

# Fisheries and Aquatics Bulletin



Winter/Spring 2008

Edited by Janet A Cushing

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## From the Editor's Desk

The times, they are a-changin'. Just like this title track from one of Bob Dylan's early albums, this year seems to be overflowing with change: Global or climate change, the changing of the seasons from winter to spring, the theme for this year's AFS meeting, "Fisheries in Flux," the change in the website of the National Fish Habitat Action Plan, just to name a few.

And so, to be consistent with this sentiment of change (irony intended), the Fisheries and Aquatics Bulletin will try something new for the next couple of issues. In the past, the FAB, as it is affectionately called, has had a random assortment of Science Features articles. The reason for this was partly to give readers an idea of the wide breadth of research being done by our wonderful scientists, and partly as a result of what we received from our scientists. There are pros and cons to this approach, the pro being that we all get to see the wide variety of research being done. However, the risk to this approach is that during busy times of the year for scientists, we might not get many Science Feature articles.

The plan for the next issue will be to focus the Science Features section around a common theme. I've been asked by others if the FAB would ever go that route, and now seems like a good time to do so. If you have ideas for the themes that you would like to see for future issues, please let me know. Soon after this issue hits the on-line press, I will be contacting specific people about submitting an article around a theme. This is certainly not meant to dissuade others from submitting an article—by all means, please do, at any time, I will probably build a theme issue around it. I also still hope to receive news and updates for our other sections as well: Science Center News, New Publications, Funding Opportunities, Meeting Notes, etc.

So, keep those ideas  
And articles comin',  
And don't be surprised  
When you hear the phone.  
I'll be calling on you,  
To write and make known,  
The research that you've  
    spent time doin'.  
For the times, they are a-  
    changin'....

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## Science Features:

### Fish Discard Mortality Negatively Affects Performance of Length Limits

-Lew Coggins, USGS, Grand Canyon Monitoring and Research Center

Matt Catalano, Mike Allen, Bill Pine, and Carl Walters, University of Florida

Discard mortality, the post release death of sublegal sized fish, is receiving increased attention from fishery scientists as a substantial contributor to overfishing. Fishery collapse causes substantial economic and ecological harm, and therefore harvest regulations often require release of some portion of the catch in an attempt to reduce fishing mortality. Minimum length limits are perhaps the most common harvest regulation used in both commercial and recreational fisheries, but their conservation benefits can be influenced by discard mortality. We recently evaluated the influence of discard mortality on the efficacy of minimum length limits to sustain fish populations and maximize yield

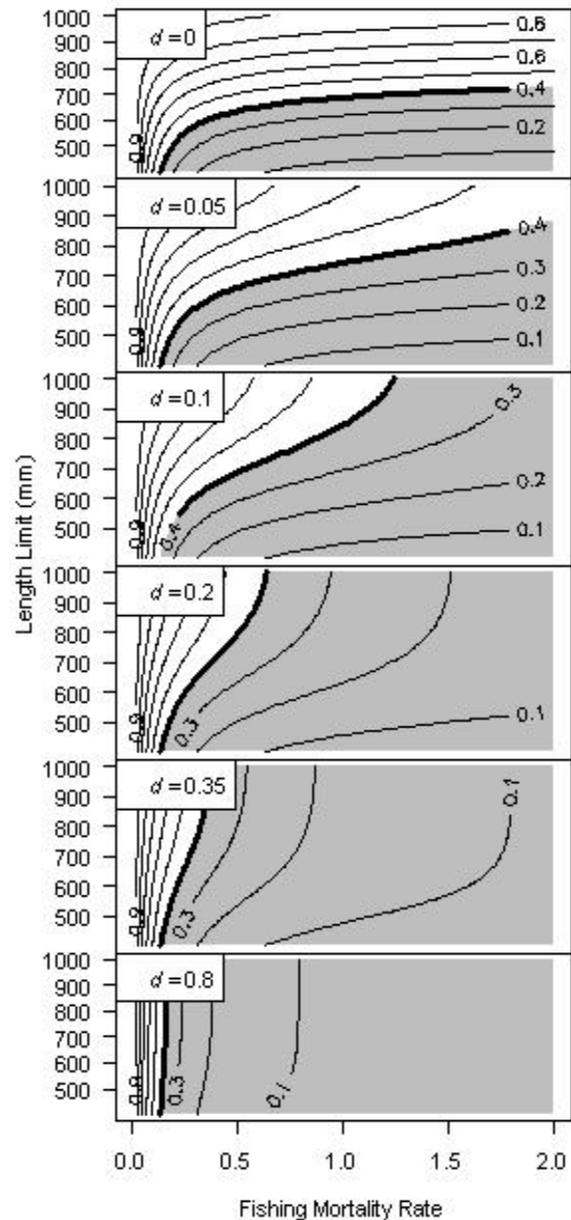
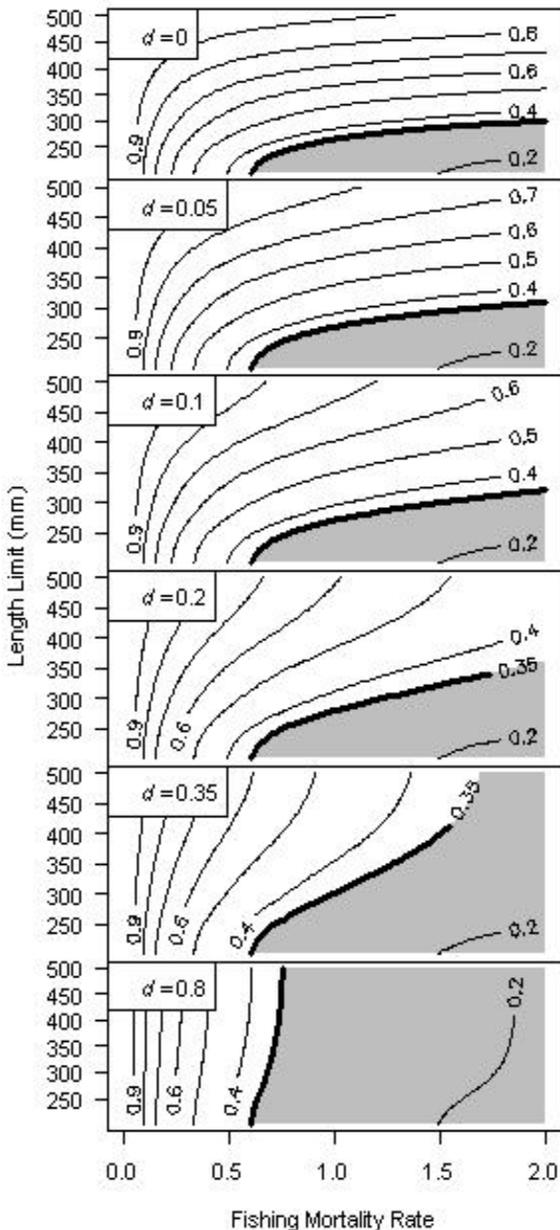
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and fishery efficiency. Using a simulation model, we evaluated the performance of length limits in the face of varying levels of discard mortality for two disparate fish life history types: short lived and long-lived. Length limits failed to prevent recruitment overfishing when discard mortality rate exceeded about 20% for short-

lived species (Figure 1) and 5% for long-lived species (Figure 2).

**Figure 1. Spawning potential ratio (SPR) representing the ratio of exploited to unfished egg production per recruit across length limit (ordinate), fishing mortality rate (abscissa) and discard mortality rate (d, sub plots) for short-lived, high-productivity life-history strategists (SLHP). Shaded areas represent scenarios resulting in SPR < 0.35 and potentially leading to recruitment overfishing.**

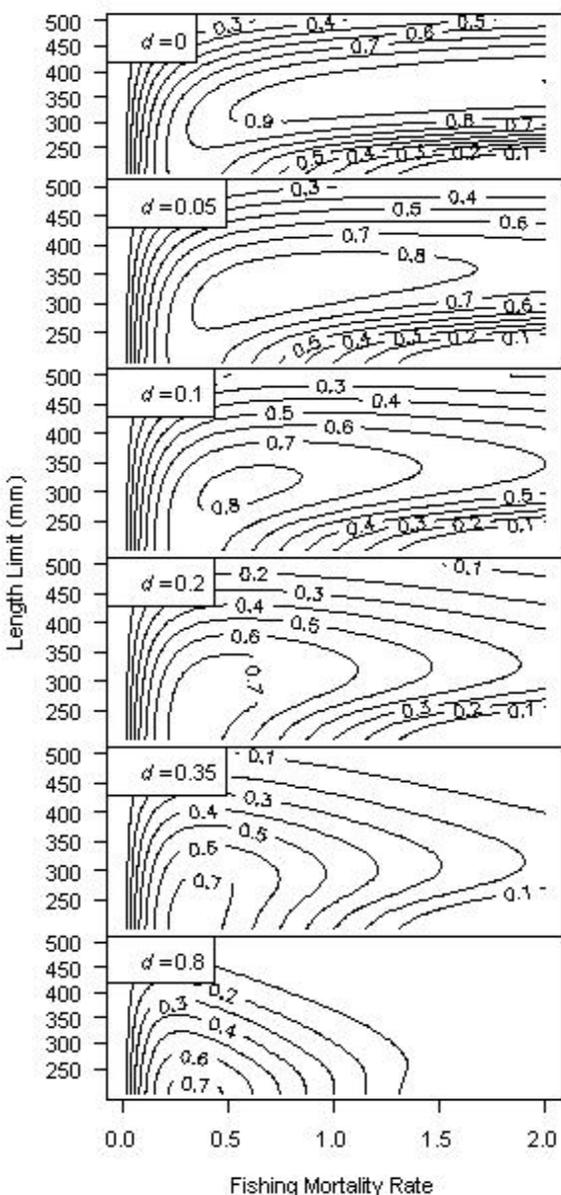
**Figure 2 Spawning potential ratio (SPR) representing the ratio of exploited to unfished egg production per recruit across length limit (ordinate), fishing mortality rate (abscissa) and discard mortality rate (d, sub plots) for long-lived, low-productivity life-history strategists (LLL). Shaded areas represent scenarios resulting in SPR < 0.40 and potentially leading to recruitment overfishing.**



An important finding of the work was that reductions in overall fishing mortality (e.g., lower fishing effort) were

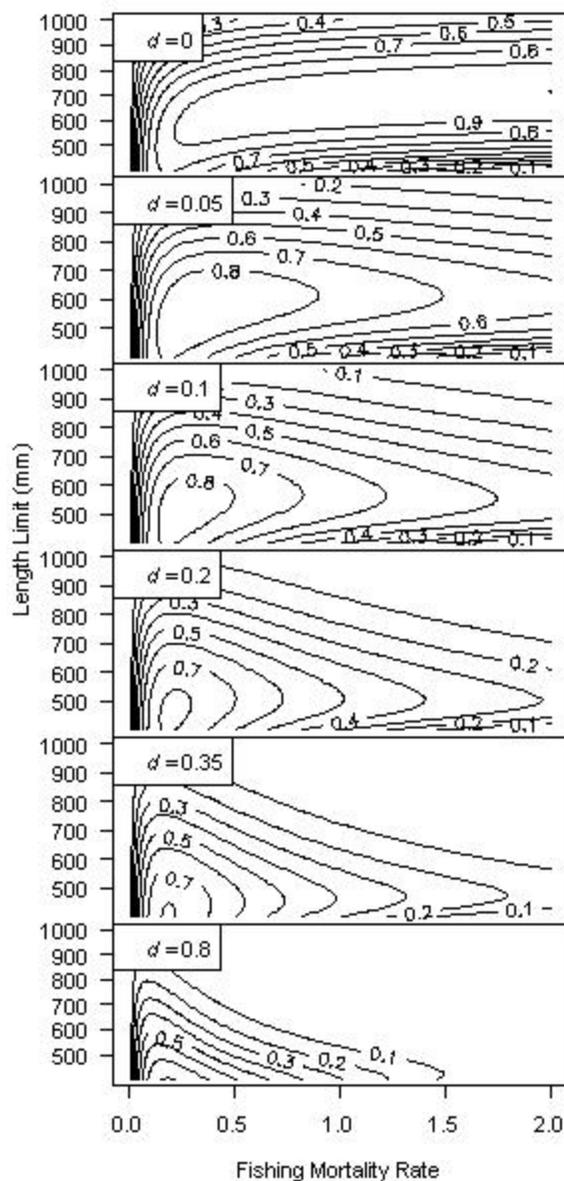
required to prevent recruitment overfishing if discard mortality exceeded these rates. Even relatively low discard mortality rates ( $d < 5\%$ ) rendered maximum yield unobtainable and caused a substantial shift in the shape of the yield response surface (Figures 3 & 4).

**Figure 3 Yield (i.e. biomass of harvested fish) for the SLHP species across length limit, fishing mortality rate and discard mortality rate. All yield values are scaled to the simulated maximum yield across all values of length limit, fishing mortality rate and discard mortality rate.**



Analysis of fishery efficiency showed that length limits caused the simulated fisheries to be much less efficient (i.e., harvest became a lesser proportion of total fishery

**Figure 4 Yield (i.e. biomass of harvested fish) for the LLLP species across length limit, fishing mortality rate and discard mortality rate. All yield values are scaled to the simulated maximum yield across all values of length limit, fishing mortality rate and discard mortality rate.**



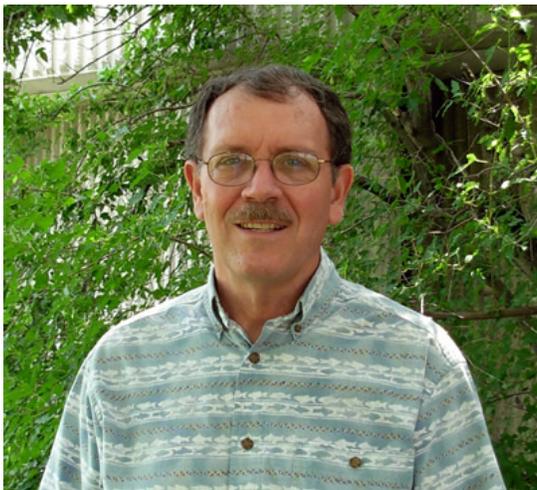
deaths), potentially exposing the target species and ecosystem to increased negative effects of the fishing process. The findings suggest that for overexploited fisheries with moderate to high discard mortality rates, reductions in fishing mortality will be required to meet management goals. In addition, we show that discard mortality rates of around 20% can have substantial effects on fisheries, and these rates are within the range of observed discard mortality rates for many fisheries. Resource managers should carefully consider

impacts of discard mortality on fishery sustainability. The work was presented to several agencies (Florida Fish and Wildlife Research Institute, St. Petersburg, and the National Oceanographic and Atmospheric Administration, Miami, Florida) and at regional and national meetings of the American Fisheries Society. The paper was published in the journal *Fish and Fisheries* in November 2007 and has since garnered substantial international attention with reprint requests coming from seven countries on four continents.

*Editor's note: The citation for the full article is: Coggins, L.G., M.J. Catalano, M.S. Allen, W.E. Pine, and C.J. Walters. 2007. Effects of cryptic mortality and the hidden costs of using length limits in fishery management. Fish and Fisheries, 8: 196-210. For more information about this study, please contact Lew Coggins at lcoggins@usgs.gov.*

## Science Centers in the News

### Dr. Bill Gingerich Retires



The staff of the Upper Midwest Environmental Sciences Center is both happy and sad to inform our friends, partners, collaborators and supporters that Dr. William "Bill" Gingerich retired in January 2008 after over 30 years of active research to support and enhance our Nation's natural resources. Bill started his federal career as a draftee in the U.S. Army in 1968 where he served as a lab technician in a hospital clinical diagnostic laboratory. After his time in "green", Bill completed

his graduate work at California State University-Humboldt (M.S. 1972) and Oregon State University (Ph.D. 1977). After a stint as an assistant research professor at OSU, Bill rejoined government service in 1978 when he was selected to lead the Physiology Branch at the National Fisheries Research Center in La Crosse, WI. Though his career includes many notable achievements, the one with undoubtedly the greatest impact on our Nation's resources has been the leadership he provided from the inception of the Federal-State Aquaculture Drug Approval Project Partnership through the Project's ultimate goal, the approval of new aquaculture drugs. Through Bill's leadership, new aquaculture drug approvals have been obtained or will soon be obtained for five drugs including Halamid® (chloramine-T), Aquaflor® (florfenicol), formalin, 35% Perox-Aid® (hydrogen peroxide), and oxytetracycline (Terramycin-200® for Fish and oxytetracycline hydrochloride). Bill's contributions to our National resources have been widely honored through his receipt of several awards including:

- Association of Fish and Wildlife Agencies Award, in recognition of sustained "leadership and tireless efforts on behalf of the Federal-State Aquaculture Drug Approval Partnership Project" - September, 2002.
- Department of Interior's Meritorious Service Award, in recognition of outstanding and sustained efforts to develop fishery management chemicals and drugs for public fishery management agencies—September, 2003.
- Schering-Plough Animal Health Corporation Recognition Award, for contributions leading to the approval of Aquaflor®, the first oral drug developed for aquaculture in more than 20 years—February, 2006.
- Eka Chemicals, Inc., Recognition Award, for leadership and sustained contributions resulting in the approval of 35% Perox-Aid, the first broadly approved waterborne drug for U.S. aquaculture—February, 2007.
- Food and Drug Administration's Commissioner's Special Citation, "For exceptional leadership, outstanding coordination of resources, and sustained efforts in the development of data for the approval of new animal drugs for aquaculture" - June, 2007.

Though Bill's daily leadership and guidance will be missed, Bill will remain active in graduate education as an adjunct faculty of the University of Wisconsin-La Crosse. He also has a long list of interests and hobbies that will finally get his full attention.

## Tribal Liaison News

### USGS Native American Internships Awarded

Many worthy proposals were received for the 2008 Student Interns in Support of Native American Relations (SISNAR) grant, managed by the USGS Native American Liaison program. This year the Global Change Program provided additional funding to support student interns working on climate change issues. The team of USGS American Indian/Alaska Native Liaisons awarded grants ranging from \$5000 to \$10,000 to seven USGS scientists (among them, a fisheries biologist!) based on their proposals of how the project would advance the USGS scientific mission while successfully building relations between the USGS and Native American governments.

The SISNAR activity was created to meet multiple goals, including preparing American Indian and Alaska Native students for careers in science, making them and their governments and communities, aware of the value and relevance of USGS science, and developing a relationship between the USGS and Tribal governments.

Congratulations to the following scientists receiving SISNAR grants:

Jennifer Adleman (Geology) -Alaska Science Center: Volcanic hazards communications with Native communities at risk

Perry Jones (Water) -Minnesota Water Science Center: Fond du Lac Groundwater/Surface Water Interaction—Impacts of Lake Levels on Wild Rice Production

Dawn Dittman (Biology) -Lake sturgeon and aquatic ecosystem health in the St. Lawrence River

Charles Culbertson (Water) -Maine Water Science Center: Monitoring the effects of global climate change on the occurrence, frequency, and intensity of cyanobacterial harmful algal blooms on the Penobscot River

Bryan Richards (Biology) -National Wildlife Health Center: Wildlife disease investigations on tribal lands

Mark Anderson (Water) -South Dakota Water Science Center: Hydroclimatic changes and water availability on tribal lands in the Missouri River Basin

Carl Markon (Geography) -Alaska Science Center: Natural, anthropogenic and climate-induced hazard impacts on Native indigenous population

Kristi Wallace (Geology) -Alaska Science Center: Reconstruction of the climate history through paleoecology of the southern Kenai Peninsula in Alaska

Margaret Hiza Redsteer (Geology) -Flagstaff Science Center: Geo-botanical study of sand dunes in the Tuba City region of the Navajo Nation

Paul Schuster (Water) -National Water Program: Yukon River Basin Project. Water quality and ecosystem response to climate change

Peter Gogan (Biology) -Northern Rocky Mountain Center: Management plan for reintroduction of bison to the Wind River Indian Reservation in Wyoming

## New Publications

### Coral Reef Disease

**Citation: Work, T.M., G.S. Aeby, S.L. Coles. 2008. Distribution and morphology of growth anomalies in *Acropora* from the Indo-Pacific. *Diseases of Aquatic Organisms*, 78: 255–264.**

This paper describes the distribution and prevalence of growth anomalies (GAs) in *Acropora* from French Frigate Shoals (Hawaii, USA), Johnston Atoll and Tutuila (American Samoa). The authors developed a nomenclature for gross morphology, characterized GAs at the cellular level and obtained preliminary indices of their spatial patterns and progression within coral colonies.

### Aquaculture

**Citation: Gaikowski, M.P., W.J. Larson, W.H. Gingerich. 2008. Survival of cool and warm freshwater fish following chloramine-T exposure. *Aquaculture*, 275: 20-25.**

In this study, the researchers determine the safety of chloramine-T bath exposures at multiples of the proposed maximum treatment concentration, administered to lake sturgeon (*Acipenser fulvescens*), northern pike (*Esox lucius*), walleye (*Sander vitreum*), channel catfish (*Ictalurus punctatus*), and largemouth bass (*Micropterus salmoides*). Based on their mortality data,

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chloramine-T administered once daily for 60 minutes on four consecutive days at concentrations of up to 20 mg/L is not likely to adversely affect survival of cool or warmwater fish cultured in freshwater.

## National Fish Habitat Action Plan News

### Fish Habitat Partnerships

At the last National Fish Habitat Board meeting, the Board endorsed the Western Native Trout Initiative as a Fish Habitat Partnership (FHP). The Board deferred the application submitted by the Southwest Alaska Salmon Conservation Coalition until the May Board meeting, so the candidate partnership could address deficiencies in meeting the FHP criteria. The application submitted by the Lower Mississippi River Conservation Coalition initiated discussion by the Board as to how the FHPs should be organized. The Board decided to form a working group of Board members and staff to write a report on the structure of FHPs with recommendations for revised guidance. These recommendations will be provided to the Board at the May meeting.

There are currently 15 Candidate FHPs:

Lower Mississippi River Conservation Committee  
Ohio River Basin Habitat Partnership  
Great Lakes Basin Partnership  
Atlantic Coastal Fish Habitat Partnership  
Desert Fish Habitat Partnership  
Southwest Alaska Conservation Coalition  
Midwest Glacial Lakes Partnership  
Kenai Peninsula Conservation Partnership  
National Reservoir Partnership  
Salmon in the City (Anchorage)  
Fishers and Farmers Partnership (Upper Mississippi)  
California Fish Passage Forum  
Salmon Stronghold Partnership  
Great Plains Prairie Partnership  
Hawaii Fish Habitat Partnership

### National Fish Habitat Board

The National Fish Habitat Board met on February 19-20, 2008 in St. Petersburg, Florida. Besides FHP issues, the Board also approved the first set of annual

NFHAP awards and the second annual list of "10 Waters to Watch." The waters featured on this list demonstrate the results of conservation efforts under the National Fish Habitat Action Plan.

In other business, the Board discussed the draft legislation of the National Fish Habitat Conservation Act. The legislation drafting committee received Board endorsement to submit the draft legislation to Congressional members; Federal members of the Board recused themselves from voting.

The next Board meeting will take place on May 13-14 at The Nature Conservancy office in Arlington, VA.

### Science and Data

The National Fish Habitat Science & Data Committee met on February 5-7, 2008 in San Antonio, TX. The meeting focused on the national assessment of fish habitat, with discussions centered around stratification variables, the linkage between the national assessment and the efforts of the Fish Habitat Partnership (FHP), and the scales at which the assessment would be conducted. The Committee also discussed its possible roles and responsibilities toward the NFH Board and FHPs, and what products or services the Committee could develop in the future.

The draft Framework for Assessing the Nation's Fish Habitat is currently undergoing revisions, with a final version expected to be presented to the NFH Board by the October meeting.

Members of the Data Team met in early April to begin planning for the development of the national Project Tracking Database that will be part of the overall national Data System, as outlined in the Science and Data Committee's draft framework report.

### National Casting Call

The National Casting Call took place on the banks of the Potomac River at Fletcher's Cove in Washington, D.C. on April 27th and 28th. Both the 1st Annual NFHAP awards and 10 Waters to Watch were presented to the public. There were multiple displays at the event, including the Fisheries program and Water Quality mobile unit from the DE-DC-MD Water Science Center. The NFHAP continues to grow as the focus of this annual event.

### Renovated Website

The NFHAP website was recently renovated and its new look was activated on April 28th. To see how you can link to the NFHAP, go to: [www.fishhabitat.org](http://www.fishhabitat.org).

## Job Announcements & Funding Opportunities

### Position Announcements

#### Short Notice!!

#### Teaming with Wildlife Director, Association of Fish and Wildlife Agencies

**Duties and Responsibilities:** The Teaming with Wildlife Director is a senior staff position responsible for managing the Association's Teaming with Wildlife campaign and overseeing other activities related to activities related to state wildlife diversity programs. Responsibilities include coordinating the activities of a 5,000+ organization coalition, managing legislative advocacy efforts around funding for state fish and wildlife agencies to prevent wildlife from becoming endangered, and carrying out extensive outreach activities around the Teaming with Wildlife initiative and the state wildlife action plans. The Director coordinates activities through the Association's Teaming with Wildlife Committee and works closely with partner organizations to develop and advance a legislative agenda and mobilize the members of the coalition. The Director also serves as a member of the Association staff's senior leadership team, providing input and direction on overall Association activities.

**Salary:** Negotiable commensurate with experience.

**Benefits package includes:** Medical insurance, life insurance, short- and long-term disability, worker's compensation, pension plan, annual and sick leave, paid holidays.

**Deadline for application:** **May 15, 2008.**

For more information, please go to: <http://www.fishwildlife.org/pdfs/JobAnnouncements/TeamingWildlifeDirectorPosition2008.pdf>.

#### Atlantic States Marine Fisheries Commission

The Commission is currently seeking to fill the positions of ASMFC Science Director, ACCSP Outreach Coordinator, Fisheries Data Coordinator, and Assistant State Fisheries Coordinator for New Jersey. The vacancy announcements along with the position descriptions can be found at <http://www.asmf.org/>, then click on the Breaking News link located on the left side of the webpage.

#### JSPS Invitation Fellowship Programs for Research in Japan

For those of you who have been working with colleagues in Japan, here is a possible fellowship program for you. A program offered by the Japan Society for the Promotion of Science (JSPS) is designed to enable Japanese researchers to invite their foreign colleagues to Japan to participate in cooperative work and other academic activities at Japan's Public Works Research Institute. JSPS conducts two programs (a short- and long-term program) under the Invitation Fellowship heading. Funded by a subsidy from the Japanese government, these fellowship programs are to promote international cooperation and mutual understanding through scientific research. The programs allow researchers employed at designated Japanese research institutions and laboratories to invite fellow researchers from other countries to Japan to participate in cooperative activities. For more information, go to <http://www.jsps.go.jp/english/e-inv/main.htm>.

#### Ph.D. Assistantship

The United States Geological Survey, Northern Appalachian Research Lab and Michigan State University are seeking a Ph.D. student in fisheries and aquatic ecology to develop a decision support system for management of the Delaware River System. The successful applicant will be expected to incorporate models of climate change into this decision support system. For more details, please go to <http://groups.google.com/group/afs-fisheries/msg/4781bd96278e9c5f> or contact either Bill Taylor, MSU, [taylorw@msu.edu](mailto:taylorw@msu.edu), Bill Lellis, USGS, [wlellis@usgs.gov](mailto:wlellis@usgs.gov) or Doug Beard at [dbeard@usgs.gov](mailto:dbeard@usgs.gov).

#### Meeting Notes

##### Southeastern Fishes Council

The Southeastern Fishes Council held its annual meeting in Chattanooga, Tennessee, November 8-9, 2007. Approximately 150 participants gathered to listen to over 50 presentations and view a dozen posters on fish and fish habitat issues by scientists and resource managers from throughout the region. SFC president and USGS researcher Noel Burkhead started the meeting with a report on the status of imperiled fishes of North America, an effort he and other researchers are

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conducting in collaboration with the American Fisheries Society (AFS). The results of his research will be published in AFS later this year.

The topic and flavor of the presentations echoed concerns voiced by Dr. Burkhead in his opening remarks about the rapid decline of fish populations nation-wide, but particularly in the southeastern United States. Presentations provided details on how habitat loss and alteration, invasive species, contaminants, and prolonged drought, are adversely impacting fish populations and threatening some species with extinction. Species at high risk of extinction identified specifically in presentations included Pygmy Sunfish (*Elassoma alabamae*), Vermillion Darter (*Etheostoma chermocki*), Watercress Darter (*Etheostoma nuchale*), Coosa Shiner (*Notropis xaenocephalus*), and others.

New techniques for propagation and new research revealing previous unknown habitat requirements for a variety of fish species were reported and new technical tools are emerging to protect declining fisheries resources. In addition, multi-stakeholder conservation efforts such as the Robust Redhorse Recovery Committee (reported on by Cecil Jennings and Rebecca Peterson of the USGS Georgia Cooperative Fish and Wildlife Research Unit), and the Southeast Aquatic Resources Partnership, (addressed by Rachel Muir, Imperiled Species Coordinator, USGS BRD) hold promise for species and habitat recovery.

The next annual meeting will be held in Chattanooga, in November, 2008. For additional information on the Southeastern Fishes Council and abstracts from the annual meeting, visiting their website at <http://www.flmnh.ufl.edu/fish/Organizations/SFC/SFCDefault.htm>.

## Upcoming Meetings

### 49<sup>th</sup> Western Fish Disease Workshop

The Northwest Indian Fisheries Commission and the Washington Department of Fish and Wildlife invite you to attend the 49<sup>th</sup> Western Fish Disease Workshop on **June 24 -25, 2008** at the Shilo Inn Suites Hotel located in Ocean Shores on the Washington Coast. The workshop will be preceded by a half-day continuing education session on the afternoon of June 23, 2008. Additional information/details will be forthcoming on the meeting and CE session but now is the time to reserve the dates on your calendar and make your room reservations. June is the beginning of the peak tourist season on the Washington Coast so don't wait too long to make your reservations. If you have any questions at this time please contact either: Bruce Stewart,

Northwest Indian Fisheries Commission, at [bstewart@nwifc.org](mailto:bstewart@nwifc.org) or John Kerwin, Washington Department of Fish and Wildlife at [kerwijek@dfw.wa.gov](mailto:kerwijek@dfw.wa.gov).

### 2008 Annual Meeting Fish Health Section-American Fisheries Society

The 2008 Annual Meeting of the Fish Health Section-AFS will be held in Charlottetown, Prince Edward Island, Canada from **July 9 - 12, 2008**. More information can be found on the conference website: [www.upei.ca/FHS-AFS2008](http://www.upei.ca/FHS-AFS2008).

### Fish Culture Training

The Conservation Fund Freshwater Institute is offering a 1-week short course on 'Water Reuse for Intensive Fish Culture', **July 28 - August 1, 2008**, in Shepherdstown, WV. This course covers the fundamentals and details of design, unit process operation, and even some process management and trouble shooting. The course will be taught at the National Conservation Training Center. The lab classes for the course will be held 2 miles away from NCTC at the Freshwater Institute. For more information, go to: <http://www.conservationfund.org/node/665>.

### 8th International Congress on the Biology of Fish

The 8<sup>th</sup> International Congress on the Biology of Fishes (<http://fishbiologycongress8.usgs.gov/>) will be held in Portland, Oregon, on **July 28 - August 1, 2008**. The Congress offers a unique opportunity to see a wide variety of research on the biology of fish presented by scientists from around the world.

### American Fisheries Society Annual Meeting

We invite you to join us in Ottawa, Canada's capital city, for the 138th Annual Meeting of the American Fisheries Society (AFS) at the Ottawa Congress Centre and Westin Hotel during **August 17-21, 2008**. The theme of the meeting is "Fisheries in Flux: How Do We Ensure Our Sustainable Future". This theme reflects President Mary Fabrizio's Program of Work for her year in office, and addresses the ongoing challenge of confronting change when managing fisheries. The on-line registration will soon be open; for more information on the conference, go to <http://www.fisheries.org/afs08/>.

## MTS/IEEE Oceans 2008: Oceans, Poles, and Climate: Technological Challenges

In **September 15-18, 2008**, the prestigious Oceans conference and exhibition comes to Quebec City, Canada. Oceans '08 will coincide with the 400th anniversary of Quebec, a jewel of the World Heritage famous for its gastronomy and joie de vivre. Oceans '08 will also happen at the pinnacle of the 4th International Polar Year (2007-2009) that focuses on the rapidly changing Polar Oceans. Thus the stars are aligning for a landmark edition of Oceans, the world's leading conference and exhibition in ocean science, engineering, technology and management. For details, go to <http://www.oceans08mtsieequebec.org/>.

## FLOW 2008

The Instream Flow Council and its sponsors and collaborators are pleased to announce that registration is now open for the *FLOW 2008 – Interdisciplinary Solutions to Instream Flow Problems* conference set for San Antonio in **October 7-9, 2008**. For registration information, go to: [www.instreamflowcouncil.org](http://www.instreamflowcouncil.org).

## Workshop on Interdisciplinary Microbiology

U.S. Geological Survey (USGS) microbiology efforts span the disciplines and cover many broad research areas, including wildlife health and disease, microbial ecology, public health and water quality, geomicrobiology and ecosystem function. An internal USGS microbiology workshop will be held **October 15-17, 2008**, in Estes Park, Colorado, and will provide an opportunity to facilitate USGS collaborations and provide a better understanding of ongoing research activities among USGS microbiologists. The seven themes selected for presentations are, Ecology of Wildlife and Fish Disease, Mechanisms of Fish and Wildlife Disease, Microbial Ecology, Geographic Patterns/Visualization, Health and Water Quality, Geomicrobiology and Ecosystem Function. To encourage broader participation in the workshop, USGS scientists are invited to submit an abstract for one of the general sessions or for the poster session. **The deadline for abstract submission is May 30, 2008**. Please contact Kay Marano Briggs, [kmbriggs@usgs.gov](mailto:kmbriggs@usgs.gov), with any additional questions or comments.

## Go to Great Links

<http://www.usgs.gov>

## Fish Passage

For those of you involved in stream restoration, fish passage, culvert design or water resources in general, this publication may be of interest. This is not a design manual, but rather a synthesis of existing methods of culvert design for fish passage. The authors divide design techniques into four categories, including:

- 1) No impedance techniques, which span the entire stream channel and floodplain;
- 2) Geomorphic simulation techniques, which create fish passage by matching natural channel conditions within the culvert crossing;
- 3) Hydraulic simulation techniques, which attempt to closely resemble hydraulic diversity found in the natural channel through the use of natural and oversized substrate; and
- 4) Hydraulic design techniques, which may utilize roughness elements such as baffles and weirs to meet species-specific fish passage criteria during periods of fish movement.

The document can be downloaded at: <http://www.fhwa.dot.gov/engineering/hydraulics/pubs/07033/>.

## Updated Aquaculture Website Link

The official JSA web site has had some changes to follow guidance provided by the Office of Science and Technology Policy. The web link for the National Coordinator for Aquaculture New Animal Drug Applications has been changed to: <http://aquanic.org/aquadrugs>. Please share this information with others who may wish to use this valuable resource site on aquatic animal drug related information.

## Share Your Expertise through the Fisheries and Aquatics Bulletin

Thank you to all those who have contributed material to this issue of the FAB: Lew Coggins, Mark Gaiowski, Rachel Muir, and Robin Schrock.

Communicate your fisheries and aquatic resources items of interest to gain national exposure. Send articles and photographs with credits and captions to:

Janet Cushing—[jcushing@usgs.gov](mailto:jcushing@usgs.gov) OR  
Robin Schrock—[robin\\_schrock@usgs.gov](mailto:robin_schrock@usgs.gov)