspection, Diagnosis, and Certification of Aquatic Animals
1999 Resolution 12: Prevention of the Introduction of Foreign Aquatic Animal Diseases

This year, in addition to normal committee business three resolutions were introduced including:

1) **RESOLUTION SUBJECT**: SIGNIFICANCE OF AQUATIC ANIMAL PATHOGENS IN AQUACULTURE EFFLUENTS

BACKGROUND INFORMATION:
On January 21, 2000 the United States Environmental Protection Agency (EPA) announced its decision to promulgate national effluent standards for aquaculture operations. Included within this decision, EPA was to evaluate aquatic animal pathogens in effluents. Guidelines and regulations are needed to safeguard human health, habitat, and native species, however, there are no standardized procedures to determine the presence and/or the concentration of aquatic animal pathogens (if present) in effluents and there are no practices currently in use to control the discharge of aquatic animal pathogens in effluents of commercial or public aquaculture facilities. In assessing the risks of aquatic animal pathogens that may occur in aquaculture effluents, the characteristics of the pathogen must be considered including their abilities to multiply and remain viable in water, survival times outside the host, and the numbers of infectious units required to cause disease. In addition, fish species present in waters receiving discharged effluents, and their inherent susceptibility to agents present in effluents (if any) should be considered. Environmental considerations also must be included such as the effects of season, hydrography and water quality on the survivability of potential pathogens and risks of transmission to susceptible species. Hence, a complete and likely complex analysis is required to assess environmental impacts of potential pathogens in effluents. Such an analysis will be difficult given the lack of available credible scientific information and the inherent variation in agent types and numbers, aquatic animal hosts present, and the type of natural ecosystem or artificial culture environment present.

RESOLUTION:
USAHA encourages U.S. Department of Agriculture-Animal Plant Health Inspection Service (USDA-APHIS) to seek authority and funding to work with EPA and federal and

state natural resource agencies to define risk-assessment procedures to determine the significance of aquatic animal pathogens in aquaculture effluents. Additionally, USAHA encourages USDA-APHIS to utilize data generated by the U.S. Fish and Wildlife Service's national survey of pathogens present in free-ranging aquatic animals. This survey may help identify where aquatic animal pathogens already exist.

2) **RESOLUTION SUBJECT**: DEVELOPMENT OF A NATIONAL AQUATIC ANIMAL HEALTH PLAN

BACKGROUND INFORMATION:
There are three major reasons to develop a national plan prioritized as follows: to prevent introduction of economically damaging foreign animal diseases and control of economically significant emerging infectious diseases, to facilitate export of US aquatic animals and products, and to facilitate interstate movement of aquatic animals and products while protecting our natural resources. Prevention of exotic economically damaging diseases is the most significant need. Changes in the international movement of aquatic animals, greater diversity of aquatic animals raised for commercial purposes and greater intensification have seemingly increased the possibility that exotic pathogens (either foreign animal disease or those arising for the first time from US aquacultured animals) could significantly impact one or several aquaculture industry sectors and our natural resources. Recent detection of several shrimp viruses, a rickettsial agent affecting tilapia, and infectious salmon anemia virus highlight this possibility. Discrimination of which pathogens meet the criteria for significant economic impact and selection of appropriate methods of control will require a carefully constructed framework, which relies on risk-based analysis. A health plan should be developed that provides for flexibility as scientifically sound data accrues. This flexibility is particularly important for new emerging diseases where little information is available.

RESOLUTION:
The USAHA encourages the JSA National Aquatic Animal Health Task Force on Aquaculture to develop a national aquatic animal health plan.

3) **RESOLUTION SUBJECT**: CONTROL STRATEGIES FOR INFECTIOUS SALMON ANEMIA IN THE NORTHEASTERN UNITED STATES

BACKGROUND INFORMATION:
Aquaculture is agriculture and salmon aquaculture is a multimillion dollar industry in the United States. The reported farm gate value of Maine aquaculture is $100 million annually. Infectious Salmon Anemia (ISA), a disease caused by Infectious Salmon Anemia Virus (ISAv), is economically devastating to salmon aquaculture. ISA is recognized as a Foreign Animal Disease and has been diagnosed on US (Maine) salmonid fish farms.

RESOLUTION:
The USAHA requests USDA/APHIS to:

1) Define its regulatory authority in aquaculture with respect to aquatic animal health.
2) Consider a response to the diagnosis of ISAv in the US similar in nature to the response taken in the instance of the diagnosis of an exotic livestock or poultry disease.
3) Endorse, modify or prepare an alternative to the ISAv Action Plan currently adopted by the Maine Department of Marine Resources and the Maine Department of Inland Fisheries and Wildlife.
4) Provide financial, logistic and personnel resources to support Maine's surveillance and biosecurity efforts.
5) Implement an indemnity plan.

6) Provide additional diagnostic laboratory support and training to existing US laboratories for ISA and other aquatic animal diseases.
7) Address the issue of importation of potentially infected waste and fresh/frozen product from known infected areas.

All three of these resolutions were forwarded to the USAHA Executive Committee and were subsequently approved and will be forwarded to USDA/APHIS for comment. The next annual AAVLD/USAHA Meeting is scheduled for October, 2003 in St Louis, Missouri. If you have any ideas, questions or need for additional information please don't hesitate to contact myself or any of the other members of the FHS Executive Committee.

FHS Participation in the AVMA Convention 2001

Scott LaPatra

At the American Veterinary Medical Association (AVMA) annual meeting an "Aquaculture Medicine Educational Program" was held on Saturday and Sunday and invited speakers covered a range of aquaculture related topics. The Theme of the program was "Veterinary Roles and Resources in Aquaculture and Aquatic Animal Medicine." On Saturday the talks focused on the
"Status of, and Issues Facing the Aquaculture Industry and the Veterinary Profession." ***The presentations included*****:**

* Current Perspectives on Aquaculture Development & Impacting Issues
  Dr. Gary Jensen
* Primary and Continuing Educational Opportunities in Aquatic Animal Medicine
  Dr. Donald Abt
* Emerging State and Federal Issues Facing Aquaculture and Aquatic Animal Medicine
  Dr. Otis Miller, Jr.
* Present and Future Pharmaceutical Directions for Aquatic Animals and Other Minor Species
  Dr. Stephen Sundlof

On Sunday talks covered the **"Topical Areas Facing the Aquaculture Industry and the Veterinary Profession." The presentations included:**

* The Veterinarian and Aquatic Animal Treatments
  Dr. Rob Armstrong
* Common & Emerging Diseases of Cultured Fish
  Dr. Stephen Smith
* Channel Catfish Industry: The Veterinary Perspective
  Dr. Lester Khoo
* Mysterious Diseases and Baffled Scientists: Desperate Needs & Deeds in Aquatic Animal Health Management
  Dr. Paul Waterstrat

On Monday a panel focused on the **"Diverse and Developing Roles of the Veterinary Professionals in Aquaculture, Aquatic Animal Medicine, Seafood and Public Health."** The Speakers were asked to focus on the areas of need, and current and future plans for advancing the role of veterinary medicine in the rapidly expanding areas of aquaculture, aquatic animal health and seafood. Points of view were provided by,

* American Association of Zoo Veterinarians – Dr. Paul Calle

* New Drug Availability – Dr. Roz Schnick
* Aquatic Diagnostic Laboratories – Dr. Peter Merrill
* FHS/AFS – Dr. Scott LaPatra
* AVMA/ASAC – Dr. Bob Bullis
* USDA/APHIS/Center for Veterinary Biologics – Dr. Dave Starling
* American Veterinary Education & IAAAM – Dr. Don Abt
* Canadian Veterinary Education – Dr. Jeff Davidson / Dr. Larry Hammell
* USFWS – Dr. Tom Bell
* International Society of Aquatic Animal Epidemiology – Dr. Jay Levine
* Pharmaceutical Industry – Dr. Rob Armstrong

The FHS presentation focused on the objectives of the Section, membership, our interest in partnering with other groups interested in aquatic animal medicine and the programs that we have available including certification, continuing education, meetings, and our new affiliate membership option. I highlighted the changes that were made in the certification categories in order to acknowledge the general training that veterinarians receive and encourage their participation. I also spoke about the collaborative project that was recently undertaken with the USFWS for development of a specific procedural manual for the detection and identification of certain finfish pathogens. I concluded with our commitment for and interest in providing our expertise and programs for the development of a national aquatic animal health management plan. I emphasized that we must focus on our objectives in the development of the plan which are to protect our natural resources and enhance the development of the aquaculture industries.
After eleven panel members completed their presentations, the last 30 minutes was used for a panel synopsis of recommendations for "What Actions are Needed to Advance the Role of Veterinary Medicine in Aquaculture, Aquatic Animal Health and Seafood." There were a diversity of talks as you can see from the panelists that participated. The discussion following the panel member presentations focused on trying to provide the AVMA Aquaculture and Seafood Advisory Committee (ASAC) with some direction and determine the need for forming a National Organization similar to other AVMA specialties. It was suggested that key leaders of the AVMA, IAAM, and the FHS meet to discuss the issue and determine the most efficient way to accomplish this goal keeping in mind what the true objectives are; i.e. to protect our natural resources and enhance the development of the aquaculture industries. John Clifford who is a Deputy Administrator for APHIS was also present and was also present in Orlando when the Section gave their input to APHIS during the first public hearing. Dr. Clifford is very interested in learning more about the FHS and is co-chairing the Joint Subcommittee on Aquaculture, National Aquatic Animal Health Task Force on Aquaculture with Tom Bell (USFWS) and Spencer Garret (NMFS). The first meeting of this Task Force is December 12-14 in Washington, DC. The purpose of the meeting is to inform stakeholders on the progress and current activities of federal agencies relative to aquatic animal health for aquaculture and to solicit stakeholder input on the issues, strategies, and projects that can lead to enhanced aquatic animal health for aquaculture. The Section has been identified as one of the stakeholders and will be involved in the Task Force.
The next AVMA ASAC meeting is in February, 2002. Dr. Marilyn Blair has been appointed to the committee as a veterinarian representing State or Federal Regulatory Veterinary Medicine and I will continue participating through July, 2003 representing Non- Veterinarian Aquaculture Production. Please don't hesitate to contact me if you have any questions, suggestions or need for additional information.

Evaluation of a Field Strain of Infectious Pancreatic Necrosis Virus for Pathogenicity

K Sakamoto, MR White, SR Albregts, C. Kanitz. Department of Veterinary Pathobiology, School of Veterinary Medicine, and Animal Disease Diagnostic Laboratory, Purdue University, West Lafayette, IN 47907-1175

In 1999, infectious pancreatic necrosis virus (IPNV) was isolated from asymptomatic steelhead trout (*Oncorhynchus mykiss*) submitted from the Mixsawbah State Fish Hatchery in Walkerton, Indiana as part of a routine health inspection. IPNV is a serious and contagious disease of salmonids that prevents participation of affected hatcheries in the Great Lakes Stocking Program.[1] IPNV is an aquatic birnavirus, however, within the aquatic birnaviruses, there exists many strains which are nonpathogenic and normally present in the aquatic environment.[2,3] In order to determine the pathogenicity, and therefore significance, of this Mixsawbah strain of IPNV, various doses of this viral strain were administered to 45 day old rainbow trout (*Oncorhynchus mykiss*), which are considered the age and species of fish very susceptible to IPNV. Following infection by IPNV, rainbow trout were euthanised and necropsied at various time intervals. Tissues from these fish were examined histologically and virus isolation was performed.

Material and Methods

Approximately 500, 30 day old Rainbow Trout (approximately 3 cm total length) were purchased from Troutlodge (WA) and acclimated for 22 days in six 40 gallon tanks maintained at a temperature between 12.0 and 14.0 degrees Celsius. The tanks were each on a flow-through system supplied by well water with discharge treated with UV filtration before release into outdoor ponds. The control tank was placed on the opposite side of the room and was supplied from the sump tank first. The fish were fed powdered Trout Chow (Zeigler Bros.) hourly by automated vibrating feeders. Light and dark cycles were set automatically at 16 hours and 8 hours, respectively. Water quality (temperature, pH, ammonia, nitrite and nitrate) was monitored twice weekly throughout the course of the project. The fish were observed twice daily for the development of clinical signs such as anorexia, altered pigmentation, anal casts, distended abdomen, circling and exophthalmia.

Frozen IPNV isolates from two fish submitted from Mixsawbah were pooled and grown on chinook salmon embryo cells. On day 0 of the study, 70 fish from each tank were each inoculated intraperitoneally with 0.1 ml of the following doses, respectively: tank 1, 12.8 x 10^4 $TCID_{50}$; tank 2, 12.8 x 10^3 $TCID_{50}$; tank 3, 12.8 x 10^2 $TCID_{50}$; tank 4, 12.8 x 10^1 $TCID_{50}$; tank 5, 12.8 x 10^0 $TCID_{50}$; tank 6, culture media only. Tank flow was turned off for 2 hours following inoculation.

On days 4, 7, 11, 15, 19, 23, 27, 30, 35 and 45 post-infection, 5 fish were sampled from each tank for histopathology and virus isolation. The fish were euthanised by overdose of tricaine methanesulfonate (MS-222) and decapitation. For histopathology, 2 fish from each tank were placed in Bouin's fixative and allowed to fixate for at least 24 hours. Mid-sagittal sections of head and coelom were processed routinely, stained with hematoxylin and eosin stains and examined microscopically. The remaining 3 fish from each group were submitted for virus isolation.

Results

The only clinical signs observed in the rainbow trout during the study were slightly darkened pigmentation and most of the death losses occurred following handling (after arrival and post-inoculation). Three fish were found dead in the tanks after the inoculation date; 2 were from the lowest dose tank and 1 from the highest dose tank.

At necropsy, average total lengths and weights were as follows (tank number in parenthesis): 7.6 cm/5.8 g (control), 8.0 cm/6.3 g (1) 8.9 cm/9.5 g (2) 8.5 cm/7 g (3), 7.6 cm/5.2 g (4) and 8.8 cm/8.9 g (5). No gross lesions were observed at necropsy.

Histopathologic lesions were observed in the pancreas of only 2 fish and were characterized by granuloma formation in 1 fish from the high dose group and a focal lymphocytic pancreatitis in 1 fish from the lowest dose group. One of the fish from the lowest dose group had a mild, focal lymphocytic hepatitis. No histopathologic lesions were observed in any of the tissues from the control fish group.

Virus isolation was negative for all controls and the lowest 2 doses. Tank 3 fish were variably positive. Tank 1 and tank 2 fish that were sampled were always positive by virus isolation, with the exception of fish sampled from tank 1 on day 45 post-inoculation.

Conclusions

The fish in this study did not show sensitivity for this strain of IPNV as evidenced by the lack of serious clinical signs and histopathologic lesions. Total lengths and weights measured at the end of the study did not show a significant difference between uninfected and treated fish. The rare lesions observed microscopically may be secondary to the intraperitoneal injection (pancreatic granuloma) or concurrent disease (lymphocytic pancreatitis/hepatitis). Positive virus isolation, however, indicates that the fish were infected and capable of replicating the virus strain. The lack of clinical signs and lesions typical of clinically significant IPNV infection, suggest that the Mixsawbah strain is a non-pathogenic strain of aquatic birnaviruses.

References:

1. Hnath, JG [Ed.]. 1993. Great Lakes fish disease control policy and model program. Great Lakes Fish. Comm. Spec. Pub. 93-1:23.
2. Hill, BJ. 1982. Infectious pancreatic necrosis virus and its virulence. In: Roberts, RJ (ed.) Microbial diseases of fish. Academic Press, London, New York, pp. 91-114.
3. Hill, BJ. 1995. Serological classification of infectious pancreatic necrosis (IPN) virus and other aquatic birnaviruses. In: Faisal, M, Hetrick, FM (eds.) Annual review of fish diseases. Elsevier Science Ltd, London, pp. 55-77.

New Trematode in Channel Catfish

Jimmy Avery, *Associate Extension Specialist*
David Wise, *Associate Fishery Biologist*
Lester Khoo, *Assistant Professor*
Jeff Terhune, *Assistant Fishery Biologist*

PREFACE

This information is presented as an update of NWAC Fact Sheet 004 “New Trematode in Channel Catfish” published in September 1999. Research, extension, and diagnostic personnel at the Thad Cochran National Warmwater Aquaculture Center (NWAC), Mississippi State University College of Veterinary Medicine, Gulf Coast Research Laboratory, USDA/ARS Harry K. Dupree Stuttgart National Aquaculture Research Center, and USDA/APHIS/WS/National Wildlife Research Center contributed to the information contained in this revision.

INTRODUCTION

Digenetic trematodes cause infections in many types of fish and are common in aquaculture operations in areas frequented by fish-eating birds. In the past, trematode infections affecting cultured channel catfish have primarily been attributed to "yellow grub" (*Clinostomum complanatum*). These infestations are generally more of a production nuisance, with severe infestations being isolated occurrences. Recently, a different species of trematode has been reported in channel catfish from Louisiana, Mississippi, and Arkansas. The organism has been identified as *Bolbophorus confusus* and is transmitted by the American white pelican.

The first documented case of this disease from channel catfish production ponds was in 1994 from a Louisiana farm that experienced extremely heavy depredation activity by American white pelicans. The resulting trematode infection severely affected production and economic viability of the operation. The first documented case of *B. confusus* infections in the Mississippi Delta occurred in July 1999. The number of trematode disease submissions to the NWAC diagnostic laboratory and the number of suspected ponds surveyed by NWAC fish health researchers during 1999 and 2000 are presented in Table 1. The percentage of ponds containing trematode positive fish on an individual farm has ranged from 0 % to 93 %. Several of the farms have experienced complete losses of fry and fingerling ponds thought to be associated with severe infections.

Table 1. Results of trematode infection submissions and pond surveys for 1999 and 2000.

Period	Disease Submissions				Pond Surveys			
	No. Farms	No. Cases	Severe Cases	Mild to Moderate Cases	No. Farms	No. Ponds	No. Positive Ponds	No. Negative Ponds
Jul. - Dec. 1999	7	49	11	38	14	496	112	384
Jan. - Dec. 2000	40	103	NA	NA	18	325	150	175

The occurrence of this infection cannot be based solely upon the number of disease submission cases or the number of ponds surveyed. It is estimated that less than half of the commercial producers routinely use available diagnostic services. In addition, fish health researchers chose survey sites based upon direct requests from producers who suspected that they had trematode problems. Therefore, the overall impact and infection rate cannot be estimated from these data.

CLINICAL SIGNS OR SYMPTOMS

Catfish infected with *B. confusus* metacercariae have small (1/32 to 1/16 inch) cysts located anywhere in the body. Most commonly the cysts appear in the tail fin area. These cysts may be white or reddish but generally appear as a raised bump under the skin or deeper in the muscle tissue.

The impact of the infection is variable, ranging from no apparent effect on production to extensive mortality in smaller fish. Limited studies and observations from some diagnostic case submissions of infected fingerlings suggest that *B. confusus* causes massive damage to the kidneys and to a lesser extent the liver. In severe infections in smaller fish, the clinical signs are similar to channel catfish virus disease or Enteric Septicemia of Catfish (distended abdomen, fluid in the body cavity, etc.) Larger fish appear to be more resistant with fewer clinical signs. However, when larger fish do become severely infected, they feed poorly and exhibit reduced growth.

LIFE CYCLE

Several studies have shown that this species of trematode has the ability to infect various species of fish. In general, the life cycle starts when the adult trematode's eggs are released from the intestinal wall of the American white pelican into ponds. The eggs hatch to produce miracidiae which infect the first intermediate host, the ram's horn snail (*Helisome* sp.) The miracidiae mature in the snail and eventually release larval trematodes called cercariae. The cercariae infect and encyst in fish to form metacercariae. The life cycle is completed when the final host eats infected fish and the metacercariae develop into adult flukes. The cycle starts over when eggs produced by the adult flukes are released back into the environment. The time interval of each stage of the life cycle of *B. confusus* is affected by temperature (Table 2).

Table 2. Life cycle time intervals for *Bolbophorus confusus*.

Event	Time	Temp.
Adult trematode in bird begins to shed eggs	3 days after ingestion of infected fish	Body Temp.
Eggs hatch to miracidium stage	16-21 days	70-75° F
	14-18 days	75-85° F
	52 days (eggs can lie dormant for at least 35-40 days at 40° F, then as water temperature increases they develop into infective stage)	35-40° F
Miracidium mature in snail	30-51 days	70-75° F
Active shedding of cercariae by snail	Can be infective for 9 months (possibly longer)	70° F and above
Metacercaria becomes fully developed in fish	30-34 days (can detect much earlier)	Body Temp.
Length of time encysted in fish	Some fish have encysted stage several months after artificial exposure.	Body Temp.

POSSIBILITY OF OTHER AVIAN FINAL HOSTS

Past studies indicate that the American white pelican and the brown pelican are the definitive hosts for this parasite. There are only two citations that implicate other bird species. One citation reported *B. confusus* from a single captive purple heron whose history was not well documented (presumably a zoo animal that was fed an abnormal diet). These specimens were not archived for further confirmation. A later citation reported *B. confusus* in two reddish egrets (*Egretta rufescens*) in Florida. However, upon subsequent examination of these preserved samples by GCRL scientists, it is believed that the parasites were misidentified and are not *B. confusus*.

Scientists from the GCRL have examined many species of fish-eating birds from severely infected commercial catfish ponds in Louisiana and the Mississippi Delta, as well as other locations across North America. Dr. Linda Pote, parasitologist with the MSU College of Veterinary Medicine, has also examined several bird species for the presence of *B. confusus*. To date, *B. confusus* has only been found in American white pelicans (Table 3). All other species of birds (cormorants, egrets, herons) examined have been negative for *B. confuses* using current techniques. The catfish ponds in Louisiana experienced active trematode infections for several seasons yet none of the bird species examined were positive for the parasite except the American white pelican.

Table 3. Presence of *Bolbophorus confusus* in necropsy of fish depredating birds.

Bird species	Location	Date Collected	Number Examined	Number Positive
Cormorant	MS Delta	1996-2000	68	0
Great Egret	13 MS Delta / 1 LA	1995-2000	22	0
Great Blue Heron	MS Delta	1997-2000	40	0
American white pelican	MS Delta	1998 & 2000	59	38

ASSESSING THE POTENTIAL FOR INFECTION

Commercial catfish farmers should assess the potential for trematode infections to occur at their facilities. Farms that are at the highest risk are those having previous episodes of pelican pressure, are in close proximity to pelican loafing / feeding areas such as lakes, rivers, bayous, and refuges, and have ponds containing high numbers of ram's horn snails. Fish populations showing decreased appetite that cannot be explained by other diseases or water quality concerns should receive high priority for evaluation. It is crucial to remember that the presence of the final host (American white pelican) and the intermediate host (ram's horn snail) are both needed for fish to become infected.

Fish-to-fish transmission of digenetic trematodes is not possible. Therefore, transferring infected stocks from pond to pond will not result in the spread of the disease to resident fish in the pond being stocked. It is also highly unlikely that sufficient cercariae could be transferred on wet material (seines, aerators, etc) to create an economically damaging level of infection.

Since this trematode appears to be endemic in the in the pelican population, the primary factor resulting in the spread of this disease is the presence of pelicans in a given area and not the presence of infected fish. If infected fish were introduced to unaffected areas, the final host (pelicans) would have to be present to complete the life cycle. Without the final host, the encysted trematode will eventually die either within the fish host or with the death of the fish host. If the final host is present, the life cycle can be completed but it is likely that this trematode is already present in the resident fish stocks.

SCOUTING PONDS

The incidence of infection in fish should be evaluated. Diagnostic laboratories at both Stoneville and Starkville are screening for trematodes during regular disease examinations. Farmers can use a small cutting seine to collect fish that have been attracted to an area by feed distribution from a feed truck. Twenty to thirty fish should be examined and the number of fish exhibiting the cysts described earlier should be recorded. To confirm the samples selected as potentially positive for *B. confusus*, suspected fish should be submitted to a fish diagnostic laboratory for confirmation. It is important that the levels of infection be documented by the catfish industry to assess economic impact, the need for therapeutic treatments, and additional farm management implications.

Farmers should also scout for the presence of ram's horn snails along the shallow areas of vegetated levee bank. The ram's horn snail should not be confused with the *Physa* sp. snails that do not serve as an intermediate host for this parasite (see Figure 1). Examine all parts of aquatic vegetation for snails that may cling to stems or root systems.

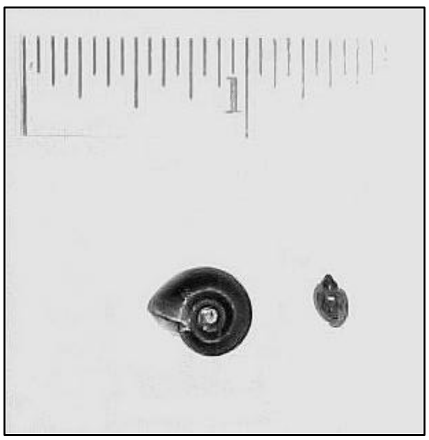

Figure 1. Ram's horn snail (left), *Physa* snail (right)

Ponds should be assigned a ranking indicating the number of snails present. A pond with a low ranking would have less than 10 snails per 10 feet of levee bank. Moderate ponds would have 10 – 50 snails per 10 feet of levee bank while ponds with high snail numbers would have over 50 per 10 feet. This ranking has no scientific meaning but serves as a quick indication of which ponds should receive priority if treatments are necessary. The ranking system is also valuable when evaluating the effectiveness of any treatment in used to reduce snail numbers.

PRIORITIZING PONDS FOR TREATMENT

Options for treatment are based on the presence of snails and the severity of the infection in individual ponds. Since the life cycle of this trematode requires the presence of ram's horn snails, ponds with little or no evidence of this snail may not warrant the expense and effort of chemical treatments. Mild fish infections most likely will require conservative measures that target reducing snail populations and preventing subsequent infections. Currently, there is insufficient information to correlate the severity of infection to the long-term performance of the fish. Producers should evaluate feeding response, length of time to harvest, and mortality rate before making radical management decisions. With respect to the severity of infection, it is not known when it is no longer economically feasible to maintain infected stocks of fish. Due to the ease with which this disease organism may be introduced to the pond and the potential for long-term negative impact on production, all farms should be proactive in implementing a prevention program, regardless of the presence of the disease.

Priority of treatment should be as follows:

1) Ponds that are experiencing an active trematode infection
2) Ponds that have a past history of pelican pressure / trematodes
3) Ponds that are feeding poorly and have snails present
4) Ponds that have moderate to high numbers of snails
5) Ponds that have no evidence of infection and only low numbers of snails.

If the number of infected ponds on a farm is high, farmers should consider treating all ponds regardless of snail numbers. It may also be a good idea to reduce the number of snails before the arrival of pelicans in the fall and winter.

PREVENTION AND TREATMENT

Currently there is no therapeutic treatment for infected fish. Control of trematode infections is therefore dependent on breaking the life cycle of the trematode. It is impractical to eliminate the free-swimming (miracidae and cercariae) life stages. The only apparent treatment for breaking the life cycle is by eliminating or reducing the numbers of the final or intermediate hosts.

The American white pelican is a common winter resident with migrating populations in the lower Mississippi valley peaking from February through April. Every effort should be made to discourage feeding by pelicans on commercial catfish operations. Pelicans can be extremely difficult to harass from a pond once they establish a feeding pattern. It is important to recognize that pelicans can establish nocturnal feeding patterns as well as feeding during daylight. If you need assistance in bird depredation problems, contact your state's USDA/APHIS/Wildlife Services agency.

In addition to preventing pelican use on farms, breaking the trematode life cycle should include reducing snail populations. This can be done by using a combination of chemical treatments, the use of a biological control species, and aquatic weed control. The chemical treatments are meant to reduce snail populations to the point where black carp can control further population growth.

CHEMICAL TREATMENTS

Pond-margin Treatments

In commercial catfish ponds, snails inhabit aquatic vegetation which provides feeding and breeding habitat. Aquatic weeds located away from the pond-margin need to be eliminated with an appropriate aquatic herbicide prior to pond-margin treatments. Pond-margin treatments using hydrated lime (either dry or as a slurry) or copper sulfate appear to be effective in reducing snail populations in the treated areas. These chemical treatments will not totally eradicate snail populations from a pond. They will only reduce the overall number of snails present. Due to the limited kill, repeat treatments will probably be necessary.

The efficacy of these chemical treatments is dependent on the applicator's willingness to assure that the proper amount of chemical is being applied and the target area is adequately covered. Thorough coverage of the treated area is critical to the success of either of the chemical treatments. The treatments target snails in a narrow band of water along the pond margin and treatment rates are calculated to apply the proper amount of chemical directly to this band. Snails that are outside of the pond-margin area will not be affected due to the dilution of the treatment. The chemical should be applied so that it penetrates through any aquatic vegetation. Areas of the pond margins with thick stands of aquatic vegetation should receive additional treatment.

There are several precautions to consider when applying these chemical treatments. Applications should be made only on calm days when mixing due to wave action is minimal. This should reduce the chance of the chemicals being diluted too fast. Avoid treating recently stocked fry ponds since fry and small fingerlings may not be able to retreat from the treated area fast enough to avoid direct contact with the chemical. Applicators should use all appropriate safety gear such as gloves, goggles, and masks when applying these treatments.

Hydrated Lime

The application of hydrated lime has minimal impact to ponds with well-buffered waters (total alkalinity > 50 ppm) when used at the rates stated below. The treated area or swath width should be limited to 3 - 4 feet from the pond margin. Hydrated lime can be applied either as a dry material or as a slurry with water.

Figure 2. Application of dry hydrated lime.

Using Dry Hydrated Lime: NWAC experiments indicate that an application of hydrated lime at a rate of 50 pounds every 75-100 feet of pond bank will give partial control of snail populations. Hydrated lime is typically sold in 50-pound bags. The material is applied with an auger-equipped hopper mounted on a tractor (Figure 2). The end of the auger can be fitted with a flexible hose to allow an applicator walking behind the tractor to apply the material directly to the target area. The difficulty in applying this type of material is that the dry powder becomes airborne and can be caustic to the applicator.

Figure 3. Application of slurried hydrated lime.

Using Slurried Hydrated Lime: Hydrated lime can also be applied as a slurry with water. The slurry is prepared at a commercial lime facility and delivered to commercial applicators or individual farmers. The bulk slurry is transferred to a large portable holding tank at the farm and subsequently pumped to smaller tanks for application (Figure 3). Formulation rates are 4.0 - 4.7 pounds of hydrated lime per gallon of water. Given this concentration, it is recommended that 20 gallons of slurry be applied per 100 feet of levee.

Copper Sulfate

Researchers at the Harry K. Dupree Stuttgart National Aquaculture Research Center have developed a treatment based on the margin application of copper sulfate. The formulation rate for this treatment is 10 pounds of copper sulfate + 1 pound of citric acid applied to 250 feet of pond margin. These dry materials should be mixed with a minimum of 70 gallons of water for each 250 feet of pond margin treated. The finished formulation should be applied to a 6-foot band around the pond perimeter.

Due to concerns about copper toxicity in low alkalinity waters, farmers should not to make treatments in ponds with less than 150-ppm total alkalinity. Researchers at Stuttgart recommend that farmers avoid treating ponds smaller than 7 acres regardless of total alkalinity concentration. Using copper sulfate in ponds with heavy blooms can also cause severe oxygen depletions.

Whole-pond Treatments

A molluscicide, Bayluscide 70 WP, has been given a Section 18 Emergency Exemption in Mississippi for control of ram's horn snail in commercially operated, man-made levee containment ponds for catfish production. Bayluscide 70 WP is applied at a rate of 1.5 pounds per acre-foot of water. The required amount of Bayluscide must be mixed in sufficient water to enable uniform application to the pond.

Unlike hydrated lime and copper sulfate, Bayluscide is a whole-pond treatment. At the application rates authorized under this exemption, this pesticide is toxic to non-target aquatic organisms such as fish and aquatic insects. Therefore, Bayluscide should only be used in those circumstances where loss of catfish is no longer a concern. One example of this situation is when the trematode infection has reduced fish stocks to a level where it is no longer economically feasible to continue production. Another example would be controlling snail populations in a pond prior to stocking fry.

Applications of Bayluscide must be made 5 to 7 days prior to stocking catfish. Do not harvest from a pond until 12 months after application of Bayluscide. Discharge of pond waters to surface waters is prohibited until 7 days after application. Bayluscide 70 WP is for retail sale to and use only by certified applicators or persons under their direct supervision.

TREATMENT CALCULATIONS

The calculation of chemical treatment to pond margins is based upon the amount of linear feet of levee and the chemical being applied. Levee lengths can be determined from pond maps, cut and fill sheets, engineering plans, or distance measuring wheels. If these measurements are not available, Table 4 provides an estimate of the levee length.

Table 4. Estimate of length of interior levee based on acreage and ratio of pond length to pond width.

	Ratio of pond length to pond width			
Acres	1:1 (feet)	2:1 (feet)	2.5:1 (feet)	3:1 (feet)
6	2045	2169	2263	2361
8	2361	2504	2613	2727
10	2640	2800	2922	3048
12	2892	3067	3201	3339
14	3124	3313	3457	3607

Example: "A 10-acre pond that is twice as long as it is wide." Look in the 2:1 column and go down to the 10-acre row. The calculated linear feet of levee to be treated would be 2800 feet.
Based on the levee lengths and the recommended rates for hydrated lime, Table 5 should provide a basis for calculating the amount of lime to be applied to the pond margin.

Table 5. Estimate of amount of hydrated lime formulation to apply to pond margin based on acreage and ratio of pond length to pond width.

	Ratio of pond length to pond width							
	1:1		2:1		2.5:1		3:1	
Acres	Dry (lbs)	Slurry (gals)	Dry (lbs)	Slurry (gals)	Dry (lbs)	Slurry (gals)	Dry (lbs)	Slurry (gals)
6	1023	409	1085	434	1132	453	1181	472
8	1181	472	1252	501	1307	523	1364	545
10	1320	528	1400	560	1461	584	1524	610
12	1446	578	1534	613	1601	640	1670	668
14	1562	625	1657	663	1729	691	1804	721

Based on the levee lengths and the recommended rates for copper sulfate, Table 6 should provide a basis for calculating the amount of copper sulfate (CS), citric acid (CA), and the minimum amount of water to be applied to the pond margin.

Table 6. Estimate of amount of copper sulfate formulation to apply to pond margin based on acreage and ratio of pond length to pond width.

	Ratio of pond length to pond width											
	1:1			2:1			2.5:1			3:1		
Acres	CS (lbs)	CA (lbs)	Water (gals)	CS (lbs)	CA (lbs)	Water (gals)	CS (lbs)	CA (lbs)	Water (gals)	CS (lbs)	CA (lbs)	Water (gals)
8	94	9.4	661	100	10.0	701	105	10.5	732	109	10.9	764
10	106	10.6	739	112	11.2	784	117	11.7	818	122	12.2	853
12	116	11.6	810	123	12.3	859	128	12.8	896	134	13.4	935
14	125	12.5	875	133	13.3	928	138	13.8	968	144	14.4	1010

Whole-pond Treatments

When applying Bayluscide 70 WP, it is extremely important to make an accurate determination of the volume of water being treated. An application of 1.5 pounds of Bayluscide 70 WP to one acre of water one foot deep (one acre-foot) should kill almost 100 % of ram's horn snails present. The same amount of Bayluscide applied to one acre of water 1.5 feet deep would only kill about 70 % of ram's horn snails present. Use the following equation to determine the correct amount of Bayluscide 70WP:

Lbs of Bayluscide 70 WP = 1.5 pounds/acre-foot X Surface Acres X Average Depth

BIOLOGICAL CONTROL

Black carp have been successful in reducing numbers of snails in ponds. Stocking rates vary from 5-20 fish per acre. Based on limited studies, it appears the most economical rate is 10 fish per acre. Check with natural resource agencies prior to obtaining any non-indigenous species. As of July 15, 2001, a permit process was in place for Mississippi producers to stock triploid black carp in commercial catfish production ponds. If you need a permit, contact the Mississippi Department of Agriculture and Commerce or call the NWAC.

Redear sunfish ("shellcrackers") are another candidate for snail control, however their use in commercial catfish ponds has yet to be experimentally evaluated. There is concern that the redear's small mouth size may restrict their foraging to juvenile snails, thus extending the time required to significantly reduce populations.

Since aquatic vegetation creates ideal habitat for snails and may limit the ability of black carp to effectively forage on snails, producers should minimize weed infestations along the margin and submerged in the pond. Grass carp and aquatic herbicides can be effective tools to control unwanted aquatic vegetation. Grass carp require a permit to be used in commercial production ponds in Mississippi. Producers who have invested time and money in planting soil stabilizing vegetation along pond margins may want to evaluate the effectiveness of other snail control measures before deciding to eliminate these plantings.

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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