Fisheries

VOL 32 NO 11
NOVEMBER 2007

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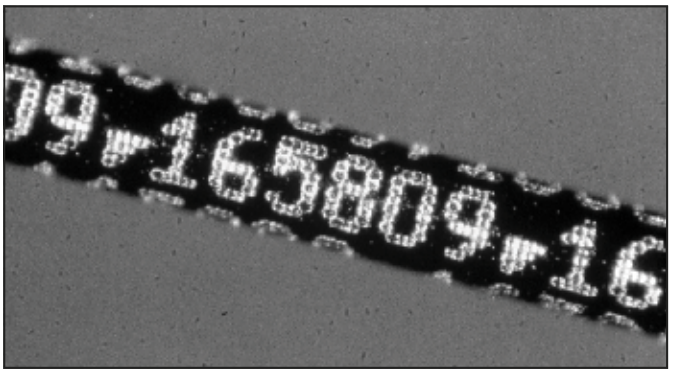
Fish News
Legislative Update
Journal Highlights
Calendar
Job Center

National Aquatic Species Risk Analysis: A Call for Improved Implementation

Development of a Standardized DNA Database for Chinook Salmon

1.1 Billion Tagged Fish



This 55 pound 5 year old Chinook salmon was coded wire tagged as a smolt before release.

Many species of aquatic organisms all around the world have been successfully tagged with Northwest Marine Technology's Coded Wire Tags. Coded Wire Tags are tiny pieces of stainless steel wire 1.1 mm in length x 0.25 mm diameter with a numeric code printed on them (enlarged, top left). Because they are so tiny, Coded Wire Tags can be implanted into very small animals with little effect on the host. Coded Wire Tags are unique in their nearly universal high retention rates, even through molts and metamorphosis. Retention for the life of the animal is the norm. Hundreds of publications describing the uses of Coded Wire Tags are available on our website.

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VOL 32 NO 11
NOVEMBER 2007

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EDITORIAL / SUBSCRIPTION / CIRCULATION OFFICES
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The American Fisheries Society (AFS), founded in 1870, is the oldest and largest professional society representing fisheries scientists. The AFS promotes scientific research and enlightened management of aquatic resources for optimum use and enjoyment by the public. It also encourages comprehensive education of fisheries scientists and continuing on-the-job training.

Dues and fees for 2007 are $76 in North America ($88 elsewhere) for regular members, $19 in North America ($22 elsewhere) for student members, and $38 ($44) retired members. Fees include $19 for *Fisheries* subscription. Nonmember and library subscription rates are $106 ($127). Price per copy: $3.50 member; $6 nonmember. Fisheries (ISSN 0363-2415) is published monthly by the American Fisheries Society; 5410 Grosvenor Lane, Suite 110; Bethesda, MD 20814-2199

Periodicals postage paid at Bethesda, Maryland, and at an additional mailing office. A copy of Fisheries Guide for Authors is available from the editor or the AFS website, www.fisheries.org. If requesting from the managing editor, please enclose a stamped, self-addressed envelope with your request.

Postmaster: Send address changes to Fisheries, American Fisheries Society; 5410 Grosvenor Lane, Suite 110; Bethesda, MD 20814-2199.
Fisheries is printed on 10% post-consumer recycled paper with soy-based printing inks.

Advertising Index

Contents

COVER: Chinook Salmon (*Oncorhynchus Tshawtscha*) caught in the Columbia River.
CREDIT: Andrew Murdoch

COLUMN:
PRESIDENT'S HOOK

Mary C. Fabrizio
AFS President Fabrizio can be contacted at mfabrizio@vims.edu.

Placing AFS on Record: Policy Statements and Resolution

The American Fisheries Society is occasionally contacted by agencies, institutions, and individuals asking for the Society's position on a particular aquatic resource issue of concern. For example, AFS recently received an inquiry from the Food and Agriculture Organization of the United Nations concerning the Society's policy on recreational fishing. Policy statements and resolutions adopted by professional societies are formal statements that place a society on record with regard to an issue of general importance. AFS adopts both resolutions and policy statements, but the distinction between these two forms of expression is not always clear.

During the Annual Meeting in San Francisco, the AFS Governing Board was asked to approve a draft policy statement on economics and fish conservation; the draft had been published in *Fisheries* for membership review and would have come to the floor for a vote by AFS members at the annual Business Meeting had the board approved the draft. However, a debate about the policy statement ensued at the Governing Board meeting and the board determined it was not ready for a vote by the membership and needed several revisions in content and format. The deliberative process used at the meeting ensured that the wishes of the majority were followed, while the voice of the minority was heard. As such, Governing Board members fulfilled the duties of their job, and they did so in an orderly and proper manner. However, the final outcome disappointed many on the board because it meant that the policy statement would need to be revised prior to consideration by the membership. In the days following the meeting, I heard from several AFS members who wondered how the process could have taken such a turn and why the current Governing Board procedures seemed inadequate with respect to dialogue and debate on the content of the policy statement.

We can learn from the difficulties encountered at the San Francisco Governing Board meeting and improve the process whereby we formulate credible and independent AFS positions on complex issues. To provide a better understanding of resolutions and policy statements, I will describe the current process for handling resolutions and policy statements, and outline a few steps we can take now to improve AFS procedures used to adopt policy statements so that future deliberations of the board will better reflect the broad interests of AFS members.

A resolution can be distinguished from a policy statement in several ways, including the format itself. A resolution typically consists of several clauses that follow a preamble beginning with "Whereas…" A resolution closes with the phrase "therefore, be it resolved that…" On the other hand, a policy statement is generally a lengthy account including full documentation of the scientific issues to be considered when addressing the aquatic resource matter of concern, including references to pertinent literature which provide the scientific basis upon which the policy is based. Thus, beyond the difference in format, resolutions and policy statements differ in scope and content.

Both general resolutions (as opposed to internal resolutions that are used to recognize individuals or organizations) and policy statements are formal declarations of AFS views, and either may address aquatic resource issues of national or international importance. Resolutions instruct and inform, while policy statements, by analyzing the science and declaring a position, also provide a framework for action. The purpose of a resolution is to call attention to issues of concern and inform members of matters important to AFS; resolutions recognize the need for action, but do not provide detailed guidance on this. For instance, a resolution on the teaching of alternatives to evolution was adopted in San Francisco. This resolution put AFS on record, along with more than 70 other scientific societies, that "the theory of evolution is the only current scientific explanation for the diversity of life on earth for inclusion in the science curricula of public schools." The resolution encouraged "citizens, educational authorities, and legislators to oppose policies that allow the teaching of creationism, intelligent design, or other political or faith-based doctrines in public school science classes," but did not specify particular actions.

The purpose of a policy statement is to present an analysis of the science, declare the position of the AFS, and provide guidance on taking action, or if warranted, to describe a course of action. Policy statements clearly delineate the scientific concerns that must be addressed or considered prior to taking action. For example, the AFS policy statement on dam removal instructs agencies, industry sectors, environmental interests, and others to consider dam removal on a case-by-case basis and to assess the costs associated with societal, cultural, environmental, engineering, and technical issues of dam removal, as well as the benefits of restoring fish habitat, fish populations, and the fisheries they support. Policy statements should be fully integrated with previous statements. For instance, the policy statement on endangered aquatic species refers to AFS policy statements on point and

Continued on page 564

Winter Short Courses

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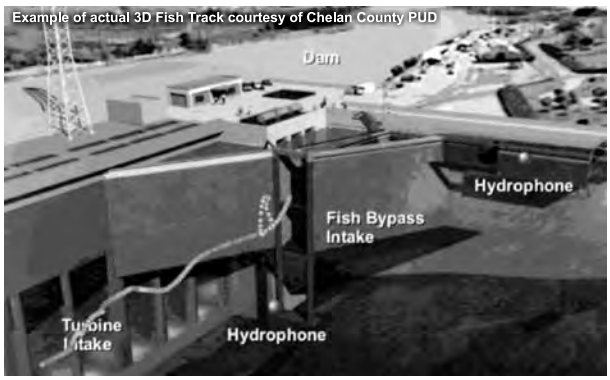

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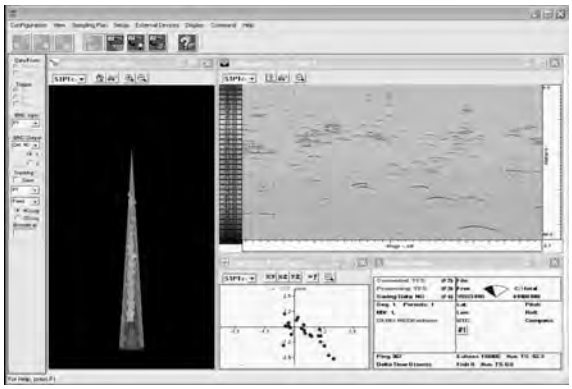
Each course includes a detailed short course manual, along with other useful publications and project reports. A demonstration of acoustic tag or hydroacoustic systems is conducted. Each of HTI's veteran short course instructors has been in the industry for 25 years, and they have conducted literally hundreds of major studies in various environments around the world. And they have also authored numerous publications and reports on the use of acoustic tags and hydroacoustics. With plentiful documentation and a seasoned team of expert instructors, attending a short course offers a perfect opportunity to discuss your specific application or ask the questions you need answered.

Using Acoustic Tags to Track Fish (January 10-11, 2008, Seattle, WA USA) addresses all aspects of tracking fish movement with acoustic tags, including three-dimensional tracking with sub-meter resolution. A variety of freshwater, marine, estuary and aquaculture applications are covered.

Using Hydroacoustics for Fisheries Assessment (January 17-18, 2008, Seattle, WA USA) covers mobile and fixed-location survey techniques. Subjects include basic hydroacoustic theory, system deployment, data collection and processing, and typical results. Split-beam, dual-beam, single-beam, and multi-frequency techniques are discussed in detail.

As per Dr. Jan H. Kemper of the Organisation for the Improvement of Inland Fisheries in the Netherlands, "We liked the course and the hydroacoustic short course manuals." Dr. Kemper is the project leader for fisheries sonar where his focus is on fish and their surroundings in all types of inland waters. To get a course agenda and registration form (and view other useful resources), visit us online at our new website HTIsonar.com. Space is limited.



Actual screen save from a lake study using a Model 241 Digital Echo Processor.

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Update on Piscicides Rotenone and Antimycin

Rotenone Reregistration

On 31 March 2007, U.S. Environmental Protection Agency (EPA) issued the Reregistration Eligibility Decision (RED), authorizing the reregistration of rotenone (EPA 738-R-07-005). The AFS Fish Management Chemicals Subcommittee (FMCS) has been working with the three registrants (called the Rotenone Task Force) and EPA for the past several years to secure the reregistration. FMCS, EPA, and the Rotenone Task Force met in Washington, D.C., in June to discuss concerns related to mitigation measures and label changes proposed by EPA to lessen risks to humans and environment. EPA was open to considering alternatives to their proposals. FMCS provided written comments on proposed risk mitigation measures and labeling changes in a July letter to EPA. The Rotenone Task Force and many state and federal fish and wildlife agencies followed suit by providing similar comments to EPA. Significant concerns include enforceability and content of operation manuals versus labels, need for additional safety gear, allowable treatment rates and sites, chemical neutralization and restrictive application procedures. FMCS has tentatively agreed to participate in the development of an operations manual provided that the major issues can be resolved.

Antimycin Reregistration

On 16 May 2007, EPA issued the RED authorizing the reregistration of antimycin (EPA 738-R-07-007). As with rotenone, FMCS has been working with the registrant and EPA for the past several years to secure the reregistration. FMCS provided written comments on proposed risk mitigation measures and labeling changes in a July letter to EPA. Many state and federal fish and wildlife agencies followed suit by providing similar comments to EPA. Concerns were similar to those for rotenone.

Training on Piscicides Offered

The EPA REDs for rotenone and antimycin recommend that applicators receive training on the use of piscicides. AFS, in conjunction with Utah State University, offered a week-long training course in May 2007 for planning and executing successful projects using rotenone and antimycin to a sold-out class of 24 biologists. The course instructors have trained 84 biologists since development of the training began in 2001. Due to numerous inquiries on the need for more training, AFS has scheduled another class from 19-23 May 2008 in Logan, Utah. For more information, contact Brian Finlayson (bfinlays@ospr.dfg.ca.gov) or Don Skaar (dskaar@mt.gov). Applications are available through Sonny Idedevbo (sidedevbo@fisheries.org) at AFS (301/897.8616 x 207).

Piscicide Symposium at AFS Annual Meeting

A day-long symposium on global piscicide use issues was held during the 2007 AFS Annual Meeting in San Francisco, California. The symposium examined how government directives, regulations, and permitting requirements; piscicide applicator training; public understanding of native fish recovery; and concerns about human and environmental safety are reflected in policies governing the use of piscicides in restoration projects. Attendees heard talks from a variety of state agencies including New York, California, Nevada, Montana, and Oregon; federal agencies including the U.S. Forest Service and U.S. Fish and Wildlife Service; foreign countries including Norway, Spain, and South Africa; and non-government organizations including The Nature Conservancy. A facilitated panel discussion that followed focused on issues that need to be addressed in piscicide projects that result in efficacy while protecting humans and the environment. The symposium provided a better understanding of how to integrate these issues into policies, guidelines, and projects and in the development a long-term strategy for the use of chemicals in fish management. The panel concluded that the piscicide training offered by AFS was a good forum for articulating and dispensing the constantly evolving strategy within the United States and around the world.

—AFS Task Force on Fishery Chemicals,
Fish Management Chemicals Subcommittee

UPDATE: LEGISLATION AND POLICY

Elden Hawkes, Jr.

AFS Policy Coordinator
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Congress briefed as Klamath River turns green

Members of Congress were shocked at the sight of the bright green reservoirs shown in photos during a late September briefing about the dangerous levels of toxic algae in the Klamath River. During the briefing designed to gather support for Klamath dam removal and educate lawmakers on the economic and health effects, sampling results from the Karuk Tribe were presented that confirmed that the bright green sheen covering the Klamath River is the same toxic algae *Microcystis aeruginosa* that has been in PacifiCorp's reservoirs for years.

In early 2007, local tribal religious leaders, fishermen, recreation businesses, and the Klamath Riverkeeper filed suit against PacifiCorp for their dams' toxic pollution. When the suit was filed, toxic algae was found mainly in the confines of the PacifiCorp's reservoirs. Now this algal toxin has migrated out into the Klamath River and has polluted it for up to 50 miles.

As the algae toxin problem is getting worse, many local residents believe that the only logical solution is to take out the Klamath dams, saying that the dams provide very little power and would cost much less to remove than bring into modern times. PacifiCorp, however, has indicated a preference to put the extra cost of keeping the dams on ratepayers.

The dams block access to over 300 miles of salmon spawning grounds in the Klamath River, a key reason for the collapse of the salmon populations. At one time, the Klamath was the third most productive salmon fishery in the West, but now the Klamath coho are threatened and Chinook are subject to harvest restrictions. The severe economic and social repercussions of these restrictions led U.S. Department of Commerce Secretary Gutierrez to declare a commercial fishery failure in 2006.

Commerce Committee approves Ballast Water Management Act

On 27 September 2007, the Senate Commerce, Science, and Transportation Committee approved S. 1578, The Ballast Water Management Act of 2007, which was introduced by Commerce Committee Chairman Daniel K. Inouye (D-HI) and Vice Chairman Ted Stevens (R-AK).

The act strengthens the existing national ballast water management program for aquatic nuisance species by:

- Implementing a recommendation by the U.S. Commission on Ocean Policy to adopt a national ballast water management program for aquatic nuisance species, including uniform, mandatory national standards for ballast water treatment. It also implements an international agreement, negotiated by the International Maritime Organization.
- Strengthening existing federal law by amending the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA) to require mandatory ballast water treatment technology on all vessels that come to a U.S. port. The bill sets performance standards 100 times stronger than the minimum international standards and includes provisions for strengthening these standards in the future, with a goal of zero discharge.
- Mandating, until treatment is required, the exchange of ballast water with water in mid-ocean to reduce the number of aquatic nuisance species being transported.
- Providing states with the authority to develop programs to regulate invasive species from ships so long as the provisions do not conflict with the federal program. Such programs could include all of the provisions included in the federal program—treatment standards, other management practices, research and technology development, as well as other provisions such as the imposition of port fees.
- Allowing states to establish no discharge zones in sensitive state waters, a mechanism for strengthening the performance standards in the future, and a right of action for states against the Coast Guard and Environmental Protection Agency.
- Authorizing $50 million for each of fiscal years 2008 through 2012 for the Coast Guard to implement the bill, of which up to a total of $10 million could be provided to states that enter cooperative agreements with the Coast Guard.

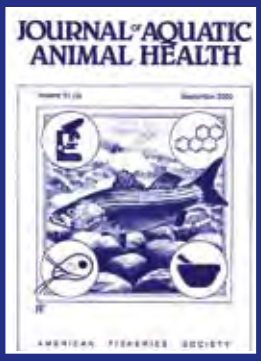
Ballast water is the water ships generally carry for stability that is usually discharged as cargo is unloaded. It is a major source of invasive species in U.S. waterways that can cause both environmental and economic damage.

Commerce Committee passes Stevens fisheries resolution

On 27 September 2007, the Senate Committee on Commerce, Science, and Transportation reported out S.J. Res.17, directing the United States to initiate international discussions and take necessary steps with other nations to negotiate an agreement for managing migratory and transboundary fish stocks in the Arctic Ocean. The resolution was introduced by Senator Ted Stevens (R-AK), and is co-sponsored by Senators Daniel Inouye (D-HI), Maria Cantwell (D-WA), Olympia Snowe (R-ME), Lisa Murkowski (R-AK), John Sununu (R-NH), Thad Cochran (R-MS), John Kerry (D-MA), Susan Collins (R-ME), Patty Murray (D-WA), and Barbara Boxer (D-CA). The resolution now awaits action by the full Senate.

S.J. Res.17 states that such agreements should address, as appropriate, catch and bycatch limits, harvest allocations, observers, monitoring, data collection and reporting, enforcement, and other elements necessary for sustaining future Arctic fish stocks. Also, the United States should consult with the North Pacific Regional Fishery Management Council (NPFMC) and Alaska Native subsistence communities of the Arctic when developing such agreements.

The NPFMC recognized the importance of properly managing these emerging fisheries, and it proposed in June that all federal waters in the Arctic Ocean be closed until a management regime is put in place. S.J. Res.17 reinforces the idea that until international agreements are in place, the United States should support efforts to halt the expansion of commercial fishing activities on the high seas of the Arctic Ocean.



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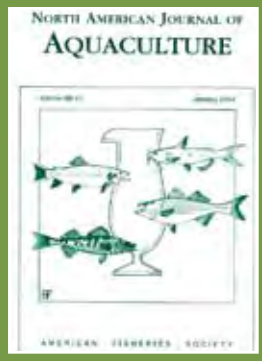

Journal of Aquatic Animal Health

VOLUME 19, ISSUE 3 (SEPTEMBER 2007)

[Communication] **Laboratory Transmission of the Monogenean *Acolpenteron ureteroecetes* Infecting the Posterior Kidneys of Largemouth Bass: Time Course and Pathology.** Charles M. Gieseker, Stanley G. Serfling, Sarah L. Poynton, and Renate Reimschuessel, pages 141-150.

Evaluation of Zebrafish *Danio rerio* as a Model for Enteric Septicemia of Catfish (ESC). L. Petrie-Hanson, C. L. Romano, R. B. Mackey, P. Khosravi, C. M. Hohn, and C. R. Boyle, pages 151-158.

Blood Culture Results from Healthy Captive and Free-Ranging Elasmobranchs. Natalie D. Mylniczenko, Brigita Harris, Rachel E. Wilborn, and Forrest A. Young, pages 159-167.

Purification and Localization of Nitric Oxide Synthases from Hybrid Tilapia (Nile Tilapia × Mozambique Tilapia). Way-Shyan Wang, Shao-Wen Hung, Yu-Hsing Lin, Ching-Yu Tu, Min-Liang Wong, Shiow-Her Chiou, and Meng-Tong Shieh, pages 168-178.

[Communication] **Comparison of Chloroform–Methanol-Extracted and Solvent-Free Triglyceride Determinations in Four Fish Species.** Pamela M. Bennett, Lynn P. Weber, and David M. Janz, pages 179-185.

Treatment of Ichthyophthiriasis in Rainbow Trout and Common Carp with Common and Alternative Therapeutics. Franz Lahnsteiner and Thomas Weismann, pages 186-194.

Effects of Dietary Arginine on Hematological Parameters and Innate Immune Function of Channel Catfish. J. Alejandro Buentello, Martha Reyes-Becerril, María de Jesús Romero-Geraldo, and Felipe de Jesús Ascencio-Valle, pages 195-203.

North American Journal of Aquaculture

VOLUME 69, ISSUE 3 (JULY 2007)

The Acute Toxicity of Praziquantel to Grass Carp and Golden Shiners. Andrew J. Mitchell and Melissa S. Hobbs, pages 203-206.

[Communication] **Removal and Quantification of Asian Tapeworm from Bonytail Chub Using Praziquantel.** David L. Ward, pages 207-210.

[Communication] **Proximate Composition and Collagen Concentration of Processing Residue of Channel Catfish.** Menghe H. Li, Edwin H. Robinson, Daniel F. Oberle, and Brian G. Bosworth, pages 211-213.

Combined Nitrogen and Phosphorus Fertilization for Controlling the Toxigenic Alga *Prymnesium parvum*. Gerald L. Kurten, Aaron Barkoh, Loraine T. Fries, and Drew C. Begley, pages 214-222.

[Communication] **The Use of Black Fly Larvae as a Food Source for Hatchery-Reared Lake Sturgeon.** Cheryl N. Klassen and Stephan J. Peake, pages 223-228.

Effects of Dietary Protein Concentration and l-Carnitine on Growth, Processing Yield, and Body Composition of Channel Catfish × Blue Catfish F1 Hybrids. Menghe H. Li, Edwin H. Robinson, and Brian G. Bosworth, pages 229-234.

[Communication] **Impacts of Water Quality and Hand-Picking of Dead Eggs on the Survival of Brown Trout and Atlantic Salmon Eggs.** Tapio Sutela, Pentti Pasanen, Pauliina Louhi, and Aki Mäki-Petäys, pages 235-238.

[Technical Note] **Small-Scale System for the Mass Production of Rotifers Using Algal Paste.** Timothy J. Pfeiffer and Gerald M. Ludwig, pages 239-243.

Fatigue and Recovery of Blue and Channel Catfish Fingerlings under Flow and No-flow Conditions. Rachel Venn Beecham, C. Douglas Minchew, and Glenn R. Parsons, pages 244-249.

[Communication] **Nighttime Lighting and Feeding in Ponds Enhance Survival of Fingerling Walleyes during Habituation to Manufactured Feed.** Thomas M. Harder and Gordon G. Gotsch, pages 250-256.

Effects of Different Types of Dietary Lipids on Growth and Fatty Acid Composition of Largemouth Bass. James H. Tidwell, Shawn Coyle, and Leigh Anne Bright, pages 257-264.

Shell Strength and Appearance in Cultured Blue Mussels *Mytilus edulis, M. trossulus,* and *M. edulis* × *M. trossulus* Hybrids. Randy W. Penney, M. Jeanne Hart, and Nadine D. Templeman, pages 281-295.

National Aquatic Species Risk Analysis: A Call for Improved Implementation

The views of the authors do not necessarily represent the views of their respective agencies, the ANSTF and its committees, or the Asian Carp Working Group.

Jeffrey E. Hill and Paul Zajicek

Hill is an assistant professor at the Tropical Aquaculture Laboratory, Department of Fisheries and Aquatic Sciences, Institute of Food and Agricultural Sciences, University of Florida—Ruskin, and is a member of the Research Committee and the Detection and Monitoring Committee of the Aquatic Nuisance Species Task Force (ANSTF). He can be reached at jehill@ifas.ufl.edu. Zajicek is a biological administrator with the Florida Department of Agriculture and Consumer Services, Division of Aquaculture, Tallahassee, an ex officio member of the ANSTF representing the National Association of State Aquaculture Coordinators, and a member of the Asian Carp Working Group.

ABSTRACT: There has been criticism of the risk analysis process used by federal agencies in the United States, the Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process (Generic Analysis) developed by the Aquatic Nuisance Species Task Force (ANSTF). Although some criticism is justified, we argue that critics as well as federal agencies implementing the process have focused on in-house risk assessment and have ignored including stakeholders in a collaborative and integrated risk analysis implementation that consists of conceptually distinct risk assessment and risk management. Although the Generic Analysis approved by the ANSTF consisted of this design, there has been only a single collaborative effort that fully integrated risk assessment and risk management. Although risk assessment and risk management are distinct, they should not be conducted in isolation or without stakeholder involvement. We argue that when stakeholders are included and these processes are effectively linked, the Generic Analysis will become the useful tool for assessing and managing nonindigenous aquatic species that the developers envisioned and constructively contribute to creating federal, state, and local synergies to address this complex biological, ecological, political, and social challenge.

Análisis de riesgo de especies acuáticas nacionales: una implementación mejorada

En los últimos años se ha suscitado una fuerte crítica en torno al proceso de análisis de riesgo que aplican las agencias federales de los Estados Unidos, llamado Proceso de Revisión del Análisis de Riesgo Genérico de Organismos Acuáticos No-nativos (Análisis Genérico) desarrollado por el Equipo de Trabajo para el Estudio de Especies Acuáticas (ETEEA). Si bien parte de las críticas están bien justificadas, en el presente trabajo se argumenta que tanto dichas críticas como las agencias federales dedicadas a implementar el proceso, han considerado el análisis de riesgo solamente hacia dentro de las propias agencias, pasando por alto la participación de otros actores involucrados; en lugar de enfocarse en una implementación de análisis de riesgo, incluyente y de colaboración, que consista en una evaluación y manejo de riesgo conceptualmente distinta. A pesar de que el proceso aprobado por el ETEEA consistió en este tipo de diseño, ha habido apenas un solo esfuerzo de colaboración que realmente ha integrado de forma completa tanto la evaluación como el manejo del riesgo. Aun cuando la evaluación y manejo del riesgo son conceptos diferentes, ninguno de los dos debe conducirse de forma aislada o sin la inclusión de todos los actores pertinentes. Aquí se discute que cuando se incluyen a tales actores y los procesos son vinculados de manera efectiva, el Análisis Genérico puede convertirse en una herramienta útil para la evaluación y manejo de especies acuáticas no-nativas, que también ha servido para impulsar sinergismos federales, estatales y locales y enfrentar una empresa política, ecológica, biológica y social tan compleja como la que aquí se describe.

INTRODUCTION

Interest in nonindigenous species is not new (Elton 1958) and has grown exponentially over recent years as the negative effects of nonindigenous species have been reported in numerous peer-reviewed, agency, and popular publications (e.g., OTA 1993; Schramm and Piper 1995; Fuller et al. 1999; Dolin 2003). High profile media reports trigger public demands for action that have forced cash-strapped resource managers into Solomonic decision making. Options range on a continuum from exhaustively researching possible threats and thereby allowing a situation to become critical to springing into action before understanding the problem, potentially leading to ill-conceived control, eradication, or regulatory programs. It is important

for federal and state resource managers to determine how to identify potential threats and mitigate a variety of complex environmental, economic, or human health risks (ELI 2002). However, a fundamental biological fact is that the vast majority of introduced nonindigenous taxa do not fit the popular "invasive species" definition: a nonindigenous species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Williamson 1996; Executive Order 13112). Astute managers realize that "(a)ddressing the impacts of nonnative species in a meaningful fashion requires a measure of discrimination, for portraying all alien species as damaging is counterproductive. The most useful kind of defense for ecosystems threatened by invasive species is careful analysis of the very real threats posed by the damaging minority" (Van Driesche and Van Driesche 2000:106).

The discovery of the zebra mussel (*Dreissena polymorpha*) in the Great Lakes during 1988 triggered national legislation (i.e., Nonindigenous Aquatic Nuisance Prevention and Control Act) in 1990, reauthorized in 1996, to address introduced nonindigenous aquatic species in general and the zebra mussel and brown tree snake (*Boiga irregularis*) in particular. As a component of that legislation, an Aquatic Nuisance Species Task Force (ANSTF) was created, composed of federal, state, tribal, interstate partnerships, and industry representatives. As authorized by the two Congressional acts, the task force is to coordinate, direct, and maximize existing agency capabilities. The ANSTF has undertaken a variety of initiatives and studies to achieve multiple mandates. One of the mandates was to develop and implement programs to prevent the introduction and dispersal of aquatic nuisance species through risk assessment and evaluation of effective and environmentally sound prevention activities (ANSTF 2005).

The ANSTF addressed assessing risk by publishing a generic risk analysis process (RAM Committee 1996) which has been used, in whole or part, by federal agencies, a consultant, academia, and at least one state agency. The generic risk analysis process history, philosophy, objectives, and implementation were thoroughly described by Orr (2003). Recent criticisms have been leveled against U.S. risk assessment efforts (e.g., Simberloff 2005; Simberloff et al. 2005; see also Hill 2003). We agree to some extent with this criticism, but will argue in this article that critics, as well as the federal agencies, have focused on the application and results of in-house risk assessment (a rigorous, replicable method conducted under protocols agreed upon by an expert community to arrive at answers to factual questions) and not the implementation of risk management (a process which includes affected stakeholders and identifies the means to manage risk). We further argue that if the generic risk analysis process envisioned by the ANSTF is implemented as originally written, a collaborative process that integrates risk assessment with risk management, the results will improve U.S. efforts to:

1. Wisely balance potential ecological, economic, and social risks against potential ecological, economic, and social gains;
2. Improve preventive programs and decision making; and
3. Yield management programs of practical and immediate value that will integrate federal, state, and local level resources (i.e., authority, manpower, equipment and funds).

GENERIC RISK ANALYSIS PROCESS

A committee of federal agency and industry representatives (Risk Assessment and Management [RAM] Committee) produced a report to the Aquatic Nuisance Species Task Force in 1996 entitled, *Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process* (hereafter, Generic Analysis), with an objective of providing

> …a standardized process for evaluating the risk of introducing nonindigenous organisms into a new environment and, if needed, determining the correct risk management steps needed to mitigate that risk

(RAM Committee 1996:1).

The Generic Analysis consists of two activities, risk assessment and risk management, and was

> …designed to be flexible and dynamic enough to accommodate a variety of approaches to nonindigenous organism risk depending upon the available resources, accessibility of the biological information, and the risk assessment methods available at the time of the assessment.

(RAM Committee 1996:1)

The committee's report reflected the practical need of producing a process that was:

1. Comprehensive for use to examine a species, genus, or family and the means or methods by which introduced species are moved by humans (i.e., in the current vernacular "pathway" or "vector");
2. Logically sound in that the Generic Analysis would be rational, reliable, unbiased, justifiable, and sensitive to different problem aspects (especially uncertainties associated with the methodology, assessor(s), or biological and environmental unknowns);
3. Commensurate with available resources in that a single knowledgeable individual or a large group could complete the process; and,
4. Open to evaluation with sufficient detail and transparency for review and challenge by independent reviewers.

The committee prudently argued that risk assessments must be completed in "…an atmosphere as free of regulatory and political influences as possible" (RAM Committee 1996:5), but carefully delineated that the risk assessment should not be isolated from risk management by quoting a National Research Council publication which notes that:

> the importance of distinguishing between risk assessment and risk management does not imply that they should be isolated from each other; in practice they interact, and communication in both directions is desirable and should not be disrupted.

(NRC 1983:6)

Very briefly, the Generic Analysis consists of a pathway risk analysis or an organism risk analysis. The steps for

both are, first, "Initiation," consisting of a request to evaluate a pathway or a single organism. The second step is "Risk Assessment," that consists of:

1. Identification of interested parties and solicitation of input;
2. List of nonindigenous organisms of concern;
3. Information collection on the pathway or organism and associated organisms (literature and investigation);
4. Assessing the risks associated with the
   a. Probability of establishment by examining the probability that an organism is in a pathway and the potential for entry and colonization and
   b. Consequences of establishment by examining the potential for economic, environmental and perceived (social and political) impacts; and
5. Recommendations.

The third and final step is "Risk Management," with the objectives of developing :

1. A risk mitigation matrix consisting of appropriate policies, regulations, and operational measures and
2. An iterative and realistic risk management operational plan that includes a monitoring system to revise and update mitigation over time (i.e., adaptive management) (RAM Committee 1996:7-16).

GENERIC ANALYSIS IMPLEMENTATION

Since 1996, we are aware of seven separate efforts to implement part or all of the Generic Analysis for an aquatic species or group of species (e.g., genus or family) in the United States. Each effort will be briefly described and then the overall implementation compared and contrasted. The analyses are presented chronologically. The only connection we are aware of between any of the analyses is that three reports have shared authors that are members of one agency (i.e., U.S. Geological Survey [USGS]) and that early reports were used as models that influenced the format used by succeeding efforts.

Black carp (Mylopharyngodon piceus)

Concurrently with the publication of the Generic Analysis, the USGS completed a report for the RAM Committee that was a result of an interagency contract between the U.S. Fish and Wildlife Service (USFWS) and USGS entitled, *Risk Assessment on Black Carp (Pisces: Cyprinidae)* (Nico and Williams 1996). As described in the report and later in an update by Nico and co-authors (2001), the assessment was conducted as a real world test of the Generic Analysis because the species was representative of real issues—societal balancing of the benefits of biologically controlling an agricultural pest with potential environmental, political, and economic concerns—and the opportunity existed to manage risks associated with the species and its uses. This report and update were presented in a multipart format: (a) a summary of biological, ecological, and economic information; (b) the risk assessment component of the Generic Analysis; (c) eight management recommendations regarding the species, uses, handling, culture, animal health, and education; and, (d) references. Copies of the publications were produced and made available by the authors upon request. The American Fisheries Society published a third black carp biological synopsis and risk assessment that expanded the biological detail from earlier versions but had little change to the actual risk assessment and did not include the risk management recommendations (Nico et al. 2005). The USFWS proposed to add the black carp to the Injurious Species List in 2002 and after a deliberative process that included extensive public comment and information gathering (e.g., Federal Register 2005), the black carp was listed in October 2007 with an effective date of rule implementation of 19 November 2007 (Federal Register 2007a).

Shrimp virus

During 1996, the Joint Subcommittee on Aquaculture (JSA), a federal interagency advisory group formed under the auspices of the President's Office of Science and Technology Policy, created a Shrimp Virus Group to address economic losses by U.S. shrimp farmers caused by viral pathogens and to consider the possible effects of the viruses on wild shrimp. This group decided to pursue a variety of actions including the development of a collaborative risk assessment. Qualitative, quantitative, and tiered risk assessment approaches were considered, including the risk assessment component of the Generic Analysis. The Generic Analysis was recognized as a recently developed methodology for an expert panel to quickly and inexpensively compile available information and judge risks and uncertainties (JSA 1997). The U.S. Environmental Protection Agency (USEPA), acting with the JSA and as a member of the Shrimp Virus Group, convened four stakeholder meetings and collected public comments that culminated in a shrimp virus peer review and risk assessment workshop held in January 1998. Twenty-two experts with various backgrounds (e.g., shrimp biology, toxicology, marine ecology, ecological risk assessment, and shrimp culture and processing) received several documents prior to the meeting, prepared written pre-meeting comments for review by all the participants, and evaluated the risks associated three exotic pathogenic shrimp virus pathways (i.e., aquaculture, processing, and other potential sources) using the Generic Analysis. The workshop report was revised based on an external scientific review in July 1998 and the combined information used as a basis for a collaborative risk management workshop held later that month (USEPA 1999). The results of the risk management workshop were never published.

Sturgeon culture

The Florida Department of Agriculture and Consumer Services used the Generic Analysis in 2000 to collaboratively assess the risks and identify risk management options for the culture of exotic and transplanted sturgeon (Metcalf and Zajicek 2000; Zajicek and Metcalf 2002). An initial mail survey to 49 federal, state, academic, or private sector representatives developed through research and agency contacts and an attendance list from a previous sturgeon conference were used to define risk issues and knowledgeable participants with a variety of backgrounds and expertise (e.g., sturgeon biology, aquaculture, fisheries, and environmental sciences). Four

major categories of potential risk issues (i.e., broodstock acquisition, hybridization, disease and pathogens, and ecological impacts) were identified. A second mailing to 117 expert invitees consisting of an invitation to a two-day risk analysis workshop, a 23-question survey, and a copy of the Generic Analysis yielded acceptances by 48 experts. The department, concurrently, contracted for a sturgeon literature review to summarize peer-reviewed literature relevant to sturgeon aquaculture and biology, including associated pathogens. Using breakout groups moderated by an objective third party, 46 experts convened to assess the ecological, genetic, and disease risks if a sturgeon species was introduced into Florida freshwater or coastal environments. After the discussion, risk ratings and uncertainty ratings were recorded and each group was challenged to develop and prioritize management options to mitigate risks. The department utilized the information developed in the workshop to devise and implement 16 separate sturgeon farming requirements related to farm design, site selection, operation, and management as well as a regulatory prohibition (FDACS 2002).

Snakeheads, Family Channidae

The USGS completed the risk assessment portion of the Generic Analysis to fulfill a contractual obligation with the USFWS in October 2002 (Courtenay and Williams 2002). Although the report was not specifically cited by USFWS in their decision making, we assume the information was used to support the addition of the family Channidae to the injurious wildlife list under the Lacey Act on 4 October 2002 (Federal Register 2002). The content of the report was reorganized and published with the same title by the USGS as an agency circular (Courtenay and Williams 2004). The report and circular contain an extensive literature review and discussion of individual snakehead species, uses and importations, regulations, potential range in the United States, and a risk assessment for the family as a whole. The risk management component of the Generic Analysis was not completed nor were any recommendations offered. However, observations relative to the effectiveness of eradication efforts in Maryland were included and, as noted, a risk management decision was carried out by the USFWS (i.e., the family was added to the injurious wildlife list).

***Peacock bass, genus* Cichla**

As part of an investigation of the ecological interactions of introduced butterfly peacock bass (*Cichla ocellaris)* and native largemouth bass (*Micropterus salmoides)* in southeastern Florida, Hill (2003) conducted a risk assessment of the genus *Cichla* using the Generic Analysis methodology. This retrospective risk assessment was conducted partly to test the predictions of a Generic Analysis using an aquatic species that was considerably different than those assessed previously, particularly regarding the limited potential range of spread of *Cichla* in the continental United States (previous organisms had large potential ranges) and the relatively greater information on species performance from introduced populations in the United States (previous organisms had few or no data). The author concluded that the risk assessment methodology was useful, being more formal than expert opinion and less time-consuming and expensive than quantitative methods. Nevertheless, he recommended changes to the methodology to increase its usefulness. The main suggestions were:

1. To change the "Probability of Establishment" to the "Probability of Establishment and Spread" to better account for species that may establish somewhere in the region of concern but with only a restricted potential range,
2. To eliminate or reduce the importance of the Overall Risk Potential (ORP) as the dominant output of the algorithm, and
3. To remove value judgments in the ORP definitions on the acceptability of risk (more properly retained in risk management).

Being part of an academic exercise evaluating only the risk assessment portion of the Generic Analysis methodology, there was no risk management component or recommended management actions.

Risk management is particularly important in cases where a risk assessment predicts high risk.

Asian carp

State and federal agencies collaborated to fund a study by a private contractor concerning the feasibility of limiting the spread of Asian carp (bighead [*Hypophthalmichthys nobilis*], silver [*H. molitrix*], grass [*Ctenopharyngodon idella*], and black carps) into the Upper Mississippi River Basin. The study included a section entitled "Ecological Risk Assessment Framework" that discussed the relative approaches and the potential to blend together the quantitative and probabilistic USEPA framework and the qualitative Generic Analysis. Due to a lack of biological, economic, and ecological information, neither the risk assessment nor management analyses were completed (FishPro 2004).

***Genus* Hypophthalmichthys**

The USGS completed the risk assessment portion of the Generic Analysis to fulfill a contractual obligation with the USFWS in April 2005 for the bighead, silver, and largescale silver carps (*Hypophthalmichthys harmandi*; Kolar et al. 2005). The report contains a summary of the biology and distribution for each species, economic uses, potential range in the United States, population and distribution control measures, state regulations, and a risk assessment for each species. The management component of the Generic Analysis was not completed nor were recommendations offered. However, the USFWS coordinated an Asian Carp Workshop in April 2000 attended by 58 state and federal natural resource agency, university, fish farm, and aquaculture trade association representatives to gather biological, economic, and ecological information as

well as to propose management and control alternatives to reduce or mitigate impacts of Asian carp (USFWS 2000). Later, the Aquatic Nuisance Species Task Force requested that the USFWS lead an effort to create an Asian Carp Working Group to develop a national management and control plan for the four carp species. In May 2004, the USFWS formed an Asian Carp working group that met to begin a collaborative process of developing the Asian carp management and control plan. The Working Group was composed of federal and state agency representatives (natural resource and agriculture), fishery and aquaculture research and extension representatives, and carp farmers. During this meeting, the Asian Carp Working Group used the proceedings of the 2000 workshop to formulate management and control objectives, action plans, and implementation time tables (USFWS 2005). A Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States (Conover et al. 2007) was accepted by the ANSTF on 7 November 2007.

The USGS *Hypophthalmichthys* risk assessment was posted to a USFWS website during the development of the draft national management plan. It was not formally distributed to the Asian Carp Working Group membership, but its information and findings were used by the members and its information was extensively cited in the draft.

The USGS *Hypophthalmichthys* risk assessment probably played a role in the USFWS decision to add silver and largescale silver carps to the injurious wildlife list under the Lacey Act in July 2007 (Federal Register 2007b) and may play a role in its review of economic and biological information for the bighead carp; unfortunately, these reports were not directly referenced by USFWS in the *Federal Register* notices. The USFWS action to consider these species for addition to the injurious wildlife list occurred in response to a petition submitted in October 2002 (Federal Register 2003a, 2003b).

The American Fisheries Society has recently published a revised and expanded version of the USGS *Hypophthalmichthys* risk assessment (Kolar et al. 2007). A chapter preceding the environmental risk assessment provides an expanded and in-depth discussion of prevention and control measures. The risk assessment chapter was little changed from the original USGS contract report.

SUMMARIZING IMPLEMENTATION

Of the five reports, one dissertation, and one study discussion completed in the nine years since the appearance of the Generic Analysis, only one effort, sturgeon culture by a state agency, coordinated a collaborative and integrated risk assessment and management process and had the opportunity and capacity to implement, monitor, and revise the risk mitigation measures identified through the Generic Analysis. The earliest version of the black carp risk analysis addressed risk management through a list of recommendations in the risk assessment (Nico and Williams 1996; see also Nico et al. 2001). The eight recommendations were seemingly given little recognition during much of the lengthy process for considering black carp for addition to the Injurious Wildlife List; however, these recommendations were explicitly addressed in the final rule (Federal Register 2007a). The shrimp virus risk analysis utilized a sequence of collaborative workshops that built one on the other to gather information, assess risk, and finally suggest management measures. Unfortunately, the last and final report concerning risk management was not made available. A joint state and federal Asian carp study completed by a contractor discussed the potential blending and relative merits of the USEPA framework and the Generic Analysis but did not carry out either method to yield a risk analysis.

The remaining four reports created by U.S. government agencies focused on assessing risk using the Generic Analysis and either ignored risk management or completed risk management as adjunct activities by unrelated parties. For the U.S. government, this is surprising and disturbing given the development of three reports by the National Research Council (NRC) dedicated to the topic of assessing, managing, and characterizing risk (NRC 1983, 1994; Stern and Fineberg 1996). As noted earlier, the Generic Analysis included NRC guidance to the federal users to integrate the risk assessment and management sequences. The NRC also strongly advised that any risk analytic-deliberative process should:

1. "...describe a potentially hazardous situation in as accurate, thorough, and decision-relevant a manner as possible, addressing significant concerns of the interested and affected parties, and to make this information understandable and accessible to public officials and to the parties…" (NRC 1983:2);
2. incorporate "the perspectives and knowledge of the interested and affected parties from the earliest phases of the effort to understand the risks" (Stern and Fineberg 1996:3)
3. include "an appropriately diverse participation or representation of the spectrum of interested and affected parties, of decision makers, and of specialists in risk analysis, at each step" (Stern and Fineburg 1996:3);

and 4. realize and accept that "experience shows that [risk] analyses, no matter how thorough, that do not address the decision-relevant questions, use reasonable assumptions, and meaningfully include key affected parties can result in huge expenses and long delays, and jeopardize the quality of understanding and the acceptability of final decisions" (Stern and Fineberg 1996: 10).

The National Research Council was particularly directed by the U.S. Congress to analyze risk assessment and noted,

> Risk assessment is … not an end to itself. The limited resources available should be spent to generate information that helps risk managers to choose the best possible course of action among the available options.
>
> (NRC 1994:15).

For very high profile exotic fishes—family (Channidae), genus *Hypopthalmichthys*, and species (black carp)—this advice commissioned by the U.S. Congress has been largely ignored.

Significantly, an Asian oyster (*Crassostrea ariakensis*) risk analysis completed by the NRC, an analytical effort that did not utilize the Generic Analysis, integrated risk assessment and risk management. In this instance, a multi-stake-

holder Committee on Nonnative Oysters in the Chesapeake Bay argued that "complex [ecological] systems require a more general framework for risk assessment and a closer integration of risk assessment and risk management" (NRC 2004: 187). The committee was provided with the management goals of a variety of interested parties and further stated "this closer integration is necessary because the risks we choose to manage determine the risks that need be assessed" (NRC 2004: 187-188). We argue that the situation the committee dealt with is typical of the United States: on the one hand complex and largely unquantified biological and ecological challenges and on the other, management goals that are already explicitly stated or implicitly understood.

Although we have concentrated on discussing the imperfect implementation of risk analysis that lacks risk management, we also note that five national risk management plans have been completed—brown tree snake, Chinese mitten crab (*Eriocheir sinensis*), European green crab (*Carcinus maenas*), *Caulerpa* spp. (a marine macroalgae), and Ruffe (*Gymnocephalus cernuus*)—without the development of risk assessments. Notably, the authors of three of the five plans (European green crab, Chinese mitten crab, and *Caulerpa* spp.) recognized this deficiency and included a recommendation to complete a risk assessment (ANSTF 2005).

Federal implementation of exotic species risk analysis has drawn criticism that the procedure is "…narrowly focused, subjective, often arbitrary and unquantified, and subject to political interference….the quantification of risk achieved by this process is largely illusory" (Simberloff 2005:216-217), and that the process "…can be cumbersome enough that species under consideration may be released or escape while the assessment is in progress." (Simberloff et al. 2005:14).

We will not argue with these criticisms other than to note that the critics narrowly focused on risk assessment and failed to recognize that risk management is seldom attempted and has been conducted, if at all, as an exercise distinctly disconnected from the risk assessment.

Critics' arguments for requiring quantified risk analysis also fail to note that this approach will add considerable cost, complexity, and time. As an example, in their laudable quantitative risk assessment effort, Kolar and Lodge (2002) used two statistical methods and in-depth literature research that were applied for each stage of a three-step sequence (establishment, spread, and impact). The methodology consisted of collecting as many quantifiable biological variables (e.g., life history characteristics, habitat needs, establishment history, and human use) as possible for a taxon in a described ecosystem for species that have become established (one group) or failed to become established (second group). For each stage, they used the statistical methods to identify certain variables common to the successful invader. Once the important variables were identified (which may or may not be in common to the two statistical methods) this framework, as a model, was used to assess new species as to whether they will successfully establish. The critical limitations to the model are "...ecosystem specific, taxon specific, and stage specific..." (Kolar and Lodge 2002:1234). Meaning that for each taxon to be assessed, the risk analyst or team of analysts must gather ecosystem, species, and stage specific data. Critical limitations to this approach include the availability of stage-specific, quantifiable biologi-

cal variables for each species of successful and failed invasions for each taxon of interest, and the resources to gather those data.

Given the urgency stakeholders and agencies accord to nonindigenous species, we agree with the conclusion that "(b)oth qualitative and quantitative approaches to risk assessment are valid and, in practice, every risk assessment is first carried out qualitatively. Only if further insight is required is it necessary to attempt to quantify the risk" (Arthur et al. 2002:42). However, Hayes (2003:387) noted that "(a)nalysts usually reject quantitative techniques because the problem is too complex or because reliable data are too few." Difficult or not, quantitative enough or not, the fact remains a qualitative approach, the Generic Analysis, is available in the United States to assess risk and identify risk mitigation measures, but it has not been effectively implemented.

PICKING UP THE PIECES

The risk assessment component of the Generic Analysis provides a process that even critics agree,

> …forces explicit consideration of many factors and can produce a highly educated qualitative prediction

(Simberloff et al. 2005:14)

We argue that a critical national challenge of effective nonindigenous aquatic species prevention, control, and management could better be achieved if the Generic Analysis was fully implemented. Thus far, there has been a failure to implement the Generic Analysis as originally designed—specifically there has been a lack of effort to involve affected stakeholders and to effectively integrate risk assessment and management. No matter how competently conducted, risk assessment alone does not fully address all relevant management questions nor does it meaningfully include all affected stakeholders (Stern and Fineburg 1996). Although effective risk assessment requires input from a variety of informational sources, including various stakeholders, in practice the emphasis on in-house risk assessments and the near exclusion of stakeholders in an integrated risk assessment and management process has failed to fully utilize scientific, economic, management, and regulatory expertise. Risk management is particularly important in cases where a risk assessment predicts high risk. We argue that if risk assessment and risk management are effectively coupled, as the developers of the Generic Analysis intended, attempts at collaborative, integrated risk analysis will:

1. Leverage manpower and knowledge across the spectrum of stakeholders that manage or study invasive species to the considerable benefit of national, state, and local entities and
2. Effectively respond to criticism that the federal and state responses to invasive species are disconnected or fragmented because of discrete or limited agency authority and responsibility.

(OTA 1993; ELI 2002)

ACKNOWLEDGMENTS

We enjoyed several insightful discussions with conference attendees following a presentation on this subject at the 14th International Conference on Aquatic Invasive Species held in Miami, Florida, during May 2006. We also thank Karen Metcalf, John Teem, Craig Watson, and three anonymous reviewers who provided constructive criticism and improvements.

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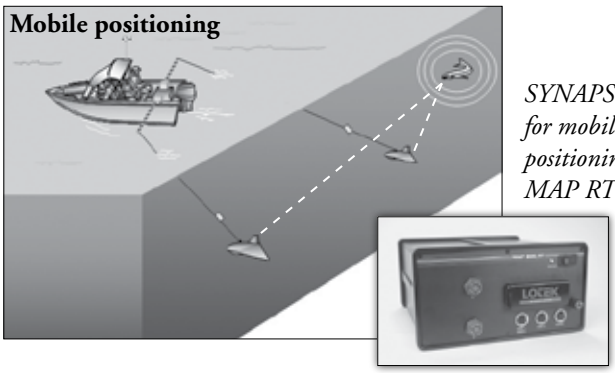
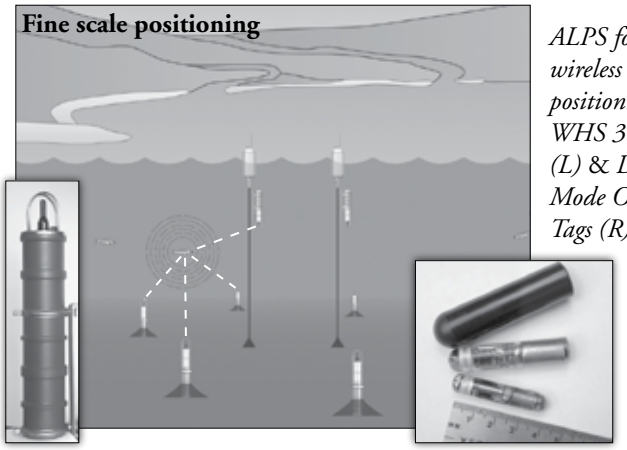
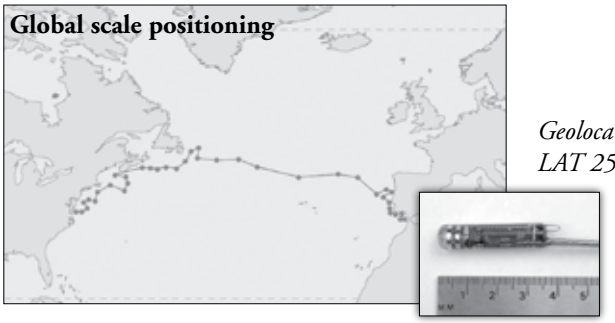


SYNAPS for mobile positioning & MAP RT



ALPS for wireless positioning, WHS 3050 (L) & Dual Mode OTN Tags (R)



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Development of a Standardized DNA Database for Chinook Salmon

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ABSTRACT: An international multi-laboratory project was conducted to develop a standardized DNA database for Chinook salmon (*Oncorhynchus tshawytscha*). This project was in response to the needs of the Chinook Technical Committee of the Pacific Salmon Commission to identify stock composition of Chinook salmon caught in fisheries during their oceanic migrations. Nine genetics laboratories identified 13 microsatellite loci that could be reproducibly assayed in each of the laboratories. To test that the loci were reproducible among laboratories, blind tests were conducted to verify scoring consistency for the nearly 500 total alleles. Once standardized, a dataset of over 16,000 Chinook salmon representing 110 putative populations was constructed ranging throughout the area of interest of the Pacific Salmon Commission from Southeast Alaska to the Sacramento River in California. The dataset differentiates the major known genetic lineages of Chinook salmon and provides a tool for genetic stock identification of samples collected from mixed fisheries. A diverse group of scientists representing the disciplines of fishery management, genetics, fishery administration, population dynamics, and sampling theory are now developing recommendations for the integration of these genetic data into ocean salmon management.

Desarrollo de una base de datos estandarizada de DNA para el salmón rey

RESUMEN: Se realizó un proyecto internacional con la participación de diversos laboratorios con la finalidad de desarrollar una base de datos estandarizada de DNA para el salmón rey (*Oncorhynchus tshawytscha*). Dicho proyecto surgió como respuesta a las necesidades del Comité Técnico Chinook de la Comisión del Salmón del Pacífico para identificar la composición poblacional del salmón rey que es capturado por la pesquería durante su migración. Un total de nueve laboratorios de análisis genéticos identificaron y reprodujeron cada uno 13 loci microsatélites. Con el objeto de probar que dichos loci fueran reproducibles entre laboratorios, se condujeron pruebas anónimas para verificar la consistencia de casi 500 alelos. Una vez estandarizada, se construyó una base de datos construida con información proveniente de más de 16,000 salmones que representan 110 poblaciones putativas distribuidas a lo largo del área de interés de la Comisión del Salmón del Pacífico, del sureste de Alaska hasta el Río Sacramento, California. La base de datos sirve tanto para identificar genéticamente los distintos stocks de salmón rey a partir de muestras combinadas provenientes de la pesquería como para diferenciar el linaje genético conocido más importante de esta especie. En la actualidad, un importante grupo de científicos especializados en disciplinas como el manejo y administración de pesquerías, genética, dinámica poblacional y teoría del muestreo están desarrollando recomendaciones para que esta base de datos genéticos se incorpore en el manejo del salmón.

INTRODUCTION

The Pacific Salmon Treaty was ratified between the United States and Canada in 1985, renegotiated in 1999, and extended to the Yukon River in 2002. Through the treaty, the two nations agreed to cooperate in the management, research, and enhancement of Pacific salmon. Pacific salmon migrate long distances during their marine period and are routinely intercepted in fisheries beyond the jurisdiction of the government in whose waters they spawn. The Pacific Salmon Treaty, through the Pacific Salmon Commission (PSC), serves as a means to coordinate management of the salmon resource and conduct conservation actions as required.

Chinook salmon (*Oncorhynchus tshawytscha*) are harvested throughout the year by commercial and sport fishers in the waters of southeast Alaska, British Columbia, and the Pacific Northwest. Fisheries typically harvest highly mixed stocks of Chinook salmon and are therefore under the jurisdiction of the Pacific Salmon Treaty. Quotas specified by the PSC are dependent on the abundance of Chinook salmon projected by its Chinook Technical Committee (CTC) using the Chinook salmon model (e.g., CTC 2005). The model uses catch, escapement, coded-wire tag (CWT) recovery, and recruitment information to forecast relative abundance in treaty fisheries.

With the increased dependence on CWT recovery data, concern has been raised regarding the quality of the CWT data and inferences drawn from those data (Hankin et al. 2005). Historically only fish carrying a CWT had an adipose clip. However, with the advent of mass-marking of large numbers of hatchery fish using an adipose clip only (e.g., Mobrand et al. 2005), recovery of CWT fish has been complicated. Recovery now requires both handling much larger numbers of individuals paired with electronic scanning of those adipose-clipped individuals to detect tags. As a further concern, abundance and harvest information is not available for most Chinook salmon stocks, so indicator stocks are used within the model to represent both larger groups of hatchery and wild stocks. The ability of the hatchery indicator stocks to accurately represent wild stocks has been generally supported in coho salmon (*O. kisutch*; e.g., Weitkamp and Neely 2002), but is still largely unknown for many stocks of Chinook salmon. The wild stocks may differ in ancestry, abundance, and timing from the indicator stock assigned to them in the model.

In 2004, the Pacific Salmon Commission convened a panel of experts to examine limitations of the CWT program in the context of mass marking and mark-selective fisheries, as well as to evaluate the capacity of alternative technologies to improve assessment of Chinook salmon (Hankin et al. 2005). The expert panel concluded that alternative technologies could not by themselves replace CWTs, but that genetic stock identification (GSI) could indeed complement the existing CWT programs or be used in combination with other techniques such as otolith thermal marking to estimate the stock composition of a landed catch in a particular time/area fishery (Findings 11-13). However, they noted limitations in the GSI methods due to the lack of coastwide genetic baselines, which are databases of genotypes from breeding populations.

> **Finding 13.** *Modern GSI methods can be used to estimate the stock composition of the landed catch in a particular time/area fishery. However, the accuracy and precision of data required to estimate stock-age-fishery specific exploitation rates using GSI*

methods is dependent upon a variety of factors. For example, microsatellite DNA-based GSI technology is not yet capable of generating consistent, replicable estimates due to the lack of a coastwide genetic baseline, the history of stock transfers within and among watersheds, and differences in methodologies and mixture separation algorithms. (Hankin et al. 2005)

Here we review a large multi-laboratory effort to develop and standardize a replicable DNA database for Chinook salmon.

History and need for coast-wide databases

Beginning in the 1980s, considerable effort and coordination was directed towards developing standardized allozyme (protein) baselines (e.g., Shaklee and Phelps 1990; White and Shaklee 1991; see Box 1). Standardization among laboratories involves identifying and adopting a common suite of loci (specific polymorphic DNA segments or their products) and adopting consistent names for the various alleles (see Box 1). Genetic analyses using allozyme databases were used extensively to estimate the stock contribution of Chinook salmon fisheries in the Columbia River, coastal Washington, and Strait of Juan de Fuca (e.g., Marshall et al. 1991; Shaklee et al. 1999). Collaborative work during the 1990s by multiple state, provincial, and federal agencies was directed towards enlargement of the database (Teel et al. 1999). The allozyme database grew to include comprehensive coverage of populations ranging from California through Alaska with representative populations from Russia (Teel et al. 1999). Although this database was comprehensive and used by multiple laboratories, a number of limitations, including the requirements for lethal sampling, cryopreservation, lack of laboratory automation, and the finite number of loci, led researchers to the decision to replace the allozyme baseline with a DNA database.

Markers based on DNA, such as mitochondrial DNA (Cronin et al. 1993) and microsatellites (Banks et al. 2000; see Box 1), were also in use and shown to be valuable for resolving Chinook salmon population structure. However, unlike allozymes where a system was developed for sharing and transferring data among laboratories, microsatellite baselines evolved for use within single laboratories (Moran et al. 2006). The large number of available microsatellite loci resulted in little overlap among researchers' datasets. For example, at the beginning of 2003 over 60 loci were in use for Chinook salmon, but most (43) were used in only a single laboratory (Figure 1a). This was not limited to Chinook salmon, but was the norm for fisheries studies of many species. Furthermore, even when identical loci were being used, differences in chemistries and instrument platforms among laboratories produced variable size calls for the same allele from the same individual, which precluded easily merging datasets from multiple regions (Figure 1b). As a result, despite collection of a substantial amount of microsatellite data (e.g., Nelson et al. 2001; Beacham et al. 2003), progress in replacing the allozyme database was slow for multi-jurisdictional fisheries, and multiple databases proliferated.

Concerns regarding these multiple and independent databases were addressed at various meetings of salmonid geneticists from 1999 to 2001, but progress was limited (LaHood et al. 2002). Finally, a workshop hosted by the CTC in 2003 resulted in funding for the database described herein. In the following year, a symposium on genetic databases for fishery management and conservation was held at the 2004 American Fisheries Society (AFS) Annual Meeting, and groups studying a number of divergent fishery resources began standardization efforts (e.g., Atlantic herring; Mariani et al. 2005). So although the advantages of DNA-based markers, and microsatellites in particular, were well documented beginning in the early 1990s (e.g., Wright and Bentzen 1994; Wirgin and Waldman 1994), coordination among laboratories lagged markedly.

The present database was constructed and evaluated through a two-year collaborative effort of an international multi-agency work group. Guiding principles required that the database would: (1) be subject to review by scientists from all interested agencies, (2) be freely available to all researchers managing or studying Chinook salmon, and (3) cover the range of Chinook salmon at a geographic scale appropriate to the management objectives of the PSC with the understanding that the database could be easily expanded to include the entire range of the species. It was anticipated that the database would allow for a wide variety of management and research applications on all life history stages throughout the species range in both freshwater and marine environments.

Box 1. Definition of terms commonly used in genetic stock identification of Pacific salmon.

Allele	An alternative form of a given gene or DNA sequence that differs from other alleles in DNA sequence or phenotype.
Allelic ladder	A pooled and diluted aliquot of multiple PCR products that originates from multiple individuals of known genotype. With the choice of appropriate individuals, a ladder with all the "rungs" necessary for successful interlaboratory allele indexing can be created.
Allozyme	Allelic form of a protein enzyme encoded at a given locus. Allozymes are usually distinguished by protein electrophoresis and histochemical staining techniques.
Locus (loci, plural)	The site that a particular gene or DNA sequence occupies on a chromosome.
Microsatellite	DNA sequences containing short (2–5 base pairs) repeats of nucleotides (e.g. GTGTGTGT).
Neighbor joining tree	A bottom-up clustering method used for the creation of phylogenetic trees that is based on the distance between each pair of populations or taxa.
PCR	The polymerase chain reaction or PCR amplifies a single or few copies of a piece of DNA across several orders of magnitude, generating millions of copies of the DNA.
SNP	Single nucleotide polymorphism; DNA sequence variation occurring when a single nucleotide (A, T, C, or G) differs between members of a species or within an individual between paired chromosomes.

METHODS AND MATERIALS

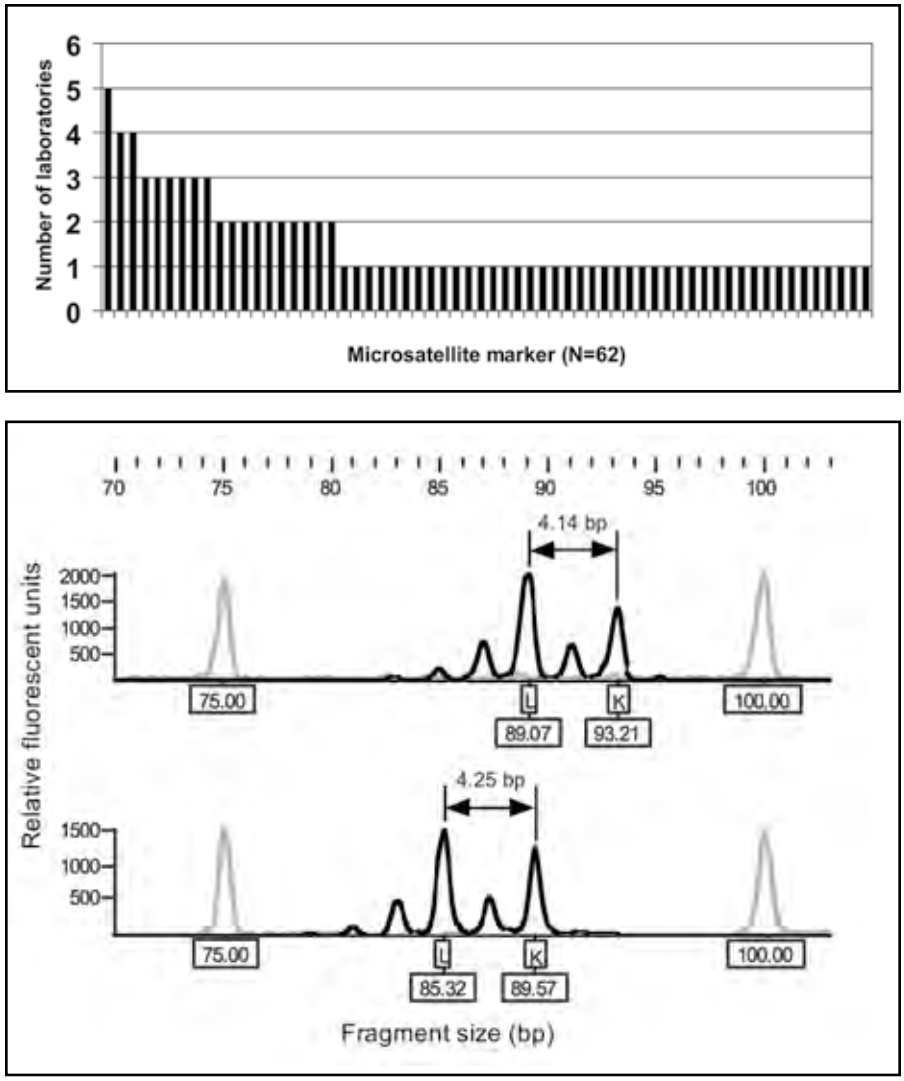
Identification of loci

During the first year of the study, each contributing laboratory analyzed an identical set of 500 individuals drawn from populations ranging from California, USA, to Kamchatka, Russia, for its own microsatellite locus panel. A total of 60 loci were evaluated, and "sponsorship" documents were created for each locus including description, source, analysis conditions, and locus variability. A subset of 25 loci drawn from the combined set was chosen based on qualitative selection criteria including the reliability of the PCR (polymerase chain reaction; see Box 1) amplification, and, to a lesser extent, allelic size range and number of alleles. Locus diversity across the range was generally not a consideration since too few individuals were assayed to reliably compute statistical measures. Each laboratory tested the 25 loci on a subset of 96 individuals drawn from the original 500 individuals. Scores for these 96 individuals were submitted to the coordinating laboratory (Northwest Fisheries Science Center, National Marine Fisheries Service). From this set, collaborators selected and tested the 15 most reliable loci for inclusion in the standardized baseline. A curator laboratory was identified for each locus with responsibility for receiving, compiling, and distributing allele information. A decision was also made to link alleles to tissues from a specific individual salmon that would reside in each laboratory. An additional set of locus documentation was prepared designating recognized alleles, assigning allelic nomenclature, and designating individuals for every recognized allele at each locus. These master allele lists were termed "curator documents."

Genotyping evaluation

To assess the ability of each laboratory to accurately resolve all 15 loci, 2 sets of 96 "blind" samples were analyzed (first and second blind samples). These samples had never been previously genotyped in any of the laboratories. In both cases, test fish were drawn from marine fisheries and assumed to be highly mixed with broad representation of stocks. The samples for the first test were collected from British Columbia; the second set was collected from southeast Alaska. Allelic scores from each laboratory were adjusted to the recognized nomenclature, submitted to the coordinating laboratory, and compared across seven laboratories. Two additional laboratories that had not been involved in locus selection or the first blind test participated in the second blind test. The alleles were not sequenced, so the absolute length was unknown. Therefore, the modal score (the most common allele scored across the participating laboratories) was defined to be the "correct" score. Concordance of scores across laboratories or percent accuracy for each locus for each laboratory was based on this modal score.

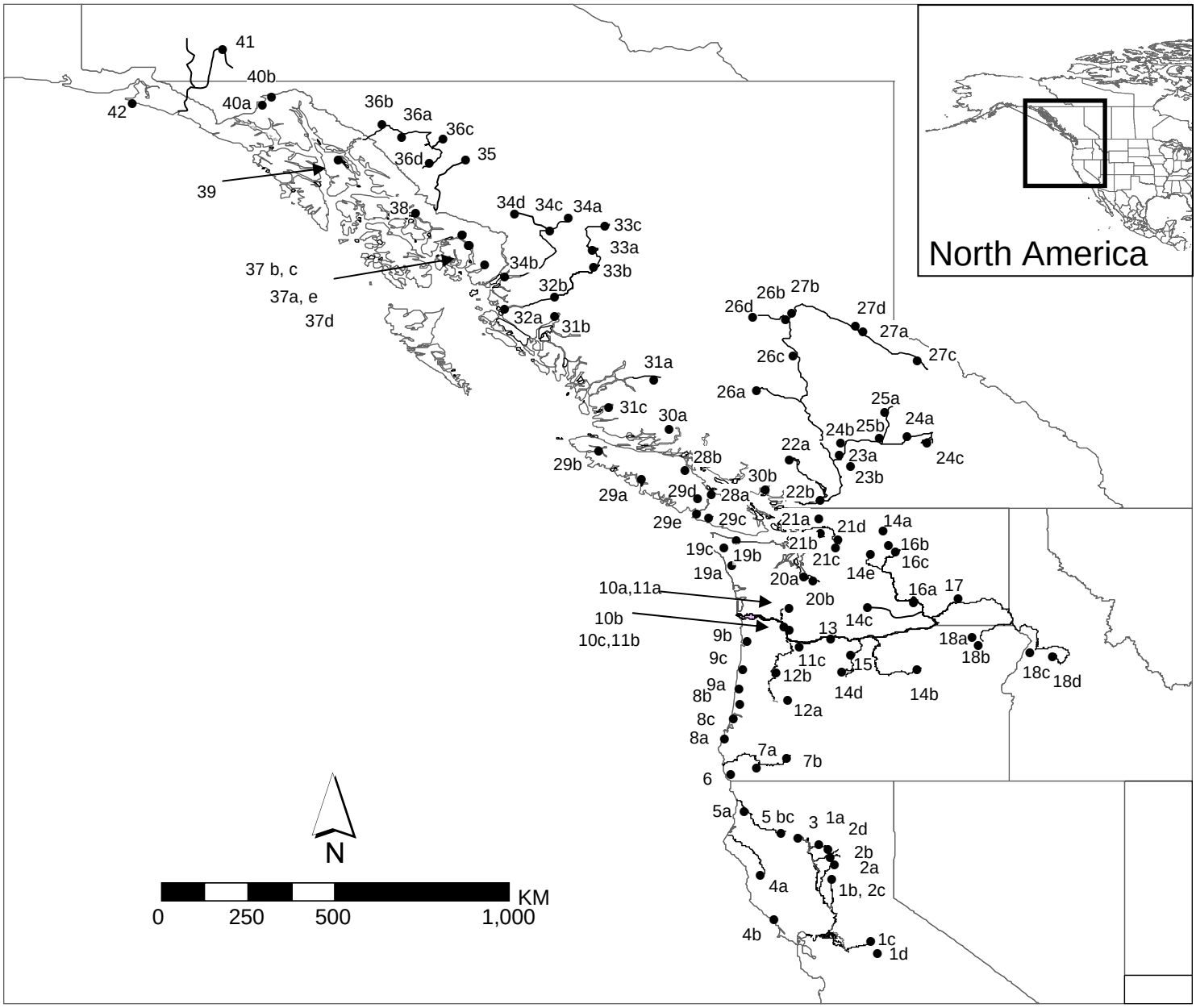
Figure 1. a. Distribution of loci analyzed across laboratories at the beginning of the study. Most markers were assayed in only a single laboratory. Only three loci were used in more than half of the laboratories. b. Electropherograms from the same individual assayed on two different instruments. Identical size standards and sizing algorithm were used, yet differences in size are seen that reflect differences in amplification chemistries and electrophoresis hardware, polymer and running conditions employed in different laboratories. The figure illustrates a significant difference in the estimated size of the alleles, in addition to a different relative size of the repeat unit (i.e., 4.14 versus 4.25 bp; adopted from Moran et al. 2006).



Construction of the Database

Baseline populations were chosen that represent all previously identified genetic lineages of Chinook salmon from the southern end of the species range north to southeast Alaska with focus on major production areas and likely contributors to Pacific Salmon Treaty fisheries (Figure 2). Six laboratories (Alaska Department of Fish and Game [ADFG]; Department of Fisheries and Oceans Canada [DFO]; Columbia River Inter-Tribal Fish Commission [CRITFC]; Oregon State University [OSU]; Southwest Fisheries Science Center, National Marine Fisheries Service [SWFSC]; and Washington Department of Fish and Wildlife [WDFW])

Figure 2. Collection sites for Chinook salmon included in the DNA baseline. These sites represent populations potentially contributing to mixtures harvested in Pacific Salmon Treaty fisheries. Sites are designated by regional groups from Table 3.



contributed to the construction of the database.

Evaluation of the database

Definition of regional groups. The database was evaluated for its ability to correctly allocate to regional groups defined based on a combination of genetic similarity, geographic features, and management applications. Population estimates are combined into regional groups to provide the desired accuracy and precision of stock composition estimates. The initial list of regional groups for compositional analyses was enlarged from those used for the allozyme baseline (Teel et al. 1999). In order to visualize how the present microsatellite data might be concordant with and/or improve upon this list, we calculated pairwise chord distances (Cavalli-Sforza and Edwards 1967) between all collections and then used PHYLIP (Felsenstein 2004) to create a neighbor joining tree (Saitou and Nei 1987; see Box 1). On such a tree, genetically similar populations will cluster together, facilitating the definition of regional groups.

Mixture simulation. Simulations were conducted to evaluate the application of these regional groups to genetic stock identification (compositional analyses) of mixtures of Chinook salmon harvested in treaty fisheries. These simulations assessed whether the baseline of microsatellite allele frequencies provided sufficient information to identify regional groups in hypothetical mixtures.

Simulations were performed using the Statistical Package for Analyzing Mixtures (SPAM version 3.7; Debevec et al. 2000). Mixture genotypes were randomly generated from the baseline allele frequencies assuming Hardy-Weinberg equilibrium. The baseline allele frequencies were parametrically resampled to account for sampling variability. Each simulated mixture (N = 400) was entirely composed (100%)

of the regional group under study with equal contribution of all populations within the regional group. Then each simulated mixture was analyzed against the complete baseline. Bootstrap means for regional groups and 90% confidence intervals were derived from 1,000 simulations per group. Regional groups with mean correct estimates of at least 90% are considered highly identifiable in potential mixtures from treaty fisheries. Regional groups with mean correct estimates lower than 90% can still be considered identifiable in mixtures, but sources of misallocation should be considered when interpreting the results (e.g., Seeb et al. 2000).

RESULTS

Locus selection and evaluation of microsatellites

The first blind test revealed that data-handling errors, such as misalignment of individuals, were the largest source of disagreement among laboratories. In addition to data-handling errors, 2 of the 15 loci selected and tested stood out as being poorly standardized across 3 or more laboratories. These 2 loci were removed, and the final group of 13 loci was identified for inclusion in the baseline (Table 1). Beyond these sources of conflict, the results of the first blind comparison indicated that technical standardization had been accomplished for greater than 90% of the observed alleles at each locus. Furthermore, much of the remaining variability among laboratories was due to alleles being observed in the blind samples that had not been observed in the original 96 samples.

The results of the second blind test indicated that technical standardization had been accomplished for more than 95% of the observed alleles (Table 2a). However, a number of low-concordance values for specific loci indicated errors in the data from two of the laboratories. One laboratory obtained a concordance of only 44% for *Ogo4*, whereas other loci provided by the same laboratory showed 98% concordance or more. Another laboratory had 0% concordance at five loci and 82% at another locus. Data for the other seven loci from this second laboratory were close to the overall average. Cursory checks in respective laboratories revealed data-handling errors that explained most of the discrepancies. After correction of these errors the overall concordance for the laboratories at these loci was over 99% (Table 2b).

Baseline construction

Data provided by the collaborators were combined to create a large database suited to GSI compositional analyses of fisheries managed under the Pacific Salmon Treaty. A total of 220 sample collections and 16,394 individual fish representing 110 putative populations were included in Version 1.1 of the baseline (Table 3, Figure 2, Appendix 1). All individual fish were assayed across 13 loci; however, failures at particular loci sometimes resulted in incomplete multilocus genotypes. A target was set of 144 individuals per population with at least 120 genotypes per locus. In some populations, fewer than 120 individuals were available, so actual sample sizes were necessarily below the target.

The number of alleles varied markedly across loci, ranging from 9 (*Ots9*) to 74 (*Omm1080*; Table 1). Across all loci, 487 alleles were observed. A voucher set of tissues from a single individual for each of the alleles were identified and provided to all collaborators. For some alleles, insufficient tissue was available for sharing between all labs, so a second individual known to exhibit the same allele was substituted as the voucher. Additional alleles are expected as coverage of the baseline expands.

Simulations

Forty-two regional groups were defined based on genetic similarity, geographic features, and management applications. Simulations were performed to examine the accuracy and precision of this baseline simulating mixtures composed of individuals drawn entirely from populations of a single region. Almost all regions were defined as highly identifiable with bootstrap means of 1,000 simulated mixtures above 90% to the correct regional group (Table 3). Exceptions were the Deschutes Fall and Upper Stikine River regions which had 89.5% and 84.5% mean correct allocations, respectively. In addition, the lower bound of the 90% confidence interval for all regions was above a 90% threshold, with the exception of the Deschutes Fall, Upper Stikine River, Taku River, and Southeast Alaska Stikine River groups.

DISCUSSION

Database construction

Our primary goal of developing a replicable set of microsatellite loci for Chinook salmon was successfully completed. With an average above 90% correct allocation to regional groups, the DNA baseline provides an unprecedented resource for improved information and management of Chinook salmon during their ocean and freshwater life stages. Additional laboratories employing various chemistries and hardware will be able to use the database through the use of voucher specimens or by using the allelic ladders (see Box 1) that are currently under construction for all loci (e.g., LaHood et al. 2002). Allelic ladders consist of a collection of alleles covering a range of known sizes that can be used as an internal measurement to standardize the data. These ladders hold the promise of simplifying standardization as laboratories will not need to analyze voucher specimens for every allele.

All geographic regions and genetic lineages likely to contribute to fisheries of CTC interest are represented in the present baseline, and these data should be appropriate for complex fishery mixtures that include diverse populations from widespread locations. Although the current baseline is broad, it is not comprehensive. Efforts are currently underway to increase local coverage. Expanded baseline data will likely improve the accuracy of allocation to the regional groups, and, in at least some cases, are likely to provide a finer scale of estimation (e.g., sub-basins within major river systems). Fine-scale geographic allocation of mixtures and potential assignment of individual fish to population-of-origin may also provide important biological and life-history information such as migration timing and pathways and age-related changes in habitat use. Expansion of the baseline to include populations throughout Alaska, Canada, and Russia is underway. In addition to improved management, the baseline will be used to better understand the biology of the species and provide information about effective population size, evolutionary and demographic history, and population boundaries.

The results of the two blind tests were encouraging, but also signalled a need for continued vigilance in error checking and data manipulation. On the one hand,

Table 1. Microsatellite loci standardized for Chinook salmon. Reference, curator agency, and observed number of alleles are given for baseline Version 1.1.

Locus	Reference	Curator agency[1]	Observed number of alleles
Ogo2	Olsen et al. 1998	ADFG	26
Ogo4	Olsen et al. 1998	WDFW	20
Oki100	DFO unpublished[2]	DFO	48
Omm1080	Rexroad et al. 2001	SWFSC	74
Ots201b	Grieg et al. 2003	ADFG	52
Ots208b	Grieg et al. 2003	CRITFC	54
Ots211	Grieg et al. 2003	ADFG	43
Ots212	Grieg et al. 2003	OSU	36
Ots213	Grieg et al. 2003	OSU	48
Ots3M	Grieg and Banks 1999	WDFW	19
Ots9	Banks et al. 1999	DFO	9
OtsG474	Williamson et al. 2002	CRITFC	19
Ssa408	Cairney et al. 2000	NWFSC	39

[1] Laboratory abbreviations: OSU, Oregon State University; SWFSC, Southwest Fisheries Science Center—National Marine Fisheries Service; DFO, Department of Fisheries and Oceans Canada; NWFSC, Northwest Fisheries Science Center—National Marine Fisheries Service; CRITFC, Columbia River Inter-Tribal Fish Commission; ADFG, Alaska Department of Fish and Game; WDFW, Washington Department of Fish and Wildlife.

[2] Personal communication, K. Miller, Department of Fisheries and Oceans Canada, Nanaimo, British Columbia, Canada.

laboratories were able to achieve a very high degree of concordance through the standardization process and voucher sample comparisons. Furthermore, two new laboratories that had not been previously involved in locus selection, baseline construction, or the first blind test were able to achieve very high concordance without any significant errors. On the other hand, significant errors in data handling were still apparent in initial blind submissions from two of the original laboratories. These results, although not unique to microsatellite data (e.g., White and Shaklee 1991), suggest that ongoing quality control and error checking procedures both internally within each laboratory and among laboratories are warranted to ensure database integrity.

Table 2. Proportional genotyping accuracy by laboratory and locus for the second blind test of 13 microsatellite loci. Averages across locus and laboratory are given. A. Results as submitted. B. Results after correction for errors (see text).

A.

Locus	Lab 1	Lab 2	Lab 3	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Average
Ogo2	0.987	1.000	1.000	1.000	0.993	0.000	1.000	0.993	1.000	0.886
Ogo4	0.439	1.000	1.000	0.995	1.000	0.000	0.995	0.994	0.990	0.824
Oki100	0.978	1.000	1.000	1.000	1.000	1.000	1.000	0.970	1.000	0.994
Omm1080	1.000	1.000	0.995	1.000	1.000	0.000	1.000	0.994	1.000	0.888
Ots201b	0.984	1.000	1.000	1.000	1.000	0.993	0.995	0.985	1.000	0.995
Ots208b	0.994	1.000	1.000	1.000	1.000	1.000	0.995	0.970	0.995	0.995
Ots211	1.000	1.000	0.994	1.000	0.993	0.955	0.994	0.985	0.994	0.991
Ots212	0.989	1.000	1.000	1.000	1.000	0.989	0.995	0.994	1.000	0.996
Ots213	0.987	1.000	0.982	1.000	0.985	0.000	1.000	1.000	1.000	0.884
Ots3M	1.000	1.000	0.988	0.994	1.000	0.000	1.000	1.000	0.995	0.886
Ots9	1.000	1.000	1.000	1.000	1.000	0.823	1.000	1.000	1.000	0.980
OtsG474	0.995	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999
Ssa408	0.987	0.929	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.991
Average	**0.949**	**0.995**	**0.997**	**0.999**	**0.998**	**0.597**	**0.998**	**0.991**	**0.998**	**0.947**

B.

Locus	Lab 1	Lab 2	Lab 3	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Average
Ogo2	0.987	1.000	1.000	1.000	0.993	0.988	1.000	0.993	1.000	0.996
Ogo4	0.994	1.000	1.000	0.995	1.000	0.968	0.995	0.994	0.990	0.993
Oki100	0.978	1.000	1.000	1.000	1.000	1.000	1.000	0.970	1.000	0.994
Omm1080	1.000	1.000	0.995	1.000	1.000	0.938	1.000	0.994	1.000	0.992
Ots201b	0.984	1.000	1.000	1.000	1.000	0.993	0.995	0.985	1.000	0.995
Ots208b	0.994	1.000	1.000	1.000	1.000	1.000	0.995	0.970	0.995	0.995
Ots211	1.000	1.000	0.994	1.000	0.993	0.955	0.994	0.985	0.994	0.991
Ots212	0.989	1.000	1.000	1.000	1.000	0.989	0.995	0.994	1.000	0.996
Ots213	0.987	1.000	0.982	1.000	0.985	0.994	1.000	1.000	1.000	0.994
Ots3M	1.000	1.000	0.988	0.994	1.000	0.949	1.000	1.000	0.995	0.992
Ots9	1.000	1.000	1.000	1.000	1.000	0.979	1.000	1.000	1.000	0.998
OtsG474	0.995	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999
Ssa408	0.987	0.929	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.991
Average	**0.992**	**0.995**	**0.997**	**0.999**	**0.998**	**0.981**	**0.998**	**0.991**	**0.998**	**0.994**

Table 3. Mean correct allocations from 100% simulations for 42 regional groups of Chinook salmon populations. Bootstrap means of 1,000 simulated mixtures and upper and lower 90% bootstrap confidence intervals are given. Number of populations per region is also given.

Region number	Region name	Number of populations	Bootstrap mean	90% confidence interval	
				Lower	Upper
1	Central Valley fall	4	0.945	0.916	0.971
2	Central Valley spring	4	0.936	0.908	0.962
3	Central Valley winter	1	0.990	0.980	0.998
4	California Coast	2	0.985	0.975	0.995
5	Klamath River	3	0.984	0.970	0.995
6	North California/South Oregon Coast	1	0.972	0.956	0.987
7	Rogue River	2	0.941	0.912	0.968
8	Mid Oregon Coast	3	0.944	0.918	0.968
9	North Oregon Coast	3	0.957	0.933	0.979
10	Lower Columbia spring	3	0.971	0.952	0.987
11	Lower Columbia fall	3	0.973	0.956	0.987
12	Willamette River	2	0.983	0.968	0.994
13	Mid Columbia Tule fall	1	0.969	0.949	0.986
14	Mid and Upper Columbia spring	5	0.965	0.945	0.985
15	Deschutes fall	1	0.895	0.859	0.931
16	Upper Columbia summer/fall	3	0.963	0.937	0.985
17	Snake River fall	1	0.946	0.915	0.974
18	Snake River spring/summer	5	0.966	0.946	0.984
19	Washington Coast	3	0.951	0.928	0.971
20	South Puget Sound	2	0.988	0.977	0.997
21	North Puget Sound	4	0.971	0.955	0.985
22	Lower Fraser	2	0.984	0.972	0.994
23	Lower Thompson River	2	0.983	0.971	0.994
24	South Thompson River	3	0.976	0.962	0.990
25	North Thompson River	2	0.978	0.964	0.990
26	Mid Fraser River	4	0.980	0.966	0.991
27	Upper Fraser River	4	0.969	0.949	0.986
28	East Vancouver Island	2	0.979	0.966	0.991
29	West Vancouver Island	5	0.990	0.980	0.997
30	South BC Mainland	2	0.975	0.961	0.988
31	Central BC Coast	3	0.960	0.940	0.978
32	Lower Skeena River	2	0.950	0.927	0.971
33	Upper Skeena River	3	0.950	0.925	0.971
34	Nass River	4	0.939	0.913	0.963
35	Upper Stikine River	1	0.845	0.793	0.893
36	Taku River	4	0.920	0.884	0.954
37	Southern Southeast Alaska	5	0.969	0.950	0.986
38	Southeast Alaska, Stikine River	1	0.917	0.884	0.947
39	King Salmon River	1	0.987	0.977	0.995
40	Chilkat River	2	0.988	0.977	0.996
41	Alsek River	1	0.980	0.967	0.992
42	Situk River	1	0.977	0.963	0.990

Power of the database

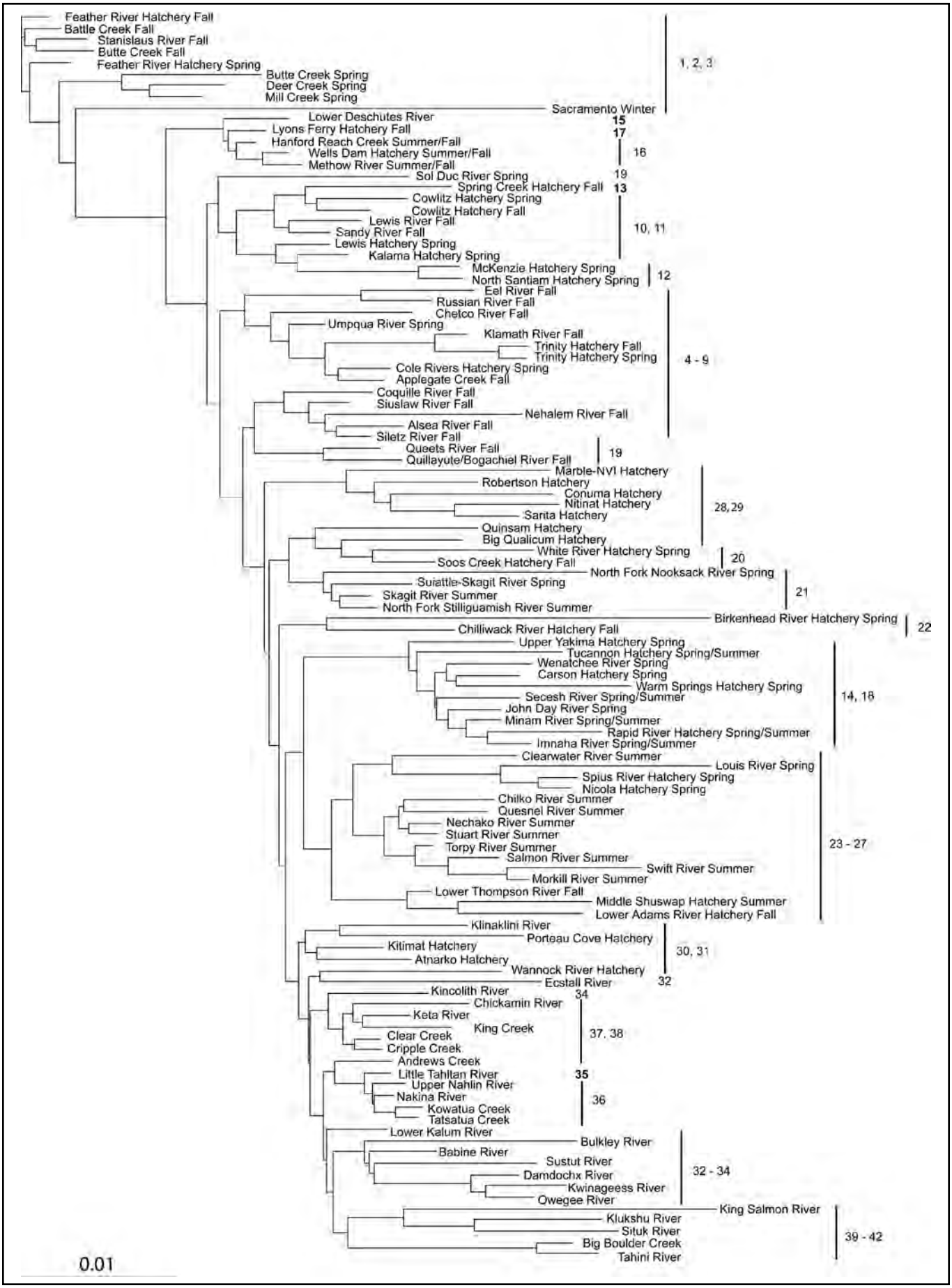
Our simulation results suggest that the present database provides greater resolution than was provided by the allozyme baseline. Only the Deschutes Fall and Upper Stikine regions fell below our target of 90% accuracy. Additional populations and tests are needed to evaluate whether these groups can be accurately identified or, alternatively, should be combined with adjacent regional groups. The similarity among the Taku and Stikine river transboundary populations was also observed with the allozyme dataset of Teel et al. (1999), and a single combined group for these populations was used in the allozyme study of Guthrie and Wilmot (2004).

The neighbor-joining tree (Figure 3) suggested that some groups that had not been distinct from one another based on the allozyme baseline might be resolvable with the present microsatellite data. Overall, 37 regional groups were resolvable with the allozyme dataset (Teel et al. 1999) while 42 were recognized in this microsatellite dataset despite that fact that more populations were included in the allozyme baseline than the microsatellite baseline. Gains in resolution were most apparent in the California Central Valley where a single allozyme group was separated into fall, spring, and winter groups.

Growth of and access to the baseline

More detailed analyses of the power of the database are ongoing. We expect future analyses to better define limitations of the present database and to identify where the addition of baseline collections and increased power via the addition of new markers are most needed. The addition of single nucleotide polymorphism (SNP) markers (see Box 1) which are easily standardized and may reflect selective

Figure 3. Neighbor-joining tree based on pairwise chord distances between collections of Chinook salmon (Appendix 1). Numbers and vertical lines on right indicate regional groups as designated in Table 3. Regional groups with only a single population are in bold.



variation (Smith et al. 2005; Smith et al. in press) is presently underway.

As part of the collaboration, a web-based application has been developed to allow the fisheries and research community to access the genotype data, curator documents, and supporting metadata. The Pacific Salmon Commission provided developmental funding to the Northwest Fisheries Science Center, National Marine Fisheries Service, Seattle, Washington (www.nwfsc.noaa.gov/research/divisions/cbd/standardization.cfm), and a test version of the web application is now being evaluated. The permanent location and support for the database are currently under discussion by the collaborating agencies and the Pacific Salmon Commission. Until the final location of the database is established, the data are available at the ADFG website (www.genetics.cf.adfg.state.ak.us/publish/data/PSCchinookver1_1.pdf).

CONCLUSIONS

Here we described a large collaborative study to develop a shared, web-accessible database of DNA markers to allow multiple agencies to conduct genetic stock identification studies of Chinook salmon. Replicate scoring of the microsatellite loci was successfully accomplished among nine geographically-dispersed laboratories. However, the study also revealed that ongoing coordination and error-checking will be required to ensure the integrity of the database as it expands. Growth of the database is presently underway via the addition of new collections and additional SNP markers. The database is now being used to estimate compositional analyses of PSC and other fisheries around the Pacific Ocean.

In May and September of 2007, the PSC convened a workshop focusing on the current and future capabilities, limitations, and use of genetic stock identification methods in ocean salmon management. A diverse group of scientists attended representing the disciplines of fishery management, genetics, administration, population dynamics, and sampling theory. Attendees were divided into four workgroups: genetics, management, logistics, and modeling/sampling. Reviews of the workshop are available at the PSC website (http://psc.org/). The final recommendations will be published when completed in 2008.

As genetic approaches to fisheries management become more commonplace, we anticipate the growth of this and similar types of databases that are publicly available through web applications. Ultimately, these databases will provide a wealth of information not only for fisheries applications, but also for researchers from a variety of disciplines investigating diverse aspects of salmonid life history, population genetics, and evolutionary theory.

ACKNOWLEDGEMENTS

This study was result of a collaboration among three National Marine Fisheries Service laboratories—Northwest Fisheries Science Center, Auke Bay Laboratory, and Southwest Fisheries Science Center; Washington Department of Fish and Wildlife; University of Idaho/Columbia River Inter-tribal Fisheries Commission/Idaho Department of Fish and Game; Oregon State University; Canadian Department of Fisheries and Oceans; and the Alaska Department of Fish and Game. The U.S. Fish and Wildlife Service, Anchorage, Alaska, and Idaho Department of Fish and Game, Eagle, Idaho, participated in the second blind sample. Primary funding for the study was provided by the U.S. Department of Commerce, NOAA, NMFS, funds appropriated to fund the technical work required for the U.S. section of the Pacific Salmon Treaty to implement the Chinook Salmon

Agreement regarding abundance based management. Partial funding for the U.S. Fish and Wildlife Service was provided by the U.S. Yukon River Research and Management Fund (USRM-08-05) and to the University of Washington by Joint Institute for the Study of the Atmosphere and Ocean (JISAO) under NOAA Cooperative Agreement NA17RJ1232, Contribution 1444. Significant matching funds were provided by all participating institutions. We thank the many members of the Chinook Technical Committee of the Pacific Salmon Committee for their vision and support for the study and five anonymous reviewers for their valuable comments on the manuscript.

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Appendix 1. Chinook salmon populations analyzed in this study and included in baseline Version 1.1. Run time, hatchery (H) or wild (W) origin, life stage, collection data, and analysis laboratory are given. Lower case designations within a region correspond to locations on Figure 1.

Region number	Region name	Population	Run time[1]	Origin	Life stage	Collection date	Analysis laboratory[2]
1	Central Valley fall	Battle Creek (a)	Fa	W	Adult	2002, 2003	SWFSC
		Feather Hatchery fall (b)	Fa	H	Adult	2003	SWFSC
		Stanislaus River (c)	Fa	W	Adult	2002	SWFSC
		Tuolumne River (d)	Fa	W	Adult	2002	SWFSC
2	Central Valley spring	Butte Creek (a)	Sp	W	Adult	2002, 2003	SWFSC
		Deer Creek spring (b)	Sp	W	Adult	2002	SWFSC
		Feather Hatchery spring (c)	Sp	H	Adult	2003	SWFSC
		Mill Creek spring (d)	Sp	W	Adult	2002, 2003	SWFSC
3	Central Valley winter	Sacramento River winter	Wi	W/H	Adult	1992, 1993, 1994, 1995, 1997, 1998, 2001, 2003, 2004	SWFSC
4	California Coast	Eel River (a)	Fa	W	Adult	2000, 2001	SWFSC
		Russian River (b)	Fa	W	Juvenile	2001	SWFSC
5	Klamath River	Klamath River fall (a)	Fa	W	Adult	2004	SWFSC
		Trinity Hatchery fall (b)	Fa	H	Adult	1992	SWFSC
		Trinity Hatchery spring (c)	Sp	H	Adult	1992	SWFSC
6	North California/ South Oregon Coast	Chetco	Fa	W	Adult	2004	OSU
7	Rogue River	Applegate (a)	Fa	W	Adult	2004	OSU
		Cole Rivers Hatchery (b)	Sp	H	Adult	2004	OSU
8	Mid Oregon Coast	Coquille (a)	Fa	W	Adult	2000	OSU
		Siuslaw (b)	Fa	W	Adult	2001	OSU
		Umpqua (c)	Sp	W	Adult	2004	OSU
9	North Oregon Coast	Alsea (a)	Fa	W	Adult	2004	OSU
		Nehalem (b)	Fa	W	Adult	2000, 2002-1, 2002-2	OSU
		Siletz (c)	Fa	W	Adult	2000	OSU
10	Lower Columbia spring	Cowlitz Hatchery spring (a)	Sp	H		2004	CRITFC
		Kalama Hatchery spring (b)	Sp	H		2004	CRITFC
		Lewis Hatchery spring (c)	Sp	H		2004	CRITFC
11	Lower Columbia fall	Cowlitz Hatchery fall (a)	Fa	H		2004	CRITFC
		Lewis fall (b)	Fa	W	Adult	2003	WDFW
		Sandy (c)	Fa	W	Adult	2002, 2004	OSU
12	Willamette River	McKenzie (a)	Sp	H	Adult	2002, 2004	OSU
		North Santiam (b)	Sp	H	Adult	2002, 2004-1, 2004-2	OSU
13	Mid Columbia Tule fall	Spring Creek	Fa	H		2001, 2002	CRITFC
14	Mid and Upper Columbia spring	Carson Hatchery (a)	Sp	H		2001, 2004	CRITFC
		John Day (b)	Sp	W	Juvenile, Adult	2000-1, 2000-2, 2000-3, 2000-4, 2000-5, 2000-6, 2004	OSU
		Upper Yakima (c)	Sp	H	Adult, Mixed	1998, 2003	WDFW
		Warm Springs Hatchery (d)	Sp	H		2002, 2003	CRITFC
		Wenatchee spring (e)	Sp	W	Adult	1993, 1998, 2000	WDFW
15	Deschutes fall	Lower Deschutes River	Fa	W		1999-1, 1999-2, 2001, 2002	CRITFC
16	Upper Columbia summer/fall	Hanford Reach (a)	Su/Fa	W		1999, 2000-1, 2000-2, 2000-3, 2001-1, 2001-2, 2001-3	CRITFC
		Methow River summer (b)	Su/Fa	W		1992, 1993, 1994	CRITFC
		Wells Dam (c)	Su/Fa	H		1993-1, 1993-2	CRITFC
17	Snake River fall	Lyons Ferry	Fa	W	Adult	2002-1, 2002-2, 2003-1, 2003-2	WDFW
18	Snake River spring/summer	Imnaha River (a)	Sp/Su	W		1998, 2002, 2003	CRITFC
		Minam River (b)	Sp/Su	W		1994, 2002, 2003	CRITFC
		Rapid River Hatchery (c)	Sp/Su	H		1997, 1999, 2002	CRITFC
		Sesech River (d)	Sp/Su	W		2001, 2002, 2003	CRITFC
		Tucannon (e)	Sp/Su	H	Adult	2003-1, 2003-2, 2003-2	WDFW
19	Washington Coast	Queets (a)	Fa	W	Adult	1996, 1997	WDFW
		Quillayute/Bogachiel (b)	Fa	W	Adult	1995-1, 1995-2, 1995-3, 1996-1, 1996-2	WDFW
		Sol Duc (c)	Sp	H	Adult	2003	WDFW
20	South Puget Sound	Soos Creek (a)	Fa	H	Adult	1998-1, 1998-2, 2004	WDFW
		White River (b)	Sp	H	adult	1998-1, 1998-2, 2002	WDFW

21	North Puget Sound	NF Nooksack (a)	Sp	H/W	adult	1999	WDFW
		NF Stilliguamish (b)	Su	H/W	adult	1996, 2001-1, 2001-2	WDFW
		Skagit summer (c)	Su	W	adult	1994, 1995	WDFW
		Suiattle (Skagit) (d)	Sp	W	adult	1989, 1998, 1999	WDFW
22	Lower Fraser	Birkenhead River (a)	Sp	H	Adult	1996, 1997, 1999, 2001, 2002, 2003	SWFSC
		Chilliwack (b)	Fa	H	Adult	1998, 1999	DFO
23	Lower Thompson River	Nicola (a)	Sp	H		1998, 1999	OSU
		Spius River (b)	Sp	H	Adult	1996, 1997, 1998	SWFSC
24	South Thompson River	Lower Adams (a)	Fa	H	Adult	1996	DFO
		Lower Thompson (b)	Fa	W	Adult	2001	DFO
		Middle Shuswap (c)	Su	H	Adult	1997	DFO
25	North Thompson River	Clearwater (a)	Su	W	Adult	1997	DFO
		Louis River (b)	Sp	W	Adult	2001	DFO
26	Mid Fraser River	Chilko (a)	Su	W	Adult	1995, 1996, 1999, 2002	DFO
		Nechako (b)	Su	W	Adult	1996	DFO
		Quesnel (c)	Su	W	Adult	1996	DFO
		Stuart (d)	Su	W	Adult	1996	DFO
27	Upper Fraser River	Morkill River (a)	Su	W	Adult	2001	DFO
		Salmon River (Fraser) (b)	Su	W	Adult	1997	SWFSC
		Swift (c)	Su	W	Adult	1996	DFO
		Torpy River (d)	Su	W	Adult	2001	DFO
28	East Vancouver Island	Big Qualicum (a)		H	Adult	1996	DFO
		Quinsam (b)		H	Adult	1996, 1998	DFO
29	West Vancouver Island	Conuma (a)		H	Adult	1997, 1998	DFO
		Marble at NVI (b)		H	Adult	1996, 1999, 2000	DFO
		Nitinat (c)		H	Adult	1996	DFO
		Robertson (d)		H	Adult	1996, 2003	DFO
		Sarita (e)		H	Adult	1997, 2001	DFO
30	South BC Mainland	Klinaklini (a)		W	Adult	1997	DFO
		Porteau Cove (b)		H	Adult	2003	DFO
31	Central BC Coast	Atnarko (a)		H	Adult	1996	DFO
		Kitimat (b)		H	Adult	1997	DFO
		Wannock (c)		H	Adult	1996	DFO
32	Lower Skeena River	Ecstall (a)		W	Adult	2000, 2001, 2002	DFO
		Lower Kalum (b)		W	Adult	2001	DFO
33	Upper Skeena River	Babine (a)		H	Adult	1996	DFO
		Bulkley (b)		W	Adult	1999	DFO
		Sustut (c)		W	Adult	2001	DFO
34	Nass River	Damdochax (a)		W	Adult	1996	DFO
		Kincolith (b)		W	Adult	1996	DFO
		Kwinageese (c)		W	Adult	1996	DFO
		Owegee (d)		W	Adult	1996	DFO
35	Upper Stikine River	Little Tahltan River		W	Adult	1989, 1990	OSU
36	Taku River	Kowatua Creek (a)		W	Adult	1989, 1990	ADFG
		Nakina River (b)		W	Adult	1989, 1990	ADFG
		Tatsatua Creek (c)			Adult	1989, 1990	ADFG
		Upper Nahlin River (d)		W	Adult	1989, 1990, 2004	ADFG
37	Southern Southeast Alaska	Chickamin River (a)		W	Adult	1990, 1993	ADFG
		Clear Creek (b)		W	Adult	1989, 2003, 2004	ADFG
		Cripple Creek (c)		W	Adult	1988, 2003	ADFG
		Keta River (d)		W	Adult	1989, 2003	ADFG
		King Creek (e)		W	Adult	2003	ADFG
38	Southeast Alaska, Stikine River	Andrews Creek		W	Adult	1989, 2004	ADFG
39	King Salmon River	King Salmon River		W	Adult	1989, 1990, 1993	ADFG
40	Chilkat River	Big Boulder Creek (a)		W	Adult	1992, 1995, 2004	ADFG
		Tahini River (b)		W	Adult	1992, 2004	ADFG
41	Alsek River	Klukshu River		W	Adult	1989, 1990	ADFG
42	Situk River	Situk River		W	Adult	1988, 1990, 1991, 1992	ADFG

[1]1 Run time abbreviations: spring (Sp), summer (Su), fall (Fa), and winter (Wi)

[2]Laboratory abbreviations: OSU, Oregon State University; SWFSC, Southwest Fisheries Science Center – National Marine Fisheries Service; DFO, Department of Fisheries and Oceans Canada; CRITFC, Columbia River Inter-Tribal Fish Commission; ADFG, Alaska Department of Fish & Game; WDFW, Washington Department of Fish & Wildlife.

COLUMN
GUEST DIRECTOR'S LINE

John T. Everett
Everett, after 31 years with the National Marine Fisheries Service, is president of Ocean Associates, Inc.,and an be contacted at JohnEverett@OceanAssoc.com.

AFS Members and the Intergovernmental Panel on Climate Change: A Broad Partnership

Climate change has been important to our understanding of fisheries since the first hook went in the water. More recently, it has become associated with change contributed by our society. Since we in "fisheries" have long studied environmental changes and their impacts on our flock, we tend to recognize that fisheries rise and fall with changes in the local and global environment, with many synchronous population changes in stocks around the world. Our understanding of these fast and vast changes gives us a distinct advantage in dealing with this complex issue. Change happens but not all change is equal. A change of 1 degree F (0.5 C) over 150 years is like noise in a system with El Niños, Pacific Decadal Oscillations, and North Atlantic Oscillations. The fisheries community has been much more reasoned in its response to climate change than many other sectors.

Some of us worked on climate cooling in the 1970s. This truly frightening possibility takes some of the dread out of present modeling projections. Even though we know that fish and all other aquatic life have endured much warmer (and cooler) times in the past, we realize that any human contributions to climate change will have an exaggerated effect due to present fisheries stresses and sharp conflicts among competing uses of aquatic ecosystems. As the Intergovernmental Panel on Climate Change (IPCC) noted in 1995, "Climate change impacts are likely to exacerbate existing stresses on fish stocks, notably overfishing, diminishing wetlands and nursery areas, pollution, and UV-B radiation. The effectiveness of actions to reduce the decline of fisheries depends on our capacity to distinguish among these stresses and other causes of change. This capacity is insufficient and, although the effects of environmental variability are increasingly recognized, the contribution of climate change to such variability is not yet clear." Repeating this theme, AFS member **Gary Sharp** and I testified earlier this year in the U.S. House of Representatives about the impact of climate change on fisheries, oceans, and ecosystems. The materials gathered for my testimony underpin a website at www.ClimateChangeFacts.info.

AFS and its members have been involved in climate change research and issues since the cooling scare of the 1970s and the transition to warming in the late 1980s. For example, AFS co-hosted with Sea Grant an important symposium on "Climate Change and Fisheries" in Arizona in 2000 and the AFS website and its publications have many articles on the issue. With the IPCC sharing the Nobel Peace Prize, it is fitting to recognize all the AFS members who participated over the years. No one person has been involved in all phases of this extraordinary effort, but member **James Meehan** and I were involved in the first oceans meeting in Moscow in 1988 and I have continued, now as an IPCC expert reviewer, since leaving NOAA. If anyone is missing from the following recognitions, I'll take the blame (Please do let AFS know for future reference).

The IPCC structure and process focuses on assessments every five years, each with three working groups. Working Group I addresses the science of climate change, WG II addresses the impact and adaptations from climate change, and WG III examines the socioeconomic issues of both climate change and emission reductions. Fisheries issues have always been tackled by WG II (headed by Russia). Chapter co-chairs manage the entire process for each topical chapter and present and defend their reports during plenary. Lead authors usually prepare a section of a chapter, such as coastal or inland fisheries. Contributors write a paragraph or two, or make comments during several peer reviews of each document. More background information and the last two reports by WG II are available at www.ipcc-wg2.org. The selection of authors and topics is done by negotiation among nations.

Here are some contributions of AFS members we can identify. In the IPCC First Assessment Report in 1990, the World Oceans and Coastal Zones chapter was co-chaired by John Everett, with assistance from lead author James Meehan. Everett also co-chaired World Oceans and Coastal Zones in the IPCC Impacts Assessment Supplement in 1992.

In the 1995 assessment, Everett and **John Magnuson** served as lead authors for Chapter 8: Oceans, with **Suzanne Bolton, Stephan Arnott,** and **David Fluharty** as contributing authors. Chapter 16: Fisheries was chaired by Everett, with **Henry Regier** and **Daniel Lluch-Belda** serving as lead authors, and contributions by Bolton, **Steve Clark, Glenn Flittner, Churchill Grimes, Jonathan Hare, Richard Methot, J. Richey, Gary Sharp, Kenneth Sherman,** and **David Welch.**

A 1998 special report: Polar Regions was co-chaired by Everett with contributions by Bolton. Climate Change 2001 included the efforts of Magnuson and **Richard Beamish** as lead authors of Chapter 5: Ecosystems and Their Goods and Services with contributing authors **J. Morgan, R. Neilson,** and **K. Wilson.** Beamish also served as lead author on Chapter 6: Coastal Zones and Marine Ecosystems.

Contributions to outside groups such as IPCC require support from supervisors, colleagues, and staff. AFS members **Bill Fox** and **Glenn Flittner** were my bosses while I spent inordinate amounts of my own and agency time writing and traveling. NMFS Director **Terry Leitzell** assigned global cooling to me and **Bill Evans** later changed it to global warming. All five bosses gave me all the resources I needed, particularly the assistance of Suzanne Bolton, who spent the equivalent of a lifetime in the library. Gary Sharp taught me to question conventional climate wisdom and modeling as he challenged the NOAA Climate Board's inability to consider the biology in the oceans as integrators and sensors of all that was going on. Lastly, special thanks go to Henry Regier for helping me keep some sanity as we got the fisheries chapter off the ground, and for suggesting to Gus that these IPCC contributions be recognized. This message is his idea!

I encourage everyone, particularly our young members, to participate in IPCC and similar global endeavors. The new contacts, ideas from different disciplines, broad views experienced, and most importantly, lessons learned in managing a global task force, will lead to enhanced productivity down the road for everyone. For organizations, major unrelated benefits also are made possible. For NOAA Fisheries, the trust built during IPCC meetings led to the rescue of 80 years of invaluable Soviet and Ukrainian fishing research done in U.S. waters and on the high seas, much of it on virgin stocks.

AWARDS: 2007 AFS AWARD WINNERS

The following award winners were honored at the AFS Annual Meeting in San Francisco for their contributions to the AFS, to their profession, and to resource conservation.

Peter B. Moyle receives the **Award of Excellence** and congratulations from Jennifer Nielsen. Moyle, a professor of fisheries biology at the University of California—Davis for 34 years, has served as the associate director of the Center for Watershed Science since 2002. He is a major force in efforts to understand, conserve, and restore native fishes and aquatic habitats. Moyle is best known for his book *Inland Fishes of California*, which has had an enormous impact on the conservation of California's inland fishes. He also authored, with Joe Cech, a textbook titled *Fishes: An Introduction to Ichthyology*. One of his early papers, "In defense of sculpins," is a classic treatise on the value of native fishes, and he has espoused their value through innovative, interdisciplinary research as well as through expert testimony on issues related to water flows and conservation.

The Wetlands Initiative (TWI) receives the **President's Fishery Conservation Award.** Donald Hey accepts the award and congratulations from Jennifer Nielsen. TWI's successes include brokering land acquisitions for aquatic resource conservation purposes. One of their most noted acquisitions is the Hennepin and Hopper Lake Restoration Project. By orchestrating partnerships with agencies and private donors, TWI raised over $5 million dollars for this project. They then brokered the transfer of the 2,600-acre Hennepin Drainage and Levee District from eight private landowners and commenced work on this vision to create one of the most productive aquatic resource ecosystems in the Midwest.

Walter R. Courtenay, Jr., U.S. Geological Survey, receives the **William E. Ricker Resource Conservation Award** and congratulations from Jenifer Nielsen. Courtenay has worked tirelessly for more than 30 years, conducting research, educating students, and raising public awareness of the environmental threats posed by invasive species. His studies and publications encompass both introduced and indigenous exotic fish populations throughout their ranges. Most of these species are important in the ornamental and aquaculture industries and can be extraordinarily destructive to native communities. Consequently, his work influences regional to international trade and conservation policy, and benefits conservation of native aquatic communities in North America and elsewhere in the world.

Milton Love displays his **Carl R. Sullivan Fishery Conservation Award**—"The Sully," presented by Jennifer Nielsen. Love works at the University of California—Santa Barbara and is honored for his dedication to scientific discovery and effective public communication about marine fish species, especially the Pacific rockfish. Love has contributed at least 100 public outreach activities, including magazine articles, books for lay readers, videos, movies, educational materials, teacher guides, and photo libraries. Many of his information products, especially those designed for public consumption, inject a keen sense of humor. His books include *Probably More than You Want to Know about the Fishes of the Pacific Coast—A Humorous Guide to Pacific Fishes.* This book on is widely recognized as *the* source of scientific information for Pacific rockfish in the Northeast Pacific.

Paul J. "Jack" Wingate receives the **Meritorious Service Award** and congratulations from Jennifer Nielsen. Wingate chaired numerous committees and served as president of the Minnesota Chapter, president of the North Central Division, and the parent Society. After his presidency, he served on a joint committee with TWS to assess the environmental impact of lead in fishing gear. He also served on the steering or program committees of the highly successful Third and Fourth World Fisheries Congresses. He has been exceptionally committed to the programs, ideals, objectives, and long-term goals of AFS over his entire career.

Robert L. Curry, **Dennis DeVries, Henry E. Booke**, and **Donald C. Jackson** are joined by Jennifer Nielsen to display their **Distinguished Service Awards.**

Robert ("Bob") L. Curry, a North Carolina Wildlife Resources employee and an AFS member since 1979, has served as Southern Division president since 2006. When Hurricanes Katrina and Rita devastated the coast of the Gulf of Mexico, Curry was first to ask, "What can the Southern Division do to help?" His vision and will to see that good ideas were turned into good actions proved instrumental to the successes of the disaster relief. His actions are now a model for AFS, so that it can respond in a more timely manner to major disasters in the future.

Dennis DeVries, Auburn University, has served as associate editor for the *North American Journal of Fisheries Management*, and associate editor and editor for *Transactions of the American Fisheries Society*. DeVries served as AFS Constitutional Consultant and contributed to the governance of AFS when he served on a special committee to revise the AFS Constitution and Bylaws in 2001–2002. He is committed to the effective communication of fisheries research and the efficient and fair execution of governance.

Henry E. Booke, who is retired from the U.S. Geological Survey, has a long record of service to the AFS in the areas of fiscal stability and investing for long-term wealth generation. For many years on both the Northeastern Division and AFS Investment Advisory Committees, Brooke was excellent in his perspicacity regarding investment opportunities and was rarely wrong in predicting the direction the stock market was headed. The funds provide financial buffers for years when income is markedly reduced or expenses markedly increased. He helped the AFS earn money from its investments at no cost and to date with no losses.

Donald C. Jackson, Mississippi State University, has been an active member in the AFS for more than 20 years. Jackson served as chairman of the Hurricane Relief Disaster Task Force. Results of his efforts include members receiving gratis membership renewals and subscriptions, gear and library material, and additional financial support for travel, plus valuable care and concern from many colleagues and friends.

Eric M. Hallerman displays his **Excellence in Fisheries Education Award** with Jennifer Nielsen. Hallerman is professor and department head of the Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University. Classes that he teaches include genetics for aquaculturists, conservation genetics, and advanced conservation genetics. He is author, coauthor, and editor of three books, including *Population Genetics: Principles and Applications for Fisheries Scientists,* published by AFS. He has mentored nine M.S. and three Ph.D. students to completion, with two M.S. and three Ph.D. students in progress. He is a past president of the Genetics and Introduced Fish Sections. His research interests include population genetics of fish and wildlife species, genetic improvement of aquaculture stocks, and aquaculture biotechnology and related policy. He has published over 100 peer-reviewed papers in scientific journals, and is on the editorial advisory boards of two scientific journals.

Anne M. Cooper receives the **J. Frances Allen Scholarship** from Jennifer Nielsen. Cooper is a Ph.D. candidate at the University of Minnesota working under the direction of Anne R. Kapuscinski. Cooper's Ph.D. dissertation is on developing a methodology for measuring key ecological effects on native fishes from Nile tilapia using the framework of ecological risk assessment. Specifically, her dissertation focuses on the ecological consequences of interference competition between Nile tilapia and native freshwater species in Thailand. She examined the interface of one of the largest documented declines of Atlantic salmon and the successful restoration program that followed in Norway as a Fulbright Fellow. Her Master's thesis examined how a conservation hatchery is contributing to rehabilitation through genetic conservation and management of both wild and hatchery coaster brook trout populations in Lake Superior. She served as the student representative to the Executive Committee of the Minnesota Chapter.

Patricia E. Bigelow (not pictured) is the **J. Frances Allen Scholarship Runner-Up.** Bigelow is a Ph.D. candidate at the University of Wyoming.

GOLDEN MEMBERS

This award honors individuals who have been AFS members for 50 years.

The Class of 1958

(pictured above)
Charles F. Cole and Asa T. Wright

(not pictured)
James R. Adams
Walter T .Burkhard
James P .Clugston
Merle G. Galbraith
William H. Herke
Joseph B. Hunn
William R. Meehan
Paul C. Neth
Richard J. Nitsos
Robert G. Piper
Richard L. Ridenhour
C. P. Ruggles
D. Roger
E. A. Schoumacher
Ray J. White

Fredy Tu (not pictured) is the **Hutton Scholar Award** winner. Tu was mentored in Oakland, California, by Pete Alexander at the East Bay Regional Park District

Chapter Awards recognize outstanding professionalism, active resource protection and enhancement programs, and commitment to the mission of the Society by a large Chapter (≥100 members), a small Chapter (≤100) members), and a Student Subunit.

The **Oregon Chapter** (above) receives the **Outstanding Large Chapter Award.** This Chapter creates visibility for itself, the Western Division, the parent Society, fishery and aquatic professionals, and the latest advancements in fisheries and aquatic sciences. Its annual meeting has boasted over 500 attendees in recent years. The Chapter supports the Hutton Junior Fisheries Biology Program with several members serving as mentors for the program and others serving on the Hutton Committee. The Chapter publishes the quarterly newsletter, *Piscatorial Press,* on their website, updates their web site to increase content, and uses the most current web tools. Each spring, the Oregon Chapter hosts a technical session where professional and student attendees are invited to present their work as oral presentations or posters. The Chapter has developed a list of university faculty who teach fisheries related courses or who have demonstrated an interest in this field.

In a tie the **Tennnessee Chapter,** represented by David Rizzuto (left), and the **Indiana Chapter,** represented by North Central Division President Stu Shipman (right), receive the **Outstanding Small Chapter Award**.

The Tennessee Chapter promotes the sport of fishing with activities such as an auction conducted at annual Chapter meetings to support kid's fishing rodeos during free fishing week in Tennessee. The Education Committee funds school programs by promoting the awareness of Tennessee fishes, fisheries management, and biodiversity by selling t-shirts sporting different aquatic themes.

The Indiana Chapter is committed to education. It hosts an annual technical session where professional and student attendees are invited to present their work as oral presentations or posters. This Chapter developed a list of university faculty who teach fisheries related courses or who have demonstrated an interest in this field. The Chapter promotes legislation for the benefit of the state's natural resources and members attend the state's annual Conservation Day .

East Carolina University Student Subunit (ECU-AFS) receives the **Outstanding Student Subunit Award.** Within the greater AFS community, the East Carolina University Student Subunit has been referred to as "the sparkplug" of the Tidewater Chapter. ECU-AFS members have been very active at professional conferences, both as attendees and presenters. In addition ECU–AFS is represented at this meeting by oral and poster presenters, as well as session chairs.

The following graduate students or exceptional undergraduate students (not in the order pictured) receive the **John E. Skinner Memorial Fund** monetary travel awards to attend the AFS Annual Meeting:

Winners:
Jessica Brewster, North Carolina State University
Christin Brown, North Carolina State University
Mark Carter, University of Illinois
Jeff Eitzmann, Kansas State University
Jesse Fischer, Kansas State University
Julianne Harris, North Carolina State University
Jeff Jolley, South Dakota State University
Lisa Kerr, University of Maryland
Bryan Spindler, South Dakota State University
Melissa Wuellner, South Dakota State University

Honorable Mentions:
Nathan Bacheler, North Carolina State University
Kristopher Bodine, Oklahoma State University
Lisa Kamin, University of Alaska-Fairbanks
Michael Meeuwig, Montana State University
Norm Ponferrada, University of California-Davis

AFS Publications Awards:

Elise Zipkin, the **AFS Student Writing Contest Winner,** receives her award from Jennifer Nielsen. Her article communicates the value of fisheries science to the public and and is titled "Balancing the scales: dam removal and sea lamprey control in the Great Lakes." Zipkin is a student at Cornell University.

Wes Bouska (not pictured) is the **AFS Student Writing Contest Runner-up** for "Stream Crossings and Fish Conservation." He is a student of Kansas State University.

Peter Rand (left), The Wild Salmon Center, **S. G. Hinch, J. Morrison, M. G. G. Foreman, M. J. MacNutt, J. S. Macdonald, M. C. Healey, A. P. Farrel,** and **D. A. Higgs** receive the **The Robert L. Kendall Best Paper in *Transactions of the American Fisheries Society* Award** for "Effects of river discharge, temperature, and future climates on energetics and mortality of adult migrating Fraser River sockeye salmon."

Julie A. Henning, Department of Fisheries and Wildlife, Oregon State University; **Robert E. Gresswell** (left)**,** U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center; and **Ian A. Fleming,** Department of Fisheries and Wildlife, Oregon State University won **The Mercer Patriarche Best Paper in the *North American Journal of Fisheries Management*** for "Juvenile salmonid use of freshwater emergent wetlands in the floodplain and its implications for conservation management."

Jonathan J. Ledford (left)**,** Vanderbilt University; and **Anita M. Kelly,** Southern Illinois University, Fisheries and Illinois Aquaculture Center (not pictured) won **The Best Paper in the *North American Journal of Aquaculture*** for **"**A comparison of black carp, redear sunfish, and blue catfish as biological controls of snail populations."

Kyle A. Garver, Pacific Biological Station; and **William N. Batts** and **Gael Kurath,** U.S. Geological Survey, Biological Resources Discipline, Western Fisheries Research Center won the ***Best Paper in the Journal of Aquatic Animal Health*** for "Virulence comparisons of infectious hematopoietic necrosis virus U and M genogroups in sockeye salmon and rainbow trout."

AFS/Sea Grant student paper and poster awards were given for presentations made at the 2006 AFS Annual Meeting in Lake Placid, New York:

Kris Homel, Utah State University, won the **AFS/Sea Grant Best Student Paper** competition for "Evaluating genetic population structure and movement patterns of bull trout (*Salvelinus confluentus*) in Northeast Oregon."

Bart Durham, Texas Tech University, won the **AFS/Sea Grant Honorable Mention Student Paper** for"A framework for the study of stream-fish population dynamics."

Brent Murry, State University of New York, College of Environmental Science and Forestry, received **AFS/Sea Grant Honorable Mention Student Paper** for "Effect of maternal size and condition on the variation in egg nutrient content and larval success in northern pike."

Ann Gulka, Saint Michael's College, is **Best Student Poster Award Winner** for her presentation at the AFS 2006 Annual Meeting in Lake Placid, New York. The poster is titled "Dietary overlap between invasive white perch and three native fishes in Missisquoi Bay."

Belita Nguluwe, University of Maryland Eastern Shore, received **Student Poster Honorable Mention** for "Comparison of two methods of aging monkfish: vertebrae vs. illicia."

Representatives of **"Team AFS:"** David Manning, Larry Brown, and Eric Wagner; accept plaques declaring a **Resolution of Appreciation to the Hosts** from Jennifer Neilsen.

Resolution of Appreciation to the Hosts for the Annual Meeting of the American Fisheries Society

WHEREAS, the 137th Annual Meeting of the American Fisheries Society, convened in San Francisco, California, on September 2nd to 6th, 2007, was hosted by the "Team AFS in SF 2007," a group of 50 dedicated members;

WHEREAS, our hosts provided an ideal setting for professionals, students, and families, and all to explore this dynamic urban area and nearby National Parks, while contemplating this year's theme of thinking downstream and downcurrent, addressing uncertainty and unintended consequences in Fish and Fisheries;

WHEREAS, our hosts have provided the facilities and coordination for the most comprehensive technical program to date, with 61 symposia, 1400 oral presentations, 350 posters, and 23 concurrent technical sessions and numerous division, section, committee, and business meetings;

WHEREAS, the continuing education committee provided 11 courses from River 2-D modeling, Biotelemetry technology, GIS concepts, to Project planning boot camp, and Leadership principles;

WHEREAS, seven special worshops were held on topics of general importance to Society members and guests including the National Fish Habitat program, hydroacoustics, multibeam sonar, ultrasonic telemetry, MesoHABISM, charting the course for ocean science, and working with people;

WHEREAS, we were welcomed to the area with the exhilarating rhythms of Taiko Dojo (traditional Japanese drumming) and marveled at the Kei Lun Martial Arts Performers while learning about new research and technologies at the trade show and poster session;

WHEREAS, students mingled with their peers, mentors, and professionals at the Aquarium of the Bay- Fisherman's wharf in order to make connections that will carry them into the future;

WHEREAS, we gathered to socialize among our colleagues and enjoy breathtaking views of the Golden Gate, Alcatraz, and Fisherman's Wharf from the San Francisco Maritime National Historic Park's Hyde Street Pier;

WHEREAS, we toured the wine country, tasting fine wines, tried our luck fishing for lingcod, halibut, salmon, rockfish, visited Alcatraz, and explored the beauty of the Muir woods;

NOW, THEREFORE, BE IT RESOLVED THAT the membership of the American Fisheries Society, having enjoyed the hospitality of San Francisco, extends its hearty appreciation.and thanks to our hosts, "Team AFS in SF 2007," to the General Chair David Manning and his Planning Committee; to Program Committee Co-chairs Larry Brown and Eric Wagner; and to the Program Poster Committee Chair Kathy Hieb.

2007 AFS SECTION AWARDS

Computer User Section

Best Student Poster Award:
James R. Watson

Estuaries Section

Student Travel Award:
Talia Bigelow,
Abigail Franklin,
Joshua Newhard, and
Cassie Reed Martin

Fisheries Management Section

Hall of Excellence:
Hannibal Bolton,
Dave Willis, and
Jack Wingate

Award of Excellence:
James H. Cowan, Jr. and
Roy O. Williams

Award of Merit:
Forrest Bonney,
Paul Balkenbush, and
James Vincent

Conservation Achievement Award:
Southeast Aquatic
Resources Partnership

Genetics Section

James E. Wright Award:
Jocelyn Lin

Stevan Phelps Memorial Award:
Wendy E. Tymchuk,
Carlo Biagi,
Ruth Withler, and
Robert H. Devlin

Marine Fish Section

Student Travel Award:
Nathan Bachelor,
Bernice Bediako,
William Smith, and
Justine Woodward

Socioeconomics Section

Stephen Weithman Award:
Thomas Lang

AMERICAN FISHERIES SOCIETY
APPRECIATION

Thank You to the Sponsors of the 137th Annual Meeting

California Department Fish and Game

Sonoma County Water Agency

NOAA Fisheries Service

National Ocean and Atmospheric Administration/NCCOS

U.S. Bureau of Land Management

California Department of Water Resources

U.S. Geological Survey

Southern California Edison

U.S. Fish and Wildlife Service

California Trout

U.S. Fish & Wildlife Service–California Nevada Operations Office

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United Anglers of Southern California

Trout Unlimited

NOAA/OAR

Oregon Department of Fish & Wildlife

Marin Municipal Water District

Cachuma Conservation Release Board

US Forest Service Southwest Center

Columbia Basin Fish & Wildlife Authority

Pacific States Marine Fisheries Commission

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American Fisheries Society—Alaska Chapter

American Fisheries Society—Montana Chapter

American Fisheries Society—Oregon Chapter

American Fisheries Society—Colorado Wyoming Chapter

Sustainable Forest Initiative

Wildlife Computers Inc.

USGS Idaho

Sierra Nevada Brewery

Sustainable Fisheries Foundation

CALENDAR: FISHERIES EVENTS

To submit upcoming events for inclusion on the AFS Web site Calendar, send event name, dates, city, state/province, web address, and contact information to cworth@fisheries.org. (If space is available, events will also be printed in *Fisheries* magazine.)

To see more event listings go to www.fisheries.org and click Calendar of Events.

Dec 5-7—**Applied Hydrogeologic Site Characterization and Monitoring Well Construction for Environmental Professionals Course,** Troutdale, Oregon. See www.nwetc.org/ghyd-401_12-17_troutdale.htm.

Dec 8-10—**International Symposium of Integrative Zoology,** Beijing, China. See www.globalzoology.org.

Dec 9-12—**68th Midwest Fish and Wildlife Conference,** Madison, Wisconsin. See www.midwest.ncd-afs.org.

Dec 13-14—**Introduction to Aquatic Toxicology: Understanding Impacts of Organic Chemicals and Metals on Aquatic Ecosystems,** San Diego, California. See www.nwetc.org.

2008

Jan 10-11—**Using Acoustic Tags to Track Fish,** Seattle, Washington. See www.htisonar.com/Training.htm.

Jan 16-18—**Eighth National Conference on Science, Policy, and the Environment—Climate Change: Science and Solutions,** Washington, DC. www.NCSEonline.org/2008conference.

Jan 16-18—**Texas Aquaculture Association 38th Annual Trade Show and Conference,** El Campo, Texas. See www.texasaquaculture.org. Contact Peter Woods, 979/245-4100.

Jan 17-18—**Using Hydroacoustics for Fisheries Assessment,** Seattle, Washington. See www.htisonar.com/Training.htm.

Jan 21-23—**Alaska Marine Science Symposium,** Anchorage, Alaska. Contact Clarence Pautzke, epautzke@nprb.org, 907/644-6700

Jan 23—**28th Annual Ecological Farming Conference,** Pacific Grove, California. See www.eco-farm.org.

Feb 4-8—**15th Western Groundfish Conference,** Santa Cruz, California See http://tundra.iphc.washington.edu. Contact Mary.Yoklavich@noaa.gov.

Feb 9-12—**Aquaculture America,** Lake Buena Vista, Florida. See www.was.org.

Feb 24-28—**Advances in Tagging and Marking Technologies in Fisheries Management and Research,** Auckland, New Zealand. See www.fisheries.org/units/tag2008

Feb 28-Mar 2—**Southern Division of the American Fisheries Society and West Virginia Chapter of AFS,** Wheeling, WV. See AFS www.sdafs.org/meetings.

Mar 2-7—**2008 Ocean Sciences Meeting,** Orlando, Florida. See http://aslo.org/meetings/orlando20081.

Mar 5-8—**26th Annual Salmonid Restoration Conference,** Lodi, California. See www.calsalmon.org.

Mar 18-19—**Introduction to Electrofishing,** Vancouver, Washington. See www.smith-root.com. Contact info@smith-root.com.

Mar 30-Apr 2—**20th Northeast Recreation Research Symposium**, New York Adirondack Park, New York. See www.esf.edu/nerr/.

Apr 6-13—**National Shellfisheries Association,** Providence, Rhode Island. See www.shellfish.org.

Apr 6-13—**37th Annual Meeting for the Benthic Ecology Meeting,** Providence, Rhode Island,. See www.shellfish.org.

April 14-17—**Resilience, Adaptation, and Transformation in Turbulent Times,** Stockholm, Sweden. See www.resilience2008.org.

Apr 28-30—**Northeast Fish and Wildlife Conference,** Galloway, New Jersey. See www.neafwa.org.

May 4-8—**Western Division of the American Fisheries Society and the Oregon Chapter of the AFS Annual Meeting: Human Population Growth and Fisheries: The Western Challenge,** Portland, Oregon. See www.wdafs.org.

May 18-22—**Sixth National Monitoring Conference,** Atlantic City, New Jersey. See www.wef.org.

Jul 7-11—**11th International Coral Reef Symposium,** Fort Lauderdale, Florida. See www.nova.edu/ncri/11/11icrs. Contact Nancy Copen, ncopen@faseb.org, 301/634-7010.

May 12-16—**River Management Society Meeting,** Portland, Maine. See www.river-management.org/symposium.asp.

May 19-23—**International Conference on Echohydrological Processes and Sustainable Floodplain Management: Opportunities and Concepts for Water Hazard Mitigation, and Ecological and Socioeconomic Sustainability,** Lodz, Poland. See www.erce.unesco.lodz.pl.

May 19-23—**PICES Symposium: Effects of Climate Change on the World's Oceans.** Gijon, Spaid. See www.pices.int/meetings/international_symposia/2008/symposia.

May 21-24—**Interactions between Social, Economic, and Ecological Objectives of Inland Commercial and Recreational Fisheries and Aquaculture,** Antalya, Turkey. See www.fao.org/fi/eifac.htm.

Jul 7-11—**11th International Coral Reef Symposium,** Fort Lauderdale, Florida. See www.nova.edu/ncri/11/11icrs. Contact Nancy Copen, ncopen@faseb.org, 301/634-7010.

Aug 17-21—**American Fisheries Society 138th Annual Meeting,** Ottawa, Ontario. See www.fisheries.org.

Continued from page 524

nonpoint source pollution, introduction of toxic substances, sedimentation, acid precipitation, and habitat modifications. This integration ensures consistency of policies and recognizes the relationships among aquatic resource issues. Another important difference between resolutions and policy statements concerns longevity. Policy statements are reviewed 5 years after adoption, and have a 10-year lifespan; after 10 years, a policy statement must be reapproved or rescinded by the Governing Board. Because they have no such requirement for review, resolutions tend to be relevant for shorter periods of time.

DEVELOPING, CONSIDERING, AND ADOPTING RESOLUTIONS AND POLICY STATEMENTS

Resolutions are typically developed by AFS Sections or AFS Chapters and Divisions prior to consideration by the AFS Resolutions Committee. Resolutions considered and adopted by AFS Units before being forwarded to the Society allow the broadest segment of the membership to participate in discussions and debate. AFS resolutions undergo a thorough and rigorous formal review, which is conducted by the AFS Resolutions Committee. In some cases, the Resolutions Committee may request the publication of the draft resolution in *Fisheries* so members may have sufficient time to fully consider the resolution and offer modifications prior to the actual vote. AFS resolutions are adopted after majority vote of the membership at the annual Business Meeting.

Policy statements are developed through the Resource Policy Committee (RPC) in a process that may take years to complete. An individual member or AFS Unit may propose a topic for development into a policy statement and a study report is usually prepared prior to drafting the policy statement. Oftentimes, arriving at consensus on a controversial topic is difficult, especially if the potential course of action depends on the values of the affected groups. In these cases, the statement needs to be carefully crafted without risking the loss of its substantive content. The procedures currently used by AFS and the RPC are described in detail in the *AFS Procedures Manual*; the process is deliberative and requires input from individuals and units with scientific expertise in the resource issue that is the focus of the policy statement. Policy statements are published in *Fisheries* for review and comment by the membership prior to final Governing Board consideration and a vote by Society members at the Annual Meeting.

IMPROVING THE POLICY STATEMENT PROCESS

Given the uncertainty about resolutions and policy statements experienced over the last year, I am proposing four steps that will help to improve the process of developing and communicating AFS policy statements.

First, we want to ensure adequate Governing Board discussion on policy statements and study reports. Although all AFS members (including Governing Board members) have 60 days to review and comment on the draft statement published in *Fisheries*, the Governing Board, as a body meeting twice per year, has limited time for debate and discussion of the content of the draft statement. According to the *AFS Procedures Manual*, the Governing Board (1) together with the RPC Chair, determines if a proposed topic is appropriate for development into a policy statement, (2) considers the policy statement after it has been revised to reflect member input and comment, and (3) based on the recommendation of the RPC chair, determines if the revised policy statement is brought to the AFS membership for a vote. Input from the Governing Board appears warranted after a policy statement and study report are first drafted, but before the statement is published in *Fisheries*. In recent years, the Governing Board has voted to proceed with the publication of the draft statement in *Fisheries*, but has not had input on the statement itself prior to its publication. I recommend that Governing Board input and review needs to be provided to assure that the statement reflects the diversity of views among AFS members and Units as represented on the board.

For broader member input, significant representative debate is not possible at the Society Business Meeting and must be achieved through other means. The *Procedures Manual* stipulates that draft policy statements are to be published in *Fisheries* to permit review by the membership prior to a vote. In the past, publication in *Fisheries* was the only feasible and efficient means of widely distributing the draft statement. However, the published draft policy statement may later be rejected by the membership or substantially revised by member input. In both cases, the result is the existence of a draft policy statement in citable print format within *Fisheries*. This can lead to the erroneous attribution of a policy statement to AFS, particularly by individuals or organizations that are not members of the Society and who are unaware of the process used by AFS to develop and adopt policy statements. With the increasingly free access to electronic communication, I suggest we can avoid this potential problem by posting draft policy statements on the AFS web site and alerting members (through an announcement in *Fisheries*, for instance) of the availability on the web. A

hard copy of the policy statement may be mailed upon request to members who do not have Internet access. Following the suggestion of the 2007 Resolutions Committee, a similar process can be used for resolutions.

Currently, AFS policy statements adopted by the membership are posted on the web as full statements and also in an abbreviated format (these, for example, lack background documentation and the detailed scientific analysis of the policy issue). Unfortunately, until now, a few policy statements were available only in the abbreviated format and this may have contributed to some of the confusion about appropriate content and formats of policy statements. Thanks to efforts by Elden Hawkes, AFS policy and development coordinator, the policy section of the AFS web page is being reorganized so that policy statements are posted in their entirety and in PDF format, allowing members to search the documents. Recognizing that members may also find brief statements useful, an executive summary of the policy statement will also be available, but will be clearly identified as such.

Finally, policy statements expressing AFS views and guidance on appropriate actions can be used to plan for future AFS activities. To accomplish this, the AFS Strategic Plan should be aligned with AFS policy statements. For example, AFS Policy Statement #30 on the Responsible Use of Fish and Other Aquatic Organisms states that "AFS should develop a resource base of experts and educational materials to provide the necessary support for its members, including continuing education workshops on conflict management skill building." To better prepare ourselves for addressing conflicts about human interactions with aquatic organisms, skills such as facilitation, mediation, and arbitration are necessary, and continuing education workshops can provide a means whereby members can attain these skills. The AFS Strategic Plan can therefore identify the need for such workshops.

Resolutions and policy statements are important mechanisms whereby AFS views are placed on record. Increasing the effectiveness and utility of AFS resolutions and policy statements will be realized as we improve the communication of these views, and as we ensure the procedures for adopting policy statements become more inclusive.

3RD CALL FOR PAPERS

Fisheries in Flux

American Fisheries Society • 138th Annual Meeting
August 17-21 2008 • Ottawa • Ontario

The Ontario Chapter of the American Fisheries Society and the Ontario Ministry of Natural Resources will host the 138th Annual Meeting of the American Fisheries Society in downtown Ottawa, Ontario, 17–21 August 2008. The meeting's theme, "Fisheries in flux: how do we ensure our sustainable future,"addresses the ongoing challenge of confronting change when managing fisheries. Fisheries and fish communities are not static properties of ecosystems. Stressors such as exploitation, species invasions, climate change, and water resource demand are a few of the factors that drive changes. These changes potentially threaten sustainable use. Can we find solutions to these threats? What are we doing to ensure a sustainable future and what changes need to be made in our management of aquatic ecosystems?

Ottawa FACT

Ottawa: Canada's Museum Capital

As Canada's capital city, Ottawa is home to most of the national museums, including the Canadian War Museum, Museum of Nature, Canadian Aviation Museum and the Museum of Technology. Foremost amongst them is the Museum of Civilization, the site of the Wednesday night social for the 2008 Annual Meeting. The museum is located on the shore of the Ottawa River across from the Parliament Buildings. It is housed in a spectacular building designed by renowned Aboriginal architect, Douglas Cardinal. Cardinal's architecture has been characterized by his sensuously curving forms and his use of earth-tone materials that create a sculpted effect reminiscent of natural landforms. Cardinal described his vision for the museum as: "The building flows with the contours of the land like a massive natural outcropping of stratified native rock." The Grand Hall, the focal point of the Wednesday night social, celebrates the rich Aboriginal cultural heritage of Canada's Pacific Northwest and boasts the largest indoor collection of totem poles in the world.

General Information

Aquatic resource professionals are invited to submit symposia proposals and abstracts for papers in a range of topics and disciplines. Participation by scientists at all levels and backgrounds, especially students, is encouraged. The scientific program includes two types of sessions: symposia (oral and poster presentations that focus on a single topic) and contributed papers (oral and poster presentations on any relevant topic).
Oral presentations are limited to 20 minutes (15 minutes for presentation plus 5 minutes for speaker introduction and questions). All oral presenters are expected to deliver Powerpoint presentations. Presenters must bring their PowerPoint file to the meeting on CD or USB flash memory stick by 7 p.m. the evening before their presentation. Laptop computers and LCD projectors will be provided and technicians will be available to help.
Traditionally, symposia have been dominated by oral presentations and sometimes supplemented by posters. Next year's meeting will experiment with a new symposium format that encourages greater use of posters in order to shorten the time demands of symposia. This new format elevates the profile of symposium posters through a "speed presentation sub-session" that provides a time slot for short (i.e., 3 minute) oral presentations and dedicated viewing of symposium posters. See the "Speed Presentation" box for details.

What is a "Speed Presentation?"

"Speed Presentation" refers to a sub-session of a symposium that showcases posters. The speedy part is the oral presentation. The sub-session begins with a series of 3-minute talks (3 slides per speaker) during which each speaker advertises a poster. Following the mini-talks, speakers attend their posters for a one-hour period and address questions from interested parties. Speed presentation sub-sessions will be scheduled into the symposia program. Symposium posters will be displayed as a group within the general poster area and remain posted for the duration of the conference. The target number of posters in each sub-session is 10, allowing completion of the oral portion in 30 minutes and the entire sub-session in 90 minutes.

Symposia

The Program Committee invites proposals for symposia. Topics must be of general interest to AFS members. Topics related to the meeting theme will receive priority. Symposium organizers are responsible for recruiting presenters, soliciting their abstracts, and directing them to submit their abstracts through the AFS online abstract submission form. A symposium should include a minimum of 10 presentations and the time requested should not exceed two days (i.e., about 40 oral presentations). Regular oral presentations are limited to 20 minutes, but double time slots (i.e., 40 minutes) may be offered to keynote speakers. Posters associated with a symposium will be presented in the "speed presentation" format (see box). Symposium organizers are urged to consider this poster format as an efficient means of communication that reduces time required for scheduling symposia. Symposium proposals must be submitted by 11 January 2008 via e-mail to Mark Ridgway (mark.ridgway@ontario.ca) with the proposal attached in the correct format in MS Word or WordPerfect; please contact Mark Ridgway (address and phone below) if you do not receive confirmation by January 18. The Program Committee will review all symposium proposals and notify organizers of acceptance or refusal by 4 February 2008. If accepted, organizers must submit a complete list of all confirmed presentations and titles by 22 February 2008. Symposium abstracts (in the same format as contributed abstracts; see next page) are due by 29 February 2008.

Format for Symposium Proposals

1. **Symposium title:** Brief but descriptive
2. **Organizer(s):** Provide name, address, telephone number, fax number and e-mail address of each organizer. Indicate by an asterisk the name of the main contact person.
3. **Description:** In 300 words or less, describe the topic addressed by the proposed symposium, the objective of the symposium, and the value of the symposium to AFS members and participants.
4. **Format and time requirement:** Indicate the mix of formats (oral and poster). State the time required for regular oral presentations (i.e. 20 minutes per speaker) and the time required for speed presentations and poster viewing (3 minutes per speaker plus one hour of poster viewing).
5. **Chairs:** Supply name(s) of individual(s) who will chair the symposium.
6. **Presentation requirements:** We encourage speakers to use PowerPoint for presentations. All Mac-based presentations must be converted to PC format prior to the meeting. Presentations in other software programs must be approved prior to acceptance.
7. **Audiovisual requirements:** Symposium chairs must provide a PC-interface laptop computer for their session. LCD projectors will be available in every room. Other audiovisual equipment needed for the symposium will be considered, but computer projection is strongly encouraged.
8. **Special seating requests:** Standard rooms will be arranged theatre-style. Please indicate special seating requests (for example, "after the break, a panel discussion with seating for 10 panel members will be needed").
9. **List of presentations:** Please supply information in the following format:

Presenter's Name	Tentative title of presentation	Confirmed (yes/no)	Format (oral/speed presentation)
1. _____	_____	_____	_____
2. _____	_____	_____	_____

10. **Sponsors:** If applicable, indicate sponsorship. A sponsor is not required.

Contributed Oral and Poster Papers

The Program Committee invites abstracts for presentations (oral and poster) at contributed paper sessions. Authors must indicate their preferred presentation format: (1) oral only, (2) poster only, (3) oral preferred, but poster acceptable. Only one oral presentation will be accepted for each senior author. Poster submissions are encouraged because of the limited time available for oral presentations. The program will include a dedicated poster session to encourage discussion between poster authors and attendees.

Abstracts for contributed oral and poster papers must be received by 8 February 2008. All submissions must be made using the AFS online abstract submission form, which is available on the AFS website (www.fisheries.org). When submitting your abstract:

- Use a brief but descriptive title, avoiding acronyms or scientific names in the title unless the common name is not widely known;
- List all authors, their affiliations, addresses, telephone numbers, and e-mail addresses;
- Provide a summary of your findings and restrict your abstract to 200 words.

All presenters will receive a prompt e-mail confirmation of their abstract submission and will be notified of acceptance and the designated time and place of their presentation by 30 April 2008.

For contributed papers, please indicate which two general topics best fit the concept of your abstract. Topics include: Bioengineering, Communities and Ecosystems, Contaminants and Toxicology, Education, Fish Culture, Fish Health, Fish Conservation, Freshwater Fish Ecology, Freshwater Fisheries Management, Genetics, Habitat and Water Quality, Human Dimensions, Marine Fish Ecology, Marine Fisheries Management, Native Fishes, Physiology, Policy, Population Dynamics, Statistics and Modeling, Species Specific (specify), and Other (specify).

Late submissions will not be accepted. AFS does not waive registration fees for presenters at symposia, workshops, or contributed paper sessions. All presenters and meeting attendees must pay registration fees. Registration forms will be available on the AFS website (www.fisheries.org) in May 2008; register early for cost savings.

Format for Submitted Abstracts

For abstracts submitted to a Symposium

Enter Symposium title: _____
Specify format:
(1) Oral
(2) Speed presentation (i.e., Poster)

For abstracts submitted as a Contributed Paper

Enter 2 choices for topic:_____
Specify format:
(1) Oral
(2) Poster
(3) Oral preferred, but poster acceptable

Title: An example abstract for the AFS 2008 Annual Meeting

Authors:

Lester, Nigel. Ontario Ministry of Natural Resources, 2140 East Bank Drive, Peterborough, Ontario K9J 7B8; 705-755-1548; nigel.lester@ontario.ca
Maraldo, Dave. Ontario Ministry of Natural Resources, 300 Water St., Peterborough, Ontario K9J 8M5; 705/755-1906; dave.maraldo@ontario.ca

Abstract: Abstracts are used by the Program Committee to evaluate and select papers for inclusion in the scientific and technical sessions of the 2008 AFS Annual Meeting. An informative abstract contains a statement of the problem and its significance, study objectives, principal findings and application, and it conforms to the prescribed format.

Student presenter?
(Work being reported was completed while a student):
No

Contacts

Meeting logistics and planning:
Dave Maraldo
Fisheries Section, MNR
dave.maraldo@ontario.ca
705/755-1906

Symposia:
Mark Ridgway
Aquatic Science & Development Section, MNR
mark.ridgway@ontario.ca
705/755-1550

Contributed papers:
Nigel Lester
Aquatic Science & Development Section, MNR
nigel.lester@ontario.ca
705/755-1548

Posters:
Tim Haxton
Southern Science, MNR
tim.haxton@ontario.ca
613/258-8240

Organizing a continuing education course or workshop:
Craig Woolcott
J J Howard Marine Science Lab
craig.woolcott@noaa.gov

ANNOUNCEMENTS: JOB CENTER

EMPLOYERS: To list a job opening on the AFS Online Job Center submit a position description, job title, agency/company, city, state, responsibilities, qualifications, salary, closing date, and contact information (maximum 150 words) to jobs@fisheries.org. Online job announcements will be billed at $350 for 150 word increments. Please send billing information. Listings are free (150 words or less) for organizations with Associate, Official, and Sustaining memberships, and for Individual members, who are faculty members, hiring graduate assistants. If space is available, jobs may also be printed in *Fisheries* magazine, free of additional charge.

To see more job listings go to www.fisheries.organd click Job Postings.

JIMAR Assistant Researcher (PFRP)—ID# 27569, Research Corp of the University of Hawaii.
Responsibilities: Perform research on models of the spatial dynamics of tunas and other large pelagic marine animals ranging from small-scale individual dynamics to ocean basin scale population dynamics. Develops methods to assimilate data from both conventional and electronic tags into population models currently used by researchers within the Pelagic Fisheries Research Program (PFRP). Co-author reports and manuscripts describing area of research for publication.
Qualifications: Ph.D. from an accredited college or university in an appropriate field of study (e.g., applied mathematics, computer science, or ecology). One to three years experience with object-oriented computer languages applied to numerical problems. Programming experience in C++. Knowledge and understanding of numerical solutions of partial differential equations. Able to communicate effectively (orally and in writing).
Salary: $3,837.00 per month.
Closing date: 15 January 2008.
Contact: Nicole Wakazuru, 808/956-9465. Apply at www.rcuh.com. EEO/AA Employer.

Ph.D. Graduate Research Assistantship—Larval Sturgeon Survival in Reservoir Headwaters, Montana Cooperative Fishery Research Unit, Montana State University, Bozeman.
Responsibilities: Describe the factors that influence survival of larval shovelnose and pallid sturgeon in reservoir headwater environments. Specific objectives to be addressed are: (1) describe the transition zone and headwater habitat in Ft. Peck Reservoir; (2) experimentally evaluate larval pallid sturgeon and shovelnose sturgeon behavior and survival at different developmental stages in controlled environments simulating the river, transition zone, and headwater environments; and (3) experimentally evaluate larval pallid sturgeon and shovelnose sturgeon survival at different developmental stages in river, transition zone, and headwater environments in situ.
Qualifications: M.S. in fisheries, ecology, or a related field and a minimum 3.0 GPA and 1100 (Verbal + Quantitative) GRE score. Quantitative skills are required, as are a good work ethic, creativity, a commitment to research productivity (publishing and presenting), ability to work both independently and cooperatively, and professional activities (e.g., AFS).
Stipend: $1,450 per month, plus non-resident tuition waiver.
Closing date: 30 November 2007.
Contact: Send letter of interest, resume, reprints, names and contact information for three references, reprints, and copy of transcripts and GRE scores (photocopies, scans, and e-mail attachments acceptable) to: Christopher Guy (cguy@montana.edu), Montana Cooperative Fishery Research Unit, Department of Ecology, Montana State University, Bozeman, MT 59717, USA. For more information go to www.montana.edu/mtcfru/Guy/gradopp.html.

Ph.D. Assistantship in Fish Physiological Ecology, Oregon State University, Department Fisheries and Wildlife, Corvallis.
Responsibilities: Investigate the use of sub-population-level metrics to assess freshwater salmonid habitat quality, and to develop methods to supplement population-level monitoring when evaluating the effectiveness of habitat restoration efforts.

Qualifications: Minimum qualifications include M.S. degree in a biological field, GPA > 3.0 and GRE scores in the upper 50th percentile. Strongest applicants will have high GPA and GRE scores, strong field and laboratory skills, and peer-reviewed publications. Applicants must apply to OSU through the OSU Graduate Admissions Office: http://oregonstate.edu/admissions/graduate.html.
Salary: $21,000 per year plus tuition.
Closing date: 31 December 2007.
Contact: Send a CV w/GPA and GRE scores, reference contact information, a letter of interest, and publications to Scott Heppell, Department of Fisheries and Wildlife, 104 Nash Hall, Oregon State University, Corvallis, OR 97331; Scott.Heppell@Oregonstate.edu; 541/737-1086. See http://oregonstate.edu/heppell/.

Ph.D. Assistantship in Trophic Ecology,
West Virginia University, Division of Forestry and Natural Resources, Morgantown.
Responsibilities: Examine fatty acids as the novel natural tags as surrogates for diet composition of the Chesapeake Bay striped bass, focusing specifically on the key species such as Atlantic menhaden, bay anchovy, blue crab, and spot for NOAA-funded study. Work on multi-collaborative field and laboratory feeding experiments along with chemical analyses which will be conducted to compare the putative trophic linkages with traditional gut analyses.
Qualifications: M.S. in chemistry, aquatic ecology, fisheries, or related field. We require a minimum 3.0 GPA and strong GRE scores (generally > 50th percentile on verbal and quantitative). Interest in biochemistry and ability to work as part of a multidisciplinary team.
Salary: $15,450 increasing to $18,000 in August 2008 with annual increases. Full tuition waiver and student health benefits.
Start dated: January 2008 preferred, but a May 2008 date could be negotiated.
Closing date: 1 April 2008.
Contact: Kyle Hartman, 304/293-2941 ext. 2494; Kyle.Hartman@mail.wvu.edu or Ashok Deshpande, 732/872-3043; Ashok.Deshpande@noaa.gov

M.Sc. and Ph.D. Assistantships in Fish Ecology,
Fish Ecology and Conservation Physiology Laboratory, Carleton University/Ottawa, Canada.
Responsibilities: Projects are typically interdisciplinary, ranging from basic (e.g., energetics of parental care, the relationship between physiological stress and population level processes) to applied (e.g., hydropower impacts, catch-and-release science). Perform substantial field work and collaboration with a diverse team of stakeholders and scientists.
Qualifications: Interest in the behaviour and physiology of freshwater and marine fish. Creative and self-motivated with exceptional problem solving abilities. Superior communication skills.
Closing date: 15 February 2008.
Start date: May or Sept 2008.
Contact: Send a CV, letter of interest, and unofficial summary of grades to Steven Cooke, Biology Department, Carleton University, 1125 Colonel Drive, Ottawa, ON Canada K1S 5B6; Steven_Cooke@carleton.ca; 613/867-6711. See www.carleton.ca/fecpl.

UAF UNIVERSITY OF ALASKA FAIRBANKS

The **School of Fisheries and Ocean Sciences** at the University of Alaska Fairbanks invites applications for four FISHERIES faculty vacancies.

Specialty preferences include: curation, human dimensions, physiological ecology, and marine shellfish/benthic invertebrate biology.

These positions are tenure-track, assistant/associate level faculty within the SFOS Fisheries Division located in Fairbanks and Juneau, Alaska.

To learn more about the UAF School of Fisheries and Ocean Sciences, please visit **www.sfos.uaf.edu**

For additional information on these positions, visit **www.uakjobs.com** and reference postings 0054133, 0054134, 0054140, and 0054142.

UAF is an AA/EO employer and educational institution.

Oregon Sea Grant Director, Oregon State University/ Corvallis, Oregon.
Responsibilities: Provides overall leadership for Oregon Sea Grant, and oversee a total annual budget of approximately $5,000,000, and approximately 60 staff and faculty who carry out research, administrative, communication, and outreach services. Reports to the university vice president for research.
Qualifications: A terminal degree with professional experience and a record of excellence in research/ scholarship, policy, and/or management in marine, coastal, natural resources or a related field are required. Significant experience with natural resource issues. Preference will be given to candidates with a demonstrated commitment to the Land Grant/Sea Grant concept of research, education, and outreach.
Salary: Commensurate with experience.
Closing date: Until filled.
Apply: https://jobs.oregonstate.edu/applicants/Central?quickFind=51786
Contact: Chair, Sea Grant Director Search Committee, c/o Eric Dickey, A322 Kerr Administration Building, Oregon State University, Corvallis OR 97331; 541/737-2715; eric.dickey@oregonstate.edu.

Assistant Professor Riparian Ecology, College of Natural Resources, Department of Fish and Wildlife Resources, University of Idaho, Moscow.
Responsibilities: Academic year, tenure track assistant professor. 40% teaching; 40% scholarship; 20% advising/ outreach/service. Successful candidate expected to develop comprehensive, externally funded research program involving graduate students; teach undergraduate course in riparian ecology and management; participate in other undergraduate courses as needed; teach a graduate course in riparian ecology, management, and restoration; and a graduate course in specialty area.
Qualifications: Successful candidate must have Ph.D. with focus on riparian ecology emphasizing impacts of humans on riparian systems from headwater systems to large rivers, biotic-abiotic interactions, and restoration; must demonstrate successful research productivity through external funding and refereed publications; and must demonstrate a commitment to teaching excellence. Post-doctoral or equivalent experience desired.
Closing date: Review begins 12 October 2007 and continues until successful candidate identified.
Contact: Apply online at www.hr.uidaho.edu. Questions can be addressed to Carrie Barron at cbarron@uidaho.edu.

2008 Membership Application

PAID:

American Fisheries Society • 5410 Grosvenor Lane • Suite 110 • Bethesda, MD 20814-2199
301/897-8616 x203 or 218 • fax 301/897-8096 • www.fisheries.org

NAME _____
Address _____
_____
_____
City _____ State/province _____
Zip/postal code _____ Country _____

Please provide (for AFS use only)
Phone _____
Fax _____
E-mail _____
Recruited by an AFS member? yes__ no__
Name _____

Employer
Industry _____
Academia _____
Federal gov't. _____
State/provincial gov't. _____
Other _____

MEMBERSHIP TYPE (includes print *Fisheries* and online Membership Directory)	**North America/Dues**	**Other Dues**
Developing countries I (includes online *Fisheries* only)	N/A	$ 5
Developing countries II	N/A	$25
Regular	$76	$88
Student (includes online journals)	$19	$22
Young professional _____ (year graduated)	$38	$44
Retired (regular members upon retirement at age 65 or older)	$38	$44
Life (*Fisheries* and 1 journal)	$1,737	$1,737
Life (*Fisheries* only, 2 installments, payable over 2 years)	$1,200	$1,200
Life (*Fisheries* only, 2 installments, payable over 1 year)	$1,000	$1,000

JOURNAL SUBSCRIPTIONS (optional)	**North America**		**Other**	
Journal name	**Print**	**Online**	**Print**	**Online**
Transactions of the American Fisheries Society	$43	$25	$48	$25
North American Journal of Fisheries Management	$43	$25	$48	$25
North American Journal of Aquaculture	$38	$25	$41	$25
Journal of Aquatic Animal Health	$38	$25	$41	$25
Fisheries InfoBase		$25		$25

PAYMENT Please make checks payable to American Fisheries Society in U.S. currency drawn on a U.S. bank or pay by VISA or MasterCard.
Check _____ P.O. number _____
Visa _____ MasterCard _____ Account # _____ Exp. date _____ Signature _____

All memberships are for a calendar year. New member applications received January 1 through August 31 are processed for full membership that calendar year (back issues are sent). Those received September 1 or later are processed for full membership beginning January 1 of the following year.

Fisheries, Vol. 32 No. 11, Nov. 2007

Fish stock assessment and movement patterns

ATS takes fisheries research to new depths and detection ranges.

To determine movement patterns and conduct stock assessment of Chinook Salmon on the Yukon and other Alaskan Rivers, researchers turned to ATS.

Very sensitive receiver/dataloggers, in combination with uniquely coded fish transmitters, were designed by ATS to accurately detect fish movement and run timing in the deep and remote reaches of the rivers. Hourly data was relayed via satellite to researchers and participating agencies.

On one project, researchers captured 1,000 salmon at the mouth of the river and implanted a uniquely coded transmitter. The fish were then tracked as they progressed upriver using 39 fixed data collection sites with satellite data transmission capability. The study also used ATS receivers equipped with on-board GPS for aerial survey work.

With data capture rates as high as 98 percent, ATS coded transmitters and R4500 Receiver/Dataloggers resulted in increased detection ranges of up to 100 percent.

Tracking systems designed by ATS play a key role in aiding fisheries professionals conducting important research worldwide. To learn more about how our systems will benefit your next project, contact an ATS representative today.

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